

ARAB REPUBLIC OF EGYPT

Reshaping Egypt's Economic Geography: Domestic Integration as a Development Platform

Volume II

Technical Background Reports



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Poverty Reduction and Economic Management Department (MNSPR)
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CURRENCY AND EQUIVALENTS
(Exchange Rate Effective as of May 2012)

FISCAL YEAR

Currency Unit = Egyptian Pound (LE)
LE 1 = US\$
US\$1 = LE

ABBREVIATIONS AND ACRONYMS

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Volume II

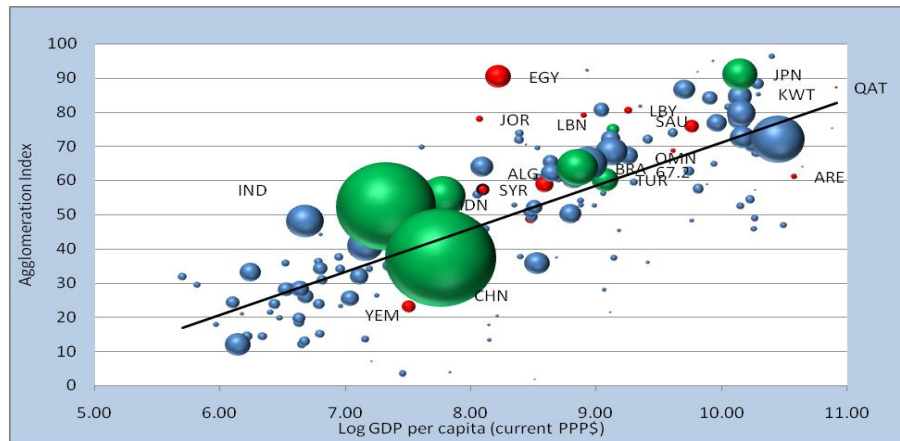
Background Technical Reports

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2. Sources of welfare disparities between and within regions of Egypt
3. Equality of opportunity for children in Egypt, 2000-2009: achievements and challenges
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I. Convergence in living standards¹

Income and agglomeration are positively correlated, as described in the WDR 2009. Egypt has a high level of agglomeration that has outpaced economic growth.² Egypt's agglomeration level is similar to that of countries with much higher income per capita levels, such as Japan, as shown in Figure 1.1.

Figure 1.1 Growth and agglomeration



Source: WDR 2009

The WDR describes how location is the most important correlate of an individual's welfare. Some regions grow faster than others and some places concentrate production. While this kind of regional disparities may sometimes be attributed to natural endowments and conditions, economies of scale and spillover effects generally explain why economic activity concentrates in some areas, making growth unbalanced. But basic living standards should ultimately converge.

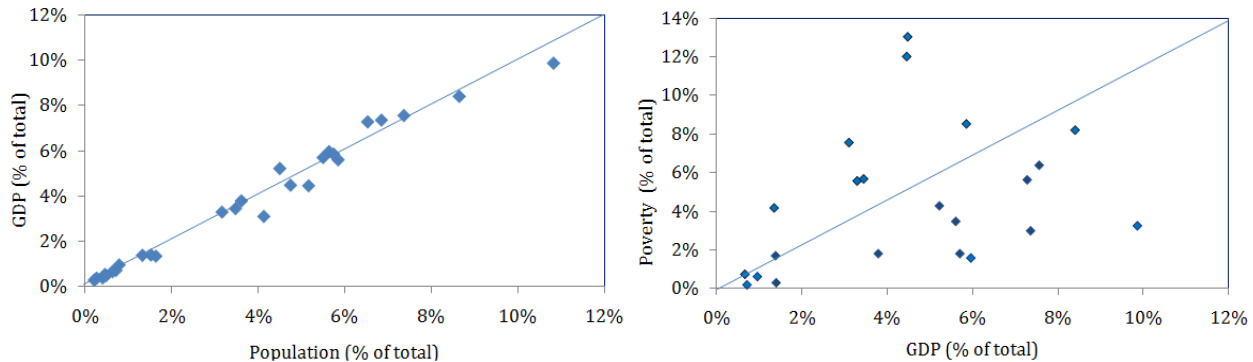
In Egypt, each governorate's share of economic activity corresponds closely with its population share (Figure 1.2). However, there are significant disparities in poverty rates between urban and rural areas and between regions within the country. Moreover, there is no clear association between the concentration of activity and the prevailing poverty rate in the governorate. Poor people also tend to concentrate in specific regions: For instance, 65% of the poor live in Upper Egypt.

This chapter presents the stylized facts of the evolution of living standards in Egypt during the last decade, as well as the disparities across the different regions. The chapter first describes consumption per capita in the regions and through time, and then proceeds to describe the evolution of other measures of living standards: unemployment, health, nutrition, education and access to basic public services to examine if they converge through time across regions.

¹ Draft May 17. Prepared by Santiago Herrera, Hoda Youssef, Karim Badr, Ahmad Youssef, and Tarik Chfadi.

² The agglomeration index is calculated as indicated in the WDR, based on a minimum population size to define a sizeable settlement (50,000), a minimum population density (150 people per sq. km.), and a maximum travel time, by road, to the nearest sizeable settlement (60 min).

Figure 1.2 Population, GDP and poverty in Egypt's governorates, 2008

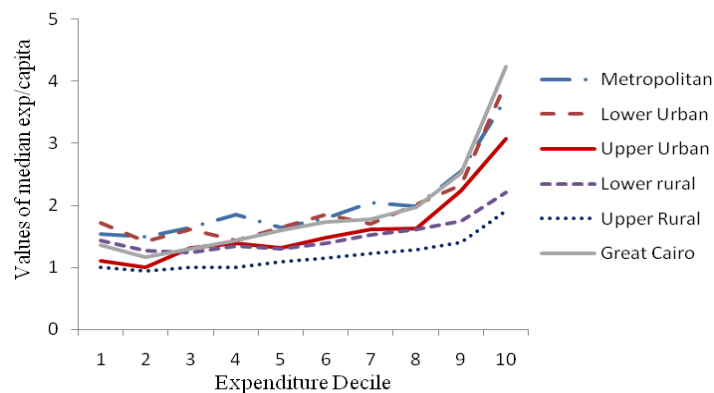


Source: *Egypt Human Development Report (EHDR), 2010*

A. Consumption in the different regions.

To compare consumption across regions and different income groups³, we deflate each regional expenditure aggregate by the poverty consumption basket in each region, so we have expenditure in terms of the number of consumption baskets of the poor. Figure 1.3 shows, for 2009, consumption levels in Egypt's regions for the different income groups categorized by deciles. The vertical axis shows the median consumption level per capita, and the horizontal axis is each decile. Consumption increases with the wealth level⁴: there is a rising trend in all regions, with the higher values achieved in the Metro areas (Alexandria, Port Said and Suez) and Greater Cairo (GC). The lowest decile of the population consumes the equivalent of one consumption basket used to construct the poverty line in Upper Egypt, while the median household of the top decile consumes 4.2.

Figure 1.3 Consumption by region, expenditure distribution, 2009



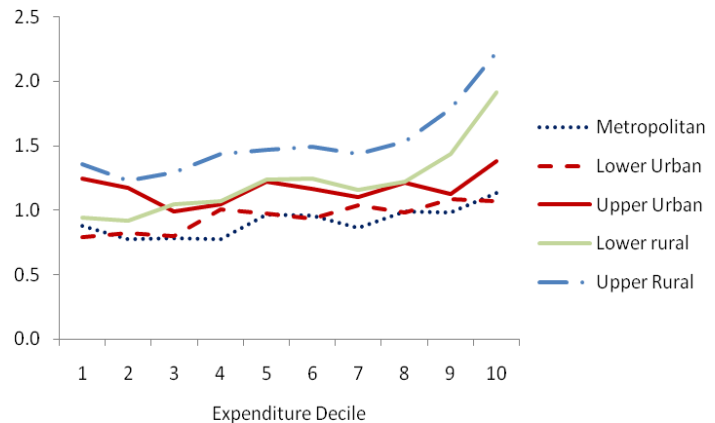
Source: *Authors calculations based on Household Income, Expenditure and Consumption Survey (HIECS), 2009*

³ The appendix replicates this analysis in terms of differences based on income rather than expenditure. There are no significant differences.

⁴ The consumption aggregate used is total consumption of durables and non-durables, deflated by the poverty line. It is the consumption in terms of units of consumption baskets of the poor. Results don't change when the overall price index is used, but the poverty line deflator was chosen for consistency with other papers in the report that use this measure of welfare. Wealth is proxied by the spending level.

To compare consumption across regions, we examine the ratio of consumption in Cairo to each of the other regions. Consumption in Cairo is larger than in Upper rural (UR) areas and Lower rural (LR), but lower than in the other metro areas. Only in the top decile is Cairo's consumption greater than in all other regions (Figure 1.4). The ratio oscillates between 1.5 and 2.2, which does not seem to be a large difference. This is in line with the values of the ratio of consumption between leading and lagging regions reported in the WDR 2009 for countries of similar income.⁵

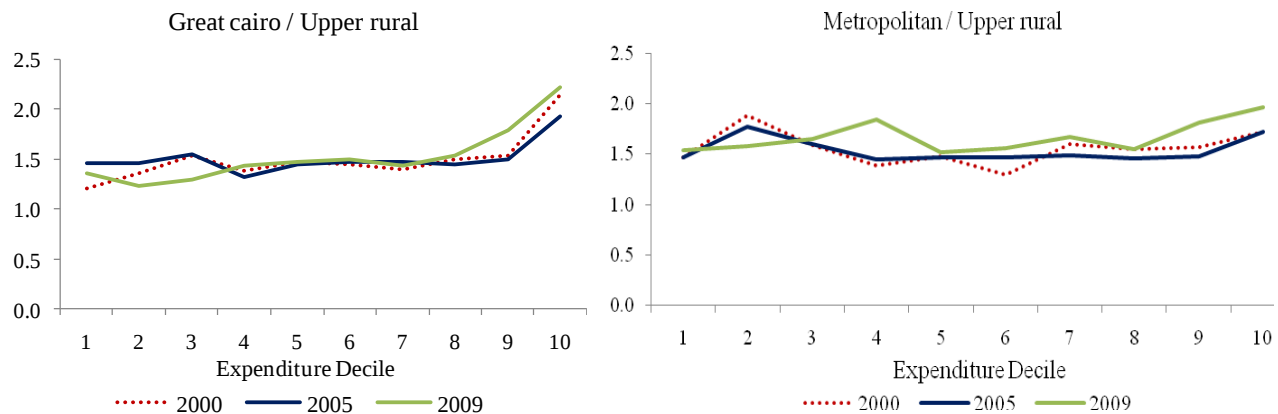
Figure 1.4 Ratio of Cairo consumption over each region, 2009



Source: Authors calculations based on HIECS 2009

To examine whether there is convergence in consumption through time, we construct the ratio between consumption in the region with the largest value (either Cairo or the Metro areas) and that of the region with the lowest one (Upper Rural Egypt). Figure 1.5 shows this ratio for different groups of the population categorized by their spending levels. Comparing the consumption of households in GC with the UR, we observe that the median household of the top decile in GC consumed twice as much as the median household of the top decile in UR in 2000. By 2009, the ratio had slightly increased. The opposite happens in the bottom three deciles, showing some convergence in living standards, but the differences are not significant. When the metro areas are taken as the benchmark, the ratio of consumption in the leading region is higher over time throughout the entire spectrum.

Figure 1.5 Ratio of households' consumption in Greater Cairo and metropolitan to Upper Rural areas



Source: Authors calculations based on HIECS

⁵ Figure 2 of the WDR 2009 shows the ratio of consumption in urban areas to rural areas. This report shows particular urban areas (either Greater Cairo or Metro areas) to a particular rural area (Upper Egypt).

In sum, there is a slight convergence trend across time in the consumption levels of the poorest deciles of the population, but at the top of the wealth distribution there is a divergent trend. The small changes in the ratio can be attributed to the relatively small differences in consumption levels referred to in the WDR. According to the WDR, the differences in household consumption tend to fall quickly, while the differences in other measures of living standards show greater persistence.

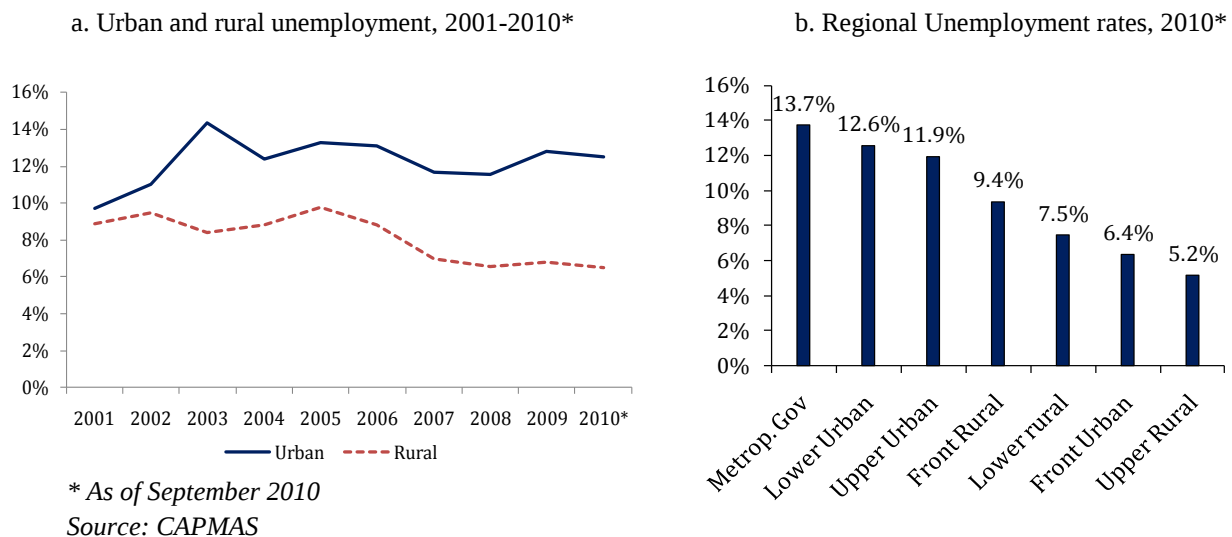
B. Other indicators of living standards

The living standards are defined by more than consumption levels. Employment, access to essential housing infrastructure and services, as well as education and health are equally important dimensions to consider when examining living standards. This section describes some of these indicators, focusing on the differences in levels and converging trends.

1. Regional Unemployment

This section presents the stylized facts of unemployment across different regions in four different time periods: 2001, 2005, 2008 and September 2010. The first pattern to be observed is the geographical disparity between regions in terms of absolute unemployment rates. Figure 1.6 shows that the gap between urban and rural areas has widened through the decade, with metropolitan and urban areas having unemployment rates of more than twice those of the rural areas.

Figure 1.6 Unemployment rates



Moreover, the disparity in terms of unemployment rates can be observed within the regions themselves, as there are unemployment differentials between governorates, even if those governorates are in close proximity and face a comparable institutional setting. For instance, figure 1.7 shows the unemployment rates of individual governorates in Upper Egypt.

Figure 1.7 Unemployment rates in Upper Egypt, 2010

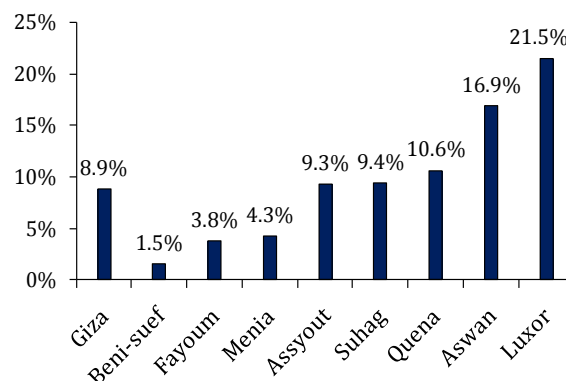


Figure 1.8 shows that through time, the most notable change is the rise in unemployment in metropolitan areas, from 7% in 2001 to 13% in 2010. Lower rural Egypt witnessed a precipitous fall from 10% to 6%. The rest of the regions saw little change through the decade. This regional disparity in unemployment rates across time is more striking when we look at the varying convergence trends between regions. The ratio between the rates in the metropolitan areas and the rural areas of Lower and Upper Egypt has substantially increased through the decade, reaching more than the double by 2010. However, it seems like there is some convergence between the metropolitan areas and urban areas of Upper and Lower Egypt regions (figure 1.9).

Figure 1.8 Unemployment rates across time and regions

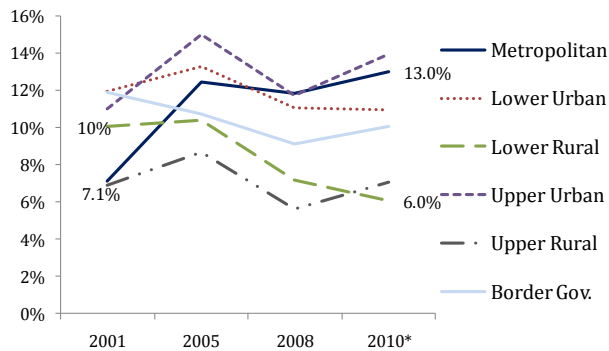
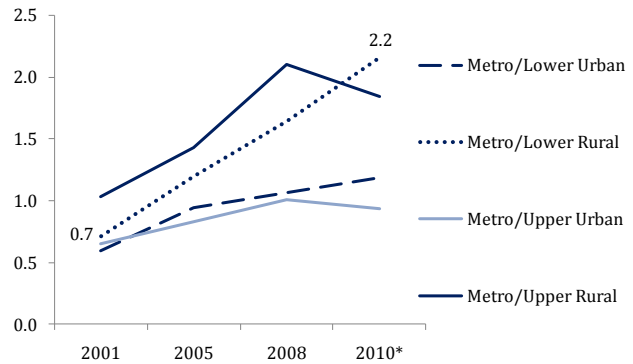


Figure 1.9 Regional convergence in unemployment rates

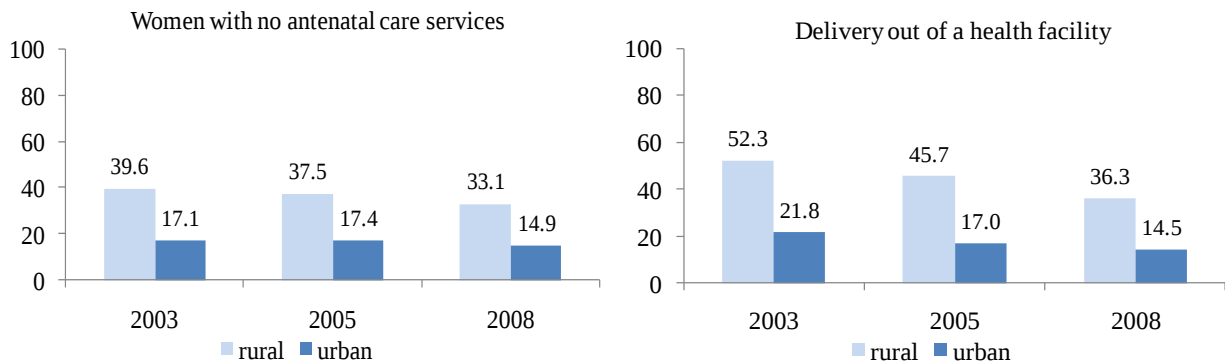


* As of September 2010. Source: CAPMAS

2. Urban/Rural disparities

Disparities between urban and rural areas are especially notorious in health. For instance, Egyptian women who live in rural areas receive much less antenatal care from a medical provider than those who live in urban areas, and more than 36 percent of the mothers in rural areas did not give birth in a health facility compared to less than 15 percent in urban areas (Figure 1.10).

Figure 1.10 Urban/rural disparities, selected health indicators



Source: Demographic and Health Survey (DHS), 2008

However, these regional disparities tend to decrease over time. This trend is particularly evident in the early childhood (under-five) mortality rates which show a clear convergence between urban and rural areas (Figure 1.11). Access to basic housing services is more homogeneous across urban and rural areas, with an increasing availability and access to improved sanitation and drinking water (Figure 1.12).

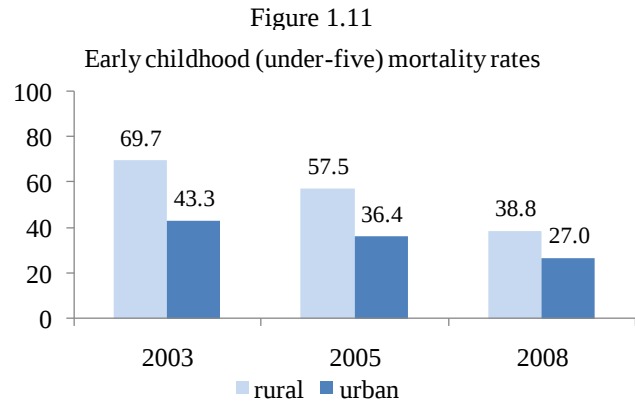
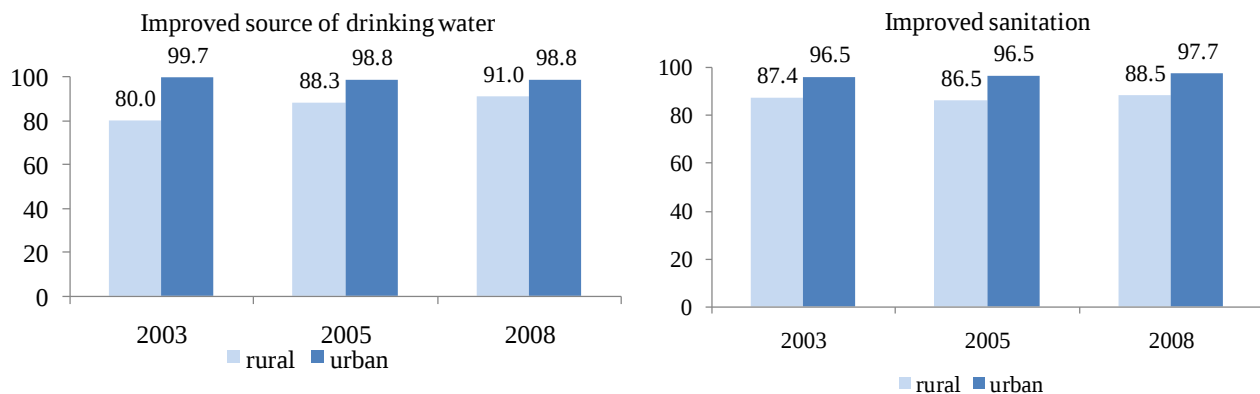


Figure 1.12 Access to basic services in urban and rural areas



Source: DHS, 2008

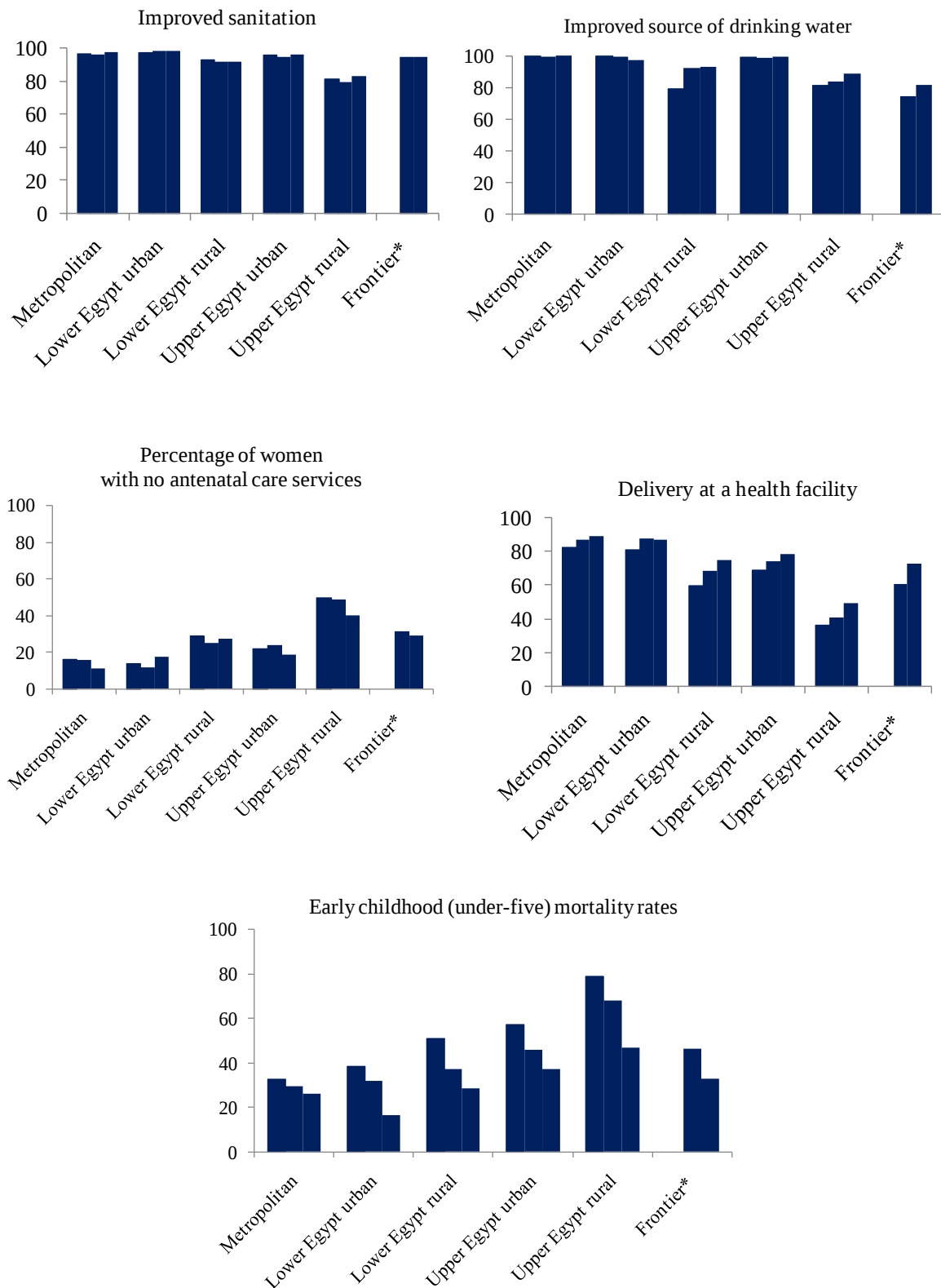
3. Regional disparities

Disparities across regions show similar patterns as the urban-rural trend: access to basic housing services such as drinking water and improved sanitation is relatively homogeneous, but health and education indicators reveal large disparities between regions.

Figure 1.13 summarizes the regional averages for some indicators. The homogeneity of the averages hides some substantial differences across different groups. For the moment we will focus on the regional averages.

The large improvement in some health indicators such as the level of childhood mortality is remarkable: it has fallen through the decade (from 79 to 47 per 1000 births in upper rural Egypt) and converged to other regions' levels.

Figure 1.13 Regional disparities, selected living standards indicators in 2003, 2005 & 2008

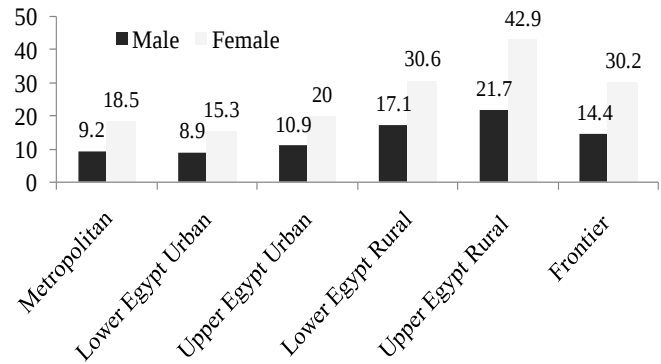


* 2003 data not available for the frontier governorates.

Source: DHS, 2008

The educational level of household members is one of the most important characteristics of the welfare status of a household due to its association to many standard of living conditions. Figure 1.14 shows the percentage of household members age six and older with no education at all. The figure highlights the gap in education between males and females, as well as the gap between different regions. Urban residents are more likely to receive a minimal education than rural residents and the gender difference in educational attainment is also less evident in urban than in rural areas.

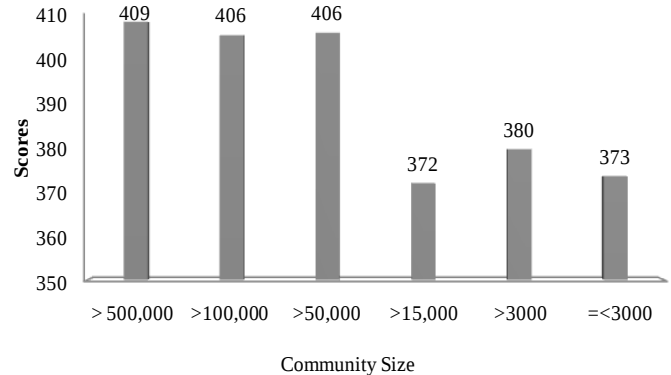
Figure 1.14 Regional disparities in education, 2008



Source: DHS, 2008

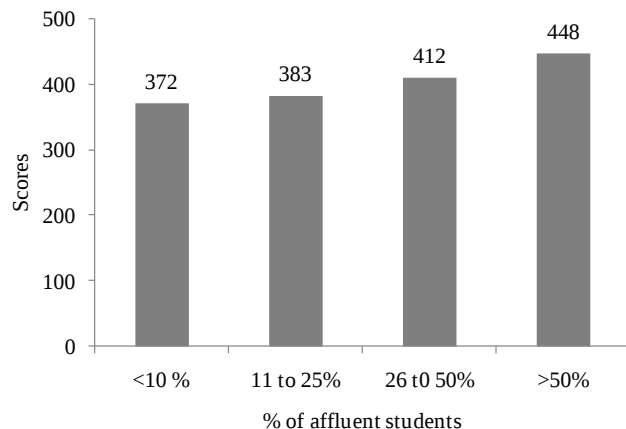
To examine educational disparities across regions it is essential to consider differences in the quality of education. The available information in this respect is the TIMSS scores in Egypt. Presented by city size, it shows a clear difference between the TIMSS scores in large cities and small villages (Figure 1.15). When the raw data is provided by the Ministry of Education we will provide a more complete regional analysis.

Figure 1.15 TIMSS scores by size of the city



The full data set would allow a more complete regional analysis that controls for the students level of income and other characteristics. Students coming from more affluent households score higher on the TIMSS, as shown in Figure 1.16. These figures refer to averages in each category (city size, or affluence level), but proper econometric techniques with the full data set would allow testing for the impact of regional location on the students test scores.

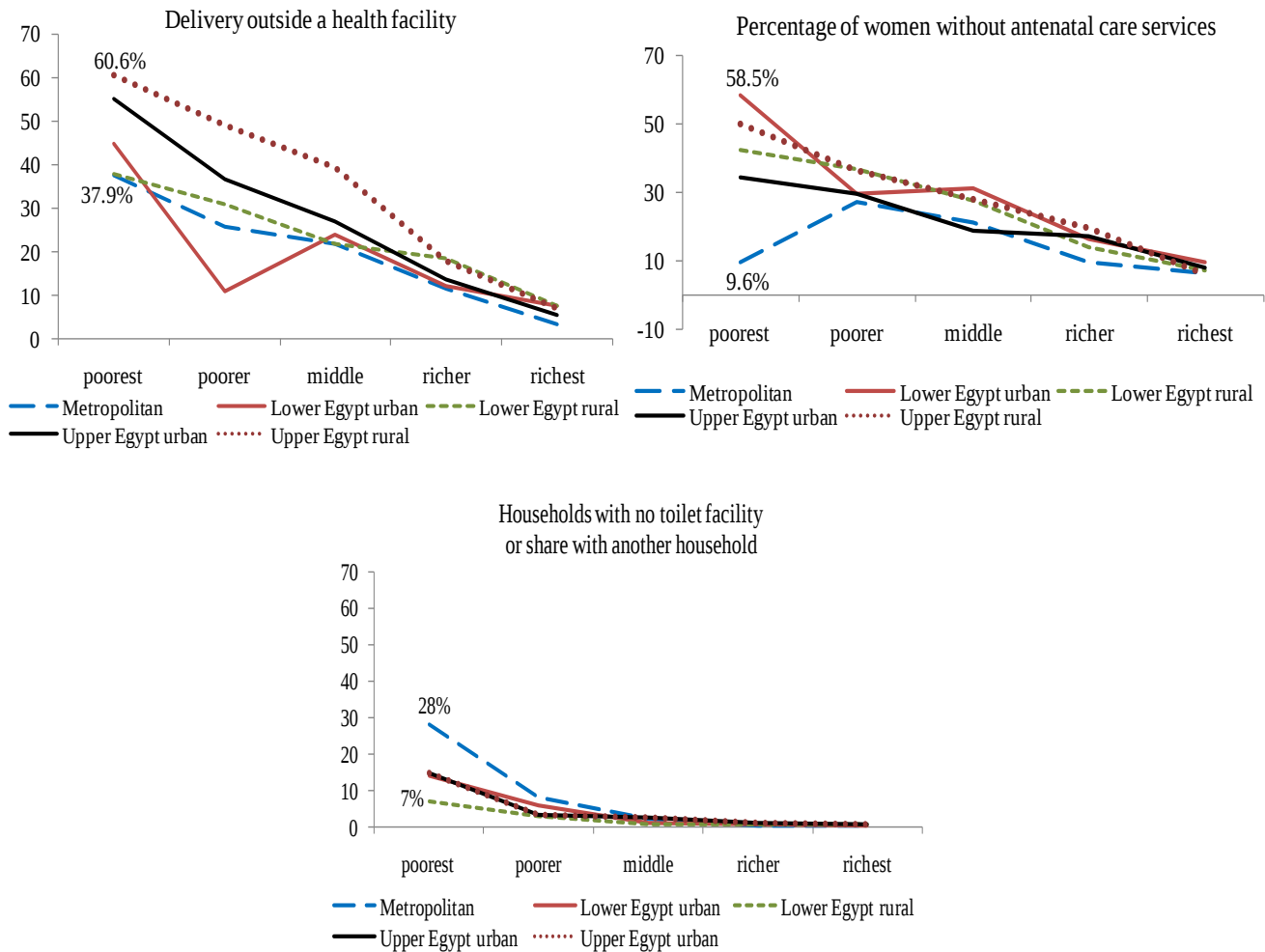
Figure 1.16 TIMSS scores by affluence level



Source: TIMSS International, 2007

When comparing the living standards across regions for different groups of the population (by expenditure quintile), there are large differences for the lowest (poorest) quintile, but these differences decrease as wealth increases. These gaps are less sizeable in the basic housing services but they are considerable in the health indicators. For instance, in 2008, less than 10 percent of the poorest women living in metropolitan areas did not receive antenatal care services versus 58.5 percent for those women who live in the urban areas of Lower Egypt (Figure 1.17).

Figure 1.17 Regional disparities by wealth quintile, 2008

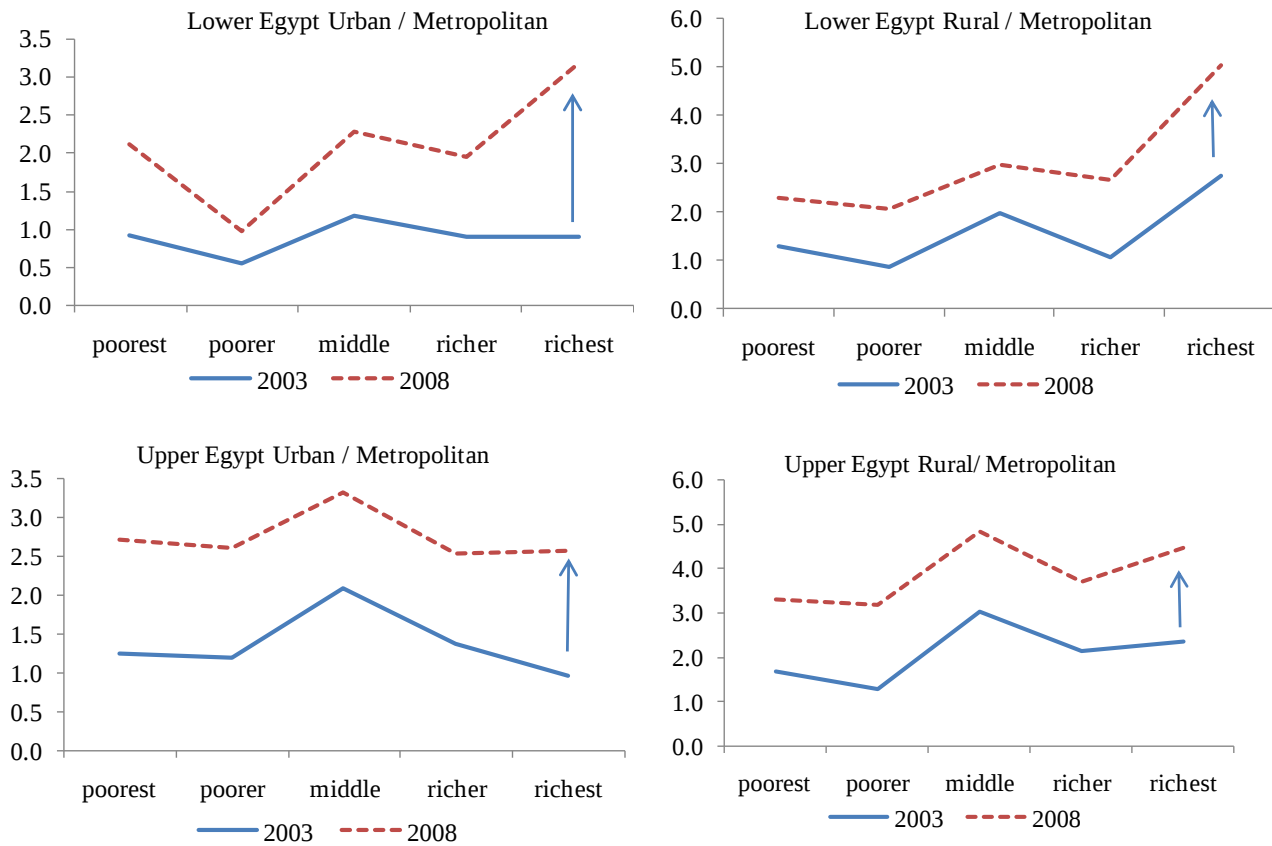


Source: DHS, 2008

This regional disparity in health indicators across time is even more striking, as there is no convergence. For example, the ratio between the indicators in the metropolitan areas and the Lower Egypt urban area show similar levels (ratio around one) for the poor in 2003, but by 2008 the gaps have widened (the ratios increased) as can be seen in Figure 1.18. The disparity increases at the top of the distribution, indicating that the wealthier households in the metropolitan areas have much better access to health services than the wealthier households in the other areas to which it is compared. The widening gap through time is a common trend for all Egypt regions when compared to the metropolitan area.

Figure 1.18 Disparity between metropolitan and other areas

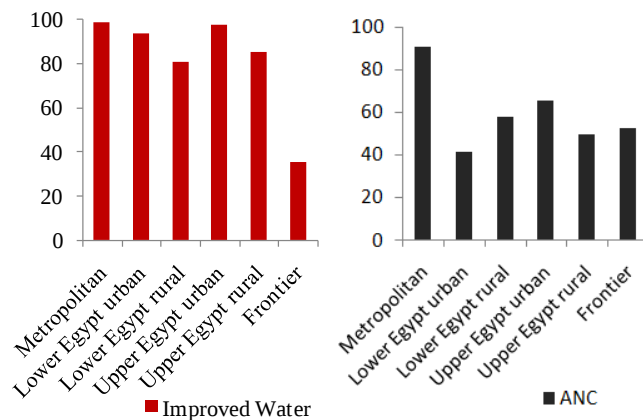
Percent of deliveries that took place out of a health facility



Source: DHS, 2008

Going beyond comparisons of regional averages shows that there is disparity between regions for the same wealth groups. For instance, access to improved water sources for the poorest quintile varies from about 35% in the Frontier Governorates to almost 100% for the poorest households in metro areas. Ante natal care also shows great variation across the poorest households in different regions of the country (Figure 1.19).

Figure 1.19 – Poorest households' access to services according to residence, 2008

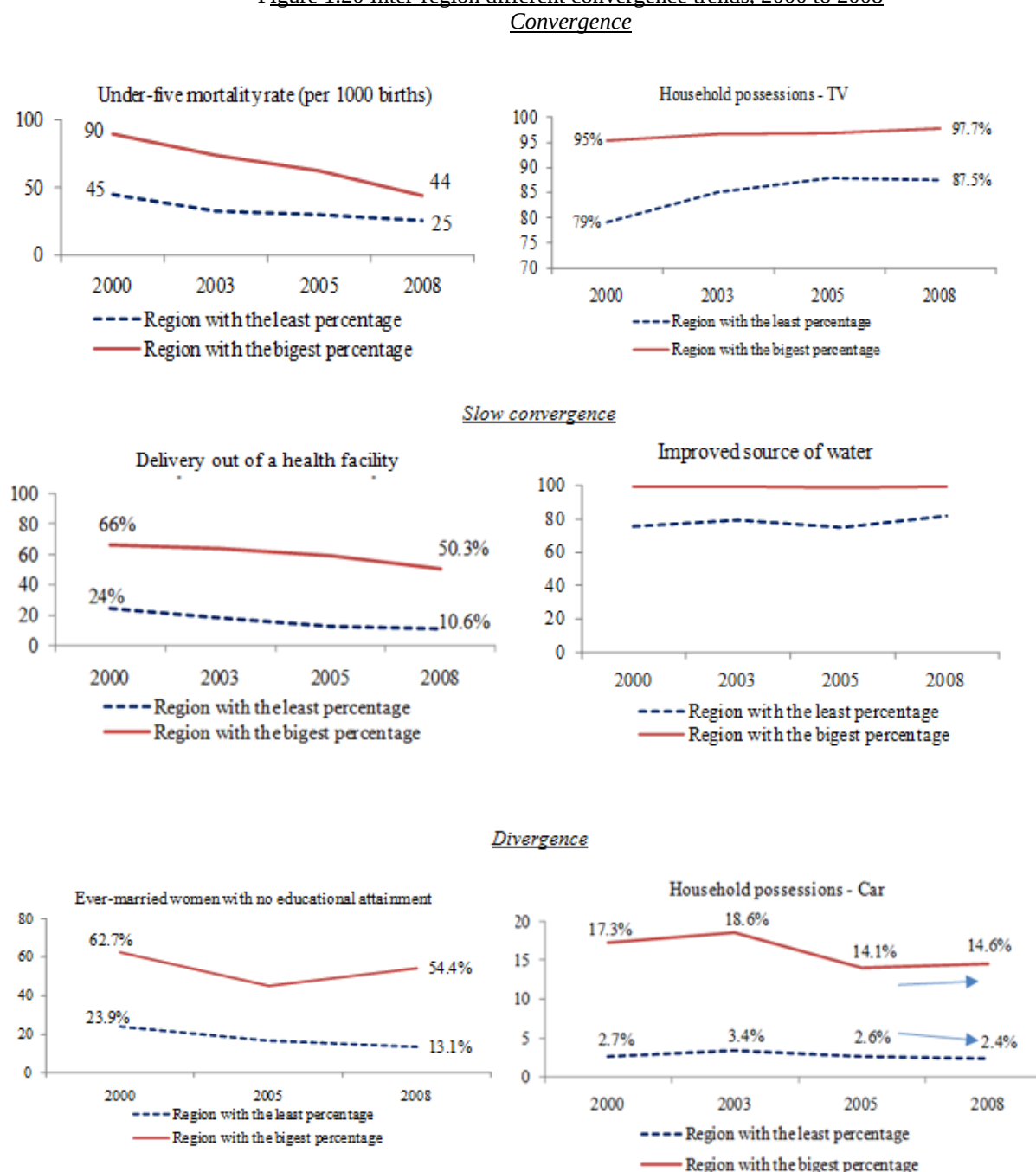


Source: DHS, 2008

4. Inter-region convergence

A fundamental question in the analysis of the spatial inequality of welfare within Egypt is to explore whether the observed differences tend to increase or to lessen over time. A simple plot of the conditions prevailing in the most privileged region (which almost always is the metropolitan region) and the least favored one (varies depending on the specific indicator) shows ambiguous results: some disparities have increased over time, while others show a clear convergence between regions. In many cases, all the regions show an improvement in welfare indicators but the gap remains unchanged between the most and the least favored areas (Figure 1.20).

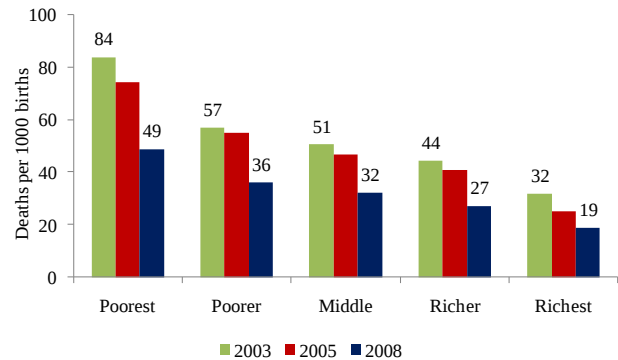
Figure 1.20 Inter-region different convergence trends, 2000 to 2008



Source: DHS, 2008

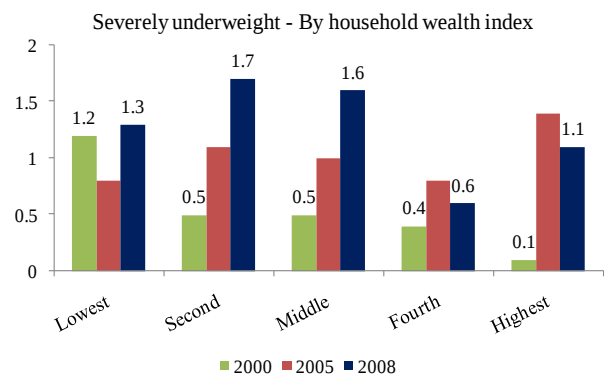
Some welfare indicators do not only show an improvement through time, but also point to a convergence between wealth groups. This is the case for the early childhood mortality rate which has substantially declined from 84 to 49 deaths per 1000 births in the poorest quintile in the last five years, in spite of remaining at high levels. In 2008 the range between the highest and lowest values is smaller (as a fraction of the richest quintile), indicating a converging trend (Figure 1.20).

**Figure 1.21 – Early childhood mortality
by household wealth index**



However, other indicators point to a convergence between wealth groups, but in the wrong direction. For instance, in the beginning of the decade, children from the richest quintile were the least suffering from malnutrition, with only 0.1 percent being severely underweight in 2000. However, there was a trend reversal in 2008, with a considerable increase of underweight children among the richest quintile to levels that are similar to those of the poorest one (Figure 1.21).

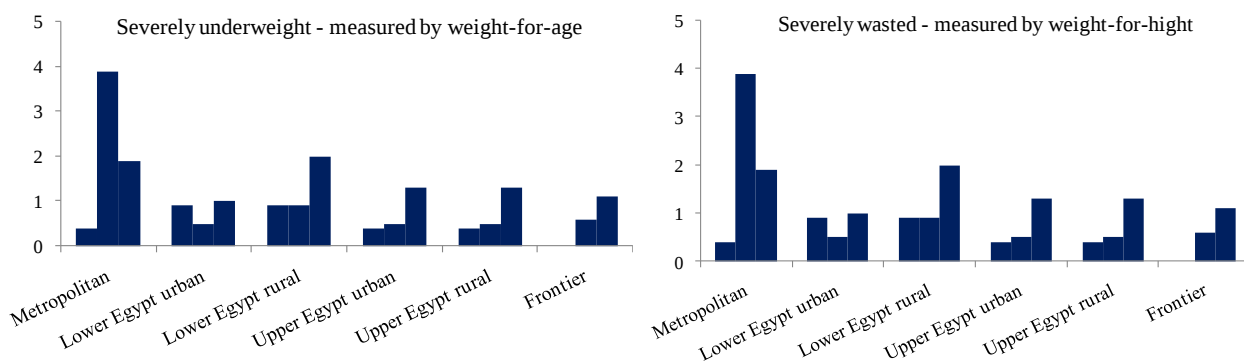
**Figure 1.21 – Children malnutrition
by household wealth index**



Source: DHS, 2008

When considering the nutrition indicators by region, it appears that, unexpectedly, the metropolitan area is one of the most severely affected regions, especially in the middle of the decade (Figure 1.18).

Figure 1.18 – Children malnutrition by region



Source: DHS, 2008

Conclusions and main findings of this chapter

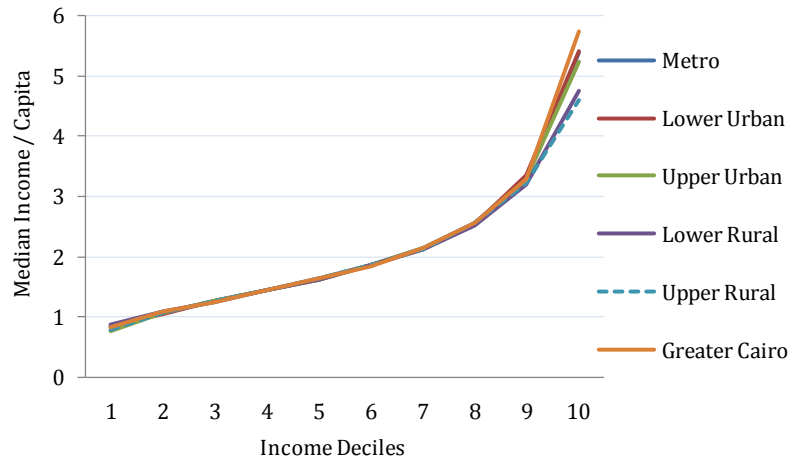
1. Consumption per capita differences between leading and lagging regions are not large by international standards.
2. Over time, there seems to be convergence of consumption levels of the poorest members of the population, but there is divergence in the top quintiles.
3. There is a widening gap in unemployment rates between urban and rural areas, in addition to a disparity between governorates within the regions themselves,
4. Other indicators of welfare show larger discrepancies in living standards, though some of them show convergence. For instance, health indicators such as under-5 mortality rates, or birth delivery outside a health care facility, show large discrepancies between urban and rural areas as well as across regions, but strong convergence. Other health indicators such as birth deliveries out of health facilities show divergence.
5. Access to basic housing services is more homogeneous across urban and rural households, but general averages hide some inequality between the poorest across regions. Regional differences are marked along the same lines: health indicators show large disparities, while basic housing services show more homogeneity.
6. While this is true at the regional level on average, within each region there are differences between income groups.
7. Education indicators show a significant disparity between large and small towns, and across regions. If the TIMSS scores can be interpreted as reflections of differences in the quality of education, then large cities provide better quality education than small towns.
8. Nutrition indicators show a deterioration of living standards through time, and with the highest malnutrition rates achieved in the metropolitan areas. There is convergence, but in the wrong direction: the regions are reaching the metropolitan high malnutrition rates.

Annex 1
List of regions and governorates

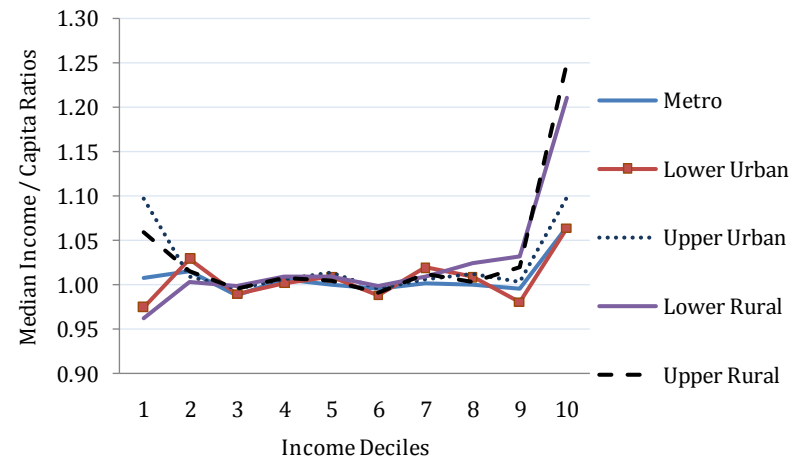
Metropolitan areas (or urban governorates)	Cairo
	Alexandria
	Port Said
	Suez
Lower Egypt	Damietta
	Dakahlia
	Sharkia
	Kalyoubia
	Kafr El Sheikh
	Gharbia
	Menoufia
	Behera
	Ismalia
Upper Egypt	Giza
	Beni Suef
	Fayoum
	Menia
	Assiut
	Suhag
	Qena
	Luxor
	Aswan
Frontier governorates	Red Sea
	New valley
	Matrouh
	North Sinai
	South Sinai

Annex 2 – Income across regions and different income groups

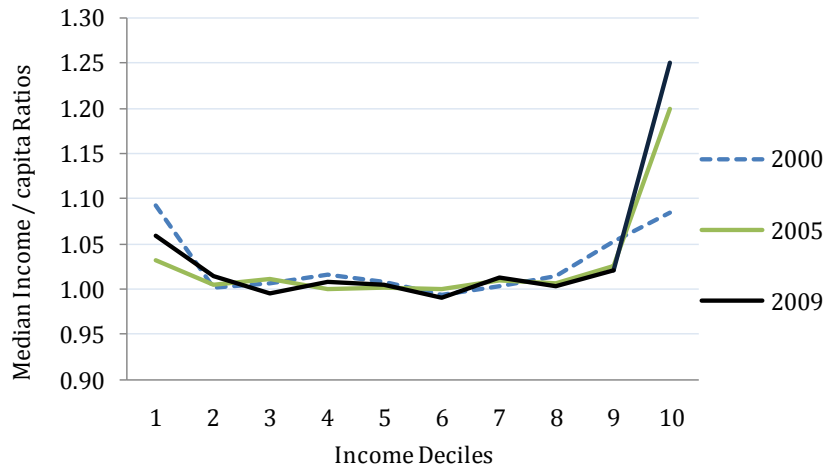
Income per capita by region, income deciles, 2009



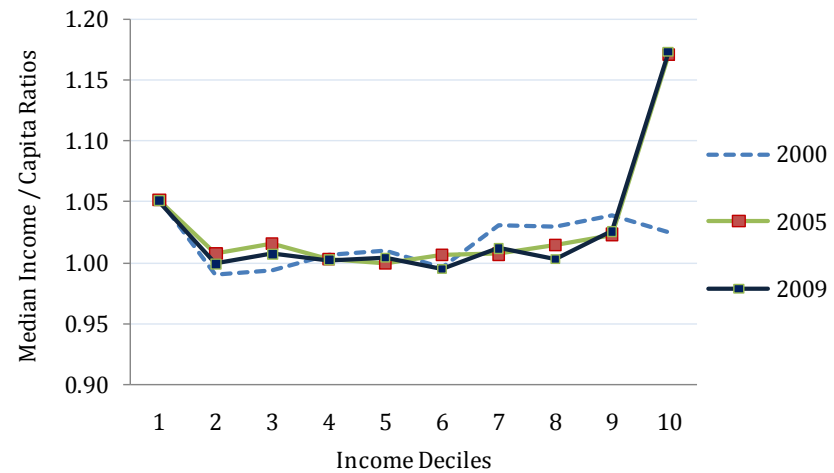
Ratio of Cairo income per capita over each region, 2009



Ratio of income per capita in Greater Cairo to Upper Rural areas



Ratio of income per capita in Metropolitan area to Upper Rural areas



Sources of welfare disparities between and within regions of Egypt

Nancy Lozano-Gracia and Vivian Y. N. Hon

1. Introduction

Regional disparities in income and welfare have existed for some time in Egypt. However, not much work has been done towards understanding the source of these differences. There is no real consensus on whether regional disparities are mainly due to differences in returns to characteristics or due to the differences in characteristics themselves. In this chapter we explore these issues in more depth by using consumption as a measure of welfare and looking at the differences across 8 regions and using the Greater Cairo area as reference (Upper Rural Egypt, Upper Urban, Upper, Lower Rural, Lower Urban, Lower, Alexandria and Cairo). The consumption disparities are also examined without reference to Cairo. For instance, disparities are examined between Lower and Upper Egypt, and between Urban and Rural areas.

We disaggregate regions in rural and urban areas to provide a better understanding of regional disparities between the Greater Cairo Area and the rest of the country. Furthermore, we look at differences both in mean welfare and differences across the welfare distribution using the Oaxaca-Blinder decomposition for the analysis at the mean and Melly (2006) quantile regression decomposition technique for the analysis across the welfare distribution. Finally, an important contribution of this work is that we look at the evolution of welfare gaps across time in Egypt.

Results from this chapter show that: 1) the consumption gaps have been relatively stable throughout the last decade; 2) but the explanation of the gaps has shifted from differences in accumulation of capital to returns to the characteristics. The returns to factors of production are larger in urban and leading regions. 3) the rising consumption in Lower Egypt urban centers can be associated with the growing share of tradable activities during the decade

This chapter is organized as follows. Section 2 presents a general description of the data that is used for the analysis; the methodology used for the decomposition of mean and quantile welfare differentials is introduced in section 3. Section 4 presents the results of the analysis.

2. Data

In this study we used the Household Income and Expenditure Consumption Survey (HIECS) for Egypt for the years 2000, 2005 and 2009. These surveys are representative at the national and governorate levels, as well as for the urban and rural dimensions. For 2005 we have access to the full sample, which comprises 47,094 households. For the other two years we have access only to a random sample representing 25 percent of the full sample for that year. For 2000 this is equivalent to 11,919 households; for 2009 the subsample available includes 11,634 households. In this study, rather than focusing only on the governorate of Cairo as our leading region, we take the Greater Cairo Areas (GCA) defined as the area including the governorates of Cairo and Giza, as well as the urban areas of Kaliobia. The regional breakdown of households for each year is shown in Table 1 below.

Table 1. Sample of Households by Region

	GCA	Alexandria	Upper Egypt	Lower Egypt
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			Urban	Rural	Urban	Rural
2000	3,402	1,072	996	1,661	1,535	2,728
2005	11,013	2908	5,768	11,094	6,027	13,985
2009	2,564	694	761	2,237	1,104	3,579

Source: HIECS 2000, 2005 and 2009

This survey allows us to use consumption, rather than income, as a measure of household welfare. For a several reasons that are widely discussed in the literature (Deaton, 1997), consumption is considered to provide a more accurate measure of household welfare. First, consumption tends to be more stable in the short terms than income, as seasonality issues of employment influence the latter. Furthermore, when rural areas are included, consumption measures are thought to be a better representation of welfare, as they would account for production for self-consumption that would otherwise not be included when using an income measure. Furthermore, consumption expenditures would also reflect access to credit markets and savings, which would otherwise be ignored (Skoufias and Katyama, 2010). We use the welfare ratio as a measure of living standard (see Blackorby and Donaldson, 1987; Ravallion, 1998; Deaton and Zaidi, 2002), calculated as the ratio between consumption expenditure and the appropriate region-specific poverty line. By deflating the nominal consumption expenditure with the regional poverty line, one expects to account for all cost of living differences by the poor in different areas; poverty lines are defined for each year, metropolitan areas, and urban and rural areas in lower and upper Egypt as shown in Table 2 below.

Table 2. Regional Poverty Lines

	Metropolitan	Upper Egypt		Lower Egypt	
		Urban	Rural	Urban	Rural
2000	1097	1021	953	1013	968
2005	1453.4	1416.3	1408.3	1403	1429.2
2009	2196.55	2161.68	2216.31	2144.77	2274.33

Source: World Bank (2010) and World Bank (2002)

In our work, we use the natural logarithm of the welfare ratio as dependent variable. Explanatory variables include household composition, characteristics of the head of household including education and occupation, as well as access to basic services such as connection to the water service, electricity and garbage collection systems. Variables used to describe the household composition include total number of children (including its squared value) and percentage of unemployed adults; for characteristics of the head of household we include age (and its squared value), three dummy variables to describe marital status, three dummy variables to capture the different education levels, and industry dummy variables to capture the occupation of the head of household. Dummies for connection to the water system, drainage and electricity are included together with two dummies for the garbage collection system. Welfare ratios vary considerably both across and within regions with the Greater Cairo Area being the region with highest average welfare ratios.

3. Methodology

In this section we describe the methodology used to estimate the welfare differences across Egyptian regions and understand their main drivers. As a first step, we estimate a welfare equation where the log of real per capita expenditure of the *i*-th household is defined as a function of the household's characteristics. For each year, poverty lines for each region are used to deflate

expenditures in each region, to account to some extent for differences in living expenses. The welfare relationship defined in equation (1) is estimated for each region j (and each year), using standard OLS regressions.

$$y_j = X_j \beta_j + \varepsilon_j \quad (1)$$

where y_j is the log welfare ratio in region j , and X_j is a set of household characteristics. As a second step, we use a Oaxaca-Blinder type decompositions to classify the determinants of the differences in welfare ratios across regions in two types of effects: first, the characteristics effects, which represent all differences attributed to a set of covariates included in the estimation of equation (1) and represented by the matrix X ; second the returns effects which are related to differences in the estimated parameters beta from equation (1). In general, given to regions A and B, the mean difference in the standard of living between A and B can be expressed as

$$\overline{y_A} - \overline{y_B} = \overline{X_A} \beta_A - \beta_B \overline{X_B} \quad (2)$$

where the bar over the relevant variables denotes the sample mean values of the respective variables and the error terms are iid for all regions and time periods. Adding and subtracting the term $\beta_A \overline{X_B}$, equation (2) above can be rewritten as:

$$\overline{y_A} - \overline{y_B} = (\overline{X_A} - \overline{X_B}) \beta_B - (\beta_A - \beta_B) \overline{X_A} \quad (3)$$

The decomposition described in equation (3) was first proposed by Oaxaca (1973) and Blinder (1973) and suggests that the difference in the mean log welfare ratios of regions A and B may be decomposed in two effects. The first effect, summarizes the differences in average characteristics, while the second effect stems from differences in the coefficients or differences in the returns to the characteristics. In equation (3), differences in characteristics are weighted by the returns to characteristics in region B, while differences in returns are weighted by the average characteristics of households in region A¹. Alternative specifications of equation (3) may be derived using different weights for the components of the welfare gap (see e.g. Reimers, 1983; Cotton, 1988; Neumark, 1998 and Oaxaca and Ransom 1994 among others). Following Cotton (1988) we use the average coefficients over the two regions as an estimate of a “nondiscriminatory parameter vector” and avoid the index number problem suggested by Oaxaca (1973) (for further technical details see Jann, 2008).

At this point it is important to stress that the decomposition does not intend to establish causal relationships but instead serve as a descriptive tool that allows summarizing the differences in welfare across regions in their endowments (characteristics) or coefficients (returns) effects. It is also important to note that if there is free internal migration within and between regions, the current place of residence of individuals might not be exogenous and may lead to selection bias in the decomposition (Ravallion and Wodon, 1999). Initial tests suggest that there are not significant biases in the estimated coefficients and therefore the main conclusions of our decomposition results presented below hold.

¹ Note that an analogous expression could be derived where differences in characteristics are weighted by returns to characteristics in region A, and differences in returns are weighted by average characteristics in region B if the term $\beta_B \overline{X_A}$ instead of $\beta_A \overline{X_B}$ is added and subtracted to the right hand side of equation (2).

Quantile Regression Decomposition

Estimation of welfare gaps using OLS focuses on mean effects. The effect of the covariates is limited to a “shift” effect that remains constant across the welfare distribution. However, the effect of each covariate might in fact vary across the welfare distribution. In this work, we allow for heterogeneity in characteristics and use quantile regression for the estimation of the welfare equation. A quantile regression approach introduces more flexibility to the model and allows to estimate the effects of covariates across the conditional distribution of the dependent variable (Koenker and Bassett, 1978). Extensions to the Oaxaca-Blinder decompositions to any quantile of the distribution of living standards allows us to explore heterogeneity in the decomposition of characteristics and returns effects across the welfare distribution. We apply the method proposed in Melly (2006) to estimate the welfare decomposition for each quantile. For further technical details see Annex 1.

4. Results

4.1 Welfare disparities across regions

4.1.1 Comparing Greater Cairo Area to the rest of Egypt

Figure 1 below summarizes the welfare gap estimated using the Oaxaca-Blinder decomposition for different Egyptian regions. In all cases described in this section, the welfare gap is measured with respect to the Greater Cairo Area (GCA). The composition of the gap is also shown in this figure where the contribution of characteristics and returns effects to the total gap is depicted using different colors; the size of the bar indicates the total gap.² In general, while the composition of the welfare gap has changed through time, total welfare gaps with respect to the GCA have remained fairly constant in the last ten years. Exceptions appear to be Alexandria, which has closed the gap. Urban areas in Lower Egypt have also move forward closing the gap in characteristics with respect to GCA; differences in returns fully explain the remaining gap between these two areas today.

Overall, it is interesting to observe that through time, differences in characteristics have lost ground in explaining the welfare gap of all regions with respect to the GCA. However, it is also interesting to note that the total gap between the GCA and rural areas both in Upper and Lower Egypt has not varied considerably through time. On the other hand, urban areas seem to be catching up with the GCA.

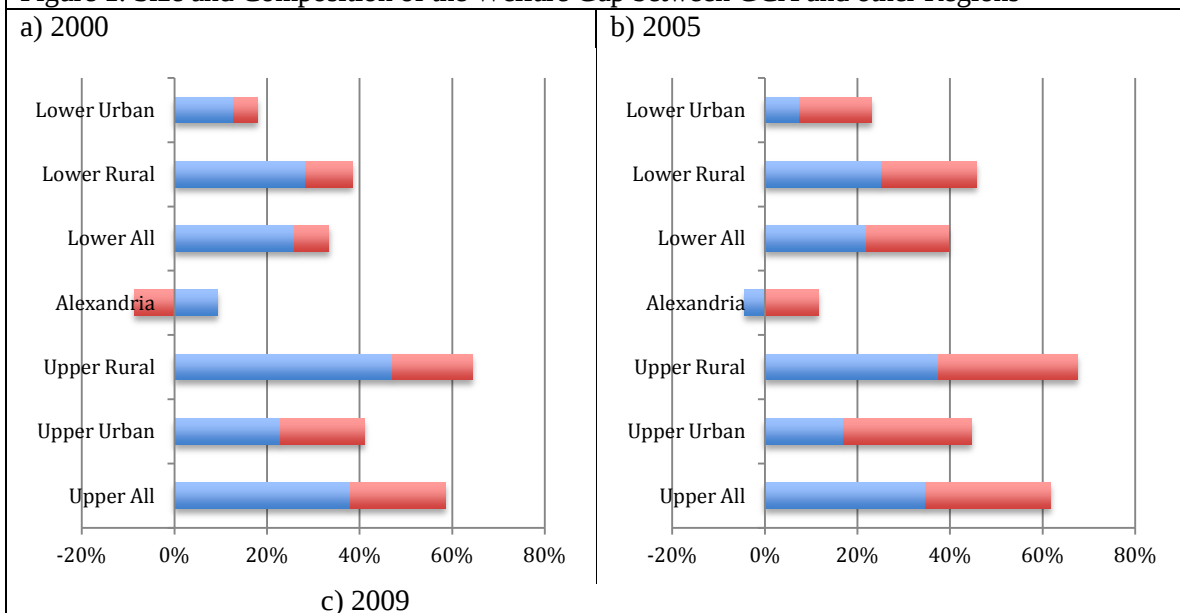
Alexandria and urban areas in Lower Egypt show faster convergence towards GCA welfare ratios than urban areas in Upper Egypt. Interestingly, both for Alexandria and urban areas in Lower Egypt, households’ characteristics lost relative importance in explaining the total gap with GCA, while differences in returns increased.

Between 2005 and 2009, differences in characteristics have move towards zero, with differences in returns also decreasing considerably. In 2009, the total gap between GCA and urban areas in Lower Egypt is only around 6 percent, with this gap being explained fully by differences in returns. For the case of Alexandria, it is interesting to observe that while the total gap is also fully explained by differences in returns, returns to characteristics seem to be on average, higher in Alexandria in 2009.

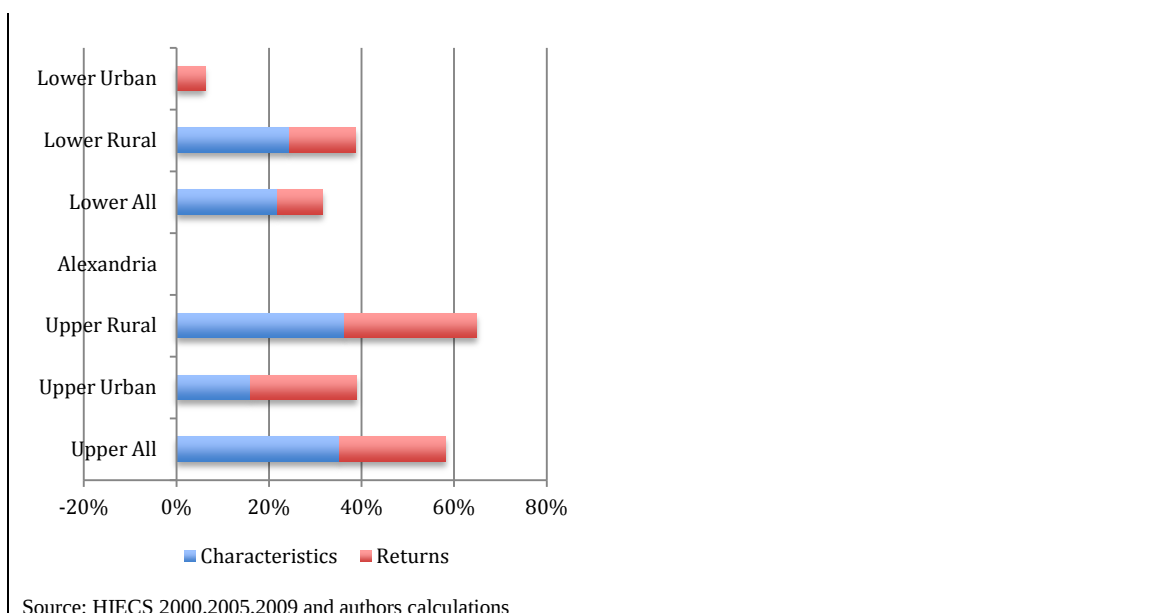
Urban areas in Upper Egypt have not been as successful in closing the welfare gap with GCA but differences in returns seem to be the new drivers of the gap today. First, a considerable reduction of the total gap was observed between 2000 and 2005, but no further improvements are observed in 2009. While the total gap between urban areas in Upper Egypt and the GCA was about 22 percent, the gap went down to 16.9 percent in 2005 and 16.1 percent in 2009. More interestingly, while differences in household characteristics represented 55 and 38 percent of the total gap in 2000 and 2005, they represented 41 percent of the total gap in 2009. However, it is important to highlight that from 2000 to 2009, the relative composition of the gap has changed with returns to households characteristics becoming the most important component of the total welfare gap, explaining almost 60 percent of the gap in 2009.

Rural areas both in Upper and Lower Egypt have been the least successful in narrowing the gaps with respect to welfare levels in the GCA. The total gap between the GCA and rural areas in Upper Egypt was around 64 percent in 2000 and it was still at that same level in 2009. Similarly, the welfare gap with respect to the GCA has remained around 38 percent for rural areas in Lower Egypt for the last ten years. While the gaps have remained fairly constant through time, their composition has changed dramatically just as it did for urban areas in these regions. Even though differences in households' characteristics still explain a greater component of the total gap, their relative importance has declined through time. In 2000 differences in characteristics explained over 73 percent of the total gap in both regions. Later, in 2009 they explain only 53 (Upper) and 63 (Lower) percent of the gap in rural areas.

Figure 1. Size and Composition of the Welfare Gap between GCA and other Regions³



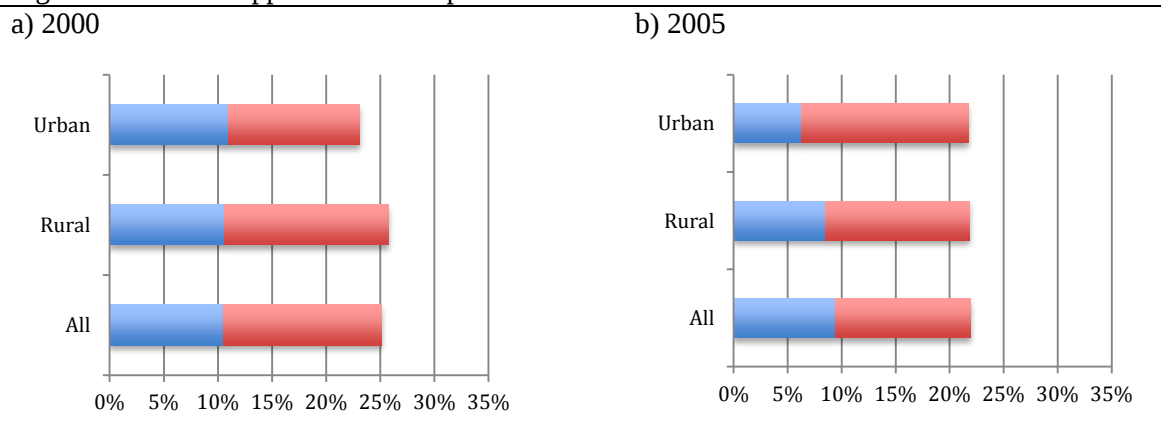
³ In all cases, welfare gaps are depicted in the Figures only if they are significant at least at a 95% confidence level. Figures including all estimates, even if non-significant, are provided in the Annex, including confidence intervals of two standard deviations from the mean.

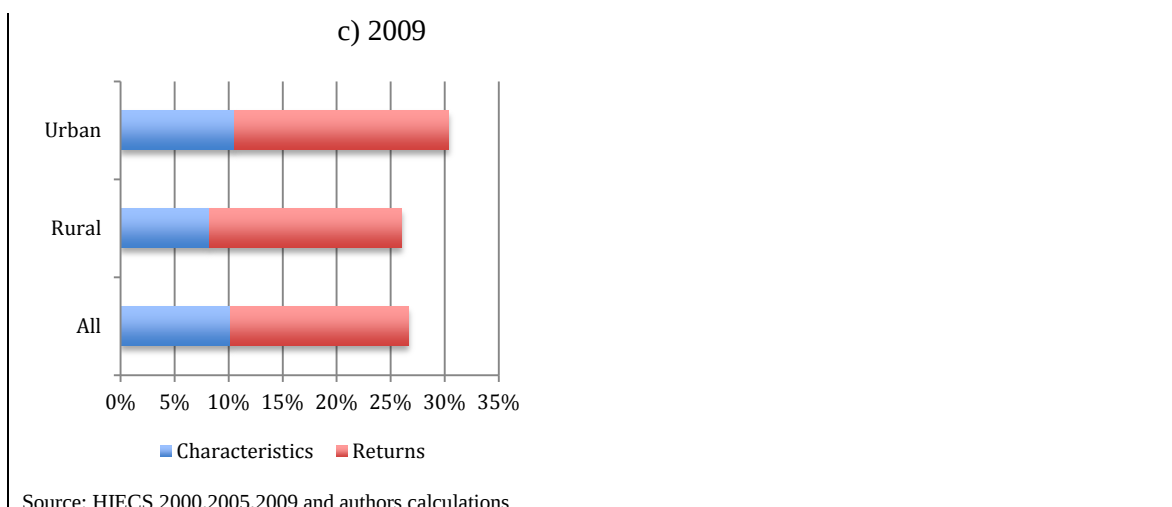


4.1.2 Upper and Lower Egypt: persistent gaps through time

Overall, welfare gaps between upper and Lower Egypt have remained fairly constant through time. While between 2000 and 2005 the gap appeared to have closed slightly by moving from 25 to just below 22 percent, in 2009 increased again going back to levels right above 25%. This increase of the welfare gap between Upper and Lower Egypt seems to be driven by the differences across the two regions particularly in urban areas. In 2000, the welfare gap between Rural areas in Lower Egypt and Upper Egypt was almost 26 percent (figure 2). While this gap decreased slightly to 22 percent in 2005 in came back to 26 percent in 2009. More importantly, the reduction of the gap came mostly from a reduction in the differences in characteristics between the two areas. After 2005, the difference in characteristics has remained constant but the difference in returns increased from 13 percent to almost 18 percent, bringing the total gap back to 2000 levels.

Figure 2. Lower – Upper Welfare Gaps





The story for urban areas in these two regions is quite different with differences in characteristics loosing relative importance in explaining the welfare gap through time. While the total gap between urban areas of Lower and Upper Egypt evidenced only a marginal change of just above one percentage point between 2000 and 2005, the composition of the total gap changed, with differences in characteristics loosing importance in explaining the gap. The increase in the gap in returns seems to be the main driver or the increase in the total gap between urban areas of Lower and Upper Egypt. While the gap in returns was about 12 percentage points in 2000, it had increase to almost 20 percentage points by 2009.

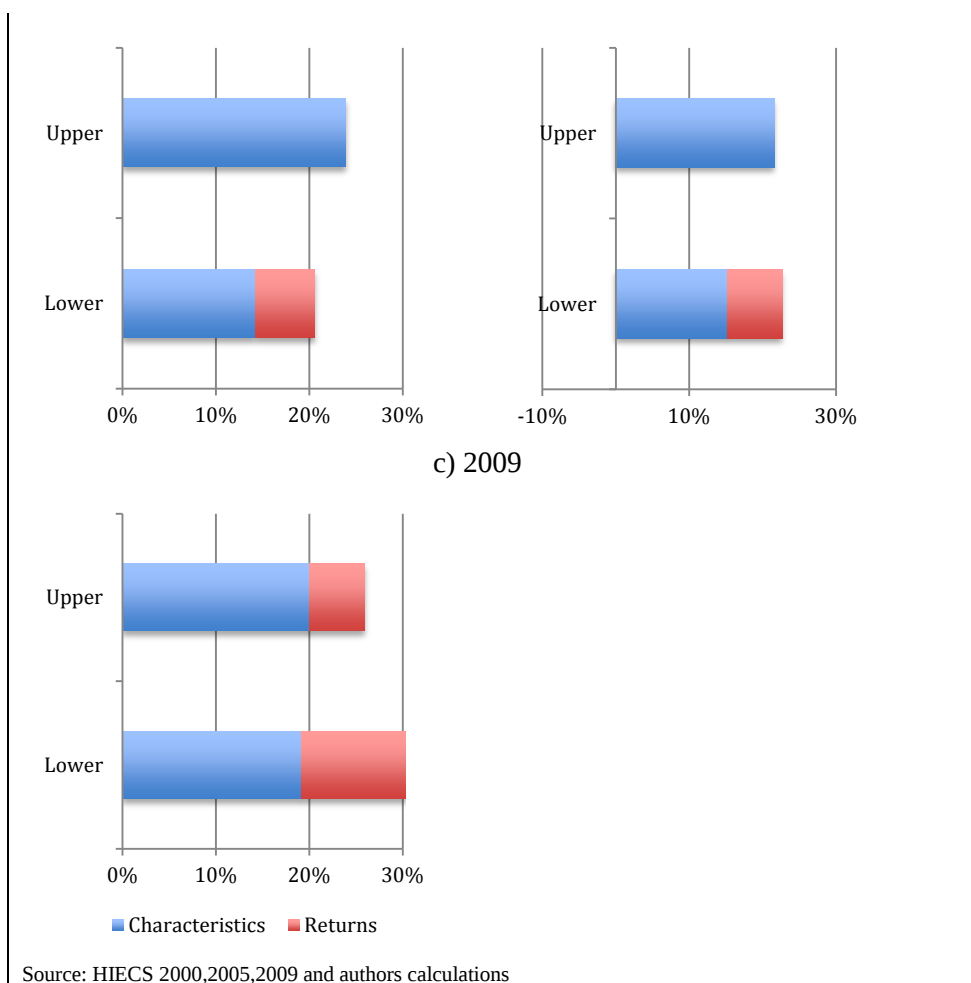
4.2 A look within regions: The Urban-Rural welfare gap

In explaining the urban-rural welfare differentials, characteristics and returns play very different roles in different regions. The Oaxaca-Blinder decompositions shown in Figure 3 below suggests that until 2005, all the welfare gap between rural and urban areas in Upper Egypt could be explained exclusively by differences in households' characteristics. Through time, this difference in household characteristics has narrowed, moving to an average of about 20 percent in 2009. It is also interesting that returns appear as a significant determinant of the total gap in Upper Egypt only in 2009, when they explain about 20 percent of the total gap.

Figure 3. Urban-Rural Welfare Gaps

a) 2000

b) 2005



For Lower Egypt, the total gap between rural and urban areas seems to be increasing through time. The composition of the gap has also varied between 2000 and 2009 with the differences in households characteristics losing relative importance in explaining the total gap. While in 2000 differences in characteristics explained about 70 percent of the total gap, in 2009 this percentage went down to about 63. In absolute terms however, the gap in characteristics as well as the gap in returns seem to be increasing, leading to an increase of about 10 percentage points in the total urban-rural gap in Lower Egypt.

4.3 Differences across Welfare Distributions

In this section we explore the welfare differences and their components (characteristics vs. coefficients) by focusing our discussion only on the data for 2005. This choice is based on the fact that the full sample is available only for this year and therefore precision of the estimates for each quantile is expected to be higher than in the cases of 2000 and 2009 when only 25 percent of the full sample is available. Results for 2000 and 2009 are presented for completion in Annex 3. Comparison of the three years may shed some light on the general patterns on the gaps across the welfare distribution and through time.

Although the decomposition at the mean described in the previous section reveals the general pattern of the gap across and within regions, it does not reveal whether the gap and its composition changes across the welfare distribution. A first exploration of the welfare ratio

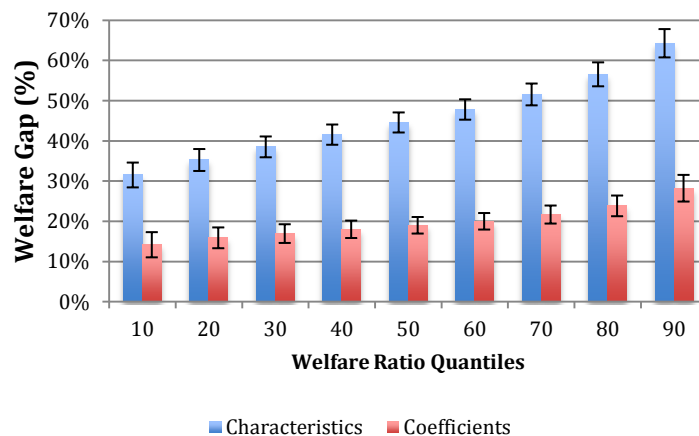
distribution for all regions suggests that the distribution are quite different across regions and therefore an analysis at the mean might overlook considerable heterogeneity of the gap across the welfare distribution.

4.3.1 Across Regions

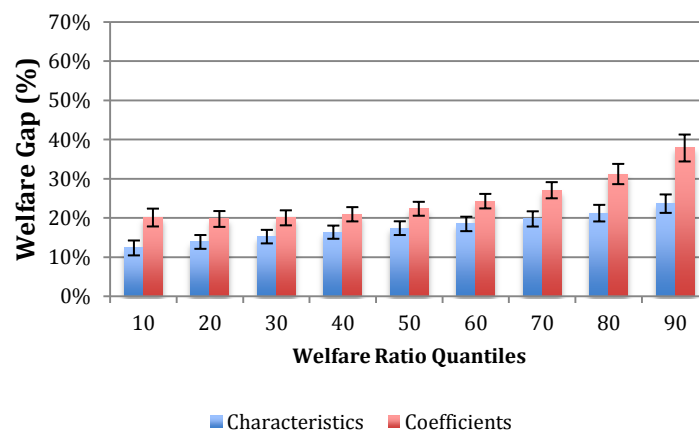
4.3.1.1 Cairo vs Other Regions

Figures 5 through 7 below show the characteristic and coefficients effects of the estimated welfare gap for each decile of the welfare ratio distribution in 2005. The black lines show the confidence intervals for the estimated characteristics and coefficient gaps for a 95 percent confidence level.⁴ It is important to recall that the sum of characteristics and coefficient (returns) effects gives the total welfare gap. Figure 5 below shows the gaps and their components for quantiles one through nine of the welfare ratio. Panel a) gives the gaps between the GCA and rural areas in Upper Egypt while panel b) gives the gaps between the GCA and urban areas in Upper Egypt.

Figure 5. Upper Egypt



a) Upper Rural



b) Upper Urban

⁴ Standard errors are obtained by bootstrapping the results 100 times.

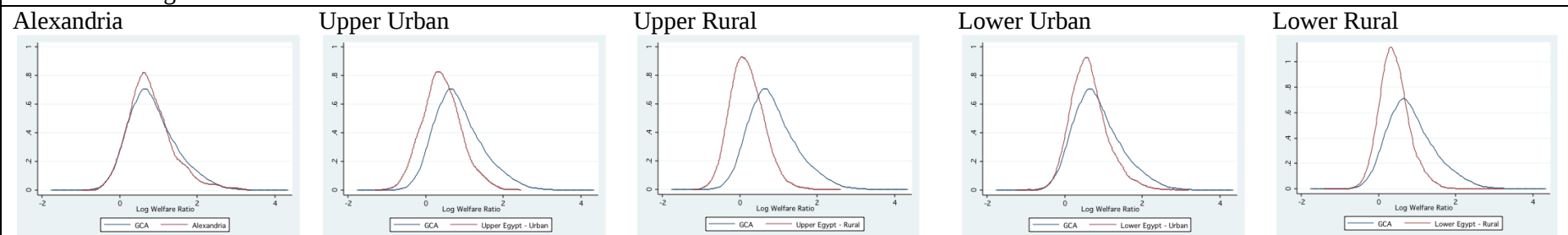
In both cases we see that the characteristics and coefficient (returns) effects are statistically different from each other for each decile. We see this by confirming that the confidence intervals do not overlap. While the main component of the gap with rural areas is with no doubt the differences in characteristics, the main component of the gap between the GCA and urban areas in Upper Egypt is the coefficients or returns effect. It is also interesting to note that when comparing households in the GCA and rural areas in Upper Egypt, the differences in characteristics increases as one moves up in the welfare distribution, as opposed to differences in returns that remains fairly constant and around 20 percent, throughout the welfare distribution. The coefficients effect is slightly higher at around 28 percent for the highest decile.

When looking at urban areas in Upper Egypt we see that the total gap increases as one moves up in the welfare distribution. For quantiles seven, eight and nine, differences in characteristics and returns are highest. As mentioned above, differences in returns are the main components of the total gap for all deciles.

The differences between the GCA and Alexandria show a very different pattern. Total gaps are considerably lower than those for Upper Egypt even when looking only at urban areas (figure 6). Furthermore, for all deciles we observe that the characteristics effect is negative, meaning that households in Alexandria have in fact *better* characteristics (e.g higher education levels). More interestingly, the differences in characteristics between GCA and Alexandria are greater for the lower end of the distribution. The difference for the highest decile is not significantly different from zero. Difference in returns tend to increase as one move up on the welfare distribution, being less than 10 percent for the lowest decile and around 17 percent for quantiles seven and eight. It is important to note as well that the total gap (sum of the characteristics and coefficient (returns) effects) is around zero for the lowest three deciles as the two effects are about the same size and go in opposite directions.

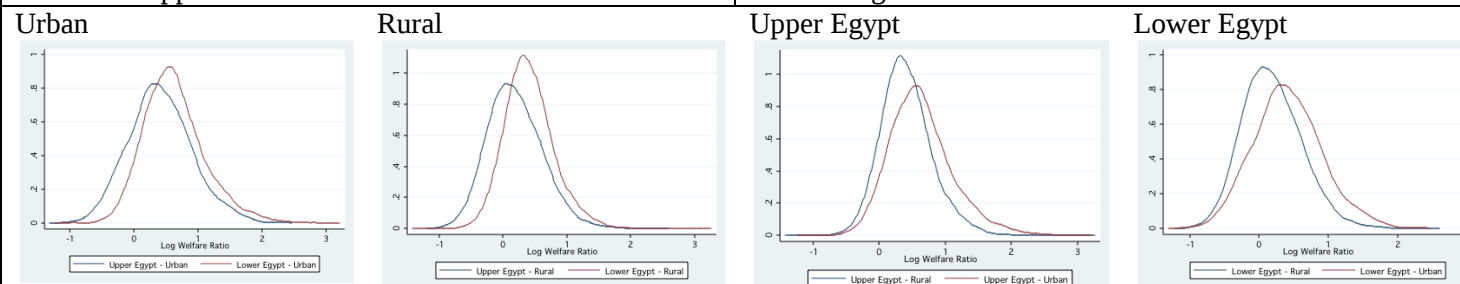
Figure 4. Distribution of Welfare Ratio

GCA-Other Regions



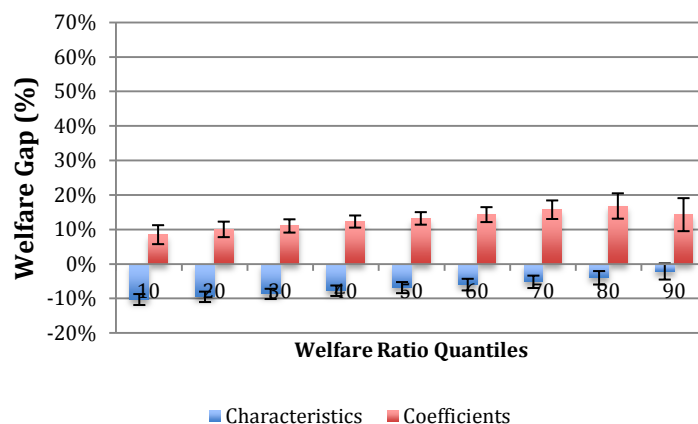
Lower vs. Upper

Within Regions: Rural vs. Urban



Note: Kernel density estimates of the log welfare ratio using an Epanechnikov kernel density. Source: HIECS 2005 and authors' calculations.

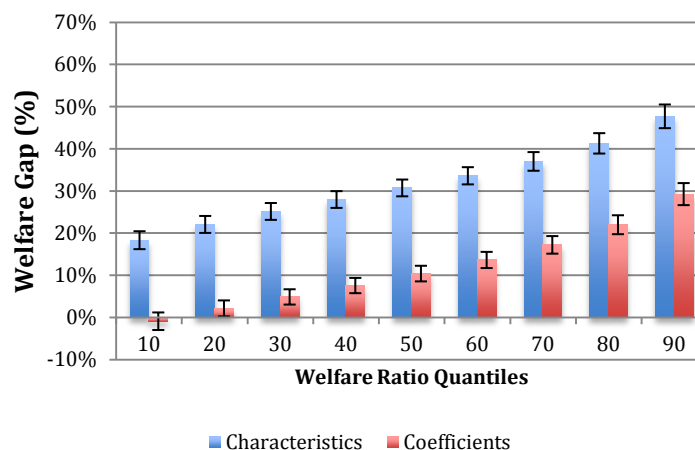
Figure 6. Alexandria



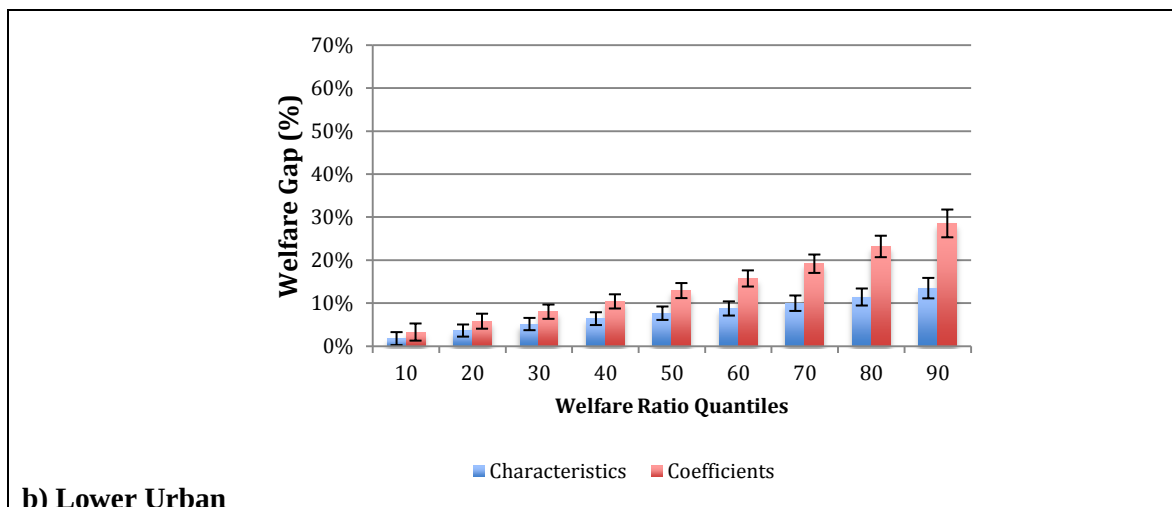
The welfare gaps between the GCA and both rural and urban areas in Lower Egypt suggest that most of the welfare gap with rural areas in Lower Egypt stems from differences in characteristics. This is consistent with the pattern seen for the gaps between the GCA and Upper Egypt (Figure 7). Moreover, just as in the case of Upper Egypt, the gap increases as one moves up in the welfare distribution. While the total gap between households in the lowest decile is less than 20 percent, households in the highest decile in the GCA have welfare ratios around 80 higher than their counterparts in rural areas in Lower Egypt. While differences in returns are a much smaller component of the welfare gap for all deciles, it is also clear that the differences in coefficients increase for higher deciles. For the first decile the difference in returns is not statistically different from zero.

When moving to urban areas in Lower Egypt, differences in coefficients explain most of the gap with households in the GCA. For the poorest population, the total gap seems to be small, i.e. less than 10 percent in all cases. Larger differences are observed for households in the upper end of the distribution with total gaps being above 30 percent. More importantly, the difference in returns explains more than 50 percent of the total gap for deciles six and above.

Figure 7. Lower Egypt



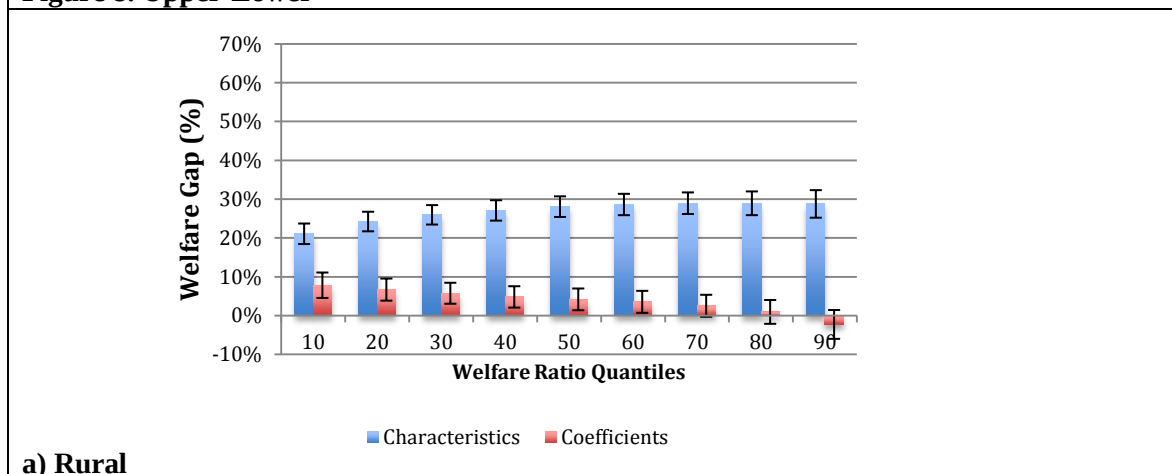
a) Lower Rural

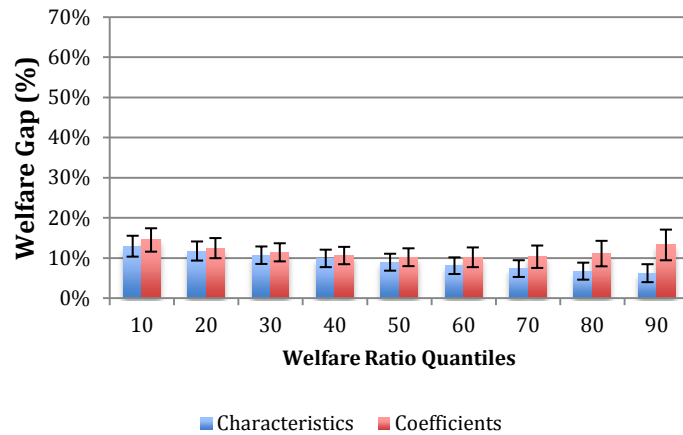


4.3.1.2 Lower vs Upper Egypt

The greatest disparities between Lower and Upper Egypt are evidenced in Rural areas, just as it was observed through the analysis at the mean of the welfare distribution in the previous section (see Figure 8 below). Interestingly, the composition of the effects seems to be fairly similar throughout the welfare distribution. Significant differences are only observed between the lowest decile and deciles four and above, with the difference in characteristics being slightly lower for households at the lower end of the welfare distribution in rural areas. Households in deciles seven through nine in rural areas do not face differences in returns; for these deciles, the total gap between Lower and Upper Egypt is fully explained by differences in households' characteristics. In urban areas, the gap between these two regions is in most cases explained in equal proportions by the two effects. The largest total gap is observed for the lowest decile, at 27 percent. The largest decile, most of the gap is explained by differences in returns.

Figure 8. Upper-Lower



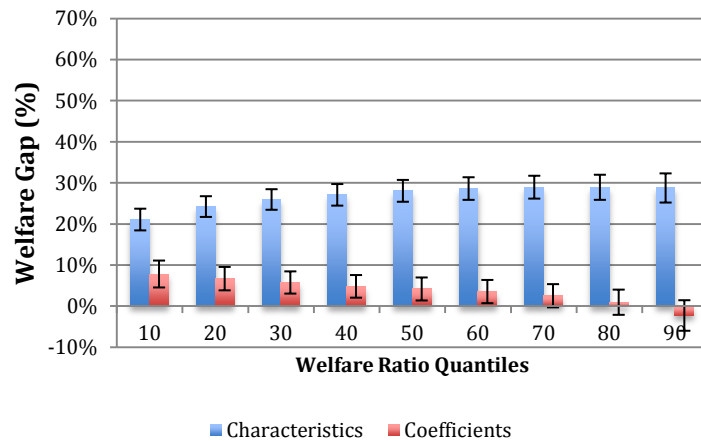


b) Urban

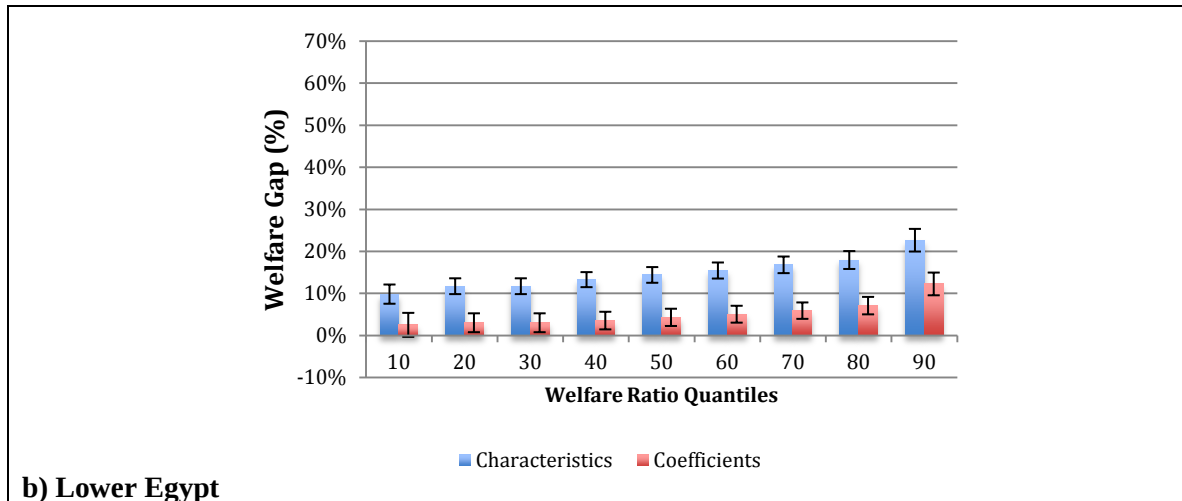
4.3.2 Within regions: Urban vs Rural

Total gaps between urban and rural areas are considerably larger in Upper Egypt than they are in Lower Egypt (see Figures 9 below). While in Upper Egypt the coefficients effect decreases as one moves up in the welfare distribution, indicating that the returns effect is larger for the poor relative to the better off, in Lower Egypt the returns effect increases as one moves up in the welfare distribution. Furthermore, while the characteristic effect also increases for the better off in Lower Egypt, it is fairly constant throughout the welfare distribution in Upper Egypt, except for the lowest decile where the coefficients effect is also lowest.

Figure 9. Urban vs. Rural Areas



a) Upper Egypt



5. Conclusions

In this chapter we looked at the different components of gap in living standards across regions. All factors associated with spatial differences in the welfare ratio are grouped into characteristics and returns effects, following the Oaxaca-Blinder decomposition. The first effect summarizes the attributes of the household while the second summarizes the returns to such characteristics. The analysis was carried out both at the mean and at different points of the welfare distribution. This analysis allows us to explore whether spatial disparities in living standards are explained by the sorting of people with low characteristics (e.g. low education levels) or by differences in returns to such characteristics; identifying the most important component of the welfare gap may shed light on the most appropriate policies to close such gaps.

Urban areas in Egypt are moving in the right direction; welfare gaps between the GCA and other urban areas have declined over time. Moreover, in all cases, while in 2000 the gap was mostly explained by differences in characteristics, today differences in returns explain more than 50 percent of the gap. Greater declines were seen between 2000 and 2005 compared to the following five years. Alexandria stands out when compared to other urban areas, as the analysis at the mean suggests that the gap has closed. Urban areas in Lower Egypt have caught up with the GCA considerably faster than those in Upper Egypt. While households in urban areas in Lower Egypt have no significant differences in characteristics when compared with the GCA, households in urban areas in Upper Egypt still have a considerable gap. Today, still 41 percent of the gap stems from differences in characteristics.

As expected, the story is quite different when comparing urban and rural areas. The total gap in living standards between rural areas in Lower and Upper Egypt and the GCA has remained fairly constant through time, around 38 and 65 percent respectively. In both cases, the differences in characteristics seem to be the main driver of the gap. When looking into one single region, the story seems to be consistent in that differences in characteristics are the main drivers of urban-rural gaps. However, it is important to note that gaps show a tendency to increase through time, which seems to be driven by increases in the returns component of the gap.

Our quantile analysis suggests that there is considerable heterogeneity in the gaps across the welfare distribution. While the general conclusions regarding the relative importance of endowments and coefficients effect hold in most cases across the welfare distribution, the total

size of the gap with the GCA seems to increase with wealth in all cases. Just as suggested by the analysis at the mean, for all quantiles in urban areas, the main component of the gap is the coefficient effects, while for rural areas the main component of the gap is the endowments or characteristics effect.

Our analysis suggests that efforts for improving education and access to services across Egypt have paid off, in particular in urban areas. Efforts in this line should continue, with special emphasis in both urban and rural areas in Upper Egypt as well as rural areas in Lower Egypt. The fact that for urban areas the returns component has become the main source of the welfare gap suggests that in such cases, location is gaining importance as a determinant of welfare. This result may point towards the existence of agglomeration effects in the GCA that are not present in other urban areas in Egypt. However, given that the result holds also when comparing urban areas of Upper and Lower Egypt, it may also point out at the presence of better infrastructure and other geographically correlated attributes that contribute to higher productivity in these areas.

6. References

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7. Annex 1 – Quantile Decomposition: technical details

As mentioned in the main text, we use the quantile decomposition suggested in Melly (2006). While other methodologies are used in the literature (e.g. Juhn, Murphy, and Pierce 1993, DiNardo, Fortin, and Lemieux 1996, Lemieux 2002, Machado and Mata 2005, among others) the methodology in Melly (2006) is appealing for different reasons. First, it accounts for heteroskedasticity, overcomes the curse of dimension, and is more efficient than the Machado and Mata (2005) estimation method (see Melly 2006 for an in depth discussion). This methodology is based on the estimation of the marginal density function of the log welfare ratios in a region implied by the counterfactual distribution of the households' characteristics. Melly's (2006) methodology can be summarized in four steps. Let first define $F_Y(q)$ and $f_Y(q)$ as the cumulative distribution function of random variable Y at the value of q and its corresponding probability density function, respectively. Then, the inverse of $F_Y(\cdot)$, $F_Y^{-1}(\theta)$, is the corresponding quantile function evaluated at quantile $0 < \theta < 1$. Then, the estimation steps are as follows:

1. Estimate $F_{Y(t)}^{-1}(\tau | X_i) = X_i \beta_t(\tau)$ where $0 < \tau < 1$. According to Koenker and Bassett (1978) the coefficients $\beta_t(\tau)$ can be estimated as $\hat{\beta}_t(\tau) = \arg \min_{b \in \mathbb{R}^K} n_t^{-1} \sum_{i:T_i=t} \rho_t(Y_i - X_i b)$, where $\rho_t(z) = z(\tau - 1(z \leq 0))$ with $1(\cdot)$ being the indicator function.

2. Estimate $F_{Y(t)}(\cdot | X_i)$ by $\hat{F}_{Y(t)}(q | X_i) = \int_0^1 1(X_i \hat{\beta}_t(\tau) \leq q) d\tau = \sum_{j=1}^J (\tau_j - \tau_{j-1}) 1(X_i \hat{\beta}_t(\tau_j) \leq q)$,

where $\hat{\beta}_t(\tau)$ prevails in the interval between τ_{j-1} and τ_j with τ_j being the point where the solution changes.

3. $\hat{F}_{Y(t)}(q | T=t) = \int \hat{F}_{Y(t)}(q | x) dF_X(x | T=t) = n_t^{-1} \sum_{i:T_i=t} \hat{F}_{Y(t)}(q | X_i)$

4. $\hat{q}_t(\theta) = \inf \left\{ q : n_t^{-1} \sum_{i:T_i=t} \hat{F}_{Y(t)}(q | X_i) \geq \theta \right\}$, and the counterfactual quantile becomes $\hat{q}_c(\theta) = \inf \left\{ q : n_t^{-1} \sum_{i:T_i=b} \hat{F}_{Y(a)}(q | X_i) \geq \theta \right\}$.

Therefore, the Oaxaca-Blinder decomposition evaluated at quantile $\tau = \theta$ can be expressed as

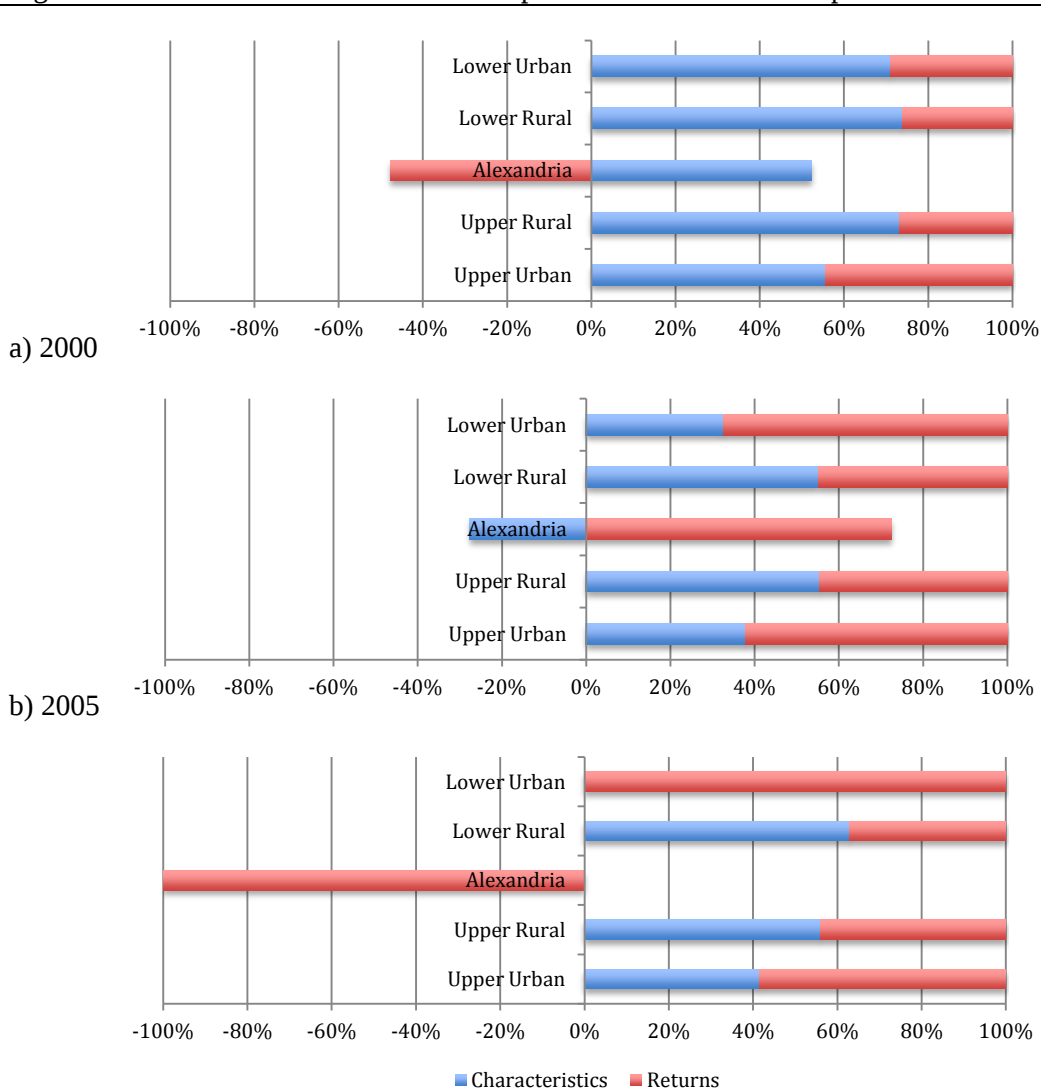
$$\hat{q}_b(\theta) - \hat{q}_a(\theta) = [\hat{q}_b(\theta) - \hat{q}_c(\theta)] + [\hat{q}_c(\theta) - \hat{q}_a(\theta)] \quad (4)$$

Standard errors are obtained by bootstrapping the results 100 times.

8. Annex 2

Figures A1 through A3 provide an alternative representation of the composition of the welfare gap. While these graphs do not show information about the size of the gap (or their components) they serve as a quick way to identify the relative contribution of characteristics and coefficient effects to the total gap. They are provided as complements to the graphs in the text that do show the actual size of the estimated gap.

Figure A1. Characteristics vs. Returns Components of the Welfare Gap: GCA vs other regions



Source: HIECS 2000,2005,2009 and authors calculations

Figure A2. Lower – Upper Welfare Gaps

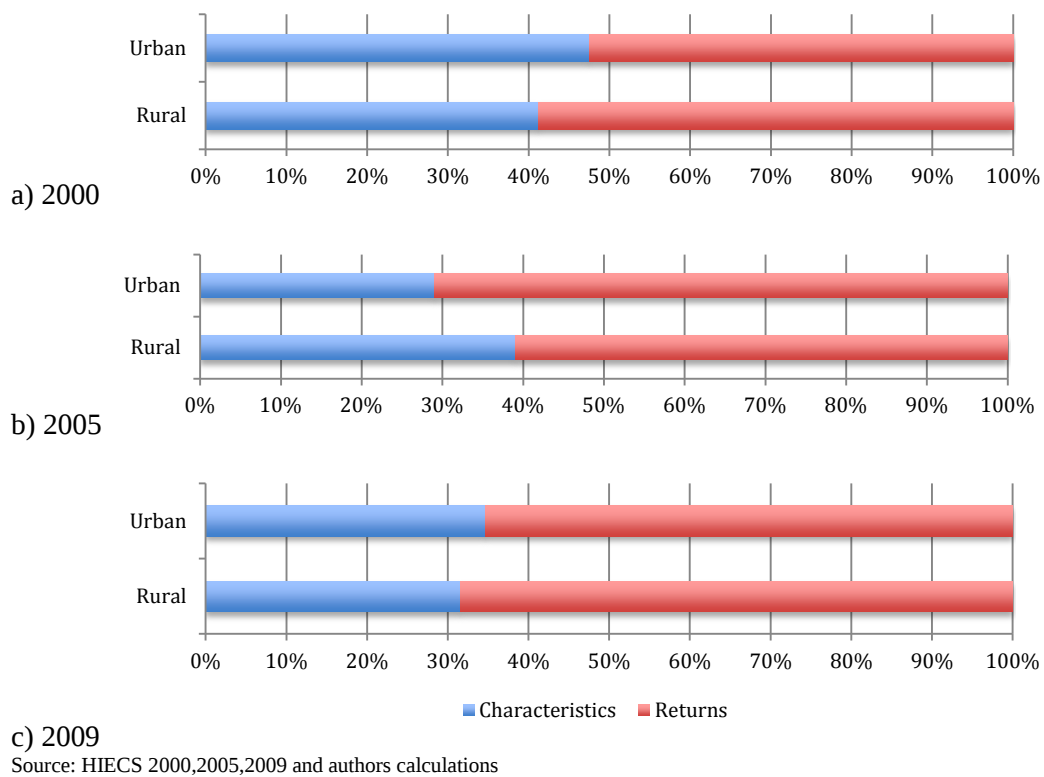
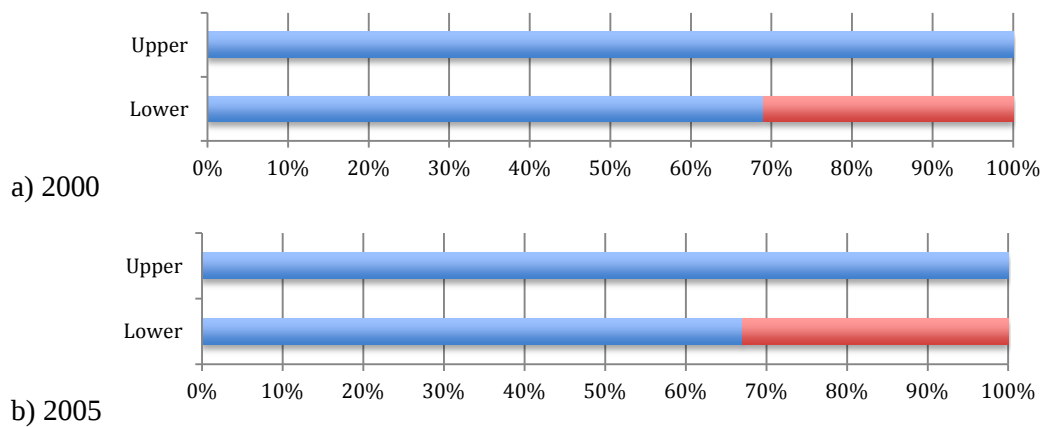
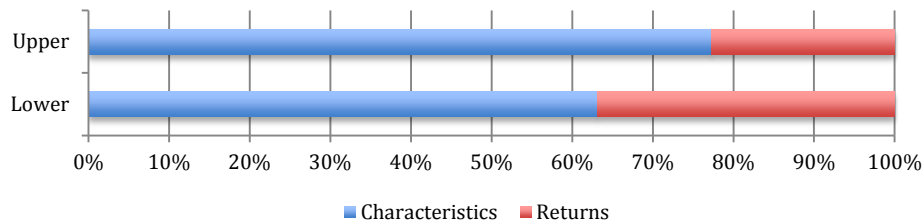


Figure A3. Urban-Rural Welfare Gaps





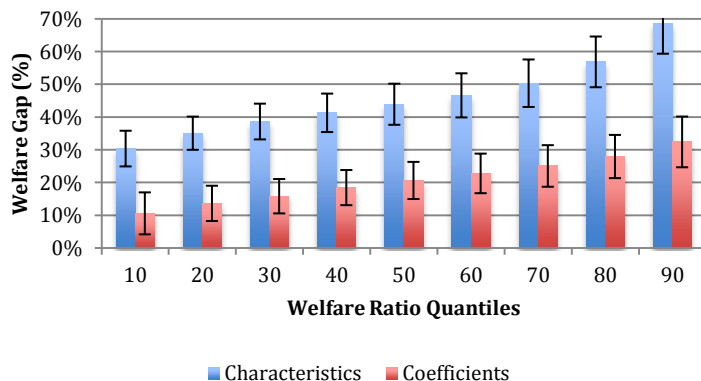
c) 2009

Source: HIECS 2000,2005,2009 and authors calculations

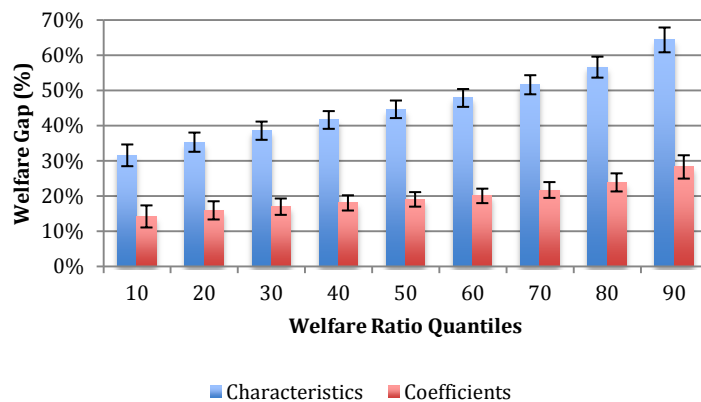
Annex 3. Quantile Decompositions and the Time Dimension

Figure A4 below suggests no drastic changes through time in the composition or size of the welfare gap between the GCA and rural areas in upper Egypt. Interestingly, the difference in characteristics has remained fairly constant through time, for all deciles of the welfare distribution.

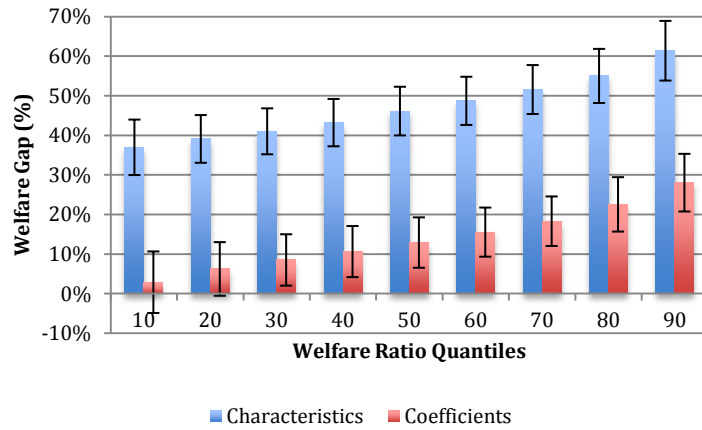
Figure A4. GCA-Upper Egypt (only Rural)



a) 2000



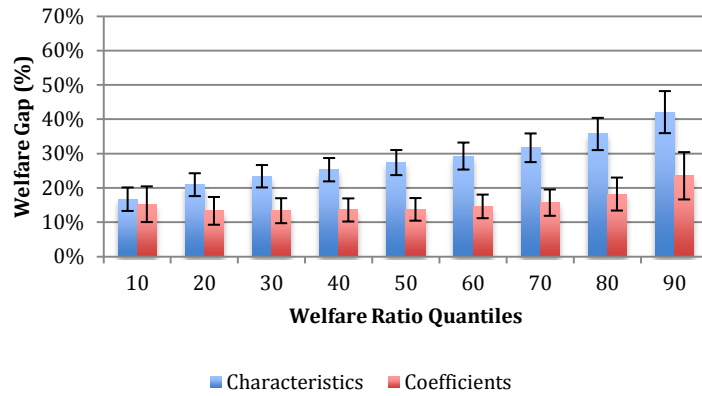
b) 2005



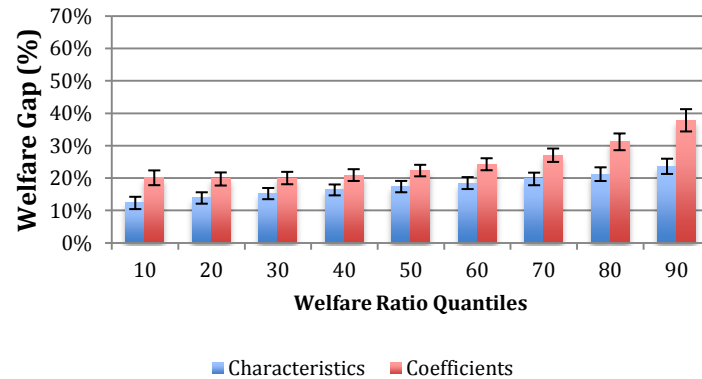
c) 2009

Between 2000 and 2005, the main component of the welfare gap changes, following the same results found for in the analysis over the mean. Between 2005 and 2009, no drastic changes are observed; the coefficient component remains the most important component of the welfare gap across quantiles. Furthermore, the size of the gap remains fairly constant.

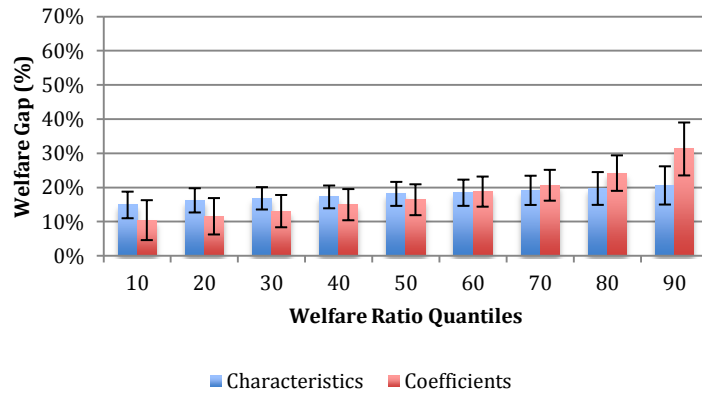
Figure A5. GCA-Upper Egypt (only Urban)



a) 2000



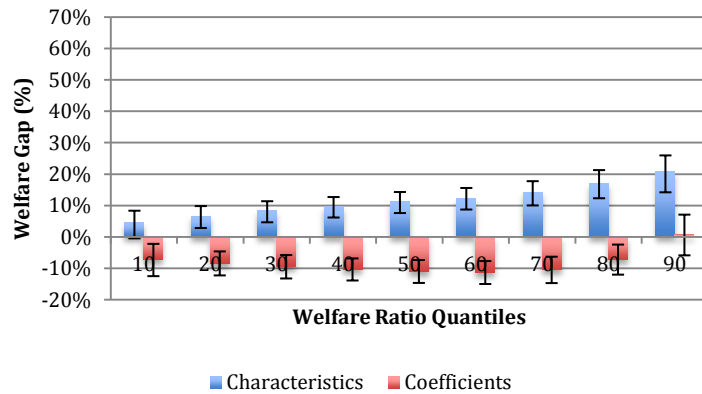
b) 2005



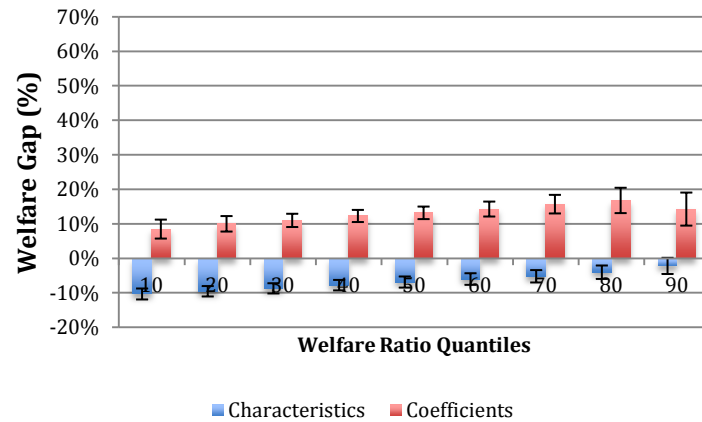
c) 2009

The changes though time of the welfare gap between GCA and Alexandria are considerable. Starting from positive gaps in 2000, which were mainly explained by gaps in characteristics, the gap has closed for almost all quantiles of the welfare distribution. A small gap remains between the lowest deciles of the welfare distribution, with returns to characteristics being higher in Alexandria.

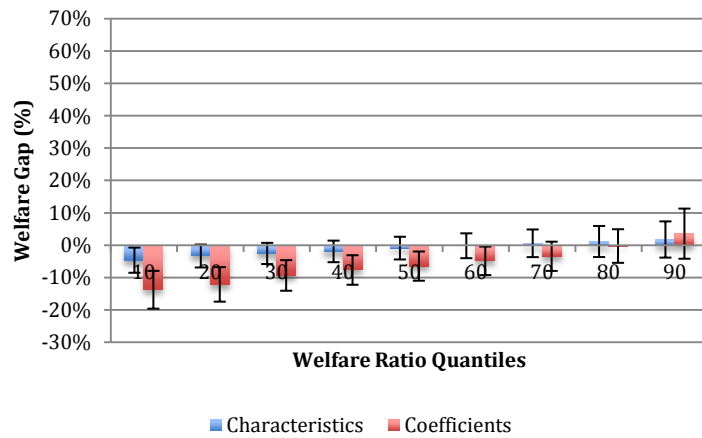
GCA-Alexandria



a) 2000



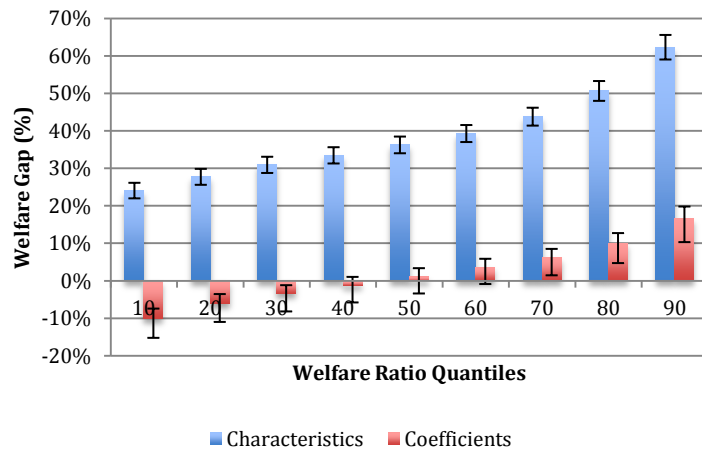
b) 2005



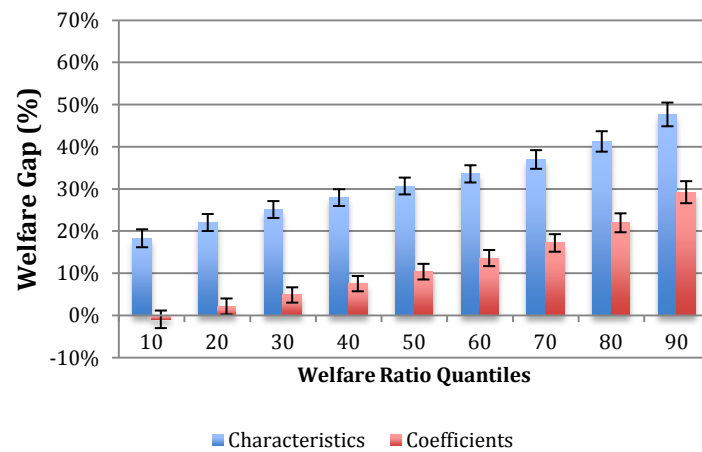
c) 2009

The total gap between GCA and rural areas in Lower Egypt has decreased through time. This changed has occurred across the welfare distribution; the difference in characteristics has remained through time as the main component of the welfare gap for all deciles.

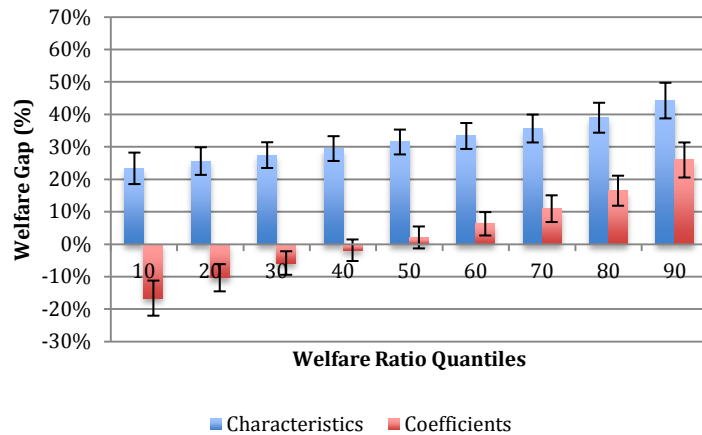
GCA-Lower Egypt (only Rural)



a) 2000



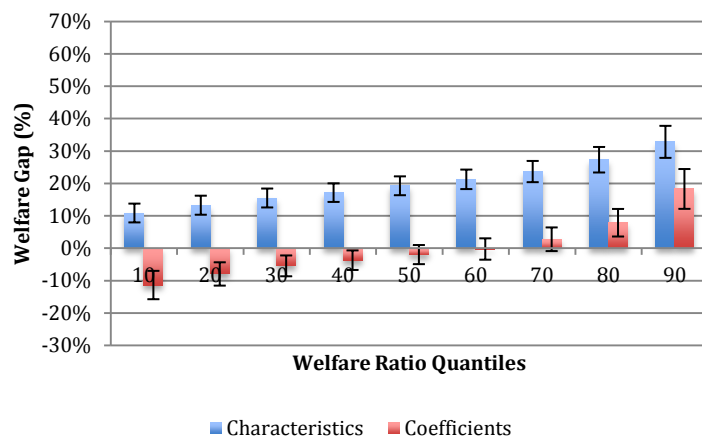
b) 2005



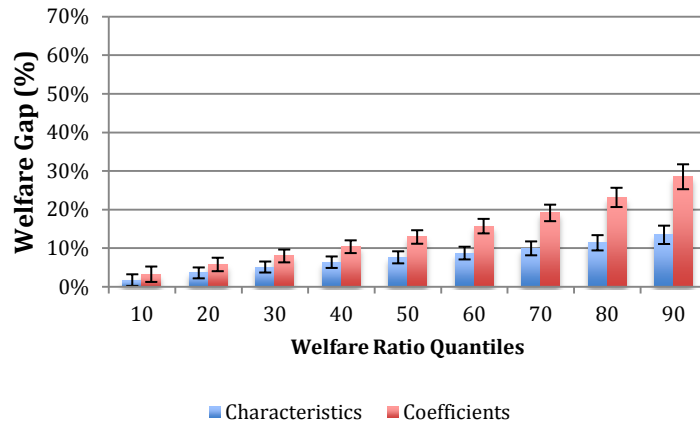
c) 2009

The most important characteristic of the time evolution of the welfare gap between GCA and urban areas in Lower Egypt is the fact that while the total welfare gap has remained fairly constant its components have changed dramatically. In 2009, the coefficients component for quantiles four and above increased considerably suggesting higher returns for this quantiles in the GCA. Moreover, by 2009, for these quantiles, the differences in characteristics reverted suggesting that if households in the GCA had the characteristics of households in urban areas in Lower Egypt, their welfare would be around 20 percent higher.

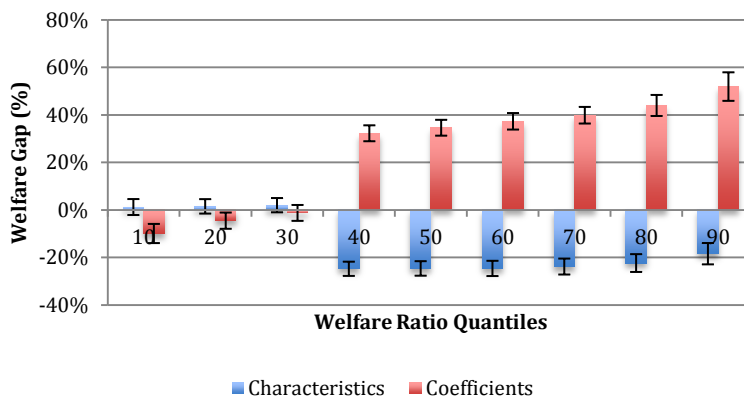
GCA-Lower Egypt (only Urban)



a) 2000



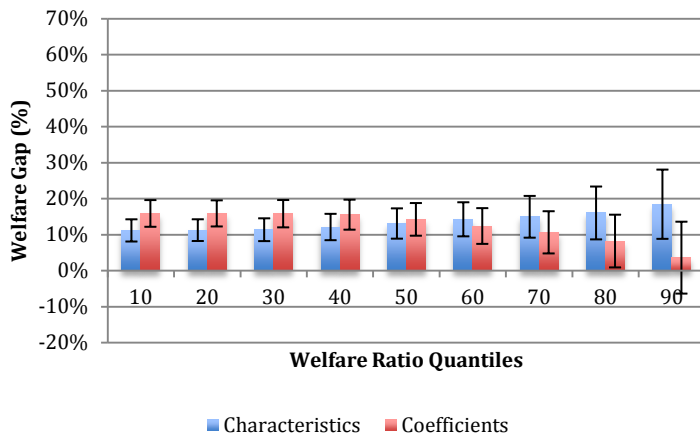
b) 2005



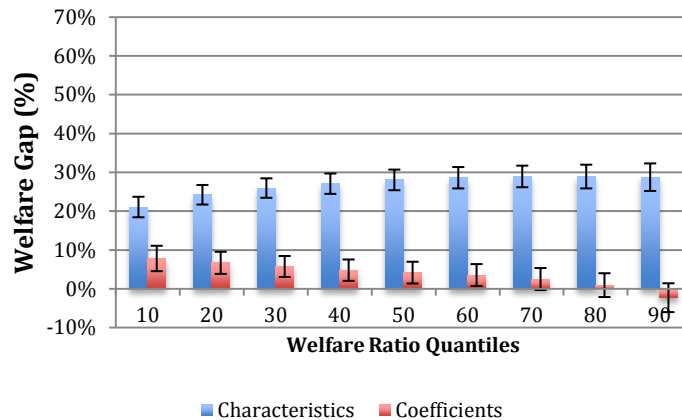
c) 2009

The composition of the welfare gaps between rural areas in Lower and Upper Egypt has changed considerably through time with the coefficients effect gaining importance in 2009. While differences in characteristics have shown a tendency to decrease the coefficients effect has shown a tendency to increase. This tendency has been even stronger for the lower end of the distribution of the welfare ratio.

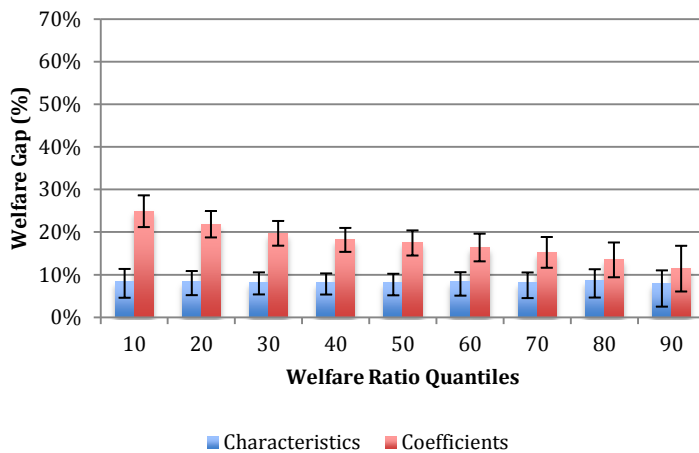
Lower-Upper (Rural areas)



a) 2000



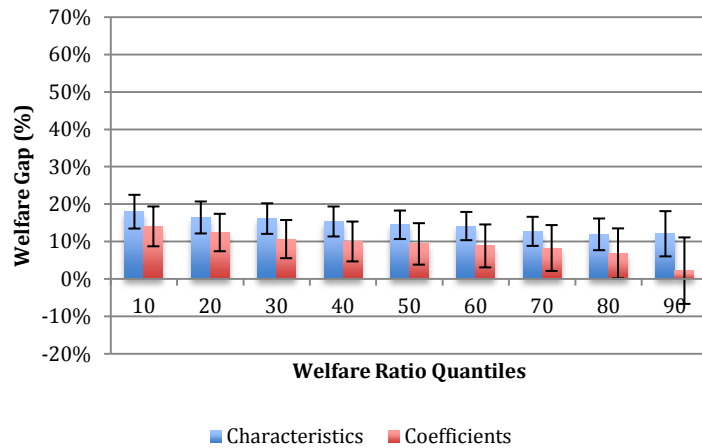
b) 2005



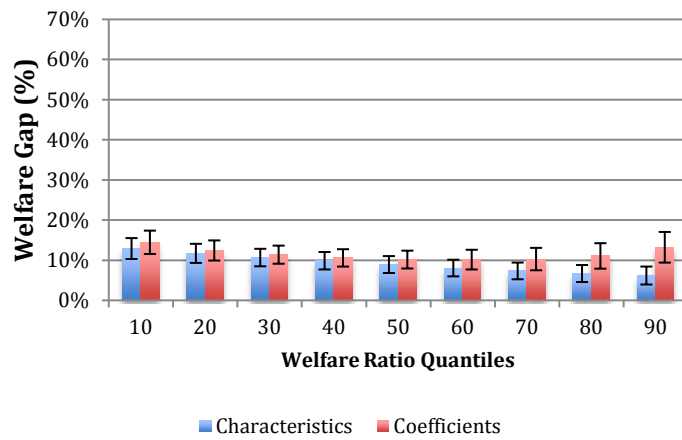
c) 2009

An important characteristic variation over time of the components of the gap between urban areas in Lower and Upper Egypt is that while in 2000 and 2005, the characteristics and coefficient effects were not significantly different from each other for each decile (confidence intervals overlapped), by 2009 the coefficient effects have become statistically different in size from the characteristics effects, and in fact, the most important component of the welfare gap accros urban areas of these two regions.

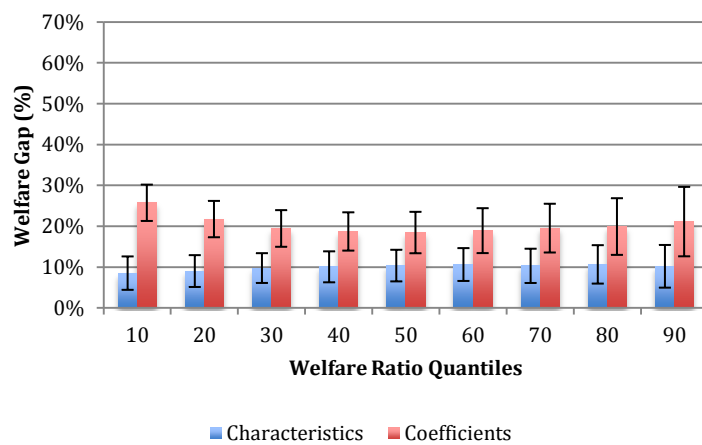
Lower-Upper (urban areas)



a) 2000



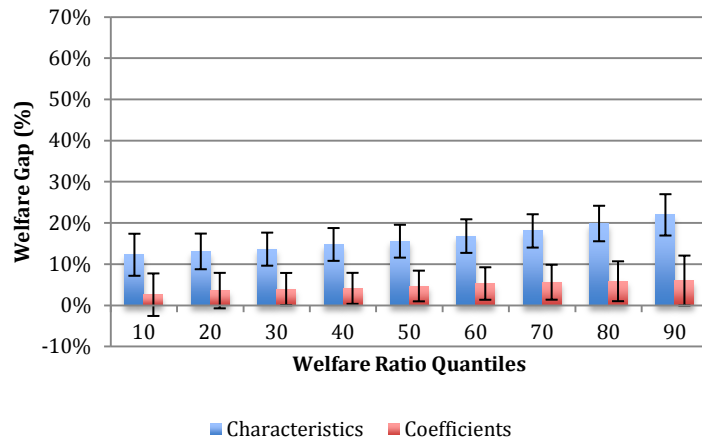
b) 2005



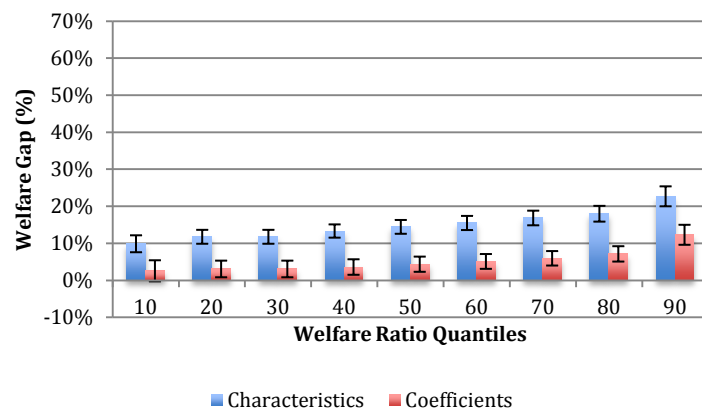
c) 2009

Urban-rural gaps in Lower Egypt are largely explained by differences in characteristics. For the lowest deciles, differences in returns have lost significance through time. However, for the largest quantiles, returns to characteristics seem to be higher in rural areas.

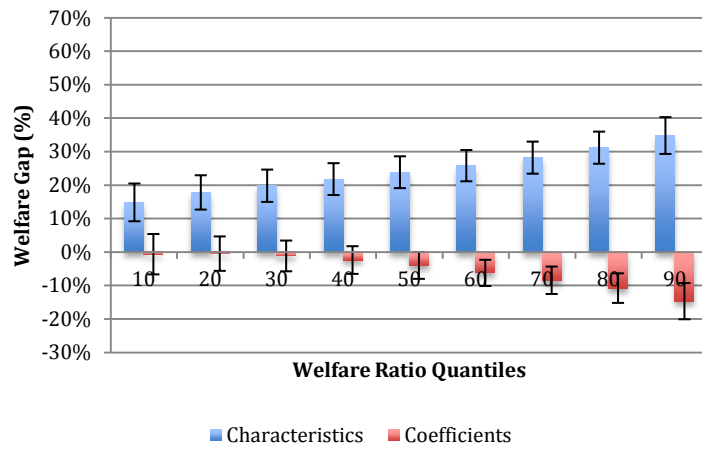
Lower Egypt: Urban-Rural Gaps



a) 2000

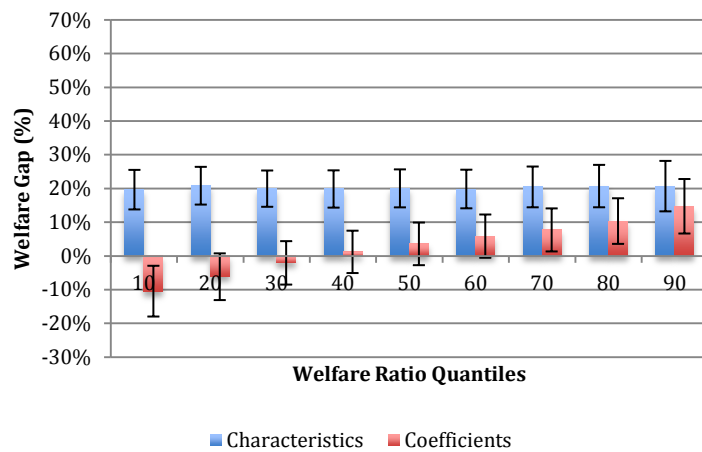


b) 2005

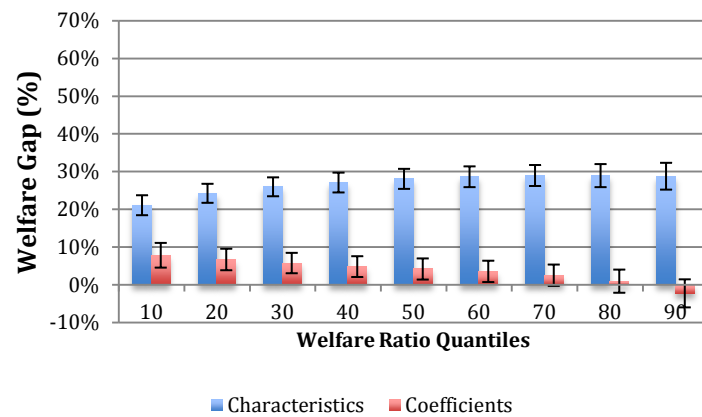


c) 2009

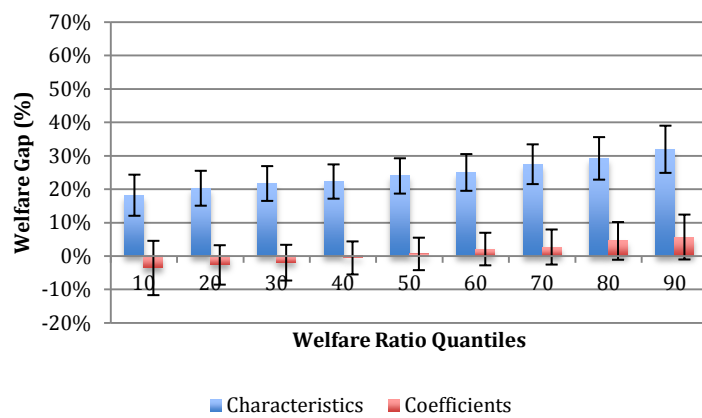
Upper Egypt: Urban-Rural Gaps



a) 2000



b) 2005



c) 2009

EQUALITY OF OPPORTUNITY FOR CHILDREN IN EGYPT, 2000-2009: ACHIEVEMENTS AND CHALLENGES

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March 2012

Middle East and North Africa Economic
and Social Development (MNSD)
The World Bank

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EQUALITY OF OPPORTUNITY FOR CHILDREN IN EGYPT, 2000-2009:

ACHIEVEMENTS AND CHALLENGES

C.E.Velez, H. El-Laithy, and S. Al-Shawarby

SUMMARY

Children's access to human development opportunities today will determine to a large extent Egypt's future development path. Egyptian children and youth comprise a third of the population, and those living in poverty are more likely to be deprived of the most basic opportunities for human development – namely, health, education, labor skills, basic shelter, and sanitation – and less likely to lead healthy, productive lives and escape poverty when they are adults. This unfair and inefficient situation justifies the concern for the equitable human development of Egyptian children and youth, and this report measures access to 17 basic opportunities for the first time. This chapter seeks to diagnose whether public policies are expanding opportunities equitably, and to identify the most important demographic and regional circumstances for efforts to improve targeting mechanisms for children.

To measure the extent to which circumstances beyond the individual's control feed into inequality of opportunities for human development of children and youth, we use the Human Opportunity Index (HOI). The HOI rewards the expansion of access and penalizes inequality of opportunity. Equality of opportunity means that a person's chances to succeed in life (access to basic services, education, a quality job, and adequate consumption levels) should be unrelated to predetermined circumstances at birth such as gender, location of birth, and socioeconomic and demographic origin.

This chapter provides relevant indicators and measurements useful for public policies seeking the expansion of equitable human development opportunities for children and youth by answering five questions: How unequal is the distribution of opportunities for access to essential goods and services for the development of Egyptian children? To what extent has equality of opportunities advanced during the past decade? By how much have the urban-rural and inter-regional gaps in opportunities improved? Which sectors provide better access to opportunities for Egyptian children, and which sectors make it more challenging for children in adverse circumstances? Which demographic and location circumstances of children are most correlated with deprivation of basic development opportunities in Egypt?

The eight main findings of this chapter are:

- Most opportunities for children and youth improved unambiguously during the past decade. Improved opportunities advanced thanks to a combination of better access and more equality of opportunity, but access played the dominant role.
- Improvements in human opportunities for children were uneven across sectors. Although improvement in the opportunity indices of basic housing services and early childhood development were impressive, opportunities in education and nutrition and hunger had modest improvements or worsened.
- Despite the progress made, there are substantial opportunity gaps between children in favorable and unfavorable circumstances. The four largest opportunity

gaps range from 29 to 71 percentage points. In order of importance, they are access to sanitation, completion of secondary education on time, non-overcrowded housing, and access to telephone.

- Although urban centers offer better opportunities for Egyptian children, the urban-rural gap was partially reduced during the decade. In 2009, there were significant urban-rural opportunity gaps for all HOI indices and they were particularly large for basic housing services and early childhood development HOIs (except immunization vaccines, lighting and cooking energy sources).
- In the Metropolitan region, children enjoy better opportunities than in other regions of the country; nevertheless, the inter-regional gap was narrowed during the decade. The Upper Egypt region experienced the largest gains and jumped one place in the inter-regional ranking, and Lower Egypt reached levels of opportunity in education and nutrition more comparable to the Metropolitan region.
- The five most unequalizing circumstances are parents' education, income per capita, urban-rural location, number of siblings, and regional location. These are at least twice as important as gender, presence of elderly family members, and presence of both parents in the household.
- The most unequalizing set of circumstances differs across sectors; therefore, policy makers should adjust targeting mechanisms accordingly.
- For nearly all opportunities (14 of 16), demographic circumstances considered jointly lead to greater inequality than location circumstances.

Four policy recommendations follow from these findings:

- The fact that the most unequal set of circumstances varies across sectors must be disseminated and discussed with government officials as a key reference to revise targeting designs *within each sector*, in order to remove the barriers to access for children in the most unfavorable circumstances and improve equality of opportunity. Special attention should be paid to children with more than two or three unfavorable circumstances because the cumulative effects multiply the barriers to access.
- An agenda for reforming expensive and inequitable subsidies for food and fuel is clearly justified in order to promote equality of opportunity among Egyptian children. The relatively poor performance of the HOI nutrition indicators (non-stunting, 2-17, and non-wasting, 0-4), and the poor targeting of food subsidies are good reasons to reform those programs.
- Moreover, the substantial resources that could be saved in the fuel and food subsidy programs might be devoted to conditional cash transfer nutrition programs, which would compensate for the most unfavorable circumstances (income per capita and number of siblings) that have been found to prevent access to nutrition opportunities.
- Finally, to increase awareness of inequality of opportunities among stakeholders and policy makers, the computation of opportunity indicators should be updated and disaggregated. HOIs available by sub-region and municipality -using census data- would provide relevant information to sub-national governments to

implement more equitable policies for human development.

1. Introduction

Children's access to human development opportunities today will determine to a large extent their country's future development path. Today, income poverty among Egyptian children, the single largest group of the Egyptian population (more than one-third), is higher than for the entire population, and has been increasing during the past decade. Moreover, there is evidence that children living in poverty are more likely to be deprived of the most basic opportunities for human development – namely, health, education, labor skills, basic shelter, and sanitation – and less likely to lead healthy, productive lives and escape poverty when they are adults. As Nobel laureate James Heckman (2008) shows, early childhood interventions that improve health and social, emotional, and cognitive abilities enhance a wide range of outcomes later in adulthood (e.g., school achievement, labor productivity, and health status) and, moreover, reduce crime and prevent teen pregnancy. There is evidence that these kinds of interventions at the start of the life-cycle have the highest rates of return (*vis-à-vis* all other social programs), because they reduce the costs of expensive measures to alleviate problems later in life.² Hassine (2009) shows that inequality of opportunity accounts for 30-40 percent of total inequality of earnings. Moreover, a recent study (Rocco et al., 2011) finds that malnutrition in Egypt is one of the main factors behind chronic diseases in adults, and that those diseases cause sizeable reductions in employment, imposing major efficiency losses on the economy. In summary, there are both equity and efficiency reasons that justify the concern about the availability and equity of human development for Egyptian children and youth. This chapter measures them for the first time.

The main objective of this chapter is to diagnose whether public policies are expanding and allocating opportunities equitably, and identify which demographic and regional circumstances should be considered to improve targeting mechanisms. This chapter measures the extent to which circumstances beyond the individual's control feed into inequality of opportunities for the human development of children and youth. *Equality of opportunity* means that a person's chances to succeed in life (access to basic services, education, a quality job, and adequate consumption levels) should be unrelated to predetermined circumstances at birth such as gender, location of birth, and socioeconomic and demographic origin.³ Comprehensive measurement of the levels and changes in inequality of opportunity in Egypt informs the policy debate in the search for a more equitable society. In addition, acting on reducing inequality of opportunity today might prove effective for reducing future inequality of outcomes in the medium and long term—such as income and employment status.

This chapter aims to provide answers to the following questions: How unequal is the distribution of opportunities that are essential goods and services for the development of Egyptian children? To what extent has equality of opportunities advanced during the past decade? By how much have the urban-rural and inter-regional gaps in opportunities improved? Which sectors provide better access to opportunities for children in Egypt, and

² See Carneiro and Heckman (2003), Schweinhart (2004), Federal Interagency Forum on Child and Family Statistics (2007), Heckman and Masterov (2007), WHO (2007), Heckman (2008), and Kilburn and Karoly (2008).

³ See Roemer (1998), Barros et al (2008) and Molina et al (2010).

which sectors make it more challenging for children in adverse circumstances? Which demographic and location circumstances are most correlated with deprivation of basic development opportunities in Egypt?

To measure equitable access to opportunities, we use the Human Opportunity Index (HOI) to examine the evolution of 17 basic opportunity indicators grouped in four sectors: four HOIs linked to education, six to basic housing services, four to early childhood development, and three to nutrition and hunger. These 17 indicators cover human development milestones at the three stages of the life-cycle between birth and 17 years of age: infancy, childhood, and adolescence. The selected indicators take into account two criteria: relevance to wellness and quality of life for children and youth and their responsiveness to public policies.

Section 2 of this chapter summarizes the facts about the poverty, inequality, and deprivation of Egyptian children, and describes the most important programs for children's human development in the recent past. Section 3 explains the Human Opportunity Index methodology, the 17 opportunities to be assessed, and the set of individual circumstances selected given the data availability for Egypt. Section 4 presents the trends in the opportunities (national, urban-rural, and regional), and the main opportunity gaps across regions. Section 5 describes the main opportunity gaps across individual circumstances, identifies the most critical circumstances for the inequality of opportunities, and explores whether public expenditures across sectors (trends and targeting) are consistent with the time trends of opportunities and the evolution of regional opportunity gaps. Section 6 summarizes and concludes.

2. Background

2.1 Poverty, Inequality, and Deprivation

Although income poverty has remained widespread in Egypt during the past decade, inequality has remained relatively low. Poverty affects around 40 percent of the Egyptian population. According to the latest available data, the overall poverty rate was 41.2 percent in 2008/09 compared with 42.6 percent in 1999/2000.⁴ Of all the poor, those in absolute poverty (living under the lower poverty line) increased from 16.7 percent in 2004/05 to 22 percent in 2008/09. However, Egypt's Gini coefficient for consumption expenditure shows persistent improvement in inequality between 1999/2000 and 2008/09 (down from 36 to around 31). Egypt is thus a moderate-inequality country.

Poor children in Egypt today could be tomorrow's poor parents. Unfortunately, absolute poverty rates for children are higher than those for the entire population, and children living in income poor households steadily increased from 21 percent of total children in 1999/2000 to 23.8 percent in 2008/09 (UNICEF, 2010b). There is evidence that poor households are faced with a vicious cycle of poverty and low levels of social mobility (World Bank, 2007). Both the lower education status of the head of household and the level of poverty limit schooling achievement, leading to an intergenerational vicious cycle of poverty and persistently low schooling. The data show that even if a non-poor head of household was illiterate, the household's members have a greater chance of being educated than if he or she was poor. In contrast, the proportion of those with secondary education in

⁴ See World Bank (2007) and World Bank (2011).

households with heads who have secondary education is lower among poor households than non-poor ones (21 versus 43 percent). For university education, the difference in proportions is even greater (24 versus 72 percent). Thus, income poverty inhibits significant social mobility in Egypt.

Many Egyptian children still face important human development challenges. Around 5 million children are deprived of appropriate housing conditions (including shelter, water and sanitation) and 1.6 million children under age 5 suffer health and food deprivation. This was one main finding of one of the few studies that looked at the deprivation of children in Egypt (UNICEF, 2010a). The study used a modified version of the Bristol definitions of severe deprivation to measure child poverty in seven areas.⁵ The prevalence of deprivation of children in Egypt is higher when children live with an uneducated mother, are raised in a household headed by a single parent, or live in a household that has three or more children (UNICEF, 2010a). Finally, the study finds that children living in income poor households are more likely to drop out of school or work, experiencing severe deprivation of education and/or income. Therefore, there is an increasing probability that today's children exposed to deprivation will pass it on to their children in the future. Failure to enhance opportunities for children today will require costly remedies tomorrow.⁶

Although health deprivation has remained almost unchanged, food and information deprivation have deteriorated. Children's risk of suffering health deprivation remained almost the same between 2000 (2.9 percent) and 2008 (2.4 percent), mainly because of the expansion of the national immunization program. Food deprivation deteriorated over time; the prevalence of severe food deprivation drastically increased from 6.3 percent in 2000 to 17 percent in 2008. In addition, the 2008 Egypt Demographic and Health Survey (EDHS) report shows that 29 percent of children in Egypt age 0-4 years showed evidence of chronic malnutrition or stunting, and 7 percent were acutely malnourished. A comparison of the results with the 2005 EDHS suggests that children's nutritional status deteriorated during the period between the two surveys. For example, the stunting level increased by 26 percent.

2.2 Major Public Policy Initiatives Linked to Human Development Opportunities

Multiple public policy programs and policies to enhance the human development of children and youth in Egypt were undertaken during the past decade. Greater attention was given to less privileged segments of the population, including poor children. The initiatives focused on four sectors: social protection, health and nutrition, basic housing services, and education. Nevertheless, in most sectors, public expenditures for human development declined, with the exception of social protection, which expanded substantially. After 2006, the programs devoted nearly all the funds to finance fuel and food subsidies, which are costly and poorly targeted programs.⁷

⁵ Although the Bristol definitions of deprivation regarding shelter, information, nutrition, and education were applicable to Egypt, the Bristol definitions of sanitation, water, and health were less applicable and were modified to reflect the conditions for children in Egypt.

⁶ See Heckman (2000).

⁷ Public investment spending on the main human development sectors (education and health) declined as a share of GDP (from 0.7 and 0.5 percent in 2000 to 0.3 and 0.2 percent in 2009, respectively). This decline

In recent years, the country has reformed laws regulating responsibilities to care for and protect children. It has introduced several important new social programs to promote the physical, social, educational, and emotional well-being of children, and established the Ministry of State for Family and Population and the local Child Protection Committees to safeguard children's rights and welfare. Unfortunately, many reforms have not yielded the expected outcomes, either because they took the form of scattered pilot projects that have not been scaled up, they lack adequate resources, and/or they have not been appropriately and sustainably implemented.

Social Protection

Although the social safety net in Egypt uses considerable resources, public investments targeted to promote the human development of less advantaged children is limited. The country spends around 8 percent of GDP on subsidies and non-contributory social assistance. The great majority of these expenditures are used to finance energy subsidies (5 to 6 percent), bread subsidies (1.5 percent), and subsidies for basic staples under the ration cards (0.6 percent). There is strong evidence that food subsidies are poorly targeted, and a reform to narrow coverage and reduce subsidy leakage could save up to 73 percent of the cost (World Bank, 2010a).⁸ The growth of fuel and food subsidies during the past decade was due to increased international commodity prices and expansion of coverage of food subsidies. The distribution of fuel subsidies is even more regressive: ECES (2010) newsletter figures show that in 2008/09 the richest urban quintile received nearly nine times the amount of subsidies given to the poorest urban quintile. In contrast, cash transfer programs to assist the poor, which if well designed could constitute an important tool to equalize opportunities and improve human capital outcomes for children, represent less than 0.2 percent of GDP. Some are directed to families while others are targeted at children.⁹ The coverage of the social solidarity pension, the main cash transfer program, has significantly widened in recent years, from 540,000 households in 2005 to 1.1 million in 2008 and 1.5 million in 2010.¹⁰

Education

The government issued the National Framework for Education Policies, which it expanded later into the "National Strategic Plan for Pre-University Education Reform in Egypt (2007/08 – 2011/12)." But it did not receive enough resources to be appropriately materialized. In 2008, the "National Authority for Quality Assurance" and the "Accreditation and a Professional Academy for Teachers" were established to improve the performance of schools and teachers. So far, only 1,055 schools of a total of 30,000 have been accredited. There were also some important pilot projects, like the Girls Education Initiative, which was launched in the early 2000s to increase girls' enrollment in primary education in targeted communities, and the Early Childhood Education Enhancement project, which improves readiness for school for 4 to 5-year-old children, particularly those

more than offset the increase in private sector investment in these sectors, reducing total investment from 1.0 and 0.7 percent of GDP to 0.8 and 0.6 percent, for education and health, respectively, over the same period.

⁸ See World Bank (2010).

⁹ The transfers are made on a regular monthly basis, on a temporary basis, or as a one-time transfer.

¹⁰ The minimum and maximum monthly values of the pension increased from LE70 to LE85 and from LE100 to LE120, respectively. In 2008, a monthly school allowance of LE20 was introduced for the children of these families, provided they go to school; the allowance was increased to LE40 in 2009.

at risk because of poverty and disabilities. Although they have been successful, both projects have been implemented only on a small scale, and need more resources to be scaled up at the national level.

Health and Nutrition

Since the 1990s, there has been a voluntary health insurance scheme for 0 to 5-year-old children for five Egyptian pounds/year, and universal health insurance for children enrolled in schools (the lowest health-risk group). Yet, 0 to 5-year-old children whose parents are not aware of the existence of the voluntary program (probably the poor, especially in remote areas) and dropouts (most likely poor children) are not covered by any health insurance. There are two major programs that address child health. First, the nation-wide Family Health Model (FHM) brings high quality, integrated primary healthcare services under the same roof for the entire family. It started in 2002/2003 and fleshed out in 2006. Second, the nation-wide Integrated Management of Childhood Illnesses promotes accurate identification of childhood illnesses and appropriate combined treatment. Yet, the introduction of fees for some health services under the FHM has resulted in significantly lower utilization rates, leading to the exclusion of some poor families that cannot afford the new fees. The government has indicated its commitment to gradually increase financing of the registration fees for the poor. There are also two important programs that relate to children's nutrition: the national breastfeeding program, which advocates for exclusive breastfeeding for the first six months and continued breastfeeding for up to two years; and the pilot program on prevention and control of micro-nutrient deficiency, which includes a concentrated vitamin A dose at vaccination time, provision of fortified biscuits and snacks for school children, and delivery of iron tablets to children and adolescents in government schools, in addition to a pilot project for iron fortification of local baladi bread that is now being expanded.

Support for the Poorest Villages

To foster social justice, in 2008/09 the government launched a geographically targeted national project for the poorest 1,000 villages. The project, which started with 151 villages, encompasses 11 main programs (i.e., development of formal education infrastructure, literacy classes, development of health and new housing units, provision of potable water and sanitation, electricity and roads, improvement of environmental conditions, as well as social protection schemes, including social fund loans).

3. The Human Opportunity Index

3.1 Definition, Properties, and Computation¹¹

Definition of the HOI

Any measure of the rate of coverage of basic social services for human development that is responsive to opportunities must take into account at least two factors: (1) the global coverage or access rate, and (2) the differential between rates of coverage across the different circumstances that characterize population groups. The construction of a rate of

¹¹ This section follows the presentation of the methodology of the Human Opportunity Index made by Molinas et al. (2010).

coverage that is responsive to equality is equivalent to aggregating rates of coverage under different circumstances into a scalar measure that simultaneously achieves two properties: it increases with the global rate of coverage and it decreases with the differences in coverage between the different groups of circumstances.

The *HOI* is a measure of access to a specific human opportunity based on discounting the rate of global coverage, C , with penalization P linked to the inequality of coverage across all groups of circumstances:

$$HOI = C - P$$

The penalization is equal to the product of the coverage and the inequality of opportunity, and is given by $P = (C * D)$, where D is the Dissimilarity Index, which measures the difference between the rates of coverage of an opportunity across different groups of circumstances. This index can be interpreted as the fraction of people to whom a service or good must be re-assigned as a percentage of the total number of people who have access to this good or service. Thus, $1-D$ would represent the percentage of opportunities available that are assigned according to the equality of opportunity principle:

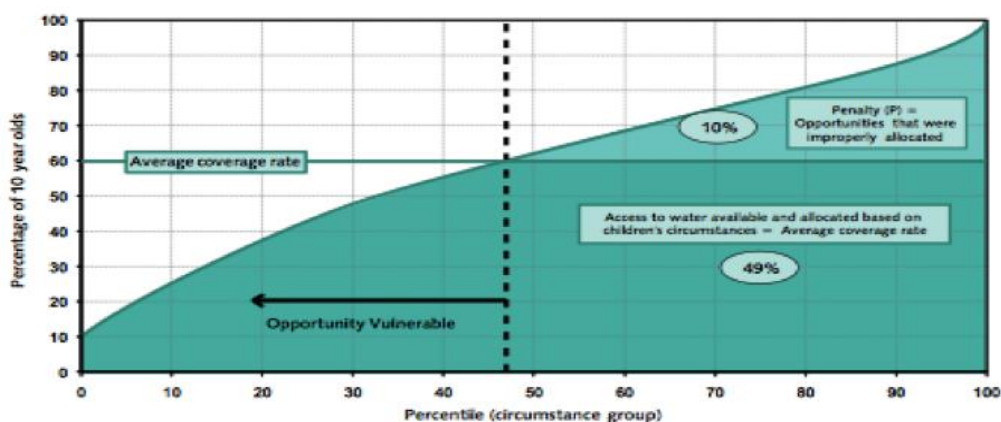
$$HOI = C - P = C * (1-D) = C * (1-P/C)$$

The penalization is zero if all the rates of coverage across all the groups of circumstances are identical, and the penalization grows positively as the differences in coverage between groups of circumstances grow.

Graphic Explanation of the HOI

For a graphic explanation of the calculation and interpretation of the HOI, we use data on access to water for 10-year-old children in a fictional country. For example, consider the case of equality of opportunities where the rate of total coverage is 59 percent, with the same value for each group of circumstances. This situation of equality of opportunities is represented in Figure 1 by the horizontal line at the 59 percent coverage level. In this case, despite the fact that access does not depend on circumstances and the inequality penalty is zero, the HOI is equal to 59 points.

Figure1. Penalty for Inequality of opportunity in Fictitious Country



Source: Molina et al. (2010)

Now consider a second case where 59 percent of children still have access to water and 41 percent do not, but the assignment of opportunities differs between the specific circumstances of the children. Thus, the sloped line in Figure 1 represents the situation of inequality of opportunities, and the "vulnerable groups" are those with rates of coverage *below* the line of equality of opportunities (or average coverage) and to the left of the vertical dotted line. In this case, P , the penalty for inequality of opportunity, is positive and is represented by the size of the shaded area over the line of the average rate of coverage and to the right of the vertical dotted line. In other words, the amount of access to water that was assigned unequally is equivalent to 10 percentage points. Therefore, in this case, the HOI is equal to 49 points: the average rate of coverage (59 percent) minus the penalty for the inequality of opportunities (10 percent).

Box 1. Computing the Inequality Penalty of the HOI

Computing the penalization for inequality of opportunities, P , requires the identification of all the groups of circumstances with rates of coverage below the average. We refer to these groups as "vulnerable" to human opportunity. For each group vulnerable to opportunity, M_k is the number of people in group k with access to the basic good or service, while M_k^* is the number of people who should have access in order to make their rate of coverage equal to the average of the population. $M_k - M_k^*$ is thus the difference in opportunities or the opportunity gap within the vulnerable group k . The penalization is the sum of the differences in opportunities of all the vulnerable groups (the total difference in opportunities) divided by the total population (N):

$$P = (1/N) \sum (M_k - M_k^*), \text{ for all } k = 1, \dots, v$$

Intuitively, P can be interpreted as the percentage of people whose access would have to be re-assigned to people in groups with lower rates of coverage to reach equality of opportunities. If all the groups have exactly the same rate of coverage, then the penalization is zero, and no re-assignment would be necessary. As long as the coverage approaches universality for all groups, the re-assignment required will be close to zero.

Properties

The HOI has three important properties. First, it is defined as a rate of coverage that is responsive to inequality of opportunity. Thus, its value falls as the inequality of the allocation of a given number of opportunities grows. Second, this indicator is responsive to inequality and is Pareto consistent. If no one loses access and at least someone gains access, then the index will always increase, independently of whether this person belongs to a vulnerable group. Third, when the rate of coverage of all the groups of circumstances increases proportionally, the HOI will increase in the same proportion.¹²

Thus, the HOI will always improve when (1) inequality decreases and total coverage stays the same, or (2) total coverage increases while inequality stays the same. Lastly, given that the HOI is equal to the difference between the rate of coverage and the penalization, it will always be equal to or less than the total rate of coverage. We present the index on a scale of 0 to 100 points.

¹² It can be shown that in this case both the rate of coverage and the penalization increase by the same percentage, like the HOI.

Decomposition of the Changes in the HOI: Distribution and Coverage Effects

Any improvement in the HOI can be decomposed in two additive steps. The first step would be through proportional increments in the rates of coverage of all the specific groups of circumstances. In this case, inequality of opportunities would remain unchanged and the HOI would increase exclusively due to changes in the average rate of coverage. We call this type of change the *scale or coverage effect*.

The second step would be achieved through improvements in the rates of coverage of some groups, exactly compensated by a decrease in the rates of other groups, leaving the total rate of coverage unchanged. In this case, given that the total rate of coverage remains unaltered, the HOI would change only due to the reduction of the inequality of opportunities (and the penalty P). We call this type of change *the distribution effect*. All the changes in the HOI can be expressed as a combination of a scale and a distribution effect.

3.2 HOI Indicators for Egypt¹³

This document measures the living conditions of infants, children, and youth, to provide a richer description than the one given by monetary measures of poverty alone. From this perspective, the HOI is an instrument that allows us to detect situations of inequality and/or exclusion between individuals in the first stages of the life-cycle, specifically associated with circumstances beyond the individual's control. At the same time, the measure of the HOI represents the first step for the recurrent measurement of the living conditions of Egyptian infants, children, and youth and for the evaluation of progress in access or equality of opportunities as a result of public policy programs at the national, regional, and municipal levels.

This study covers 16 opportunity indicators for children, which can be classified into four groups or sectors: education (three), basic housing services (six), early childhood healthcare (four), and nutrition (three) – see Table 1. These 16 indicators cover human development milestones at the three stages of the life cycle between birth and 17 years of age. All 16 opportunities take into account two criteria: relevance to wellness and quality of life for children and youth, and their responsiveness to public policies. These opportunity indicators are measured at the beginning and end of the decade, in 2000 and around 2009. All nine education and basic housing service opportunity indicators are obtained from the 2000 and 2009 Household Income, Expenditure and Consumption Surveys (HIECSs).¹⁴ And all seven early childhood and nutrition opportunity indicators are estimated from the 2000 and 2008 EDHSs .

Education

This exercise includes four opportunities for education. One is associated with attendance and three are associated with quality or performance. The indicators for attendance include school attendance for children between 9 and 15 years of age. The performance indicators

¹³ This section draws on the definitions of indicators used by Velez et al. (2010) for the case of Colombia.

¹⁴ For 2000, one of the education indicators (school attendance) was not available. Thus, the number of opportunity indicators for 2000 is 16.

include finishing primary schooling on time, at age 13-15; and finishing secondary general or technical on time, at age 19-20.

Basic Housing Services

Six human opportunity indicators represent adequate access to basic household services for the dwelling: water, sanitation, lighting energy source, cooking energy source, non-overcrowding, and telephone. Criteria for adequate access are: for water, connection to public network; for sanitation, connection to public network; for lighting energy source, electricity; for cooking energy source, use of gas bottles, natural gas, or electricity; and for telephone, access to a fixed or mobile telephone. Access to these services is measured for children between the ages of 0 and 17. The sixth indicator is non-overcrowding and is measured as the opportunity to live in a home that is not overcrowded for children between the ages of 0 and 5.

Table 1. Human Development Opportunity Indicators for Egypt, 2000 and 2009

<i>Category</i>	<i>Label</i>	<i>Definition</i>
Education	Complete primary education on time **	Completion of below intermediate education on time (primary schooling)
	Complete secondary education on time **	Completion of intermediate education on time (general or technical secondary schooling).
	School attendance, 9-15 **	Attended school, 9–15
Basic housing services	Water **	Access to clean water without interruption,, 0–17
	Sanitation **	Access to adequate sanitation, 0–17
	Lighting energy source **	Access to adequate lighting energy source, 0–17
	Cooking energy source **	Access to adequate cooking energy source, 0–17
	Non-overcrowding, 0-5 **	Children under 5 in non-over-crowded homes
	Telephone	Access to a telephone, 0–17
Early childhood	Assisted birth delivery*	Access to institutionally assisted birth delivery, 0-4
	Post-natal care, 0-5*	Access to adequate post-natal care, 0-5
	Prenatal care, 0-4*	Access to prenatal care for children under age 4
	Immunization vaccines, 0-4*	Access to complete vaccinations, children under age 4
Nutrition and hunger	Non-wasting, 0-4 *	Adequate nutrition by weight-for-height measures for children under age 4
	Non-stunting, 2-17*	Adequate nutrition by height-for-age measures for children ages 2–17
	Non-underweight, 0-17*	Adequate nutrition by weight-for-age measures for children 0–17

* Available from the EDHS 2000 and 2008 surveys. ** Available from the CAPMAS HIECS 2000 and 2008.

Early Childhood Development

This group includes four opportunities that are associated with key factors of development and growth during early childhood: access to assisted birth delivery (0-5), access to post-natal care (0-5), access to prenatal care (0-4), and access to immunization vaccines (0-4).¹⁵ Access to assisted birth delivery is defined as birth delivery assisted by a healthcare professional. Access to post-natal care 0-5 is defined as access to at least one prenatal checkup by a healthcare professional. Prenatal care for children under 5 is defined as access to at least one prenatal checkup by a healthcare professional. Finally, access to immunization and vaccines is defined as those children who have access to a vaccination card.

Nutrition and Hunger

This group contains three opportunities based on nutrition: non-wasting for children age 0-4, non-stunting for children age 2-17, and non-underweight for children age 0-17. The nutritional indicators measure correct diet and growth. The first indicator, non-wasting or “weight-for-height,” measures nutrition in children age 0-4. The second, non-stunting, or “size-for-age” indicator captures *chronic deficits* in a child’s nutrition and health; it is a *long-term* indicator. The third, non-underweight or “weight-for-age” indicator captures both short and long-term problems and reflects body mass in comparison to age. It is the most widely used indicator for the measurement of this kind of nutrition problem (WHO, 2007).

The specific measure for each child is compared with a distribution of the same variable for a “healthy” sample, following the WHO Child Growth Standards. For each individual indicator, z-scores are computed as the difference between the measure of the individual and the median of the reference population, divided by the standard deviation of the reference population. WHO classifications of malnutrition are applied: mild (z-score ≤ -1), moderate (z-score ≤ -2), and severe (z-score ≤ -3).¹⁶ Access to the opportunity of nutrition is assigned to all children with z-scores greater than -1.

Aggregate HOIs

In addition to the sixteen HOIs for the same number of opportunities, this chapter presents three aggregate HOIs, two for children between 0 and 4 years and one for children between 9 and 15 years. The first aggregate HOI for children in the 0-4 range, is built from all seven individual opportunities included in the Early Childhood Development, and the Nutrition and Hunger groups, which are computed with the DHS surveys. The second aggregate HOI for children between 0 and 4 years, is built from six opportunities in the Basic Housing Services group which are reported in the HIECS surveys. The aggregate HOI for children between 9 and 15 years, is based on five opportunities in the Basic Housing Services group and one education opportunity (school attendance). We assume that a children achieves the aggregate opportunity if he has access to *at least four of them*.^{17 18} The labels for these for

¹⁵ Early childhood development opportunities are computed for children under age 5.

¹⁶ More specifically, the routines ANTHRO and ZANTHRO are applied with statistical software. See O’Donnell, Doorslaer, Wagstaff and Lindelow (2008) and WHO (2007).

¹⁷ Figure A-1 in the appendix shows the number of opportunities (maximum 6 or 7) reached by children in the age groups 0-4 years of age and 9-15 years of age.

aggregate opportunities are respectively IOHa0-4-Nutrition & ECD, IOHa0-4-Housing Services y IOHa9-15-Housing Services.

3.3 Relevant Circumstances: Household Characteristics and Location

The choice of the circumstances vector is limited by the availability of information from different opportunity-measuring data sets – DHS and HIECS household surveys in this case. The circumstances vector includes variables specific to the child, the demographic composition of the household, income/wealth of the household, and variables for location. The following circumstances are included in the exercise:

- Gender of child
- Number of children under age 5 in the household
- Number of children between ages 6 and 17 in the household
- Number of people over age 70 or disabled in the household
- Presence of father and mother in the household
- Education of father and mother (education of the head and his spouse in the HIECS survey)
- Household income per capita (modified to wealth per capita quintile for the DHS survey)
- Location of residence (rural/urban)
- Region of residence (Upper Egypt, Lower Egypt, Metropolitan Egypt, or Frontier Governorates).

4. Evolution of Opportunities for Children in Egypt, 2000-2009: Time Trends and Regional Comparisons of the HOIs

4.1 Aggregate HOI Trends

Improvements in Opportunities for Children

Table 2 reports the values of the 16 opportunity indices and their respective average annual rate of change, for 2000 and circa 2009.¹⁹ The overall HOI for between 9 and 15 years, *IOHa9-15-Housing Services* – the aggregate of all 5 human opportunities in housing and on education – increased from 35 points in 2000 to 72 points in 2009, which means an improvement of 37 points for the whole period, and a quite satisfactory annual rate of progress of 4.1 points per year. Similarly the aggregate HOI for housing for children between 0 and 4 years, *IOHa0-4-Housing Services*, did experience substantial progress from 49 to 83 points during the decade. But in contrast, the other aggregate HOI for children in the range 0-4 years of age, *IOHa0-4-Nutrition & ECD*, performed very poorly and stayed at merely 14 points (!). In summary the aggregate performance of access to opportunities of basic housing services is quite satisfactory for both cohorts, but access to

¹⁸ An alternative way of building aggregate indices would be to average all 16 HOIs across the whole population. However these kind of “mash-up” indices suffer serious limitation, as pointed out by Ravallion (2010). And a solution to this critique is to build a multidimensional opportunity index for a children cohort with an appropriate threshold (minimum number of opportunities) to reach the multidimensional opportunity.

¹⁹ School attendance was not available for 2000.

nutrition and early childhood services for the youngest cohort is clearly unsatisfactory, because access has remained very low and very unequal during the whole decade.²⁰

Table 2. Human Opportunity Index for Egypt, 2000 and 2009

<i>Opportunity</i>	<i>2000</i>	<i>Circa 2009</i>	<i>Annual rate of change</i>	<i>Decomposition *</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education on time	84	86	0.4%	51%	49%
Complete secondary education on time	62	63	0.3%	37%	63%
School attendance, 9-15	n.a.	89	---	---	---
Water	77	88	1.3%	67%	33%
Sanitation	26	30	0.5%	64%	36%
Lighting energy source	98	99	0.1%	---	---
Cooking energy source	73	98	2.8%	64%	36%
Non-overcrowding, 0-5	48	59	1.2%	62%	38%
Telephone	14	71	6.3%	78%	22%
Assisted birth delivery	64	84	2.5%	74%	26%
Post-natal care, 0-5	19	28	1.1%	91%	9%
Prenatal care, 0-4	58	78	2.6%	76%	24%
Immunization vaccines, 0-4	87	85	-0.2%	12%	88%
Non-wasting, 0-4	88	75	-1.6%	79%	21%
Non-stunting, 2-17	69	69	0.0%	---	---
Non-underweight, 0-17	80	85	0.6%	60%	40%
<i>Aggregate HOIs</i>					
IOHa9-15-Housing Services	35	72	4.1%	66%	34%
IOHa0-4-Housing Services	49	83	3.8%	64%	36%
IOHa0-4-Nutrition & ECD	14	14	0.0%	--	--

Note: (*) Decomposition is omitted for trivial cases in which the HOI change is negligible.

Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.

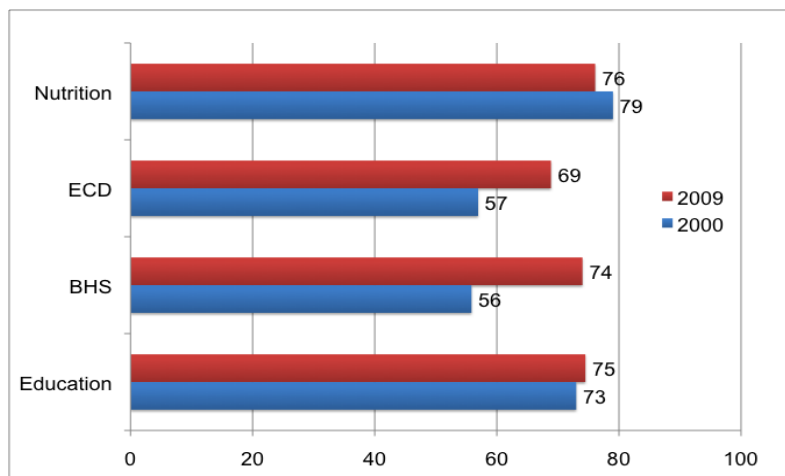
Uneven Improvement across Sectors

Figure 2 displays the aggregate HOIs by sector at the beginning and end of the decade. The improvements in the opportunity indices of basic housing services (BHS) and early childhood development (ECD) were impressive (18 and 12 points respectively). The rates of improvement of the opportunities in education and nutrition and hunger were modest or suffered a setback (5 points and -3 points, respectively). Table 2 (third column) shows the rates of annual progress for each opportunity separately. The telephone HOI recorded the largest annual rate of improvement at 6.3 points, followed by three opportunities: cooking energy, prenatal care, and assisted birth delivery (with similar annual rates, 2.8-2.5 points). Three opportunities – access to water, non-overcrowding, and post-natal care – showed rates of progress close to the average rate (between 1.1 and 1.3 points). These were followed by five opportunities with *modest* improvements at rates close to half the average rate, namely the two education opportunities for graduation on time, access to sanitation, and nutrition weight-for-age. By contrast, the HOI index for nutrition non-stunting did not

²⁰ In circa 2009 the percentage of children with access to four of six opportunities in ECD and nutrition was just 25% and inequality of access was the highest across all opportunities (see Table A.1).

show any progress, and two other indices for children between 0 and 4 years deteriorated, namely nutrition non-wasting (-1.6 points per year) and immunization vaccines (-0.2 points per year).²¹

Figure 2. Aggregate HOI by Sector in Egypt, 2000-2009



Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Progress Driven by Access Rather Than Equality of Opportunity

Table 2, in the last two columns, summarizes the decomposition of the total change in HOI improvements in access and equality of opportunities, and indicates that the improvement in Egypt's HOI for children is mainly due to the *scale effect* (increasing the *access* of all groups while maintaining the degree of equality of opportunities unchanged). For all 11 HOIs that improved more than 0.5% points per year, at least 60 percent of the improvement is explained by the scale effect.²² This is particularly pronounced for four indices: in fact the scale effect explains 91 percent for post-natal care index; 78 percent for the telephone index; 76 percent for the prenatal care index; 74 percent for the assisted birth delivery index. During the past decade, the least regressive scale effects were for nutrition non-underweight, with 60 percent, and the remaining basic housing services indices – between 62 percent for non-overcrowding and 67 percent for access to water. For the two cases in which opportunities deteriorated, there is a clear contrast between immunization vaccines, which concentrated the moderate setback among children in adverse circumstances (88 percent distribution effect) and nutrition non-wasting, which concentrated a small proportion of the setback among children in adverse circumstances (21 percent distribution effect). Finally, it should be noted that for the complete secondary education index, equality of opportunity explained 63% of its very modest improvement.

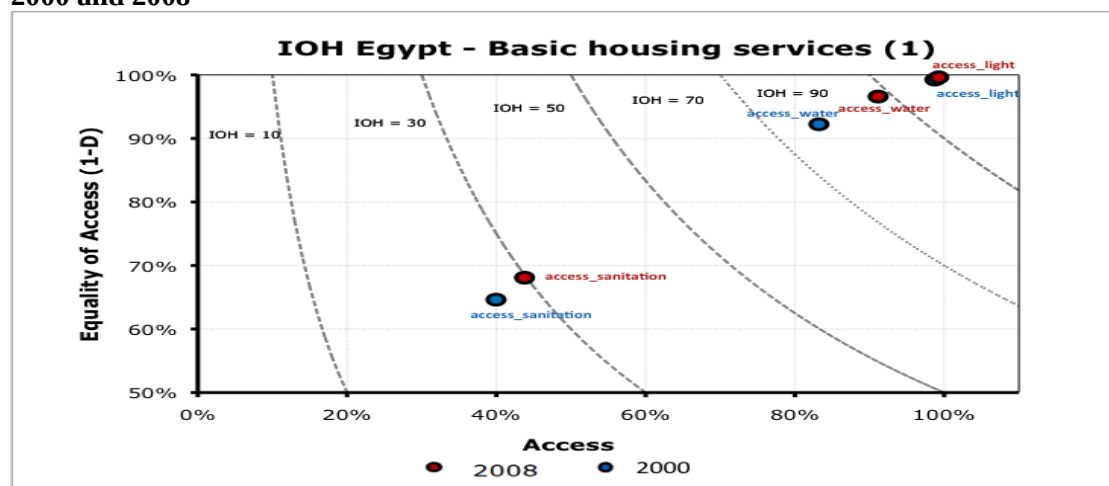
²¹ Anthropometric measures for 2008 are based on a new reference population, the "WHO Child Growth Standards reference population," adopted in 2006. However, even when the old reference population was applied, the percentage of stunting of children increased in 2008 compared with the corresponding measures in 2000 and 2005, but with a smaller gap.

²² For other 7 HOIs their rate of annual progress was too small, negative or zero. And for the school attendance opportunity, there was no HOI available for the year 2000.

A more disaggregated alternative decomposition of the changes in HOIs between 2000 and circa 2009 is presented in the appendix (Table A-3). It adds the “composition effect” to isolate any intertemporal changes in the circumstances of the population, which vary over time as young households enter the household pool and old households retire from it as they culminate their lifecycle, and also as the location (via migration) and the levels of income and wealth change for the whole population over time. The remaining improvement in HOIs, after discounting the “composition effect”, is divided between the *scale* and *equality of opportunity* effects. The evidence presented in Table A-3 indicate an even weaker effect of *equality of opportunity*, reinforcing the proposition that the *scale* effects were the main drives of HOIs improvements for Egyptian children during the last decade.

Figure 3 illustrates explicitly how the changes in coverage and equality of distribution of coverage contribute to the improvements in the HOIs for some basic housing services. In 2000, the low (24 percent) and unequal coverage (56 percent) of telephones rendered an HOI of 14 points. The considerable jump in coverage (to 78 percent) with simultaneous gains in equality of access (to 91 percent) rendered an HOI of 71 at the end of the decade. In a similar fashion but on a smaller scale, access to an adequate cooking energy source started from a relatively high HOI of 73 points (access 82 percent and equality of access 89 percent) and increased access by 17 percentage points and equality of access by 10 percentage points to become practically a universal opportunity. In the case of non-overcrowding, the initial HOI had a moderate value (48 points) and the increase in access by 8 percentage points and equality of access by 6 percentage points brought the HOI to 59 points in 2009.

Figure 3. Basic Housing Services: Access and Equality of Opportunity. Egypt 2000 and 2008



Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations

4.2 Urban-Rural Differences

Better Opportunities in Urban Areas

Tables 3 and 4 present the estimates of all HOIs for urban and rural areas, respectively. The fact that urban areas availed more services to children than rural areas in 2008/09 is registered by an urban-rural gaps of 17, 28 and 4 points in the three aggregate HOIs

computed for children in the 9-15 cohort and 0-4 the cohort.²³ Several sizeable gaps are reported for all the HOI indices, except for immunization vaccines, lighting energy source, cooking energy source, all three nutrition opportunities, completion of primary education and school attendance. On average, basic housing services and early childhood development are the sectors with the largest urban-rural gaps, driven by a 57-point gap in sanitation, and by a 20-point gap in access to a telephone, and to a lesser extent by a 14-point gap in ante-natal care and a 13-point gap in assisted birth delivery. For nearly all opportunities, rural areas offer more restricted access with more inequality of opportunity.

Box 2. Comparison of Five Opportunities for Children in Egypt and Latin America

Finding adequate comparator countries is somewhat challenging, because cross-country HOIs are available for only *five basic opportunities* and for 20 Latin American countries, which have a higher level of economic development than Egypt.¹ However, the aggregate HOI indicates that opportunities available to Egyptian children are moderately above the opportunities available to average children in Latin America (5 points). Moreover, the relative ranking of aggregate opportunities for Egypt in 2010 is just above mid-table (9th of 21) and the annual rate of progress in HOIs during the past decade was 0.9 percent, marginally lower than the average for Latin American countries (1.0 percent). However, similarities in the aggregate hide differences across specific opportunities.

The opportunities available to Egyptian children look relatively better if we consider complete primary education, and two basic housing services, access to electricity and water. Egypt's HOI for completing primary education on time is 14 percent above the Latin American average and it was ranked fifth by around 2005. Egypt's water HOI (88 points) exceeds the Latin American average by 38 percent by around 2005 and was only surpassed by the water HOIs of Argentina, Chile, Costa Rica, and Uruguay. Moreover, the rate of annual progress in opportunities, 1.3 percent, is clearly above the Latin American average, 1.1 percent per year. In the case of electricity, Egypt had already achieved almost universal coverage at the beginning of the decade and its HOI exceeded the Latin American average by 19 percent, by around 2005.

The main deficits in opportunities for children in Egypt relative to children in Latin American countries appear to be in sanitation and education school attendance. For sanitation, Egypt has a very low score, ranking near the bottom (16th of 20) and its annual progress during the decade was less than half the average for Latin America (0.5 percent versus 1.3 percent per year).¹ Egypt's school attendance HOI (89 points by around 2005) also was not a good relative score (rank 16th of 20).

In summary, comparisons with Latin American countries show the achievements of Egypt in access to opportunities in completion of primary education, water and electricity and the large challenges in sanitation and somewhat in school attendance (9-15). However, those challenges are less pronounced when comparisons are made with low-income Latin American countries (Bolivia, Honduras, Nicaragua, and Paraguay).

²³ They are respectively: IOHa9-15-Housing Services, IOHa0-4-Housing Services, and IOHa0-4-Nutrition & ECD.

Table 3. Human Opportunity Index for Egypt, Urban 2000 and 2009

<i>Opportunity</i>	<i>2000</i>	<i>Circa 2009</i>	<i>Annual rate of change</i>	<i>Decomposition</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education on time	92	88	-0.6%	84%	16%
Complete secondary education on time	76	69	-0.7%	92%	8%
School attendance, 9-15	---	92	---	---	---
Water	97	96	0.0%	53%	47%
Sanitation	68	74	0.7%	95%	5%
Lighting energy source	100	100	0.0%	62%	38%
Cooking energy source	94	99	0.6%	60%	40%
Non-overcrowding, 0-5	58	64	0.7%	50%	50%
Telephone	38	84	5.1%	79%	21%
Assisted birth delivery	83	93	1.2%	64%	36%
Post-natal care, 0-5	23	33	1.2%	92%	8%
Prenatal care, 0-4	76	87	1.3%	76%	24%
Immunization vaccines, 0-4	84	85	0.1%	---	---
Non-wasting, 0-4	88	74	-1.7%	85%	15%
Non-stunting, 2-17	78	72	-0.8%	---	---
Non-underweight, 0-17	86	88	0.3%	57%	43%
<i>Aggregate HOIs</i>					
IOHa9-15-Housing Services	83	94	1.2%	60%	40%
IOHa0-4-Housing Services	77	92	1.7%	63%	37%
IOHa0-4-Nutrition & ECD	17	16	-0.1%	---	---

Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Narrowing the Urban-Rural Opportunity Gap

Between 1999/2000 and 2008/09, the urban-rural opportunity gap contracted for basic housing services and education, but remained unchanged for nutrition opportunities. This was caused not only by much faster improvement in the average HOI in rural areas, but also by the fact that most rural HOIs improved at a faster pace while eleven urban HOIs had little progress or deteriorated.²⁴ Basically, the average rate of progress of rural HOIs more than doubled the urban annual rate (1.4 versus 0.5 points) and the aggregate rural HOIs for basic housing services for 9-15 and 0-4 year olds increased by 42 and 41 points, while the same urban HOIs increased by 11 and 15 points respectively. Although telephone access was by far the opportunity with the largest improvement in both urban and rural areas, the annual rates of improvement were faster in rural areas (6.3 versus 5.1). Similar comparisons, in terms of annual rates of improvement, apply to opportunities such as prenatal care, assisted birth delivery, cooking energy source, and overcrowding. Three

²⁴ Only three of the urban HOI indicators – lighting energy source, water, and cooking energy source – approached universal coverage and had reached 100, 97, and 94 points, respectively by 2000. Three other stagnant urban HOIs were completion of primary education, sanitation and immunization-vaccines. A major cause of concern is the deterioration in the HOIs for nutrition non-wasting and non-stunting by 14 and 6 points, respectively, and the HOIs for primary and secondary education by 4 and 7 points, respectively.

opportunities that remained stagnant in urban areas showed moderate improvement in rural areas, namely, access to water and completion of primary and secondary education (respectively by 14, 7, and 7 points). In only three cases – completion of post-secondary education, sanitation, and immunization vaccines – urban improvement was marginally ahead of rural progress. For the remaining five opportunities, rates of improvement in rural areas were moderate or negative, but always superior to the urban rates.

Table 4. Human Opportunity Index for Egypt, Rural 2000 and 2009

Opportunity	2000	Circa 2009	Annual rate of change	Decomposition	
				Access	Equality of opportunity
Complete primary education on time	78	85	0.9%	77%	23%
Complete secondary education on time	53	60	0.9%	69%	31%
School attendance, 9-15	---	87	---	---	---
Water	70	85	1.6%	81%	19%
Sanitation	11	17	0.6%	78%	22%
Lighting energy source	97	98	0.1%	62%	38%
Cooking energy source	63	97	3.8%	61%	39%
Non-overcrowding, 0-5	43	55	1.3%	64%	36%
Telephone	8	64	6.3%	70%	31%
Assisted birth delivery	55	79	3.1%	82%	18%
Post-natal care, 0-5	16	24	1.0%	92%	8%
Prenatal care, 0-4	48	73	3.1%	82%	18%
Immunization vaccines, 0-4	89	85	-0.5%	42%	58%
Non-wasting, 0-4	87	75	-1.5%	75%	25%
Non-stunting, 2-17	65	67	0.3%	33%	67%
Non-underweight, 0-17	77	82	0.7%	67%	33%
<i>Aggregate HOIs</i>					
IOHa9-15-Housing Services	36	77	4.6	71%	29%
IOHa0-4-Housing Services	22	64	4.7	82%	18%
IOHa0-4-Nutrition & ECD	12	12	0.0	---	---

Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

4.3 Regional Differences

Better Opportunities for Metropolitan Children Relative to Their Peers in Other Regions

Table 5 presents the HOIs across the four main regions in 2000 and 2009. The evidence indicates that in 2009 the overall aggregate HOI (*IOHs16*) was highest in Metropolitan areas (81 points) and lowest in Frontier Governorates (63 points), with Lower Egypt in between (75 points) and Upper Egypt (69 points) just marginally superior to the Frontier Governorates. A similar pattern is found when comparing inter-regional ranking within each sector or group of HOIs. In 2009, the same inter-regional ranking order held in two sectors: early childhood development and nutrition and hunger (see Figure 4). For the other two sectors a different pattern emerges: in basic housing services, everything was equal except that Frontier Governorates held third place, offering better opportunities than Upper Egypt, and in education, Lower Egypt overtook the Metropolitan region and claim the first place of the ranking. Moreover, a count of the number of opportunities for which each region offered the first best or second best opportunities (see Table A-4) shows the lead of

the Metropolitan region with 14 HOIs (of 16 HOIs in total), followed by Lower Egypt with 11, Upper Egypt with four, and Frontier Governorates with two. In summary, the regional ranking based on average HOI is quite similar to the regional ranking across the four sectors, grouping the 16 opportunities evaluated for Egyptian children.

Table 5. HOIs in Four Egyptian regions, 2000 and 2009

<i>Opportunity</i>	<i>2000</i>					<i>2009</i>				
	<i>Metropolitan</i>	<i>Lower Egypt</i>	<i>Upper Egypt</i>	<i>Frontier Governorates</i>	<i>Inter-regional opportunity gap (max) *</i>	<i>Metropolitan</i>	<i>Lower Egypt</i>	<i>Upper Egypt</i>	<i>Frontier Governorates</i>	<i>Inter-regional opportunity gap (max) *</i>
Complete primary education	93	87	76	92	17	85	89	82	87	7
Complete secondary education	76	64	53	69	23	67	67	58	67	9
School attendance, 9-15	---	---	---	---	0	90	92	86	82	10
Water	98	80	69	94	29	97	87	88	83	14
Sanitation	97	35	7	30	90	88	33	16	36	72
Lighting energy source	100	99	96	92	8	99	100	99	86	14
Cooking energy source	98	89	53	93	45	99	99	97	93	7
Non-overcrowding, 0-5	57	57	38	58	20	64	72	45	64	27
Telephone	44	12	9	41	35	88	73	63	88	25
Assisted birth delivery	87	66	53	52	35	93	88	75	63	30
Post-natal care, 0-5	25	17	18	10	15	40	24	30	11	29
Prenatal care, 0-4	79	57	51	36	43	90	77	74	64	26
Immunization vaccines, 0-4	81	89	86	73	16	85	85	81	80	5
Non-wasting, 0-4	85	89	86	76	13	67	79	72	71	12
Non-stunting, 2-17	78	70	64	51	27	74	64	74	53	21
Non-underweight, 0-17	86	81	76	68	18	89	87	80	72	17
<i>Aggregate HOIs by group **</i>										
IOHaEducation	85	76	65	80	20	76	78	70	77	8
IOHaBasic housing services	82	62	45	68	37	89	77	68	75	21
IOHaEarly childhood	68	57	52	43	25	77	69	65	55	23
IOHaNutrition	83	80	75	65	18	77	77	75	65	11

Notes: (*) The gap is computed as the difference between the maximum and the minimum HOI for each opportunity. (**) Aggregate HOIs by group are the average of HOI values within the group.

Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

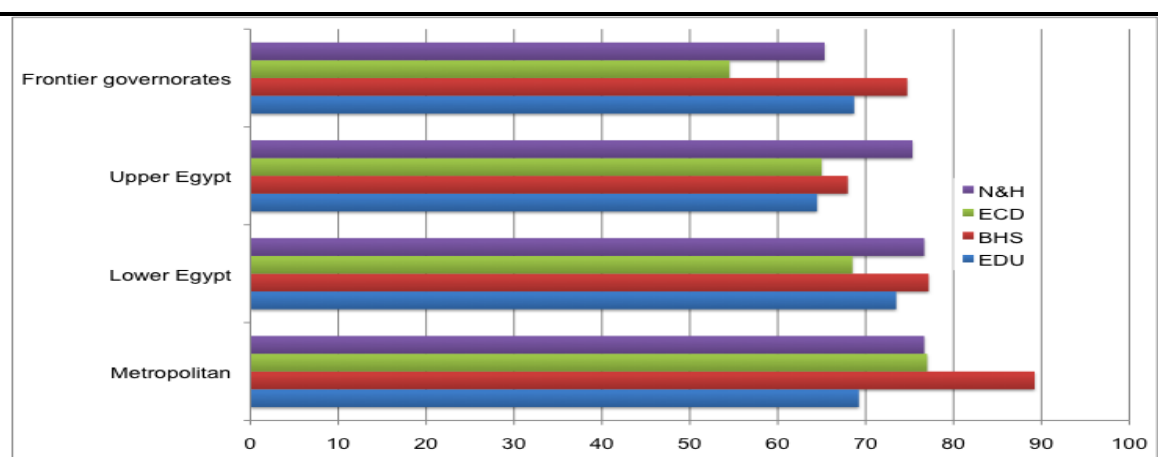
Improvements Across Region Benefit Upper Egypt

Figure 5 shows aggregate HOIs by region in 2000 and 2009. The fact that all points in the graph are above the 45 degree line indicates that all four regions had better aggregate HOIs in 2009 than in 2000. Nevertheless, regions that made larger progress were those further from the 45-degree line, the Upper and Lower Egypt regions. Although for those two regions the aggregate HOIs advanced at a much faster pace (15 and 10 points, respectively), the Metropolitan and Frontier Governorates regions made only moderate progress in the aggregate HOI, by 3 and 7 points, respectively.²⁵ As a result, in 2009 the Upper Egypt

²⁵ The pattern of progress of the Upper and Lower Egypt regions held as well for the sector-specific opportunity indicators for education, basic housing services, and early childhood development, with one significant exception, the nutrition and hunger sector.

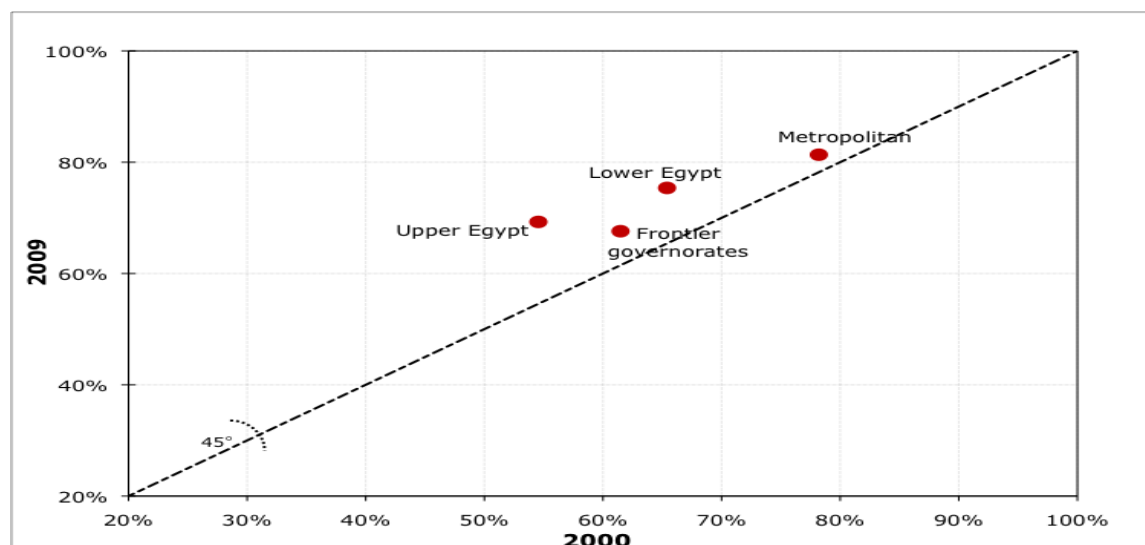
region, which was 6 points behind the aggregate HOI of the Frontier Governorates in 2000, was ahead of the latter by five points. These event produced important changes in the inter-regional ranking across the four sectors: in education, Lower Egypt jumped from third to first place overtaking the Metropolitan region; in basic housing services, Lower Egypt took over the second place from Frontier Governorates; in early childhood development Upper Egypt took over the third place from Frontier Governorates; and finally in nutrition, Lower Egypt caught-up to the Metropolitan region and Upper Egypt took over Frontier Governorates.

Figure 4. Aggregate HOI by Sector in Four Egyptian Regions, Egypt circa 2009



Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Figure 5. HOI by Region –Average of 16 Opportunities. Egypt, 2000 and 2009

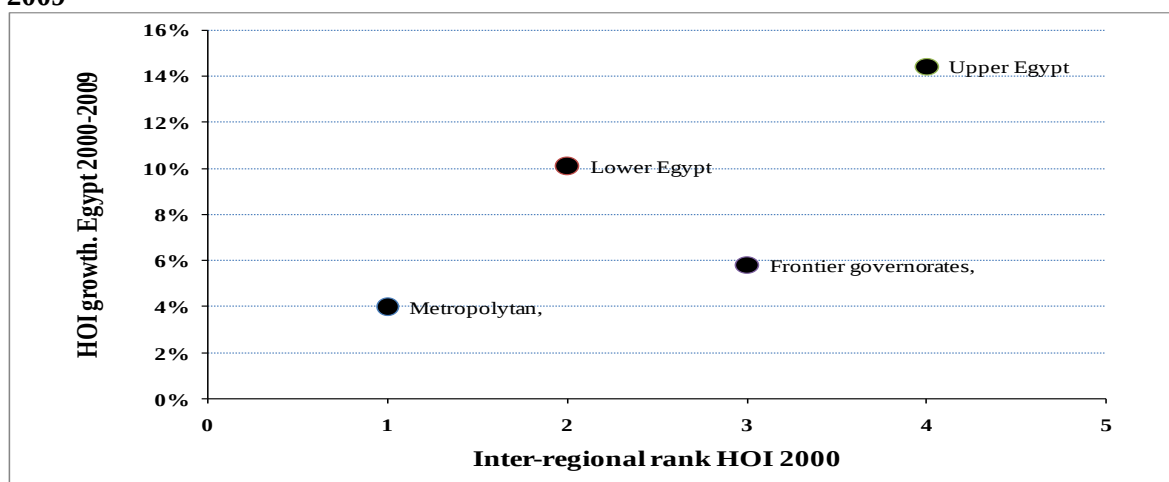


Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Aggregate Inter-regional Convergence is Narrowing the Gap Relative to the Metropolitan Region

Figure 6 shows how the growth of opportunities for each region was inversely related to the ranking of the region at the beginning of the period, except for the Frontier Governorates region. The largest gain in the aggregate HOI (15 points) occurred in Upper Egypt, which ranked last in 2000, and was followed by the gain in the Lower Egypt region (10 points), the gain in the Frontier Governorates region (6 points), and the gain in the Metropolitan region (3 points), which ranked first in 2000. As a result, the inter-regional gaps relative to the Metropolitan region became smaller (Figure 5). For example, the gap relative to Upper Egypt was reduced from 24 points in 2000 to 14 points in 2009. A similar pattern of inter-regional convergence is found when the HOI indicators are disaggregated by sector.

Figure 6. Interregional Convergence? Inter-regional Rank vs. HOI Growth, Egypt, 2000 and 2009



Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations

This interregional convergence is the result of significant changes favoring specific opportunities in the Lower and Upper Egypt regions vis-à-vis the Metropolitan region. Namely gains in education and basic housing services (BHS) opportunities in Lower Egypt, and gains in nutrition and hunger and basic housing services opportunities in Upper Egypt. In order to assess the evolution specific opportunities across regions, we examine the changes in inter-regional ranking over the period, that is, the number of sectors in which each region was in first or second place (using Table A-4 in the Appendix). In 2000, the Metropolitan region ranked first in 12 of the 16 HOIs, while the Lower Egypt region ranked first in only two HOIs – immunization and nutrition weight-for-height – and ranked second in the other six HOIs. However, by 2009, Lower Egypt increased its count of first places to eight HOIs of 16, plus three HOIs with second ranking, while the Metropolitan region was relatively stable in first place for 9 of the 16 HOIs, and in second place for five HOIs. The most important gains for Lower Egypt were in telephone, assisted birth delivery, ante natal care, adequate cooking energy source and non-overcrowding. Upper Egypt also advanced mostly in five opportunities: telephone, cooking energy source, assisted birth delivery, ante natal care, and no-overcrowding. By contrast, Frontier Governorates lost ground with only one first (assisted birth delivery) and one second ranking in 2009, after having one first and

5 seconds in 2000.

Although inter-regional convergence held for most opportunities, for four HOIs the inter-regional gap became larger. In fact, between 2000 and around 2009, the inter-regional gap increased by 14 points for post-natal care, by six points for non-overcrowding, and by six points for lighting energy source.

Finally, the eight largest inter-regional opportunity gaps in 2009 fell predominantly in the basic housing services and early childhood development sectors. In BHS, these were sanitation (72 points), non-overcrowding (27 points), and telephone (25 points). In ECD, the three opportunities were assisted birth delivery (30 points), post-natal care (29 points), and prenatal care (26 points). In nutrition the largest gaps were in nutrition were non-stunting (21 points), and non-underweight (17 points).

Trends Robust to Changes in Demographic Weights. The aggregate HOIs have been computed as the average of all individual HOIs available for Egypt as a whole and for each of the four regions of the household surveys. Ravallion (2010) appropriately warns about the risk of using “mash-up” indices without knowing their limitations. Accordingly, in this paper we check the consistency and robustness of the levels and trends of aggregate HOIs (including by sector) to demographic weights. For this reason, the discussion of aggregate HOI levels and trends is followed by examination of their consistency with less aggregated indices. We complement the consistency checks with a comparison of original aggregate HOIs with aggregate HOIs *computed as weighted averages* of the individual opportunity indices (using the demographic weights of the age group corresponding to each of the 17 HOI indices; see Table A-9-a).²⁶

Table A-9-b reports the figures for the unweighted and weighted aggregate HOIs for Egypt and the four regions in 2000 and 2009. The average of all 16 opportunities (except school assistance), for Egypt presents a higher value when weighted, but the trend remains unchanged and the progress for the decade increased marginally from 10 to 12 points. The same pattern is found for the aggregate HOI across the four regions. Comparison of aggregate HOIs by sector offers similar results; both the trends and the order of magnitude of changes in the opportunity indices remain unchanged (with two exceptions, that turn from no change to negative). Moreover, the ranking of regions is the same with both weighted and unweighted aggregate HOIs (with the exception of two regions that were very close in their nutrition and hunger HOIs). In summary, the trends in aggregate HOIs are stable to changes in relative demographic weights and behave consistently with less aggregated indices.

5. The Main Circumstances behind Inequality of Opportunities for Children

This section examines two aspects of the role of demographic and location circumstances in the inequality of opportunities of Egyptian children. The first part examines the magnitude

²⁶ This kind of demographic re-weighting raises the relative weight of basic housing services HOIs from 35 to 55 percent, and the relative weight of nutrition indicators from 18 to 22 percent. This is at the expense of lower relative weights for early childhood development HOIs and education HOIs (both reduced from 24 to 11 percent). The use of demographic weights implies that all children (independent of their age) have the same value in the aggregate opportunity index. However, it could be reasonably argued that more weight should be given to younger children who are more vulnerable and for whom lack of opportunity could have more detrimental consequences throughout their lives.

of the opportunity gaps between children in favorable and unfavorable circumstances, and how those gaps have evolved. The second part explores the most critical circumstances for the inequality of opportunities and whether some patterns of circumstances more unequalizing for opportunities in education, and whether they differ with the most unequalizing profiles of circumstances for opportunities in basic housing services, early childhood development, or nutrition and hunger opportunities. Finally, the last part examines the extent to which the evolution of opportunity indices (national and regional) is consistent with the trends in public expenditure by sector and its distribution across regions.

5.1 Opportunity Gaps for Children in the Most Unfavorable Circumstances

The first step to assess the link between circumstances and the inequality of opportunities is to examine the access gaps between children in *favorable* circumstances (90th percentile of circumstances, P90 hereafter) and children in moderately *unfavorable* circumstances (percentile 30 of circumstances, P30 hereafter). We address three questions. How large are the opportunity gaps and how did they evolve during the decade? Which sectors present the largest opportunity gaps for children in the most unfavorable circumstances? Which sectors have managed to improve access to opportunities by reducing the opportunity gaps for children in unfavorable circumstances? The opportunity gaps for all 17 opportunities are summarized in Table 6 and Figure 7.

Table 6. Opportunity Gaps between Percentiles P90/P30, Egypt, 2009 and 2000

Opportunity	Access probability						Change in gap
	2009			2000			
	p90	p30	gap	p90	p30	gap	
Complete primary education on time	0.99	0.76	0.23	0.97	0.80	0.18	0.05
Complete secondary education on time	0.92	0.51	0.41	0.86	0.55	0.31	0.10
School attendance, 9-15	1.00	0.88	0.11	---	---	---	---
Water	0.99	0.87	0.12	1.00	0.77	0.23	-0.11
Sanitation	0.91	0.20	0.71	0.98	0.25	0.73	-0.02
Lighting energy source	1.00	0.99	0.01	1.00	0.99	0.01	0.00
Cooking energy source	1.00	0.99	0.01	1.00	0.85	0.15	-0.14
Non-overcrowding, 0-5	0.95	0.60	0.36	0.96	0.47	0.49	-0.13
Telephone	0.98	0.69	0.29	0.87	0.10	0.77	-0.48
Assisted birth delivery	0.98	0.84	0.14	0.97	0.61	0.36	-0.23
Post-natal care, 0-5	0.45	0.26	0.19	0.35	0.17	0.19	0.00
Prenatal care, 0-4	0.97	0.75	0.22	0.91	0.51	0.39	-0.17
Immunization vaccines, 0-4	0.98	0.84	0.14	0.94	0.87	0.07	0.06
Non-wasting, 0-4	0.89	0.75	0.14	0.93	0.87	0.06	0.08
Non-stunting, 2-17	0.81	0.68	0.13	0.88	0.70	0.18	-0.05
Non-underweight, 0-17	0.94	0.86	0.08	0.94	0.84	0.10	-0.02
<i>Aggregate HOIs</i>							
IOHa9-15-Housing Services	0.98	0.66	0.32	0.97	0.24	0.73	-0.41
IOHa0-4-Housing Services	0.99	0.81	0.18	0.99	0.4	0.59	-0.41
IOHa0-4-Nutrition & ECD	0.54	0.04	0.50	0.44	0.08	0.36	0.14

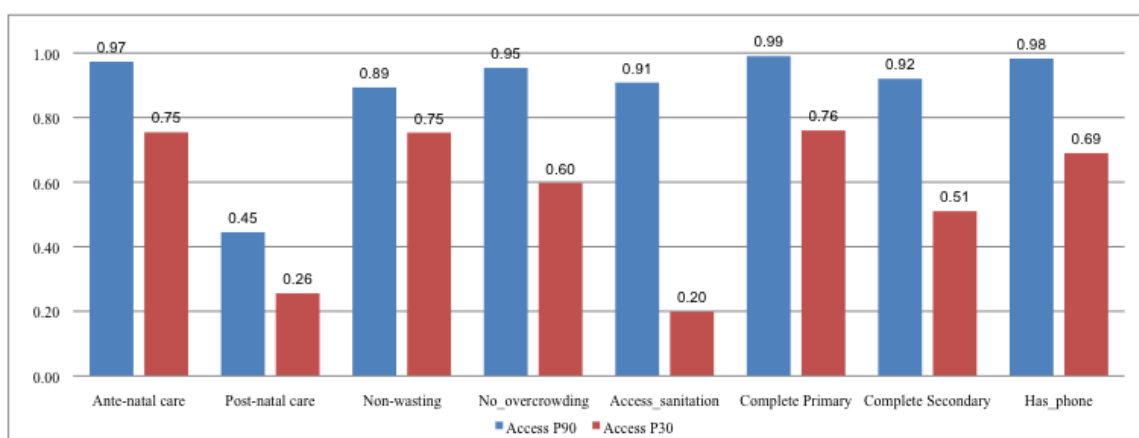
Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Substantial Opportunity Gaps between Children in Favorable and Unfavorable

Opportunity gaps between children in favorable and unfavorable circumstances in the year 2009 are considerable if we consider that the for largest opportunity gaps range between 29 and 71 percent. The opportunity gaps shown in Table 6 indicate that in 2009 the eight main obstacles faced by Egyptian children in unfavorable circumstances (P30) that were not obstacles for children in favorable circumstances (P90) are distributed accross all sectors: education, BHS, ECD and Nutrition and Hunger. The eight largest opportunity gaps in order of magnitude were: sanitation (71 percent), completion of secondary education (41 percent), non-overcrowding (36 percent), access to a telephone (29 percent), completion of primary education (23 percent), access to prenatal care (22 percent), and post-natal care (19 percent) and Non-wasting 0-4.

A decade earlier, children in unfavorable circumstances faced somewhat similar challenges. Comparison of the 2009 results with those of 2000 shows that the eight largest opportunity gaps corresponded to nearly the same set of opportunities one decade later. Five of the eight largest gaps corresponded to the same opportunities in 2000 and 2009. In fact, the eight largest opportunity gaps ranged from 77 percent to 19 percentage points, and complete primary and non-wasting entered this set of opportunities in 2009, as water and assisted birth delivery fell below the 8th place in 2009. Nevertheless, in 2000 the three largest opportunity gaps were concentrated in the BHS sector: telephone (77 percent), sanitation (73 percent), and non-overcrowding (49 percent).

Figure 7. Opportunity Gaps between Percentiles P90andP30, Egypt, 2009



Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Figure 7 explicitly illustrates the eight largest opportunity gaps, showing by how much the probabilities of access to opportunities for children in favorable circumstances exceeded those for children in the most unfavorable ones. The five largest opportunity gaps faced by the youngest children are in ante-natal care (22 percent), post-natal care (19 percent), non-wasting (14 percent), non-overcrowding (36 percent) and sanitation (71 percent), followed by substantial opportunity gaps during their childhood and adolescence in education opportunities (26 percent for primary education, 41 percent for completion of secondary education).²⁷ Evidently the doors to opportunities for basic human development close much

²⁷ Moreover those gaps became larger for completion of primary and secondary education between 2000 and 2009 (Table 6).

faster for children in unfavorable circumstances.²⁸

Children in extremely unfavorable circumstances must deal with similar challenges. The obstacles faced by Egyptian children in the worst circumstances (percentile 10, *P10* hereafter) are somewhat larger but in the same sectors as for children in *moderately adverse* circumstances (*P30*). The rankings (see Table A-6) are mostly consistent, except that priorities are a bit higher for basic housing services (sanitation and overcrowding rank first and second), while all education opportunities remain second.

Main Achievements for Children in Unfavorable Circumstances

The main achievements for children in unfavorable circumstances were reductions in six opportunity gaps by more than 10 percentage points (see Table 6). The reduction of the opportunity gap of immunization was due to the combined effect of improved access to *P90* and moderate reduction in access for *P30*, while for nutrition access deteriorated for both percentiles, although significantly for children in *P30* circumstances, by 12 percentage points. A note of concern must be raised for four cases in which the opportunity gaps are larger in 2009 than in 2000: namely, complete primary and secondary education, non-stunting, and immunization vaccines.

In summary, the most important challenges facing Egyptian children in unfavorable circumstances are lack of access to four basic human opportunities with gaps exceeding 36 percent points: sanitation, completion of secondary education, non-overcrowding and access to telephone. Four other opportunities that represent a smaller but considerable challenge are completion of primary education, access to prenatal care and post-natal care, and non-wasting. These challenges remained basically the same during the decade.

5.2 Inequality of Opportunities by Circumstance

In order to identify the most influential circumstances on the inequality of opportunities, we compute the *matrix of inequality of opportunities by circumstances* (IOC). The matrix has 16 rows corresponding to the number of opportunities and eight columns corresponding to the number of circumstances – namely, gender, number of siblings, presence of parents, presence of elderly family members, parents' education, income per capita, urban-rural location, and regional location. The intuition is that each element of the IOC matrix, $IOC(i, j)$, corresponding to the i th opportunity and the j th circumstance j , represents the inequality penalty P on the $HOI(i)$ associated with the inequality of opportunity linked to the j th circumstance.²⁹ The larger is the penalty, the larger is the inequality of the i th opportunity associated with the j th circumstance. In order to isolate the effect of the variability of circumstance j on the inequality of access to opportunity i , the probability of access to opportunity i must be computed for each child using a *modified vector of circumstances* for each individual, which eliminates the variability of circumstances, *except for the variability of circumstance j* . This “equalized” vector of circumstances is identical for all individuals, *except for circumstance j* , which preserves the original value corresponding to each

²⁸ This situation is confirmed by the large opportunity gaps in the year 2009 for the aggregate HOIs of infants (IOHa0-4-Housing Services, 18% and IOHa0-4-Nutrition & ECD, 50 percent) and children (IOHa9-15-Housing Services, 32 percent), shown in Table 6. Furthermore, during the last decade the opportunity gap for IOHa0-4-Nutrition & ECD increased by 14 percentage points

²⁹ The penalty concept was introduced in Section 3.

individual.³⁰ Once the probabilities of access to the i -th opportunity have been computed using the equalized vector of circumstances (except the j -th), the “equalized” dissimilarity index $D^*(i,j)$ is computed. Then each cell in the IOC matrix, $IOC(i, j)$, is computed as the product of the “equalized” dissimilarity index $D^*(i,j)$ and the average access or coverage of opportunity i in the sample data.³¹ Consequently, the element $IOC(i, j)$ can be interpreted as the penalty P on the HOI(i) due to the inequality of opportunities associated with circumstance j . These computations represent the profile of inequality of opportunities by circumstance and are presented in Tables A-7-a and A-7-b in the Appendix. A summary of the main features of the profile of inequality of opportunities by circumstance is presented in Tables 7 and 8. Moreover, Table A-7-e in the appendix presents the results of an alternative method to compute the *IOC matrix*, the *Shapley* decomposition of inequality of opportunities.³² This methodology measures the change in inequality of opportunity by adding one circumstance and takes into account its correlation with all other circumstances.

Table 7. Analysis of the IOC Matrix: Inequality of Opportunity by Circumstance, Egypt, 2000 and 2009

<i>Distribution of {δs}</i>	<i>2000</i>	<i>2009</i>
Mean	1.2	1.7
1st Quartile	0.1	0.2
Median	0.5	0.9
3rd Quartile	1.3	2.2
<i>Circumstance</i>	<i>Mean of {IOCs} by circumstance*</i>	
Parents Eduaction	1.9	2.5
Income per capita	2.2	2.3
Urban-rural location	1.6	2.2
Number of children	1.9	2.1
Regional location	1.4	2.0
<i>Circumstance</i>	<i>Frequency of high value {IOCs} by circumstance **</i>	
Income per capita	7	8
Number of children	7	5
Regional location	4	6
Parents Eduaction	7	5
Gender	1	2
Presence of elderly	0	2
Presence of parents	0	2
Urban-rural location	5	2

(*) list only the five most unequalizing circumstances based on the mean of the column corresponding to each circumstance in the IOC matrix (see Tables A.7a and A.7b in the appendix). (**) reports the count of cells in the column corresponding to each circumstance of the IOC matrix with values in the top quartile of the distribution, that is the number of cells indicating inequality of opportunities by circumstance. Source: HIECS 2000 and 2009 and DHS 2000 and 2008. Author's calculations.

³⁰ All other circumstances in the “equalized” vector take their respective mean value for the reference population of that opportunity. Hence the probability of access i under the “equalized” vector indicates for one individual by how much that probability deviates from the average probability due to the specific value of circumstance j for that individual.

³¹ Section 3 introduced the average coverage concept, which corresponds to variable $C(i)$.

³² Developed by Hoyos and Narayan (2011), following the application of the Shapley decomposition concept by Shorrocks (1999)

Aggregate Analysis

The first notable feature of the IOC matrix is that the profile of the penalty of inequality of opportunities by circumstance showed an increasing trend in 60 percent of the cases. The figures in the top panel of Table 7 indicate that the mean, median, and all quartiles increased between 2000 and around 2009. Nevertheless, a more detailed analysis shows that the increasing trend in inequality of opportunity by circumstance applied to the majority of the cells in the matrix, but not all of them. In fact, 60 percent of the cells in the IOC matrix in 2009 exceeded their corresponding value in 2000, but 38 percent of the cells were *below* their value compared with 2000.³³ In summary, this is not an unambiguous pattern of increasing or decreasing inequality of opportunities by circumstance.³⁴ The five most influential circumstances for inequality of opportunity are parents' education, income per capita, urban-rural location, number of children in the household, and regional location. The second panel of Table 7 reports for each circumstance the mean of the inequality penalties across all opportunities, in other words, the mean of the column in the IOC matrix for the corresponding circumstance, in the initial and final periods.³⁵ Circumstances are listed in decreasing order of magnitude. The five most influential circumstances are at least twice as important as gender, presence of the elderly, and the presence of both parents in the household. Moreover, those circumstances correspond to the set of most influential circumstances in 2000, except that income per capita, which was the first most influential circumstance at the beginning of the decade, was replaced by parents' education at the end of the period.

Comparing means indicates broad trends but carries the risk of missing significant effects of certain circumstances on specific opportunities or the spread of the influence of each circumstance across the set of opportunities. To detect those cases and complement the previous analysis, the third panel of Table 7 indicates for each opportunity the number of times that the cells in its column in the IOC matrix score above the third quartile of the cells in the IOC matrix.³⁶ That is, the number of times that each circumstance was highly influential in the inequality of access to any opportunity. By this criterion, in 2009 there were *four* most influential circumstances on inequality of opportunity that scored in the top quartile at least four times (in the set of 16 opportunities), namely income per capita, number of children in the household, regional location, and urban-rural location. By the same criterion, in 2000 the set of circumstances with the most spread influence across opportunities was nearly identical, except that urban-rural location was a highly influential circumstance one decade earlier (with a count of 5 in 2000 *versus* a count of 2 in 2009) and regional location was somewhat less influential (with a count of 4 in 2000 *versus* a count of 6 in 2009).

These results are mostly consistent with the conclusion that identified the most influential

³³ See Tables A.5-1-a, A.5-1-b, and A.5-1-c in the Appendix.

³⁴ This result differs partially from the findings of Hassine (2009), which find a trend of decreasing inequality of opportunities as a share of total inequality of earnings, when comparing cohorts 40-49, 30-39, and 20-29. See Hassine (2009), Table 4, Model 3. This paper uses different inequality measures (Dissimilarity Index versus Gini, Atkinson, or Theil) and a different metric (access to opportunities versus earnings).

³⁵ See Tables A.7-a and A.7-b in the Appendix.

³⁶ See Tables A.7-a and A.7-b in the Appendix.

circumstances under the largest mean value criterion; nevertheless, the latter criterion provides a more nuanced perspective of the profile of inequality of opportunity by circumstance. For instance, the urban-rural location circumstance concentrated its influence in just two opportunities in 2009 – completion of secondary education on time and sanitation. And three other circumstances concentrated their influence on the inequality of access for the same two opportunities in 2009, namely gender, presence of elderly, and presence of parents.

A more detailed picture of which opportunities are subject to the highest unequalizing effects of the most influential circumstances is shown in Table A.7-c. There are two rows without blanks corresponding to completion of secondary education on time and sanitation, which means that all circumstances are highly influential on those two opportunities. The influence of urban-rural and regional location on sanitation is particularly relevant.³⁷ Non-overcrowding is highly influenced by four circumstances: number of children, income per capita, parents' education, and regional location. Two other educational opportunities – completion of primary and secondary – are highly influenced by parents' education, number of children, income per capita and regional location. Completion of secondary education on time is also very influenced by all other circumstances. There are four columns with fewer blanks, indicating that three circumstances – income per-capita, regional location, parents' education and number of children – are highly influential across numerous opportunities. Income per capita is highly influential for the two opportunities of completion of education grades on time, for three basic housing service opportunities (non-overcrowding, sanitation, and telephone) and three early childhood development opportunities (assisted birth delivery, post-natal care, and prenatal care). Regional location is highly influential for two educational opportunity (completion of secondary and primary education), two basic housing service opportunities (sanitation and non-overcrowding), and post-natal care and nutrition non-stunting. Parent's education is highly influential on all three educational opportunities, sanitation and non-overcrowding. Finally, number of children is highly influential on the two opportunities for completion of education on time, two basic housing opportunities (sanitation and non-overcrowding), and completed immunization vaccines. In summary, there is no single circumstance that is the most unequalizing across all opportunities. Nevertheless, this could possibly be the case within each sector, or if we compared the joint influence of demographic circumstances with the joint influence of all location circumstances.

For nearly all opportunities, demographic circumstances are more unequalizing than location circumstances. The last two columns of Table A.7-a summarize the unequalizing effects on each opportunity of all the demographic circumstances compared with the unequalizing effects of location circumstances. The results indicate unambiguously that for nearly all opportunities (15 of 16) demographic circumstances are the most unequalizing. Moreover, on average the inequality penalty of all demographic circumstances (jointly) on the HOIs is nearly three times the inequality penalty of all location circumstances (jointly) on the same HOIs, and in four cases this ratio is four-fold or larger. The only two exceptions to the joint dominance of demographic circumstances occur for sanitation and non-underweight. This is particularly important for sanitation, for which the ratio of the inequality penalty of location circumstances is 2.6 times the penalty associated with

³⁷ These rank as the first and second largest HOI penalties among all cells in the IOC matrix.

demographic circumstances. The fact that the *joint* unequalizing effect of demographic circumstances is significantly larger than the average of the unequalizing effects of demographic circumstances considered *one by one* suggests that there is some degree of (perverse) complementarity between unfavorable circumstances. That is to say, a household with two or three unfavorable circumstances would be subject to disproportionate penalties in its access to basic human development opportunities, well beyond the *linear* proxies given by the IOC matrix.³⁸

The Importance of Specific Circumstances across Sectors

In order to understand whether certain circumstances are more unequalizing within some sector than in others, the same methodology used in the previous sub-section can be applied to analyze the IOC matrix *by sector*. Table 8 reports, for 2000 and around 2009, the average inequality penalties for the HOIs *within each sector*, and for each circumstance. Each row lists one of the four sectors and each column corresponds to one of the eight circumstances. In each row the cells corresponding to the three most unequalizing circumstances are highlighted, and additional cells are highlighted if they exceed the mean inequality penalty of the period.³⁹

Table 8. Analysis of the IOC Matrix: Inequality of Opportunity by Circumstance -IOC- within Sectors, Egypt, 2009 *

<i>Sector of opportunities \ circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural location</i>	<i>Regional location</i>	<i>Mean</i>
	2009								
Education HOIs	1.5	3.2	1.6	1.5	5.5	2.7	1.7	2.0	2.5
Basic housing services HOIs	0.9	2.1	0.9	0.9	2.1	2.7	4.6	2.7	2.1
Early childhood development HOIs	0.3	1.4	0.2	0.0	0.8	2.9	0.3	1.5	0.9
Nutrition HOIs	0.7	1.6	0.1	0.1	0.9	1.4	0.6	1.5	0.9
	2000								
Education HOIs	0.5	1.6	0.1	0.0	2.2	0.5	0.7	0.5	0.8
Basic housing services HOIs	0.0	2.6	0.3	0.0	2.6	2.5	3.3	2.3	1.7
Early childhood development HOIs	0.3	1.1	0.1	0.4	1.4	3.2	0.9	1.2	1.1
Nutrition HOIs	0.5	1.9	0.3	0.2	0.9	1.9	0.1	0.6	0.8

Note: * Each cell reports the mean of {IOCs} by sector for each circumstance. See Tables A.7 a, b, c and d in the Appendix. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.

Education. The first row in Table 8 shows the marginal effects of circumstances on education opportunities in 2009. The figures presented in the education row indicate that in this sector *all eight* circumstances are significantly unequalizing, with *parents' education* being the most important (nearly twice the inequality penalty of other circumstances), followed by *number of children* in the household and income per capita. These results suggest that, for education opportunities in 2009, all differences in circumstances matter for inequality of opportunities. It must be noted that this pattern differs from the situation in

³⁸ The Shapley decomposition presented below captures the correlation across circumstances and the results indicate that the number of most influential circumstances is smaller.

³⁹ Reference values for the mean inequality penalty are 1.8 in 2009 and 1.2 in 2000.

2000, when only *two* circumstances were significantly influential – parents’ education and number of children – and the inequality of opportunity in education was three times smaller.⁴⁰

Basic housing services. The second row in Table 8 shows the marginal effects of circumstances on basic housing service opportunities in 2009. The results indicate that there are *five* significantly unequalizing circumstances. Urban-rural location circumstance presents the highest inequality penalty with 4.6 points (presumably due to economies of agglomeration), followed by income per capita and regional location with an inequality penalty of 2.7 points, and number of children and parents’ education with a penalty of 2.1 points. Compared with the situation a decade ago, both the level of inequality of opportunity in basic housing service opportunities and the profile of inequality of opportunity by circumstances have remained basically unchanged.

Early childhood development and nutrition. The third and fourth rows in Table 8 show the marginal effects of circumstances on early childhood development and nutrition opportunities in 2009. The results indicate that these two sets of HOIs have similar profiles of inequality of opportunity by circumstance. They both have similar levels of average inequality of opportunity by circumstance (the average penalty is 0.9), which is fortunately much lower than the penalties for education and basic housing services, considering the fact that the former are fundamental and critical opportunities in the earliest stages of human development. The *three* most unequalizing circumstances are number of children, region, and income per capita. Although they are of similar importance in the case of nutrition and hunger opportunities, in the case of early childhood development opportunities income per capita is twice as important as the other two. Compared with the situation one decade earlier, the assessments of both sectors differ. For early childhood development opportunities, both the level and the profile of inequality penalties by circumstance were similar. But for nutrition and hunger opportunities, despite the similar level of the average inequality penalty, the regional location circumstance did not play a significant unequalizing role, as it did around 2009.

Shapley decomposition of inequality of opportunity: consistent results

The results of the Shapley decomposition of inequality of opportunity by circumstances presented in table A-7-e are quite consistent with the results of the basic methodology of “equalization” of circumstances –presented above-. From the perspective of aggregate analysis the five most influential circumstances on inequality of opportunity are exactly the same and nearly in the same order of importance: parents’ education, income per capita, number of children in the household, urban-rural location, and regional location.⁴¹ Nevertheless, the application of the Shapley decomposition to the analysis across sectors shows some interesting differences: for the education sector there are only three most influential circumstances, parents’ education, income per capita and number of children, while the other five circumstances are nearly irrelevant. For the basic housing services sector, the set of five most influential circumstances remains unchanged. For the Early

⁴⁰ The average of the inequality penalties across the whole education row in the IOC matrix was 2.9 in 2009 and 0.8 in 2000.

⁴¹ Although the influence is more concentrated in the first four circumstances. This ranking results from the application of two criteria: comparing the average penalty for each circumstance across all 16 opportunities and comparing the number of highly influenced opportunities for each circumstance (see Table A-7-e).

Childhood Development sector, two of the three circumstances remain most influential (income percapita and the number of children) and two other circumstances *become* most influential (parents' education and urban-rural location). Finally for the Nutrition sector, two circumstances (urban-rural location and gender) are added to the set of most unequalizing circumstances (number of children, income percapita and regional location). Finally, the results of Shapley decomposition across every opportunity indicate that there are *four* circumstances that have a more predominant influence, parents' education, income percapita, number of children and urban-rural location.⁴²

Summing Up

The arguments presented here show that the largest challenges for Egyptian children in unfavorable circumstances are concentrated in improving access to *eight* opportunities. In addition, there is a clearly identified set of *five* most influential circumstances on aggregate inequality of opportunities. Nevertheless, the circumstances of children subject to deprivation in one sector might not be the same in another. For instance, although the profile of circumstances subject to deprivation of nutrition and ECD opportunities is characterized by three circumstances, the profile of deprivation of opportunities of education is more complex and involves five additional circumstances. And this profile differs from the profile of BHS opportunities, in which regional and location variables play a dominant role.

These differences in profiles of inequality of opportunity by circumstance across sectors provide obvious rationales for differential incentives and targeting across sectors. In other words, in order to reduce the eight largest opportunity gaps for Egyptian children, targeting and incentive measures to compensate for unfavorable circumstances should be revised with differentiated and sector-specific approaches. For example, a conditional cash transfer nutrition grant could be put in place that is proportional to the number of children and targeted to the poor by proxy mean test correlated with lower income and parents' education. This would apply to all ECD and nutrition opportunities and would be conditional on regular visits to monitor the children's development. In the case of BHS opportunities, the key seems to be regional targeting. Finally, it seems that conditional cash transfers would work for education opportunities because they compensate for some (not all) of the unfavorable circumstances, but would require complementary interventions to compensate for all the other unfavorable circumstances.

5.3 Targeting and Resource Allocation across Regions and Opportunities

To what extent do explicit or implicit targeting practices and rules for resource allocation across regions and sectors reinforce or counterbalance the adverse circumstances that prevent access to basic opportunities for Egyptian children? Are opportunity trends consistent with trends in resource allocation in education, health, water, and electricity, and by region? In relation to the first question, the available evidence indicates that there is room to improve the targeting of food and fuel subsidies to influence positively the HOIs of nutrition and cooking energy source.⁴³ For the second question, judging from the available

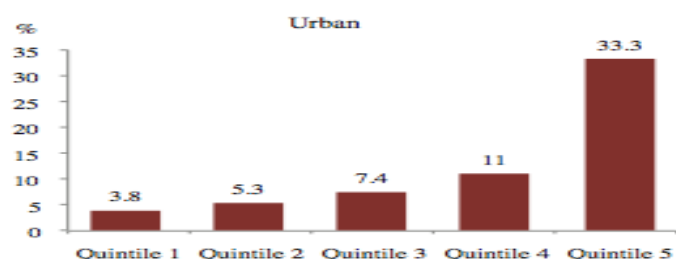
⁴² While the Shapley decomposition method indicates that those two circumstances account for 19 of the 32 highly influence cells of the IOC matrix, the "equalization method" assigns just 13 of the 32 highly influential cells to those two circumstances.

⁴³ Given the considerable magnitude of the resources devoted to services, there might be an opportunity to

evidence, the allocation of public expenditure across sectors and regions *alone* is not consistent with the trends in most HOIs, except in two sectors. There seem to be other powerful determinants that influence the efficacy of public expenditure and are crucial in explaining the evolution of opportunities.⁴⁴

Given the sector priorities in the sixth five-year plan – water and sanitation, transportation, agriculture and irrigation, education, and health – public investment in those sectors would have been expected to rise. However, only the share of water in public investment increased significantly (from around 3 to 8 percent) over the decade, and to a much lesser extent the share of real estate and housing (from 0.2 to 0.5 percent). By contrast, the share of education and health services in total public investment declined from 10 and 4.5 percent, respectively, to around 3 percent in FY10, and the share of communication from around 5 to 2.5 percent. For those sectors and over the same period, the same trend applies to government investment items. At the same time, social protection expenditure increased from 1.6 percent in 2002 to 9 percent of GDP at the end of the decade, and most of those resources were devoted to fuel and food subsidies.⁴⁵ By 2009, total fuel subsidies reached 6 percent of GDP and food subsidies were 2 percent of GDP.⁴⁶

Figure 8. Distribution of petroleum subsidies across urban income groups



Source: ECES (2010) *Policy Viewpoint 25: 2-4*

Targeting across Regions or Income Groups

Unfortunately, fuel and food subsidies are not only a substantial fiscal burden, but inequitably distributed as well. In fact, fuel subsidies vary significantly across energy products (from 20 to 93 percent) and are much lower for the fuels broadly demanded by low-income households. As a result, “the poorest twenty percent of urban population benefits from only 3.8 percent of total subsidies, while the richest [urban] twenty percent receives one-third of total subsidies” (see Figure 8).⁴⁷ Food subsidies are also poorly

save public resources in these sectors. See World Bank (2010) for estimates of the savings under alternative scenarios for reform.

⁴⁴ Explaining the trends in opportunities would require complex sector-specific modeling with much richer information and data to explain the behavior of all agents involved.

⁴⁵ See Martinez-Vasquez and Timofeev (2011), p. 404.

⁴⁶ See Albers and Peters (2011), Box 3, p. 17. “Other” social protection expenses accounted for 1 percent of GDP in 2009.

⁴⁷ ECES (2010, p. 2–4).

targeted, but less severely. Due to the wide coverage of ration cards (69 million beneficiaries), four in five households buy subsidized “baladi” bread and the three middle-income quintiles receive the highest shares of bread subsidies. Moreover, the wheat subsidy creates huge incentives for leakage into the black market because fully subsidized flour can be sold for ten times the price.⁴⁸ In summary, there is ample room to improve the current allocation of public social spending in the case of fuel and food subsidies to target better to the needy and prevent the irreversible consequences of nutritional deficiencies suffered by underprivileged children.

Opportunity Trends, Resources, and Allocation Across Regions

Although the evidence is inconclusive, available figures suggest that investment is allocated with some degree of inequity across regions. In principle, the allocation of investment to different governorates is supposed to be determined according to a funding formula that includes various indicators: population size, poverty rate, and human development indicators.⁴⁹ Prior to 2008, the share in the total population was the main criterion for allocating public investment, with some privileges provided in some years to Upper Egyptian governorates. Nevertheless, in FY09 Metropolitan and Frontier Governorates received much more than the expected shares according to their shares in population or poverty (see Table 9).⁵⁰ Investment in education and health benefited the Metropolitan and Frontier Governorate regions, as it allocated much larger resources per-capita and per-poor. Other sources indicate that for education and health, Lower and Upper Egypt spend less than the national average per capita, but Frontier Governorates spend at least twice the national average.⁵¹ It is notable that although the Upper Egypt region had 50 percent of the population in FY09, it received only 18.2 percent of the health expenditure, 19.5 percent of water expenditure, and 29.4 percent of education expenditure. This was in contrast to its more proportionate share for the electricity sector (48.4 percent).

Table 9: Shares of Regions in Government Investment in Selected Sectors, 2009 (percent)

	<i>Population</i>	<i>Poverty</i>	<i>Total public investment</i>	<i>Total government investment</i>	<i>Electricity</i>	<i>Water</i>	<i>Educational Services</i>	<i>Health Services</i>	<i>Information</i>
Metropolitans	17	4.6	33.6	30	6.4	16.9	30.4	32.1	0.7
Lower Egypt	31.1	16.2	30.3	30.6	20	53.9	35.6	32.4	7.4
Upper Egypt	50.3	78.5	25.6	32	29.7	20.9	30.2	30.9	91.1
Border	1.5	0.7	10.4	7.4	43.9	8.4	3.9	4.6	0.7
Share in total public investment					10.1	12.9	6.7	2.7	0.5

⁴⁸ Ibidem, p. 7.

⁴⁹ This is in the context of the Decentralization Project supported by the Ministry of Local Development and funded by USAID; the formula can also be applied at the district level.

⁵⁰ This bias increased between FY03 and FY09.

⁵¹ See Martinez-Vasquez and Timoneef (2011, p. 404).

Source: Poverty and population shares from the Household Income, Expenditure and Consumption Survey of 2008/09, and investment data from the MOED.

Furthermore, Table 10 shows that the allocation of teachers by region over the decade decreased the student-to-teacher ratio in the primary cycle in Metropolitan governorates and (more significantly) in Frontier governorates, while it increased the ratio in Upper Egypt and to a lesser extent in Lower Egypt. This was associated with an increase in class density across all regions, but more significantly in Lower Egypt.

Table 10. Inputs to the education sector by region, 2000 and 2008

	<i>Pupils/teacher ratio</i>						<i>Class Density</i>					
	<i>Primary</i>			<i>Preparatory</i>			<i>Primary</i>			<i>Preparatory</i>		
	<i>2000</i>	<i>2008</i>	<i>%Change</i>	<i>2000</i>	<i>2008</i>	<i>%Change</i>	<i>2000</i>	<i>2008</i>	<i>%Change</i>	<i>2000</i>	<i>2008</i>	<i>%Change</i>
Metropolitans	21.0	18.2	-13.3	18.0	7.4	-58.9	42.0	47.1	12.1	44.0	38.0	-13.6
Lower Egypt	21.0	21.2	1.0	23.0	15.6	-32.2	39.0	51.4	31.8	43.0	38.4	-10.7
Upper Egypt	26.0	28.0	7.7	26.0	17.8	-31.5	42.0	43.5	3.6	44.0	41.8	-5.0
Frontiers	12.0	6.7	-44.2	12.0	4.9	-59.2	25.0	26.0	4.0	29.0	25.3	-12.8
All Egypt	22.0	22.0	0.0	22.0	13.4	-39.1	40.0	42.5	6.3	43.0	39.3	-8.6

Source: World Bank (2010).

In summary, the trends in allocation of resources across sectors and regions are insufficient to provide a satisfactory explanation of the evolution of HOIs during the decade. This should not be surprising if we anticipate that, in addition to the obvious impact of resources available by sector and region, there must be significant variability in the efficacy of public expenditures (across sectors and regions) that influence access and inequality of access at the national and regional levels.⁵² For instance, the decreasing share of public investment in education is consistent with the modest progress of education HOIs during the decade. However, the distribution of resources across regions (Tables 9 and 10) favoring the Metropolitan and Frontier Governorate regions cannot explain the substantial progress of education HOIs in Upper and Lower Egypt. The early childhood development HOIs (except immunization vaccines) advanced substantially during the period, while the share of public expenditure in health showed a decreasing trend. Moreover, the distribution of health resources across regions (Table 9) favoring the Metropolitan and Frontier Governorates is contradictory to the substantial progress of ECD HOIs in Lower and Upper Egypt. Finally, some nutrition HOI indicators deteriorated or showed no progress, while food subsidies increased substantially during the period. Only in the case of the HOI for water and cooking energy source was substantial progress observed for this opportunity consistent with the increasing trend in fuel subsidies. Yet, access to water improved substantially in Upper Egypt, while the allocation of resources mostly favored Lower Egypt and Frontier Governorates.

6. Summary and Conclusions

This paper provides relevant indicators and measurements that are useful for public policies seeking the expansion of equitable human development opportunities for children and

⁵² A more comprehensive analytical framework – different from the HOI methodology – including both supply and demand determinants of access to opportunities seems necessary to identify the key factors (beyond public expenditure) behind the observed trends in the HOI.

youth. First, it identifies which opportunities progressed during the past decade, how they compared across regions, and which services require the most urgent attention to close the opportunity gaps faced by Egyptian children in the most adverse circumstances (either demographic or location). And second, it indicates under which circumstances are children's more likely to be excluded from access to basic opportunities. In summary, the answers to the five specific questions stated in the introduction are the following:

Measurement of the HOIs: Trends and the Main Opportunity Gaps

Although income inequality has been relatively stable in Egypt during the past decade, opportunities for children and youth improved unambiguously in nearly all cases, with some important exceptions.

In fact, the improvement in human development opportunities for children has been uneven across sectors. Although the rates of improvement in the opportunity indices of basic housing services and early childhood development were impressive, improvement in the opportunities in education and nutrition and hunger were modest or worsened. Telephone access recorded the largest annual rate of improvement, followed by cooking energy, prenatal care, and assisted birth delivery with substantial rates of progress. Access to water, non-overcrowding, and post-natal care showed rates of progress close to the average rate, followed by five opportunities with modest improvements, namely all three education opportunities, access to sanitation, and nutrition non-underweight. By contrast, three HOI indices that merit a note of concern are: nutrition non-stunting, which did not show any progress, and two of the indices for children between 0 and 4 years that deteriorated, namely, nutrition non-wasting and immunization vaccines. Not surprisingly, the aggregate HOI for Nutrition and ECD showed zero progress during the last decade

Despite the progress made in access to several opportunities, there were still substantial opportunity gaps between children in favorable and unfavorable circumstances. The most important challenges faced by Egyptian children in unfavorable circumstances in 2009 were lack of access to five opportunities in education and basic housing services, with gaps ranging from 23 to 71 percentage points. In order of importance, they are: access to sanitation, completion of secondary education on time, non-overcrowded housing, access to telephone and complete primary education. Four other opportunities that represent considerable challenges, with 14 to 22-point gaps, are access to prenatal and post-natal care, assisted birth delivery and nutrition non-wasting.

Although urban centers offer better opportunities for Egyptian children, the urban-rural gap was partially reduced during the decade. Significant opportunity gaps were reported for all HOI indices, and were particularly large for basic housing services and early childhood development, with four notable exceptions: nutrition non-wasting, immunization vaccines, lighting energy source, and cooking energy source. The rural-urban gap in basic housing services was driven by a 57-point gap in sanitation, and by a 20-point gap in access to a telephone. And the early childhood development gap is explained by a 14-point gap in ante-natal care and a 13-point gap in assisted birth delivery. The most significant rural-urban education gap is in completion of secondary education.

In the Metropolitan region, children enjoy better opportunities than in other regions of the country, nevertheless the inter-regional gap narrowed during the decade. In 2009, the overall HOI was highest in the Metropolitan region and lowest in Frontier Governorates, with Lower Egypt in between and Upper Egypt just marginally superior to the Frontier Governorates. The same inter-regional ranking was found when using HOI indicators for early childhood development and nutrition and hunger, but for education and basic housing services the inter-regional ranking showed a differentiated pattern. Lower Egypt's HOIs in both sectors reached equal or higher level than the Metropolitan region; and Upper Egypt reached higher HOIs than Frontier Governorates in both sectors.

The Upper Egypt region experienced the largest gains and jumped one place in the inter-regional ranking, although all four regions improved opportunities for children. In fact, the overall aggregate HOI and the sector aggregate HOIs advanced at a much faster pace in the Upper and Lower Egypt regions, while in the Metropolitan and Frontier Governorates regions the aggregate HOI made just moderate progress. The faster improvement of opportunities by these two regions, which had offered fewer opportunities in 2000, narrowed the gap relative to the Metropolitan region and suggests a pattern of moderate inter-regional convergence. It was mainly driven by their progress in HOIs for education, basic housing services, and early childhood development.

Better access was more important than greater equality of opportunity. The progress in opportunities for Egyptian children, as measured by the HOI, was predominantly driven by increased access and to a lesser extent by equality of opportunity. At least 59 percent of the improvement in all HOI indices is explained by the scale effect, and in the three extreme cases – post-natal care and completion of secondary and post-secondary education – it ranged from 82 to 91 percent.⁵³

International comparisons with Latin American countries render mixed results. Finding adequate comparator countries for benchmarking the opportunities available to Egyptian children is somewhat challenging, because nearly all comparable information on HOIs has been produced for Latin American countries (not for countries in the Middle East and North Africa) and only for a small subset of basic opportunities. Comparisons with Latin American countries indicate mixed results across opportunities. On the one hand, it shows the achievements of Egypt in offering opportunities in water and electricity. On the other hand, Egypt faces large challenges in expanding access to opportunities in education and sanitation to catch up with Latin America. Nevertheless, those challenges are similar to those for a subset of low-income countries in Latin America.

This document provides no sufficient explanation of the trends in opportunities for Egyptian children during the past decade. The evidence suggests that access to opportunities is not simply a matter of quantities of resources allocated across sectors and regions over time. There are other key (supply and demand) sector-specific determinants that should be considered in any future work. Additional analysis of contemporary sector-specific policies is necessary to identify the key factors behind the expansion or contraction of specific opportunities.

⁵³ Consistent results are obtained with an alternative methodology for decomposition of intertemporal changes that includes the so-called “composition effect.”

Profile of Opportunities by Circumstances

The five most unequalizing demographic and location circumstances for Egyptian children are: parents' education, income per capita, urban-rural location, number of children in the household, and regional location. These are at least twice as important as gender, presence of the elderly, and presence of both parents in the household. However, when demographic circumstances are considered jointly, they are more unequalizing than location circumstances for nearly all opportunities.

Nevertheless, the set of most unequalizing circumstances in one sector might not be the same in other sectors; therefore, policy makers should adjust targeting mechanisms accordingly. Although the profile of the most unequalizing circumstances for opportunities in the early childhood development and nutrition and hunger sectors is characterized by three circumstances – income per capita, number of children, and regional location – the profile of deprivation of opportunities of basic housing services is more complex and includes two additional dimensions with the most unequalizing effect – parents' education and urban-rural location. The profile of education opportunities is a case apart, because all eight circumstances play an important unequalizing role, and it includes gender and the presence of parents and the elderly. The main results of the profile of opportunities by circumstances appear robust to an alternative methodology (Shapley decomposition), except of education opportunities. For those opportunities the alternative methodology identifies a much smaller set of *three* highly influential circumstances: parent's education, income percapita and number of children in the household.

It remains uncertain the extent to which the inequalities in opportunities of today's children – -measured by the HOI – will map into inequality of earnings when the children grow up and enter the labor market. The findings of this paper do not coincide squarely with Hassine's (2009) decreasing inequality of opportunities for younger cohorts. Nevertheless, it must be acknowledged that the comparability of the results is compromised by the different inequality indicators and metrics used. Moreover inequality of access to certain opportunities, such as education, could have a greater impact on earnings in the labor market. Further work should be devoted to understand these important links.

Four Policy Recommendations

The fact that the set of most unequalizing circumstances varies across sectors must be disseminated and discussed with government officials as a key reference to revise and adjust targeting designs *within each sector* in order to remove the barriers to access for children under the most unfavorable circumstances and improve the equality of opportunity. This is especially important for those children with less educated parents, a larger number of siblings, and lower income, and moreover if they live in rural areas or in the less developed regions – Upper Egypt and Frontier Governorates. Special attention should be paid to children with more than two or three unfavorable circumstances because there is some “perverse” complementarity between them.

An agenda for reform of expensive and inequitable subsidy programs for food and fuel is clearly justified in order to promote equality of opportunity among Egyptian children.⁵⁴ The relatively poor performance of the HOI indicators for nutrition (non-stunting and non-wasting), and the poor targeting of food subsidies merit the reform of those programs. The evidence presented suggests that there is ample room to improve the current allocation of public social spending on both food and fuel subsidies to better target it to the needy and prevent irreversible consequences of nutritional deficiencies suffered by underprivileged children.⁵⁵

Moreover, the substantial resources that could be saved in the fuel and food subsidy programs might be devoted to conditional cash transfer nutrition programs, which would compensate for the most unfavorable circumstances (income per capita and number of siblings) that have been found to prevent access to nutrition opportunities.

Finally, to increase awareness of inequality of opportunities among stakeholders and policy makers, the computation of opportunity indicators should be updated and disaggregated. More disaggregated HOIs – by sub-region or municipality using census data – would provide relevant information to sub-national governments to implement more equitable policies for human development.

⁵⁴ This point reinforces the recommendation made in the World Bank's report on food subsidies (World Bank, 2010).

⁵⁵ Rocco et al. (2011) show the link from malnutrition of Egyptian children to chronic diseases in adults, and to major economic efficiency losses due to reductions in employment.

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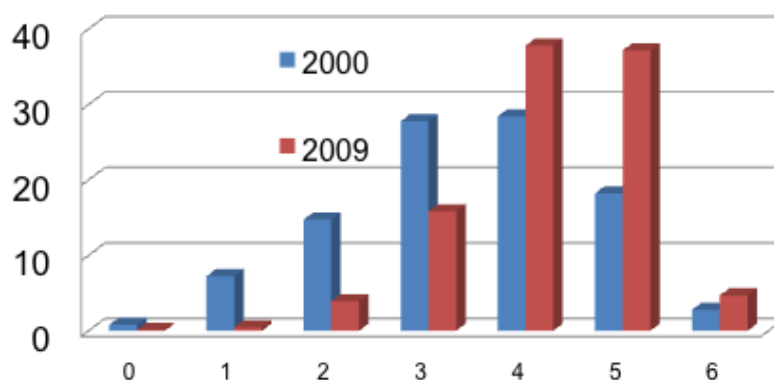
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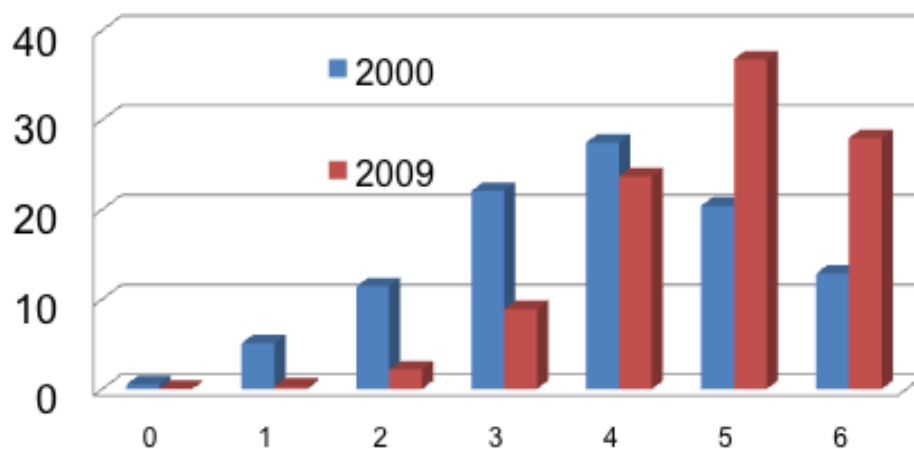
Statistical Appendix

Figure A-1. Aggregate HOIs: Histograms children and access to number of opportunities 2009

Number of Housing Services opportunities accessed by 9-15 year olds



Number of Housing Services opportunities accessed by 0-4 year olds



Number of Nutrition and ECD opportunities accessed by 0-4 year olds

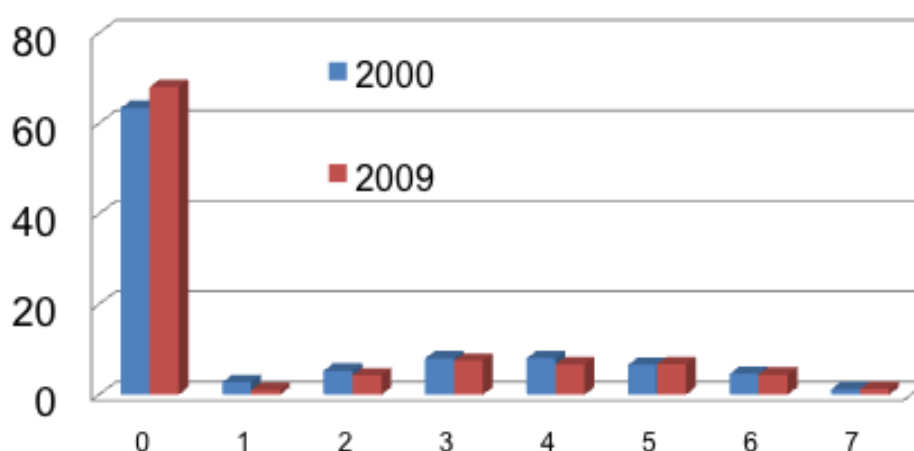


Table A.1 IOH Egypt circa 2009: Access, Equality of Access, and Opportunity Index

Opportunity	Access	Equality (1-D)	HOI	Rank equality
Complete primary education on time	86	95	82	13
Complete secondary education on time	63	11	57	6
School attendance, 9-15	92	97	89	4
Water	91	97	88	4
Sanitation	44	68	30	1
Lighting energy source	99	100	99	2
Cooking energy source	99	99	97	14
Non-overcrowding, 0-5	69	85	59	14
Telephone	78	91	71	9
Assisted birth delivery	89	95	84	16
Post-natal care, 0-5	32	88	28	10
Prenatal care, 0-4	83	94	78	7
Immunization vaccines, 0-4	89	96	85	11
Non-wasting, 0-4	79	95	75	12
Non-stunting, 2-17	72	96	69	8
Non-underweight, 0-17	87	97	85	13
<i>Aggregate HOIs</i>				
Aggregate 0-4 years HIECS	72	90	72	
Aggregate 9-15 years HIECS	83	94	83	
Aggregate 0-4 years DHS	14	56	14	
<i>Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.</i>				

Table A.2 IOH Egypt 2000: Access, Equality of Access, and Opportunity Index

Opportunity	Access	Equality (1-D)	HOI	Rank equality
Complete primary education on time	84	93	78	5
Complete secondary education on time	62	87	54	11
---School attendance, 9-15	---	---	---	7
Water	83	92	77	15
Sanitation	40	65	26	1
Lighting energy source	99	99	98	8
Cooking energy source	82	89	73	13
Non-overcrowding, 0-5	61	78	48	16
Telephone	24	56	14	9
Assisted birth delivery	73	88	64	12
Post-natal care, 0-5	22	85	19	10
Prenatal care, 0-4	66	87	58	3
Immunization vaccines, 0-4	89	98	87	2
Non-wasting, 0-4	89	99	88	6
Non-stunting, 2-17	74	93	69	4
Non-underweight, 0-17	85	95	80	5
<i>Aggregate HOIs</i>				
Aggregate 0-4 years HIECS	35	71	35	
Aggregate 9-15 years HIECS	49	77	49	
Aggregate 0-4 years DHS	14	66	14	
<i>Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.</i>				

**Table A3. Human Opportunity Index for Egypt, 2000 and 2009:
Three way decomposition**

<i>Opportunity</i>	<i>2000</i>	<i>Circa 2009</i>	<i>Annual rate of change</i>	<i>Decomposition *</i>		
				<i>Composition</i>	<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education on time	78	82	0.4%	---	---	---
Complete secondary education on time	54	57	0.3%	---	---	---
School attendance, 9-15	n.a.	89	---	---	---	---
Water	77	88	1.3%	85%	5%	10%
Sanitation	26	30	0.5%	133%	-27%	-7%
Lighting energy source	98	99	0.1%	---	---	---
Cooking energy source	73	98	2.8%	72%	16%	12%
Non-overcrowding, 0-5	48	59	1.2%	178%	-66%	-13%
Telephone	14	71	6.3%	-439%	320%	220%
Assisted birth delivery	64	84	2.5%	32%	50%	18%
Post-natal care, 0-5	19	28	1.1%	14%	76%	10%
Prenatal care, 0-4	58	78	2.6%	23%	58%	19%
Immunization vaccines, 0-4	87	85	-0.2%	---	---	---
Non-wasting, 0-4	88	75	-1.6%	0%	79%	21%
Non-stunting, 2-17	69	69	0.0%	---	---	---
Non-underweight, 0-17	80	85	0.6%	---	---	---
<i>Aggregate HOIs</i>						
IOHa9-15-Housing Services	35	72	4.1%	66%	34%	66%
IOHa0-4-Housing Services	49	83	3.8%	64%	36%	64%
IOHa0-4-Nutrition & ECD	14	14	0.0%	---	---	---
Note: (*) Decomposition is omitted for trivial cases in which the HOI change is negligible. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.						

Table A-4. Ranking of Egyptian Regions by HOIs, 2000 and 2009								
	2000				2009			
<i>Opportunity</i>	<i>Metropolitan</i>	<i>Lower Egypt</i>	<i>Upper Egypt</i>	<i>Frontier Governorates</i>	<i>Metropolitan</i>	<i>Lower Egypt</i>	<i>Upper Egypt</i>	<i>Frontier Governorates</i>
Complete primary education on time	1	3	4	2	3	1	4	2
Complete secondary education on time	1	3	4	2	2	1	4	3
School attendance, 9-15	---	---	---	---	2	1	3	4
Water	1	3	4	2	1	3	2	4
Sanitation	1	2	4	3	1	3	4	2
Lighting energy source	1	2	3	4	2	1	3	4
Cooking energy source	1	3	4	2	1	1	3	4
Non-overcrowding, 0-5	2	3	4	1	2	1	4	3
Telephone	1	3	4	2	2	3	4	1
Assisted birth delivery	1	2	3	4	1	2	3	4
Post-natal care, 0-5	1	3	2	4	1	3	2	4
Prenatal care, 0-4	1	2	3	4	1	2	3	4
Immunization vaccines, 0-4	3	1	2	4	1	1	3	4
Non-wasting, 0-4	3	1	2	4	4	1	2	3
Non-stunting, 2-17	1	2	3	4	1	3	1	4
Non-underweight, 0-17	1	2	3	4	1	2	3	4
<i>IOHa16</i>	1	2	4	3	1	2	3	4
<i>Count of opportunities in 1st rank</i>	12	2	0	1	9	8	1	1
<i>Count of opportunities in 2nd rank</i>	1	6	3	5	5	3	3	2
<i>Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.</i>								

Table A-5.A. HOIs for Metropolitan Region: Rate of Progress and Decomposition between 2000 and 2009.

<i>Opportunity</i>	<i>HOI 2000</i>	<i>HOI Circa 2009</i>	<i>Annual Rate of change</i>	<i>Decomposition*</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education	90	80	-1.2	78%	22%
Complete secondary education	68	58	-1.0	88%	12%
School attendance 9-15	---	90	---	---	---
Water	98	97	-0.1	---	---
Sanitation	97	88	-1.0	77%	23%
Lighting energy source	100	99	-0.1	---	---
Cooking energy source	98	99	0.1	---	---
No-overcrowding 0-5	57	64	0.8	43%	57%
Telephone	44	88	4.9	55%	45%
Assisted Birth Delivery	87	93	0.8	70%	30%
Post-Natal care 0-5	25	40	1.9	68%	32%
Ante-natal Care 0-4	79	90	1.4	66%	34%
Immunization Vaccines 0-4	81	85	0.5	176%	-76%
Nutrition weight-for-height, 0-4	85	67	-2.3	85%	15%
Nutrition height-for-age 2-17	78	74	-0.5	143%	-43%
Nutrition weight-for-age 0-17	86	89	0.4	99%	1%

Note: (*)Decomposition is omitted for trivial cases in which the HOI change is negligible.
Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.

Table A-5.A. HOIs for Metropolitan Region: Rate of Progress and Decomposition between 2000 and 2009.					
<i>Opportunity</i>	<i>HOI 2000</i>	<i>HOI Circa 2009</i>	<i>Annual Rate of change</i>	<i>Decomposition*</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education	90	80	-1.2	78%	22%
Complete secondary education	68	58	-1.0	88%	12%
School attendance 9-15	---	90	---	---	---
Water	98	97	-0.1	---	---
Sanitation	97	88	-1.0	77%	23%
Lighting energy source	100	99	-0.1	---	---
Cooking energy source	98	99	0.1	---	---
No-overcrowding 0-5	57	64	0.8	43%	57%
Telephone	44	88	4.9	55%	45%
Assisted Birth Delivery	87	93	0.8	70%	30%
Post-Natal care 0-5	25	40	1.9	68%	32%
Ante-natal Care 0-4	79	90	1.4	66%	34%
Immunization Vaccines 0-4	81	85	0.5	176%	-76%
Nutrition weight-for-height, 0-4	85	67	-2.3	85%	15%
Nutrition height-for-age 2-17	78	74	-0.5	143%	-43%
Nutrition weight-for-age 0-17	86	89	0.4	99%	1%
Note: (*)Decomposition is omitted for trivial cases in which the HOI change is negligible. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.					

Table A-5.B. HOIs for Lower Egypt Region: Rate of Progress and Decomposition between 2000 and 2009.					
<i>Opportunity</i>	<i>HOI 2000</i>	<i>HOI Circa 2009</i>	<i>Annual Rate of change</i>	<i>Decomposition*</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education on time	83	86	0.4	70%	30%
Complete secondary education on time	58	61	0.3	86%	14%
School attendance 9-15	---	92	---	---	---
Water	80	87	0.8	67%	33%
Sanitation	35	33	-0.2	4%	96%
Lighting energy source	99	100	0.1	---	---
Cooking energy source	89	99	1.1	67%	33%
No-overcrowding 0-5	57	72	1.7	60%	40%
Telephone	12	73	6.8	69%	31%
Assisted Birth Delivery	66	88	2.8	75%	25%
Post-Natal care 0-5	17	24	0.9	87%	13%
Ante-natal Care 0-4	57	77	2.5	79%	21%
Immunization Vaccines 0-4	89	85	-0.5	34%	66%
Nutrition weight-for-height, 0-4	89	79	-1.3	65%	35%
Nutrition height-for-age 2-17	70	64	-0.8	106%	-6%
Nutrition weight-for-age 0-17	81	87	0.8	55%	45%
Note: (*)Decomposition is omitted for trivial cases in which the HOI change is negligible. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.					

Table A-5.C. HOIs for Upper Egypt Region: Rate of Progress and Decomposition between 2000 and 2009.					
<i>Opportunity</i>	<i>HOI 2000</i>	<i>HOI Circa 2009</i>	<i>Annual Rate of change</i>	<i>Decomposition*</i>	
				<i>Access</i>	<i>Equality of opportunity</i>
Complete primary education on time	69	78	1.0	67%	33%
Complete secondary education on time	43	51	0.8	58%	42%
School attendance 9-15	---	86	---	---	---
Water	69	88	2.1	72%	28%
Sanitation	7	16	1.0	62%	38%
Lighting energy source	96	99	0.3	46%	54%
Cooking energy source	53	97	4.9	68%	32%
No-overcrowding 0-5	38	45	0.8	66%	34%
Telephone	9	63	6.0	67%	33%
Assisted Birth Delivery	53	75	2.8	108%	-8%
Post-Natal care 0-5	18	30	1.5	85%	15%
Ante-natal Care 0-4	51	74	2.9	81%	19%
Immunization Vaccines 0-4	86	81	-0.6	63%	37%
Nutrition weight-for-height, 0-4	86	72	-1.8	90%	10%
Nutrition height-for-age 2-17	64	74	1.3	70%	30%
Nutrition weight-for-age 0-17	76	80	0.5	36%	64%
Note: (*)Decomposition is omitted for trivial cases in which the HOI change is negligible. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.					

Table A-5.D. HOIs for Frontier Governorates: Rate of Progress and Decomposition between 2000 and 2009.					
<i>Opportunity</i>	<i>HOI 2000</i>	<i>HOI Circa 2009</i>	<i>Annual Rate of change</i>	<i>Decomposition*</i>	
				<i>Acces s</i>	<i>Equality of opportunity</i>
Complete primary education on time	88	80	-0.9	64%	36%
Complete secondary education on time	61	57	-0.4	52%	48%
School attendance 9-15	---	82	---	---	---
Water	94	83	-1.2	53%	47%
Sanitation	30	36	0.7	6%	94%
Lighting energy source	92	86	-0.7	55%	45%
Cooking energy source	93	93	0.0	---	---
No-overcrowding 0-5	58	64	0.7	53%	47%
Telephone	41	88	5.2	67%	33%
Assisted Birth Delivery	52	63	1.4	135 %	-35%
Post-Natal care 0-5	10	11	0.1	---	---
Ante-natal Care 0-4	36	64	3.5	61%	39%
Immunization Vaccines 0-4	73	80	0.9	39%	61%
Nutrition weight-for-height, 0-4	76	71	-0.6	-7%	107%
Nutrition height-for-age 2-17	51	53	0.3	---	---
Nutrition weight-for-age 0-17	68	72	0.5	- 40%	140%
Note: (*) Decomposition is omitted for trivial cases in which the HOI change is negligible. Source: HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, And authors' calculations.					

Table A.6 Opportunity Gaps between Percentiles P90/P10, Egypt, 2009 and 2000

Opportunity	Access probability						Change in gap
	2009			2000			
	p90	p10	gap	p90	p10	gap	
Complete primary education on time	0.99	0.75	0.24	0.97	0.65	0.32	-0.08
Complete secondary education on time	0.92	0.44	0.48	0.86	0.38	0.48	0.00
School attendance, 9-15	1.00	0.82	0.18	---	---	---	---
Water	0.99	0.81	0.18	1.00	0.64	0.35	-0.17
Sanitation	0.91	0.10	0.81	0.98	0.05	0.93	-0.12
Lighting energy source	1.00	0.98	0.02	1.00	0.97	0.03	-0.02
Cooking energy source	1.00	0.96	0.04	1.00	0.46	0.54	-0.50
Non-overcrowding, 0-5	0.95	0.29	0.66	0.96	0.15	0.81	-0.15
Telephone	0.98	0.53	0.45	0.87	0.05	0.83	-0.38
Assisted birth delivery	0.98	0.69	0.28	0.97	0.43	0.55	-0.26
Post-natal care, 0-5	0.45	0.21	0.24	0.35	0.12	0.23	0.01
Prenatal care, 0-4	0.97	0.66	0.31	0.91	0.39	0.51	-0.20
Immunization vaccines, 0-4	0.98	0.75	0.23	0.94	0.81	0.13	0.10
Non-wasting, 0-4	0.89	0.67	0.23	0.93	0.85	0.08	0.15
Non-stunting, 2-17	0.81	0.62	0.19	0.88	0.56	0.32	-0.12
Non-underweight, 0-17	0.94	0.79	0.15	0.94	0.68	0.26	-0.11
IOHa9-15-Housing Services	0.98	0.64	0.34	0.97	0.11	0.86	-0.52
IOHa0-4-Housing Services	0.99	0.64	0.35	0.99	0.16	0.83	-0.48
IOHa0-4-Nutrition & ECD	0.54	0.02	0.52	0.44	0.02	0.42	0.10

Source: HIECS 2000 and 2009 survey, EDHS 2000 and 2008, and authors' calculations.

Table A-7.a. IOC Matrix: Inequality of Opportunity by Circumstance, Egypt, 2009 *										
<i>Opportunities \ circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural location</i>	<i>Regional location</i>	<i>All Demographi</i>	<i>All Location</i>
Complete primary education on time	1.7	5.0	1.7	1.5	7.8	3.1	2.2	2.3	10.4	2.1
Complete secondary education on time	2.4	4.2	2.5	2.4	6.4	3.9	2.4	2.9	8.2	2.7
School attendance, 9-15	0.5	0.5	0.5	0.5	2.4	1.0	0.5	0.7	3.2	0.7
Water	0.4	0.4	0.5	0.4	1.1	1.3	1.5	0.7	2.1	1.5
Sanitation	2.6	4.7	2.7	2.6	6.4	5.4	23.4	11.4	9.7	25.3
Lighting energy source	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1
Cooking energy source	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.4	0.1
Non-overcrowding, 0-5	1.5	6.4	1.5	1.5	2.8	5.6	1.4	2.9	10.5	3.0
Telephone	0.9	1.2	0.9	0.9	1.9	3.7	1.4	0.9	4.4	1.5
Assisted birth delivery	0.4	0.2	0.0	0.2	0.6	3.5	0.7	0.6	3.7	0.7
Post-natal care, 0-5	0.3	1.4	0.4	0.0	1.0	2.6	0.3	3.4	3.5	3.5
Prenatal care, 0-4	0.2	0.6	0.0	0.0	0.9	4.8	0.1	1.1	5.3	1.1
Immunization vaccines, 0-4	0.1	3.6	0.4	0.0	0.8	0.8	0.3	1.0	4.0	1.2
Non-wasting, 0-4	0.9	1.9	0.0	0.0	1.1	2.1	0.1	1.8	3.2	2.1
Non-stunting, 2-17	0.4	1.4	0.2	0.3	0.8	1.2	0.7	2.8	2.2	3.0
Non-underweight, 0-17	0.9	1.6	0.1	0.0	0.7	0.9	1.0	0.0	2.5	1.3
Note: * Each cell reports the mean of {IOCs} by sector for each circumstance. Source: HIECS 2009, EDHS 2008, and authors' calculations.										

Table A.7.b_ IOC Matrix: Inequality of Opportunity by Circumstance, Egypt, 2000 *								
<i>Opportunities \ circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural location</i>	<i>Regional location</i>
Complete primary education on time	0.6	1.6	0.1	0.0	2.2	0.9	1.0	0.7
Complete secondary education on time	0.3	0.8	0.1	0.0	1.2	0.3	0.4	0.3
School attendance, 9-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water	0.0	0.1	0.0	0.0	1.3	0.7	2.1	0.6
Sanitation	0.1	1.8	0.2	0.0	1.5	1.1	10.7	9.8
Lighting energy source	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Cooking energy source	0.0	0.1	0.0	0.0	1.0	1.3	0.7	0.9
Non-overcrowding, 0-5	0.1	10.0	0.4	0.0	4.3	3.8	1.3	2.1
Telephone	0.0	3.4	0.9	0.0	7.6	7.8	5.0	0.5
Assisted birth delivery	0.3	1.2	0.3	0.5	1.7	4.4	1.4	1.4
Post-natal care, 0-5	0.4	0.6	0.1	0.0	1.2	2.7	0.5	1.1
Prenatal care, 0-4	0.5	1.2	0.1	0.9	2.0	5.3	1.5	1.4
Immunization vaccines, 0-4	0.1	1.5	0.0	0.3	0.7	0.4	0.4	0.9
Non-wasting, 0-4	0.2	0.1	0.3	0.0	0.6	1.1	0.0	0.4
Non-stunting, 2-17	1.2	2.9	0.3	0.5	1.0	2.0	0.1	0.9
Non-underweight, 0-17	0.3	2.7	0.2	0.0	1.2	2.5	0.2	0.5
<i>Note:</i> * Each cell reports the mean of {IOCs} by sector for each circumstance. <i>Source:</i> HIECS 2000 survey, EDHS 2000, and authors' calculations.								

Table A.7.c__ IOC Matrix: Highly Unequalizing Circumstances by Opportunity, Egypt, 2009 *								
<i>Opportunities \ circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural location</i>	<i>Regional location</i>
Complete primary education on time	---	X	---	---	X	X	---	---
Complete secondary education on time	---	X	---	---	X	X	---	X
School attendance, 9-15	---	---	---	---	---	---	---	---
Water	---	---	---	---	---	---	---	---
Sanitation	X	X	X	X	X	X	X	X
Lighting energy source	---	---	---	---	---	---	---	---
Cooking energy source	---	---	---	---	---	---	---	---
Non-overcrowding, 0-5	---	X	---	---	X	X	---	X
Telephone	---	---	---	---	---	X	---	---
Assisted birth delivery	---	---	---	---	---	X	---	---
Post-natal care, 0-5	---	---	---	---	---	X	---	X
Prenatal care, 0-4	---	---	---	---	---	X	---	---
Immunization vaccines, 0-4	---	X	---	---	---	---	---	---
Non-wasting, 0-4	---	---	---	---	---	---	---	---
Non-stunting, 2-17	---	---	---	---	---	---	---	X
Non-underweight, 0-17	---	---	---	---	---	---	---	---
Note: * Cells with X indicate fourth quartile value of inequality of opportunity by circumstance in the IOC matrix 2009, Table A-7.a in the Appendix. Source: HIECS 2009, EDHS 2008, and authors' calculations.								

Table A-7.d. IOC Matrix: Ranking of Highly Unequalizing Circumstances by Opportunity, Egypt, 2009 *

<i>Opportunities \ circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural</i>	<i>Regional location</i>
Complete primary education on time	---	10	---	---	4	25	---	---
Complete secondary education on time	---	14	---	---	5	16	---	27
School attendance, 9-15	---	---	---	---	---	---	---	---
Water	---	---	---	---	---	---	---	---
Sanitation	33	12	31	32	7	9	1	2
Lighting energy source	---	---	---	---	---	---	---	---
Cooking energy source	---	---	---	---	---	---	---	---
Non-overcrowding, 0-5	---	6	---	---	30	8	---	28
Telephone	---	---	---	---	---	18	---	---
Assisted birth delivery	---	---	---	---	---	20	---	---
Post-natal care, 0-5	---	---	---	---	---	34	---	21
Prenatal care, 0-4	---	---	---	---	---	11	---	---
Immunization vaccines, 0-4	---	19	---	---	---	---	---	---
Non-wasting, 0-4	---	---	---	---	---	---	---	---
Non-stunting, 2-17	---	---	---	---	---	---	---	29
Non-underweight, 0-17	---	---	---	---	---	---	---	---
<i>Note:</i> Cells with numbers indicate fourth quartile value of inequality of opportunity by circumstance in the IOC matrix 2009, Table A-7.a in the Appendix. <i>Source:</i> HIECS 2009, EDHS 2008, and authors' calculations.								

Table A-7-e. IOC Matrix by Shapley method: Inequality of Opportunity by Circumstance, Egypt, 2009 *

<i>Opportunities \ Circumstances</i>	<i>Gender</i>	<i>Number of children</i>	<i>Presence of elderly</i>	<i>Presence of parents</i>	<i>Parents Education</i>	<i>Income per capita</i>	<i>Urban-rural</i>	<i>Regional location</i>
Completion of Below Intermediate OT	0.0	0.3	0.0	0.0	2.5	0.8	0.1	0.1
Completion of Intermediate OT	0.1	1.1	0.0	0.0	3.6	1.4	0.4	0.2
School attendance 9-15	0.0	0.2	0.0	0.0	1.1	0.6	1.0	0.1
Water	0.0	0.2	0.0	0.0	1.1	0.6	1.0	0.1
Sanitation	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
Lighting energy source	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.2
Cooking energy source	0.0	4.2	0.1	0.0	2.4	3.0	0.3	0.6
No-overcrowding 0-5	0.0	0.3	0.0	0.0	2.8	2.5	1.1	0.5
Telephone	0.1	0.1	0.0	0.0	1.2	1.7	0.6	0.5
Assisted Birth Delivery	0.1	0.6	0.1	0.1	1.0	1.2	1.1	0.1
Post-Natal care 0-5	0.0	0.2	0.0	0.1	1.1	1.5	0.6	0.3
Ante-natal care 0-4	0.0	4.1	0.1	0.0	0.2	0.2	0.0	0.6
Immunization Vaccines 0-4	0.5	1.6	0.1	0.1	0.4	0.8	0.2	0.1
Nutrition weight-for-height, 0-4	0.1	0.9	0.1	0.4	0.5	0.4	0.9	0.3
Nutrition height-for-age 2-17	0.8	0.3	0.0	0.1	0.4	0.4	0.2	1.0
Nutrition weight-for-age 0-17	0.0	0.3	0.0	0.0	2.5	0.8	0.1	0.1
<i>Average penalty by circumstance across all HOIs</i>	0.1	0.9	0.1	0.0	1.3	1.0	0.8	0.5
<i>Number of highly influenced opportunities by circumstance</i>	0	6	0	0	10	9	5	2
<i>Aggregate HOIs</i>								
IOHa9-15-Housing Services	0.0	0.5	0.0	0.0	2.5	1.9	2.1	0.7
IOHa0-4-Housing Services	0.0	0.8	0.0	0.0	1.7	2.2	1.0	0.6
IOHa0-4-Nutrition & ECD	0.1	0.1	0.5	0.2	0.3	0.0	0.1	0.6
note: cells with numbers indicate fourth quartile value of inequality of opportunity by circumstance in the IOC matrix 2009, Table A-7.a in the appendix. Source: HIECS 2009 and DHS 2008. Author's calculations.								

Table A-8. HOIs Confidence Interval 95% and Significant Differences over Time, Egypt, 2000 and 2009

Opportunity	2000			Circa 2009			Significant Difference
	LL	UL	sd	LL	UL	sd	
Complete primary education on time	83.0	84.2	0.48	85.1	86.4	0.52	*
Complete secondary education on time	61.3	63.3	0.35	62.4	64.4	0.30	*
School attendance, 9-15	---	---	---	88.5	89.4	0.23	n.a.
Water	76.3	77.1	0.19	87.8	88.4	0.14	*
Sanitation	25.5	26.1	0.15	29.6	30.2	0.16	*
Lighting energy source	97.7	98.0	0.07	98.8	99.0	0.05	*
Cooking energy source	72.5	73.2	0.18	97.9	98.1	0.07	*
Non-overcrowding, 0-5	47.3	48.5	0.31	58.1	59.4	0.32	*
Telephone	13.5	13.9	0.11	70.2	70.9	0.18	*
Assisted birth delivery	62.5	65.7	0.82	83.0	85.8	0.70	*
Post-natal care, 0-5	17.7	20.3	0.67	26.3	29.6	0.85	*
Prenatal care, 0-4	56.1	59.5	0.85	76.7	79.9	0.82	*
Immunization vaccines, 0-4	85.4	88.3	0.74	83.1	86.7	0.92	no
Non-wasting, 0-4	86.6	89.5	0.74	72.7	77.4	1.19	*
Non-stunting, 2-17	66.5	71.2	1.18	65.8	71.4	1.43	no
Non-underweight, 0-17	78.6	81.7	0.79	83.1	86.2	0.81	*
<i>Note:</i> LL, lower limit of confidence interval; UL, upper limit; sd, standard deviation; (*) significant difference at 95%.							
<i>Source:</i> HIECS 2000 and 2009 surveys, EDHS 2000 and 2008, and authors' calculations.							

Table A-9-a Demographic Weights Corresponding to Each HOI, 2000 and 2009				
<i>Opportunities</i>	<i>Age range</i>	<i>Original weights</i>	<i>Demographic weights</i>	
			<i>2000</i>	<i>2009</i>
Complete primary education on time	6-15	6.3%	5.7%	5.5%
Complete secondary education on time	16-22	6.3%	3.8%	4.0%
Complete post-secondary education on time	23-25	6.3%	1.3%	1.6%
School attendance, 9-15	0-17	6.3%	10.3%	10.2%
Water	0-17	6.3%	10.3%	10.2%
Sanitation	0-17	6.3%	10.3%	10.2%
Lighting energy source	0-17	6.3%	10.3%	10.2%
Cooking energy source	0-5	6.3%	3.5%	3.6%
Non-overcrowding, 0-5	0-17	6.3%	10.3%	10.2%
Telephone	0-4	6.3%	2.7%	2.8%
Assisted birth delivery	0-5	6.3%	3.5%	3.6%
Post-natal care, 0-5	0-4	6.3%	2.7%	2.8%
Prenatal care, 0-4	0-4	6.3%	2.7%	2.8%
Immunization vaccines, 0-4	0-4	6.3%	2.7%	2.8%
Non-wasting, 0-4	2-17	6.3%	9.5%	9.2%
Non-stunting, 2-17	0-17	6.3%	10.3%	10.2%
Sum (16 weights)		100%	100%	100%
IOHaEducation		24%	11%	11%
IOHaBasic housing services		35%	55%	55%
IOHaEarly childhood		24%	11%	12%
IOHaNutrition		18%	23%	22%
<i>Source: HIECS 2009, EDHS 2008, and authors' calculations.</i>				

Table A-9-b Robustness of aggregate and sector HOIs to demographic weights. Egypt and regions.

Aggregate Opportunity index	2000					2009				
	Egypt	Metropolitan	Lower Egypt	Upper Egypt	Frontier Governorates	Egypt	Metropolitan	Lower Egypt	Upper Egypt	Frontier Governorates
Equal Weights										
IOHa16	57.0	73.2	60.0	49.6	57.0	67.2	76.9	68.8	62.8	61.9
IOHaEducation	37.4	52.1	39.8	29.4	46.5	42.5	52.1	44.7	37.0	42.6
IOHaBasic Housing services	55.8	82.3	61.9	45.3	67.9	74.0	89.2	77.2	68.0	74.7
IOHaEarly Childhood	56.9	68.0	57.3	52.0	42.8	68.9	77.0	68.5	65.0	54.5
IOHaNutrition	79.0	83.0	80.0	75.3	65.0	76.1	76.7	76.7	75.3	65.3
Demographic Weights										
IOHa16	59.9	80.1	63.6	51.5	63.2	72.2	83.9	73.4	68.2	67.7
IOHaEducation	46.9	64.0	50.3	37.0	60.2	51.3	61.1	54.2	45.2	51.7
IOHaBasic Housing services	56.8	85.4	62.6	46.2	69.1	75.9	92.3	77.8	70.7	76.1
IOHaEarly Childhood	54.3	65.0	54.4	49.6	40.5	66.1	74.5	65.5	62.7	51.6
IOHaNutrition	76.3	82.5	77.3	72.1	61.8	76.8	80.0	76.4	76.5	64.0
DIFFERENCE										
IOHa16	2.9	6.9	3.6	2	6.2	5.0	7.1	4.6	5.4	5.8
IOHaEducation	9.5	11.9	11	7.7	14	8.8	9.0	9.5	8.2	9.1
IOHaBasic Housing services	1.0	3.1	0.7	0.9	1.2	1.8	3.1	0.6	2.7	1.4
IOHaEarly Childhood	-2.6	-3.0	-2.9	-2	-2.3	-2.7	-2.5	-3.0	-2.3	-2.9
IOHaNutrition	-2.7	-0.5	-2.7	-3	-3.2	0.7	3.3	-0.3	1.2	-1.3
IOH growth 2000-2009 (Equal Weights)										
IOHa16						10	4	9	13	5
IOHaEducation						5	0	5	8	-4
IOHaBasic Housing services						18	7	15	23	7
IOHaEarly Childhood						12	9	11	13	12
IOHaNutrition						-3	-6	-3	0	0
IOH growth 2000-2009 Demographic Weights)										
IOHa16						12	4	10	17	5
IOHaEducation						4	-3	4	8	-9
IOHaBasic Housing services						19	7	15	24	7
IOHaEarly Childhood						12	10	11	13	11
IOHaNutrition						0	-3	-1	4	2

Table A-10-a. Comparing Opportunities in Egypt with Latin American Countries: HOI Values, Circa 2000 and 2010

Country	HOI (aggregate 5 opportunities)		Water HOI		Sanitation HOI		Electricity HOI		School attendance HOI		Complete Primary Education HOI	
	Circa 1995	Circa 2010	Circa 1995	Circa 2010	Circa 1995	Circa 2010	Circa 1995	Circa 2010	Circa 1995	Circa 2010	Circa 1995	Circa 2010
Argentina	86	88	94	97	51	63	99	100	97	97	84	83
Bolivia	63	69	58	65	20	28	49	63	94	97	73	74
Brazil	57	76	56	82	53	78	80	96	87	97	15	35
Chile	83	92	83	94	66	86	92	99	97	98	74	82
Colombia	67	79	68	71	45	65	86	93	86	92	50	70
Costa Rica	77	88	92	95	69	92	91	99	84	96	57	66
Dominican Republic	64	73	61	69	36	48	82	95	97	96	38	53
Ecuador	60	76	23	66	40	49	81	91	79	86	65	79
Egypt	70	78	77	88	26	30	98	99	---	89	78	82
El Salvador	44	53	18	18	16	19	65	82	81	89	28	43
Guatemala	43	51	54	63	11	20	57	66	74	80	17	24
Honduras	42	48	13	18	31	25	47	51	73	82	33	45
Jamaica	79	81	28	23	99	98	74	84	94	95	90	93
Mexico	65	86	31	80	44	71	89	98	85	92	67	87
Nicaragua	35	46	11	14	4	35	46	51	76	85	23	34
Panama	66	69	77	80	28	30	54	58	89	91	68	71
Paraguay	61	71	42	63	36	46	83	94	91	92	45	56
Peru	55	69	37	42	30	54	47	63	92	95	52	74
Uruguay	89	90	84	89	96	96	97	98	96	95	76	78
Venezuela	82	87	87	87	77	82	98	98	92	95	62	73
Average LAC countries	64	73	53	64	45	57	75	83	88	92	53	64
Difference Egypt- LAC (%)	4	5	44	38	(42)	(48)	31	19	n.a.	(4)	25	18

Source: World Bank and Universidad de La Plata (CEDLAS), Socioeconomic Database for Latin America and the Caribbean, and authors' calculations.

Table A-10-b. Comparing Opportunities for Egyptian Children with Latin American Countries: HOI Ranking and Annual Growth, Circa 2000 and 2010																		
Countries	HOI (aggregate of 5 opportunities)			Water			Sanitation			Electricity			School attendance			Complete primary education		
	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress	Ranking Circa 1995	Ranking Circa 2010	Annual rate of progress
Argentina	2	3	0.2%	1	1	0.3%	7	9	1.2%	1	1	0.1%	2	3	0.0%	2	3	-0.2%
Bolivia	12	14	0.7%	10	13	0.8%	17	17	0.9%	17	16	1.6%	6	4	0.3%	5	7	0.2%
Brazil	15	10	1.4%	11	7	2.0%	6	6	1.9%	12	8	1.2%	11	2	0.8%	20	18	1.5%
Chile	3	1	0.9%	5	3	1.1%	5	4	2.0%	5	2	0.7%	1	1	0.1%	4	4	0.8%
Colombia	7	8	1.1%	8	10	0.2%	8	8	1.8%	8	11	0.6%	12	12	0.6%	13	11	1.8%
Costa Rica	6	4	0.7%	2	2	0.2%	4	3	1.6%	6	4	0.5%	14	6	0.7%	10	12	0.6%
Dominican Republic	10	11	1.1%	9	11	1.0%	11	12	1.4%	10	9	1.6%	3	5	-0.1%	15	15	1.9%
Ecuador	14	9	1.4%	17	12	4.0%	10	11	0.8%	11	12	0.9%	16	17	0.6%	8	5	1.3%
Egypt	7	9	0.9%	6	5	1.3%	16	16	0.5%	2	3	0.1%	n.a.	16	n.a.	3	5	0.4%
El Salvador	17	17	1.0%	18	19	0.0%	18	20	0.2%	14	14	1.9%	15	15	0.9%	17	17	1.6%
Guatemala	18	18	1.4%	12	15	1.3%	19	19	1.5%	15	15	1.6%	18	20	1.1%	19	20	1.3%
Honduras	19	19	0.7%	19	18	0.7%	13	18	-0.8%	18	19	0.5%	19	19	1.1%	16	16	1.5%
Jamaica	5	7	0.1%	16	17	-0.4%	1	1	0.0%	13	13	0.8%	5	8	0.0%	1	1	0.2%
Mexico	9	6	1.7%	15	9	4.1%	9	7	2.2%	7	7	0.7%	13	11	0.6%	7	2	1.7%
Nicaragua	20	20	1.6%	20	20	0.4%	20	14	4.5%	20	20	0.7%	17	18	1.2%	18	19	1.5%
Panama	8	16	0.5%	7	8	0.6%	15	15	0.3%	16	18	0.8%	10	14	0.3%	6	10	0.5%
Paraguay	13	13	1.1%	13	14	2.3%	12	13	1.1%	9	10	1.2%	9	13	0.1%	14	14	1.2%
Peru	16	15	1.4%	14	16	0.5%	14	10	2.4%	19	17	1.7%	8	7	0.3%	11	8	2.2%
Uruguay	1	2	0.7%	4	4	2.1%	2	2	0.3%	4	6	0.4%	4	9	-0.4%	3	6	1.4%
Venezuela	4	5	0.5%	3	6	0.1%	3	5	0.5%	3	5	0.0%	7	10	0.3%	9	9	1.1%
Mean LAC countries			1.0%	1.1%			1.3%			0.9%			0.5%			1.2%		
Median LAC countries			1.0%	0.7%			1.2%			0.8%			0.3%			1.3%		
Source: World Bank and Universidad de La Plata (CEDLAS), Socioeconomic Database for Latin America and the Caribbean, and authors' calculations.																		

Understanding the role of public sector in deepening spatial inequality in Egypt

Spatial inequality is an important dimension of overall inequality. Spatial inequality matters for many reasons, at the top of them comes the issue of unfair development. However, others include the congestion in 'mega-cities with all negative implications on environment, slums and quality of life degradation. Lagging regions in Egypt are most likely to be the southern and remote areas from Cairo region.

The need to respond to it appropriately has underlain GoE purposeful interventions to try to bring about a more equitable spread of economic activity and opportunity, among these interventions are upper Egypt initiative and the 1000 poorest village program. While a little bit early, but one can tell that these policy interventions may not be up to expectations due to inherited factors that contribute to deepening the spatial inequality in Egypt. Better understanding the national space economy and to afford the foundation for regionally appropriate interventions to address spatial inequalities.

Many research tried to understand the issue of regional inequality. Many factors were examined, such as, albeit not mutually exclusive, local assets with regional innovation, local capacities devolution of functions, household characteristics and yields on employment, the lack of and poor quality of public infrastructure with respect to private sector (including FDI with openness and globalization) locating away of the region.

While some of these factors are natural (natural resources, proximity to prosperous regions), others could be seen to be the outcome of poor performance of the budgeting and planning systems, which illustrate a lot of the regional inequality in Egypt.

In the following, we will build on the work of the WB (2009), and recently and specifically for Egypt on the work done by Velez, El Shawarby, El Laithy(2010), to show how the absence of the geography or space dimension if accompanied by factors related to massive centralization and dominance of the central agencies can lead to deepening the regional disparities, to the contrary of the argument for centralization.

1- The impact of budgeting and planning practices on the landscape of opportunities,:

As it was shown earlier the distribution of opportunities is not equal. Some regions are deprived. The allocation of public investments plays a crucial role in this respect. Budgeting in Egypt could be seen as having a major impact on the landscape of opportunities. Both the budget structure and the budgetary institutional relations have an impact on the territorial nature of the budget.

We can identify some features of the state budget in Egypt that play independently as well as collectively major roles in shaping the landscape of investment allocations and hence opportunities. They are:- While **the dominance of the central spending over the local spending**, in itself shouldn't affect negatively the spatial distribution of public funds, to the contrary- as literature and international experience elsewhere show that centralization sometimes is needed to make the public spending works for the poor through equitable transfers to lagging nations. The case of Egypt signifies that when centralization is accompanied by **poor budgeting practice**, then the more the centralization, the more the negative impact on the spatial dimension of budgeting. Specifically, we argue that the lack of transparency in budgeting in terms of missing funding formulas or criteria for allocation of public money geographically and the bad practice of budgeting through the year, in addition to lack of accountability for outcomes of public spending because of the a phenomenal fragmentation in planning and budgeting and the externalization of decision making, all shape negatively the impact of centralization on the landscape of public spending in Egypt.

In the following we discuss these features more and show their spatial implications:

A- Central dominance:

The state budget of Egypt is almost completely executed through central agencies; being ministries or service authorities.

Table (1) Local Agencies' Actual spending (governorates *Diwans*¹ and *Moderiat*) to total Public Expenditure 07/2008-10/2011, million L.E.

Items	2008/07	2009/08	2010/09	2011/10
Total local administration spending	33169.4	38622.9	46909.1	54181.0
Total expenditure of the state budget	241551.3	340912.4	319137.2	394494.2
%	%13.7	%11.3	%14.7	%13.7

Source: State budget

As shown in table (1) local agencies in Egypt have executed not more than 14% of total public spending in general.

¹ Diwans are the offices of governors, Moderiat are the sectoral service offices, both of them have the status of budget authorities.

When we further analyze that figure, we find that the developmental investment content is very low and it is almost limited to that investment projects implemented by local administration “the *Diwan* of the governorate”. Investments allocated to “*Moderiat*” are to cover those projects related to the operational side of those offices like refurbishing their premises and the like.

As table (2) presents, local recurrent expenditure is as high as 95%, leaving very little room for capital spending. Also as in table (3), there was no capital spending allocated to the “*Moderiat*” in 10/2011.

Table (2): Structure of expenditure of Local Agencies 07/2008-10/11, million L.E.

	2008/07	2009/08	2010/09	2011/10(budget)
Current expenditure	31409.4	36865.9	45039.1	51581.0
%	(%94.7)	(%95.4)	(%96.0)	(%95.2)
Capital expenditure	1760.0	1757.0	1870.0	2600.0
%	(%5.3)	(%4.6)	(%4.0)	(%4.8)
Total expenditure	33169.4	38622.9	46909.1	54181.0
%	(%100)	(%100)	(%100)	(%100)

Source: MoF

Table (): structure of expenditure of governorates *Diwans* and Sectoral *Moderiate*, budget of 10/2011,

million L.E.

Authorities	Current expenditure					Total current	Capital expenditure	Total expenditure
	Others	Subsidies and grants	Interest	Procurement of goods and services	wages			
Governorates <i>Diwans</i>	80.0	66.4	212.1	3722.3	4212.7	8293.5	2600.0	10893.5
Sectoral	21.9	230.6	0.0	3082.3	39952.7	43287.5	0.0	43287.5

Moderiat :								
Moderiat of Property Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moderiat of Organization and administration	0.1	0.2	0.0	4.8	62.4	67.5	0.0	67.5
Moderiat of Supply	2.4	0.8	0.0	23.4	637.2	663.8	0.0	663.8
Moderiat of Employment	0.2	0.3	0.0	20.1	228.1	248.7	0.0	248.7
Moderiat of Agriculture	0.9	2.4	0.0	64.7	2125.9	2193.9	0.0	2193.9
Moderiat of Veterinary	3.0	0.7	0.0	21.7	500.6	526.0	0.0	526.0
Moderiat of Roads and transport	0.5	0.5	0.0	31.3	246.5	278.8	0.0	278.8
Moderiat of Housing	0.3	0.5	0.0	36.3	350.3	387.4	0.0	387.4
Moderiat of Health	9.0	9.9	0.0	1246.6	4576.8	5842.3	0.0	5842.3
Moderiat of Youth and Sports	0.2	117.5	0.0	32.1	692.4	842.2	0.0	842.2
Moderiat of Education	5.0	16.4	0.0	1562.8	29654.2	31238.4	0.0	31238.4
Moderiat of Solidarity	0.3	81.4	0.0	38.5	878.3	998.5	0.0	998.5
Total	101.9	297.0	212.1	6804.6	44165.4	51581.0	2600.0	54181.0

Source: State Budget, MoF

It is worth noting that Local administration (the *Diwan*) , as of the budget bylaw, is conducting investment in areas just related to urban management such as local roads (tertiary roads), solid waste management and street cleaning, street lighting and some civil safety works. They are not entitled to invest in social spending related to education or health or social protection which is the domains of the central public agencies.

Table (3) shows the same central dominance from the revenue side.

Table (3) Local appropriations and allocations as a percentage of different tax revenues(2009/2010)

Items	Value (billion L.E)	As a percentage of income taxes	As a percentage of sales taxes	As a percentage of total taxes**
investment appropriations that assigned to local development projects	2.6	2.9%	3.3%	1.3%
Local projects assigned in the central budget and implemented by central agencies	36	40.6%	46.3%	18.3%
Conditional (specific) grants to finance local deficit	49.4	55.7%	63.6%	25.1%
Total appropriations related to local budget	88	99.2%	113.3%	44.7%

* In this year, budget data shows that income tax revenues (88.7 billion L.E), Sales tax revenues (77.7 billion L.E), and total tax revenues (197 billion L.E).

** Total taxes include income taxes, sales taxes, property taxes, customs, and other taxes.

As table 3 shows, while 44% of total tax revenues is spent on local development, only 1.3% of total tax revenues is appropriated to development projects performed by local entities, all the remaining is done through central agencies and under their complete control.

Limitations on the developmental role of local agencies left the spatial dimension of budgeting within the authority of central agencies.

Budgeting through the fiscal year:

This portrait of domains of conducting developmental investment in Egypt would not be a factor affecting the landscape of social opportunities if there has been a vision shaping the geographical distribution of central capital spending over different locations.

Here we raise two concerns: how budget is allocated between the local level and the central one, and how it is allocated among localities.

For the first concern, there is no rule that governs this allocation. The localities are the weakest partner in budget negotiation, especially that the 27 governorates do their budget negotiation on their own, and one by one. The Ministry of Local Development is not conducting this negotiation

on behalf of all localities and it has never presented an analysis to show the real needs for local projects conducted by localities, even for a program as important for local development as that of local roads. Also the GoE never declared that they apply any funding formula, based for example on count per head to allocate funds to localities.

For the second concern, the GoE has no criteria related to population or to poverty or any other factor that based on them one can expect the share of each governorate in the appropriation of education or health or any other sector. What deepens the problem of fiscal intransparency is that a big portion of the investment fund is budgeted during the fiscal year. Many ministries are given block item to allocate to projects in localities. They never declare their proposal. It just appeared allocated in the actual budget. Its distribution depends on ad hoc circumstances that will take place during the fiscal year.

Table (4) gives information on the investment funds that appeared as a block item in budget proposal for the sectors of education and health. As could be seen the majority of investments are assigned to the relevant ministry with no vision ahead on geographical distribution.

Table (4) Examples of block funds

Central investment of the <i>Diwan</i> , million L.E.	Budget 11/2012
Investment appropriated to the Ministry of Health with no proposal for geographical allocation.	2 064.25
Investment appropriated to the Ministry of Health with a proposal on geographical allocation.	106
Investment appropriated to the Ministry of Education with no proposal for geographical allocation. Investment appropriated to the Ministry of Health with a proposal on geographical allocation.	1 416.995 392.1

Source: Ministry of Planning

This problem of budgeting through the fiscal year prevents the parliament from recognizing and discussing the geographical allocation of budgeting and the issues of equities and unbalanced opportunities.

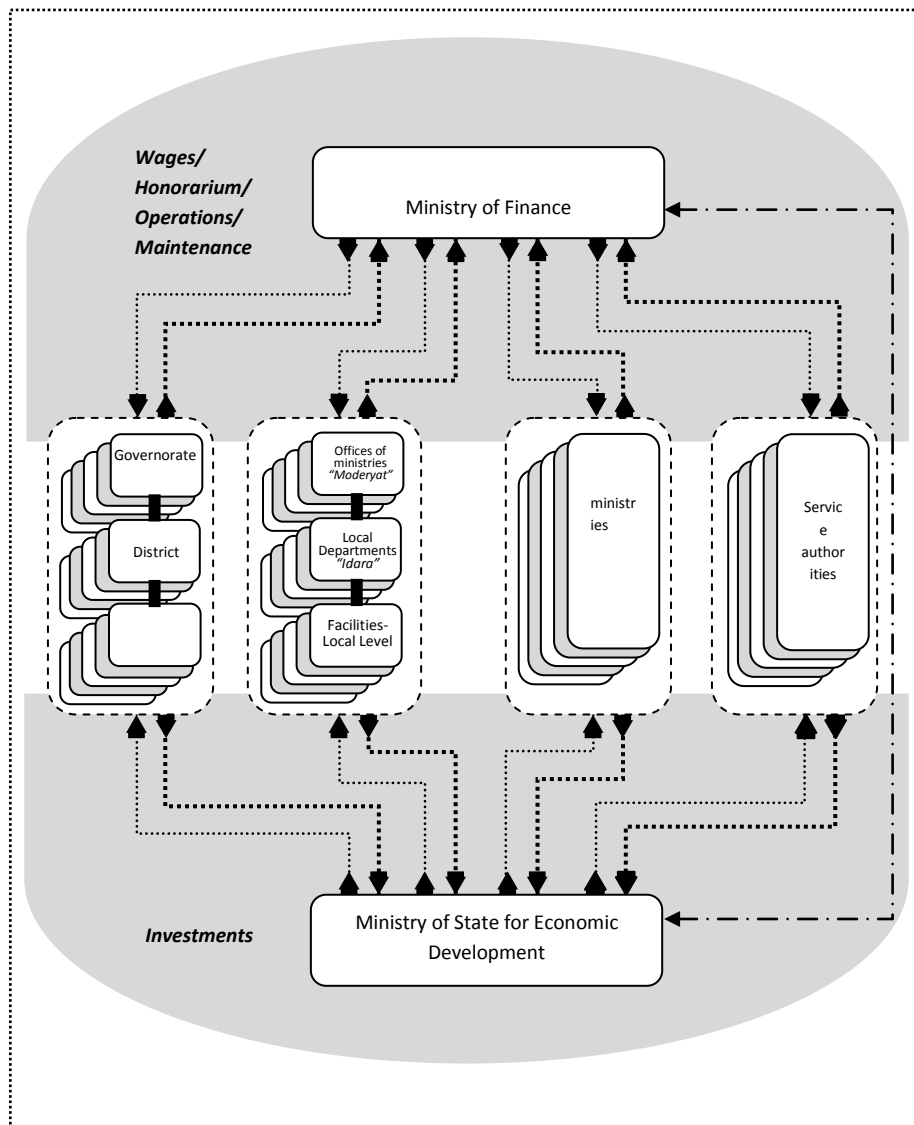
These two problems of lack of criteria for allocation of funds and the budgeting through the year lent themselves to the local administration methodology of allocating resources among different local units inside the boundary of the governorate. Governors decide on this allocation with no funding formula shared with the local elected councils or even the central level represented by the ministry of local development. Most of the investment would be allocated to the capital cities of the governorates and those of districts justified by the concept of city-region relation, i.e., investment conducted at cities has the highest externalities over all the population of the governorate. While this may be a practical solution for lack of resources, to function properly it needs an integrated or at least a functional coordinative approach of development, which is not the case in Egypt.

As seen in table (4), some of the central investments are allocated by space in the budget proposal. One has to add that most of the capital investment by Service authority is distributed geographically in the budget proposal. However, being implementing agencies, their responsibilities lie in implementing projects, with likely no responsibility about the service provision itself at any local place. For example GAEB is responsible on building schools in general, which means that it is not committed to any local community for the provision of schools. Also it is not committed to operating them or on any aspect of the education service. This may lead in many cases to give care to the project more than the outcome. Service Authorities (SAs), such as GAEP, are keen to implement the project. If due to some circumstances it is difficult to implement in a place they shift funds to another one with no commitment to the place that lose the opportunity of the project or with the approval of its local community. SAs are accountable to spending money on implantation. According to budget bylaw, after the approval of the MoP, money could be shifted from a place to another given that the nature of spending is the same (current or investment or others). The approval of the parliament or the local councils or any beneficiary is not required. Fragmentation between spending agencies and service provider agencies, like the case of GAEB and the local community (represented in this case by its education office like the Education Moderia or Idara), reflects itself negatively on the landscape of the executed budget by space. The original spatial distribution of projects and hence services, are not guaranteed to happen. Lacking of criteria of allocation of funds among local places in the proposed budget and also performance indicators for fiscal spending to assess the executed budget led to frequent shifts in spending by space with no accountability on the spatial outcomes.

Planning and budget fragmentation:

The budgetary and planning institutional set up needed to assure the integration of development projects at the local level or the coordination among central agencies are not available. In Egypt planning and hence budgeting are done on a sectoral base. Each budget authority determines its projects with almost no coordination with others at the central or local levels. Figure (1) illustrates the process of budgeting for investment projects.

Fig. (1): Budgeting in Egypt



Source: Eid, Y., Attia, A., and Abdellatif, M. (forthcoming), 'Strategic City Planning in Egypt: Revisiting urban governance issues', Ain Shams Engineering Journal.

It illustrates the bottom up approach of planning, while the budgeting system has a top down approach. Each level informs the upper with its needs. For example all central budget authorities inform MoF and MoP with their needs. Also each local level informs its upper level (e.g. the city level informs the district level which in turn informs the governorate level with their needs, also the education office at the district level –the IDARA- collects all the needs from schools in its jurisdiction and inform the education office of the governorate –the Moderia- which in turn collect all the Idarat's needs to inform the MoF and MoP with the needs of education sector at that local level). Then MoP and MoF after aggregating all needs, they provide ceilings on sectors' budgeting capacity and also by budget authority. All budget authorities are informed with those ceilings. They have to trim down their investment programs by dropping some of the projects or reducing funds for each project. Partially this process in itself encourages any budget authorities not to present its proposal distributed by location because this gives them more flexibility in adopting to the reduction with no consequences, neither on the development or

spatial fronts. Given the absence of criteria for allocating funds facilitate the process of cutting the required amounts as needed by different budget authorities.

Also whilst budget is consolidated through a mere aggregation and adding up process at the top, it is not coordinated at any level, being local or central.

Moderiat, while seen as budget authorities in the state budget, they are not actual partners to the relevant ministries when comes to decisions on investment geography. Decisions on investments for sector development at any local level are taken at the central level. The role of *Moderiat* stops at collecting needs or information. This limited role is accompanied by another limitation on the developmental role of local administration. Local administration is not seen to champion local development at their levels. As seen above they receive transfers from the state budget to perform very limited types of development projects. The absence of any integrated frame for local development leads to the dominance of the sectoral/central approach to development. Therefore, we may find schools with no infrastructure in terms of a connecting road or water and sanitation.

Another relevant feature related to the structure of budget and has implications on coordination on the central level, is the huge number of budget authorities; they almost exceed 600. Ranging from appropriation of few billions LE, to few millions, leading to fragmentation in planning and overlapping of functions (table (5)).

Table (5) budget authorities by magnitude of appropriation

Appropriation, million L.E.	Number of budget authorities
20 000>	1
10 000>	1
5000>	3
1000>	39
500>	37
100>	136
50>	65
10>	201
5>	70
1>	88
<1	7
Total	648

Source: authors' calculation based on State Budget 2009/2010

Worth mentioning is that some agencies claim the position of many budget authorities. The Ministry of Social solidarity in itself comprises three budget authorities; the office of social justice and that of food subsidies, in addition to the Child fund. While all of these authorities have functions and programs inside the ministry, they receive separate appropriation from the

budget. This means that fiscal fragmentation is a real problem, especially in the light of the absence of a program based budgeting that lies a frame for coordination clear to all players inside the budget. Again this highlights that the spatial coordination issue is not simple and needs a massive effort to let it happen at the central level.

fiscal fragmentation is attributed to the huge number of fiscal authorities in addition to the presence other players outside the state budget frame that share part of local development such as the Economic authorities(for example Economic Authority for Rail Roads). .

Fragmentation has more attributes. Egypt has many modes of planning, while they coexist together according to the planning complicated legal web, they add to fragmentation.

Officially, the annul plan produced by MoP is based on a longer term planning framework (5& 10years). However, it is not straightforward to draw a link between that framework and the investment projects of the annual plan. The longer planning frameworks, as produced by the MoP, portraying the economy within the span of the plan in a very generic manner with no hints to how the strategic objectives related to growth and production will find its way of implementation through mapping them to specific targets that could be linked in a measurable way to activities conducted by the budget authorities to link long term planning with the annual investment program in the state budget. What facilitate the jump between long term objectives to annual projects is the absence of the development component of the annual plan .. Justification for project selections is done with no link to any development targets or clear reference to the strategic objectives of the longer planning framework. Hence, follow up reports of the plan track the implementation, but don't measure or assess or refer to the development outcome or impact.

Also none of the planning framework (long, medium or annual) has a territorial perspective. When it was clear that there is a development problem in Upper Egypt, the plans had a separate component on that region. No analysis was made to challenge the weakness of the traditional planning approach and how such very poor spatial results could result. Also, no commitments to specific targets for the lagging region were taken or a regionally integrated development framework was produced. There was some consultancy work done to set some spatial specific programs for the region, but never integrated in the planning framework and shared with the public. Also the lagging issue of Upper Egypt, didn't drive a new mode of regional planning. Some spatial work was done with UNDP, but never taken to wider discussion circuits or, again, reflected in the planning framework. The same applies to the program of the 1000 poorest village. While it appeared as a distinct item in the annul plan, it had never triggered any dialogue on the spatial dimension of planning. It was implanted in the traditional mode of planning. The mechanism of implanting that program shows the high level of inconsistency between the content of the program (local community development) and the process of implementation which was fully national and central (7 ministers are following the framing and implanting the program by themselves) with very little role for the local set up of planning and development. No effort was made to integrate spatial programs like this one and that of Upper Egypt into the mainstream of planning through the traditional sectoral items.

It is worth mentioning that parallel to this tradition of setting the annual plans, there is the process of strategic planning backed by GOPP. The concept is to produce long term spatial integrated investment plans with costs for each project and a suggested time line for implementation based on consultation with all local agencies, and in abidance to all national standards set by central ministries. These strategic frameworks are done for villages and also cities, separately. Till now there is no vision how to link both together or to level them up to a strategic frame for the governorate, let aside the region². The concept of city-region relation (city-district or city-governorate) is there behind the criteria but no clear rules on how to reflect it in projects of connectivity or the strategies of socio-economic inclusion. So those strategic plans, while managed the issue of sectoral integration for the specific place, they are no relatively or relationally geographically integrated at the level of governorates or higher (economic regions for example).

Moreover, there is a lack of coordination between the annual investment program as produced by the MoP and the spatial strategies of GOPP. While the planning product of MoP is reflected in the budgeting process and finds its way to implementation, that of GOPP is not linked to the state budget. The annual plan is produced under the supervision of MoP, while the strategic plan is produced under the patronage of GoPP. No official document was produced to highlight the link and how to let the long term investment proposal in the strategic plan informs the annual selection of projects for the annul plan. Also, and because, sectors are represented by the Moderiat and not by the central agencies, the proposed projects are not seen by the central level as something they have to be guided with, given that they see the Moderiat as not a real partner in sector development. So the proposed investment projects of the strategic plan remain a wish list from the local side that could be completely ignored by the central level given that it has the dominance on investment decisions, as shown above.

Also, attention should be paid that each of the two types of planning has its own mode of participation. The former is a mere adding up of different sectoral investment programs and projects, while the latter is an integrated sectoral planning at the local level. Consultation of all stakeholders, such as civic society organizations and elected councils, is encouraged in both of them. But while it is ad hoc for preparing the annual investment plan it is built in the the approach of strategic planning adopted by GOPP., however, for both of them, without any enforcement mechanism to include consultation findings in the the final product of planning (annual plan or strategic plan) or to reach compromises. The vision of the executives, especially thoses representing the central tier, is dominant in both types of planning

Accordingly, state budget in Egypt is prepared in an annual base with no MTF.

All this deprives society and everybody from having a vision with time line. It also signifies lack of commitment. It means that not only next year projects are not known, but also it jeopardizes the completion of any unfinished project. Moreover, according to the budget by law as

² Egypt is divided into 7 economic regions, each of which comprises 3 governorates or more.

mentioned earlier, any implementing agency can change the spatial location of any assigned project with only the approval of the Minister of Planning. This factor alone creates a lot of tension with localities. It reflects itself on the ownership of development in Egypt, because it gives the executives the upper hand in reallocating projects which affects the geography of the budget. Of course political capture has an implication and effect on the shift of resources from place to another. MPs, like anybody and organization in Egypt, can't trace their constituencies into the budget. Also given the missing participatory component in a discipline manner from the traditional way to conduct annual planning, MPS have no workable channel to share their input with the government at any phase of preparation of the plan. This reflects itself negatively on the work in the parliament and weakens massively the level of dialogue and contribution during the sessions of discussion of budget and plan. The easiest way to contribute is to jump into via exerting pressures on ministers who find it easier to respond by shifting resources from a place to another, or not to do any proposal for distribution early in the fiscal year, and to do budgeting through the year according to faced political pressures.

Another feature of planning in Egypt that it doesn't reflect the changing role of the state and its new institutional relations with other players inside and outside the economy. With the tendency to openness and globalization, trade agreement and international relation economics and its geography had to reflect itself in the plans. Also the marketization and the uprising role of the private sector were expected to have some touch on the process and methodology of planning. The democratization of society with implications of voicing the opinion of citizens and strengthening the role of civil society organization in watching human rights in planning and budgeting were supposed to set a shift in the mode of planning. Surprisingly, all of these major changes are detached completely from the planning process or content. Absence of a genuine role of cities combined with lack of a decentralized institutional set up for local development squandered many potential for local innovations and bottom-up initiatives.

Of course this fiscal fragmentation has its impact on augmenting the operation cost of keeping and maintaining the public sector, which affects negatively potential of spending on the provision of services, or in other words decreasing the fiscal space. For some public agencies, the cost of the operation consumes almost half its budget. One quarter to one third of the budget is common portions in many agencies. Table (6) shows the percentage of budget allocated to the operation program by government agency.

Table (6) The percentage cost of the operation program in the state budget 2010/2011

Budget sectors by function	Program of administrative support (operation) % of total spending	Number of budget authorities (only with appropriation in 10/2011)

General	24.8	113
Presidency	12.1	
Defense, police and justice	15	19
Supply and trade	23.9	Economic Affairs 208
Labor and migration	34.6	
Agriculture , veterinary and irrigation	45.6	
Electricity, industry and energy	52	
Transportation, roads and communication	17.9	
Finance and international trade	30.4	
Housing and infrastructure	4.1	38
Health	29.9	94
Youth, culture and religion	21.7	68
Education	15.4	69
Social service and women	15.3	33

Source: constructed from Gender analysis of budget expenditure by sector, MoF May 2010

Questioning the impact of public spending in service provision is an issue given all that spending on the operation of the administration (running the *diwan* of the agency, personnel affairs and legal affairs; both current and capital). This concern gains importance given the fact that there is a noticeable degree of overlapping in functions, not just between central and local agencies but also among central agencies.. Many of the health central agencies, including the MoH, are doing the same functions, they have hospitals to provide the same service in the same region, with no coordination at the spatial level. The same applies in education, MoE and the Central Agency for IT Development, having the same IT development function, again with no coordination at the spatial level.

The concerns of fiscal fragmentation and the almost impossible coordination mean that the spatial distribution could be much better if the functions could be mapped to clear programs with some consolidation of tasks and activities to create more fiscal space for provision of service.

Absence of spatial presentation or any spatial reporting for public spending:

A major question that could be raised here is about the role of the legislative bodies at central and local levels in doing oversight on the geographical allocation of investment projects.

Budget in Egypt, as elsewhere, is presented in three forms; the administrative, the economic and the functional. The first displays how the work load inside the government is distributed among different agencies, by area of specialization as well as between the different tiers of the government, i.e., central agencies as opposed to the local ones. The economic classification is crucial for conducting the financial auditing. Finally classifying fiscal magnitudes by functions

reflects the different responsibilities carried by the government which is important to study the directions of the role of the government in both the economic and social arenas.

Budget presentation in Egypt doesn't inform the dialogue of economic geography of services or the landscape of opportunities. It notifies all government implementing agencies on their role in executing the assigned investment projects. However, the missing geography perspective suppresses the role of legislatures in establishing equity among local units.

And despite that the executed budget could be presented spatially, it was never prepared in that format for discussion with the legislature or local councils. Here we have to stress the fact that when we discuss the geography of the budget, territorial issues should be discussed in details. It is not sufficient to holistically lump sum all territorial affairs up to the level of the governorate or regions, as it always the case in most of, if not all, development studies in Egypt. The landscape of opportunities differs a lot inside each governorate; in the following we show some examples from education.

Table (7): coefficient of variation of non-enrolled children by governorate

Group	Mean	Std. Deviation	variance	Coefficient of Variation
Aswan	1.344	1.357	1.840	100.9%
Assuit	7.577	6.357	40.410	83.9%
Alexandria	4.920	7.094	50.328	144.2%
Ismailia	2.178	3.793	14.385	174.2%
Red Sea	1.675	2.651	7.027	158.3%
Behera	5.654	5.200	27.037	92.0%
Giza	5.114	4.647	21.597	90.9%
Daquahlia	2.790	2.799	7.835	100.3%
Suez	1.864	2.147	4.609	115.2%
Sharkia	2.540	2.750	7.564	108.3%
Kharbia	2.238	1.524	2.321	68.1%
Fayoum	7.186	2.476	6.131	34.5%
Cairo	4.613	6.061	36.733	131.4%
Kalyobia	3.006	2.327	5.414	77.4%
Luxor	.689	1.193	1.424	173.2%
Menofya	1.846	1.301	1.692	70.5%
Menia	8.969	4.511	20.351	50.3%
New valley	1.744	3.020	9.121	173.2%
Bani Suef	7.827	2.535	6.428	32.4%
Port said	5.703	5.851	34.229	102.6%
South Sinai	1.563	3.125	9.766	200.0%
Damietta	5.368	8.176	66.839	152.3%
Sohag	6.119	3.925	15.403	64.1%
North Sinai	5.889	8.828	77.928	149.9%
Quana	3.666	3.398	11.545	92.7%

Kafr ElShiekh	3.406	3.007	9.043	88.3%
Matrouh	20.742	15.656	245.123	75.5%
Overall	4.600	5.584	31.186	121.4%

Calculated based on Population census 2006 and HICS 2009

The coefficient of variation (CV) is defined as the ratio of the [standard deviation](#) σ to the [mean](#) μ :

$$c_v = \frac{\sigma}{\mu} ; \text{ where } \sigma = \sqrt{\text{variance}} , \text{ and } \text{variance} = E[(X - \mu)^2]$$

As table (7) shows, for the phenomena of non-enrolling to schools for basic education, variation among each governorate assures that the territorial development fabrics is not uniform. Again, we recall from above that the same problem of lacking of a funding formula for distribution of public resources among governorates, applies when coming to the allocation of public spending among different administrative units inside the same governorate. As table (8) shows, the phenomena of non-enrolled children varies in an apparent manner between the rural and urban areas in the same district inside the governorate of Assuit. In both cases, among governorates and inside each governorate, the geography of deprivation should direct development efforts to the most deprived places.

Table (8) Non-enrolled to total aged 7-14 years in Districts of Assuit governorate by urban and rural areas.

District	Urban	Rural
Division 1 Assuit	3.38	.0
Division 2 Assuit	.0	.0
Abnoub	3.19	36.93
Abu teag	1.08	18.04
Assuit	.00	9.40
Al badary	.00	5.21
Al ganayem	.00	1.09
Al fateh	.00	21.35
Al kosya	3.08	10.31
Dayrout	.0	14.67
Sahel selim	.0	6.42
Sadfa	.0	5.16
Manflout	7.36	44.68

The missing spatial aspect applies also to the revenue side. You never can know about the tax capacity of any place in Egypt. Simple analysis of the spatial cross subsidization is not possible for direct tax against spatial spending programs. Because of the high degree of centralization of the revenue side of the budget, local administration can't see the shared benefit of supporting the central effort in widening the tax pool. For example the non-corporate tax in Egypt is completely a central tax. Tapping this important revenue source of financing service provision is almost impossible if the local community can't see the benefit of revealing the local tax society to contribute to local budget. Such special earmarking of revenues or decentralization of the revenue side of the budget in some tax pools with special local nature could help the endeavor of

creating fiscal space by widening the capacity of local administration to link spatially between revenues and spending through creating this direct horizontal network of authority/ responsibility to replace the complex system of the vertical bottom-up relation through centralization of resources and then the vertical top-down distribution of spending.

The only factor that can explain the allocation of resources by region is population. As tables 9 and 10 show, the current distribution of budget by governorate is as close as to the distribution of population. The distribution has nothing related to poverty indicators.

Table (9) **Different Scenarios of Fiscal Transfers Compared to Current Situation**

(value of transfers = million L.E)

Governorates	Pop Share	Poverty share	Current Situation (2010/2011 budget)*		First Scenario		Second Scenario		Third Scenario	
			Transfers	Share of transfers	60% for population, and 40% for poverty		70% for population, and 30% for poverty		80% for population, and 20% for poverty	
					Transfers	Share of transfers	Transfers	Share of transfers	Transfers	Share of transfers
Cairo	10.8%	3.3%	10234.4	11.7%	6789.5	7.7%	7455.1	8.5%	8122.3	9.3%
Alexandria	5.5%	3.3%	6265.1	7.1%	3433.2	3.9%	3791.2	4.3%	4150.0	4.7%
port said	0.8%	1.5%	1189.5	1.4%	497.9	0.6%	542.9	0.6%	588.0	0.7%
Suez	0.7%	0.3%	1162.0	1.3%	390.9	0.4%	448.5	0.5%	506.3	0.6%
Damietta	1.5%	0.1%	1964.4	2.2%	855.2	1.0%	975.6	1.1%	1096.4	1.3%
Dakahlia	6.8%	0.2%	5332.2	6.1%	4599.1	5.2%	4948.8	5.6%	5299.3	6.0%
Sharkia	7.4%	2.9%	6605.0	7.5%	6252.5	7.1%	6311.3	7.2%	6370.3	7.3%
Qualiobia	5.8%	6.8%	4663.8	5.3%	4348.2	5.0%	4543.6	5.2%	4739.6	5.4%
Kafr el sheikh	3.6%	3.7%	2724.9	3.1%	2535.3	2.9%	2694.5	3.1%	2854.0	3.3%
Garbeyya	5.5%	1.8%	4099.2	4.7%	3518.0	4.0%	3835.6	4.4%	4153.9	4.7%
Menoufia	4.5%	1.9%	3444.9	3.9%	3902.0	4.4%	3913.5	4.5%	3925.1	4.5%
Beheira	6.5%	4.4%	3886.4	4.4%	5556.9	6.3%	5605.5	6.4%	5654.2	6.4%
Ismailia	1.3%	6.1%	1513.7	1.7%	1025.8	1.2%	1059.8	1.2%	1093.8	1.2%
Giza	8.6%	0.9%	7052.0	8.0%	7407.8	8.4%	7439.9	8.5%	7471.9	8.5%

Bani suef	3.2%	8.3%	2341.9	2.7%	3904.9	4.5%	3630.4	4.1%	3355.3	3.8%
Fayoum	3.5%	6.4%	2211.4	2.5%	3797.2	4.3%	3626.0	4.1%	3454.3	3.9%
Menia	5.8%	5.5%	3525.9	4.0%	6136.9	7.0%	5872.2	6.7%	5606.9	6.4%
Assiut	4.8%	8.9%	3516.7	4.0%	7288.4	8.3%	6518.5	7.4%	5746.6	6.6%
Sohag	5.2%	13.7%	3697.7	4.2%	6951.9	7.9%	6352.4	7.2%	5751.6	6.6%
Qena	3.4%	12.1%	3502.4	4.0%	4139.1	4.7%	3861.1	4.4%	3582.4	4.1%
Aswan	1.6%	6.7%	2668.1	3.0%	1977.7	2.3%	1840.7	2.1%	1703.3	1.9%
Luxor	1.3%	3.2%	1656.6	1.9%	1200.0	1.4%	1187.3	1.4%	1174.6	1.3%
Red sea	0.4%	1.5%	955.7	1.1%	258.1	0.3%	280.0	0.3%	301.9	0.3%
New valley	0.3%	0.1%	553.7	0.6%	143.5	0.2%	163.8	0.2%	184.1	0.2%
Matrouh	0.5%	0.0%	982.0	1.1%	250.2	0.3%	292.2	0.3%	334.4	0.4%
North sinai	0.5%		1266.6	1.4%	547.9	0.6%	517.7	0.6%	487.4	0.6%
South sinai	0.2%	0.8%	691.6	0.8%	102.6	0.1%	119.8	0.1%	137.1	0.2%
Total			87708.1	100.0%	87708.1	100.0%	87708.1	100.0%	87708.1	100.0%

*IDSC based on MOF (a seminal set of data prepared specially for the IDSC 2010 report on the achievements of GOE between two parliamentary elections 2005-2010)

Table (10) Correlation Rates Between Types of Fiscal Transfers and Population and Poverty Rates

Indicators	Local projects assigned in the central budget and implemented by central agencies	Local Investment	Local Revenues	Conditional grants to finance local deficit
local projects assigned in the central budget and implemented by central agencies	1	0.72	0.3	0.49
Local Investment	0.72	1	0.51	0.82
Local Revenues	0.3	0.51	1	0.29
Conditional grants to finance local deficit	0.49	0.82	0.29	1
Population Rate	0.75	0.93	0.38	0.9

Poverty Rate	-0.23	0.05	-0.1	-0.21
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2. The regional dimension of the budget

Two programs have been integrated recently into the budget to reflect the development challenges in some places and regions in Egypt, mainly the lag of development in Upper Egypt and the dispersion of poverty as a spatial phenomenon covering most, if not all, governorates with different density³. Table (11) shows the capital spending by program for the period 08/2009-01/2011. As it appears from the table, the spatial targeting of poverty appears as a separate sub item of some of the already existing traditional programs. No attempt was made to mainstream it into the fabrics of planning and budgeting, such as give it a thought about the spatial impact of the existing programs and why a lot of poverty prevailed in many places. Surprisingly enough that the traditional programs have sub item with spatial dimension, as the spatial spending appears as an additional item to the current ones, and as if the current spending is taken place in other areas; which attack and challenge the whole frame of planning and budgeting.

Table (11) Capital Spending by Program

Million, L.E.

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
1-Agriculture and land reclamation	512.2	438.7	307.1
Development and Extension (flora)	426.2	329.4	235.1
Development and Extension (veterinary and fishery)	86.0	109.3	72.0
2-Irrigation	2156.8	2077.8	1631.8
Networks	1233.4	1154.2	948.1
High dam	331.1	295.4	257.1

³ See annex 1 for more details on the one thousand poorest villages and development of upper Egypt

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
Development of water resources	592.3	628.2	426.6
3-transportation	3163.8	7597.8	4446.4
Main roads and bridges	1394.9	3517.9	1684.6
Roads	1160.1	2960.1	1333.6
Bridges	234.8	557.8	351.0
Underground	1417.1	3460.0	2236.3
New lines(III,IV)	1295.4	3134.8	1722.4
Development of first and second lines	121.7	325.2	513.9
Ports	27.2	89.0	298.3
Nile transport	324.6	530.9	227.2
4-Housing and infrastructure	17288.4	17449.8	6891.1
Targeting the poorest villages	0.0	325.0	405.0
Potable water	8183.1	5771.1	1207.0
NOPWASD	6374.6	4174.6	800.0
CAPW	1808.5	1596.5	407.0
Sewerage	6686.7	8144.0	3396.7
NOPWASD	3680.7	5998.8	1693.7
CAPW	3006.0	2145.2	1703.0
Urban development and	2418.6	3209.7	2287.4

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
others			
5- Education and research	4480.6	5443.5	6222.5
Pre education	1919.5	2574.0	2302.8
MoE	1919.5	2424.0	2152.8
Buildings: of which	1117.0	1578.3	1260.6
Targeting the poorest villages	0.0	149.0	200.0
Development	802.5	995.7	1042.2
Refurbishing	350.3	150.0	150.0
Vocational education, development	0.0	350.0	237.0
High schooling, development	0.0	137.0	350.0
Technology and scientific exploration	353.0	250.0	250.0
Others	99.2	108.7	55.2
High education and universities	2239.6	2446.2	3524.1
Education development fund, buildings	91.3	10.0	160.0
Higher education and universities	2148.3	2436.2	3364.1
Study abroad	637.0	692.0	603.0

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
MoHE	1511.3	1744.2	2761.1
Buildings	865.6	915.6	1002.5
University buildings	801.2	858.1	923.5
Old universities	536.5	438.6	543.9
New universities	264.7	419.5	379.6
Others	64.4	57.5	79.0
University hospitals	478.2	528.6	1458.6
Old universities	424.5	417.8	1402.4
New universities	53.7	110.8	56.2
Quality accreditation	167.5	300.0	300.0
Research	321.5	423.3	395.6
6-El Azhar ElSharif and university	230.1	169.2	124.7
Pre university	108.3	78.3	59.5
Buildings	89.5	70.3	53.5
Development	18.8	8.0	6.0
Higher and university	121.8	90.9	65.2
University buildings	88.4	43.2	40.6
University hospitals	33.4	47.7	24.6

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
7-Health (including family and population)	2387.2	3207.8	2237.5
MoH	2344.2	3150.2	2070.2
Family health units; of which:	720.5	1346.1	790.0
<i>Targeting the poorest villages</i>	0.0	41.0	50.0
Specialized centers and hospitals	1136.5	1331.2	772.3
Emergency and ambulance	415.5	366.9	343.0
Preventive	55.9	85.0	61.9
Population and family	15.8	21.0	103.0
MoFH	43.0	57.6	167.3
8-Local development	5238.4	4312.7	3150.0
MoLD Diwan	570.3	651.3	300.0
<i>Targeting the poorest villages</i>	0.0	151.3	150.0
Remote areas	0.0	0.0	75.0
Matching grants	0.0	0.0	75.0
Integrated development project	570.3	0	0
Governorate	0.0	230.0	94.5

Program	2009/2008 Actual	2010/2009 Actual	(budget)2011 10/
support			
Slums upgrading	0.0	600.0	150.0
Governorates' Diwans	4652.0	2826.9	2600.0
others	16.1	4.5	5.5
9-Culture and social development	2161.7	2807.1	2142.5
Targeting the poorest villages	0.0	70.5	136.0
10-Contingency	0.0	159.9	1023.0
11- Others	5810.8	5882.0	5682.8
Total: of which	43430.0	49221.3	33859.4
Targeting the poorest villages	0.0	736.8	941.0

Source: State Budget, MoF

It is worth mentioning that the program of the spatial targeting of poverty did not lead to any reallocation of resources regarding any of the traditional programs or to a reduction of spending on them the program is a pure addition to the public spending. This gives an idea about the budgetary thinking in Egypt. The concept of prioritizing and reallocation is not used. The solution is always to pump new resources to the budget, which would, with the expansion of geographically targeting programs, hit the fiscal stance.

Also the management of the program is completely central via a ministerial committee establish for that purpose and comprised of ministries that have sectoral portfolio related to poverty combating in addition to MoF , MoP and social fund. The role of local agencies in planning or managing the implementation activities was absent. Giving room for local innovation through the social assets and local institution was not a sub target on the agenda of the spatial targeting. While ministers in their local visits to some of the villages within that program have realized the importance of integrating local development efforts at the local level and the criticality of managing a local development fund as a block grant, i.e., not conditional or specific, no proposal to make development in this front was introduced.

In addition, the Upper Egypt development program is part of the current spending of the sector of social justice (200 millions L.E.) and the capital spending of the sector of transportation. The program is not comprehensive to comprise all aspects of development that are covered under other budget sectors.

Similar to the situation of all programs of capital spending or other current social programs, there is no development vision of the two spatial programs of the poorest villages or Upper Egypt. No document was produced to show the targets of these two programs. Was it to level up development in them to the average at the national level! What's the time dimension, the road map; all remained unanswered questions.

To conclude; Egypt is a highly centralized country; its fiscal system is characterized by a large vertical imbalance between the central government and local governments "Governorates" from one hand, and horizontal imbalance between these governorates on the other hand.

In this context, the central government has control over all major revenue sources and collects 98 percent of total government's revenues. At the same time, it is responsible for 86 percent of total government's expenditures. While local governments spend almost 14 percent of total expenditures, and collect only 2 percent of total revenues.

Local governments' budgets depend mainly on transfers from central government, as local revenues cover only 10 percent of local spending, so transfers from central government to governorates account for nearly 90 percent of local spending. These transfers take two broad forms, namely:

Conditional grants to finance local deficit and fill the gap between each governorate's revenue and its spending. These grants amount nearly 85 percent of local spending.

Equalization appropriations to reduce horizontal imbalance between the different governorates, as follows:

Direct Equalization transfers which take the form of investment appropriations that assigned to local development projects. These transfers amount 5 percent of local budgets.

Indirect Equalization appropriations administered by the central government to achieve national policy objectives, which are local projects assigned in the central budget and implemented by central agencies. For example, local projects in public sectors like education, health, and water and sanitation are executed by central authorities (General Authority for Educational Buildings, General Authority for Health Insurance, and General Authority for Water and Sanitation).

The imbalanced development shown in Egypt could be linked to decentralization and difference in the fiscal capacity among governorates. This means that the solutions given should take into consideration that despite the country is unitary and highly centralized, the issue of socially balanced development, despite the fact that GoE insists that it is a major corner, has not found a workable way to attain in a sustainable way within the main stream of the state budget. Also what is dangerous about the imbalance in Egypt is that it is not specific to certain area, it is widely spread. This fact should shape the solution to be recommended because it would not be as simple as asymmetric transfer program to lagged area.

Therefore the proposal is to conduct a fiscal reform that deals with the mal practices that led to this mal spatial distribution of public spending and social, and hence also economic, opportunities. Transparent funding formula is crucially a must. Preventing the shift of resources from a place to another and the pattern of budgeting through the fiscal year is also crucial to link budgeting with development. However, to continue channel fiscal transfers to a fragmented fiscal pattern that has many budget authorities at the local level will weakened the desirable development impact of transfers. Therefore, a fiscal consolidation is needed, i.e., to consolidate all fiscal authorities at the local level to come up with one under the governor and fix a strong local deconcentrated system. The reform that should accompany that is to stop appropriating development money to service authorities and to channel them directly to the budget of local governments whom can outsource the service production from service authorities.

3. Reshaping the geography of public spending in Egypt:

All of the above analysis shows the importance of revisiting the territorial implications of public practices. Firstly, reforms cover the strengthening of the spatial dimension of budgeting through correction measures to the practices of budgeting. secondly, reforms could be more radical and shoot for major political changes in budgeting and planning in Egypt through fiscal decentralization and a program of intergovernmental fiscal transfers.

Correction of the unhealthy budget and planning practices includes short term reforms such as: to limit, as much as possible, the issue of budgeting through the year and apply a transparent funding formula, to tie the possibility of shifting project funds from a place to another to clear criteria and conditioned to approval from local popular councils(or any other local channel). These budgetary reforms are expected to create better practices for the spatial dimension of public spending in the budget proposal, instead of being surprised by the end of the year mal distribution of public spending and its implications on unbalanced distribution of opportunities. So they will inform the dialogue on the geography of public spending and reflect on the decisions of the design of programs of public spending and link it in a clear way to medium to long term development targets.

However, deeper reforms on the fiscal and planning fronts are needed. Public spending could be rationalized by sectors' restructuring. Internalizing many decisions of spending by limiting the pattern of budget fragmentation, would have good impact on coordination of planning by creating a better planning frame. Keep on trying to enforce higher level of coordination among budget authorities (implementing agencies) in the same sector could not be seen as a practical solution. Sector reform through functions consolidation may be a better scenario. For example in education, MoE would assume the role of the leader of the sector. This means that it has to do the job of negotiating the appropriation for the sector with the MoF and MoP. Also all functions of development that carried by many of the Service Authorities in the sector would be part of the MoF responsibilities. That is to say that The Fund for Education Development and the Agency for IT development for Education, which are currently service authorities, would be dissolved and integrated into the organizational structure of MoE. Another important sector reform is to appropriate funds to service providers instead of the current practice which channel the funds directly to service producers. General Authority for Education Buildings (GAEB) is a service producer. The service provider according to the Law of Local Administration is localities. So funds should be appropriated to them, then to be channeled to GAEB through contracts to purchase the service of building schools. Another transformation that should be linked to this central sector reform is a local budgetary reform through fixing a strong frame of fiscal deconcentration. Moving the power of decision making on service provision to local agencies, in itself, is a good move, however, to fully reap its benefits it would be desirable to create an integrated frame for planning and budgeting at the local level. This frame could be as simple as enforcing a coordination frame and fixing a centrally monitoring mechanism to assure that coordination. However, it is better to fix another budgetary reform at the local level by consolidating all local budget authorities (Diwan and Moderiat) at the level of the governorate into one budget authority. While this is in essence a budgetary issue, it has its organizational implications. The Governor, as being the head of the executive council of the governorate will not assume a mere coordinating role among fiscally autonomous budgeting authorities (Diwan and each Moderia), the role will be leveled up to hold a consolidated budget for local development. All local agencies will be departments in the new formed local structure.

The consolidation of budget authorities at both the central level as well as that at the local level will have the benefit of internalizing public spending decisions in a sense to help create more fiscal space for more policy options and more development projects. In addition bring budgetary decision closer to people will trigger new thinking about democratization of the society through budget and planning dialogues. We see this as a medium to long term reforms. That is to say the fiscal and planning reforms should comprise some structural aspects related to division or consolidation of work in the public sector. The central superiority in planning and implementation of development projects should be revised. Now it is built in the budget and based on the de facto division of responsibilities between the central agencies and the local ones. This issue is crucial as a result of the importance of bringing the design of plans and development projects as much as closer to people to capture the difference in culture, history and to allow for the inclusion of local institutional relations, i.e. to admit that geography matters.

This may bring to discussion the issues of fiscal decentralization as tools to strengthen the territorial side of the budget. The concept of decentralization is not new to Egypt's system of governance. However, the real difficult issue here is to design a decentralization mode of governance that meets the expected set of outcomes. Till now this set has not been clear and not yet stated in a transparent way. Politicians are used to see decentralization as part of the democratization of the society and voicing the opinion of citizens. While for executives, it is a way for better usage the fiscal resources or to reshape their portfolio of central responsibilities. Both perspectives lead to different designs for the program of decentralization. For the former perspective, political decentralization is a real issue, while for the second, a good deconcerated program will do.

Adding to this ambiguity of targeting, there is the issue of mistrust, as a point of weakness of the social assets in Egypt, which complicates more the implementation of decentralization. Central budget agencies don't trust the capacity of local agencies to deliver services with quality, in case of devolving the authority of planning and budgeting for these services to the local administration in collaboration with "*Moderiat*", aside from the type of that collaboration being a consolidated or coordinated scheme. Also citizens don't trust the capacity of local agencies to serve them in a better way. One of the findings of a recent survey⁴ that only 2% of the interviewees trusts the competency of local agencies, being executives or elected. This highlights the problematic issue of applying decentralization in Egypt and the importance of having a well designed package. One can advocate that in a poor society, like Egypt, where the needs are almost the same as basic education and health, the central role in planning and budgeting have the merit of achieving savings in bedding and procurement. However, all practical observations show that even for services of basic needs nature, differences in history, culture, institutional relations and social assets from a place to another are subjects that are important to consider when shaping the development program. Sometimes, different weights for the same activities are desired. The above mentioned survey questioning the perception of people in two governorates; Sohag and Kafr Elsheikh, on most services needed to combat poverty showed the difference in the poverty pattern between them in a way that makes the design of a successful development program should take into consideration all the attributes of each place. Central management of programs that shaped to host these differences could be impossible.

Moreover, dealing with the issue of fragmentation of development decisions through a coordinative mode of planning and budgeting would not be practical if it continued to be a function assigned just to the upper level of administration. There is a need to localize this function. Regional Planning Authorities (RPAs)⁵ were created to do this function as stated in the presidential decree establishing them and stated in the law of Local Administration. In addition

⁴ Abdellatif, Tohami and Abdellhaleem, 2011 forthcoming

⁵ RPAs were established by a Presidential decree in 1979. The of Law of Local Administration of 1979, elaborates on their role. They have to coordinate the activity of local development among governorates lying in the same region. Egypt is divided into 7 economic regions; each has three governorates or more. A recent assessment done by EDI 2010 (A USAID funded project) showed that due to many reasons, among them are the aged staff and poor equipping, the absence of enforcement mechanism at the regional level and planning fragmentation of local development activities, these agencies are week and could not perform their coordinating role.

to the issue of coordinating sectoral development plan to reach a coordinative mode of spatial planning, they also were assigned the function of coordinating relational planning among governorates' development plans. RPAs are suited in the MoP to better fulfill these complicated functions. However, in reality, they couldn't perform and their role has been limited to oversight on the plans of local administration with no outreach to other sectors of importance to local development which relaxed the relational planning aspect accordingly. Role of RPAs could be revitalized through the new reforms of planning and budgeting.

To sum up, it may better for the case of Egypt to fix, at least for the medium term, **a system of fiscal federalism with administrative deconcentration with limited political decentralization.**⁶ This resolution would create some pressure for institutional reform between central/local agencies inside the same sector. It will also create others between RPAs and many local agencies. However, it doesn't require a huge political institutional reform that calls for a massive change and reshuffle in the politics of provision of public services. To some this may appear as accommodating centralization in new attire. However, till the society be more assure of the expected results from decentralization, the development situation in the country can't wait to link decentralization with localization. There is a clear need to fix the aspect of geography in the mode of governance of planning and budgeting and to host local institutions. Accountability will stay, mainly, within the central level for a while till the local political institutions are capable to better reflect in a democratic way the traits and features of their local communities. It is advisable to embark on a two track reform:

First: fiscal reform to:

I- Limit the practice of budgeting through the year:

All programs should be proposed with their spatial distribution. No budget authority is to be offered a block line item for spatial projects. They have to declare the proposal for spatial projects in the budget proposal.

II- Complement the budget document with an addendum for the spatial distribution of public spending with a clear geographical funding formula.

A complementary document to the budget to be prepared according to the special distribution of investment projects, even if the budget continues the current practice of appropriating the funds to service producers. Spatial transparency is a must. This will help in assessing in advance the spatial impact of budget. It will enhance the readability of budget to MPs and their constituencies. It also will pave for linking budget to development. Sorting the budget by region or location, will facilitate linking it to development indicators such as HDI (human development index) or HOI (human opportunity index). This step will increase the openness of the budget to society and foster public discussion around the budget figures. In addition it will raise questions about the spatial criteria for distributing public money. This will level up the fiscal dialogue on funding formula and intergovernmental transfers, in addition to the role of equitable grants.

⁶ See annex 2 for a note on the decentralization program in Egypt.

III- Fix some performance indicator on the outcome to do the link between spending and development and introduce that in the budget pre-statement.

Based on the two above reform steps, the MoP could produce a decent document on planning linking development to public spending in a transparent manner using a connected chain of strategic objectives and activities passing through targets and measures. Such a reform will enable MoP to fix a real system of M&E and to replace it with the simple follow up report that it produces currently to do tracking for the implementation of investment activities with no link to development outcomes or impact.

Here it is worthy to revisit the role of MoP in light of the role of MoF. The current budget duality is not accepted any more. All symptoms indicate that it affects negatively any advance to rethinking the budget as a development tool. Also introducing MTF necessitates the consolidation of the recurrent and investment budgets. In addition the involvement of the MoP in investment distribution among budget authorities weakens its strategic role in fixing the link between development and budget spending. Here we recommend a two step budgeting process. It starts with MoP do negotiation with ministries (recalling the proposed sector and organizational reform from above, which will be discussed in details below) and come up with strategic direction in allocating public money. Parliament goes into Vote I on these big quantities of appropriation for education, health, The appropriation should reveal all spending on the sector (the strategic program for sectors). It has to cover both recurrent and investment expenditure and also reveals the operation programs to distinguish them from development programs. It also has to link the appropriation with development indicators.

Then ministers work with their ministries to allocate funds among different players in the sector according to the fiscal principle that money follows responsibilities. For this step, ministries work with MoF to create the figures for Vote II in the parliament. In this way the role of MoP will level up to be accountable before the parliament and society for the strategic outcomes of public spending. It has to present a set of criteria to distribute public money among sectors (strategic functions) and among regions (spatial distribution) to assure development with equity.

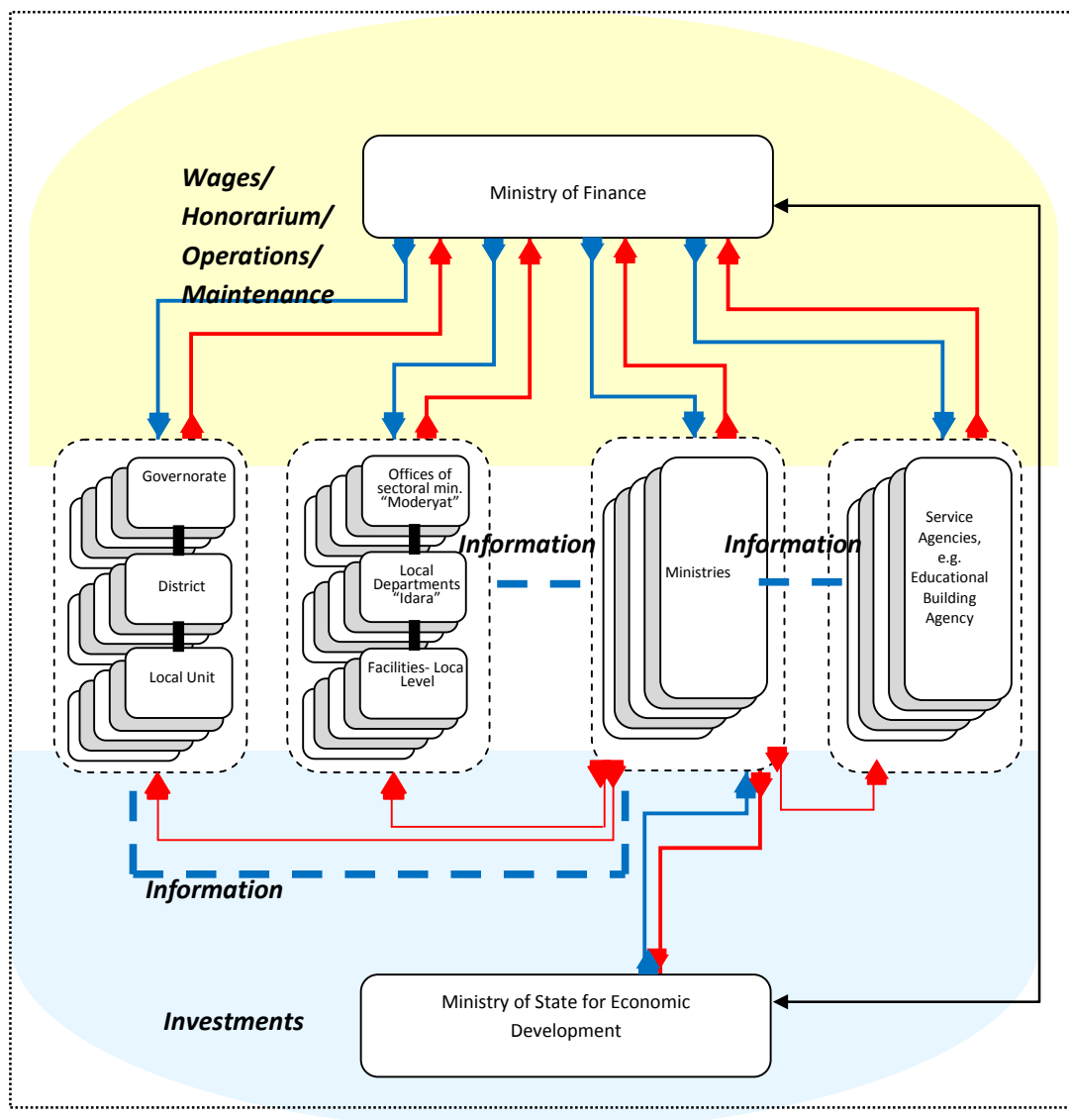
IV- Create a horizontal financial deconcentration to match the new planning frame of strong deconcentration,

Step III could be implemented in two phases. In Phase one MoP is to enforce a horizontal financial deconcentration, where every minister is to do the sector negotiation on behalf, with their presence, of all budget authorities in the sector. Then he has to declare the funding criteria for allocation funds to them. And also be responsible to enforce a transparent and declared funding formula for the spatial distribution. This horizontal deconcentration will take off the shoulder of the MoP the headache of individual negotiation with each budget authority. Setting the big picture for each sector is the responsibility of the line sectoral ministries. In some cases some coordination among ministries is required like in putting the plan for the transport sector at the national and regional level, which is the responsibility of the central agencies at the national level, and local roads network which is the responsibility of the local administration in

collaboration with the MoLD. So here we can apply the concept of primary authorities and secondary authorities without any legal amendments to the current structure of the budget.

This is a mere restructuring of the planning power of many of budget authorities by reforming the structure of budget authorities to primary (ministries) which get first appropriation and secondary to which money is allocated from the former (second appropriation). All *moderiat* and service authorities are to be secondary authorities. This does not need any change in the structure of the budget., see fig (3). As it appears in the figure, the role of ministries is leveled up to set the strategy of the sector, do consultation with all players (governorates' *Diwans*, *Moderiat*, and service Authorities) to consolidate the financial negotiation with MoF and MoP. However, this could not be seen as a comprehensive solution for coordination even inside the same sector. Other mechanisms should be fixed in the longer term.

Fig (3), A nationally sectoral coordinative planning frame



Source: developed by authors based on Eid, Atteia and Abdellatif

V- Review the structure of budget authorities in the budget to reduce the number by consolidation or getting some out of the budget to sustainably fix reform in as of # IV.

For example: Differentiate between the producer and provider of services for the sake of accountability. Then shrink- or end up- the planning and budgeting power of the implementing agencies that are responsible on the production of services, by assigning the money to the budget authority responsible on the provision of the service. This may be accompanied by limiting the position of budget authorities on just those responsible on the provision of services. Others are to leave the budget and have other status such as public companies.

Second: planning reform (it overlaps sometimes with the abovementioned fiscal reform):

VI- Limit the spatial shift of investment funds done by implementing agencies

As shown earlier this shift hits negatively any development vision that could be there behind the distribution of resources. Also it raises the level of citizens' dissatisfaction towards the government. The problem that implementing agencies because they work at the national level in the absence of any mechanism to reflect of the shift they do, they don't feel the wider outcome and the impact. It shallows the process of planning and budgeting and restrict them to a mere operational executive process. In the short run, the process of shifting funds among different places should be tied to the approval of a body accountable for development results. It's difficult to assign to the parliament. However, it could be linked to the approval of the governor of the region with a sort of blessings from the elected popular councils. The concept in the longer term is to close any chance for the mishap. This could be done through the spatial presentation of the plan and budget that will perform as an alarm to the loss in development that may happen because of the shift of resources away from the place to another, which will be strengthened more when the plan and budget are linked to development indicators. Of course when there is a frame for integrating development at the local level (through a strong deconcentration or any other advanced forms of decentralization) whilst assigning the public funds to service providers and not to service producers, this phenomena of shifting resources among localities will stop completely.

VII- Complete the reform for program-based budget

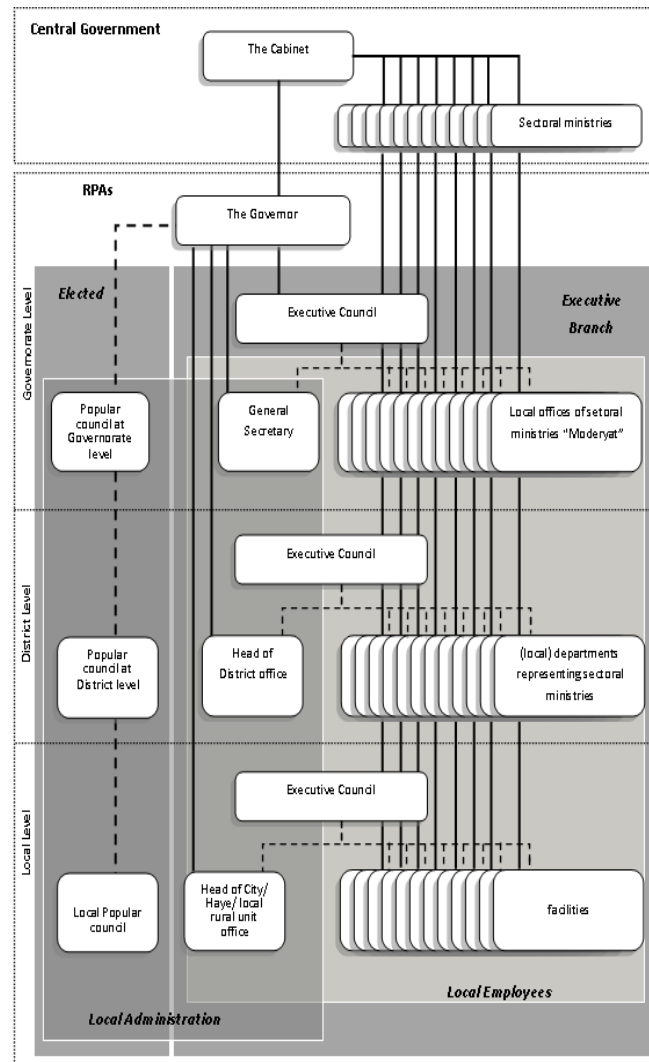
This reform is multi objective: to help in prioritizing the targets of public spending, inform the dialogue on the division of functions between the central and local agencies. While MoF has started that effort and produce a good base to build on, it needs to tighten the process by setting clear targets to enlighten the transformation. Unfortunately the issues of planning and budgeting governance in Egypt are performed in complete isolation from other planning and fiscal reforms. Fiscal reform should incorporate issues of governance as a main component of improvement. Distinction among strategic programs, ministerial and functional programs should

be made in a clear way to build a coherent whole frame for the government. This will not only facilitate budget discussion with all stakeholders, it also enlightens the development road map. In addition it shed light on the importance for coordination and facilitate monitoring its outcomes.

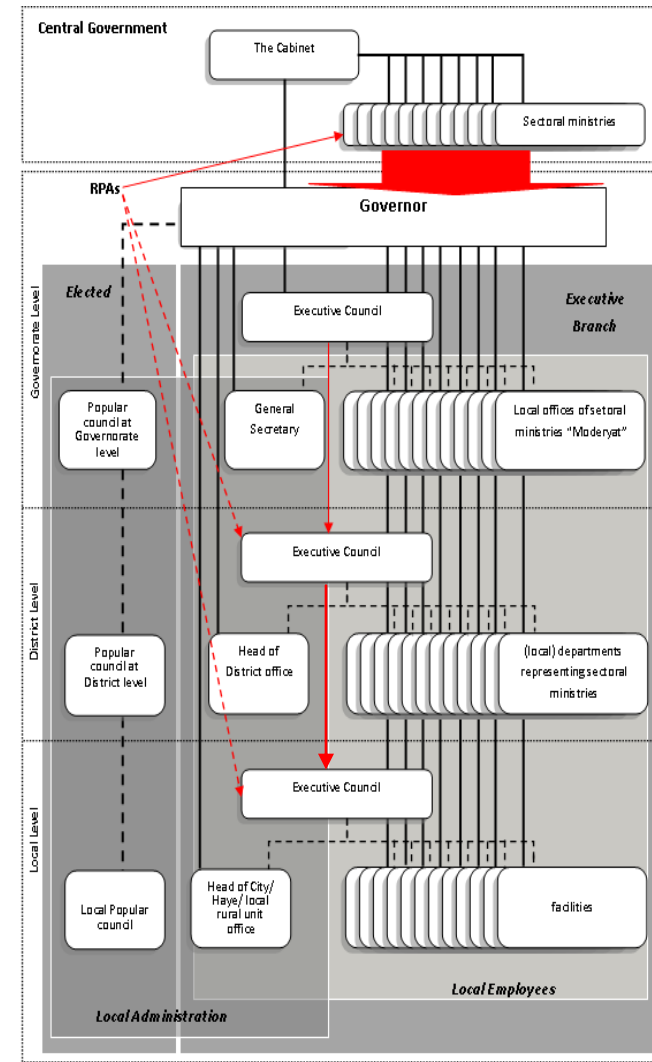
VIII- Foster the role of the RPAs through creating a concrete mechanism to empower them in performing their coordinating role.

Ministries strategize for the sector, play the role of a nationally sectoral coordinator on the strategic level, but they don't perform local implementation. Ministries are requested to handle the Governors and the RPA a sector strategy for each governorate, where RPAs should help Governors to perform the local integration among all sectors' strategies and be responsible for development performance. RPAs can depend on the existing local coordinative mechanism of the current executive councils, as it appears in fig (4).

fig (4): planning coordination at the local level



Current frame



Proposed frame

Source: developed by authors based on Eid, Attia and Abdellatif

The left diagram portrays the current frame of governance as illustrated in Eid, Attia and Abdellatif (forthcoming). It shows the strong link between the Moderiat and the line sectoral ministries. As it depicts there is no champion for any integrated frame of local development at the local level. All agencies work in a weak coordinating frame.

The right diagram shows the proposed frame, where we broke the relation between ministries and the Moderiat, and had a new relation between ministries and governors and established a **one tier** local deconcentrated government. Governor is representing the centralization at the local level. He manages the central transfers for local development and is responsible before the cabinet for that function. The main features of this deconcentrated system are:

- Governors represent the central level and appointed by prime minister (currently by the president)
- Minister of local administration (currently local development) presents and advocates the local interests in the cabinet
- Minister of local administration do oversight on behalf of the cabinet on the performance of localities
- Moderiat are not any more budget authorities. Diwan is the only budget authority at the local level. Moderate are departments inside the Diwan. They receive allocations. Relation between Moderiat and Edarat remain as it is now. Edarat are subordinates for Moderate.
- Local elected councils represent the interest of local communities. They advise the governor on the preference of local communities, but they do not lead the executive work. So the separation of power at the central level is replicated at the local level. They can question the development outcome and the performance of governors. While they cannot fire governors, they can request that from the minister of local administration.
- Governor has to produce an integrated local plan. He has to fix and declare a funding formula by place. The criteria that determine the share of each city or any other local territory should be known to all.
- Governors are obliged to produce a medium term development plan where RDAs can channel through outsourcing some technical assistance.
- Governorates receive central transfers in addition to local resources.
- MoP gives technical assistance to ministers and governors to develop the relevant funding formula.
- Central transfers could be conditional in the beginning with little room to switch resources among sectors and functions.

- Budgetary resources are assigned to ministries or local administration but not to service authorities or any other entities that produce public services. However, they receive funds from ministries and local administration to produce public services for them. This doesn't necessitate in itself any change in their nature as budget authorities. But it is need to fix a pattern for accountability on outcomes and impacts, i.e., to develop a fiscal governance frame.
- Ministries are responsible on implementation only of national programs.
- While ministers do negotiation with MoP and MoF for the sector, they retain just the funds for their operational program and that for investment with national nature; otherwise, funds are channeled to local administration.

I. People mobility and Market Accessibility; an illustrative example of the outcome of the current budgeting and planning features

Economic theory stemming from Marshall (Marshall, 1989) states that improved accessibility to markets, agglomerations and services will allow benefits from agglomeration externalities, including proximity to input suppliers or final consumers, reduced transport costs for goods and people, and benefits from human capital and intellectual spillovers facilitating innovation. Access to markets is a function of geographic heterogeneity and space, of course, but is also a function of the quality and speed of infrastructure connections. In this sense, “accessibility” is a function of geography and also a product or outcome of the transportation system, both of which determine the locational advantage of a region relative to all regions, including itself.

In general, “access” to markets is determined by the household's or village's true cost of traveling to or accessing market centers. This could include the cost of transporting goods for sale, transporting (back to the village) key inputs for production or consumption, or the cost of transporting people for migratory or more permanent employment.

Thus, effective access to urban markets also depends on the willingness and ability to afford transport costs, and these in turn are directly a function of road quality as well as actual measured road distance, topography, climate, rivers or any other potentially inhibiting (and thus more costly) exogenous geo-physical barriers.

Egypt's road system suffers from poor quality. In addition, all roads indicators, in terms of length, density per head or space(squared meter), are lagging behind the international average⁷:

- ◆ Awad 2011⁸ mentioned that the universal practices are to allocate a percentage that ranges from 15-20% of total public investments to the roads sector. If this percentage is calculated for the Egyptian budget, allocations for the roads sector should have been increased to 14.5-19.5 billion L.E. ⁹the size of the gap can be imagined if we know that the total governmental allocations for roads in the Egyptian case in 2009/2010 budget does not exceed 8.5% of the benchmarked amount.
- ◆ Maintenance of roads is a major problem; the total amount of resources allocated for maintenance tiny when compared with the calculated needs according to international norms (2-3% of the total investments for roads annually). Resources needed to perform road maintenance ranges from Needs 2 to 3.4 billion L.E when the allocated resources for maintenance in 2009 did not exceed 1.2 billion L.E.
- ◆ Egypt is ranked 64th (of 222 country) internationally when countries are sorted by the total length of roads network. Of a roads network of 75725 K.M. Egypt comes after Turkey, Democratic Congo, Saudi Arabia, Algeria, Kenya and Nigeria.
- ◆ As for roads density, which is an internationally used indicator that calculates Roads length/Km2 of the country's area; Egypt is still lagged behind international average. The international average is having 250 Meters of roads per kilometer of the country's area. In Egypt, each 75 meters of roads serve a kilometer of land. This means that Egypt needs three multipliers of the value of the indicator to reach the international number. On this regard, Egypt is ranked number 190 out of 222 countries. It here comes after Nigeria, Yemen, Kenya and Syria¹⁰.
- ◆ On another side, the international average that each thousand citizens is served by 4.2 Kilo Meters of roads. In the Egyptian case each thousand citizens are served by 941 meters of roads. Egypt's rank is now deteriorated to 210 of 222 countries according to this indicator. To catch up with international average, the length of the Egyptian road network should reach 390 000 k.m. which is 5 times the current length.

To sum up, all information mentioned above conveys a main message, which is Egyptian society suffers from a noticeable degree of connectivity deprivation as measured by comparative

⁷ Shura Council study on roads in Egypt, 2010, unpublished (in Arabic). It is consistent with John Felkner and Aaron Wilson 2011

⁸ Awad, Mohamed "Decentralization of the Transport Sector in Egypt" 2011, EDI

⁹ Total expenditure on roads and bridges in 2009/2010 reached 8.9 billion L.E. of which 6.3 billion L.E. allocated according to the previously shown table. In addition to 2 billion L.E. of the Armed Forces, mainly allocated to Assuit/Beni Suef Road with a cost of 1.7 billion L.E. and 100 Million L.E. to Geish Bridge in Cairo/Alexandria Road

All

¹⁰ Calculated based on CIA world fact book data.

international roads indicators. As of WB c 2010), Upper Egypt is more deprived more than other regions in the north part of the county.

In addition the sector of transportation is high fragmented when considering the landscape of decision making of the roads network. Table (12) names the agencies (central and local) responsible about the sector. It is worth mentioning that there is no entity assigned to it the responsibility of integrating all the sector activities, including setting standards, regulations, implantation or assure network integration at the national , regional or local levels.

Table (12) landscape of managing the transport sector:

Ministry	Responsibilities	Affiliates
Ministry of Transportation	1- Roads Network planning and design & execution 2- Transportation and Shipping services 3- River Transportation	1- General Authority of Roads and Bridges 2- Authority of Railway services 3- Authority of River Transportation 4- Maritime Transportation and Logistics sector 5- National Co. of Underground Systems 6- Transportation institute.
Ministry of Civil Aviation	Roads Network planning and design	Holding Companies of Aviation
Ministry of Housing	Roads Network planning and design and implementation	1- Central Agency of Reconstruction. 2- Authority of Urban Planning 3- Authority of Urban Communities
Ministry of Investment	Transportation and Shipping services	1- Transportation companies that are affiliated to the Transportation holding companies 2- Company of Shipping and

		Cargo 3- Companies that work inside local boards
Ministry of Interior	Traffic management	1- General Directorate of Traffic 2- Surface water police
Ministry of Defense	Roads Network planning and design & execution	--
Localities	1- Transportation and Shipping services 2- River Transportation	--
Ministry of Water Resources and irrigation	1- Local Bridges (on Village level) 2- Some local roads	--
Ministry of Planning	To manage the investment plan and set priorities	--
Ministry of Finance	1- Transport Sector finance. 2- Taxi projects	--

Source: Shura Council 2010, unpublished

This makes transportation sector management in Egypt quite complex and unorganized. Roles are in many times overlapped. Projects vary in quality among different destinations of implementation. At the same time the local roads projects are subject to management of two different ministries; the ministry of local development (localities) and the Ministry of Irrigation and Water resources in addition to the 27 governorates, leaving a wide room for mismanagement and overlapping. There is no frame of coordination among all the above agents.

It is worth to mention that while that 68% of total length of Roads Network is under localities (the 27 governorates) supervision, operating and management responsibility, nevertheless, localities get only 17% of the public investment budget allocated to roads construction (part of the 1086 million L.E. is allocated to them through a budget transfer to the Ministry of local

development, another portion is self finance), see tables ()&(). Such pattern of allocation is an obvious example of the unbalanced allocation of resources among different governmental layers¹¹. Governorates are the weakest partner for financial negotiation for roads' transfers from the state budget. Recalling again the fact that no study was prepared to alarm the dangers of financial constraints on funding local roads and the importance of the integration of the roads network on all its levels; national, regional and local. Many interviews with local units¹² showed that sometimes the availability of the social services, like a school or health unit is not the problem, the real challenge is the accessibility especially in rural areas in winter time. Some highlighted that when counting for achieving MDGs in Egypt, the issue of accessibility should be taken into consideration. As mentioned in the National Plan of Action for Childhood and Motherhood (NCCM forthcoming) the frequency of a pregnant mother to seek maternal care is less than that in the urban areas because of the time of journey and the quality of roads.

Total public investments in roads sector in 2009/2010 and planned investments in 2010/2011 (Million L.E.):

Indicator	2009/2010	2010/2011
Ministry of Transportation	2950	1920
Ministry of Housing	1500	1500
Ministry of Investment	800 ¹³	500 ¹⁴
Ministry of Local Development	1086 ¹⁵	1251
Ministry of Tourism	135 ¹⁶	135
Total	6471	5306

Currently; The Minister of Transportation is requesting extra subsidy of 2 billion L.E., Despite that what was used already of 2010/2011 allocations does not exceed 1.1 billion L.E.

The current allocations for 2009/2010 is only 97.6 Billion L.E., expected to increase.

¹² Author's interviews with LPCs in 2010 to assess the first piloting phase for implementing decentralization

¹³ For the accomplishment of Red Sea –Upper Egypt Road in 2009/2010. Allocation for the doubling the same road in 2010/2011.

¹⁴ Allocations for the Ministry of Transportation for Roads in 2009/2010 was 3.5 Billion, of which 2.95 billion only was used.

¹⁵ The amount of money that has already been used by localities for a local road in the year 2001/2010 is about 1086 million L.E. it is divided into 881 million L.E. public funding and the rest of the amount is gathered through self financing of Governorates' own resources.

¹⁶ According to the average data of the Ministry of Tourism-Tourism Fund for years 2009/2010 and 2010/2011, these allocated investment is the average of what has been allocated through the fund to develop and improve roads in several governorates and Ministries (13 Governorates, Ministry of Transportation and Ministry of Housing)

Most of the investments at the national and regional levels are implemented by the General Authority of Roads and Bridges (GARB) which is a central authority affiliated to the Ministry of Transportation. However, through a book asset transfer, most of the regional roads is owned by the local administration and they are responsible about operation and maintenance through their local budget. GARB is implementing only those regional roads that are important from the national perspective, which means that the target is not to facilitate regional mobility, but national mobility. Lack of regional roads makes mobility of people inside the same governorate a truly difficult issue and force people to limit their movement to major cities inside their governorate. The issue of difficult accessibility from a local place to regional road led to many negative impacts, migration to and congestion of major cities and informal housing on the agriculture land or state land where the regional roads passes are among them.

Moreover, the thinking of planning for service provision in Egypt concentrates many services in urban place and assuming that people will commute for these services. Given the fragmentation of the transport sector planning and also the financial constraints on funding local roads as well as the fragmentation and sectoral nature of planning for local development , most likely rural citizens or even those in the auxiliary villages will not be able to commute to mother villages or cities for those services. That's to say due to planning and budgetary problems, the concept of city-region relation is not working for the poor in rural areas of Egypt.

Table() Total Length of of main roads' network classified into main and local roads as of 2009:

Indicator	Length (Km.)
Total paved Roads implemented by Ministry of Transportation	24022 (32% of total length of paved roads)
Total paved Roads affiliated to localities	51703 (68% of total length of paved roads)
Total length of paved roads	75725
Total dust roads	17035
Total roads length	92760
% paved of total	81.6%

Source: Awad 2011

Challenges of transport as driven by the problems attributed to roads landscape of decision making and quality, aggravated the problem of mobility and forced people for many decades to migrate leaving homes for job opportunities and better services. Roads are not just affecting the mobility of people but also the accessibility to markets. Part of the poverty of agriculture sector

in upper Egypt is attributed to lack of roads¹⁷. In addition part of the interpretation of illegal encroachment on agriculture land is to suit their houses at a regional road to better be connected. Inspired with the recommendation in section II, here some suggestions could be drawn:

Sector reform:

- Ministry of Transportation (MoT) is to take the responsibility of setting the whole mobility strategy for Egypt (people and goods)
- MoT should produce and publish data on mobility and connectivity in terms of road density to number of inhabitants and space of square meter, as other ministries do for their sectors (education and health for example)
- It has to negotiate with the Ministry of Planning and the Ministry of Finance the funds to finance all types of roads in addition to maintenance.
- Responsibility of provision of local and regional roads should be assigned to localities, even that GABR is to continue construction of regional roads.
- budget for roads transferred to the budget of local authorities should not be in the form of multipurpose block grant; i.e. for all urban management activities including roads. It has to be specific to roads.
- to revisit the criteria of service allocation in rural areas and move to criteria related to population density instead of the rural/urban dichotomy.
- to give the localities the responsibility of integrating the plan of local development at their level and to show proves for that to the Regional Development Authorities.

¹⁷ In some papers that discussed poverty in upper Egypt, they found that small farmers there have to sell their products in field because it is hard to access markets in cities or in the north because of lack of roads.

Accessibility and Transport Costs in Egypt: An Empirical Analysis

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Part 1: Analysis of Spatial Distribution of Key Economic Indicator Variables and Market Accessibility in Egypt

I. Introduction

This section analyzes the spatial distribution of key economic development indicators such as population density, poverty, illiteracy, unemployment, and access to services such as water and sewerage for Egypt, using 2006 Egyptian Census data disaggregated to the Egyptian Shekhia (district) level. By combining the key economic development indicators with the detailed national-level GIS road network data obtained from the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS), we are able to analyze the spatial distribution of key indicators relative to market accessibility by 2006 Shekhia districts. For example, we are able to identify areas with highest poverty levels or illiteracy rates *and* poorest market access, as well as areas with high poverty rates and good market access.

I. Analysis of Spatial Distribution of Key Economic Indicator Variables in Egypt

Map 1 displays Egyptian population 2006 population density. The map shows the concentration of population density in the Greater Cairo Area (GCA), north of Cairo in Alexandria, and in localities along the Nile River leading to Upper Egypt. The map shows clearly the primacy of the GCA in Egypt, providing a central “primate city” with the greatest concentration of population, as well as relatively high spatial densities along the Nile moving south into Upper Egypt.

Map 2 displays a close-up of population density distribution in Cairo. The map shows that the highest population density is concentrated in the eastern and northern districts of the primary urban area, with lower density in the northeast of the city.

Map 3 displays the 2006 poverty rate for each Shekhia (district). The map shows that the highest poverty rates in Egypt cluster along the Nile river, primarily in Upper Egypt, and in urban or peri-urban areas primarily to the northeast of Cairo, but also to the northwest. Poverty rates are lower in the Cairo urban area and the delta features relatively low poverty rates compared to the national levels. A comparison between Figure 1 and Figure 3 shows that the impoverished areas northeast and northwest of Cairo tend to be less urban and more rural, with low population densities, whereas the Nile river areas tend to have both high population density and high poverty rates.

Map 4 provides a closer look at poverty rates in the Cairo urban area, showing that the eastern areas of the city feature extremely low poverty rates – less than 5 percent - both compared to the western areas of the city and to the national mean rate of 19.6 percent, and lower even than the mean for urban

areas in Egypt of 8.4% (see Table 1). However, certain districts of Cairo on the western side of the city have very high poverty rates, ranging between 20 and 35 percent.

Due to limited data availability, maps 5-6 shows spatial distribution for rural Shekhias only.¹ Access to clean water is greater than 90 percent in most of Egypt, including rural areas (Map 5). Conversely, sewerage access is generally poor in rural Egypt (Map 6)

II. Market Accessibility

We consider here the measurement of market accessibility in Egypt: how it is defined, what its benefits are, how it can be measured quantitatively using spatial data and Geographic Information Systems (GIS) and given differing levels of data availability, and methods for measuring it and producing possible market accessibility indices. We review previous methods for measuring market access, and propose some alternative, hybrid methods that could be applicable.

The Benefits of Accessibility. Improved accessibility to markets, agglomerations and services will allow benefits from agglomeration externalities, including proximity to input suppliers or final consumers, reduced transport costs for goods and people, and benefits from human capital and intellectual spillovers facilitating innovation (Marshall, 1989). Access to markets is a function of geographic heterogeneity and space, of course, but is also a function of the quality and speed of infrastructure connections. In this sense, “accessibility” is a function of geography and also a product or outcome of the transportation system, both of which determine the locational advantage of a region relative to all regions, including itself. In general, “access” to markets is determined by the household’s or village’s true cost of traveling to or accessing market centers. This could include the cost of transporting goods for sale, transporting (back to the village) key inputs for production or consumption, or the cost of transporting people for migratory or more permanent employment. Thus, effective access to urban markets also depends on the willingness and ability to afford transport costs, and these in turn are directly a function of road quality as well as actual measured road distance, topography, climate, rivers or any other potentially inhibiting (and thus more costly) exogenous geo-physical barriers. In Egypt and other developing countries, accessibility can vary tremendously across regions and due to the lack of inter-regional transport infrastructure linking small centers to large urban areas, thereby reducing the opportunities for efficient location decisions. Henderson (2000) documents the linkages between improvements in inter-regional infrastructure and growth of smaller agglomerations outside of larger city centers.

¹ Data for rural areas were collected as part of community survey data. A similar exercise was not done for urban areas.

The classic gravity model which is commonly used in the analysis of trade between regions and countries states that the interaction between two places is proportional to the size of the two places as measured by population, employment or some other index of social or economic activity, and inversely proportional to some measure of separation such as distance. Equation 1, following Hansen (1959), shows that

$$I_i = \sum_j \frac{S_j}{d_{ij}^b}$$

Equation 1: Classical Accessibility Indicator

where I is the “classical” accessibility indicator estimated for location i (for example, a village), S is a size indicator at a market destination j (for example, population, purchasing power or employment), and d is a measure of distance (or more generally, *friction*) between origin i and destination j , while b describes how increasing distance reduces the expected level of interaction. Empirical research suggests that simple inverse distance weighting describes a more rapid decline of interaction with increasing distance than is often observed in the real world (Weibull, 1976), and thus a negative exponential function is often used. However, more simply, accessibility is also frequently measured simply as a function of travel-time or travel-cost to the nearest major city, market or access point on the larger infrastructure network (Uchida & Nelson, 2009; Roberts et al, 2006).

Calculation of Egyptian Accessibility Indicators. A suite of market accessibility indices were calculated for Egypt² using the GIS road network data and variation in road quality. The accessibility variables were calculated by generating travel-time indices through a GIS Egyptian road network, using a least-cost path algorithm, minimizing a value of travel-time estimated for each individual road segment. Source data for the road network merged spatial network data provided by the Egyptian Central Agency for Public Mobilization And Statistics (CAPMAS) and data provided by the Euro-Mediterranean Partnership (EUROMED) of the European Union are shown in Maps 7 and 8.

The CAPMAS GIS road network data provided data with exceptional spatial detail, resolution and comprehensiveness, but lacked sufficient attribute variable information on road quality for estimation of travel-time speeds per segment. The EUROMED data, in contrast, on the spatial detail was more limited, but provided useful variables per road segment for number of lanes, lane direction, and multiple categorization of road types – variables useful for estimation of travel speeds. The CAPMAS GIS spatial road network data was used for all accessibility calculations was merged with the road quality data from EUROMED. Travel-time estimates for each road segment were then calculated, based on the road quality

² See appendix for methodology.

variables and the road categorization data provided by both CAPMAS and EUROMED, and divided by the precise length of each road segment to estimate a travel-time speed for each segment. For each travel-time measure calculated, the shortest path through the network from the centroid point of each Shekhia (district) was calculated, using a least-cost-path algorithm and minimizing the travel speed estimate.

Spatial of variation of primary accessibility indices are shown below in Maps 9-15:

- Map 9: Travel-Time Through Road Networks, Considering Variation in Road Quality, To Central Cairo
- Map 10: Travel-Time Through Road Networks, Considering Variation in Road Quality, To The Nearest of the 5 Largest Egyptian Cities (Cairo, Alexandria, Port Said, Suez, and Al-Mahalla Al-Kubra)
- Map 11: Travel-Time Through Road Networks, Considering Variation in Road Quality, To The Nearest Egyptian City Greater than 100,000
- Map 12: Travel-Time Through Road Networks, Considering Variation in Road Quality, To The Nearest Major Egyptian Port (Alexandria, Port Said, Damietta, Suez, and Safaga)
- Map 14: Travel-Time Through Road Networks, Considering Variation in Road Quality, To Port Said
- Map 15: Travel-Time Through Road Networks, Considering Variation in Road Quality, To Safaga

Table 1 summarizes the key economic indicator variables, for Egypt, and by market accessibility indices.

Table 1: Summary of Key Economic Development Indicators by Market Accessibility Indices ¹

	Poverty Rate	Water Access	Sewage Access	Total Population	Percent of Population
Mean Rate: All of Egypt	19.60%	N/A	N/A	69827070	100%
Mean Rate: Urban Areas	8.36%	N/A	N/A	29260242	41.90%
Mean Rate: Rural Areas	21.73%	94.03%	14.60%	40566828	58.10%
Travel-Time to Cairo:					
1st Quartile (Best Access):	12.36%	94.69%	13.49%	24233037	34.70%
2nd Quartile	11.79%	94.03%	19.36%	13920835	19.94%
3rd Quartile	16.56%	94.18%	17.96%	17858815	25.58%
4th Quartile (Worst Access):	38.85%	93.24%	4.55%	13814383	19.78%
Travel-Time to Nearest Large City (5)					
1st Quartile (Best Access):	7.15%	96.96%	28.88%	28333389	40.57%
2nd Quartile	12.82%	94.22%	18.20%	13629377	19.52%
3rd Quartile	20.67%	92.78%	9.84%	13236675	18.96%
4th Quartile (Worst Access):	38.80%	93.04%	4.86%	14627629	20.95%
Travel-Time to Nearest City over 100,000					
1st Quartile (Best Access):	13.26%	96.39%	24.25%	23689328	33.93%
2nd Quartile	17.00%	94.97%	14.33%	20194378	28.92%
3rd Quartile	21.23%	92.91%	12.21%	15142837	21.69%
4th Quartile (Worst Access):	27.68%	91.93%	8.83%	10800527	15.47%
Travel-Time to Nearest Port City					
1st Quartile (Best Access):	14.72%	94.60%	12.70%	26640365	38.15%
2nd Quartile	16.72%	95.12%	16.76%	16346715	23.41%
3rd Quartile	18.35%	94.01%	19.01%	14755487	21.13%
4th Quartile (Worst Access):	28.72%	92.28%	7.29%	12084503	17.31%
Population Density:					
1st Quartile (Highest Density):	15.99%	95.42%	15.92%	34409400	49.25%
2nd Quartile	22.74%	94.38%	13.93%	15641352	22.40%
3rd Quartile	19.64%	94.05%	13.79%	12065414	17.28%
4th Quartile (Lowest Density):	20.01%	92.74%	15.66%	7710904	11.04%

Note:

¹ Data available for rural areas only.

Source: Staff estimates based on data from CAPMAS.

Poorer accessibility is associated with higher poverty. For all measures, the poverty rate of the 4th quartile of accessibility (worst access) is highest and is considerably higher than the mean rate for rural Shekhias (21.73%), indicating that accessibility appears to be a better measure of poverty than the “urban/rural” designation.

Rural accessibility is important in ensuring equal access to basic services. Given the almost universal access to water in Egypt, rural accessibility did not vary significantly across quartiles. In contrast, the best access to sanitation services were 2-3 times greater than Shekhias in the worst quartile.

Analysis of Poverty and Other Economic Indicators with Market Accessibility. Table 1 shows clearly that poverty increases with poorer market accessibility, as do illiteracy and poor sewage access. This implies that improvement of connectivity to areas with poor accessibility would be a worthwhile investment to reduce overall poverty levels and improve development in lagging areas. However, where are the priority areas for this investment? Areas with particularly high poverty or low economic development *and* poor market accessibility would be candidates for prioritized investment.

In this section, we use the GIS analysis to identify areas with high poverty or low economic development that have poor market accessibility. Identification of such areas is important for policy decisions on investment for development or connectivity, as improving connectivity to these areas could be a priority to reduce their poverty levels, or to boost lagging areas in Egypt.

Priority Poverty Areas: High Poverty Rates and Poor/Good Accessibility. Map 16 displays Egyptian Shekhia(Districts) in the highest quartile nationally of poverty rates that are also in the lowest quartile of travel-time to the nearest city greater than 100,000 in red. By contrast, Shekhia Districts in the lowest quartile of poverty rates but in the quartile of best travel-time accessibility to cities larger than 100,000 are shown in green.

Areas in Upper Egypt clearly have a combination of both high poverty rates and poor travel-time accessibility to major cities and markets. However, a few areas in the Nile river delta, particularly northeast of Cairo, are also identified as being particularly problematic, with high poverty rates and poor market accessibility to large cities. Map 17 shows accessibility to the nearest of the 5 largest cities in Egypt. Here the results are even starker: Upper Egypt exists as a solid cluster of poorest access , while the central Cairo metropolitan area has the lowest poverty and best access to the nearest of the 5 largest cities. Notably, the area around Suez also now emerges as an area of low poverty and high accessibility. Poverty/poor accessibility also emerge in Lower Egypt, especially northeast of the central Cairo area. Furthermore, areas with low poverty and excellent accessibility (colored green) are scattered with higher resolution throughout the Greater Cairo area.

Part 2: Simulation of Impacts on Accessibility under Alternative Infrastructure Improvement Scenarios

Egypt Infrastructure Scenarios. In this section, we estimate the quantitative econometric and spatial assessment of likely impacts of alternative scenarios of infrastructure improvements in Egypt on improving market accessibility, improving inter-regional connectivity and reducing transport costs, utilizing the assembled data on poverty, transport costs, development indicators and the quantitative spatial data on Egyptian road networks the location of Egyptian Shekhia Districts. Three scenarios which varied significantly in cost were selected for simulation in the GIS model among the range of Egyptian road improvement scenarios implemented and planned by Egyptian General Authority for Roads, Bridges & Land Transport (GARBLT).

Table 2: Infrastructure Improvement Scenarios

	Cairo-Asyut Scenario (1)	Sohag-Red Sea Scenario (2)	Cairo Ring Road Scenario (3)
Total Estimated Scenario Improvement Cost (in Million EGP)*	350	640	1500
Length of Scenario Improvement in Km*	356	375	110
Scenario Improvement Cost/Km (in Million EGP)	0.983	1.707	13.636
Scenario Improvement Time Frame	2006-2008	2007-2009	2000-2009
Total Lanes	2	4	8
Objectives and map	Links Cairo to Asyut, Upper Egypt (Map 18)	Links Upper Egypt with ports on the Red Sea (Map 19)	Reduce Cairo congestion to accommodate Cairo population growth (Map 20)
Development Policy Objectives	Connecting Upper and Lower Egypt	Development of Upper Egypt	Cairo congestion alleviation

* Source: Egyptian General Authority for Roads, Bridges & Land Transport (GARBLT)

These three scenarios were chosen for the following reasons:

- First, they were specifically identified in discussions with Egyptian infrastructure experts as being key to the overall development of the larger Egyptian transport infrastructure: playing a key role in connecting key regions of Egypt, providing improved transport corridors to facilitate increased trade and shipping of goods, or facilitating transport for major metropolitan populations.
- Second, they are representative of three alternative types of Egyptian infrastructure improvement: a scenario specifically improving connection between Lower and Upper Egypt; a scenario specifically improving transport within the urban Greater Cairo Area (GCA); and a scenario of “opening up” and developing Upper Egypt, by improving the connectivity of Upper Egypt region to the Red Sea .

Maps 18-20 show the spatial locations of each proposed scenario.

Calculating Impacts on Accessibility Under Scenarios of Improvement. Impacts on accessibility at the Shekhia District level were re-estimated for each infrastructure improvement scenario using the following methodology. First, individual road segments in the GIS road network for each improvement scenario were coded with unique identifiers. In the case of the Sohag-Red Sea and Cairo Ring Road scenarios, new road segments had to be digitally added to the existing CAPMAS road GIS networks, as the CAPMAS network did not reflect the recent improvements for those scenarios. Next the existing travel speed estimate for the road segments in each scenario were increased by a factor approximating the likely impact on road speed for those segments, given the type of road improvement (number of lanes, type of paved improvement). Each road segment in each scenario was then divided by its length to determine its approximate travel-time. The least-cost path algorithm was then re-run for all Egyptian Shekhias, to calculate the new travel-time values to markets for all accessibility indices.

Impacts on Accessibility. The new values for accessibility for each scenario, for all accessibility indices and for all Egyptian Shekhia districts are shown in Tables 3 for each scenario. For each scenario, the individual road improvements result in improved accessibility for different regions, and impact different regions differently depending on the accessibility index.

Maps 21-23 display the varying impacts of the three different road scenario improvements for the three different regions of Egypt. Map 21 displays the estimated improvements in accessibility to central Cairo due to the Red Sea scenario improvement. The values color-coded here are the *differences* in the estimated travel-times from the baseline (no improvement) scenario, so darker greens are areas with the greatest reduction in accessibility travel-time, and light greens have lower or no improvement. Because of the relatively sparse

populations served by the Red Sea improvement, the regional effects are minimal: benefits in access to central Cairo are obtained only for a relatively small population located near to Sohag, distinguished by the dark green color. By contrast, Map 22 displays spatial variation of the relative improvements in accessibility under the Cairo-Asyut scenario road improvement. Here the effects are more widespread, improving access to Cairo for a large number of Shekhia districts located along the western side of the Nile river moving south from the Nile delta area, as well as for scattered isolated Shekhia districts in Upper Egypt.

Map 23 displays relative improvements in accessibility to central Cairo resulting from the Ring Road improvement scenario. Here the impacts are most widespread, with large areas along the Nile south into Upper Egypt, as well as areas to the east of the Greater Cairo Area (GCA), experience significant improvements in travel-time to central Cairo due to the improvement. These results show how effects from road improvements can have large impacts “downstream” that may be disproportionate to their cost. In this case, since the Cairo Ring Road improvement improves access to the greatest metropolitan market center in Egypt, the effects are wide ranging across almost the entire country.

Part 3 of this study provides a cost-benefit analysis for each scenario in terms of both accessibility and simulated impact on transportation prices.

Table 3 Impact of Road Improvements on Market Accessibility

	Poverty Rate (%)			
	Baseline	Cairo-Assiut	Suhag	Cairo Ring Road
Mean Rate: All of Egypt	19.6	19.6		19.6
Mean Rate: Urban Areas	8.4	8.4		8.4
Mean Rate: Rural Areas	21.7	21.7		21.7
Travel-Time to Cairo				
1st Quartile (Best Access):	12.4	12.4		12.4
2nd Quartile	11.8	11.7		11.8
3rd Quartile	16.6	16.8		16.6
4th Quartile (Worst Access):	38.9	38.7		38.8
Travel-Time to Nearest 5 Largest Cities				
1st Quartile (Best Access)	7.2	7.2		7.2
2nd Quartile	12.8	12.8		12.8
3rd Quartile	20.7	20.8		20.7
4th Quartile (Worst Access)	38.8	38.7		38.8
Travel-Time to Nearest City over 100,000				
1st Quartile (Best Access)	13.3	13.3		13.2
2nd Quartile	17.0	17.0		17.1
3rd Quartile	21.2	21.3		21.2
4th Quartile (Worst Access)	27.7	27.7		27.7
Travel-Time to Nearest Port City				

1st Quartile (Best Access)	14.7	14.8		14.6
2nd Quartile	16.7	16.7		16.8
3rd Quartile	18.4	18.3		18.4
4th Quartile (Worst Access)	28.7	28.8		28.8
Population Density				
1st Quartile (Highest Density)	16.0	16.0		16.0
2nd Quartile	22.7	22.7		22.7
3rd Quartile	19.6	19.6		19.6
4th Quartile (Lowest Density)	20.0	20.0		20.0

Source: Study team calculations

Part 3: Disaggregation of Transport Costs in Egypt: Shipping Prices and Model Estimation

A. Transport Costs and Shipping Prices in Egypt

Transport costs play an enormous role in regional and national development. Economic interactions and movements between places of both people and goods often depend on transport costs, which increase with distance but are a function of the quality of the linking infrastructure. In Egypt, domestic transport costs can be very high. In a survey of shipping prices in Egypt conducted for this study, a round-trip journey for a 20-foot container between central Cairo and Tanta, a distance of 93 km, can cost as much as 1200 EGP: 12.9 EGP per km or about \$2.22 per km³. By contrast a similar container shipment in the United States costs about \$1.25 per km. Thus, an important question is what is driving these prices and what specific infrastructure improvements could be undertaken to reduce them? A number of factors clearly increase transport costs in Egypt, including the quality and capacity of the transportation network, but also traffic congestion which is extremely high in many parts of Egypt, especially the Greater Cairo Area (GCA). It is also likely that market forces may influence actual transport costs, as large demand and competition in certain areas may drive down price.

Obtaining data on shipping prices in Egypt from multiple shipping hubs to multiple destinations was identified as a key response variable for the estimation of a model to disaggregate these prices and estimate the relative influence of their components. However, data on road shipping prices is not easy to obtain, as in many other countries. Given this context, a survey of shipping prices was designed to capture variation in shipping prices in multiple types of cargo shipped across all of Egypt, and was undertaken specifically for this study in August-October 2010.

³ December 2010 exchange rates.

Consequently, a shipping survey was designed to collect actual transport costs in Egypt across the entire country, and then to explicitly disaggregate the drivers of these costs: to econometrically assess the relative contribution of infrastructure quality, traffic congestion and economic demand for transport services. The research focuses on road shipping transport as it is currently the dominant mode of freight transport in Egypt. This study does not address multi-modal transport processes,⁴ but the results can inform Egyptian transport policy.

Egyptian Transport Sector. The main commodities shipped via the Egyptian freight transport sector include import/export commodities, construction materials, fruits and vegetables, and miscellaneous products often shipped by small operators (one man one truck). Overall, the transport shipping sector is fragmented, with much of the shipping handled by small operators or small to medium-sized shipping firms. In addition to container trucks that specialize in transshipment, domestic distribution of consumer goods and commodities is carried out using small trucks, usually run by small operators. However, in each Egyptian Governorate, there Freight Transport Cooperatives, made up of groups of small operators. These Cooperatives have become less important in recent years, but they originally served to attempt to regulate and formalize prices and serve as market clearing centers for small operators. Their role today is to put members in contact with businesses. All cooperatives have standard prices for different types of commodities.

Egyptian Transport Prices. The survey obtained prices collected from major shipping city “nodes” in 13 different Governorates in Egypt that are responsible for the majority of domestic shipping in Egypt: Greater Cairo, Alexandria, Damietta, Tanta, Aswan City, Fayoum City, Port Said, Qena, Mansora, Luxor, Suez, Assiut and Safaga. To capture the variation in prices across the range of primary shipping types, the survey obtained prices on four key categories of Egyptian shipping: 20-foot container prices; dry bulk prices; general cargo prices and liquid cargo prices. A total of 42 transport operators were surveyed, including a range of smaller operators and larger companies. In almost all cases, prices were obtained from each destination to other nodes and then separate prices for the reverse directions, although in other cases the price quoted was for a round-trip.

Although it was not possible to obtain shipping price responses for from and to all destinations, sufficient data was collected to provide a rich dataset for this analysis, and for the estimation of the transport

⁴ The ongoing MISR study being conducted by JICA and the Egypt Transport Planning Authority will look into the multi-modal options for transport planning.

disaggregation model⁵. The final shipping price matrices for container prices, general cargo prices, dry bulk prices, and liquid cargo prices are shown in Tables 4-7, respectively.

Two immediate findings emerged from a consideration of the shipping prices. First, for the same category of shipping, prices between two hubs can vary in one direction versus the return. For example, the mean shipping price from Alexandria to Greater Cairo, in Table 7, was 0.18 per ton/km (about EGP 40.1 for the 221 km journey), while the price for the return journey was 0.24 per ton/km (about EGP 54.0), an increase of more than 30%. Second, shipping prices in cost per kilometer vary by almost a factor of 2.5 across Egypt. For example, the prices per kilometer vary from 2.2 EGP / km from Greater Cairo to Aswan City, up to an increase of almost two and a half at 5.27 EGP/km from Greater Cairo to Tanta (row 1A of table 7). Variation in price per km is also present in the survey results for general cargo, dry bulk cargo and liquid cargo, shown in Tables 5-7.

⁵ Liquid cargo prices were only available from and to Central Cairo.

Table 4: Shipping Price Survey Results - Container Price Matrix

Origin Destination				Currency	Container												
					Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansora	Luxor	Suez	Assiut	Safaga
					1	2	3	4	5	6	7	8	9	10	11	12	13
1	Greater Cairo	Mean	Cost/Trip	EGP		1478	1400	980	3820	1026	1452	2910	1076	3310	996	2500	3040
		Minimum				1190	1050	800	3000	800	1160	2500	900	2750	600	1700	2200
		Maximum				2000	1900	1200	5000	1300	1950	3500	1250	4500	1250	3500	4500
1A		Mean	Cost/Km			3.34	3.61	5.27	2.20	5.13	3.49	2.47	4.17	2.53	3.74	3.40	2.99
2	Alexandria	Mean	Cost/Trip	EGP	1627		1439	1105	5296	1717	1752	4283	1333	4775	2043	3075	4280
		Minimum			1190		1000	900	4275	1200	1200	3250	1000	3600	1500	2300	3000
		Maximum			2200		2200	1500	7000	3000	3000	5500	2000	6500	3500	4000	5500
3	Damietta	Mean	Cost/Trip	EGP	1233	1333		1050	4600	1750	825	3500	875	4200	1467	3150	2450
		Minimum			1200	1200		1000	4200	1600	750	3000	750	3600	1350	2800	1900
		Maximum			1300	1400		1100	5000	1900	900	4000	1000	4800	1600	3500	3000
4	Port Said	Mean	Cost/Trip	EGP	1400	1750	767	1300	5600	1833		4417	1200	3700	1238	3567	4000
		Minimum			1200	1350	600	1100	5000	1200		4250	900	500	1100	3000	3200
		Maximum			1600	2150	1000	1500	6000	2500		4500	1500	6000	1550	4500	4800
5	Mansura	Mean	Cost/Trip	EGP	930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
		Minimum			930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
		Maximum			930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
6	Suez	Mean	Cost/Trip	EGP	1137	1783	1457	1425	3725	4100	1336	3220	1262	3660		2840	2700
		Minimum			850	1400	1100	1100	1350	1100	900	2400	110	3000		2500	2000
		Maximum			1320	2100	1800	2000	5000	#####	1700	4500	1900	4500		3500	3000

Table 5: Shipping Price Survey Results - Dry Bulk Cargo Price Matrix

Origin Destination				Bulk cargo													
				Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga	
				“1”	“2”	“3”	“4”	“5”	“6”	“7”	“8”	“9”	“10”	“11”	“12”	“13”	
1	Greater Cairo	Mean	Cost/Ton/KM	EGP		0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
		Minimum				0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
		Maximum				0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
2	Alexandria	Mean	Cost/Ton/KM	EGP	0.22		0.23	0.30	0.15	0.21	0.22	0.17	0.25	0.16	0.19	0.17	0.17
		Minimum			0.22		0.20	0.28	0.14	0.20	0.21	0.16	0.24	0.15	0.18	0.16	0.16
		Maximum			0.23		0.25	0.31	0.16	0.22	0.23	0.17	0.25	0.17	0.20	0.18	0.17
3	Damietta	Mean	Cost/Ton/KM	EGP	0.22	0.23		0.29	0.16	0.20	0.61	0.17	0.53	0.16	0.21	0.17	0.17
		Minimum			0.20	0.20		0.27	0.15	0.18	0.56	0.15	0.49	0.15	0.20	0.16	0.15
		Maximum			0.23	0.25		0.31	0.16	0.21	0.64	0.17	0.55	0.17	0.22	0.18	0.18
7	Port Said	Mean	Cost/Ton/KM	EGP	0.16	0.22	0.61	0.23	0.16	0.21		0.17	0.31	0.16	0.22	0.18	0.21
		Minimum			0.02	0.21	0.56	0.21	0.15	0.19		0.16	0.28	0.16	0.19	0.17	0.20
		Maximum			0.23	0.23	0.64	0.23	0.17	0.21		0.18	0.32	0.17	0.24	0.18	0.21
11	Suez	Mean	Cost/Ton/KM	EGP	0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
		Minimum			0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
		Maximum			0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
13	Safaga	Mean	Cost/Ton/KM	EGP	0.20	0.17	0.17	0.19	0.19	0.19	0.19	0.26	0.19	0.30	0.19	0.20	
		Minimum			0.18	0.16	0.15	0.18	0.18	0.18	0.19	0.24	0.18	0.24	0.18	0.19	
		Maximum			0.22	0.19	0.19	0.20	0.20	0.20	0.20	0.28	0.20	0.36	0.20	0.21	

Table 6: Shipping Price Survey Results - General Cargo Prices

Origin				Destination		General Cargo Price Matrix										
						Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez
						"1"	"2"	"3"	"4"	"5"	"6"	"7"	"8"	"9"	"10"	"11"
1	Greater Cairo	Mean	Cost/Ton/KM	EGP			0.24	0.27	0.40	0.24	0.36	0.25	0.29	0.32	0.27	0.32
		Minimum					0.12	0.15	0.22	0.06	0.20	0.14	0.11	0.19	0.06	0.16
		Maximum					0.53	0.56	0.94	0.77	0.88	0.48	0.85	0.68	0.87	0.66
2	Alexandria	Mean	Cost/Ton/KM	EGP		0.18		0.20	0.28	0.12	0.18	0.20	0.13	0.22	0.13	0.17
		Minimum				0.12		0.18	0.26	0.06	0.16	0.17	0.11	0.20	0.06	0.16
		Maximum				0.21		0.23	0.31	0.15	0.22	0.26	0.15	0.25	0.16	0.20
3	Damietta	Mean	Cost/Ton/KM	EGP		0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18
		Minimum				0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18
		Maximum				0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18
4	Tanta	Mean	Cost/Ton/KM	EGP		0.43	0.46	0.47		0.29	0.40	0.41	0.33	0.43	0.32	0.38
		Minimum				0.40	0.42	0.42		0.26	0.40	0.39	0.29	0.41	0.28	0.35
		Maximum				0.45	0.49	0.52		0.31	0.40	0.44	0.37	0.46	0.36	0.41
5	Aswan City	Mean	Cost/Ton/KM	EGP		0.35	0.31	0.30	0.33		0.41	0.33	0.49	0.34	0.28	0.39
		Minimum				0.35	0.31	0.30	0.33		0.41	0.33	0.47	0.34	0.28	0.39
		Maximum				0.35	0.31	0.30	0.33		0.41	0.34	0.50	0.34	0.28	0.39
6	Fayoum City	Mean	Cost/Ton/KM	EGP		0.38	0.31	0.80	0.34	0.34		0.33	0.33	0.36	0.32	0.36
		Minimum				0.33	0.22	0.69	0.29	0.31		0.28	0.20	0.33	0.20	0.29
		Maximum				0.44	0.36	0.89	0.37	0.39		0.35	0.40	0.39	0.38	0.41
7	Port Said	Mean	Cost/Ton/KM	EGP		0.22	0.23	0.53	0.37	0.14	0.22		0.14	0.32	0.15	0.22
		Minimum				0.19	0.19	0.52	0.20	0.13	0.18		0.13	0.26	0.14	0.20
		Maximum				0.26	0.26	0.53	0.54	0.14	0.25		0.15	0.37	0.15	0.25
8	Qena	Mean	Cost/Ton/KM	EGP		0.27	0.26	0.25	0.25	0.22	0.22	0.24		0.23	0.49	0.26
		Minimum				0.26	0.26	0.25	0.24	0.22	0.22	0.24		0.22	0.45	0.26
		Maximum				0.27	0.26	0.25	0.25	0.23	0.23	0.25		0.23	0.53	0.27
9	Mansura	Mean	Cost/Ton/KM	EGP		0.75	0.68	0.78	0.87	0.69	0.69	0.76	0.66		0.68	0.66
		Minimum				0.24	0.20	0.46	0.57	0.13	0.18	0.26	0.14		0.14	0.18
		Maximum				1.03	0.96	1.00	1.11	1.00	1.00	1.08	0.97		1.02	0.95
10	Luxor	Mean	Cost/Ton/KM	EGP		0.23	0.27	0.27	0.26	0.39	0.23	0.27	0.51	0.28		0.25
		Minimum				0.22	0.25	0.26	0.23	0.39	0.22	0.26	0.51	0.26		0.23
		Maximum				0.26	0.29	0.29	0.29	0.39	0.23	0.29	0.51	0.30		0.28
11	Suez	Mean	Cost/Ton/KM	EGP		0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17	
		Minimum				0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17	
		Maximum				0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17	
12	Assiut	Mean	Cost/Ton/KM	EGP		0.14	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.12	0.13	
		Minimum				0.13	0.12	0.13	0.13	0.13	0.10	0.13	0.13	0.10	0.12	
		Maximum				0.14	0.14	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.14	

13	Safaga	Mean	Cost/Ton/KM	EGP	0.19	0.16	0.15	0.16	0.18	0.18	0.17	0.21	0.18	0.18	0.17	0.18	
		Minimum			0.18	0.15	0.15	0.14	0.17	0.17	0.16	0.19	0.17	0.17	0.16	0.18	
		Maximum			0.20	0.17	0.16	0.17	0.19	0.19	0.19	0.24	0.19	0.21	0.18	0.19	

Table 7: Shipping Price Survey Results - Liquid Cargo Price Matrix

Origin				Destination																
									Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga
									“2”	“3”	“4”	“5”	“6”	“7”	“8”	“9”	“10”	“11”	“12”	“13”
1	Greater Cairo	Mean	Cost/Ton/KM	EGP	0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20				
		Minimum			0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20				
		Maximum			0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20				

Spatial Analysis of Shipping Prices. For the estimation of the transport cost model, and to improve the spatial visual analysis of variation in shipping prices, price results from the sample of observations from the survey were entered into a GIS database and interpolated to obtain estimated shipping price values for all Egyptian Shekhia Districts, for both cumulative shipping prices to/from each destination and for prices per ton/km. Because commodities, goods and people move through space in Egypt on road networks, as a function of distance and road quality, the spatial interpolation of the shipping prices was done by interpolating values *through* the vector GIS merged CAPMAS/EUROMED digital road network, rather than a “straight-line” Euclidean spatial interpolation, to provide more accurate estimation of shipping prices for all Shekhias. Values were interpolated spatially through the road network segments to all road segment intersection nodes on the network using a distance decay function along the length of each road segment, but weighted by the estimated travel-time calculated previously for each segment (see more detailed description in Part 2).

Maps 24-29 display the resulting interpolated shipping prices for all Egyptian Shekhias to selected destinations, color-coded by variation in shipping price to specified destinations. By mapping these prices, we are able to show visually how shipping price is not always a function of travel-distance, but varies for particular regions and locations.

Map 24 displays variation in container shipping prices, per round trip cost per container, from all Shekhias to Central Cairo. The primary driver here appears to be travel distance, although there is a clear departure from the linear function of distance seen most notably in anomalous decrease in shipping prices from the Fayoum area, with prices higher both north and south of Fayoum. It is possible that the reduced prices may be due to increased demand, due to the large urban population cluster near Fayoum, bringing down prices through increased competition.

Map 25 displays the spatial variation in shipping prices to Central Cairo for dry bulk cargo, per ton. As with container prices, the prices reflect travel distance, but notably particular regional variations for dry bulk prices that are different than for the spatial variation in container prices, showing that the spatial variation in prices is not equivalent across all categories of shipping type.

Container prices to Suez show clear deviations from travel distance (map 27). Prices from the central Cairo area and from the Port Said area to Suez are *lower* than prices from areas in the surrounding Suez area. This is likely due to market demand effects, as the volume of shipping to and from Cairo and Port Said dwarfs the shipping volumes from the less developed or less populated areas closer to Suez.

Map 29 displays the price per kilometer for dry bulk cargo prices to central Cairo to illustrate that shipping prices are non-linear to travel distance. Prices *per kilometer* tend to be lowest for Upper Egypt, and within the greater Nile delta region, they tend to be uniformly higher the closer the Shekhia district is to Central Cairo: that is, there appears to be a shipping price “premium” per kilometer that correlates with the degree of urban concentration and density in the Greater Cairo Area.⁶

B. A Model for Estimation of Transport Prices

The methodology for decomposing road transport prices is grounded in spatial economic analysis and considers network wide transport prices as a function of the physical cost of traveling through the road network, with increased cost effects due to traffic congestion along shipping routes, and benefitting from transport service competition, especially from “hubs” with major demand due to high population and along routes with high trade volumes that can bring down prices.

We estimate a simple a model where transport prices TP are a function of H = the “hardware” or “friction” cost of moving through the road network, D = variation in volume of trade among locations, and (c) C = cost due to congestion, which adds to time and vehicle/fuel costs, but is separate from the “hardware” cost. One of the main applications of this model is in assisting the simulations that highlight the relative benefits of alternate road improvements on transport prices in Egypt. Premium was placed on improving the predictive power of the model, which would improve the reliability of the proposed scenarios. The results from these simulations are discussed in the next chapter.

C. Development of a Congestion Index

This section describes the methodology to develop a congestion index. This allows us to estimate the congestion encountered along shipping routes from Egyptian Shekhias to major transport hubs. This estimate in turn becomes the (C) congestion parameter in the model decomposing and estimating transport costs.

Any visitor to Cairo learns immediately that severe congestion is frequently a common experience in Egypt. Congestion is especially prevalent in the Greater Cairo Area. Population exerts great pressure on the road network. As one of the most populous metropolises of the world, the urban agglomeration of the Greater Cairo Area (GCA), is the largest urban area in Egypt, Africa and the Middle East. Including the governorates

⁶ Similar results were observed in Sri Lanka with metropolitan Colombo showing a high-cost “premium” for shipping (World Bank 2010)

of Cairo, Giza and Qalyobiya and a number of new cities, the population reached 17 million people in 2006. In addition urbanization is rapid in the GCA, where it is expected to reach 24 million by 2027 (World Bank, 2010). Sperling and Salon (2002) and Mitric (2008) cite the trend of growing motorization in mega cities.

This tremendous traffic demand results in severe delays in travel. The average person spends 500 hours per year in traffic in the Cairo metro area (EgyptCarPoolers.com, 2010) and Egypt passenger cars drive an annual 4905 million-km (IRF, 2004) (See Table 8 for other country comparisons from most recent years: 2003-2008). Average travel speeds in high congestion time periods and locations range from 11 – 20 km/h (JICA: 2003 and Nation Institute of Transit in EGSER, 2008: 56, respectively). Furthermore, JICA 2003 report projected a reduction of the travel speed from 19 km/h to 12 km/h by 2020 in the worst case scenario. The most recent estimates indicate that the travel speed had fallen to around 12 km/h in 2005, notably due to increased car ownership associated with higher income growth and urbanization (World Bank, 2010).

Mitigating congestion is at the forefront of the development agenda in Egypt. Even though the Egyptian government has actively pursued substantial efforts including new public transportation systems (e.g. metro), congestion persists. Recognizing that this has economic implications as well as adverse environmental and public health effects, efforts to understand and mitigate congestion are useful to address the range of policy intervention options and investments to alleviate congestion.

A Congestion Index for Egypt. For this study, Egyptian traffic count data at a number of locations throughout Egypt were obtained by GARBLT. However, it was determined that these data were not directly useful for an estimation of a congestion index as an input to the transportation cost model, due to limited observations and a higher spatial distribution of points in Lower Egypt. Furthermore, Traffic volumes measured at discrete locations cannot easily be used to interpolate traffic values at other locations, as congestion effects are a function not just of traffic volumes, but of road capacity (road quality and number of lanes), for which we did not have complete data for the entire Egyptian road network (see Map). So another approach was taken, as described here.

First, we defined the congestion index as the number of vehicles per kilometer of road. To keep consistent with the unit of analysis (the Shekhia), the index employs a simple model to impute the number of vehicles per Shekhia from the observed number of vehicles from each Egyptian Governorate. The hypothesis is that the number of vehicles per governorate can be predicted by kilometers of road, urban area, population, Gross Regional Product (GRP), and Poverty rate. In order to keep the observations consistent with the observed number of vehicles, an adjustment allocates the known governorate level observation by the model's

governorate proportion per Shekhia. With these results, a negative exponent accessibility model summarizes the interaction between Shekhia Vehicle-Capacity Ratio onto the road network.

Table 8 International Comparisons of Million Vehicle-Km

Country Name	Year	Million Vehicle-Km, Annual
Armenia	2008	220
Australia	2008	165890
Austria	2006	60679
Azerbaijan	2003	2901
Belgium	2008	84547
Burkina Faso	2008	418154
Bulgaria	2003	14698
Belarus	2007	796
Canada	2008	195510
Switzerland	2008	54428
Costa Rica	2007	6305
Cyprus	2004	6384
Germany	2008	584600
Denmark	2008	34704
Ecuador	2007	11299
Egypt, Arab Rep.	2004	4905
Spain	2008	342611
Estonia	2005	6373
Finland	2008	45285
France	2008	413000
United Kingdom	2008	419470
Gambia, The	2003	61
Greece	2008	78400
China, Hong Kong	2004	5934
Croatia	2008	25904
Hungary	2008	27174
Israel	2008	32322
Japan	2006	514109
Kazakhstan	2008	502
Kyrgyz Republic	2007	1982
Korea, Republic of	2007	235401
Lithuania	2007	8382
Luxembourg	2006	3841
Latvia	2008	9946
Morocco	2006	23037
Monaco	2008	80
Mexico	2008	96218
Mozambique	2008	21502
Norway	2008	30134
New Zealand	2008	36805

Pakistan	2004	21838
Peru	2003	22265
Romania	2008	34887
Saudi Arabia	2005	77681
Singapore	2008	10551
Slovenia	2008	10549
Sweden	2008	67000
Tunisia	2007	15158
Turkey	2008	47502
Tanzania, United Republic of	2007	3245
Ukraine	2008	5363
United States	2008	2600459
South Africa	2007	75573

Five variables were constructed to estimate the number of vehicles per Shekhia. In constructing the dependent variables, the model uses kilometers of road, percent urban area, Gross Regional Product (GRP), and Poverty rate. The number of vehicles per governorate for 2008 is provided by CAPMAS (Accessed, November 12, 2010). Since the vehicle data did not have data for the October 6 governorate, a population weighted proportion allocated the total number of vehicles from Al-Giza to both October 6 and Al-Giza.⁷ Next, the number of vehicles per capita is calculated, and given the distribution we take the log of total vehicles per capita as an independent variable (*log_tv_pc*).

The study used the two GIS road datasets. The CAPMAS dataset is used for capturing the kilometers of roads per Shekhia, while the EURO-MED data provides a road network of main roads for potential accessibility modeling.

Gross Regional Product is from unpublished work⁸. The GRP at the Shekhia is aggregated from a GRP model that provides estimates of production per square kilometer for 2009 (World Bank / UNEP, unpublished). Calculations aggregate the data to the Shekhia and governorate level respectively using ESRI ArcGIS software. The model uses the log of the production per capita (*log_prod_pc*).

Population data by rural and urban are from CAPMAS. CAPMAS provided geo-referenced road data with length in kilometers. ESRI ArcGIS software summarizes the total kilometers of road by Shekhia and governorate using geo-referenced boundaries also provided by CAPMAS. The model uses the log of the

⁷ By decree of President Hosni Mubarak, Helwan governorate split from Al Qāhirah (EG.QH); Sixth of October governorate split from Al Jīzah (former HASC code EG.JZ) see <http://statoids.com/ueg.html>

⁸ Background work for the Upper Egypt Growth study.

combination of kilometers of road times the urban percent population (*log_road_km2_urb*). Poverty rate data was provided from World Bank Staff calculations (*povrate*)⁹.

Using the Negative Exponential in the Potential Accessibility modeling, the model uses a tool developed by Deichmann (1997). The tool requires a node with a weight (Volume-Capacity Ratio) interpolated over a road network by travel time. A nearest function assigns the congestion value by Shekhia to the nearest node on the network given only the districts that intersect the main roads. Then, the accessibility tool outputs an interpolated value for each node and only the mid-point for each road segment are used in the transport model.

Table 9

Source	SS df	MS	Number of obs =	26
	F(3, 22)	= 26.39		
Model	8.49825944	3 2.83275315	Prob > F	= 0.0000
Residual	2.36115342	22 .107325156	R-squared	= 0.7826
	Adj R-squared	= 0.7529	Sigma	= 0.3073209
Total	10.8594129	25 .434376514	Root MSE	= .32761
log_tv_pc	Coef.	Std. Err. t	P>t [95% Conf.	Interval]
log_road_km2_urb	.2236172	.0360061 6.21	0.000 .1489451	.2982893
log_prod_pc	.3004896	.0670386 4.48	0.000 .16146	.4395192
povrate	-1.750697	.4130614 -4.24	0.000 -2.607334	-.89406
_cons	-5.035529	.4620963 -10.90	0.000 -5.993858	-4.0772

The model imputes the number of vehicles per governorate to each Shekhia using the regression model displayed in Table 9. The congestion index by Shekhia is considered as a measure of volume-to-capacity ratio. The number of vehicles per kilometer of roads ratio is 30.6 for all roads in the network and it is 35.0 when considering only the major roads. These results are a noticeable increase from previous work stating 27.9 in 1996 (IRF, 2008).

D. Estimation of Disaggregated Components of Shipping Prices

⁹ Check with Vivian Hon how to cite these data.

Estimation Approach and Methods. As described above, four different types of shipping prices were collected via the shipping survey in Egypt in August-September 2010: prices for container shipping; for dry bulk shipping; for general cargo shipping and for liquid cargo shipping (the latter of which was available only to and from key shipping nodes to Central Cairo). The decision to collect data for all four types of shipping, rather than for simply a sole representative of Egyptian shipping prices, say general cargo prices, was made due to the fact that these four shipping categories tend to carry different types of goods, at different prices, and thus as a group are more effectively representative of true Egyptian transport prices than a single category measure.

Results presented above show that prices collected for all four types of shipping show: (i) significant spatial variation in prices per kilometer, from and to different regions of Egypt; (ii), differences in prices between traveling one way between two destinations and the reverse trip, (iii)) likely impacts from congestion and from market demand effects (both of which are suggested by the spatial analysis results shown in Maps 24-29), and these results suggest the need for a quantitative decomposition of their relative effects. However, all four categories of shipping appear to behave differently with respect to these effects, and play out differently regionally and spatially in Egypt. For these reasons, we estimate the transport cost model separately for each shipping category, with results presented in Tables 10 and 11.

Although the Cairo metropolis is the dominant city, intra-Egypt shipping and transport movement occurs from and to multiple locations, including to and from other major city-hubs such as Suez, Port Said and Alexandria.¹⁰ To gain a more robust estimate of the relative impacts of each of the parameters of the model on transport costs in Egypt, and to be representative across *all* of Egypt, capturing prices to and from a greater Egyptian cross-section of shipping routes, shipping prices from and to multiple locations were pooled and regressed in a pooled structure onto the key parameters, which also were compiled using pooled data from and to each destination. For each observation, the separate prices to and from the specified destinations were averaged, to obtain a mean shipping price from/to that Shekhia to that destination.

The pooled results were estimated twice, first using robust Ordinary Least Squares (OLS) on the pooled data. However, because this pooled group of observations included many cases of different prices for the same observation (for example the price of shipping from Central Cairo to Safaga, the price of shipping from Central Cairo to Port Said, from Central Cairo to Alexandria, etc.), to avoid potential bias a Random Effects (RE) estimation was also run using indicator variables for the separate “clusters” of prices to and from specific destinations. The Random Effects estimator offers the advantage of controlling for potential bias

¹⁰ In other countries, shipping from subsidiary locations tends to be routed through the dominant city.

from omitted variables that may influence shipping prices, both those that differ for different hubs, as well as omitted variables that are influential for all hubs, but different between individual destinations to and from that hub. Here the Random Effects estimator will take advantage of the cross-sectional information between routes from a single hub to multiple destinations, as well as changes across hubs to and from the same destination, to control for potentially omitted variables that may introduce bias into the simple pooled OLS.

While 13 key Egyptian transport hubs were surveyed, data from and to all 13 hubs was not available, as shown in Tables 4-7. Of the destinations for which data to and from *all* 13 shipment hubs was available, 5 were selected for the pooled and Random Effects estimations. These were Central Cairo, Port Said, and Alexandria in Lower Egypt, and Asyut and Safaga in Upper Egypt, thus providing a robust sample of shipping prices across all of Egypt, from Lower and Upper Egypt, capturing shipment prices both within Upper and within Lower Egypt, and between Upper and Lower Egypt, and including the major metropolitan Egyptian areas in Lower Egypt.

Cross-Sectional Estimation Results. In addition to the pooled and pooled Random Effects estimations, the model was also estimated individually for prices to and from each of the 5 destinations used in the pooled and Random Effects estimators, to provide a more specific “first-pass” look at the results for each shipping type to each of the key destinations used in the pooled estimations. Results for the individual non-pooled cross-sectional estimations are presented for dry bulk and liquid cargo prices in Table 10. A total of 5,718 Egyptian Shekhia districts were included in the estimations, and thus the pooled estimations were run across a total of 28,590 observations (5718 Shekhias to and from 5 key shipment hubs).¹¹

As expected the H parameter, representing “hardware” or “friction” costs and calculated as travel-time through the road network is highly statistically significant (p-value of less than 0.01) for all types of shipping prices to all destinations. This highly salient and significant result, despite the presence of covariates for the C parameter (traffic congestion) and the D parameter (market demand effects) shows that travel-distance continues to be the single most important factor driving transport costs in Egypt.

¹¹ Note that for container prices, shipping price data to Safaga was not available, and thus the pooled estimations for container prices were only done for prices to/from 4 shipment hubs (Central Cairo, Port Said, Alexandria and Asyut), or 22872 observations. Also, liquid cargo prices were only available from Central Cairo, and thus liquid cargo estimations were only run in a “cross-section” from/to Central Cairo.

Table 10 CROSS-SECTIONAL MODEL ESTIMATIONS: DRY BULK PRICES, LIQUID CARGO PRICES

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Dry Bulk Cargo Prices: To Central Cairo	Dry Bulk Cargo Prices: To Alexandria	Dry Bulk Cargo Prices: To Port Said	Dry Bulk Cargo Prices: To Suez	Dry Bulk Cargo Prices: To Safaga	Liquid Cargo Prices: To Central Cairo
H Parameter: Travel- Time Through the Road Network	0.266*** (0.000902)	0.223*** (0.000813)	0.241*** (0.000825)	0.268*** (0.000561)	0.245*** (0.000845)	0.263*** (0.000656)
C Parameter: Congestion Index	0.0620*** (0.00269)	0.0184*** (0.000778)	-0.00196 (0.00318)	0.0434*** (0.00179)	0.0338*** (0.00157)	0.0320*** (0.00196)
D Parameter: Market Demand (Population)	9.61e-06* (5.58e-06)	-1.67e-06 (4.25e-06)	4.31e-07 (5.55e-06)	5.96e-07 (3.30e-06)	-6.37e-06* (3.37e-06)	2.37e-06 (4.06e-06)
Constant	6.144*** (0.337)	15.77*** (0.157)	20.43*** (0.242)	7.819*** (0.161)	18.06*** (0.291)	4.474*** (0.245)
Observations	5718	5718	5718	5718	5718	5718
R-squared	0.941	0.968	0.944	0.977	0.954	0.967

Standard errors in
parentheses

*** p<0.01, ** p<0.05, *
p<0.1

What is more interesting, however, is that both the C parameter for congestion and the D parameter for market demand effects, while not as consistently significant for all shipping types to all destinations, nonetheless show salient trends, including trends by shipping category type, that in part support our expectations based on our hypotheses. We would expect that congestion should increase shipping prices beyond simply the road network travel cost, and as expected the C parameter is very statistically significant and is primarily positive, except for a couple of exceptions, for three out of the four shipping category types: That is, for container shipping the C congestion parameter is positive for shipping to four out of five

destinations (with the exception of shipping to/from central Cairo, where it is unexpectedly significant but negative), for dry bulk cargo shipping it is also positive and significant for four out of five destinations (with the exception of shipping to/from Port Said, where it is not significant), and for liquid cargo shipping the results to central Cairo are also positive and significant. Clearly, congestion tends to increase shipping prices for three out of four shipping categories measured. For general cargo shipping, this positive trend for congestion continues for shipping from/to central Cairo, which is highly significant and positive, but notably the results for general cargo shipping to the other major hubs are highly significant but negative.

For the D parameter, effects from market demand, our expectation is that demand will drive down prices due to scale economies and competition, an expectation supported by the implications of the spatial analysis of shipping prices spatial distribution in Egypt presented above. Indeed, we obtain this result notably for general cargo shipping: the D demand parameter is highly significant and negative for general cargo prices to all destinations measured. For the other three shipping types, the results are mostly not significant: for container prices, only shipping to Suez is significant, for dry bulk shipping only two out of five destinations show significant results for D (it is positive for shipping to central Cairo, and negative shipping to Safaga), while liquid cargo shipping (to central Cairo) is not significant for demand.

In sum, the cross-sectional estimations show the very strong results for the H travel-time parameter. The C congestion parameter is also, as expected, highly statistically significant and positive for three out of four shipping types, while the D demand parameter appears to only be a measurable factor for general cargo shipping, where it is highly significant and negative to all destinations measured.

Results for Pooled Estimations. Table 11 presents the results for the pooled estimations for all shipping category types, both for OLS pooled (columns 1, 3, 5 and 7) and the Random Effects estimator on the pooled data (columns 2, 4 and 6¹²). The pooled estimations are run across a much larger set of observations simultaneously – up to 28590 observations pooling results for 5 key shipping hubs – they should provide more robust results. The Random Effects estimator in particular will take advantage of the cross-sectional information between routes from a single hub to multiple destinations, as well as changes across hubs to and from the same destination, to control for potentially omitted variables that may introduce bias into the simple pooled OLS.

As with the cross-sectional estimations, the results for the H parameter of network friction cost is highly significant and positive for all shipping types (top row of Table 11 for columns 1-7). For all shipping

¹² Liquid cargo shipping data was not pooled, as it was available only to/from central Cairo.

category shipping types, network friction costs is highly statistically significant (p-value less than 0.01) with shipping prices for all shipping category types. For the C congestion parameter, we still have the highly significant and positive results we obtained in the cross-sectional estimations for three out of the four shipping category types - container prices, dry bulk shipping and liquid cargo prices - indicating that congestion appears to be driving shipping prices up. The results for general cargo prices are still significant but negative, as with the cross-sectional estimates. For market demand, the D parameter, as with the cross-sectional estimation results, only general cargo prices show an expected significant negative correlation with shipping prices.

In sum, for two out of the three parameters of the model – the H network friction parameter and the C congestion parameter – the results are as expected, with the H parameter universally positively correlated with shipping prices and the congestion parameter positively correlated for three out of four shipping category types. The D parameter, representing market effects on transport costs through the proxy of Shekhia district population, shows the expected negative results only for general cargo prices, while for dry bulk and liquid cargo prices the results are not significant, and for container prices the results are significant but positive. Nonetheless, the results for the H and C parameters in general accord with our expectations about the drivers of transport costs in Egypt. While the results for the D parameter are as expected for general cargo prices, indicating that there is a negative correlation with shipping prices as Shekhia populations increase and thus supporting the possibility of a downward demand effect on transport prices, the results for container prices are positive, indicating higher prices with shipment between more highly populated routes.

Table 11 RESULTS OF POOLED PANEL ESTIMATIONS FOR ALL SHIPPING PRICES						
VARIABLES	(1) Container Prices: Pooled Estimation	(2) Container Prices: Random Effects	(3) General Cargo Prices Pooled Estimation	(4) General Cargo Prices Random Effects	(5) Dry Bulk Prices Pooled Estimation	(6) Dry Bulk Prices Random Effects
H Parameter: Travel-Time Through the Road Network	5.013*** (0.0227)	5.045*** (0.0269)	0.312*** (0.000809)	0.342*** (0.000732)	0.254*** (0.000315)	0.254*** (0.000315)
C Parameter: Congestion Index	0.671*** (0.0333)	0.230*** (0.0295)	0.0509*** (0.00134)	0.0400*** (0.000989)	0.00271*** (0.000521)	0.0040*** (0.000521)
D Parameter: Market Demand (Population)	0.000348** (0.000147)	0.000371** (0.000186)	05*** (5.70e-06)	05*** (9.34e-06)	1.34e-06 (2.22e-06)	1.42e-06 (3.35e-06)
Constant	830.6*** (5.715)	863.5*** (6.842)	21.57*** (0.237)	13.88*** (0.287)	14.73*** (0.0923)	14.43*** (0.101)
Observations	22872	22872	28590	28590	28590	28590
R-squared	0.719		0.842		0.960	
Number of objected		5718		5718		5718
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

E. Simulation of Transport Cost Impacts Under Alternative Infrastructure Improvement Scenarios

Using the transport network-simulation model, we test and evaluate the three different scenarios of potential road network improvement in Egypt described above in Table 2, for their estimated impact on transport costs and their impact on accessibility to markets, compared to the current road network, as of 2010. For each simulation, we used scenario construction costs provided by GARBLT. We estimate the network-wide/country-wide benefits in terms of overall reduction in shipping prices per Egyptian Shekhia district, and improvements in accessibility to markets per Egyptian Shekhia district, for each scenario with results presented in Tables 12-17.

Estimated impacts on market accessibility and transport costs, as well as cost-benefit analyses, are calculated both for all Egyptian Shekhia districts, and for high-poverty Shekhia districts only, to provide a comparison of the relative accessibility and transport cost implications for high poverty areas in Egypt compared to the larger population. Poverty Shekhias are defined as those having a poverty rate greater than 25%, which is approximately one-quarter of all Egyptian Shekhias.

Because our model takes into consideration not only road quality/capacity and travel-time through the road network, but also demand/competition and congestion effects, we are able to simulate outcomes that consider their interactions. That is, new optimum travel routes and corresponding route friction and demand costs can be re-calculated for each alternative road construction/improvement scenario. Network-wide effects and costs can then be simulated.

We begin with the estimated coefficients from our econometric model decomposing shipping costs (Table 11). We use the estimated coefficients to predict shipping prices out of sample. Since our econometric model is a purely descriptive decomposition of Egyptian transport prices, we are not attempting to establish causality and we therefore use the estimated correlations (with “hardware” costs, demand and congestion) to predict transport prices. We have predicted these prices for every Shekhia because this provides a comprehensive and complete prediction of the variation in prices to all parts of Egypt. We use a Random Effects estimator on the pooled shipping price data as described above to provide a more robust prediction and minimize bias.

Each of these scenarios will derive network-wide effects well beyond the immediate area of their upgrade/construction. For example, the Cairo-Asyut road improvement will also reduce transport costs and promote shipping volumes along roads that are crossed by the improved road. Thus, using the more than 5000 routes to all Shekhia districts in Egypt provides a practical way to measure network-wide externalities and benefits.

Results for Market Accessibility and Transport Costs For Each Scenario: Table 12 shows the final results for impacts on market accessibility for all scenarios per Shekhia district, and then with further breakdowns for all high-poverty Shekhias only. Rows (A) through (H) present the results for impacts on market accessibility. Columns (1) and (2) provide the actual market access values for 2010 for all Shekhias and for high-poverty Shekhias only, while columns (3) through (10) present the corresponding simulated values for each scenario. Finally, columns (9) and (10) list which scenario achieved the highest benefit for

accessibility for each type of market access index (highest reduction in mean travel-time for Egyptian Shekhia districts), for all Egyptian Shekhia districts and for high poverty Shekhia districts only.

Notably, the Cairo Ring Road improvement emerges as the scenario resulting in the highest benefit for market accessibility, achieving higher benefits (reduced market access travel-time) for 5 out of 8 market access indicators. The Ring Road improvement does even better for high-poverty Shekhia districts, resulting in the best improvement in market accessibility for six out of eight market access indicators,. Clearly, the Ring Road scenario achieves the greatest benefits in terms of best improving market accessibility in Egypt, both for the entire Egyptian population and for high-poverty areas.

The Cairo-Asyut scenario emerges as the runner-up to the Ring Road in terms of best overall impact on market access. In fact, either the Ring Road or the Cairo-Asyut produce the best impacts for all categories of market accessibility. The Cairo-Asyut scenario notably out-performs the Ring Road scenario in improving market accessibility as measured by travel-time to the nearest of the 5 largest Egyptian cities, to Alexandria and to the nearest major port for the overall population, and to the first of those two for high-poverty Shekhias.

Table 12

FINAL CALCULATION RESULTS		Baseline Scenario		Cairo-Asyut Scenario		Sohag-Red Sea Scenario		Cairo Ring Road Scenario		Scenario With Greatest Benefit:	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		All Shekhias	Poverty Shekhias*	All Shekhias	Poverty Shekhias*	All Shekhias	Poverty Shekhias*	All Shekhias	Poverty Shekhias*	All Shekhias	Poverty Shekhias*
(A)	Calculated Mean Travel Time Index Per Shekhia to Central Cairo	150.217	199.591	149.91	199.076	149.873	199.073	149.467	198.385	Ring Road	Ring Road
(B)	Calculated Mean Travel Time Index Per Shekhia to Nearest of the 5 Largest Cities	121.12	179.78	120.813	179.265	121.034	179.58	120.842	179.349	Asyut	Asyut
(C)	Calculated Mean Travel Time Index Per Shekhia to Nearest City > 100,000	35.773	47.378	35.772	47.378	35.757	47.339	35.716	47.297	Ring Road	Ring Road
(D)	Calculated Mean Travel Time Index Per Shekhia to Nearest City > 10,000	22.15	28.792	22.15	28.791	22.144	28.772	22.123	28.753	Ring Road	Ring Road
(E)	Calculated Mean Travel Time Index Per Shekhia to Nearest Major Port	59.84	76.106	59.79	76.033	59.804	76.026	59.436	75.719	Asyut	Ring Road
(F)	Calculated Mean Travel Time Index Per Shekhia to Alexandria	204.54	281.501	203.808	280.215	204.474	281.307	204.204	280.922	Asyut	Asyut
(G)	Calculated Mean Travel Time Index Per Shekhia to Port Said	213.743	276.64	213.436	276.125	213.679	276.468	212.618	274.901	Ring Road	Ring Road
(H)	Calculated Mean Travel Time Index Per Shekhia to Suez	207.95	248.29	207.645	247.779	207.863	248.112	206.884	247.039	Ring Road	Ring Road
*"Poverty" Shekhia districts defined as those with a poverty rate of 25% or greater.											

Cost-Benefit Analysis Per Scenario: Tables 13 through 17 provide cost-benefit analyses for the three scenarios considering the reductions in transport costs Egypt-wide based on the survey data and econometric model. Table 13 presents reductions transport/shipping costs *per Shekhia*, while Tables 14-17 present results *per capita*. All of Tables 13-17 present results both for all of Egypt and for high-poverty Shekhias only.

Table 13 presents the estimated reductions in shipping prices for each of the four shipping types surveyed and for each scenario *per Shekhia*, first presenting the mean reductions for each type (rows (D) through (G)), and then per kilometer of road improvement/construction. In all cases – for all shipping types – the Cairo Ring Road scenario achieves the highest reduction in estimated shipping prices. This is particularly true for container shipping and liquid cargo shipping, where the mean reductions from the Cairo Ring Road scenario are an order of magnitude larger than from the other two scenarios.

Conclusion. These results allow us to evaluate which Scenarios make the most sense, depending on the policy goals. In many countries, improvements in infrastructure are viewed as a rational national strategy to reduce transport costs and improve the connectivity of peripheral areas. However, decisions on alternative infrastructure improvements should consider how these improvements can improve accessibility for the total population and for the poor, and whether alternative improvements have a higher likelihood of improving accessibility as well as the overall efficiency of the markets for transport. Our disaggregation of transport prices is used to inform these choices by simulating the implications of alternative infrastructure improvements. These simulations can illustrate the utility of using spatially explicit data and in evaluating the country-wide benefits of specific infrastructure investments, including between those that would improve connectivity to less developed areas and those that improve transport in more developed areas.

The simulations do not seek to provide a national plan for coordinated infrastructure improvements, which would require a more detailed study that would consider the interactions of different modes of transport, or specific policy objectives such as improving accessibility to basic services such as schools, clinics, and local markets. In contrast to approaches often used by government road departments and international agencies, which use economic rate of return models considering the economic impact of a potential road improvement on the cost of vehicles traversing that particular road segment, the methodology used here considers *network-wide impacts* of improving specific transport corridors, accounting for the effects of transport demand and congestion on transport prices. This approach considers the fact that improvements in one location can have network-wide impacts, resulting in improved access or lower transport costs in areas far from the improved road section.

Which transport improvements can benefit poor areas the most? Our results show that transport expenditures in poor areas can be reduced by improving transport efficiency in the most developed areas. Improving transport connections in the central Cairo metropolitan area directly benefits a large number of poor people because the area has a high concentration of poor people. However, the simulations suggest that improving a major artery in the central Cairo metropolitan area – the Cairo Ring Road – will improve market access and reduce transport costs overall in Egypt – for the total population *and* for high-poverty Shekhias – more than alternative investments focused more in improving connectivity to the lagging area of Upper Egypt.

Both considering the overall efficiency of the Egyptian transport market and considering poverty reduction, our simulation model - simulating network-wide effects and considering the endogeneity of demand and congestion - estimates that the greatest improvement comes from the Cairo Ring Road improvement. The approach used here could be used to evaluate other alternative infrastructure improvements, and – given more detailed data – could be used to provide such evaluations considering multi-modal transport linkages and costs/benefits. Or, the approach here could be used to fine tune the proposed scenarios, or consider in more details the impacts of each scenario on specific regions or areas.

FINAL SIMULATION RESULTS		Cairo-Asyut		Sohag-Red Sea		Cairo Ring Road			
COST-BENEFIT ANALYSIS		Scenario		Scenario		Scenario			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(A)	Total Estimated Scenario Improvement Price (Billion EGP)*	0.35		0.64		1.5		Scenario With Best Cost-Benefit:	
(B)	Length of Scenario Improvement in Km*	356		375		110			
(C)	Scenario Improvement Cost/Km (in Billion EGP)	0.001		0.002		0.014			
		All Shekhias	Poverty Shekhias**	All Shekhias	Poverty Shekhias**	All Shekhias	Poverty Shekhias**	All Shekhias	Poverty Shekhias**
(D)	Egypt-wide Reduction in Container Shipping Prices per Shekhia	49.590	59.600	43.080	49.020	185.720	239.900	Cairo Ring Road	Cairo Ring Road
(E)	Egypt-wide Reduction in General Cargo Shipping Prices per Shekhia	10.900	9.400	10.820	9.200	11.500	10.210	Cairo Ring Road	Cairo Ring Road
(F)	Egypt-wide Reduction in Dry Bulk Shipping Prices per Shekhia	3.580	5.190	3.580	5.150	3.620	5.310	Cairo Ring Road	Cairo Ring Road
(G)	Egypt-wide Reduction in Liquid Cargo Shipping Prices per Shekhia	1.650	1.890	1.320	1.970	21.780	20.570	Cairo Ring Road	Cairo Ring Road
(H)	Egypt-wide Reduction in Container Shipping Prices (EGP) per Km of road improvement/construction	0.139	0.167	0.115	0.131	1.688	2.181	Cairo Ring Road	Cairo Ring Road
(I)	Egypt-wide Reduction in General Cargo Shipping Prices (EGP) per Km of road improvement/construction	0.031	0.026	0.029	0.025	0.105	0.093	Cairo Ring Road	Cairo Ring Road
(J)	Egypt-wide Reduction in Dry Bulk Shipping Prices (EGP) per Km of road improvement/construction	0.010	0.015	0.010	0.014	0.033	0.048	Cairo Ring Road	Cairo Ring Road
(K)	Egypt-wide Reduction in Liquid Cargo Shipping Prices (EGP) per Km of road improvement/construction	0.005	0.005	0.004	0.005	0.198	0.187	Cairo Ring Road	Cairo Ring Road
* Improvement/Construction Costs and Lengths supplied by Egyptian General Authority for Roads, Bridges & Land Transport (GARBLT)									
***"Poverty" Shekhia districts defined as those with a poverty rate of 25% or greater.									

Table 13: Estimated Benefits *Per Shekhia* (Source: Staff estimates based on data from CAPMAS, and GAR)

Table 14, in contrast to Table 13, presents the estimated reductions in shipping price benefits *per capita*, rather than per Shekhia, by multiplying the total population in the Shekhias experiencing reductions in shipping prices due to the scenario times the calculated reduction for that Shekhia. These results take into consideration the variation in population per Shekhia in Egypt and the fact that – due to its spatial proximity to the large Lower Egyptian populations in the metropolitan Cairo area - there are considerably higher populations in Shekhias experiencing shipping/transport price reductions due to the Cairo Ring Road scenario, than in Shekhias benefitting from price reductions driven by the other two scenario improvements. As a result, the total population and total poor populations experiencing price reductions, as shown in the table, are considerably higher for the Ring Road scenario than for the other two scenarios: for example 39.4 million people experience container price reductions under the Ring Road scenario, but only 12.6 and 9.3 million, respectively, for the Asyut and Sohag-Red Sea scenarios. For all four shipping types, the per capita benefits from the Ring Road scenario are dramatically higher than for the other two scenarios. The last column in Table 14 provides an estimate in EGP of total aggregated benefit across the Egyptian population.

Table 15 provides a simple Net Present Value (NPV) estimation of the cost-benefit for general cargo shipping from each scenario, considering the total aggregated benefits presented in Table 14, and the estimated initial capital costs for each scenario (see Table 2), given a 20-year benefit stream and a 10% discount rate. This simple analysis does not consider future road maintenance costs, nor does it consider benefits in terms of reductions in Vehicle Operating Costs (VOC) or Travel-Time reduction Costs (TTC) that are typically modeled in road investment NPV calculations (as for example with the World Bank-supported Highway Development Model, HDM). But, it does provide a discounted NPV estimate of the estimated benefits in terms of general cargo shipping price reductions balanced against the large capital costs of implementing each scenario. The NPV results, presented in the last row, show that despite its dramatically higher capital costs (1.5 billion EGP) compared to the other two scenarios (0.35 and 0.64 billion EGP, respectively, for the Asyut and Sohag-Red Sea scenarios), nonetheless due to a high estimated benefit stream from reductions in general cargo shipping per capita, the Ring Road scenario emerges with the best cost-benefit of the three scenarios over a 20-year future period.

As stated above, unfortunately the NPV estimate presented in Table 15 does not factor in future road maintenance costs which are necessary for maintenance of each scenario over a 20-year period. In order to include those in the estimate of the respective NPV for each scenario, we obtained approximate future road maintenance cost estimates (based on studies conducted in other countries for the Millennium Challenge Corporation (MCC)), and created a scenario of future road maintenance works for each scenario that are described in Table 16. Our assumptions for this maintenance regime, which we feel are reasonable or are perhaps more expensive than Egypt is likely to undertake in reality, are as follows:

road patching: \$60 per meter per lane - completed every 5 years
resealing: \$6 per meter per lane - completed every 2 years
road overlay: \$22/meter per lane - completed every 5 years
reconstruction: \$50 per meter,per lane completed every 10 years
periodic general maintenance: \$1500/km per lane, completed every 3 years

These values were calculated per km and summed in Table 16 for each year of the future 20 year horizon. Next they were multiplied first by the number of lanes maintained per scenario, and then by the total length in km of each of the improvement scenarios: 110 km for the Cairo Ring Road; 375 km for the Asyut scenario; 356 for the Sohag-Red Sea scenario. Finally, they were converted to EGP values.

The result was an estimated cost for road maintenance for each scenario for each year of a future 20-year time horizon. Each future estimated cost per year for each scenario was then subtracted from the benefit estimates of the future benefit stream displayed in Table 15. The resulting adjusted yearly benefit values are displayed in Table 18. The adjusted NPV estimates displayed in the last row of Table 18 show that, even with road maintenance costs factored in, a discount future NPV for each scenario shows the greatest benefit from the Ring Road Scenario.

Scenario	Type of Shipping Used in Estimation	Shekhias With Simulated Reductions in Transport Costs	Total Population With Reduced Transport Costs	Total Poor Population With Reduced Transport Costs	Total Aggregated Benefit in EGP: Aggregated Reduction in Transport Costs Across All of Egypt (Transport Cost Reduction * Population)
Cairo Ring-Road	Estimation Using Container Prices	3,391	39,400,000	5,370,274	7,800,000,000
Asyut Scenario	Estimation Using Container Prices	1,059	12,600,000	2,294,793	610,000,000
Sohag-Red Sea	Estimation Using Container Prices	755	9,322,030	1,595,796	598,000,000
Cairo Ring-Road	Estimation Using General Cargo Prices	3,099	37,800,000	5,187,698	444,000,000
Asyut Scenario	Estimation Using General Cargo Prices	1,037	14,700,000	1,759,798	291,000,000
Sohag-Red Sea	Estimation Using General Cargo Prices	1,027	14,400,000	1,727,101	289,000,000
Cairo Ring-Road	Estimation Using Dry Bulk Shipping Prices	2,615	31,300,000	5,227,945	119,000,000
Asyut Scenario	Estimation Using Dry Bulk Shipping Prices	1,221	15,700,000	2,855,088	101,000,000
Sohag-Red Sea	Estimation Using Dry Bulk Shipping Prices	1,268	16,300,000	2,855,088	104,000,000
Cairo Ring-Road	Estimation Using Liquid Cargo Shipping Prices	1,802	23,700,000	3,596,872	797,000,000
Asyut Scenario	Estimation Using Liquid Cargo Shipping Prices	1,065	12,500,000	2,290,434	23,400,000
Sohag-Red Sea	Estimation Using Liquid Cargo Shipping Prices	1,527	19,200,000	4,006,169	37,800,000

Table 14: Estimated Aggregated Benefits *Per Capita*

Net Present Value (NPV)		<u>General Cargo</u> <u>Shipping</u> (No Road Maintenance Costs)		
20-Year Benefit Stream				
10% Discount Rate	Ring Road	Asyut	Sohag-Red Sea	
Estimated Cost of Scenario	-1,500,000,000	-350,000,000	-640,000,000	
Year 1	444,000,000	291,000,000	289,000,000	
Year 2	444,000,000	144,000,000	289,000,000	
Year 3	444,000,000	144,000,000	289,000,000	
Year 4	444,000,000	144,000,000	289,000,000	
Year 5	444,000,000	144,000,000	289,000,000	
Year 6	444,000,000	144,000,000	289,000,000	
Year 7	444,000,000	144,000,000	289,000,000	
Year 8	444,000,000	144,000,000	289,000,000	
Year 9	444,000,000	144,000,000	289,000,000	
Year 10	444,000,000	144,000,000	289,000,000	
Year 11	444,000,000	144,000,000	289,000,000	
Year 12	444,000,000	144,000,000	289,000,000	
Year 13	444,000,000	144,000,000	289,000,000	
Year 14	444,000,000	144,000,000	289,000,000	
Year 15	444,000,000	144,000,000	289,000,000	
Year 16	444,000,000	144,000,000	289,000,000	
Year 17	444,000,000	144,000,000	289,000,000	
Year 18	444,000,000	144,000,000	289,000,000	
Year 19	444,000,000	144,000,000	289,000,000	
Year 20	444,000,000	144,000,000	289,000,000	
Net Present Value (NPV):	2,072,747,538	917,808,672	1,654,927,195	

Table 15

Year:							Ring-Road			Sohag-Red Sea			Cairo-Asyut	
	Patching	Resealing	Overlay	Reconstruction	General Maintenance	Total Per Year	x 4 for 4 Lanes	* 110 km	in EGP	x 1 for 1 Lane	* 375 km	In EGP	* 356 km	in EGP
1	60,000				1500	61,500	246,000	27,060,000	162,360,000	61,500	23,062,500	138,375,000	21,894,000	131,364,000
2		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
3						0	0	0	0	0	0	0	0	0
4		6,000			1500	7,500	30,000	3,300,000	19,800,000	7,500	2,812,500	16,875,000	2,670,000	16,020,000
5	60,000		22000			82,000	328,000	36,080,000	216,480,000	82,000	30,750,000	184,500,000	29,192,000	175,152,000
6		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
7					1500	1,500	6,000	660,000	3,960,000	1,500	562,500	3,375,000	534,000	3,204,000
8		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
9	60,000					60,000	240,000	26,400,000	158,400,000	60,000	22,500,000	135,000,000	21,360,000	128,160,000
10		6,000	22000	50,000	1500	79,500	318,000	34,980,000	209,880,000	79,500	29,812,500	178,875,000	28,302,000	169,812,000
11						0	0	0	0	0	0	0	0	0
12		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
13	60,000				1500	61,500	246,000	27,060,000	162,360,000	61,500	23,062,500	138,375,000	21,894,000	131,364,000
14		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
15			22000			22,000	88,000	9,680,000	58,080,000	22,000	8,250,000	49,500,000	7,832,000	46,992,000
16		6,000			1500	7,500	30,000	3,300,000	19,800,000	7,500	2,812,500	16,875,000	2,670,000	16,020,000
17	60,000					60,000	240,000	26,400,000	158,400,000	60,000	22,500,000	135,000,000	21,360,000	128,160,000
18		6,000				6,000	24,000	2,640,000	15,840,000	6,000	2,250,000	13,500,000	2,136,000	12,816,000
19					1500	1,500	6,000	660,000	3,960,000	1,500	562,500	3,375,000	534,000	3,204,000
20		6,000	22000	50,000		78,000	312,000	34,320,000	205,920,000	78,000	29,250,000	175,500,000	27,768,000	166,608,000

Table 16

Net Present Value (NPV)		With Road Maintenance Costs		
20-Year Benefit Stream				
10% Discount Rate		Ring Road	Asyut	Sohag-Red Sea
Estimated Cost of Scenario		-		
	Year 1	1,500,000,000	-350,000,000	-640,000,000
	Year 2	281,640,000	152,625,000	157,636,000
	Year 3	428,160,000	130,500,000	276,184,000
	Year 4	444,000,000	144,000,000	289,000,000
	Year 5	424,200,000	127,125,000	272,980,000
	Year 6	227,520,000	-40,500,000	113,848,000
	Year 7	428,160,000	130,500,000	276,184,000
	Year 8	440,040,000	140,625,000	285,796,000
	Year 9	428,160,000	130,500,000	276,184,000
	Year 10	285,600,000	9,000,000	160,840,000
	Year 11	234,120,000	-34,875,000	119,188,000
	Year 12	444,000,000	144,000,000	289,000,000
	Year 13	428,160,000	130,500,000	276,184,000
	Year 14	281,640,000	5,625,000	157,636,000
	Year 15	428,160,000	130,500,000	276,184,000
	Year 16	385,920,000	94,500,000	242,008,000
	Year 17	424,200,000	127,125,000	272,980,000
	Year 18	285,600,000	9,000,000	160,840,000
	Year 19	428,160,000	130,500,000	276,184,000
	Year 20	440,040,000	140,625,000	285,796,000
	Year 20	238,080,000	-31,500,000	122,392,000
Net Present Value (NPV):		1,513,661,862	441,315,198	1,202,576,058

Table 17

Annex1 Simulation of Road Improvements

The simulations were produced using the following steps:

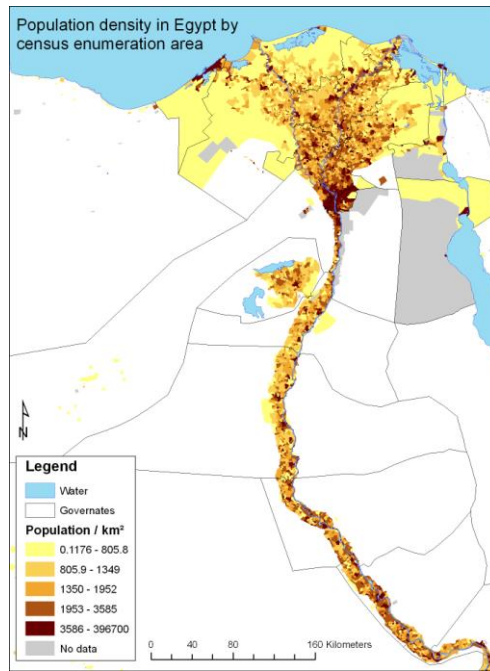
- A. We began by building into the baseline 2010 Egyptian road network the changes proposed by each scenario above. For the 3 scenarios, spatial information on the location of the new road segments and the proposed segment upgrades was precisely integrated into the GIS road network. Specifics on the quality and capacity of each segment for each impacted or new road segment were recorded in the GIS based on GARBLT estimates per type of road upgrade, number of lanes, and scenario.
- B. The “baseline” measures consist of 2010 shipping prices collected from our shipping survey. The results for each subsequent scenario were evaluated in comparison to this baseline estimate.
- C. For each Egyptian Shekhia district, the spatial centroid point was used as the starting point, and transport routes to Colombo were calculated using a least-cost path algorithm and optimizing the route to minimize the transport time variable (as described above in the model section). The “least-cost” pathway through the road network, minimizing travel-times as a function of road quality, capacity and topography, was re-estimated for each scenario (reflecting road network changes made for each scenario).
- D. Using the new Shekhia routes based on the modified road network, aggregate and per kilometer values per route for the H , D and C parameters were recalculated for each Shekhia.
- E. Using these values for the independent predictor variables, shipping price values for each Shekhia were predicted based on the model estimates.

Using the GIS, road segments for each road improvement scenario were physically created or upgraded. Consequently, estimates of travel times on those segments (as a function of road quality, topography, and number of lanes) were adjusted according to reflect their improved status.

The GIS least-cost path algorithm was used to calculate the route that minimized travel-time (considering road quality) to the specified destination for each Shekhia. This resulted in the calculation of separate routes for each Shekhia. Note that under differing road improvement scenarios, in a number of cases the GIS-calculated routes changed between scenarios, as the GIS algorithm was able to locate an improved route given the future road improvements.

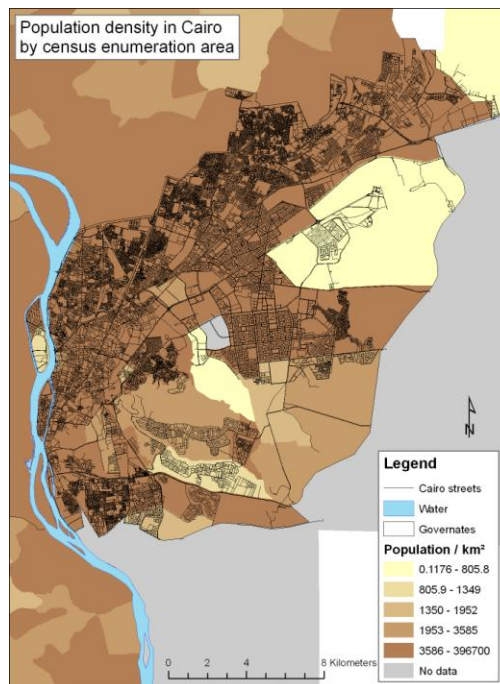
For each route, three key variables were calculated by the GIS: total distance of that route in km, total estimated travel-time of that route in minutes, and total traffic encountered along that route (values for the traffic congestion index for each segment along the route were summed). Construction costs were obtained from GARBLT estimates.

Map 1

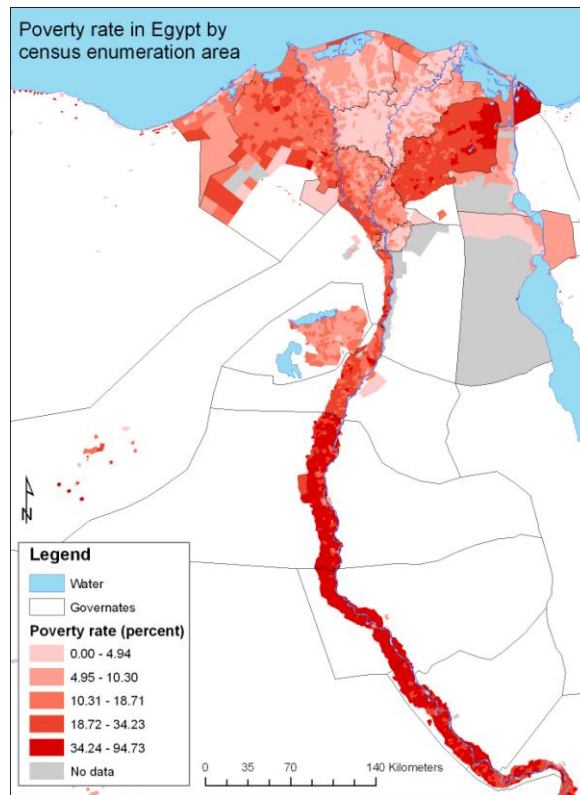


Map 1

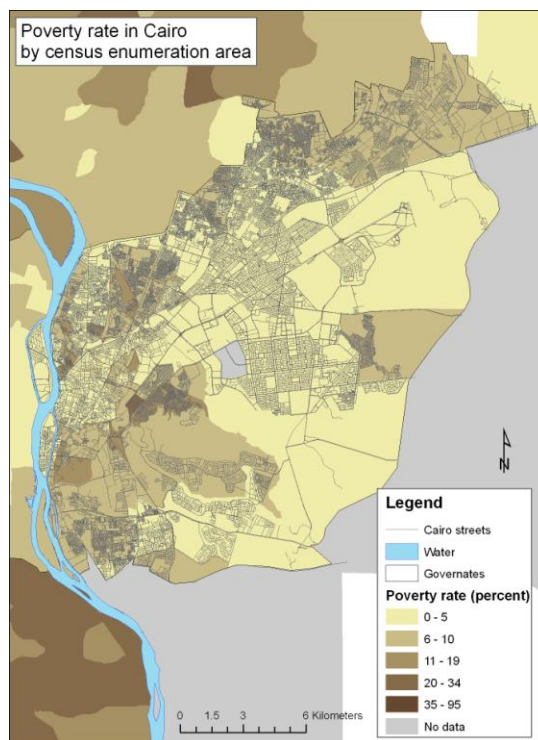
Map 2



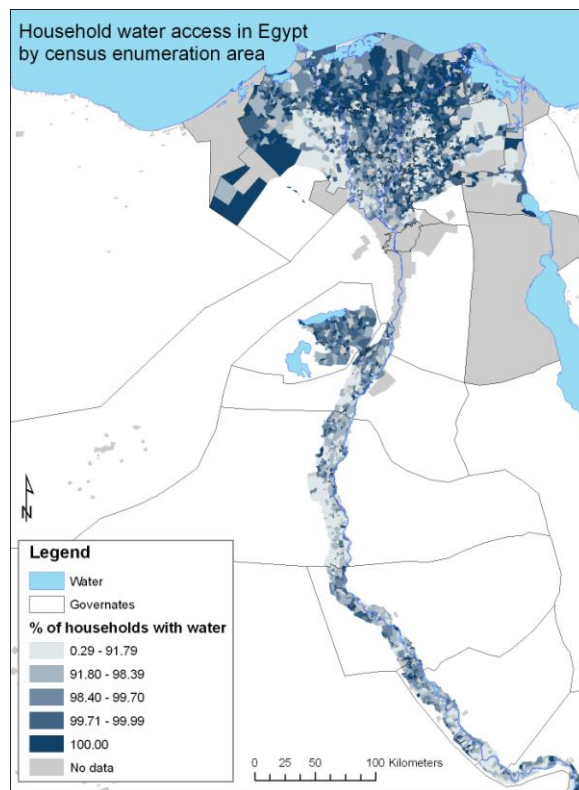
Map 2



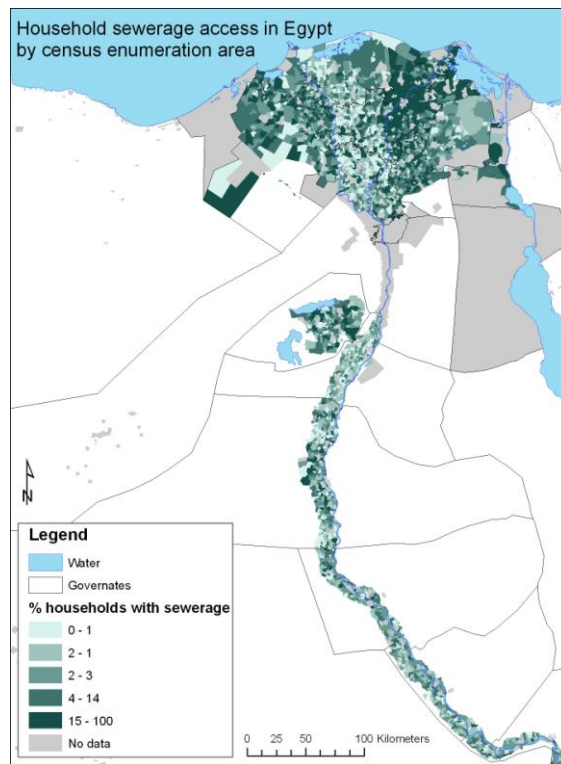
Map 3



Map 4

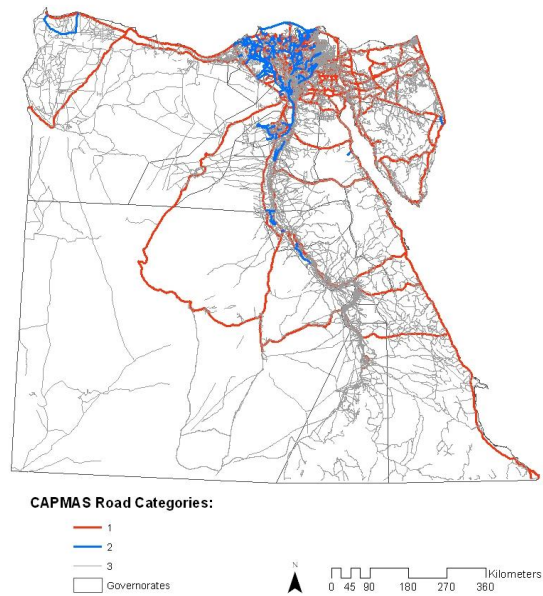


Map 5



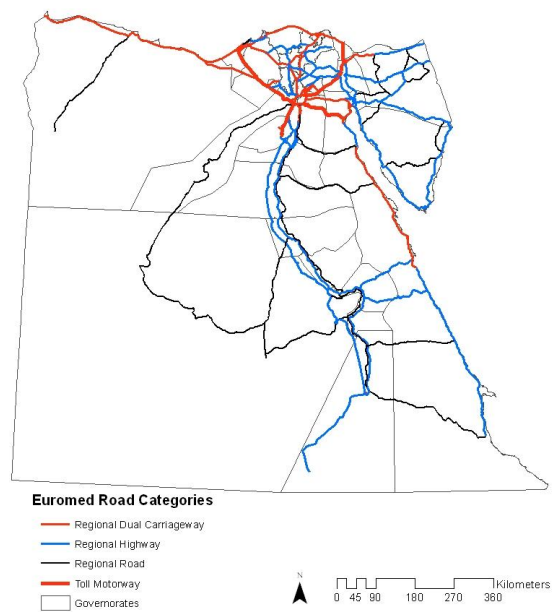
Map 6

GIS Road Network,
Central Agency for Public Mobilization
and Statistics (CAPMAS)



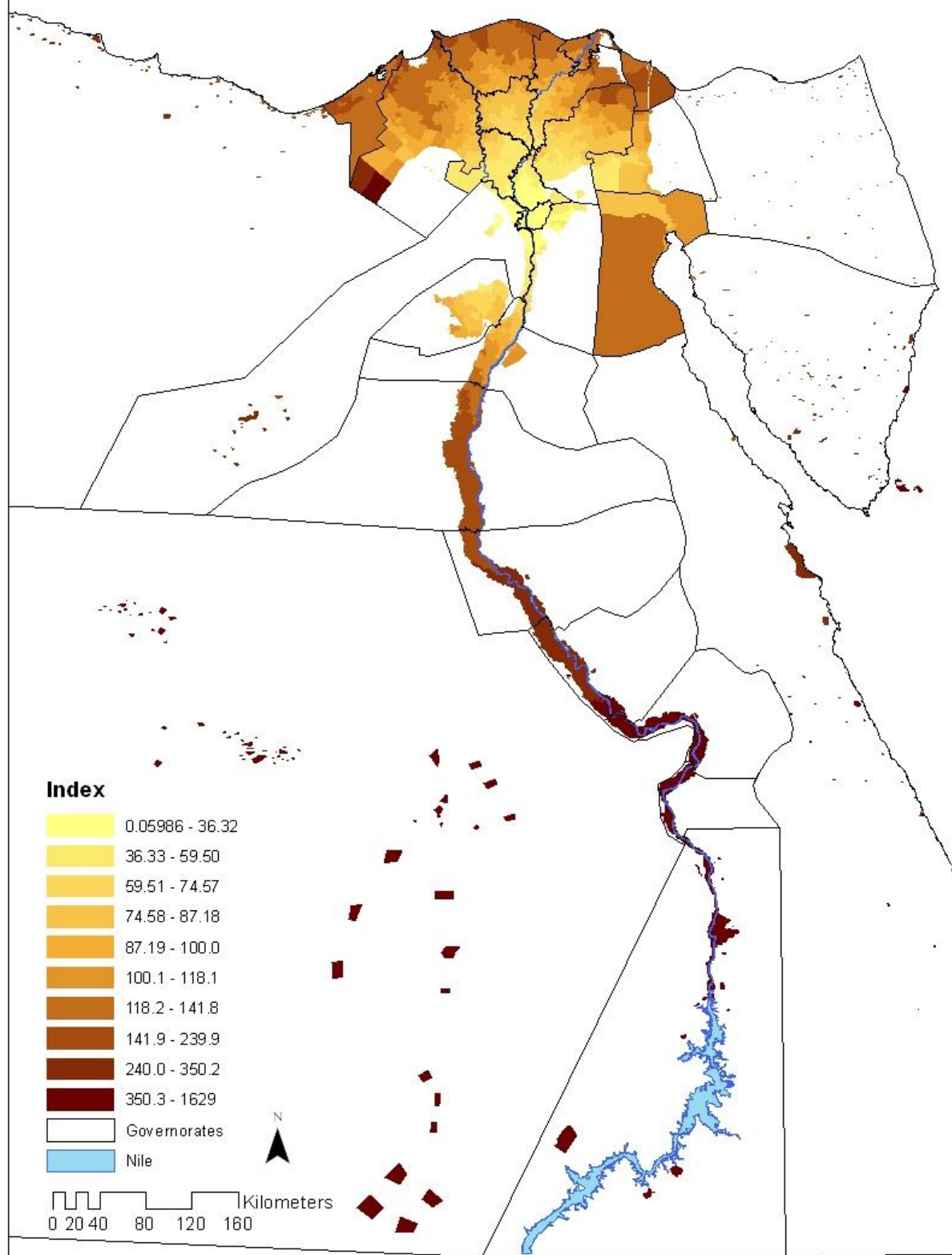
Map 7

Euromed Road Network, Egypt



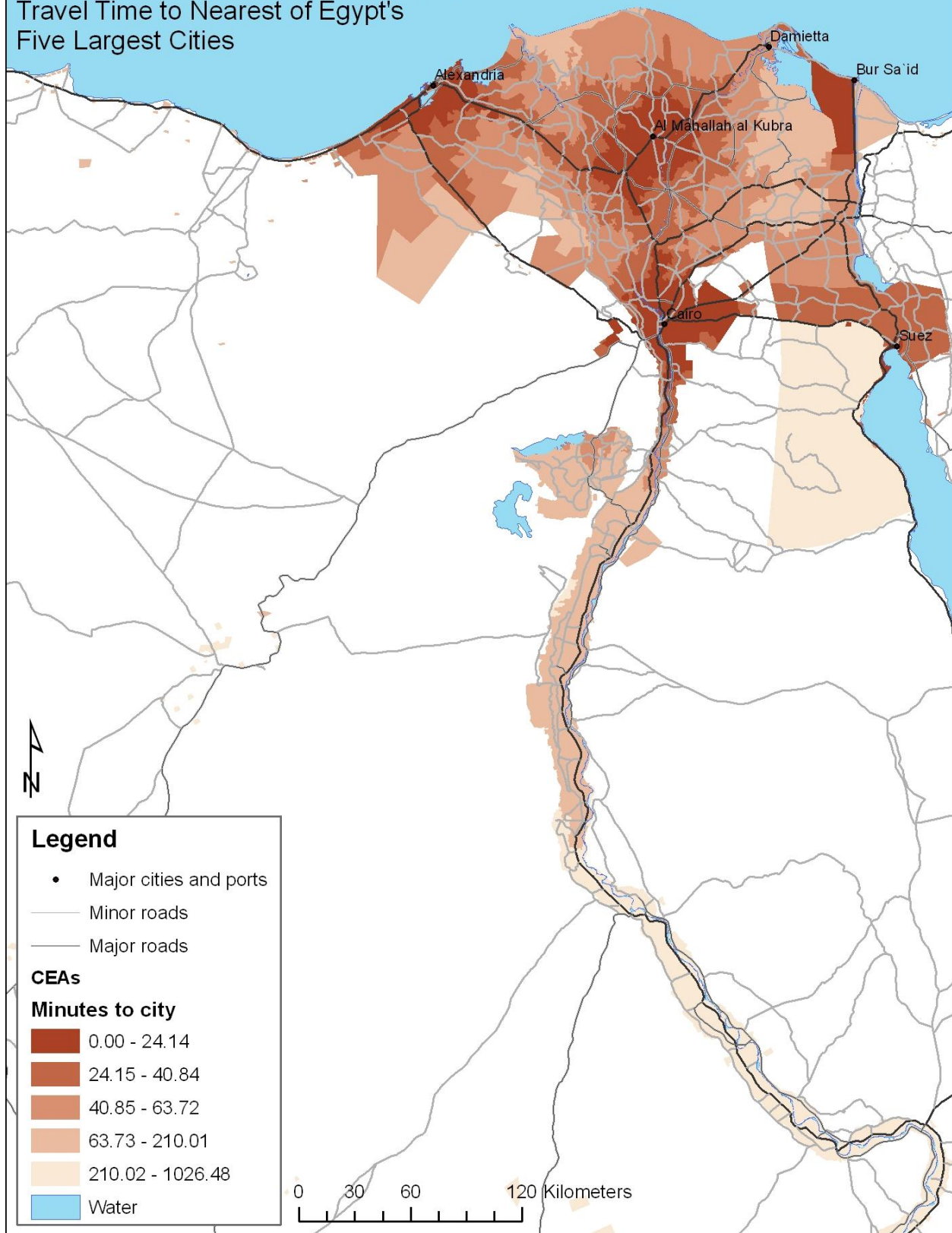
Map 8

Travel-Time Index to Central Cairo



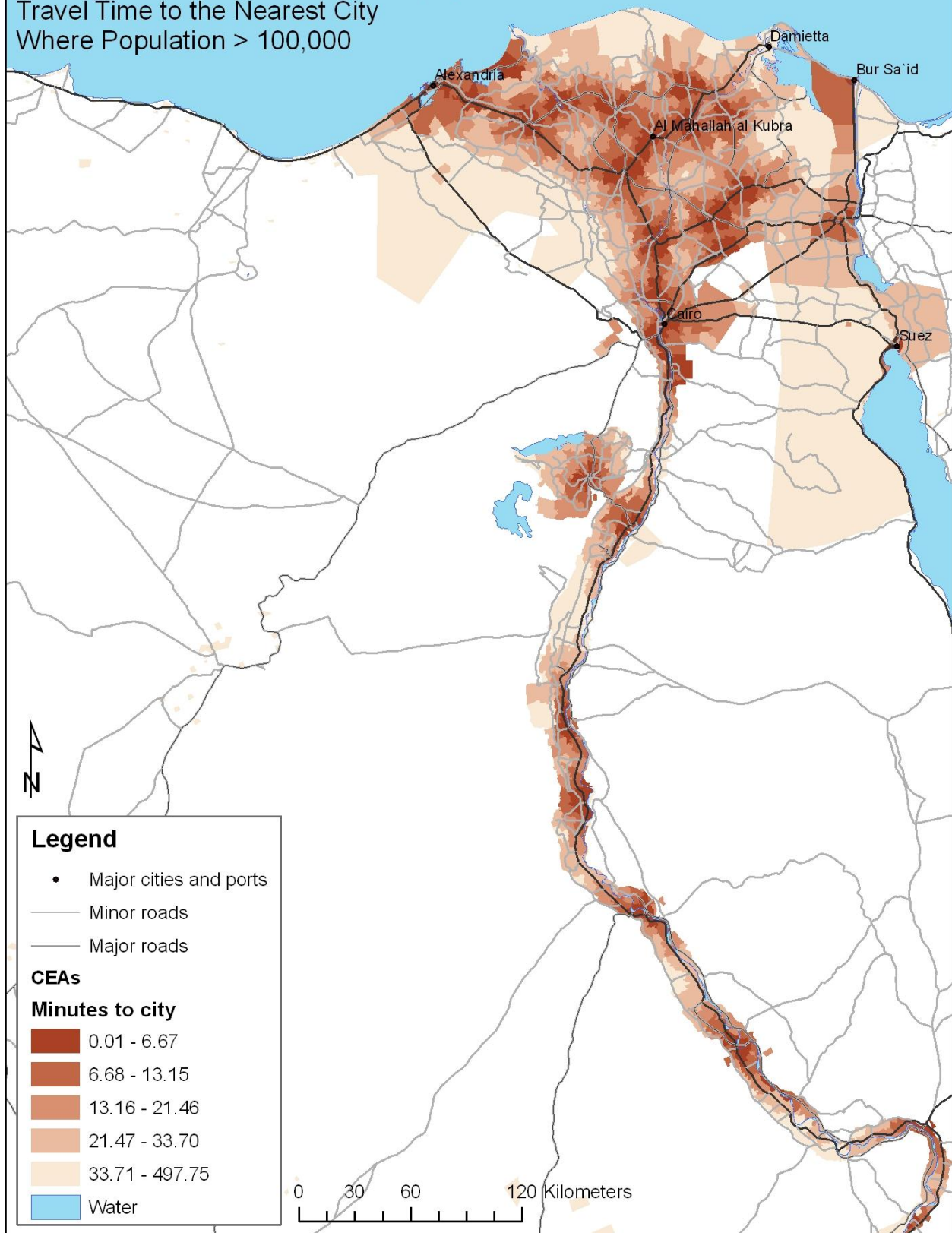
Map 9

Census Enumeration Areas (CEAs) by Travel Time to Nearest of Egypt's Five Largest Cities

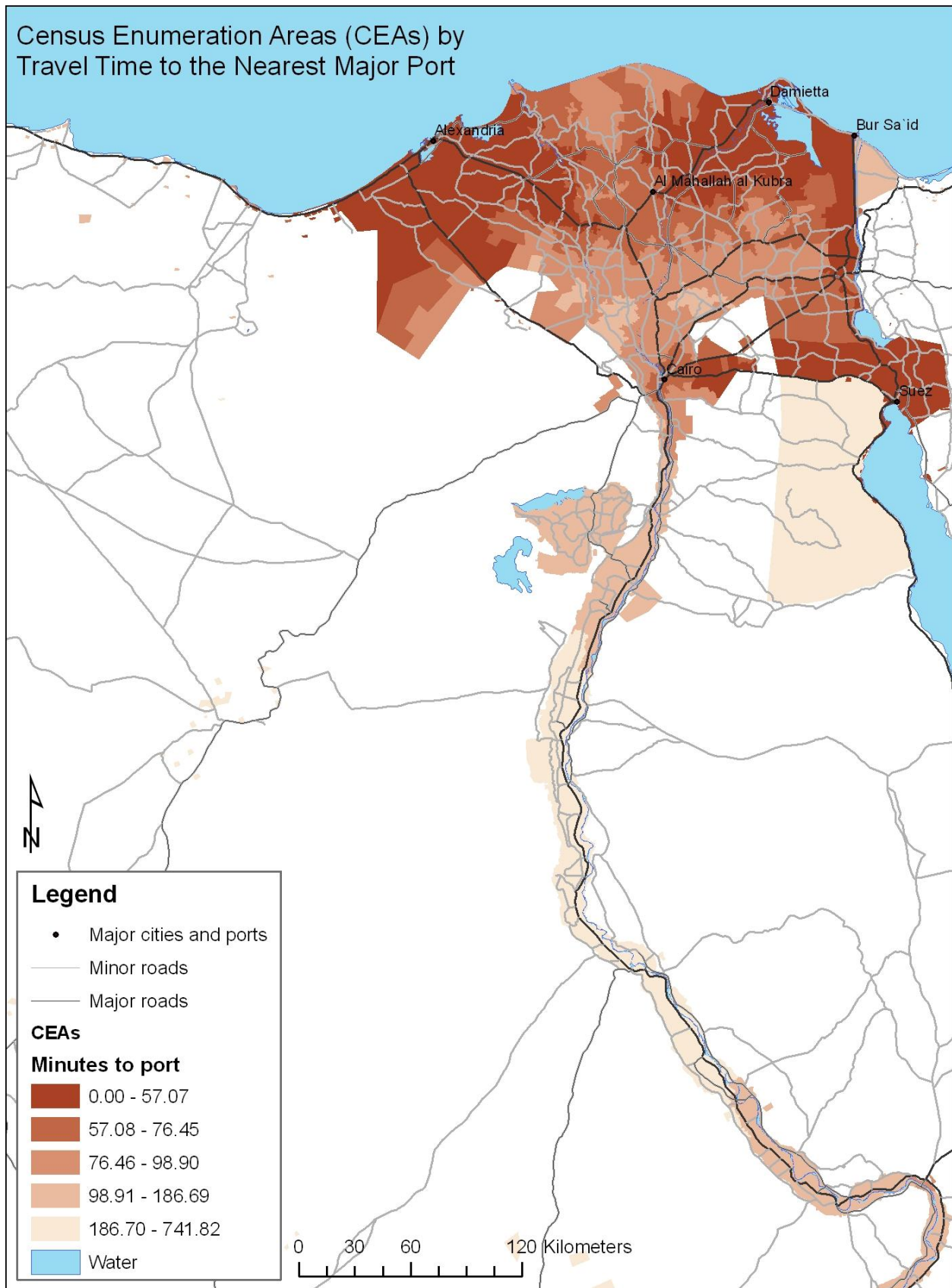


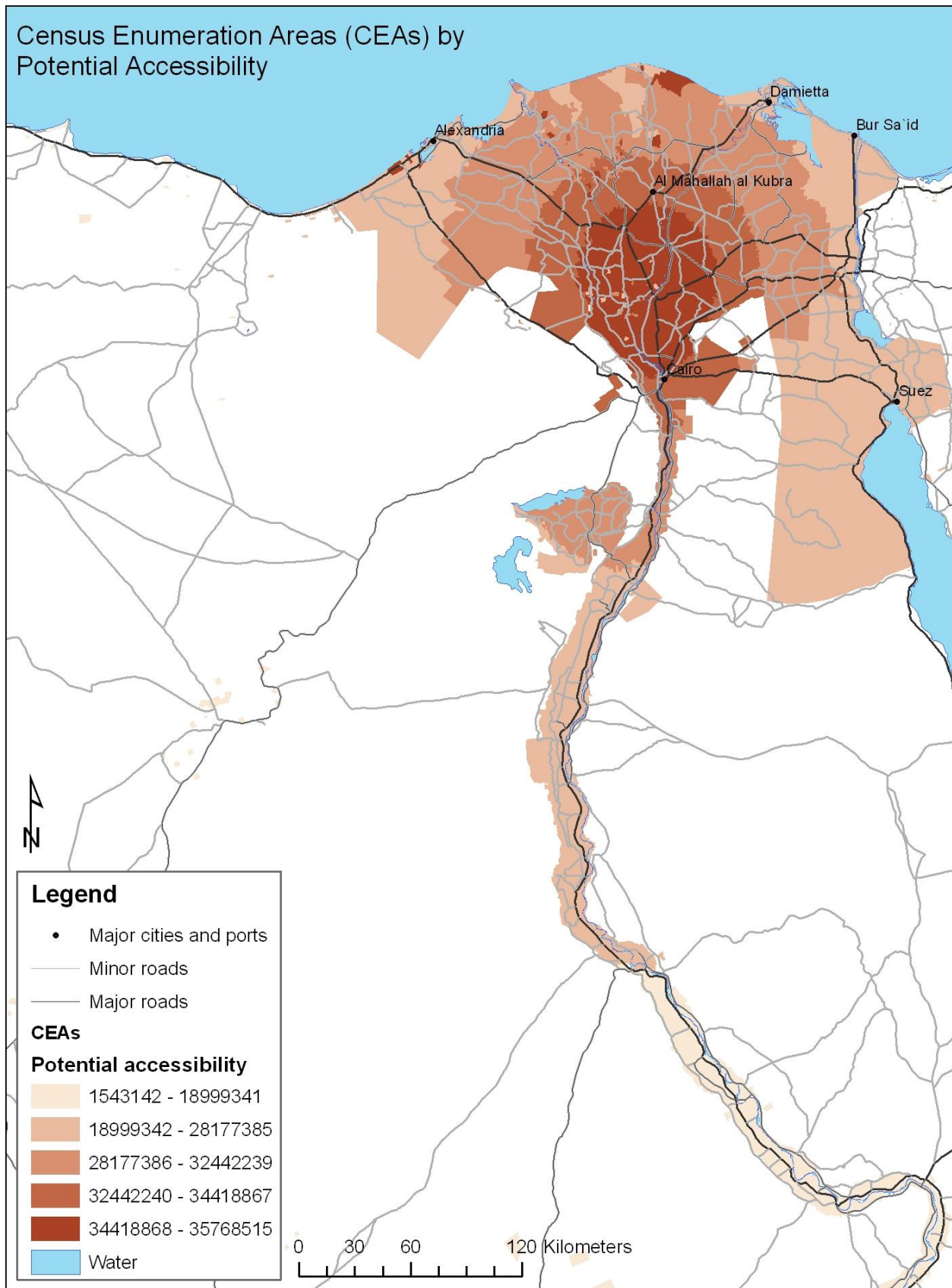
Map 10

Census Enumeration Areas (CEAs) by Travel Time to the Nearest City Where Population > 100,000

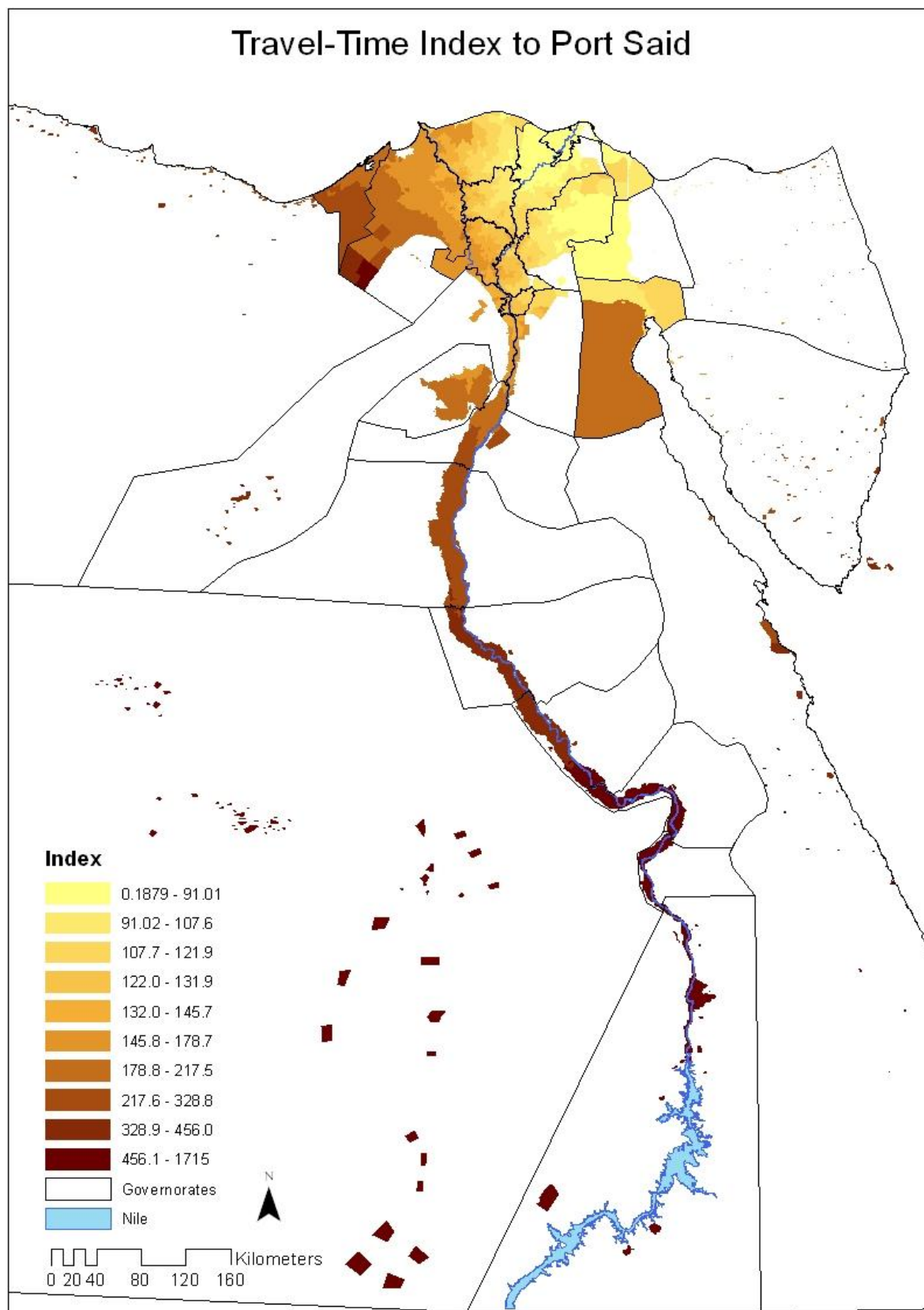


Map 11

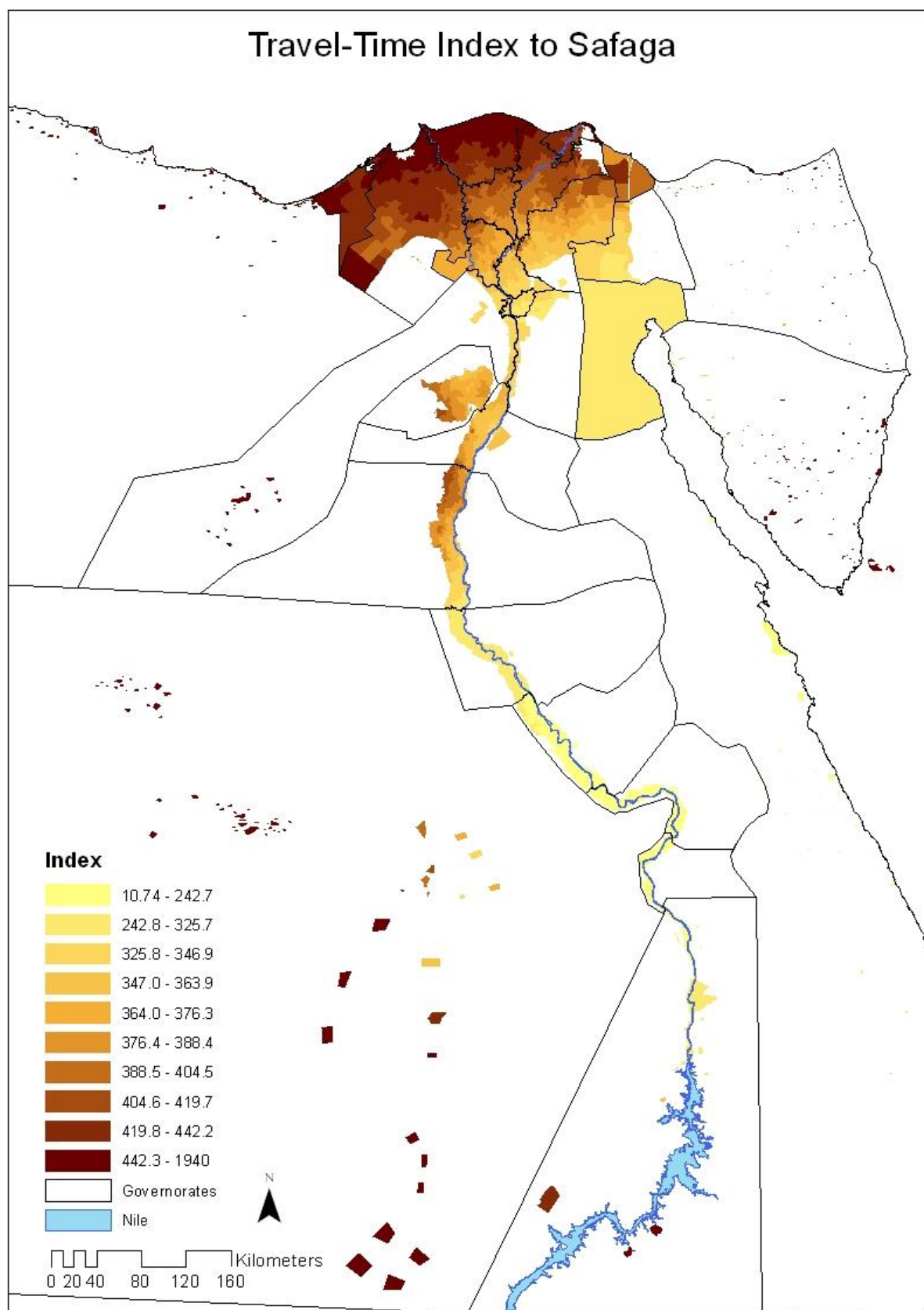




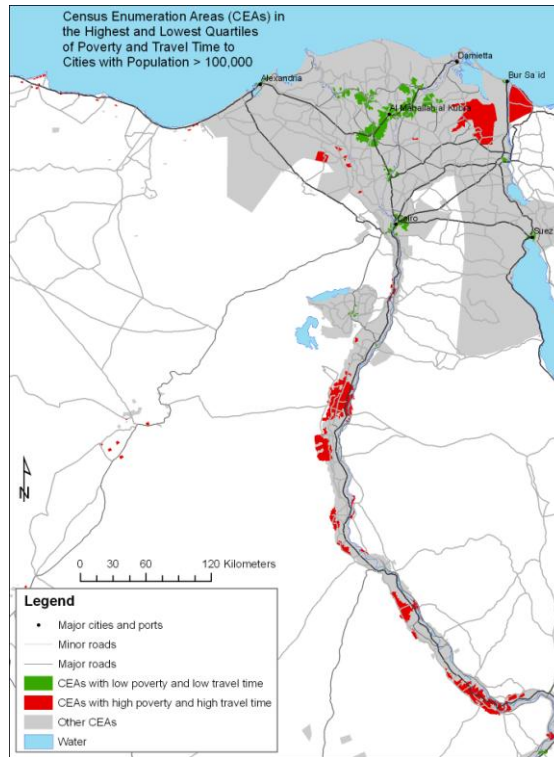
Map 13



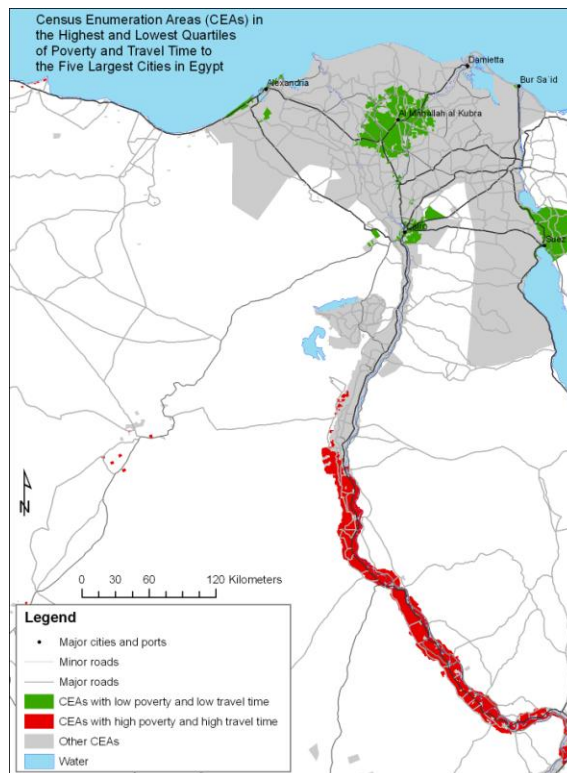
Map 14



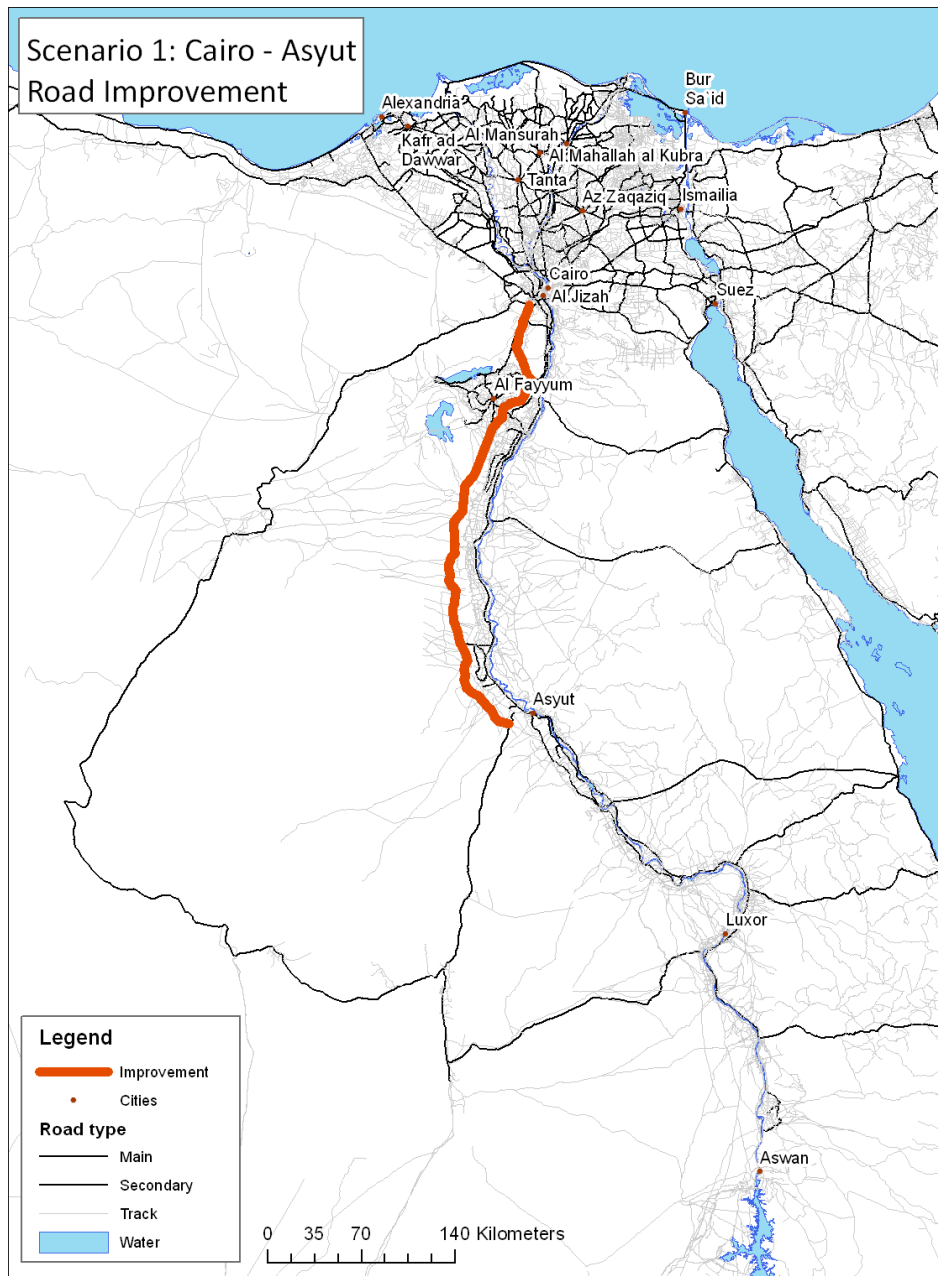
Map 15



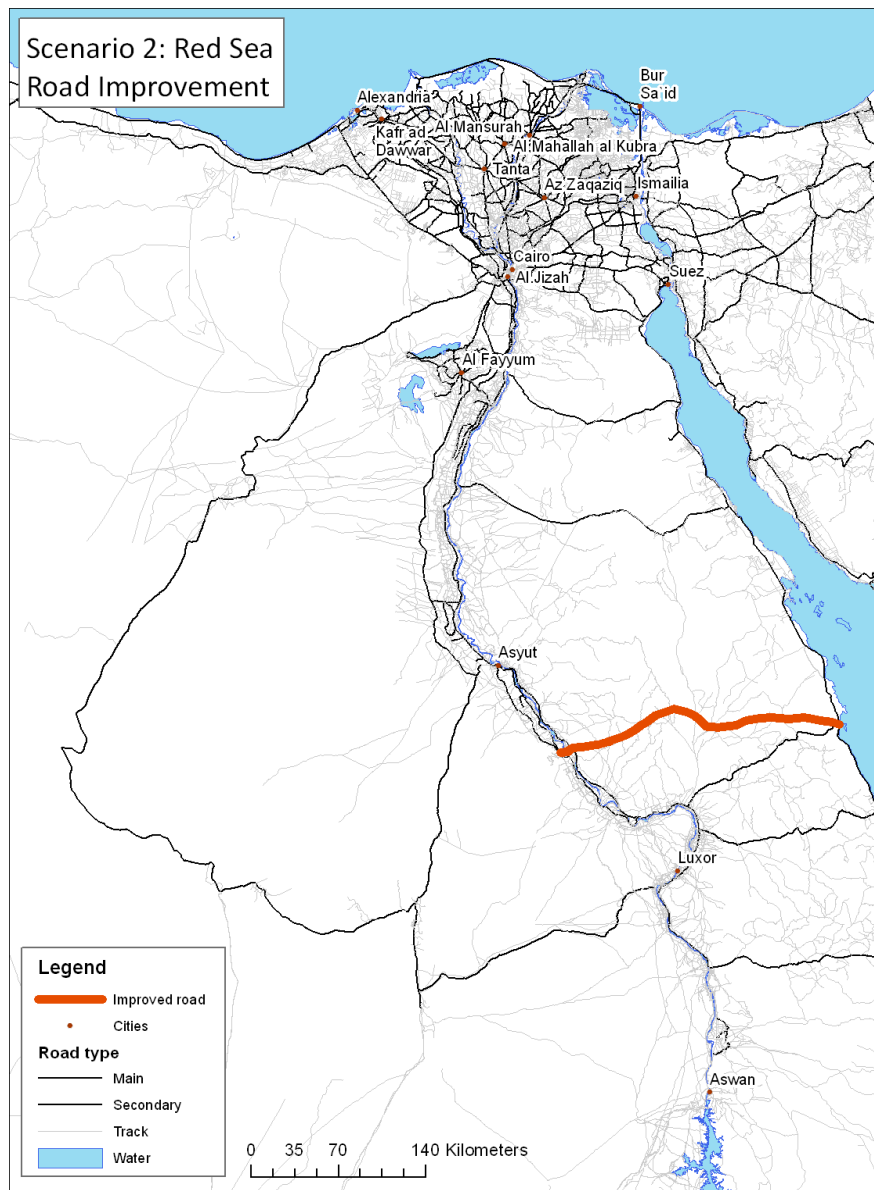
Map 16



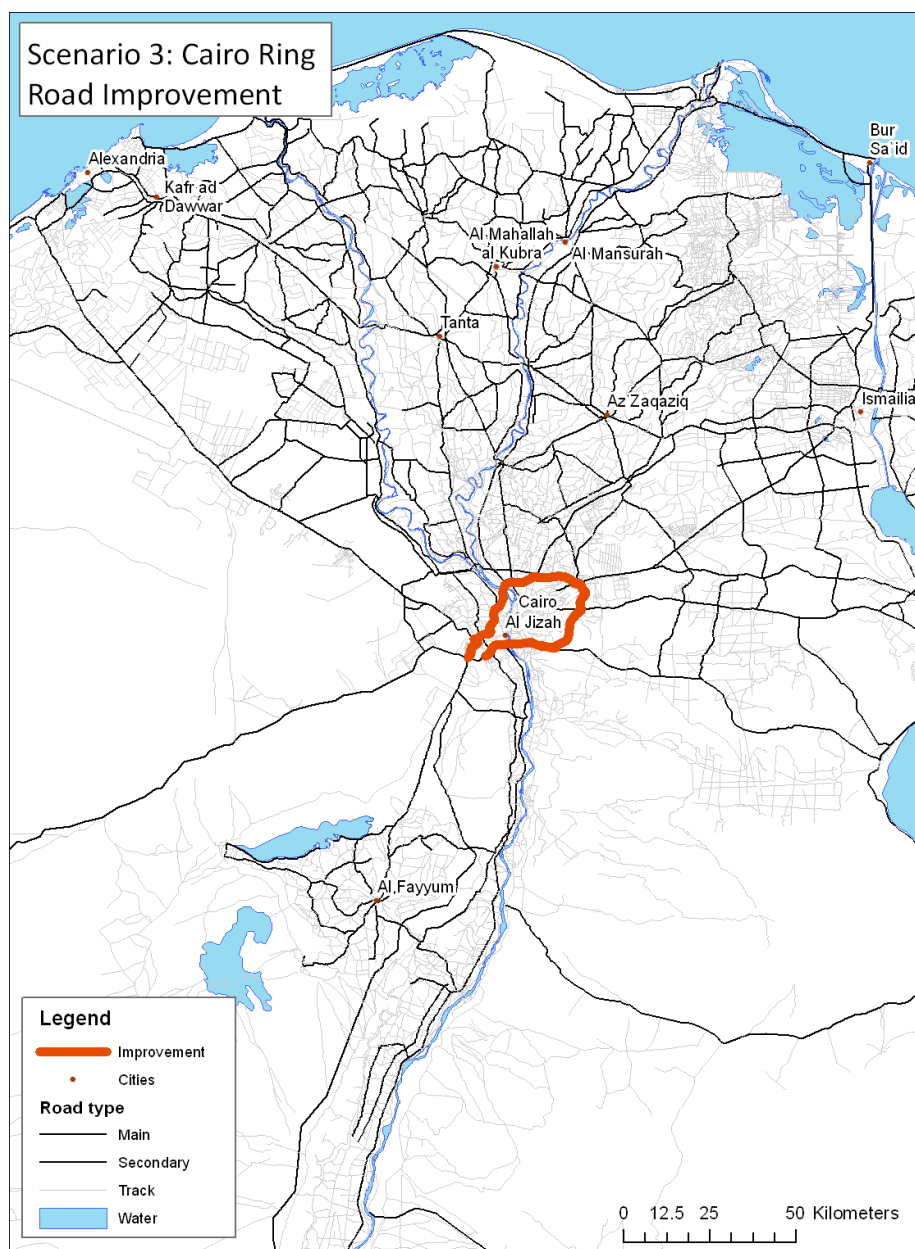
Map 17



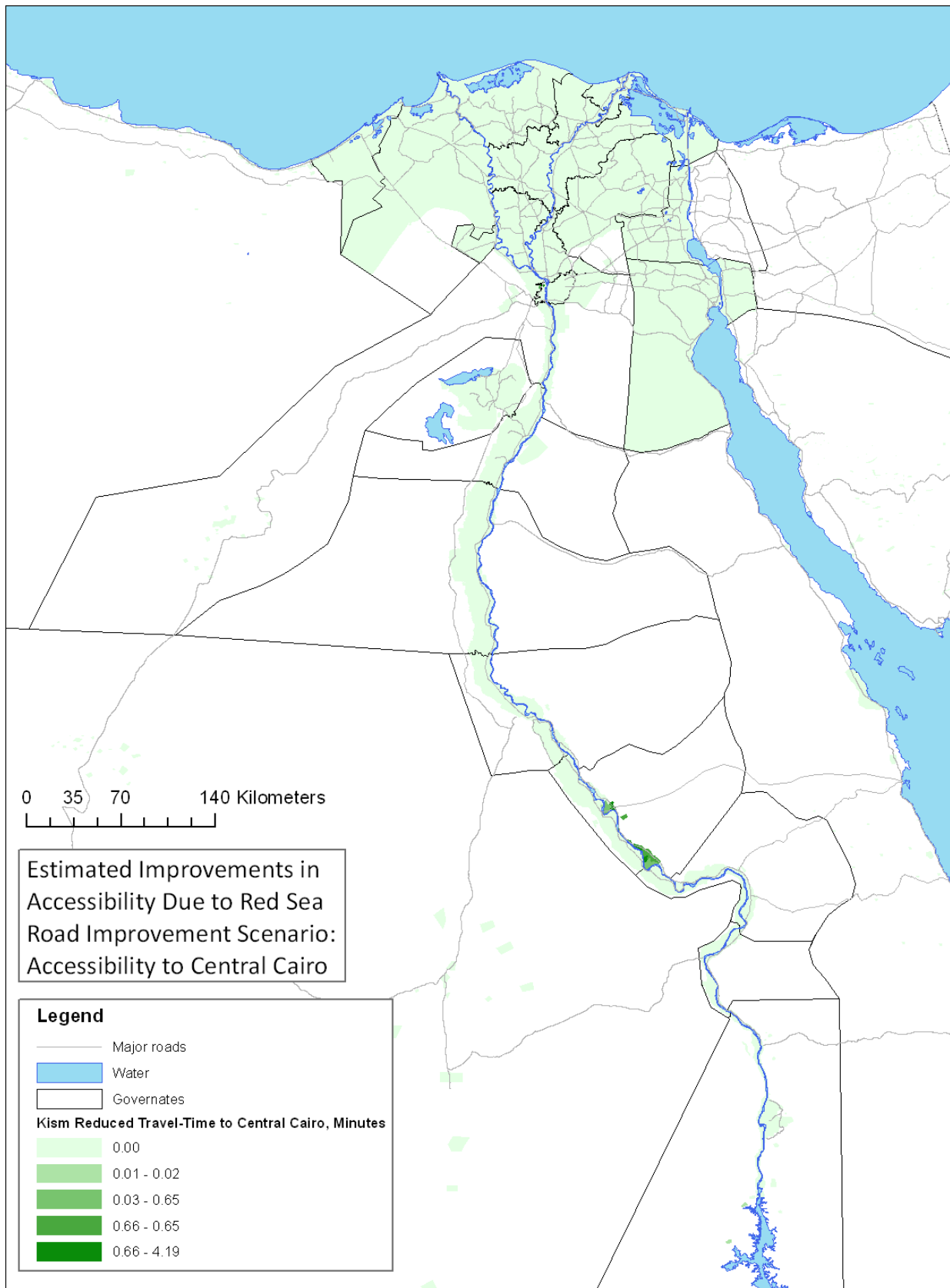
Map 18



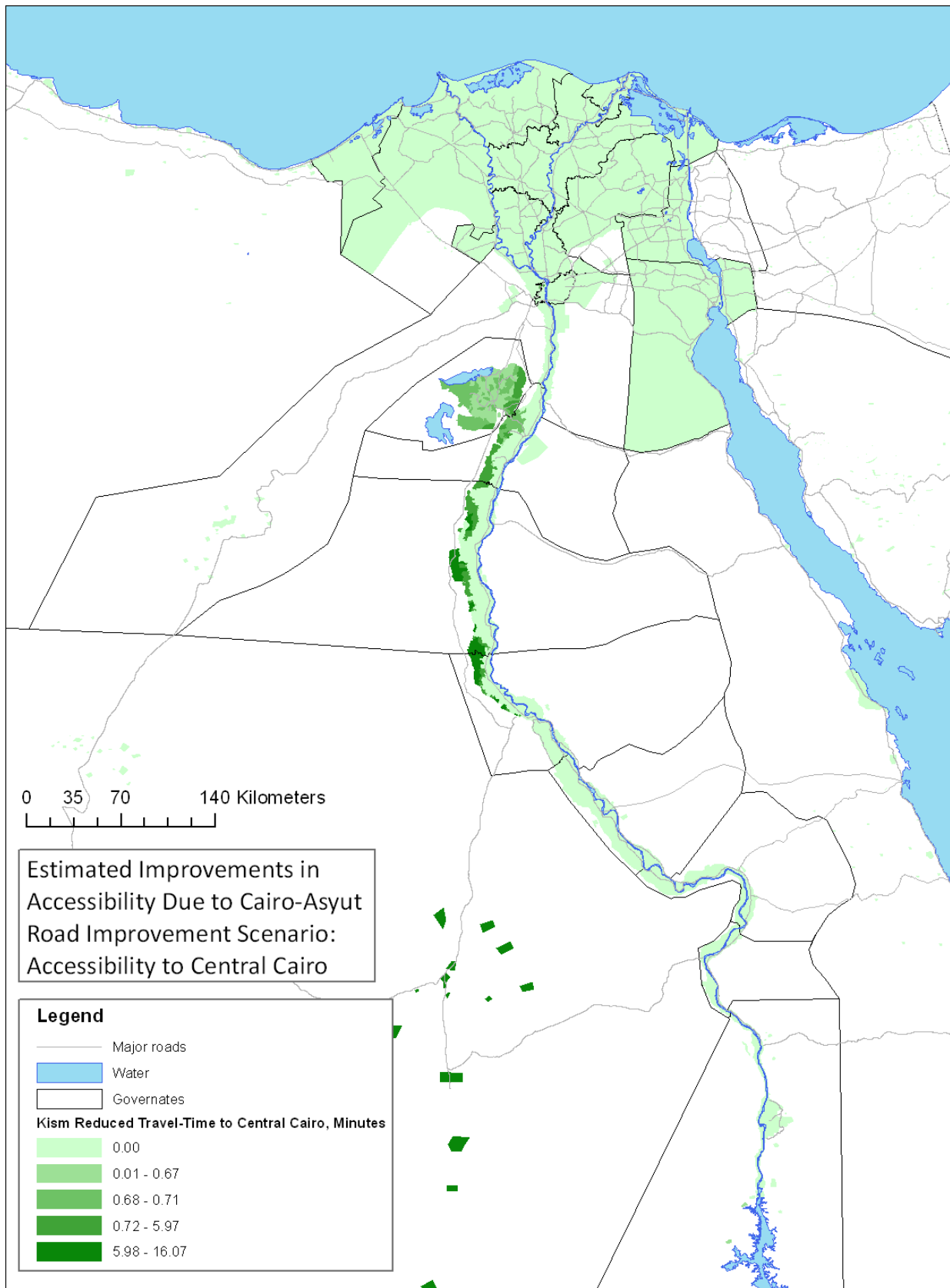
Map 19



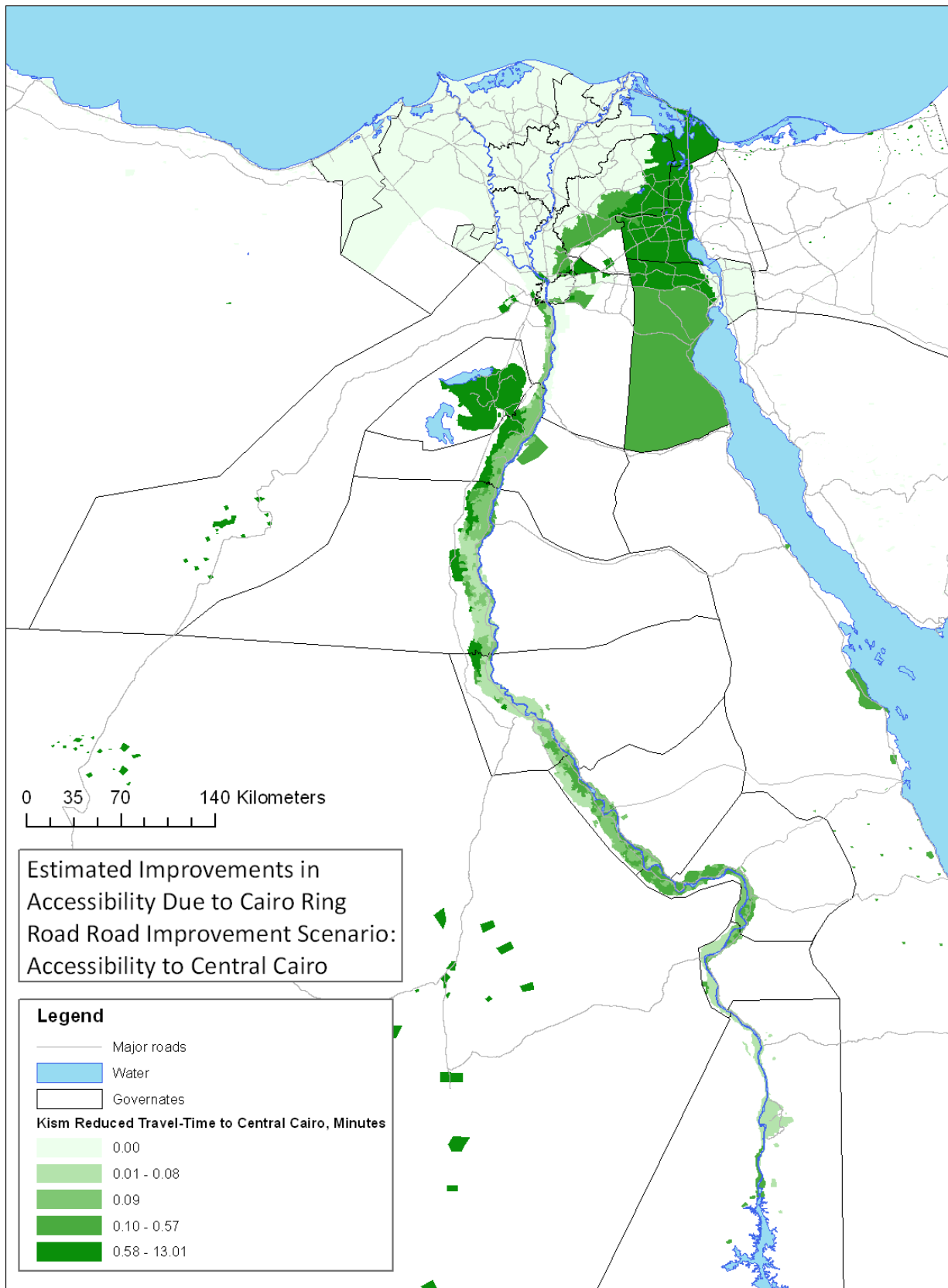
Map 20



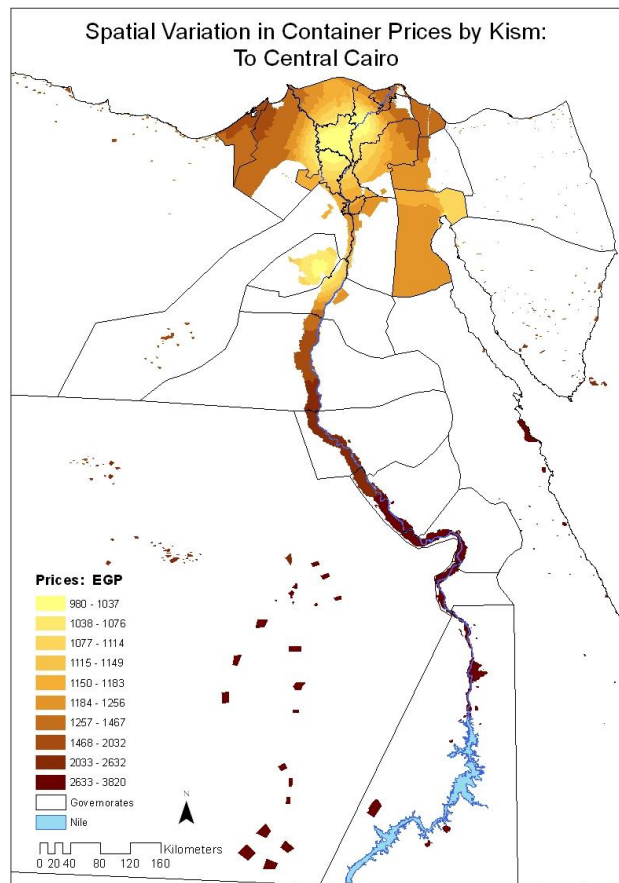
Map 21



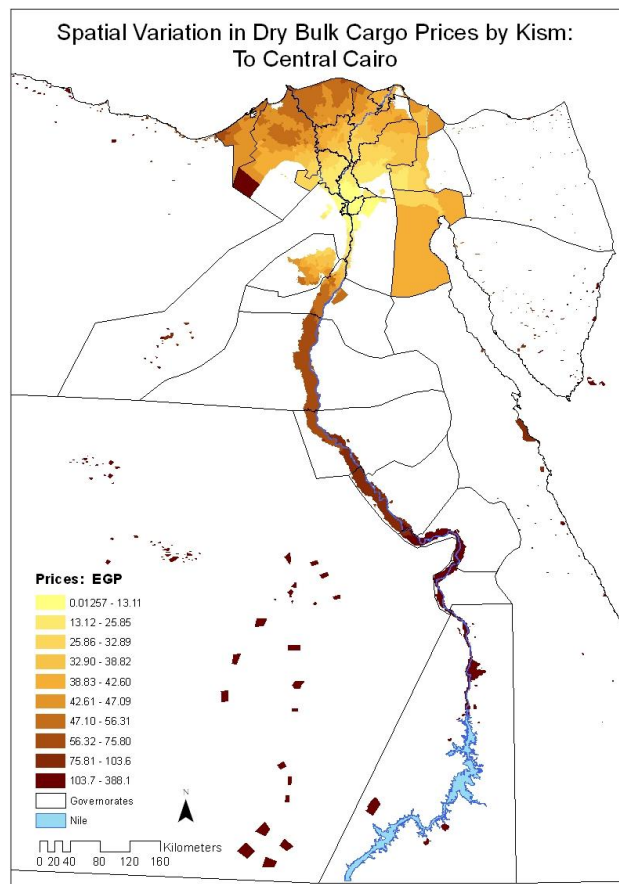
Map 22



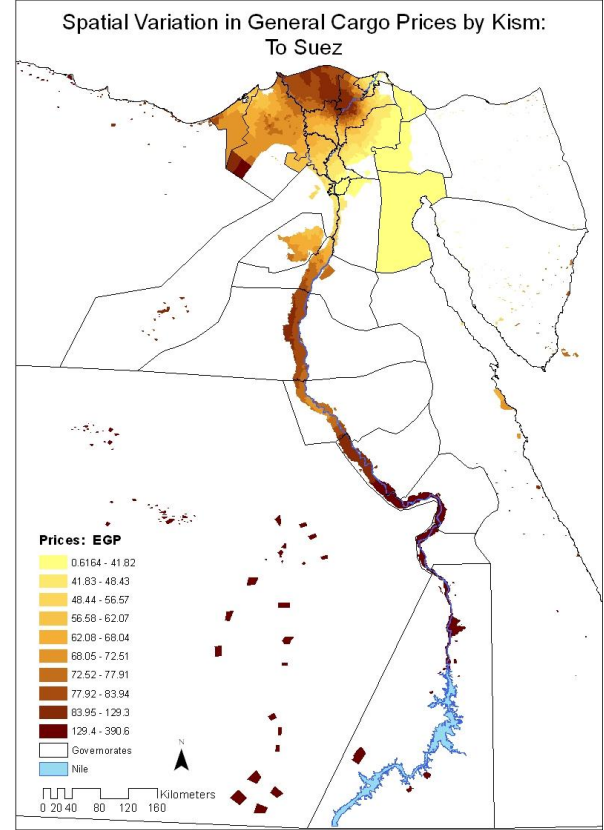
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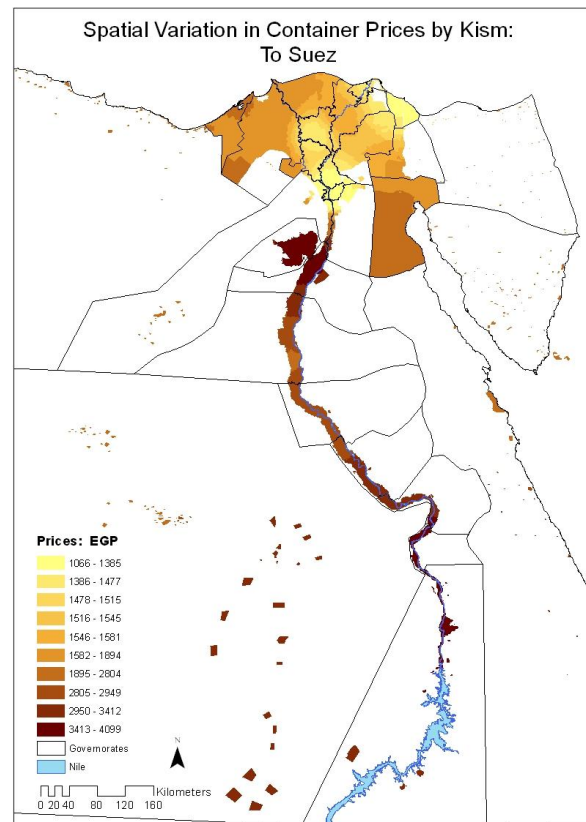
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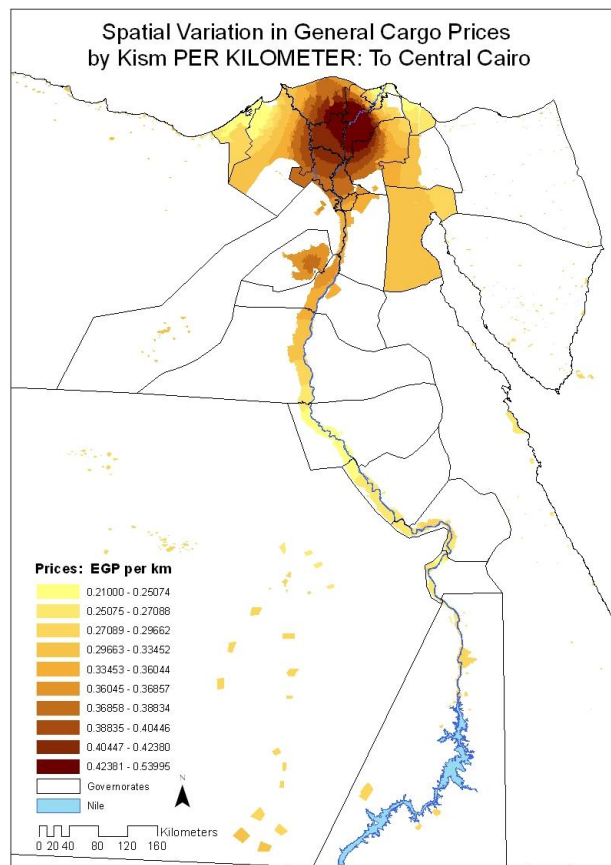
Map 25



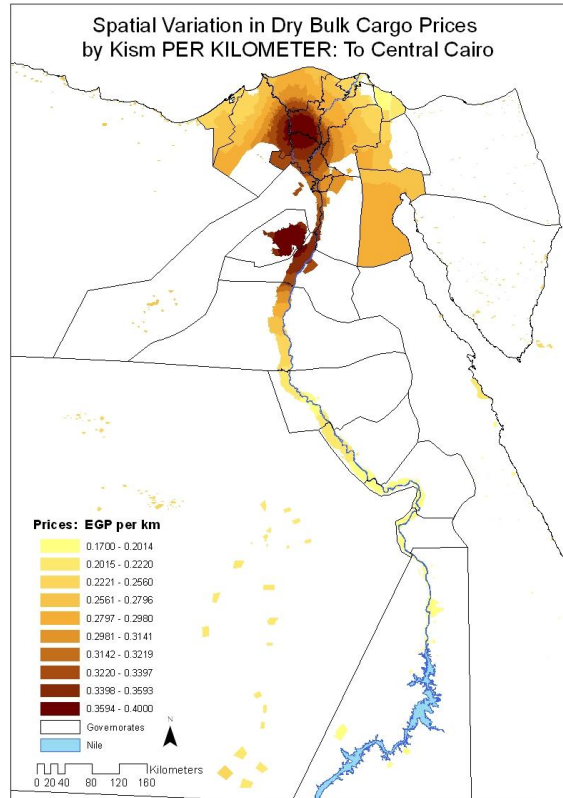
Map 26



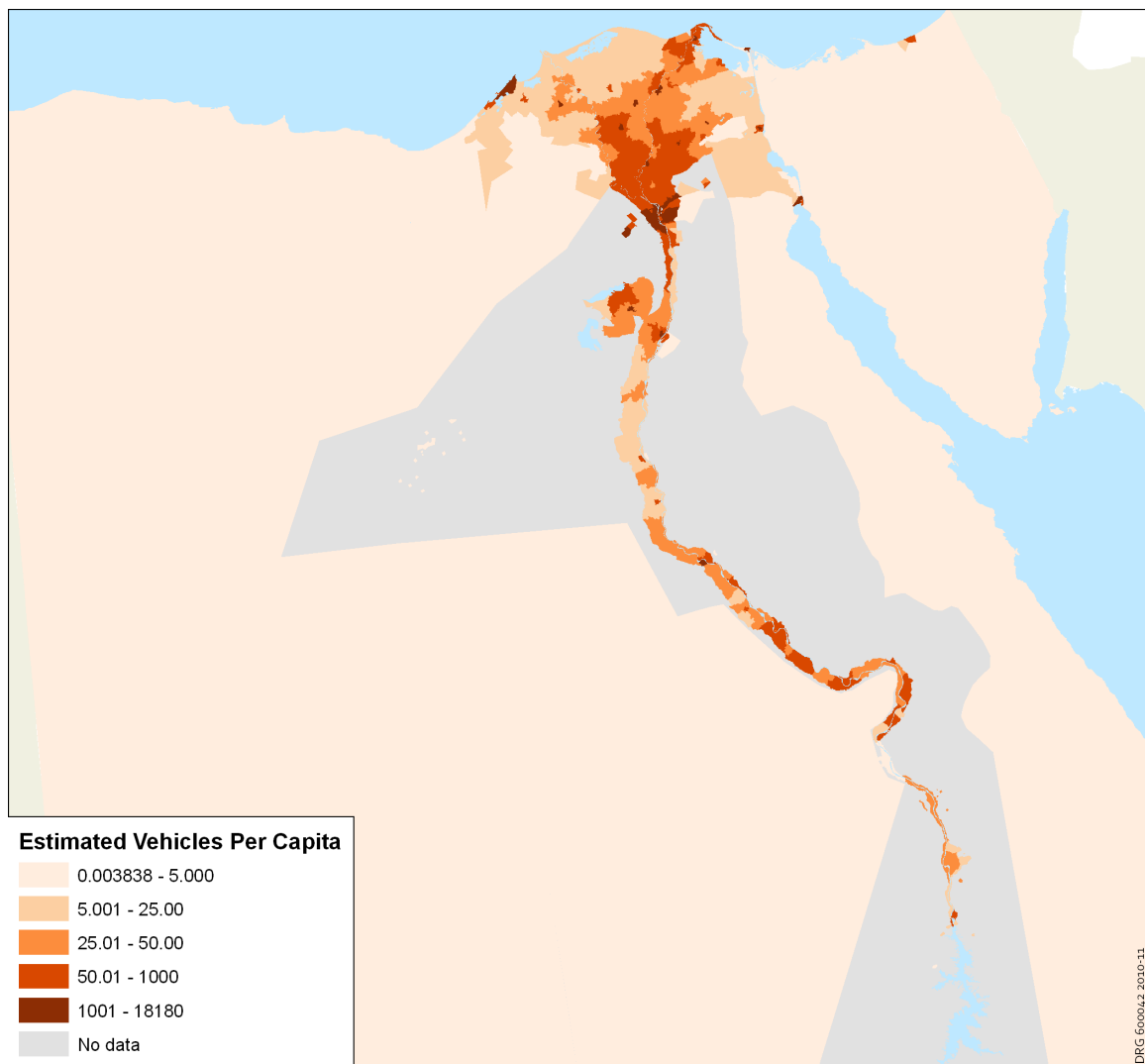
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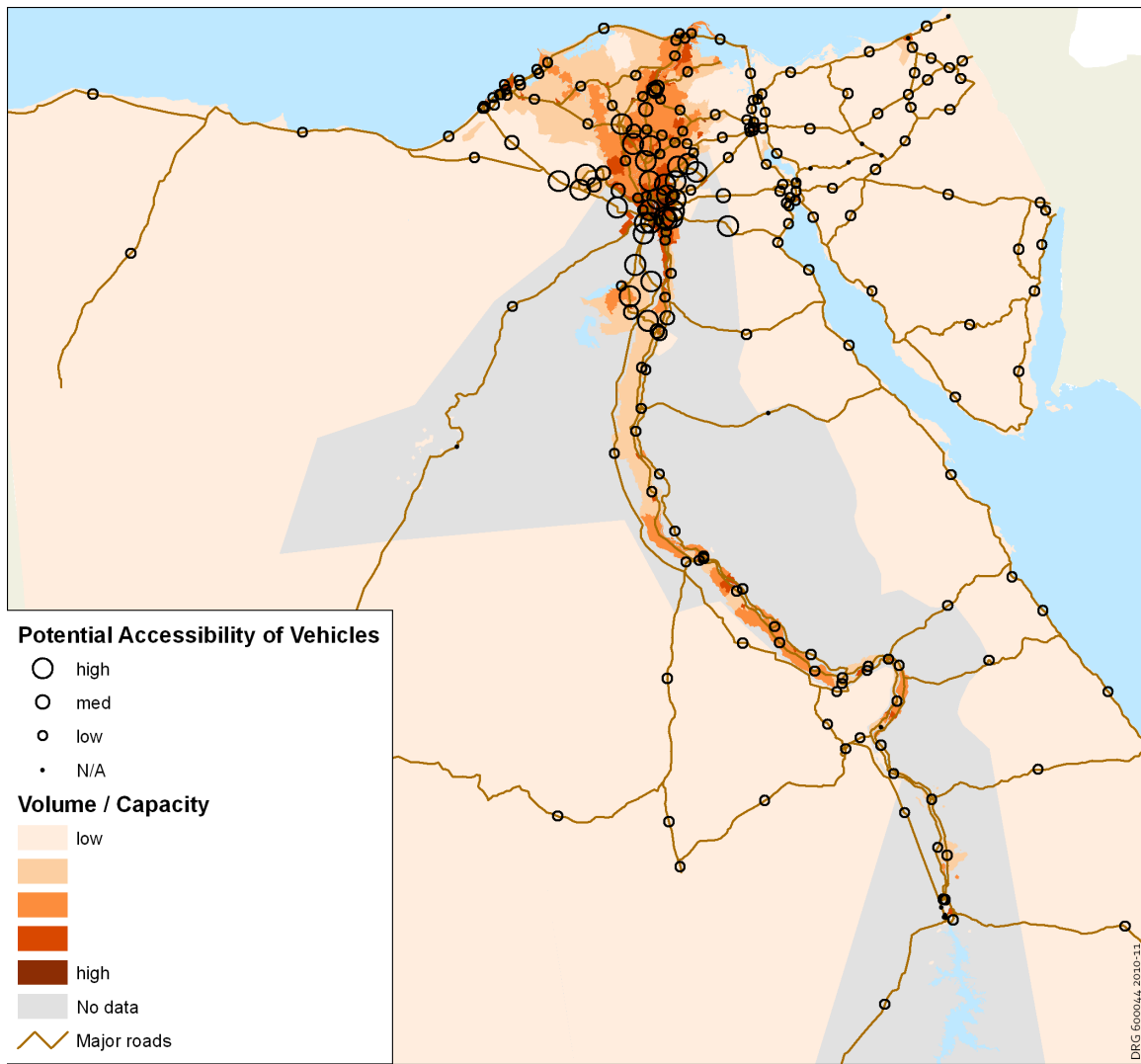
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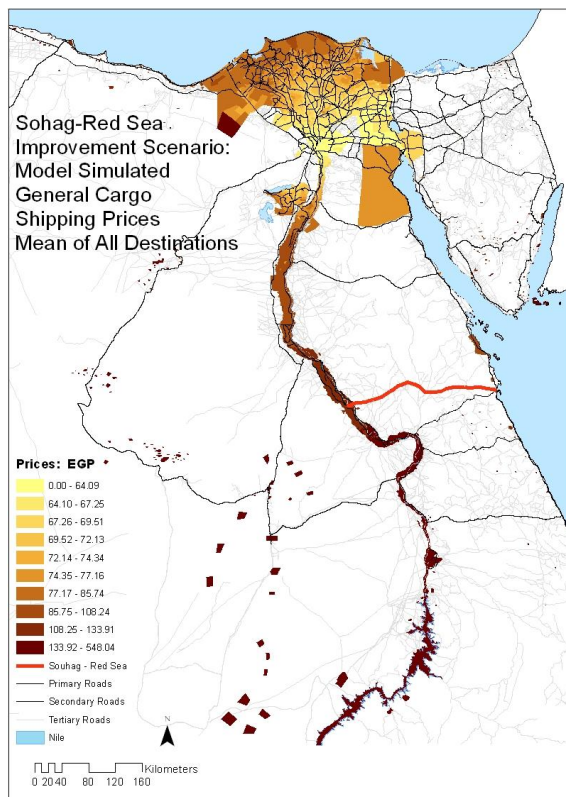
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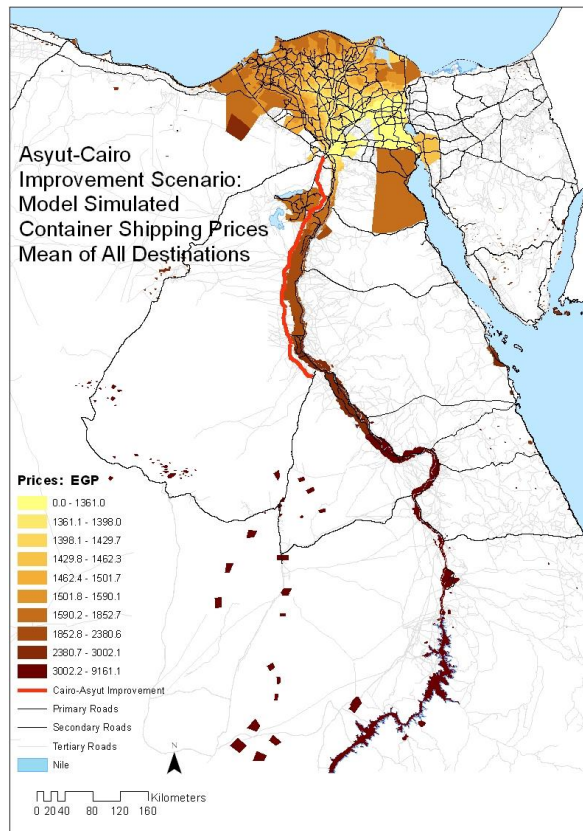
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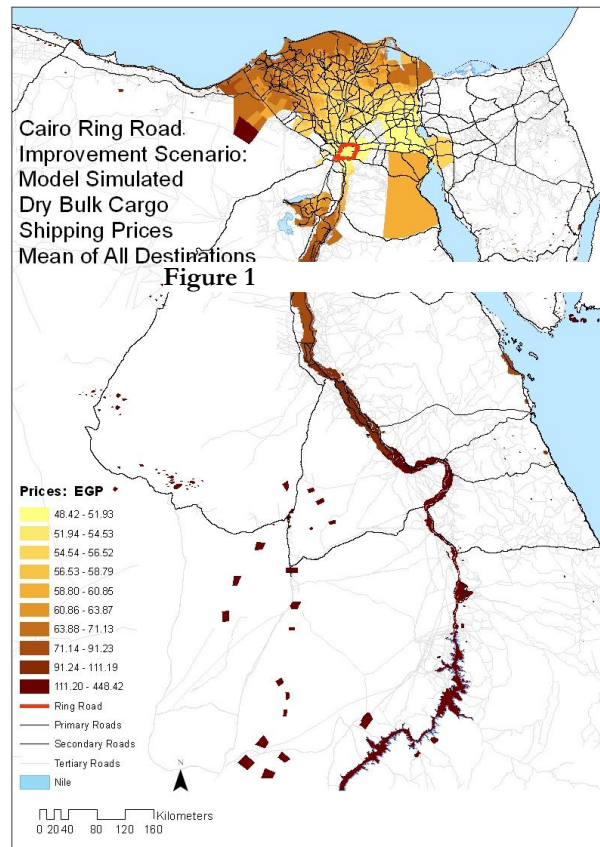
Map 31



Map 32



Map 33



Map 34

World Bank Study

Summary Report

October 2010

Growth from Knowledge
GfK Egypt



The agenda

2

1 Research Objectives and Methodology

2 Detailed Findings

- A. Small Operators
- B. Trucking Companies
 - I. General Cargo
 - II. Liquid Cargo
 - III. Bulk Cargo
 - IV. Container

3 Price Matrices

1. Research

Objectives and Methodology



Research objectives

4

The core objectives of the study are summarized as follows:

One Man Truck
Operators



- Estimate transport costs within Greater Cairo area (7 destinations)

Cooperative and
Trucking Companies



- Estimate transport costs for inter city transport (between Greater Cairo and other Governorates)

Methodology → The Study was conducted through face-to-face interviews with randomly selected companies within the above segments – One man truck operators, Transport companies and Cooperatives.

Sample Size – Small Operators

5

Areas	Sample Size
Central Cairo	10
Helwan	5
Giza	5
New Cairo	5
6 th October	6
10 th of Ramadan	5
Shubra El Kheima	6
Total	42

Sample Size – Trucking Companies/Public Transportation

6

Areas	Sample Size
Greater Cairo	14
Alexandria	4
Damietta	2
Tanta	2
Aswan City	2
Fayoum City	2
Port Said	2
Qena	2
Mansoura	2
Luxor	2
Suez	4
Assiut	2
Safaga	2
Total	42

Cooperative → ONE Interview



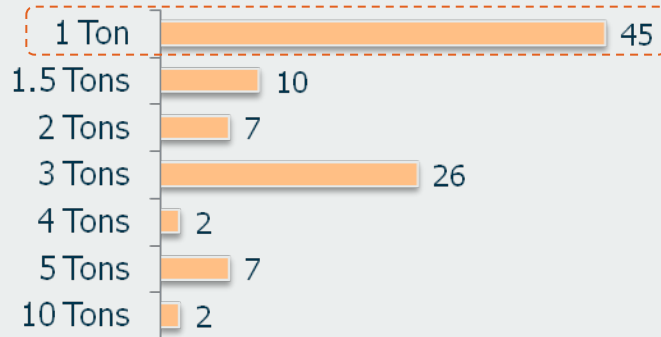
2. Detailed Findings



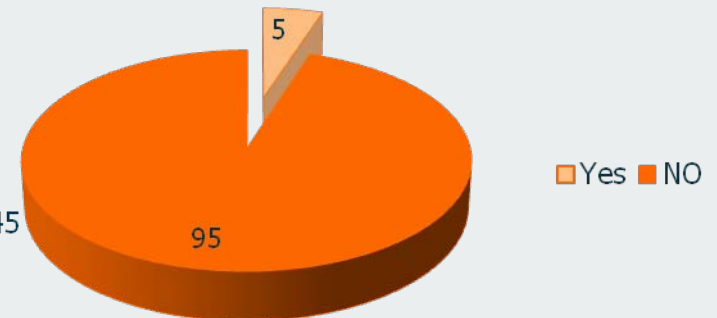
A. Small Operators

Most Frequent Commodity and Truck Capacity

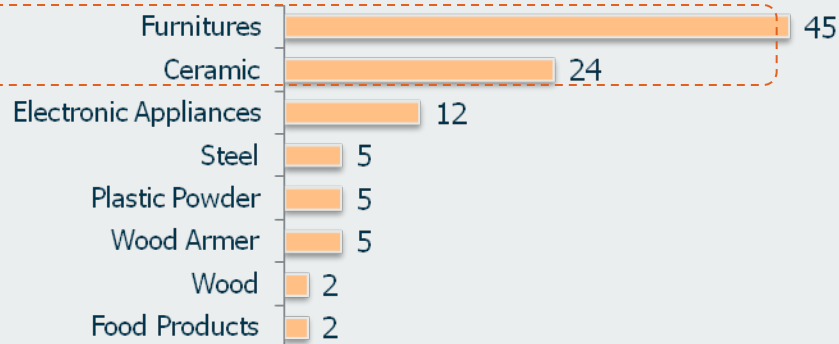
Truck Capacity



Percentage of Loading / unloading Process



Commodities



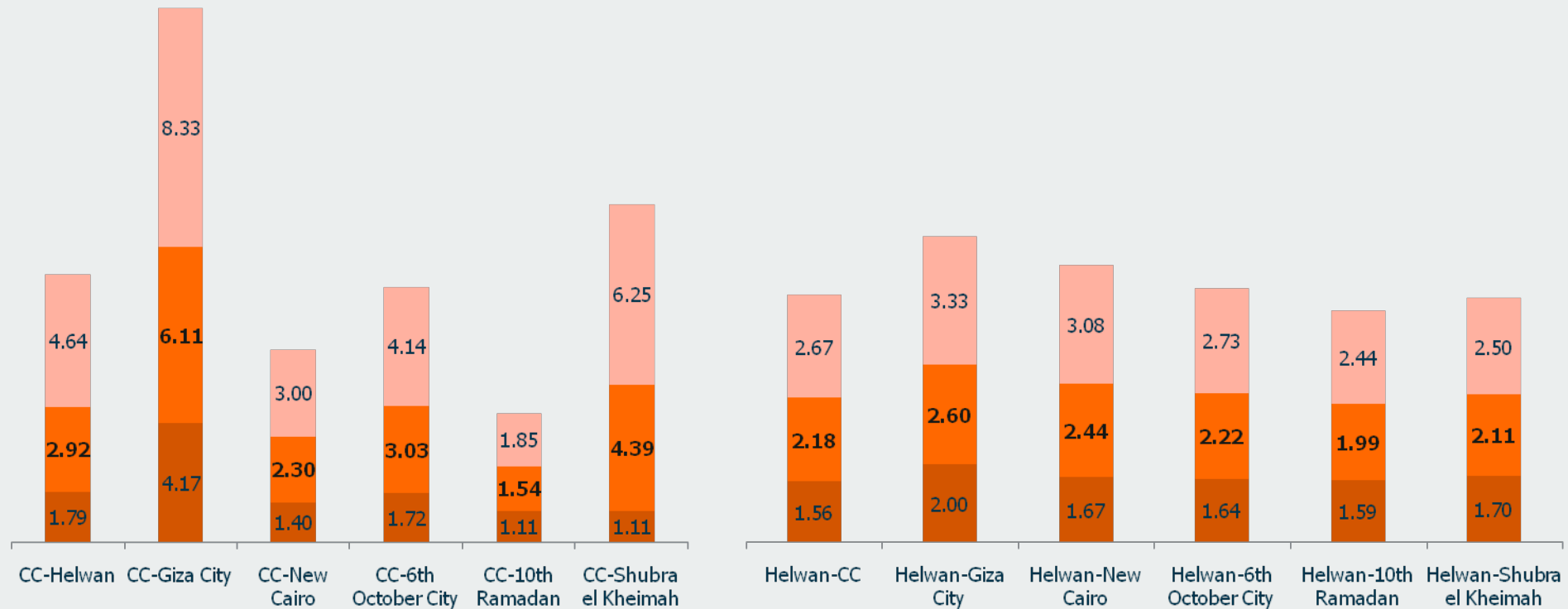
A. Small Operators

Transportation Cost/Ton/ KM between;

- . Central Cairo to different destinations
- . Helwan to different destinations

10

■ Minimum ■ Mean ■ Maximum



Central Cairo - Base: N=10

Helwan - Base: N=5

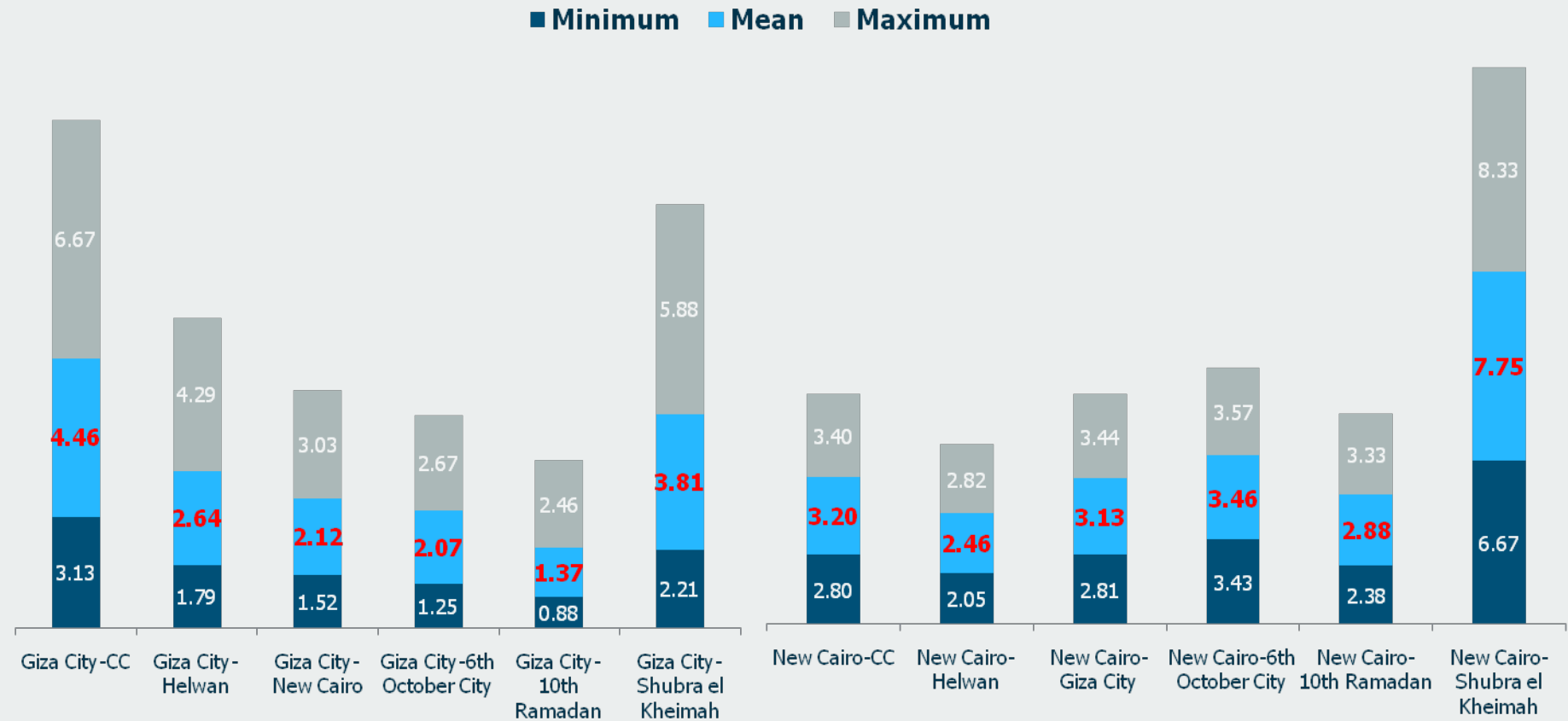
CC → Central Cairo

A. Small Operators (Cont'd)

Transportation Cost/Ton/ KM between;

- . Giza City to different destinations
- . New Cairo to different destinations

11



Giza City - Base: N=5

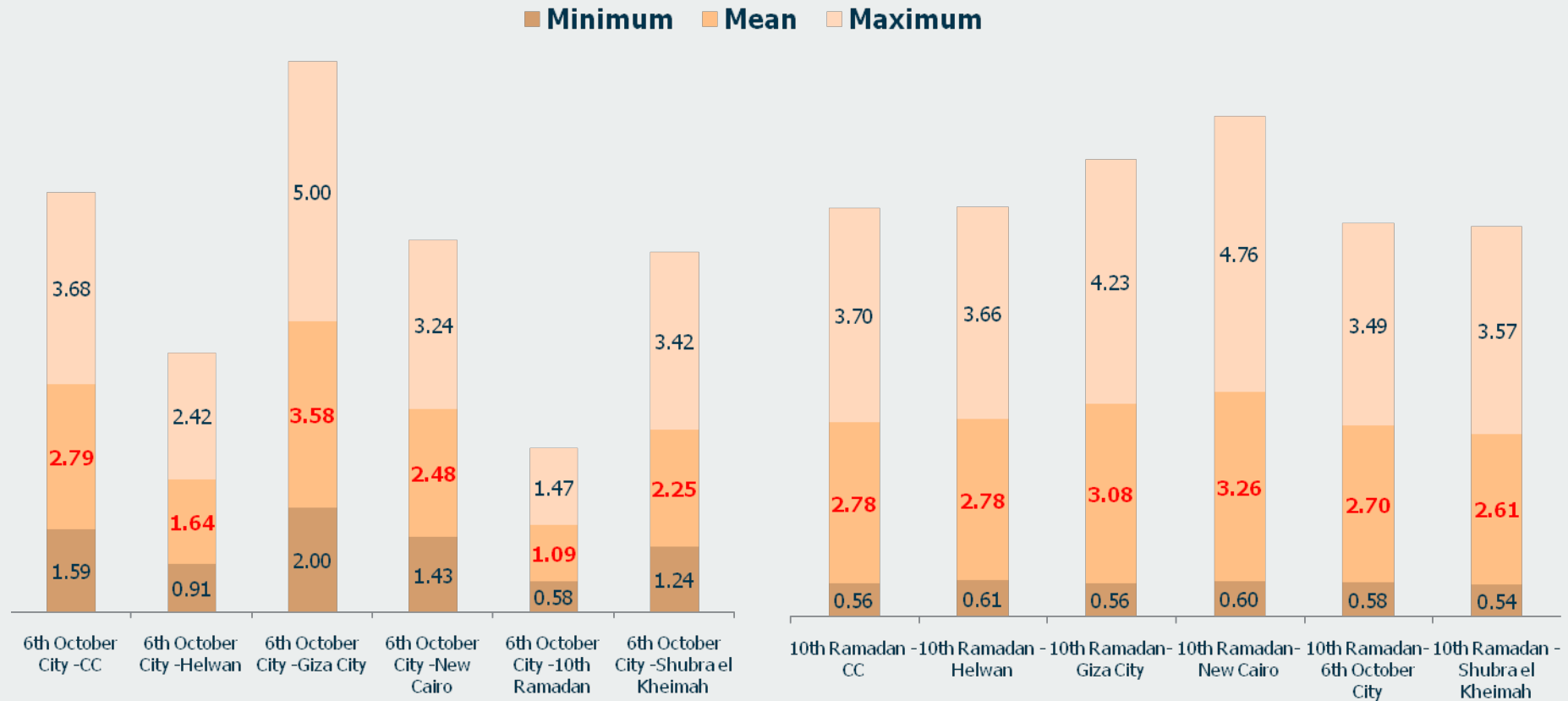
New Cairo - Base: N=5

A. Small Operators (Cont'd)

Transportation Cost/Ton/ KM between;

- . 6th October to different destinations
- . 10th of Ramadan to different destinations

12



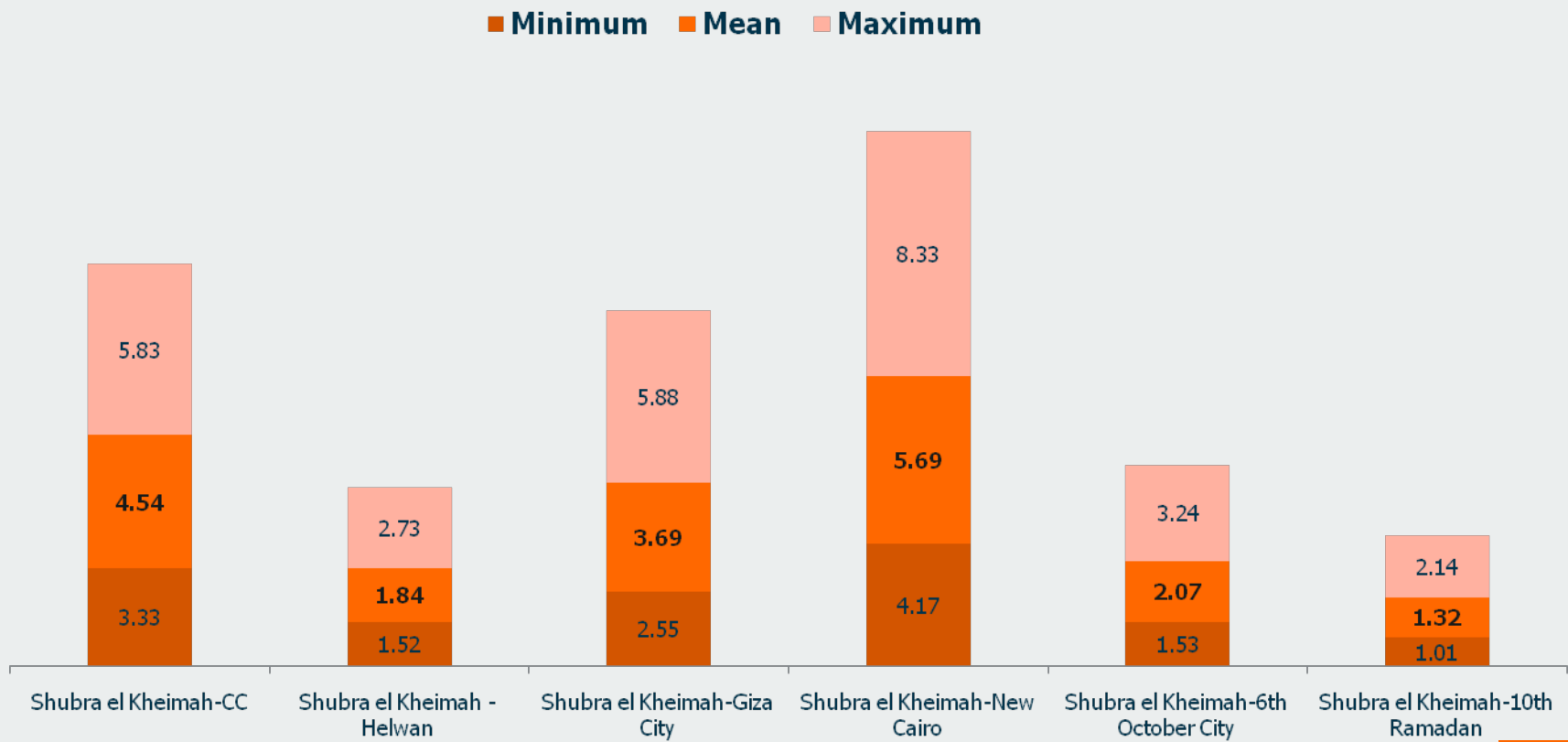
6th October - Base: N=6

10th of Ramadan - Base: N=5

A. Small Operators (Cont'd)

Transportation Cost/Ton/ KM between;
. Shubra El Kheima to different destinations

13

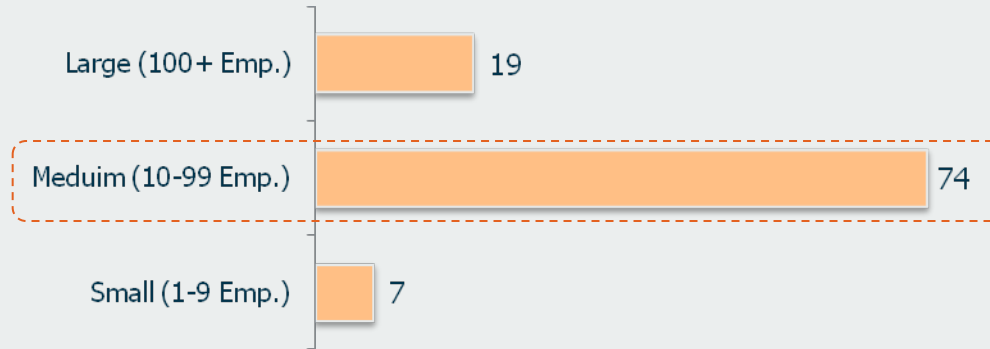


Shubra El Kheima - Base: N=6

B. Trucking Companies

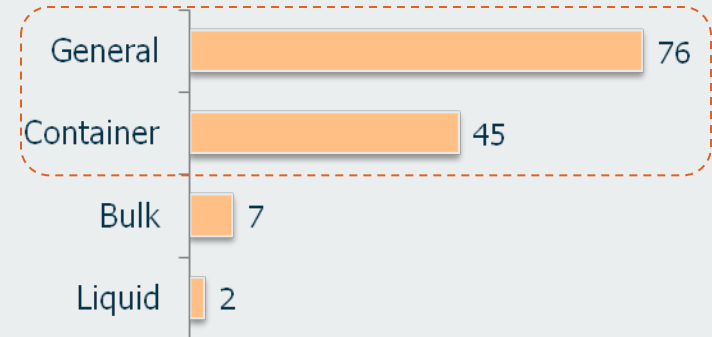
Company Size/Type of Cargos/Truck Capacity

Commodities



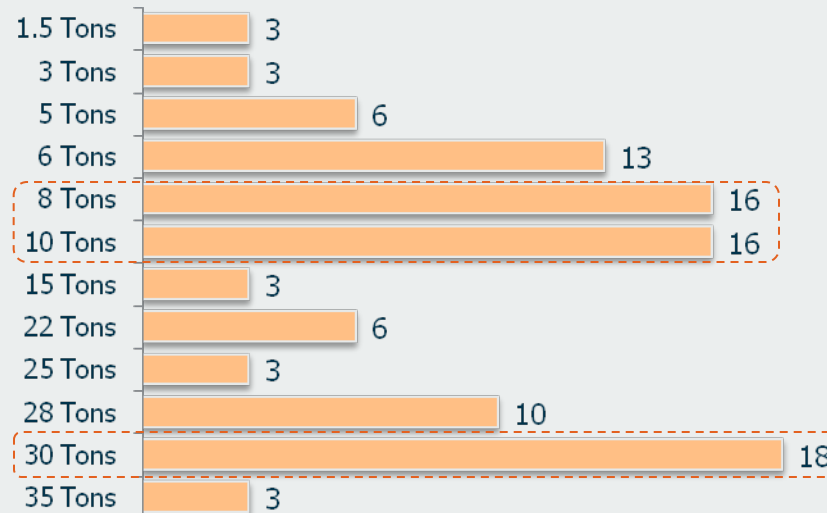
Base: All Respondents – N=42

Type of Cargos



Base: All Respondents – N=42

Most Frequent Truck Capacity - General Cargo



Base: N=32

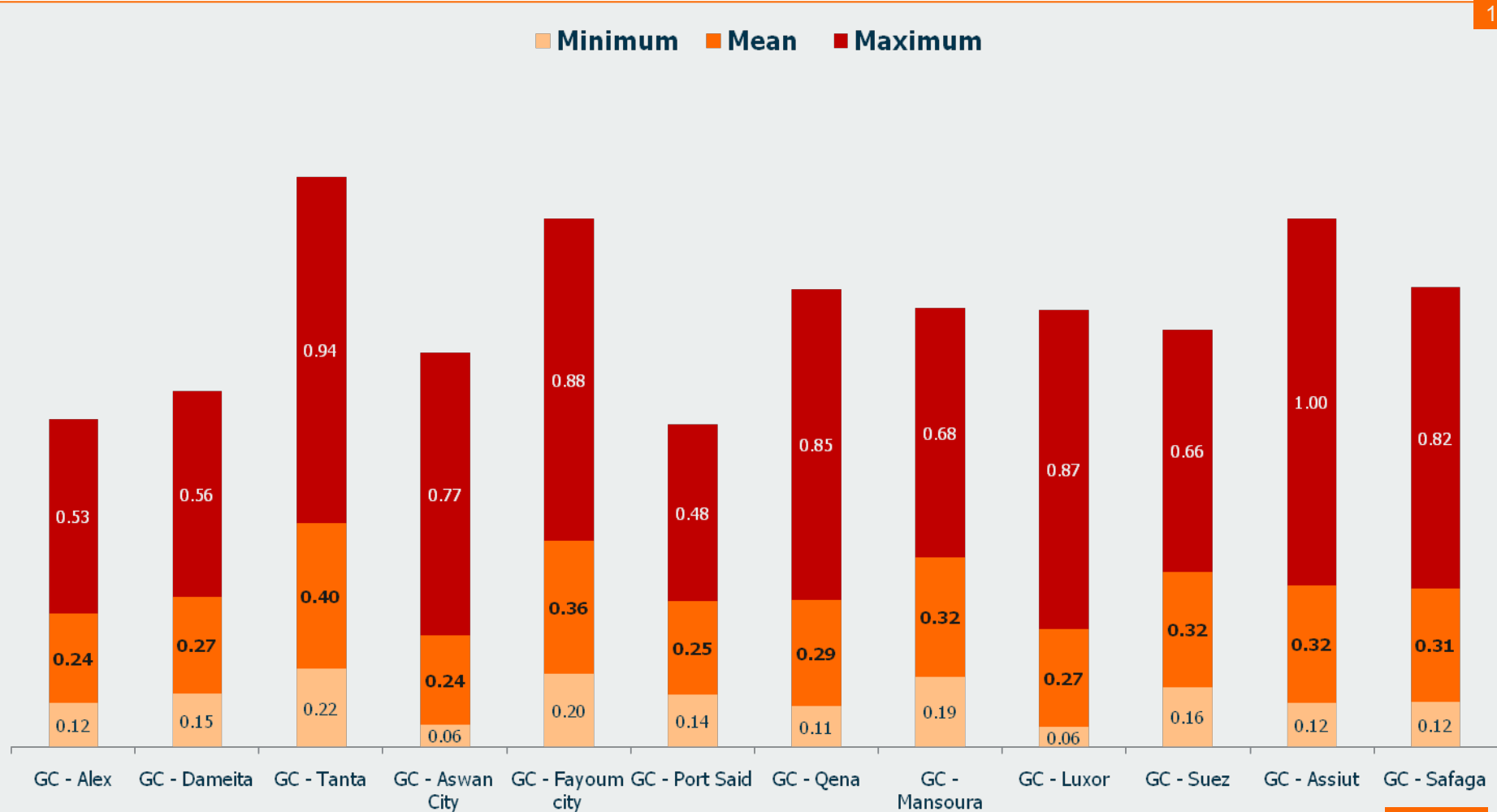
15

%

I. General Cargo

B. Trucking companies – General Cargo

Transportation Cost/Ton/KM between Greater Cairo and other Governorates



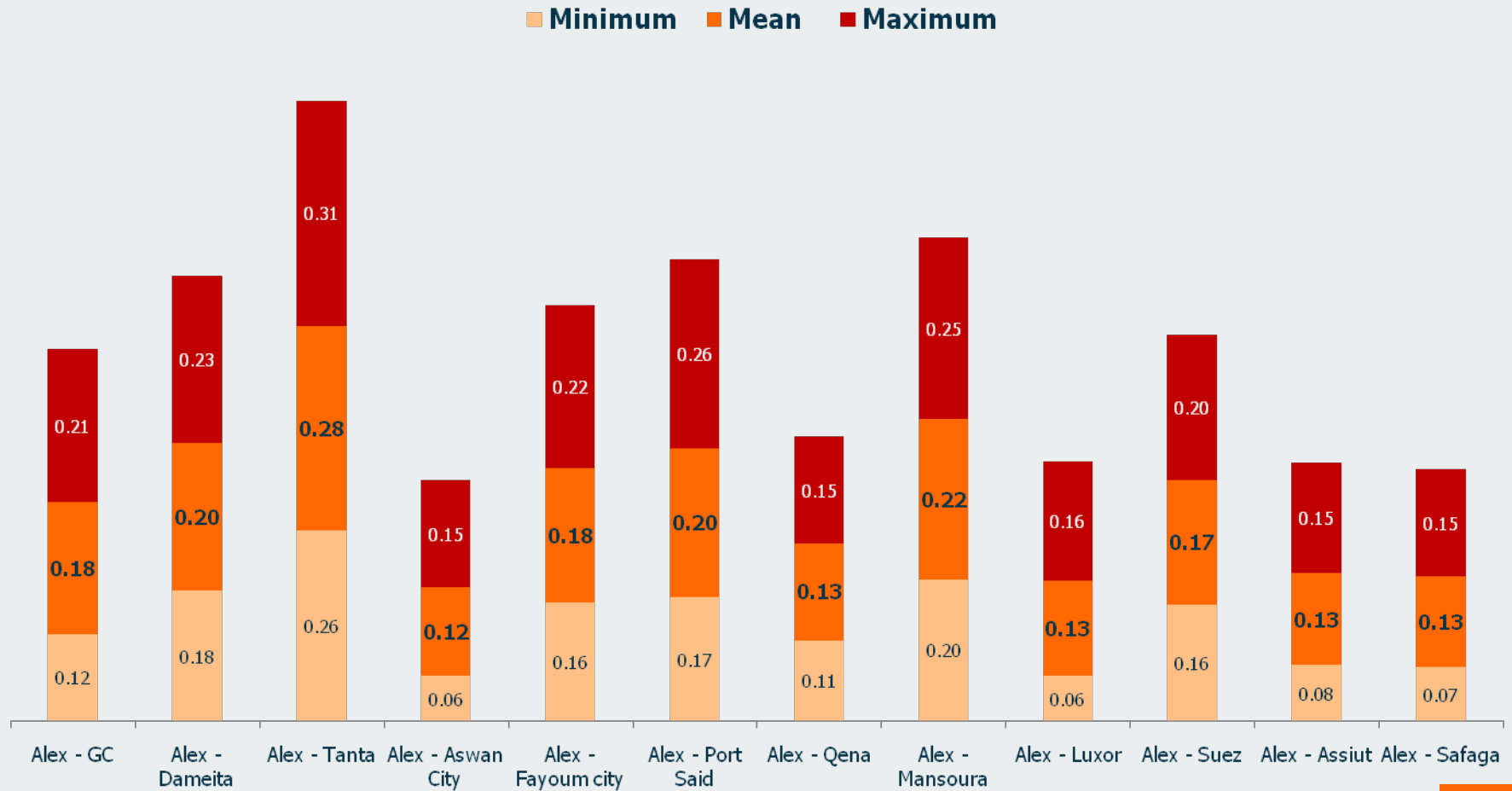
17

Greater Cairo - Base: N=14

GC → Greater Cairo

B. Trucking companies – General Cargo (Cont'd)

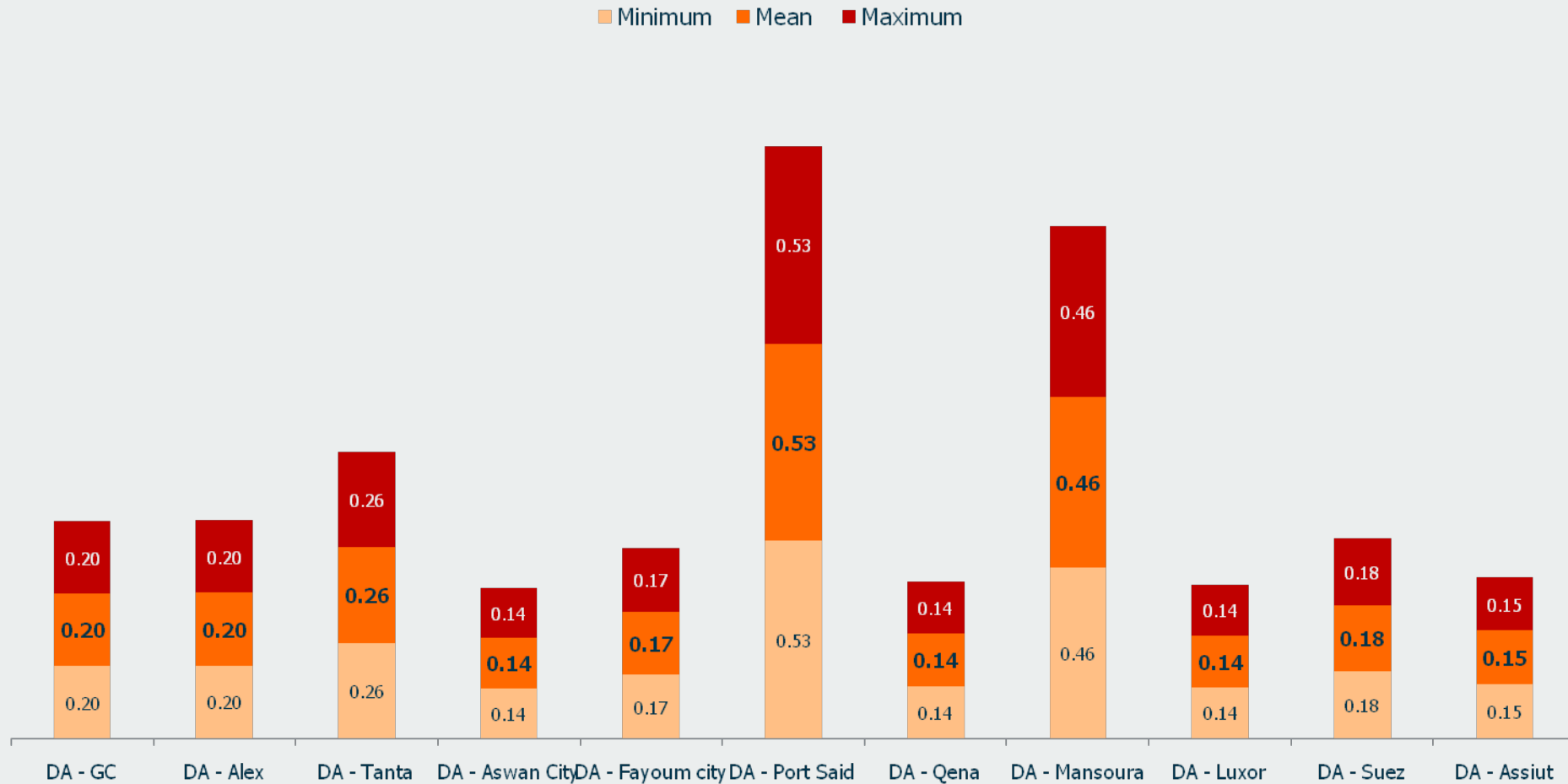
Transportation Cost/Ton/KM between Alexandria and other Governorates



B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Damietta and other Governorates

19



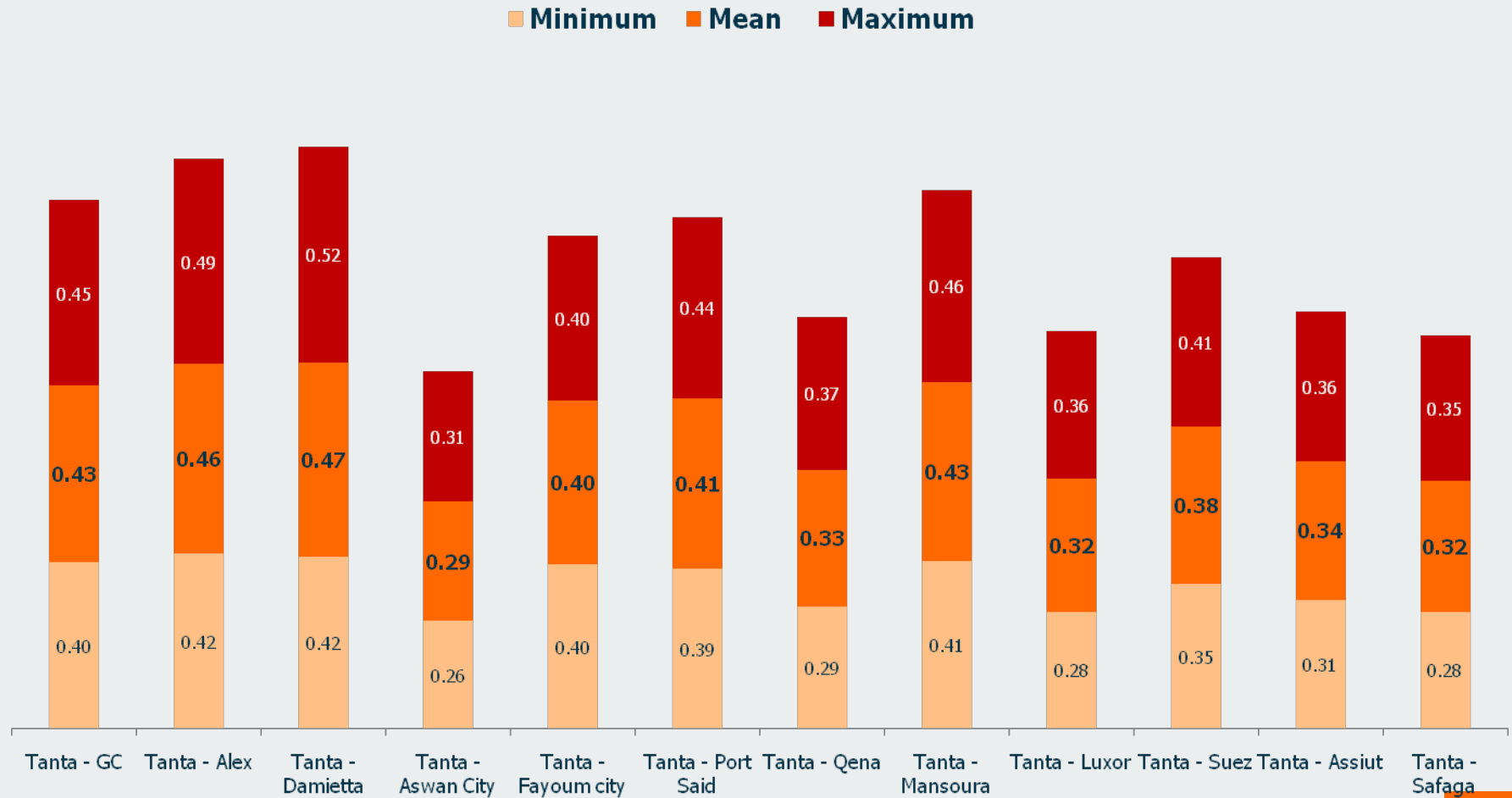
Damietta - Base: N=2

DA → Damietta

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Tanta and other Governorates

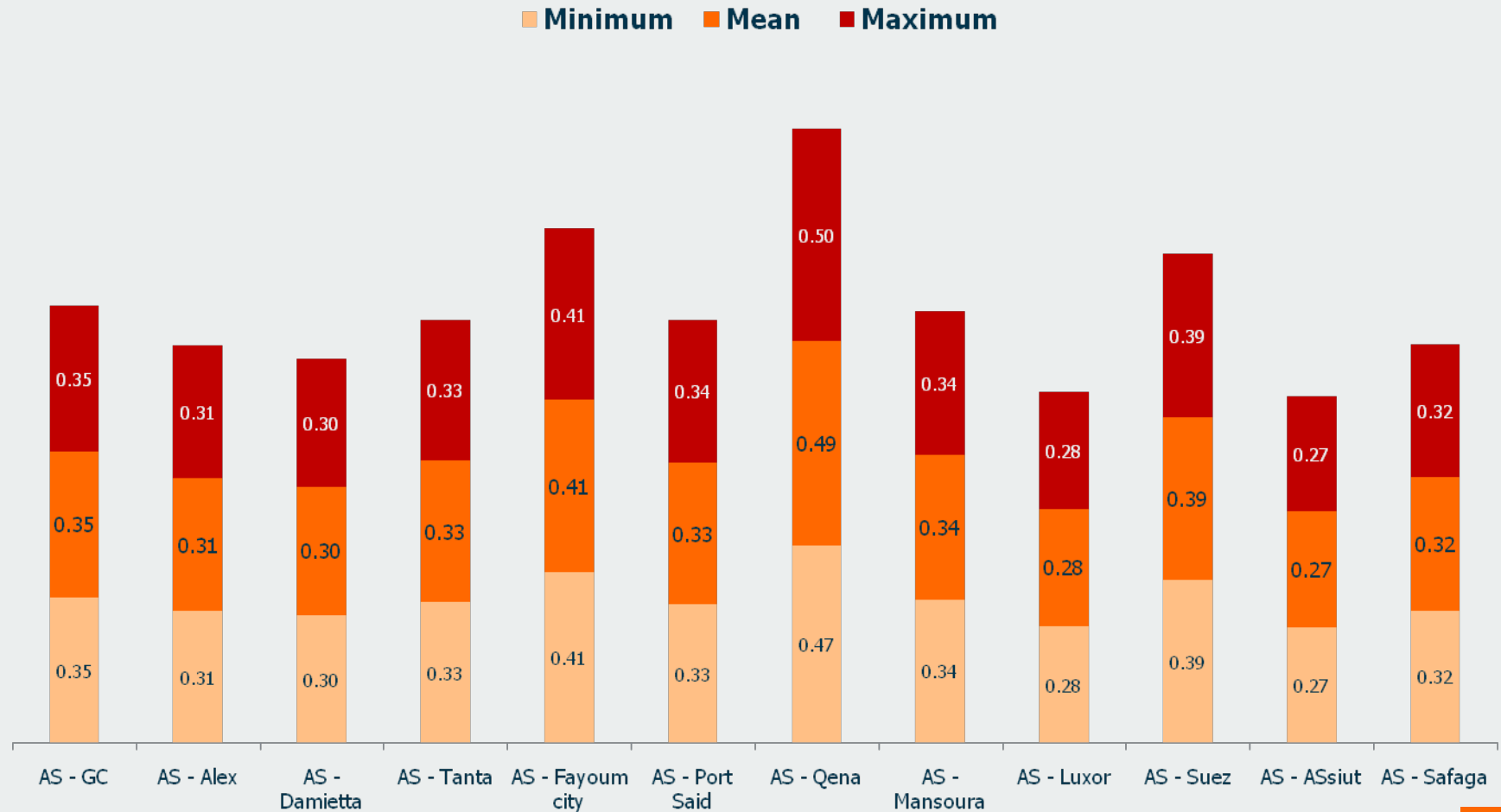
20



Tanta - Base: N=2

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Aswan and other Governorates



21

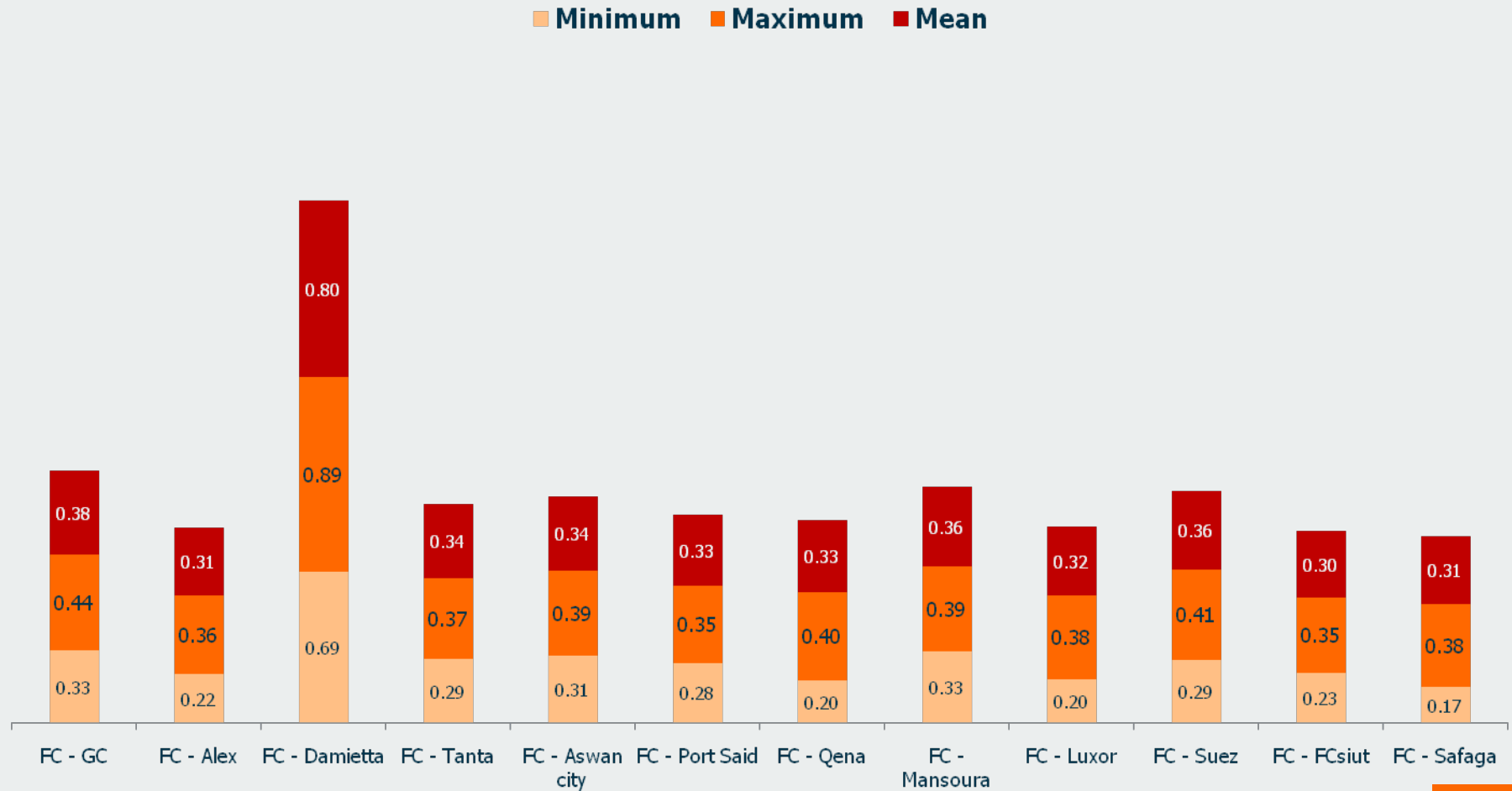
Aswan - Base: N=2

AS → Aswan

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Fayoum and other Governorates

22



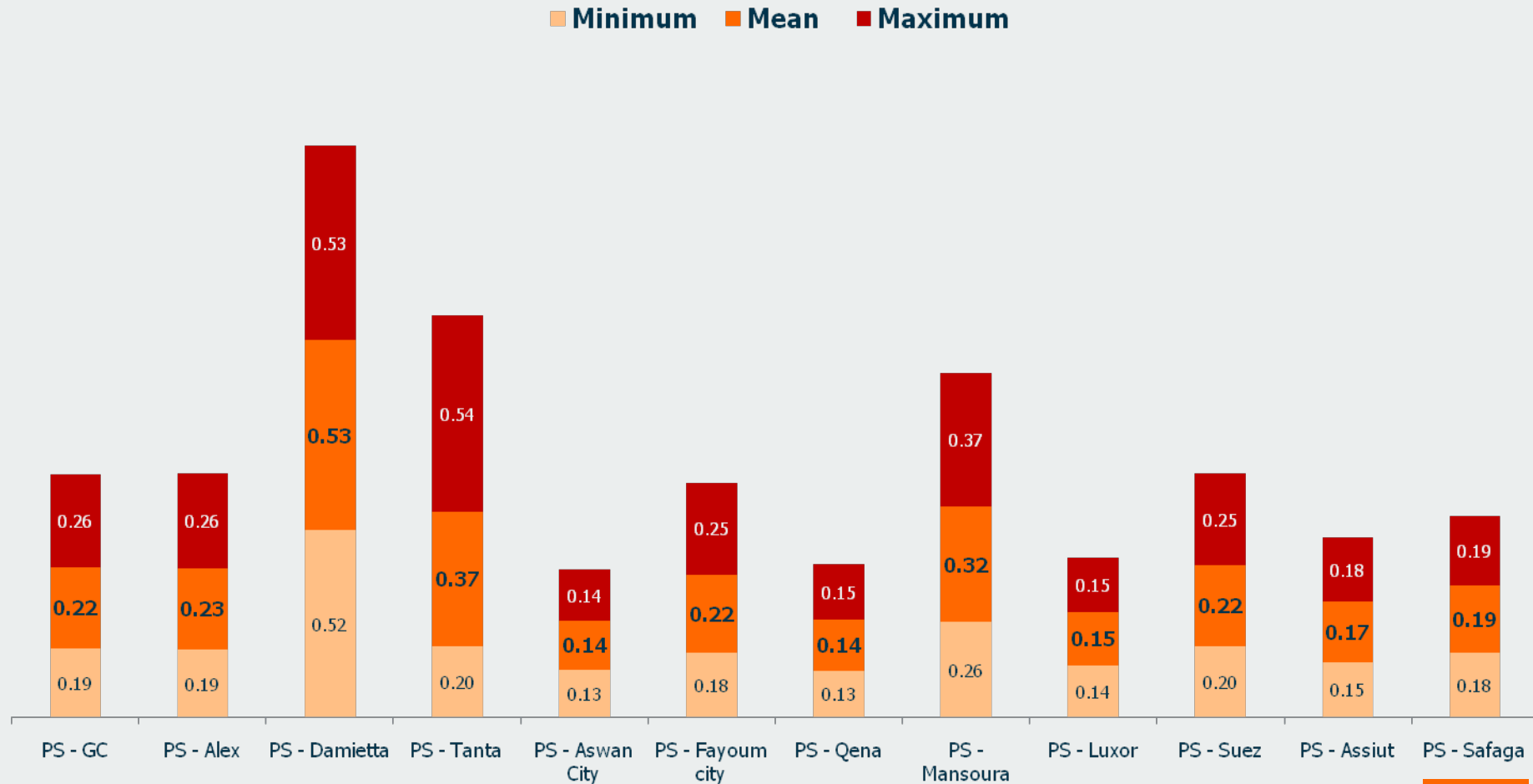
Fayoum - Base: N=2

FC → Fayoum City

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Port Said and other Governorates

23



Port Said - Base: N=2

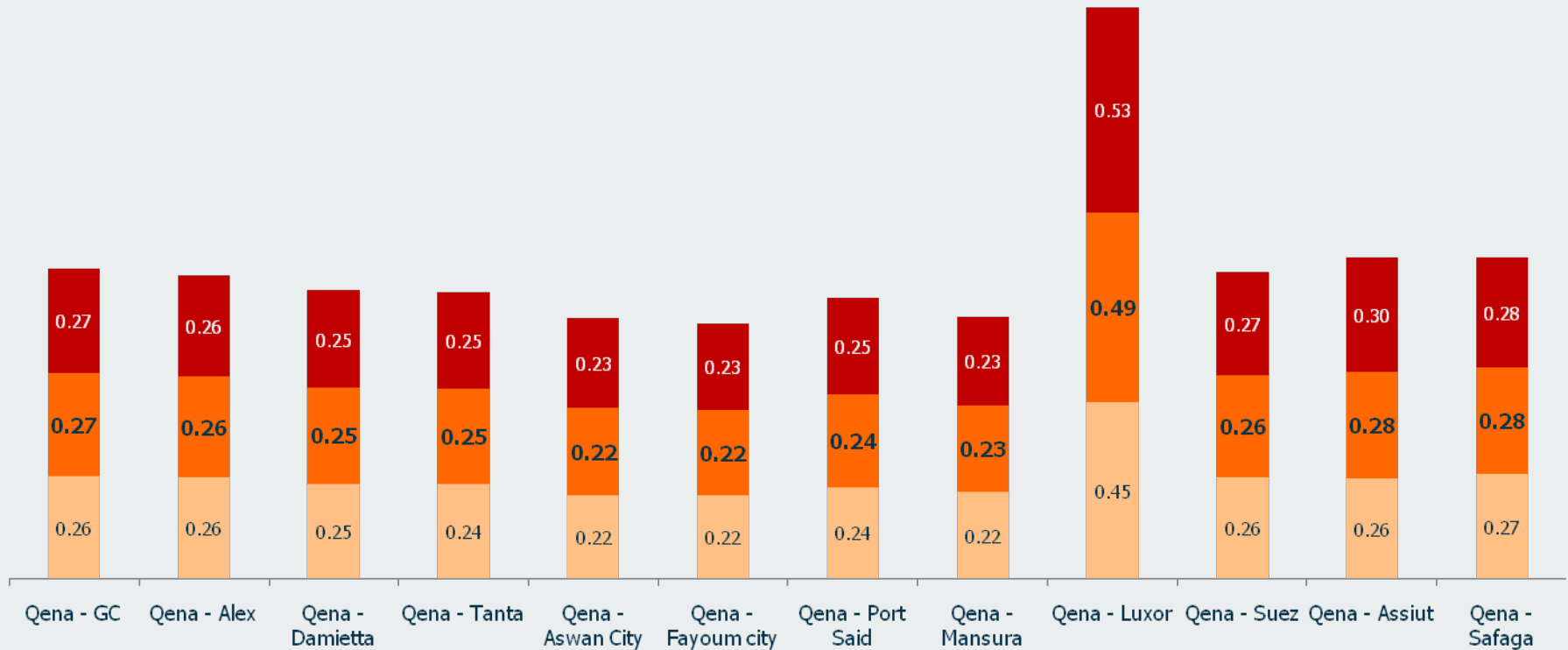
PS → Port Said

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Qena and other Governorates

24

Minimum Mean Maximum



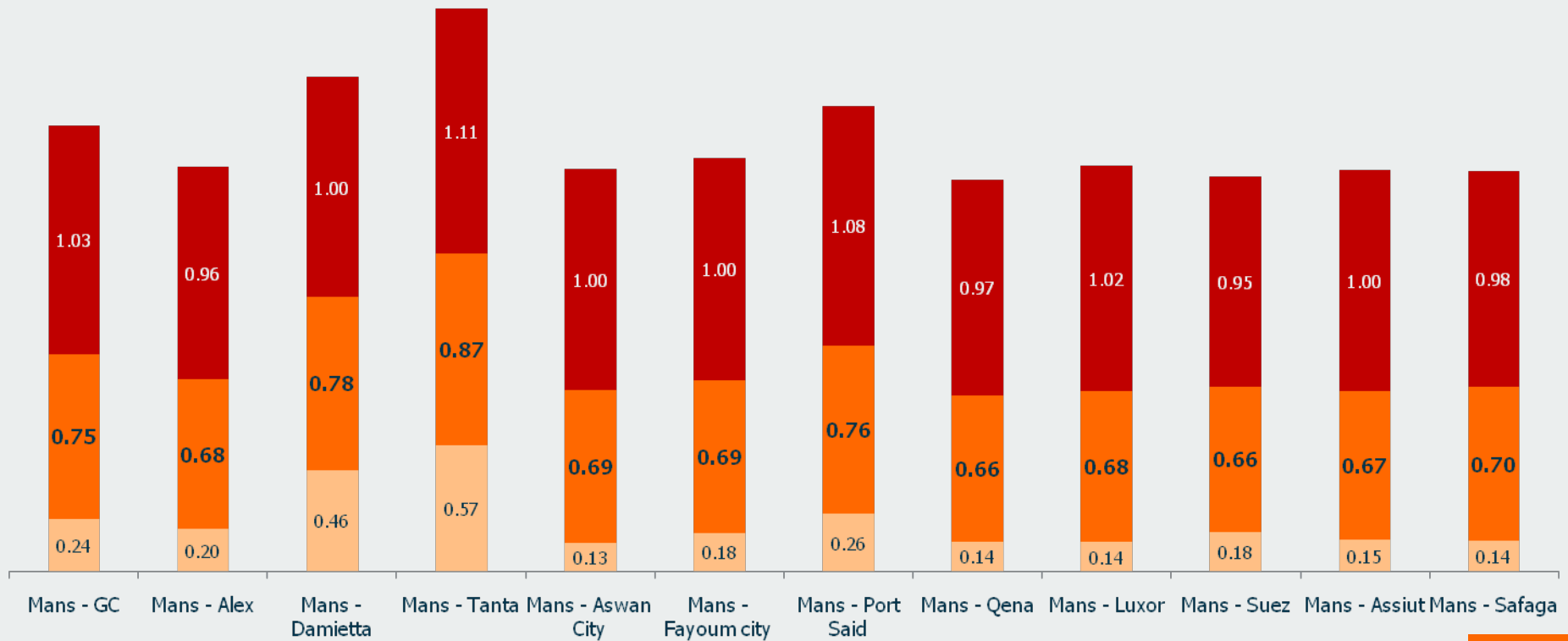
Qena - Base: N=2

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Mansoura and other Governorates

25

Minimum Mean Maximum



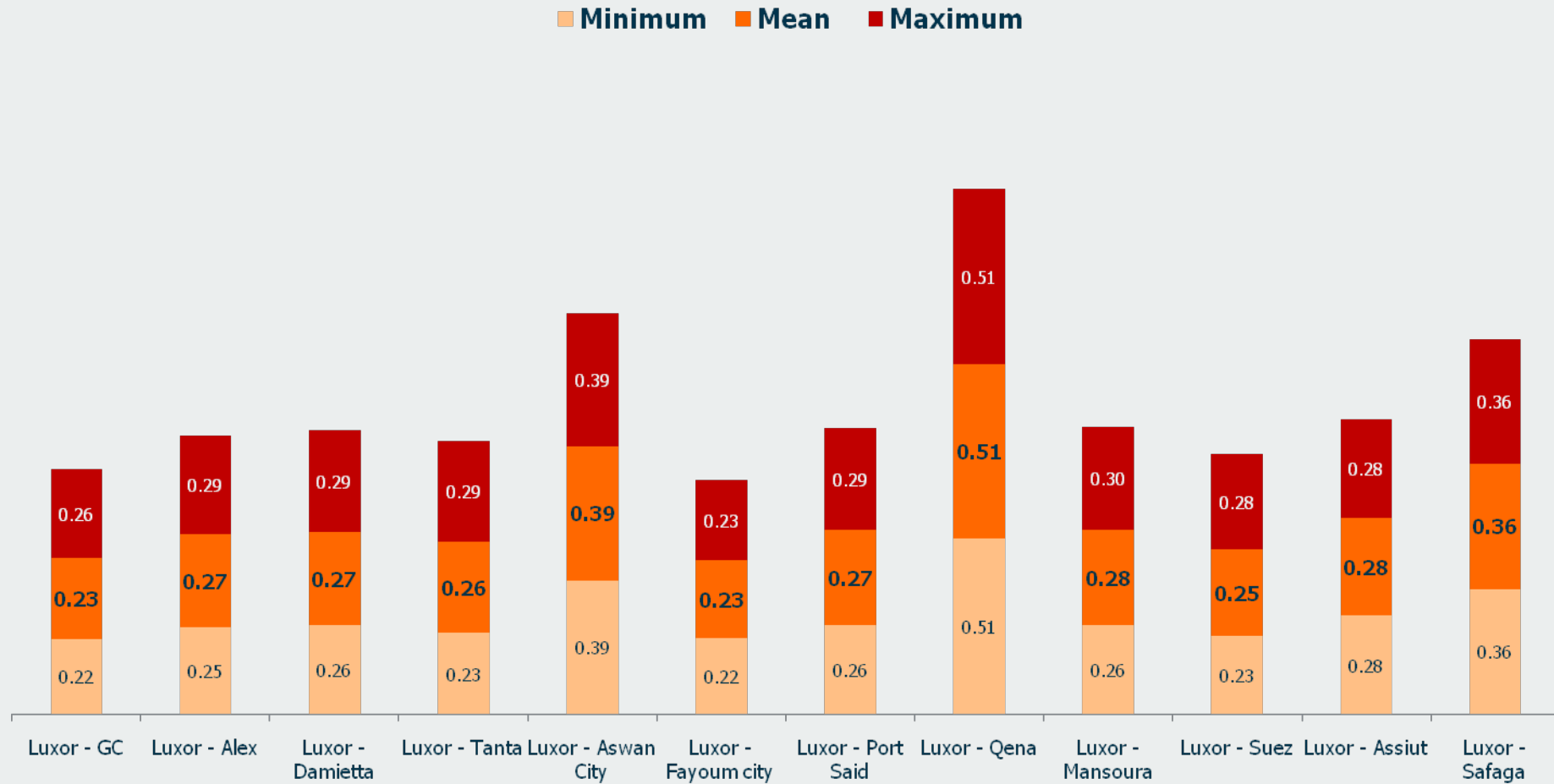
Mansoura - Base: N=2

Mans → Mansoura

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Luxor and other Governorates

26



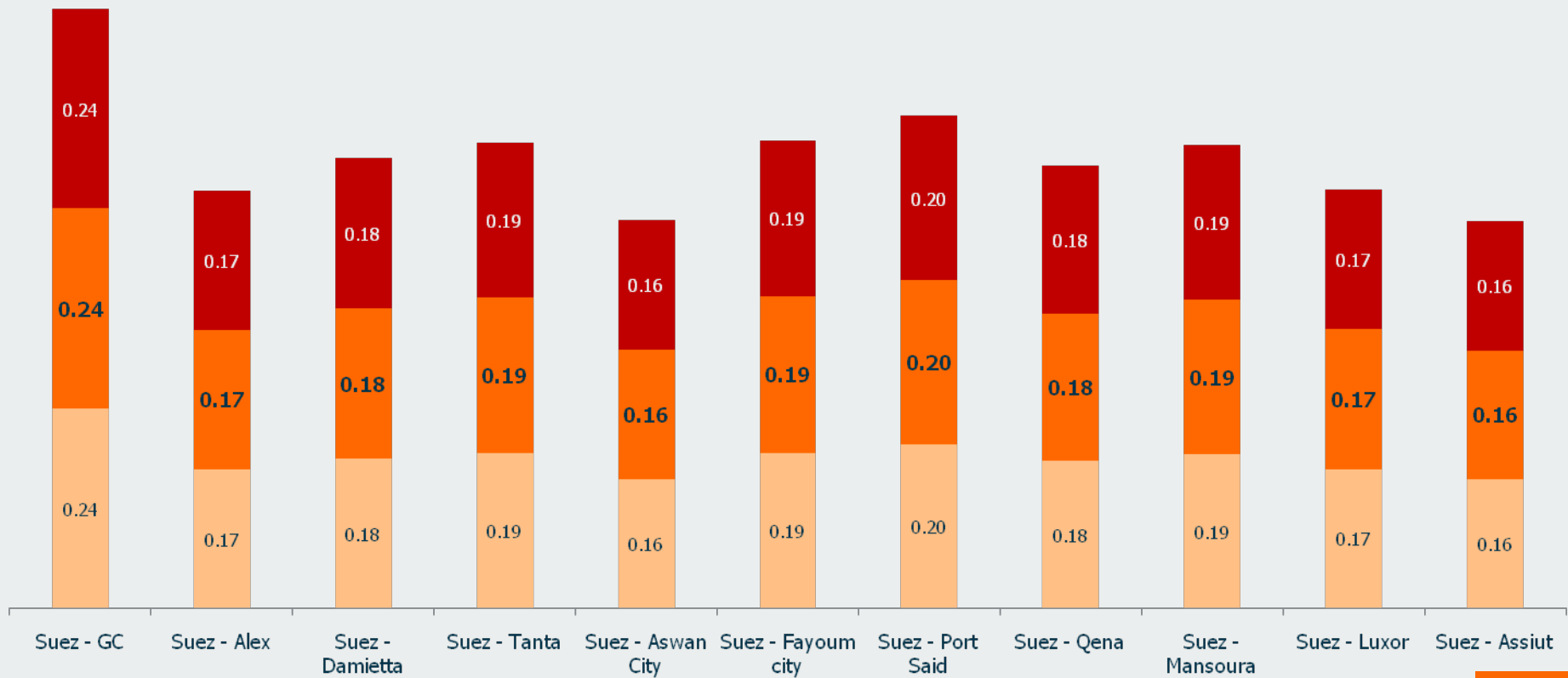
Luxor - Base: N=2

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Suez and other Governorates

27

Minimum Mean Maximum

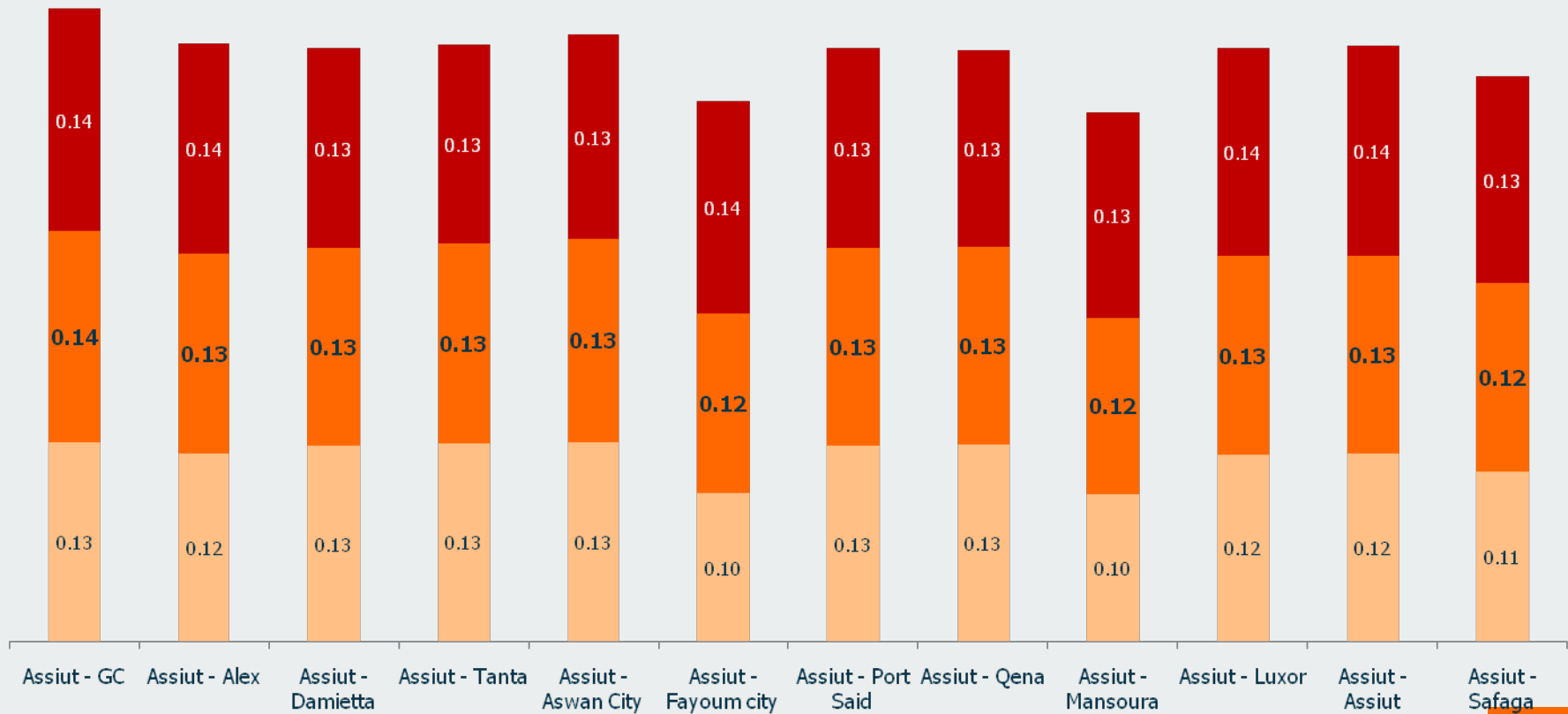


Suez - Base: N=4

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Assiut and other Governorates

Minimum Mean Maximum

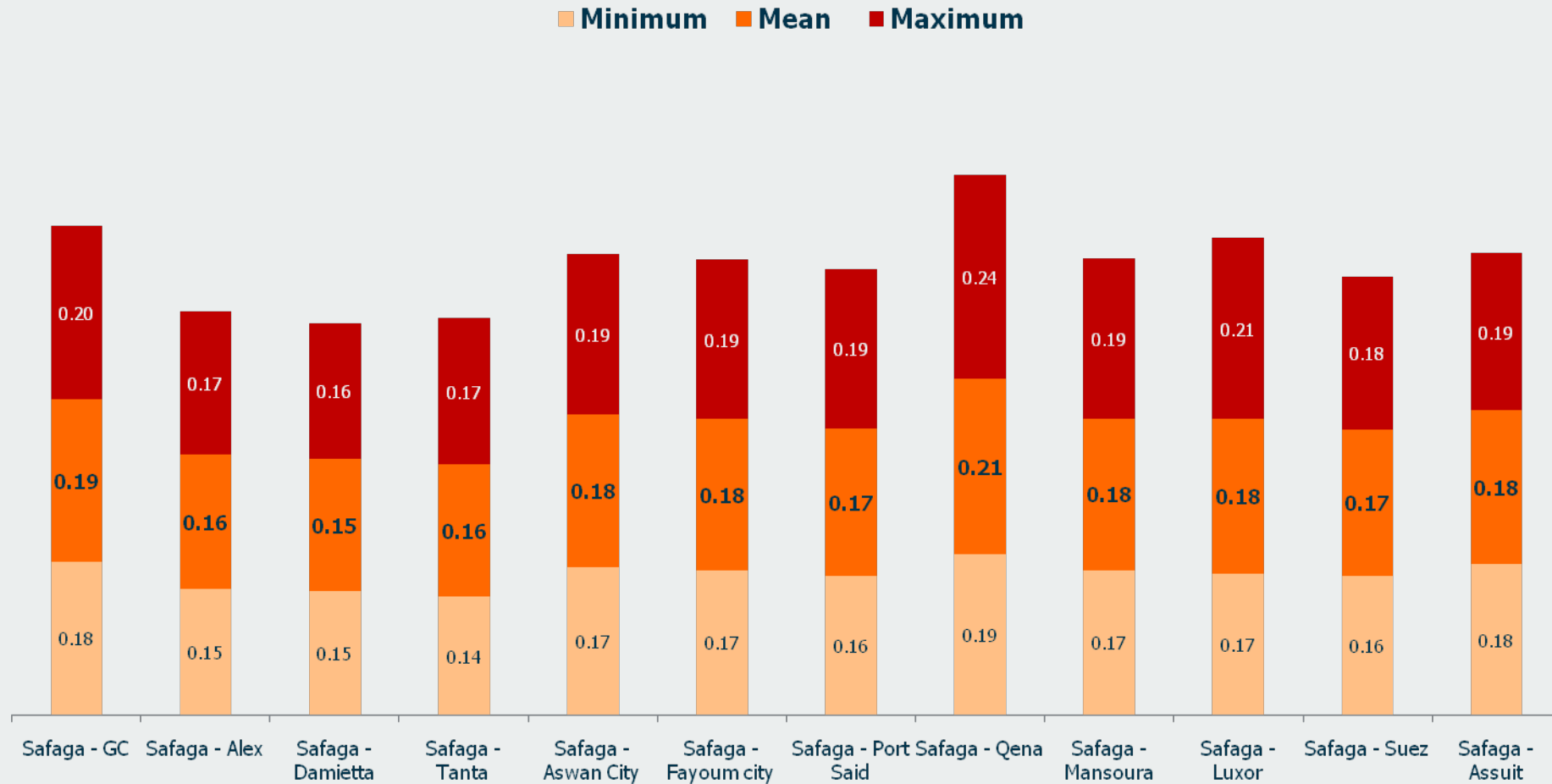


Assiut - Base: N=2

B. Trucking companies – General Cargo (Cont'd)

Transportation Cost/Ton/KM between Safaga and other Governorates

29



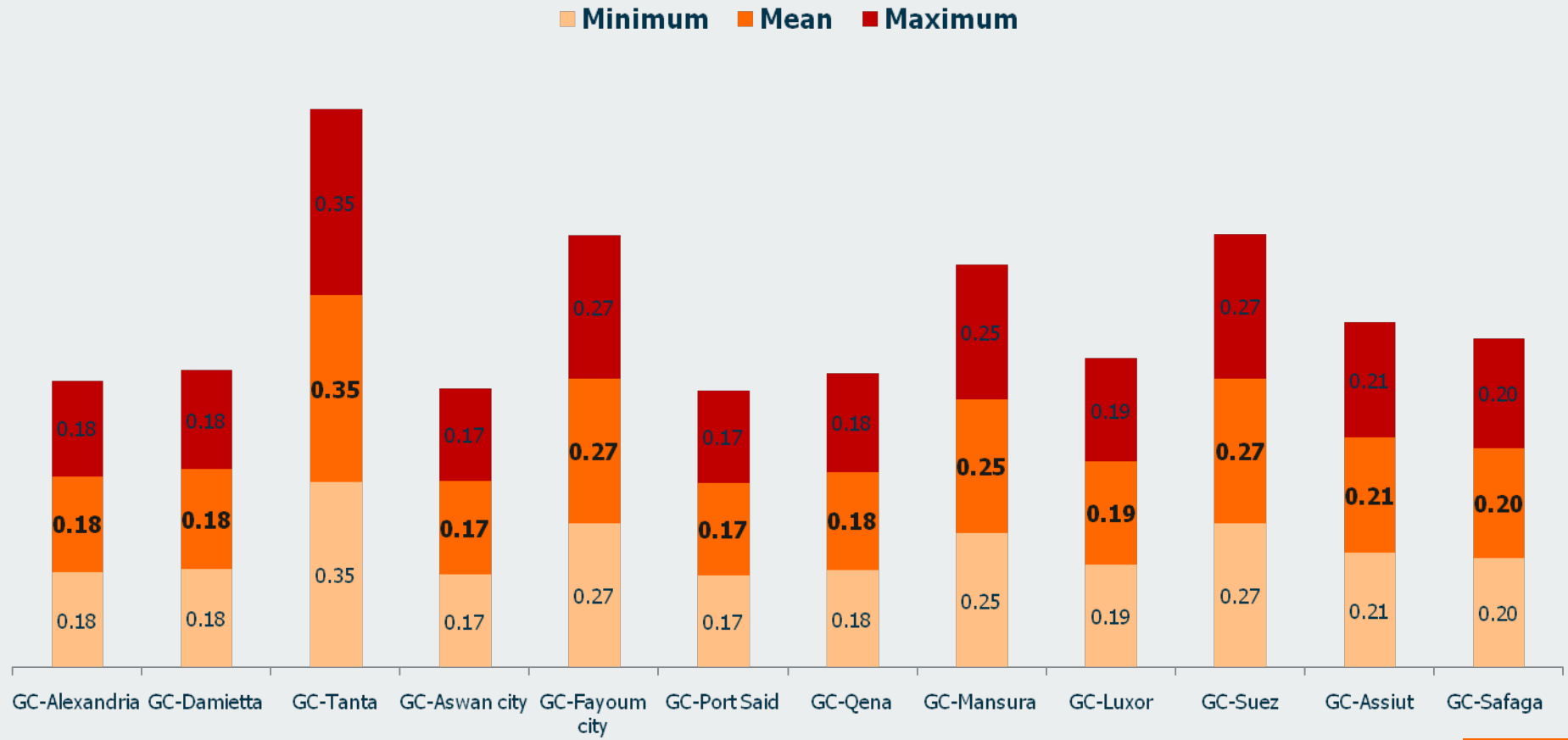
Safaga - Base: N=2

II. Liquid Cargo

B. Trucking companies – Liquid cargo

Transportation Cost/Ton/KM between Greater Cairo and other Governorates

31



Greater Cairo - Base: N=14

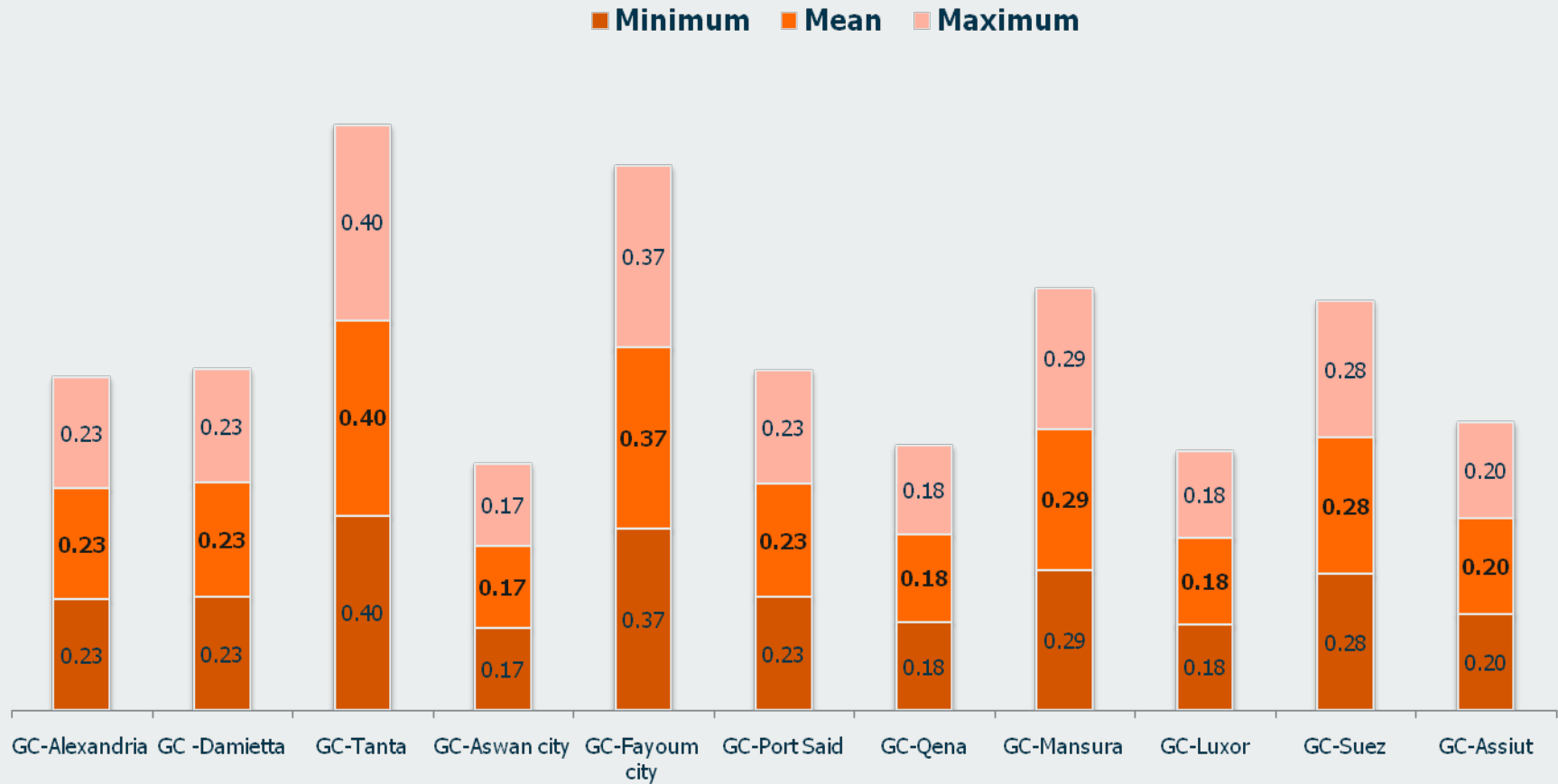
GC → Greater Cairo

III. Bulk Cargo

B. Trucking companies – Bulk Cargo

Transportation Cost/Ton/KM between Greater Cairo and other Governorates

33



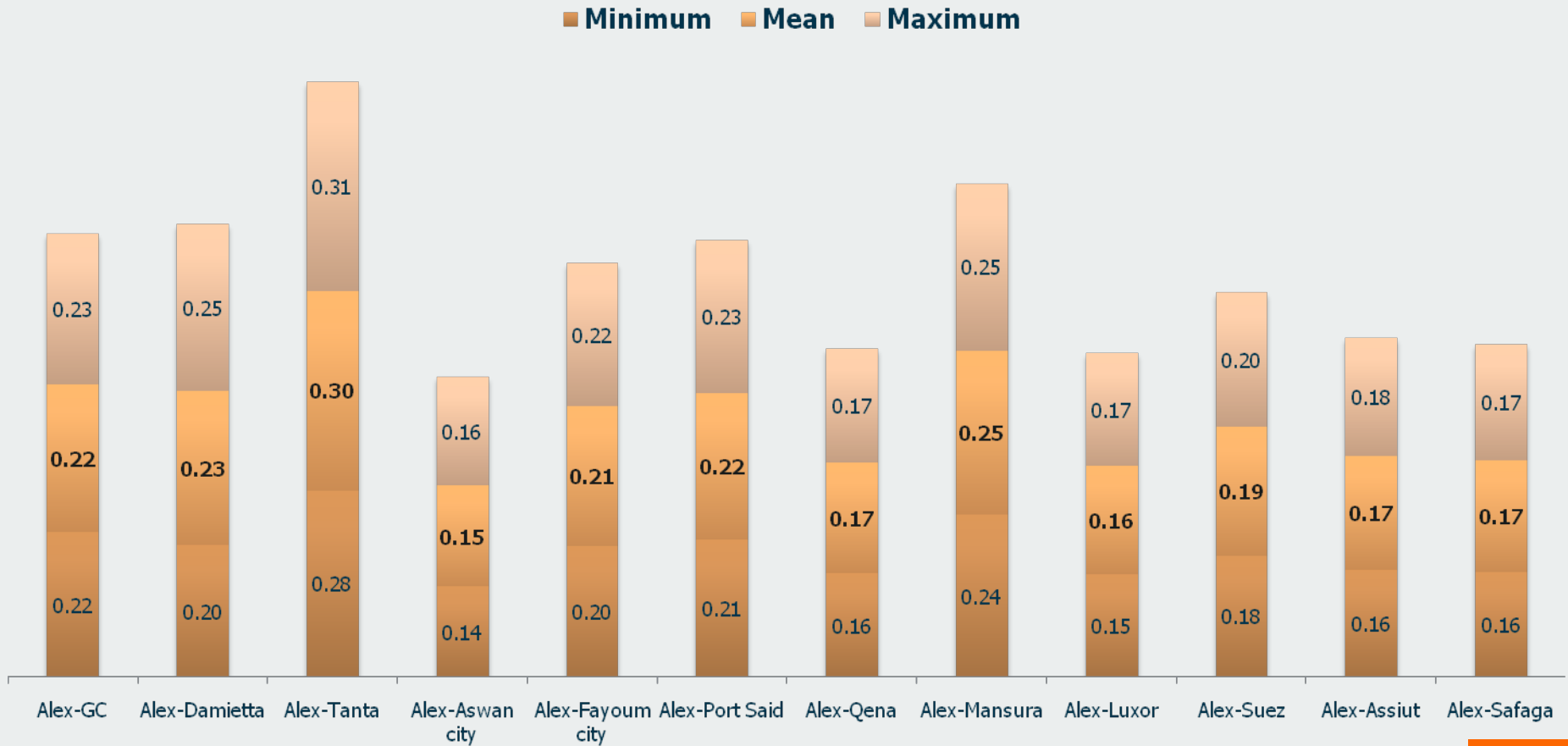
Greater Cairo - Base: N=14

GC → Greater Cairo

B. Trucking companies – Bulk Cargo (Cont'd)

Transportation Cost/Ton/KM between Alexandria and other Governorates

34

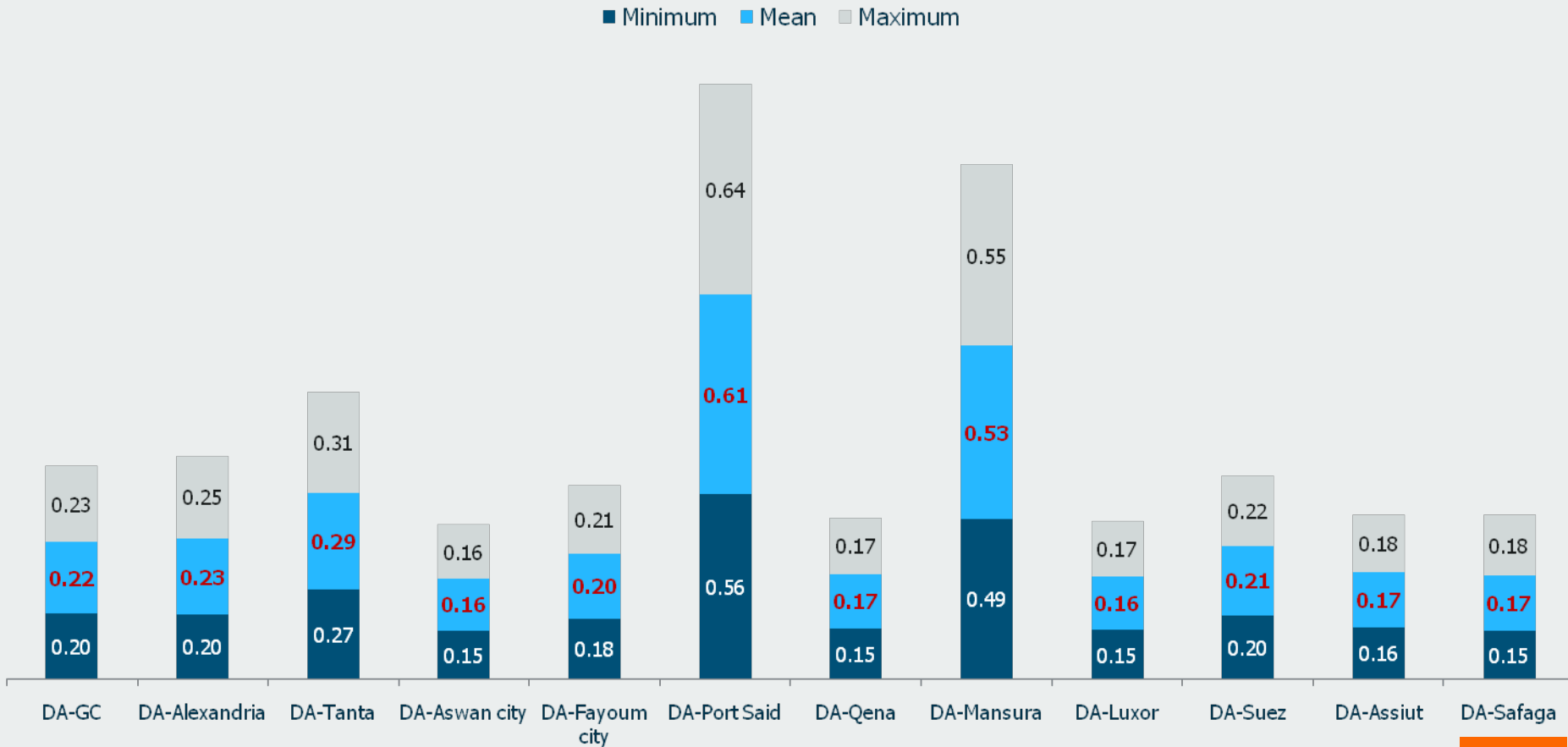


Alexandria - Base: N=4

B. Trucking companies – Bulk Cargo (Cont'd)

Transportation Cost/Ton/KM between Damietta and other Governorates

35



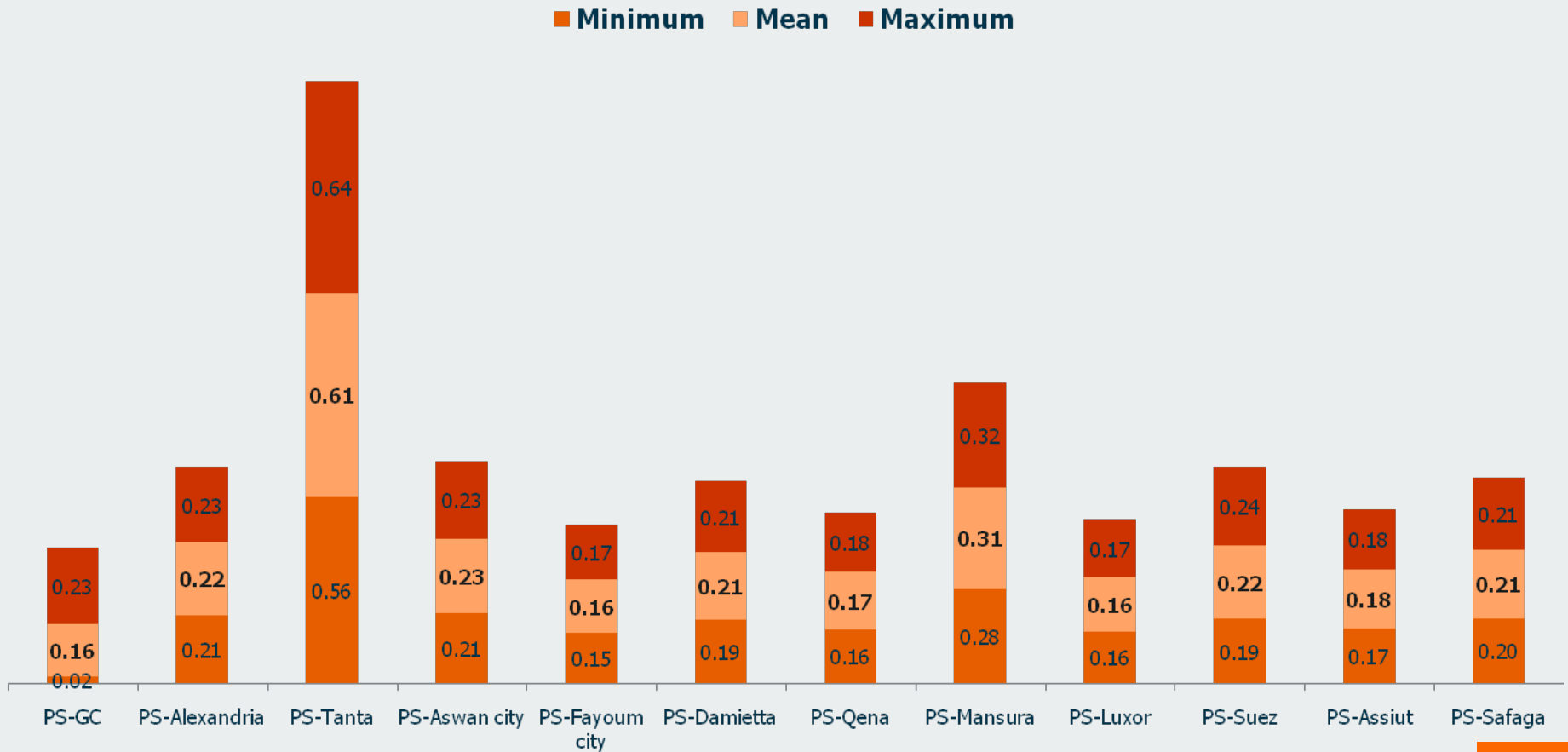
Damietta - Base: N=2

DA → Damietta

B. Trucking companies – Bulk Cargo (Cont'd)

Transportation Cost/Ton/KM between Port Said and other Governorates

36



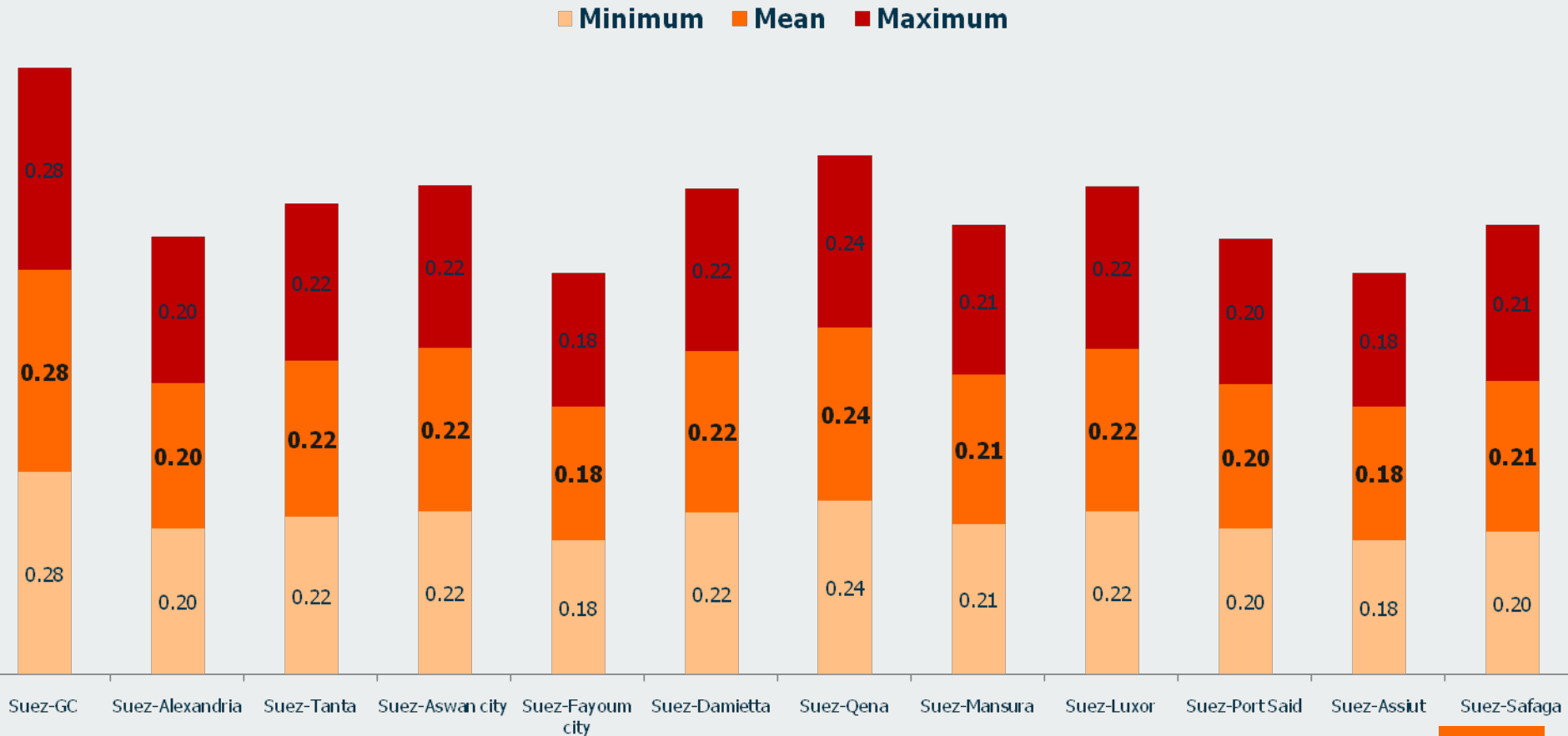
Port Said - Base: N=2

PS → Port Said

B. Trucking companies – Bulk Cargo (Cont'd)

Transportation Cost/Ton/KM between Suez and other Governorates

37

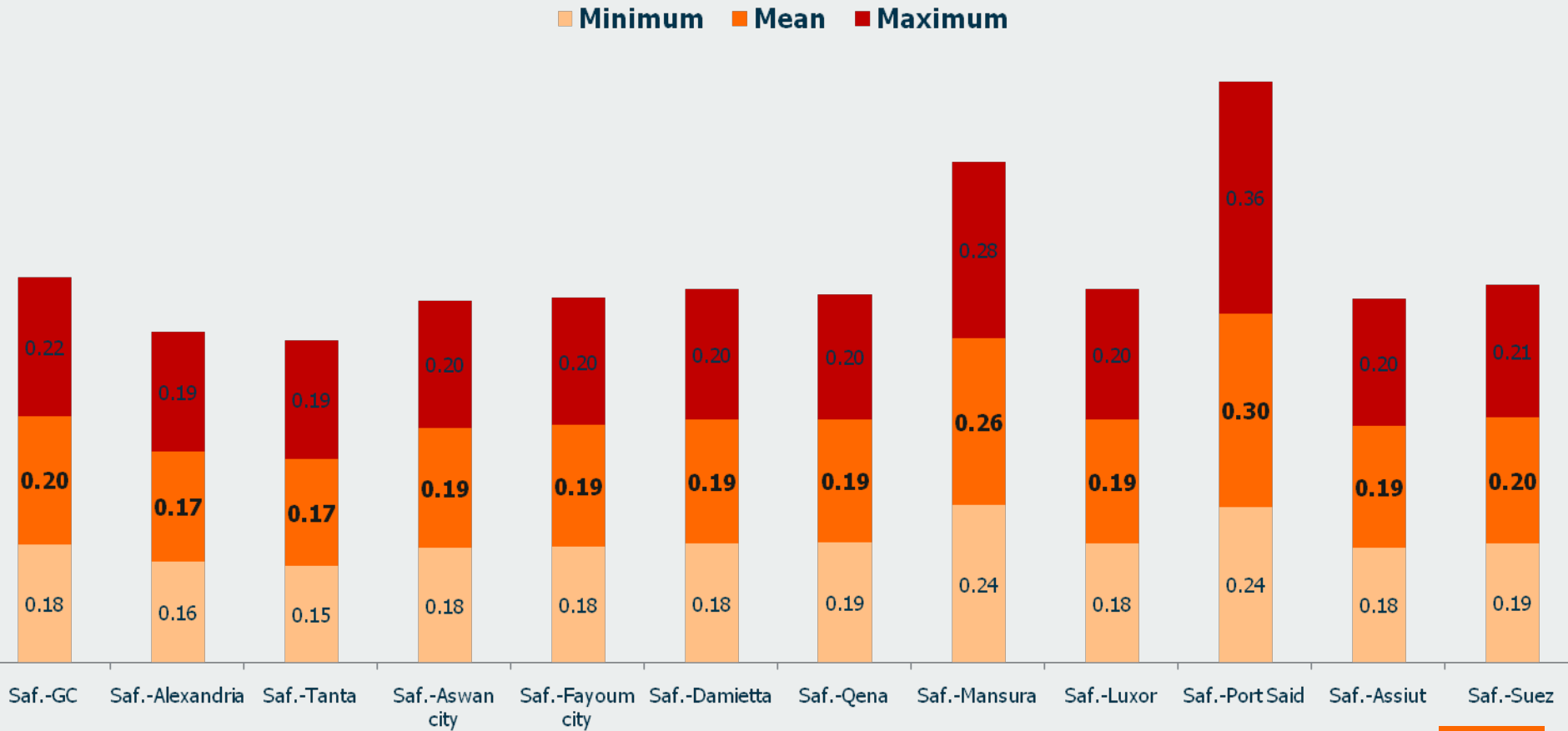


Suez - Base: N=4

B. Trucking companies – Bulk Cargo (Cont'd)

Transportation Cost/Ton/KM between Safaga and other Governorates

38



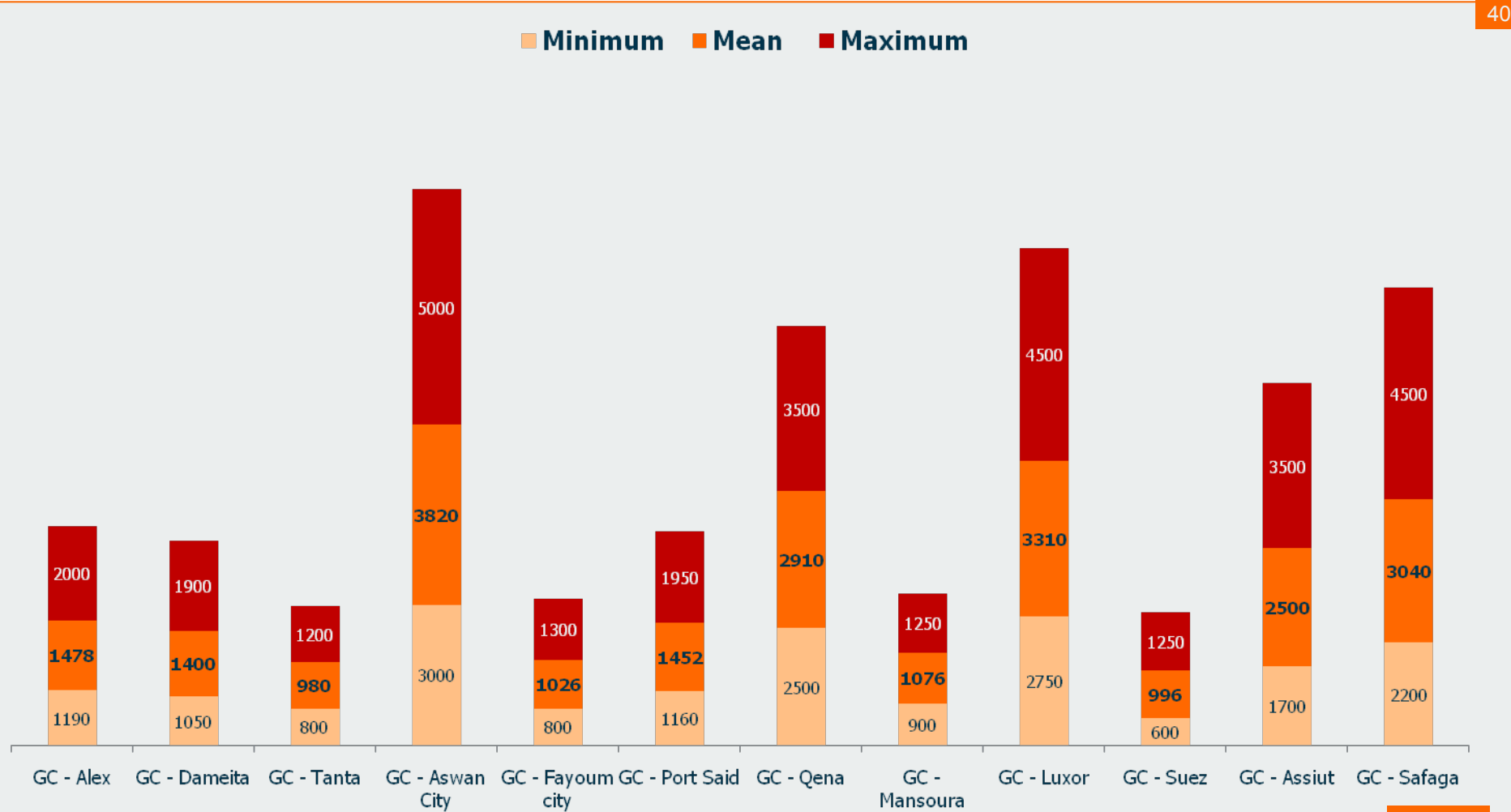
Safaga - Base: N=2

Saf. → Safaga

IV. Container Container

B. Trucking companies – Container

Transportation cost/Trip of Container (40FT) between Grater Cairo to different Governorates

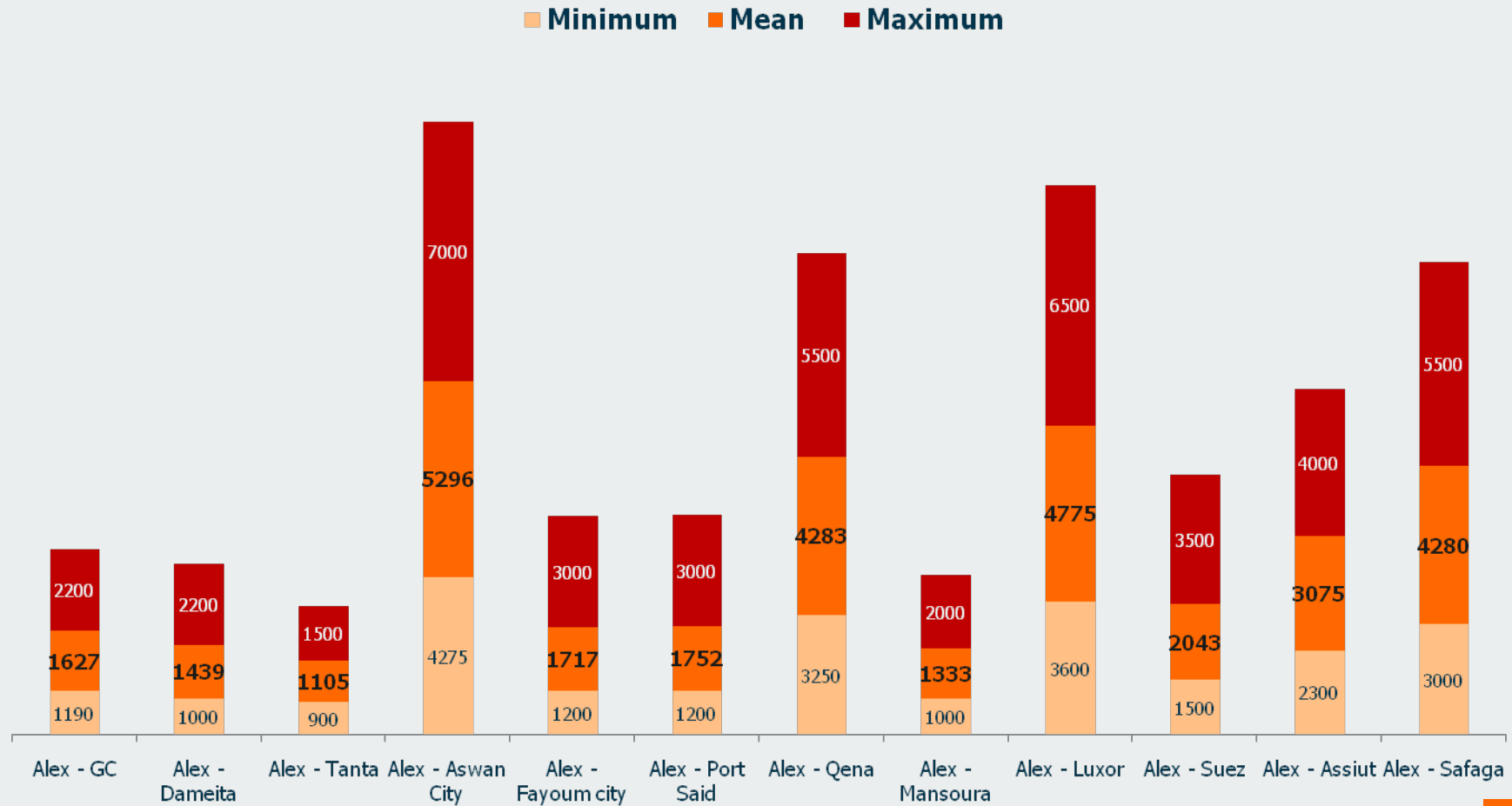


Greater Cairo - Base: N=14

GC → Greater Cairo

B. Trucking companies – Container (Cont'd)

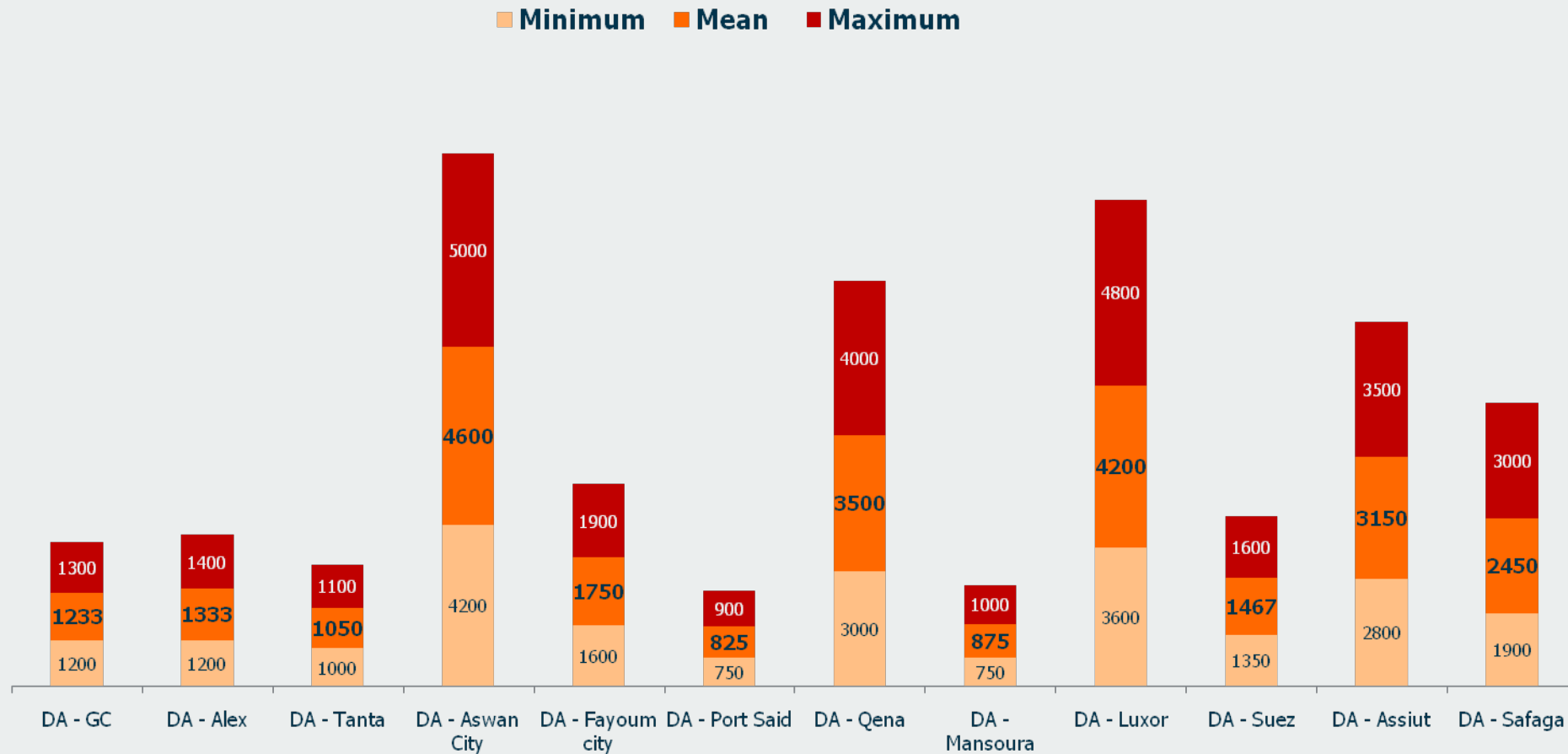
Transportation cost/Trip of Container (40FT) between Alexandria to different Governorates



B. Trucking companies – Container (Cont'd)

Transportation cost/Trip of Container (40FT) between Damietta to different Governorates

42



Damietta - Base: N=2

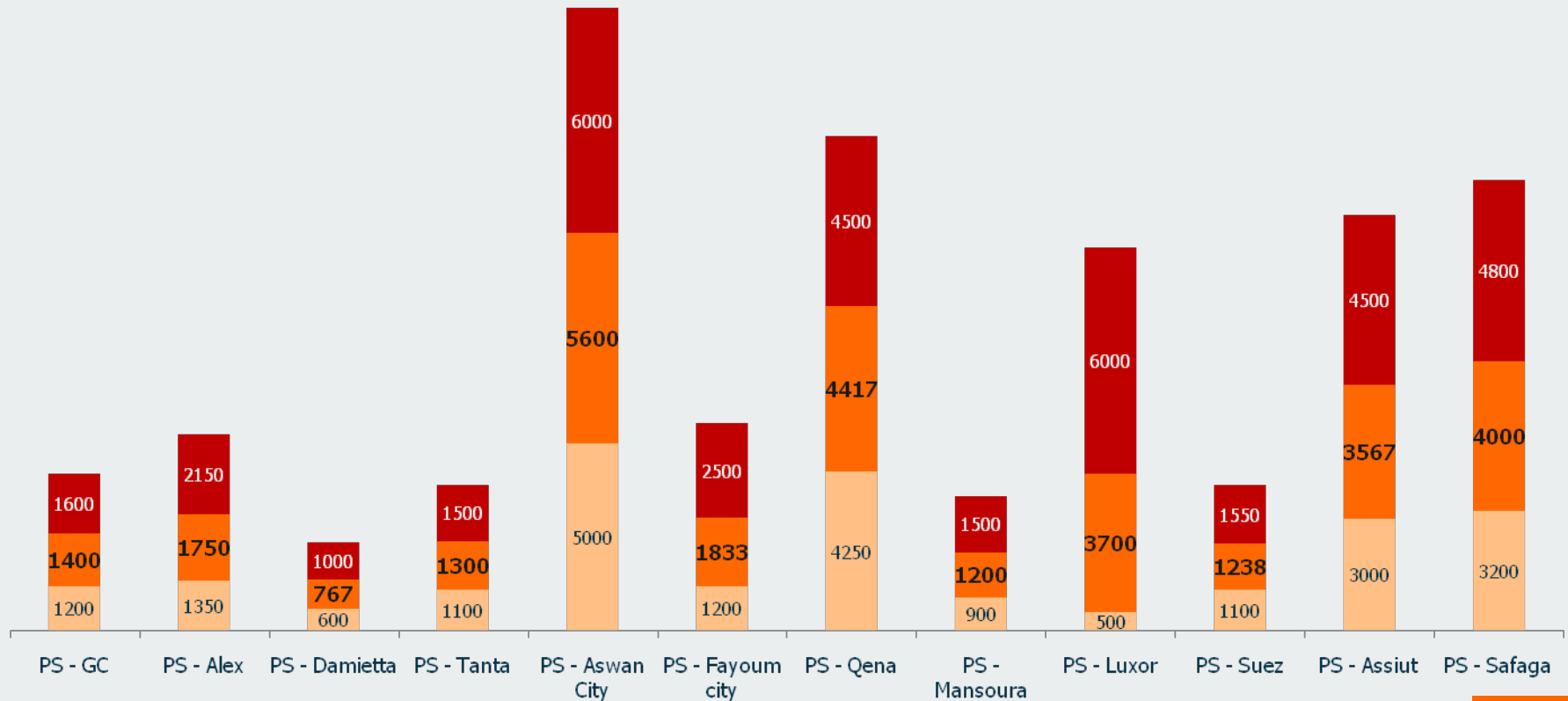
DA → Damietta

B. Trucking companies – Container (Cont'd)

Transportation cost/Trip of Container (40FT) between Port Said to different Governorates

43

Minimum Mean Maximum



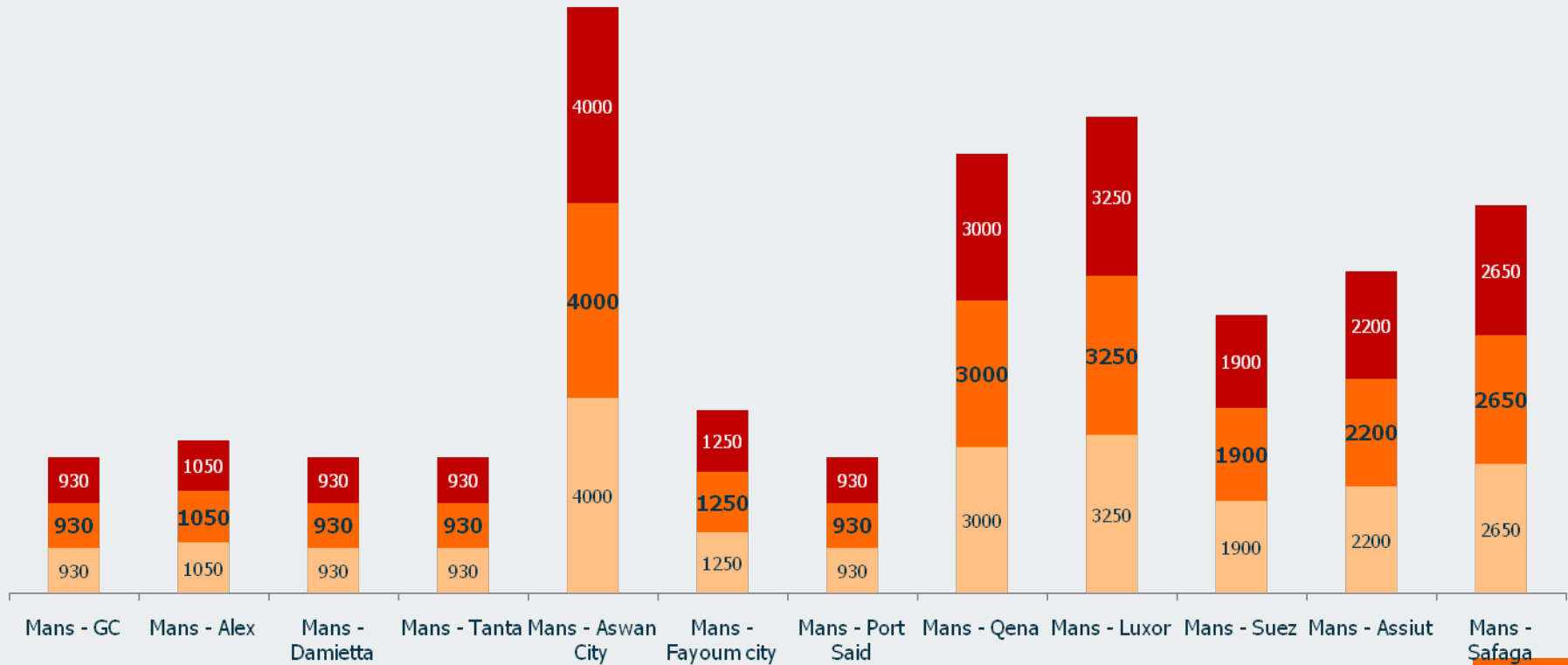
Port Said - Base: N=2

PS → Port Said

B. Trucking companies – Container (Cont'd)

Transportation cost/Trip of Container (40FT) between Mansoura to different Governorates

Minimum Mean Maximum



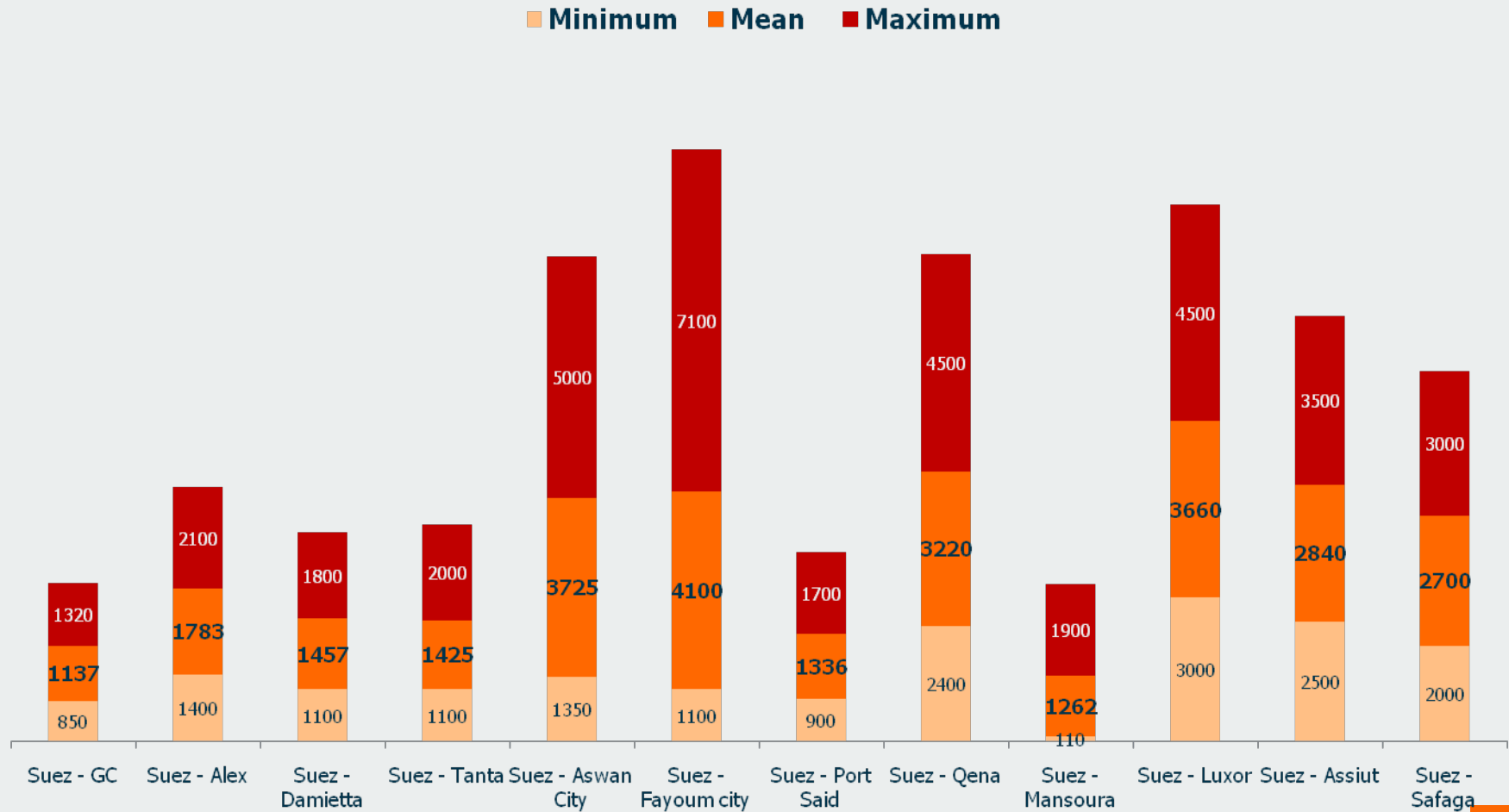
Mansoura - Base: N=2

Mans → Port Said

B. Trucking companies – Container (Cont'd)

Transportation cost/Trip of Container (40FT) between Suez to different Governorates

45



Suez - Base: N=4

3. Price Matrices

Small Operators – Price Matrix

47

Origin \ Destination		Currency	Central Cairo	Helwan	Giza City	New Cairo	6 th October City	10 th Ramadan	Shubra el Kheima
Central Cairo	Mean	EGP		2.92	6.11	2.30	3.03	1.54	4.39
	Minimum			1.79	4.17	1.40	1.72	1.11	1.11
	Maximum			4.64	8.33	3.00	4.14	1.85	6.25
Helwan	Mean	EGP	2.18		2.60	2.44	2.22	1.99	2.11
	Minimum		1.56		2.00	1.67	1.64	1.59	1.70
	Maximum		2.67		3.33	3.08	2.73	2.44	2.50
Giza City	Mean	EGP	4.46	2.64		2.12	2.07	1.37	3.81
	Minimum		3.13	1.79		1.52	1.25	0.88	2.21
	Maximum		6.67	4.29		3.03	2.67	2.46	5.88
New Cairo	Mean	EGP	3.20	2.46	3.13		3.46	2.88	7.75
	Minimum		2.80	2.05	2.81		3.43	2.38	6.67
	Maximum		3.40	2.82	3.44		3.57	3.33	8.33
6 th October City	Mean	EGP	2.79	1.64	3.58	2.48		1.09	2.25
	Minimum		1.59	0.91	2.00	1.43		0.58	1.24
	Maximum		3.68	2.42	5.00	3.24		1.47	3.42
10 th Ramadan	Mean	EGP	2.78	2.78	3.08	3.26	2.70		2.61
	Minimum		0.56	0.61	0.56	0.60	0.58		0.54
	Maximum		3.70	3.66	4.23	4.76	3.49		3.57
Shubra el Kheima	Mean	EGP	4.54	1.84	3.69	5.69	2.07	1.32	
	Minimum		3.33	1.52	2.55	4.17	1.53	1.01	
	Maximum		5.83	2.73	5.88	8.33	3.24	2.14	

General Cargo – Price Matrix

48

Origin \ Destination			Currency	Genral Cargo												
				Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga
1	Greater Cairo	Mean	EGP		0.24	0.27	0.40	0.24	0.36	0.25	0.29	0.32	0.27	0.32	0.32	0.31
		Minimum			0.12	0.15	0.22	0.06	0.20	0.14	0.11	0.19	0.06	0.16	0.12	0.12
		Maximum			0.53	0.56	0.94	0.77	0.88	0.48	0.85	0.68	0.87	0.66	1.00	0.82
2	Alexandria	Mean	EGP	0.18		0.20	0.28	0.12	0.18	0.20	0.13	0.22	0.13	0.17	0.13	0.13
		Minimum		0.12		0.18	0.26	0.06	0.16	0.17	0.11	0.20	0.06	0.16	0.08	0.07
		Maximum		0.21		0.23	0.31	0.15	0.22	0.26	0.15	0.25	0.16	0.20	0.15	0.15
3	Damietta	Mean	EGP	0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18	0.15	
		Minimum		0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18	0.15	
		Maximum		0.20	0.20		0.26	0.14	0.17	0.53	0.14	0.46	0.14	0.18	0.15	
4	Tanta	Mean	EGP	0.43	0.46	0.47		0.29	0.40	0.41	0.33	0.43	0.32	0.38	0.34	0.32
		Minimum		0.40	0.42	0.42		0.26	0.40	0.39	0.29	0.41	0.28	0.35	0.31	0.28
		Maximum		0.45	0.49	0.52		0.31	0.40	0.44	0.37	0.46	0.36	0.41	0.36	0.35
5	Aswan City	Mean	EGP	0.35	0.31	0.30	0.33		0.41	0.33	0.49	0.34	0.28	0.39	0.27	0.32
		Minimum		0.35	0.31	0.30	0.33		0.41	0.33	0.47	0.34	0.28	0.39	0.27	0.32
		Maximum		0.35	0.31	0.30	0.33		0.41	0.34	0.50	0.34	0.28	0.39	0.27	0.32
6	Fayoum City	Mean	EGP	0.38	0.31	96.53	0.34	0.34		0.33	0.33	0.36	0.32	0.36	0.30	0.31
		Minimum		0.33	0.22	83.33	0.29	0.31		0.28	0.20	0.33	0.20	0.29	0.23	0.17
		Maximum		0.44	0.36	106.25	0.37	0.39		0.35	0.40	0.39	0.38	0.41	0.35	0.38

General Cargo – Price Matrix (Cont'd)

49

Origin / Destination			Currency	Genral Cargo												
				Greater Cairo	Alexandri a	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga
7	Port Said		EGP													
		Minimum		0.19	0.19	0.52	0.20	0.13	0.18		0.13	0.26	0.14	0.20	0.15	0.18
		Maximum		0.26	0.26	0.53	0.54	0.14	0.25		0.15	0.37	0.15	0.25	0.18	0.19
8	Qena	Mean	EGP	0.27	0.26	0.25	0.25	0.22	0.22	0.24		0.23	0.49	0.26	0.28	0.28
		Minimum		0.26	0.26	0.25	0.24	0.22	0.22	0.24		0.22	0.45	0.26	0.26	0.27
		Maximum		0.27	0.26	0.25	0.25	0.23	0.23	0.25		0.23	0.53	0.27	0.30	0.28
9	Mansura	Mean	EGP	0.75	0.68	0.78	0.87	0.69	0.69	0.76	0.66		0.68	0.66	0.67	0.70
		Minimum		0.24	0.20	0.46	0.57	0.13	0.18	0.26	0.14		0.14	0.18	0.15	0.14
		Maximum		1.03	0.96	1.00	1.11	1.00	1.00	1.08	0.97		1.02	0.95	1.00	0.98
10	Luxor	Mean	EGP	0.23	0.27	0.27	0.26	0.39	0.23	0.27	0.51	0.28		0.25	0.28	0.36
		Minimum		0.22	0.25	0.26	0.23	0.39	0.22	0.26	0.51	0.26		0.23	0.28	0.36
		Maximum		0.26	0.29	0.29	0.29	0.39	0.23	0.29	0.51	0.30		0.28	0.28	0.36
11	Suez	Mean	EGP	0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17		0.16	
		Minimum		0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17		0.16	
		Maximum		0.24	0.17	0.18	0.19	0.16	0.19	0.20	0.18	0.19	0.17		0.16	

General Cargo – Price Matrix (Cont'd)

50

Origin / Destination			Currency	Genral Cargo											
				Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut
12	Assiut		EGP												
		Minimum		0.13	0.12	0.13	0.13	0.13	0.10	0.13	0.13	0.10	0.12	0.12	
		Maximum		0.14	0.14	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.14	0.14	
13	Safaga	Mean	EGP	0.19	0.16	0.15	0.16	0.18	0.18	0.17	0.21	0.18	0.18	0.17	0.18
		Minimum		0.18	0.15	0.15	0.14	0.17	0.17	0.16	0.19	0.17	0.17	0.16	0.18
		Maximum		0.20	0.17	0.16	0.17	0.19	0.19	0.19	0.24	0.19	0.21	0.18	0.19

Liquid Cargo – Price Matrix

51

Origin Destination			Currency	Truck_Liquid price per ton per KM											
				Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga
Greater Cairo	Mean	Cost / Ton / KM	EGP	0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20
	Minimum			0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20
	Maximum			0.18	0.18	0.35	0.17	0.27	0.17	0.18	0.25	0.19	0.27	0.21	0.20

Bulk Cargo – Price Matrix

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Origin \ Destination			Currency	Bulk cargo												
				Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansura	Luxor	Suez	Assiut	Safaga
1	Greater Cairo	Mean	EGP		0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
		Minimum			0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
		Maximum			0.23	0.23	0.40	0.17	0.37	0.23	0.18	0.29	0.18	0.28	0.20	
2	Alexandria	Mean	EGP	0.22		0.23	0.30	0.15	0.21	0.22	0.17	0.25	0.16	0.19	0.17	0.17
		Minimum		0.22		0.20	0.28	0.14	0.20	0.21	0.16	0.24	0.15	0.18	0.16	0.16
		Maximum		0.23		0.25	0.31	0.16	0.22	0.23	0.17	0.25	0.17	0.20	0.18	0.17
3	Damietta	Mean	EGP	0.22	0.23		0.29	0.16	0.20	0.61	0.17	0.53	0.16	0.21	0.17	0.17
		Minimum		0.20	0.20		0.27	0.15	0.18	0.56	0.15	0.49	0.15	0.20	0.16	0.15
		Maximum		0.23	0.25		0.31	0.16	0.21	0.64	0.17	0.55	0.17	0.22	0.18	0.18
7	Port Said	Mean	EGP	0.16	0.22	0.61	0.23	0.16	0.21		0.17	0.31	0.16	0.22	0.18	0.21
		Minimum		0.02	0.21	0.56	0.21	0.15	0.19		0.16	0.28	0.16	0.19	0.17	0.20
		Maximum		0.23	0.23	0.64	0.23	0.17	0.21		0.18	0.32	0.17	0.24	0.18	0.21
11	Suez	Mean	EGP	0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
		Minimum		0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
		Maximum		0.28	0.20	0.22	0.22	0.18	0.22	0.24	0.21	0.22	0.20		0.18	
13	Safaga	Mean	EGP	0.20	0.17	0.17	0.19	0.19	0.19	0.19	0.26	0.19	0.30	0.19	0.20	
		Minimum		0.18	0.16	0.15	0.18	0.18	0.18	0.19	0.24	0.18	0.24	0.18	0.19	
		Maximum		0.22	0.19	0.19	0.20	0.20	0.20	0.20	0.28	0.20	0.36	0.20	0.21	

Container – Price Matrix

53

Origin \ Destination			Currency	Container												
				Greater Cairo	Alexandria	Damietta	Tanta	Aswan city	Fayoum city	Port Said	Qena	Mansora	Luxor	Suez	Assiut	Safaga
1	Greater Cairo	Mean	EGP		1478	1400	980	3820	1026	1452	2910	1076	3310	996	2500	3040
		Minimum			1190	1050	800	3000	800	1160	2500	900	2750	600	1700	2200
		Maximum			2000	1900	1200	5000	1300	1950	3500	1250	4500	1250	3500	4500
2	Alexandria	Mean	EGP	1627		1439	1105	5296	1717	1752	4283	1333	4775	2043	3075	4280
		Minimum		1190		1000	900	4275	1200	1200	3250	1000	3600	1500	2300	3000
		Maximum		2200		2200	1500	7000	3000	3000	5500	2000	6500	3500	4000	5500
3	Damietta	Mean	EGP	1233	1333		1050	4600	1750	825	3500	875	4200	1467	3150	2450
		Minimum		1200	1200		1000	4200	1600	750	3000	750	3600	1350	2800	1900
		Maximum		1300	1400		1100	5000	1900	900	4000	1000	4800	1600	3500	3000
7	Port Said	Mean	EGP	1400	1750	767	1300	5600	1833		4417	1200	3700	1238	3567	4000
		Minimum		1200	1350	600	1100	5000	1200		4250	900	500	1100	3000	3200
		Maximum		1600	2150	1000	1500	6000	2500		4500	1500	6000	1550	4500	4800
9	Mansura	Mean	EGP	930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
		Minimum		930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
		Maximum		930	1050	930	930	4000	1250	930	3000		3250	1900	2200	2650
11	Suez	Mean	EGP	1137	1783	1457	1425	3725	4100	1336	3220	1262	3660		2840	2700
		Minimum		850	1400	1100	1100	1350	1100	900	2400	110	3000		2500	2000
		Maximum		1320	2100	1800	2000	5000	7100	1700	4500	1900	4500		3500	3000

Thank You

Demand Side Instruments to Reduce Road Transportation Externalities in the Greater Cairo Metropolitan Region

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Demand Side Instruments to Reduce Road Transportation Externalities in the Greater Cairo Metropolitan Area Cairo

Abstract

This paper discusses, and provides preliminary estimates, of economically efficient prices for the passenger transportation system in the Greater Cairo Metropolitan Region. These prices take into account the broader societal costs, or “externalities”, from travel by car, microbus, public bus, and rail, including local and global pollution, traffic congestion, and traffic accidents.

Gasoline used by automobiles and minibuses is heavily subsidized in Egypt to the tune of \$1.20 per gallon (all figures are in year 2006\$). In contrast, we put the economically efficient fuel tax at \$2.21 per gallon, with congestion and accident costs contributing \$1.40 to this tax and local and global pollution another \$0.81 per gallon (though we underscore the imprecision in these estimates). Eliminating the fuel subsidy, and imposing this level of fuel tax, would represent an extremely dramatic change, reducing long-run fuel demand in the order of perhaps 40 percent. Nonetheless, more partial pricing reforms can still yield substantial economic benefits. For example, removing of the fuel subsidy alone might achieve about three quarters of the estimated net economic benefits from implementing the optimal fuel tax.

Per mile tolls on automobiles target congestion and accident externalities from these vehicles more directly than fuel taxes. We put the optimized auto toll at 21.9 cents per mile. The optimal toll on minibuses (when implemented in isolation) is relatively modest at 7.9 cents per vehicle mile, because some of the diverted passengers will drive. Implementing tolls on both autos and minibuses at the same time is more economically efficient. Better still would be to target pollution with fuel taxes, and traffic congestion and accidents with tolls on vehicle use. In this, fully efficient outcome, we put the optimal gasoline tax at 81 cents per gallon and the optimized tolls on automobiles and minibuses at 12.1 and 18.9 cents per vehicle mile respectively. Current subsidies for public transit seem reasonable given prevailing subsidy policies, though optimal subsidies would fall as automobile and microbus externalities are addressed through taxes.

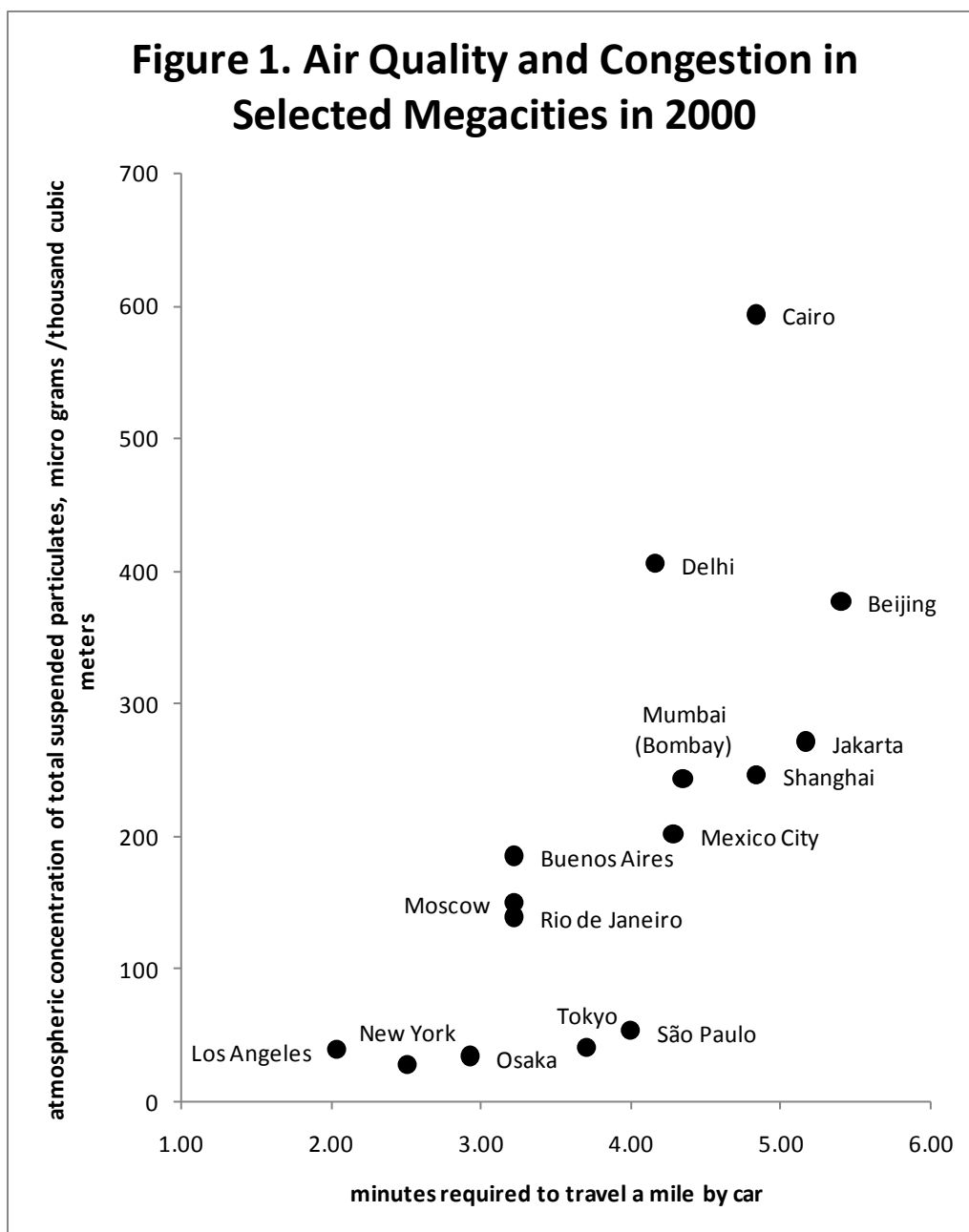
Key Words: Externalities, emissions, congestion, fuel tax, mileage toll, Egypt

1. Introduction

The Greater Cairo Metropolitan Area (GCMA) is one of the largest megacities in the World and is Egypt's largest agglomeration (it is home to 27 percent of Egypt's population). The GCMR is also one of the most polluted and congested urban agglomerations in the world. For example, among the 15 cities illustrated in Figure 1, Cairo has by far the highest atmospheric concentration of total suspended particulates, a proxy for human health risks from air pollution. And it ranks third, behind only Beijing and Jakarta, in terms of congestion among these cities, as measured by the average time it takes to drive a mile by automobile. Pressure on the environment and urban infrastructure will persist in upcoming years with continued expansion in the population of the metropolitan area.

Automobile emissions are a major cause of local air pollution (other emissions sources include industrial operations like lead smelting and cement, chaff from burning of rice straw, trash burning, and desert dust). Moreover, Cairo's climate creates conditions that are especially favorable to poor air quality.¹ Since 1994, several policies have been introduced with the aim of improving air quality in the GCMR including emissions control regulations for industry, a progressive conversion of the fleets of public bus companies from diesel to compressed natural gas, and emissions inspections programs for automobiles.

¹ During the summer, temperatures in Cairo can fluctuate from over 100°F to as low as 50°F during the course of a day. Under these conditions air closer to the ground cools faster than the air above which slows down the ascent of (polluted) surface air, resulting in a very stable atmosphere. This retards the dispersion and dilution of pollutants, keeping them closer to the ground where they pose greater environmental hazards. Moreover, atmospheric stability can lead to temperature inversions when, for part of the day, polluted surface air becomes trapped under a blanket of warmer air, posing acute health risks. High levels of photochemical smog are yet another byproduct of Cairo's hot and sunny climate. Smog develops when sunlight chemically breaks down nitrogen oxides and Volatile Organic Compounds into their constituent parts.



Note. Suspended Particulates include organic and inorganic particles (e.g., dust, sand, metals, wood particles, smoke), PM-10 (coarse particulates less than 10 micro-meters (μm) in diameter), and PM-2.5 (fine particulates less than 2.5 micro-meters in diameter).

Source. Gurjar et al. (2008) and IAPT (2007).

Traffic congestion imposes costs on the economy, particularly from wasted time, and this cost is likely to rise with continued growth in travel demand. Besides pollution and congestion, yet another major adverse side effect of vehicle use is traffic accidents. A large number of people are killed in the GCMR as a result of road accidents, over 700 a year (CAPMAS, 2010).

Traditionally in developing countries, supply-side measures are offered to address traffic congestion problems. These include expansion of road networks and improvement of public transportation systems through the introduction of new, or expansion of existing, light rail transit, bus rapid transit and metro systems. These measures are highly capital intensive and have long construction phases and are constrained by land availability, particularly in the city core and high density areas. Moreover, supply-side approaches are not enough by themselves. In fact, expanding the road network may be partly self-defeating if it creates ever greater demand for travel.² And an expansion of road networks in the city periphery does not reduce environmental emissions (Anas and Timilsina, 2009a).

There is growing interest in using demand side measures, particularly fiscal or pricing reforms, to address the broader societal costs (or negative externalities) of transportation systems.³ One option is to remove fuel subsidies and impose fuel taxes. In fact, as illustrated for a selection of countries in Figure 2, many developing countries impose high taxes on gasoline, in contrast to Egypt (and some other countries like Algeria, Libya and Venezuela) where fuel is heavily subsidized—to the tune of \$1.20 per gallon in 2006.⁴ Another possibility is to lower mass transit fares. A more novel approach is congestion tolls, which economists have long advocated as an effective way of allocating scarce roadway capacity to the highest valued users. The use of congestion pricing in London and Stockholm suggests that public opposition to this approach is not insurmountable.⁵

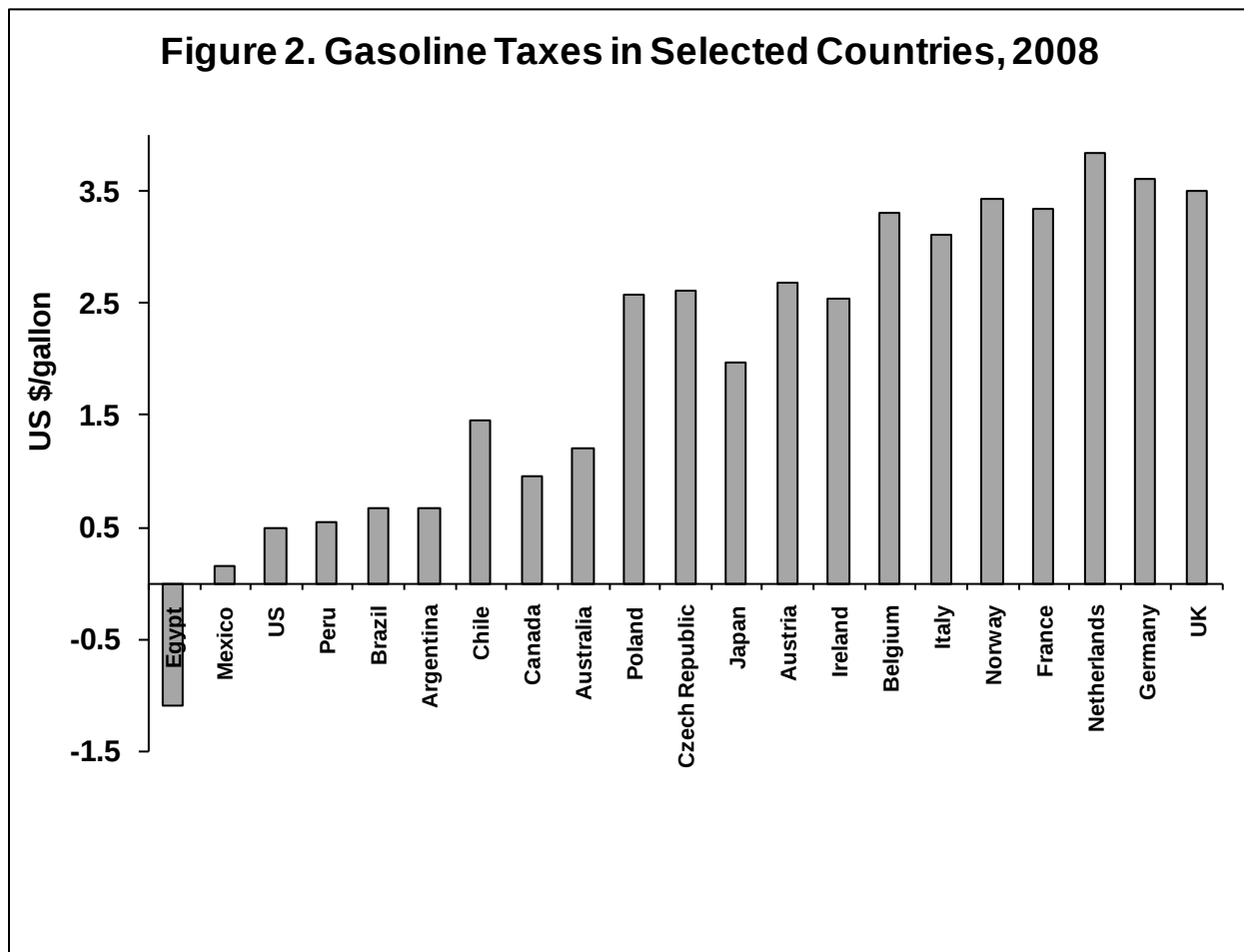
² In the United States, for example, Duranton and Turner (2009) find that urban road expansion has had minimal impact on alleviating traffic congestion.

³ See Timilsina and Dulal (2008) for an in-depth discussion on fiscal policy instruments to reduce congestion and environmental pollution from urban transportation.

⁴ Prices are expressed in US currency to facilitate comparison with other studies. To obtain values in local currency multiply by 5.6. To convert monetary values per gallon to per liter multiply by 0.26 and from per mile to per km multiply by 0.62.

⁵ See Santos and Rojey (2004) for an extensive discussion of theory behind congestion tolls and experience with their implementation to date.

Several studies have evaluated demand side instruments for other cities in the developing world.⁶ However, no study has been carried out for Cairo. This study attempts to provide, albeit in a highly simplified and preliminary way, some broad sense of how pricing instruments, particularly the replacement of gasoline subsidies with gasoline taxes, the introduction mileage tolls, and the reform of public transit fare systems, might be applied to reduce transportation externalities in the GCMR.



Source. IEA (2008) and Parry and Strand (2010).

⁶ See, for example, Anas and Timilsina (2009b), Anas et al. (2009), and Parry and Timilsina (2009) for applications to Sao Paulo, Beijing, and Mexico City, respectively.

The paper is organized as follows. The next section provides a brief discussion of the model used for the analysis. Section 3 discusses the estimation of key factors or parameters that feed into the model. Section 4 presents the main findings. Section 5 offers concluding remarks.

2. Conceptual Framework

This section briefly describes the assumptions underlying our model of passenger transportation for the GCMR, discusses the determination of optimal pricing policies implied by the model, and then comments on some limitations of the analysis.

Model Description

We assume essentially the same analytical model as that in Parry and Timilsina (2010) that was developed to assess optimal prices for the Mexico City passenger transport system. The model is also reproduced in Appendix A of this paper.

This model provides a simplified representation of an urban passenger transportation system that is meant to capture, in a parsimonious way, the most important underlying determinants of optimal transportation prices. The model is static and compares long run equilibrium outcomes to policy changes, after adjustments such as turnover of the vehicle fleet and incorporation of fuel-saving technologies.

In the model, households living in the GCMR choose how much to travel by automobile, (private) microbus, (public) bus, and (public) rail. Auto trips include those in private cars and taxis. Travel involves various monetary costs to households including transit fares, expenditures on automobile fuel, possible congestion tolls levied on auto travel, and the costs of vehicle ownership. Through a budget constraint, more spending on travel implies a tradeoff as households have less money for other goods. Travel by each mode also involves a time cost, which again involves a trade off as this reduces the amount of time people have available for other activities (work or time at home). Travel time per mile differs across mode, and reflects the inverse of the average travel speed for a transportation vehicle. The average occupancy of vehicles is taken as fixed and therefore passenger miles vary in proportion to changes in vehicle

miles. Thus, for example, an increase in passenger demand for microbus travel is met by a proportionate increase in the supply of microbus vehicle miles.⁷

Households optimize over travel options to maximize their “utility”, or benefit, from passenger travel by different modes and from other consumption goods, subject to their budget and time constraints. This implies that, aggregated over the GCMR, autos will be driven up to the point where the private benefit to passengers from an extra mile, net of the time costs, equal fuel costs (expressed on a per mile basis) plus any mileage toll. In addition, travel by microbus, bus and rail will be undertaken until the benefit from an additional passenger mile (net of time costs) equals the fare per mile.

Automobiles and minibuses are taken to run on gasoline, while public buses run on compressed natural gas or diesel fuel.⁸ In response to higher gasoline taxes, automobile and microbus fuel economy increases (over the long term) through a switch in demand towards vehicles that have greater fuel economy. Ownership or capital costs for these vehicles are greater because, for a given set of other vehicle characteristics, higher fuel economy requires the incorporation of fuel-saving technologies and the costs of these technologies are reflected in higher vehicle prices. Fuel economy is improved over the long run until the (lifetime) fuel saving benefits (valued at retail gasoline prices) equal the extra vehicle capital costs.⁹

For minibuses, public bus, and rail, the operating costs for these vehicles represent fuel costs, vehicle capital costs (which can be varied fairly easily in the medium term through fleet adjustments), manpower needed to drive and maintain vehicles, and possible tolls (for minibuses). Rail provision also involves fixed costs representing manpower needed to operate stations.¹⁰ For automobiles, minibuses, and buses, operating costs are assumed to be

⁷ Other travel modes, particularly walking, are implicit in the utility function. Their only role is to affect the price elasticity of demand for driving, microbus, and transit trips.

⁸ In contrast in Western European countries, where fuel taxes (especially those in gasoline) are high by international standards, diesel vehicles, which are more fuel efficient than their gasoline counterparts, account for a substantial share of the passenger car fleet.

⁹ The model does not account for the possibility that consumers undervalue fuel economy improvements due to myopia, imperfect information, or some other market failure. Optimal fuel taxes would be higher in the presence of such additional market failures (e.g., Parry et al. 2010). However, given the issue is highly unsettled in the empirical literature (e.g., Greene 2010) we abstract from the possibility of these market failures.

¹⁰ Capital infrastructure costs for subways, namely tracks and stations, are excluded from transit agency costs. This is because we follow the usual practice of studying how best to price rail systems given existing infrastructure, without worrying about recovering previously sunk capital investments in current fares.

proportional to vehicle miles, which is a reasonable approximation (Small and Verhoef 2007, pp. 65). For rail there are economies of scale (operating costs increase by less than in proportion to increases in vehicle miles) due to the fixed costs.

Road congestion, and hence travel time per mile by car and bus, increases with the total amount of cars, minibuses, and large buses relative to the capacity of the road network. An extra *vehicle* mile by a microbus or bus adds more to congestion than an extra car mile, as these vehicles take up more road space and stop frequently. The contribution of an extra vehicle mile by microbus or bus, relative to that from an extra vehicle mile by car, is known as its “passenger car equivalent”. However, because minibuses and buses have much higher passenger occupancy, the addition to congestion per extra *passenger* mile by these vehicles may be less than the additional congestion per extra passenger mile by car. Travel time per mile by rail is taken as constant—that is, additional trains can be run to accommodate policy-induced changes in demand for rail travel, without affecting the speed of other trains in the rail network.

Accident costs depend on the amount of miles driven by road vehicles. It is standard to assume that some of these costs (e.g., injury risks to drivers in single-vehicle crashes) are “internal” or taken into account by households when deciding how much to travel, while other costs (e.g., injury risks to pedestrians) are “external” and not taken into account. As in Parry and Small (2010) accident costs for rail are taken to be zero, since they are negligible when expressed on a per passenger mile basis, given the very high occupancy of trains with several cars.

CO₂ and local pollution emissions make households (as a group) worse off through future (global) climate change. CO₂ depends on combustion of gasoline in cars and minibuses, and combustion of diesel fuel and compressed natural gas in public buses.¹¹

Local pollution emissions make households worse off through health risks, reduced visibility, and building corrosion. Local pollution is caused by fuel combustion in transport vehicles. For minibuses and buses local emissions are unregulated and are determined by fuel use.

¹¹ We follow the conventional practice of valuing CO₂ emissions damages for the world as a whole, rather than local impacts (which would be negligible in relative terms).

For cars, it is a little tricky to judge the relationship between local emissions, vehicle use, and fuel economy. If auto emissions were unregulated, they would vary in proportion to fuel combustion, that is, long run, policy-induced, changes in fuel economy would affect emissions. At the other extreme, if all autos are subject to the same (binding) emissions per mile standards regardless of their fuel economy, and these emission rates are maintained throughout the vehicle life—that is, repairs are required if pollution control technologies deteriorate—then improvements in fuel economy would have no effect on emissions. Although many vehicles in the GCMR are imported from Europe, where they were subject to emissions per mile standards when first manufactured, typically these vehicles are second-hand when they enter the GCMR. Furthermore, inspection and maintenance programs in the GCMR are not comprehensively enforced implying that any emissions control technology may deteriorate as vehicles age. We therefore think it is reasonable to assume that local emissions vary in proportion to total fuel use (in this regard, our optimal fuel tax estimate could be biased upwards, but any bias is only moderate).

The government in the model is subject to a budget constraint equating spending with revenue from (possible) auto mileage tolls, fuel taxes, and transit fare revenues, less the operating costs of (bus and rail) transit agencies. We assume excess revenues are simply rebated back to households or firms in a lump-sum fashion.¹²

Determinants of Optimal Transport Prices

Here we describe the key factors, or parameters, that determine the optimal pricing policies in the above model. We do not provide the derivation of these formulas here, as they were previously derived in detail in Parry and Timilsina (2009).

Optimal gasoline tax. The optimal gasoline tax, in \$/gallon, has three components.

First is the damage (in monetary units) from local pollution emissions, and CO₂ emissions, from combusting an extra gallon of fuel.

¹² More generally, if revenues were used for government spending and the social value per \$1 of spending were greater/less than \$1, then optimal congestion tolls and fuel taxes would be (moderately) higher/lower than estimated below.

Second is the contribution of externalities from traffic congestion and traffic accidents. The external cost of congestion per extra auto mile reflects the increase in travel time to all other road users, as a result of (slightly) greater road congestion, where this loss is converted into a monetary measure using people's valuation of travel time (for rich countries this has been estimated at about half the market wage rate). The external cost of traffic accidents per extra auto mile is the elevated risk to other road users, pedestrians, third parties who bear property damage costs, etc. due to the increased frequency of road accidents when there is more traffic (and less road space between vehicles). If toll per mile on automobiles is in place, this would need to be subtracted from the sum of these externalities, as the toll effectively causes drivers to take into account some of these broader costs when deciding how much to drive.

These external costs, which are estimated in \$/mile, can be converted into \$/gallon by multiplying by average automobile fuel economy (miles per gallon), though we need to take into account that fuel economy is endogenous and rises over the longer term as higher fuel taxes drive up fuel prices. In addition, these automobile costs are scaled back somewhat in computing the optimal fuel tax to account for fact that only a fraction of the tax-induced reduction in gasoline comes from the automobile sector, some comes from reduced use by microbuses. Finally, they are also scaled back because only a fraction of a given, tax-induced reduction in automobile gasoline uses is due to reduced driving, some of it instead reflects improved automobile fuel economy.¹³

The final component of the optimal gasoline tax accounts for its effect on reducing the contribution of microbuses to congestion and accidents. As for automobiles, this will depend on how many microbus miles are reduced per gallon reduction in fuel use, which again depends on fuel economy and how much of the fuel reduction comes from reduced mileage as opposed to fuel economy increases.

In assessing optimal fuel and other transportation prices, we ignore some effects of policies on other transport modes which play a very minor role (as demonstrated in Parry and Timilsina 2009). For example, higher gasoline prices will cause some people to shift from cars to public buses, with a resultant increase in congestion, pollution, and accident risk from additional

¹³ In fact, if all of the automobile fuel reduction came from improved fuel economy and none from reduced automobile mileage, there would be no congestion and other benefits from mileage-related automobile externalities in the optimal gasoline tax formula.

bus mileage. However, this offsetting effect on road transport externalities is very small relative to the reduction in external costs from autos and microbus.

Optimal mileage toll for autos. There are three main determinants of the optimal mileage toll for automobiles.

First is the external cost from auto congestion and accidents, as just described, expressed per auto mile.

Second is the reduction in local and global pollution damages per unit reduction in automobile vehicle miles. These damages would be defined net of any prevailing gasoline tax, as that tax serves to raise fuel prices and effectively induce people to consider broader societal costs when making choices that affect fuel consumption. In fact, the opposite occurs at present, given that fuel is currently subsidized in the GCMR, that is, there is a larger gain associated with reductions in fuel use induced by the toll.

On the other hand, the optimal auto toll is lower to the extent this encourages a switch from autos to microbuses as, in turn, this increases congestion, accidents, and pollution associated with those vehicles.

Optimum toll for microbus. The components of the optimal toll for microbuses are analogous to those for the optimal auto toll. That is, the optimal toll depends on the reduced congestion and accident externalities from a unit reduction in microbus vehicle miles, the reduction in local and global pollution damages, and any increase in externalities due to people switching to cars.

Optimum public bus fare. The optimal fare, this time expressed per *passenger*-mile for public bus consists of three main components.

First is the cost to bus companies of accommodating an extra passenger mile through increased service, including the (variable) capital, labor, and fuel costs incurred in operating buses. This unit cost is lower the higher is the average passenger occupancy of buses. The second component is the external cost of public bus travel, expressed on a per passenger mile basis. This

captures the contribution of additional bus travel (needed to supply more passengers) to road congestion, roadway accident risk, and local pollution emissions from diesel fuel combustion. Finally, there is a downward adjustment to account for the costs of diverting people from buses to cars in response to higher transit fares.

Optimum rail fare. The formula for the optimal rail fare per passenger mile is essentially analogous to that for the optimal bus fare. The optimum rail fare is below the cost to the transit agency of accommodating an extra passenger mile on the rail system to the extent this would lead to an increase in automobile externalities.

Fully optimized transport pricing. The main difference between the auto and microbus mileage tolls and the gasoline tax is that the mileage tolls target the congestion and accident externalities more directly. This is because all of the behavioral responses to the taxes come from reduced mileage (rather than part of the response coming from improved fuel economy). In contrast, the fuel tax targets the fuel-related externalities more directly as (unlike the mileage tolls) it exploits fuel savings from improved fuel economy. If all these taxes are optimized simultaneously, then each is set equal to the relevant external cost—the gasoline tax equal to the external cost per gallon of fuel, the auto mileage toll equal to the congestion and accident externalities per vehicle mile, etc. Given this, optimal transit fares would equal the marginal costs of supplying passenger miles, accounting for any externalities from transit vehicles themselves.

Some Model Limitations

While providing a reasonable first-pass understanding of optimal transportation pricing, our analysis is nonetheless simplified in three notable respects.

First, we do not consider policies that vary either by region within the GCMR or by peak versus off-peak travel. Partly, this is because the data required to do this disaggregation, namely sub-region or time-of-day specific congestion costs and the degree of traveler substitution between sub-regions and time of day, are not available. Furthermore, it is still useful to begin with a simple and transparent analysis to fully understand the aggregate impacts of major pricing

reform options before studying more refined policies that vary by region and time of day. Moreover, this would require a more detailed, data-intensive transportation network model that is less transparent than our more simplified analysis.

Second, our analysis omits scale economies from expanding transit provision (aside from those arising from fixed costs in the rail system), that is reductions in the average cost to users of transit in larger transit systems. One additional scale economy is the shorter waiting time at transit stops for passengers when there is more frequent rail and bus service. Another is the reduced time costs to people of getting to a transit stop in a larger system with a denser network of bus and rail routes. On the other hand, scale economies can be counteracted by a diseconomy if the occupancy rate of buses and trains rises in a larger system, imposing crowding costs on passengers, and increased delays at transit stops. We lack reliable data to credibly estimate the net impact of these scale economies and diseconomies. Most likely however, accounting for them would imply somewhat lower transit fares than estimated here (Parry and Small 2009).

A final caveat is that we do not analyze the distributional effects of pricing reforms. This may be of particular concern to policymakers if, for example, fuel taxes and mileage tolls are especially burdensome to lower income groups.

3. Data and Parameters

While data is available for basic characteristics of the transportation system in the GCMR (e.g., mileage by travel mode and fuel use), it is not directly available for external costs (e.g., pollution and congestion). Therefore, we need to extrapolate evidence from other countries, and make a number of judgment calls. Our benchmark results below should not therefore be taken too literally—instead they should be viewed as a preliminary attempt at obtaining plausible parameters, which can be refined with further study.¹⁴

Nonetheless, we believe our benchmark results still provide some plausible broad brush sense of optimal transportation pricing and the appropriate direction of pricing reforms. Many

¹⁴ The spreadsheet calculations that map parameter values into the optimal pricing estimates are available upon request.

assumptions used to assess parameter values may seem somewhat arbitrary, but they have only relatively minor implications for the optimal pricing estimates.

Parameter values are for year 2006 or thereabouts and are summarized in Table 1.¹⁵ All parameters are expressed in US currency and can be converted into Egypt pounds using an exchange rate of USD 1 = EGP 5.2. Below we briefly discuss the parameter assumptions in our benchmark case. Appendix B provides an extensive documentation of data sources and discusses how parameter values were computed.

Mileage and Fuel Economy. The average person in the GCMR travels approximately 1,344 miles by vehicle per year. Of these passenger miles, approximately 26 percent are by car (or taxi), 33 percent by microbus, 31 percent by public bus, and 10 percent by rail. Modal shares for vehicle miles travelled, on the other hand, are very different from those for passenger miles. Autos account for 77 percent of vehicle miles, microbuses 17 percent, large buses 5 percent, and rail less than 1 percent. The difference between modal shares by passenger and vehicle miles is easily explained by the dramatically different vehicle occupancy rates, which vary from 2.5 people for cars, 14 people for microbus, 45 people for public bus, to 174 people by rail (given that a train pulls several cars).

Fuel economy also differs a lot across road vehicles. Autos average 19.0 vehicle miles per gallon, microbuses 7.8 miles per gallon, and large buses 3.5 miles per gallon. On a per passenger mile basis, fuel economy rankings are reversed, due to differences in occupancy rates. A gallon of fuel produces 47.6 passenger miles in a car, 109.8 passenger miles in a microbus, and 159.7 passenger miles in a public bus. Due to its relatively high fuel consumption rate, microbus still accounts for 35 percent of gasoline use—autos account for the other 65 percent—even though microbus vehicle miles are 23 percent of those for autos.

¹⁵ Ideally, optimal fuel taxes for some future year, say 2020, rather than a previous year, would be computed. This could be done but would require various parameter updates—for example, pollution damages should be adjusted for growth in income (which affects the valuation of health risks), while congestion costs should be updated for traffic growth and increases in wages (which affect the value of travel time).

Table 1. Selected Parameter Assumptions Used in the Benchmark Simulations
(for year 2006 or thereabouts)

	Mileage parameters				Total or average
	Auto	Microbus	Bus	Rail	
Annual passenger miles per capita	353	444	418	130	1,344
Annual vehicle miles per capita	141	32	9	1	183
Average vehicle occupancy	2.5	14	45	174	7.3
Vehicle miles per gallon	19.0	7.8	3.5	na	16.3
Passenger miles per gallon	48	110	160	na	109
Average vehicle speed, miles per hour	14.0	10.1	9.5	na	na
Average travel time cost, cents per passenger mile	5.5	7.7	8.1	na	na
Current fares, cents per passenger mile	na	1.5	0.8	0.9	na
Marginal operating cost, cents per passenger mile	na	1.5	2.6	1.8	na
<i>Marginal external costs</i>					
Cents per vehicle mile					
Congestion	9.7	29.2	48.7	0	15.1
Accidents	8.7	8.7	8.7	8.7	8.7
Local pollution and global pollution (converted to cents per vehicle mile)	4.2	10.3	0.3	0	0
Total	22.7	48.2	57.6	8.7	23.8
Cents per passenger mile--total	9.1	3.4	1.3	0	3.2
<i>Gasoline parameters</i>					
Fuel use, gallons per capita	11.5				
Current fuel subsidy, \$/gal.	1.20				
Retail price of fuel, \$/gal.	1.60				
<i>External cost per gallon</i>					
Local pollution costs attributable to gasoline, cents per gallon	72				
Global pollution, cents per gallon	9				
total	81				
<i>Own-price fuel elasticity</i>					
fraction of elasticity due to changes in auto and microbus miles	-0.5				
<i>Mileage elasticities</i>					
own mileage elasticity wrt own fuel price or fare	-0.25				
<i>Behavioral response coefficients</i>					
Reduction in auto vehicle miles per tax-induced gallon reduction in gasoline	6.2				
Reduction in microbus vehicle miles per tax-induced gallon reduction in gasoline	1.4				
Increase in microbus vehicle miles per toll-induced reduction in auto vehicle miles	0.06				
Increase in auto vehicle miles per toll-induced reduction in microbus vehicle miles	1.8				
Increase in auto vehicle miles per fare-induced reduction in public bus passenger mi	0.12				
Increase in auto vehicle miles per fare-induced reduction in rail passenger miles	0.09				

Source. See text and Appendix B.

Pollution costs. There is general agreement among analysts that local pollution damages are overwhelmingly dominated by mortality effects (e.g., Pope et al. 2004, 2006). However, we are unaware of any local study of pollution costs from the transportation sector in the GCMR. Therefore, local pollution costs for the GCMR were extrapolated from damage estimates for Mexico City (where natural conditions also favor pollution formation).

As discussed in Appendix B, we adjusted the pollution damage estimate for Mexico City upwards to account for greater population density (and therefore greater exposure to a given volume of polluted air) in the GCMR. And the estimate was adjusted downwards to account for the lower per capita income in Cairo and therefore, presumably, the lower willingness of people in Cairo to pay for reductions in health risks. Automobile emission rates are assumed to be the same in both urban centers. The end result is a local pollution cost of 72 cents per gallon, though this is a very crude estimate given the lack of local evidence on pollution/health effects and people's willingness to pay for risk reductions. For public bus, the external cost is 0.3 cents per passenger mile (costs are expressed on a per mile basis for this case, given that we do not consider taxes on fuel inputs for public buses).

For global pollution we adopt a value of \$10 per ton of CO₂ emissions. This is approximately a lower bound estimate from studies that attempt quantify the discounted value of future worldwide damages from global warming. Given the carbon content of fuels, this implies a further damage of 9 cents per gallon of gasoline combustion and 11 cents per gallon for diesel fuel.

Congestion. Marginal congestion costs depend on the added delay to all other road users caused by the additional congestion from an extra vehicle mile, as well as how people value travel time. We employ a widely used function relating travel time to traffic volume in order to obtain marginal delay (see Appendix B). The value of travel time is assumed to equal one-half the average gross hourly wage in Cairo, based on US studies of the wage/value of time relationship. This might be viewed as a conservative estimate to the extent that car ownership and use among Cairo residents is concentrated among people with higher than average wage rates.

Overall, the marginal congestion cost for autos is 9.7 cents per *vehicle* mile. We assume the "passenger car equivalent" for a microbus and a public bus vehicle mile are 3 and 5

respectively. Thus, marginal congestion costs for minibuses and buses are 29.2 and 48.7 cents per *vehicle* mile respectively. However, the ranking of marginal congestion costs reverses when expressed on a per passenger mile basis, due to the high occupancy rates of buses. Marginal costs are 2.1 and 1.1 cents per extra passenger mile by minibus and public bus respectively, compared with 3.9 cents per passenger mile for autos.

Accidents. External accident costs are driven primarily by fatality risks to pedestrians and cyclists (fatality risk to vehicle occupants is assumed to be internal, though there is some dispute about to what extent risks from multi-vehicle collisions are internal or external). Fatality risks are valued in the same way as pollution/health risks. Based on studies for other countries, other external costs from traffic accidents (e.g., non-fatal injury risk, third party property and medical burdens) are assumed to be 12 percent of those from fatality risk. Overall, external costs are 8.7 cents per vehicle mile for autos—for reasons noted in Appendix B costs per vehicle mile are taken to be the same for buses. On a per passenger mile basis, external accident costs are 3.5 cents for autos, 0.6 cents for minibus, and 0.2 cents for public bus.

Prices and operating costs. Gasoline is heavily subsidized in the GCMR. As of 2009, the fuel subsidy amounted to \$1.20 per gallon, leaving a retail price of \$1.60 per gallon (compared with a supply cost of \$2.80 per gallon).

The public transit system is also heavily subsidized, as is common in many countries (Kenworthy and Laube 2001). Current fare for public bus average 0.8 cents per passenger mile, only 31 percent of the operating costs per mile to the transit agency. Rail fares are subsidized at 50 percent.

Behavioral Response Parameters. Based largely on US evidence, and limited evidence for other countries, we assume the gasoline demand elasticity is -0.5, with reduced vehicle miles of travel and long run improvements in fuel economy each responsible for half of the elasticity. With per mile tolls expressed relative to fuel costs per mile, the own price mileage elasticity for autos and minibus is -0.25. The fuel and mileage price elasticities affect the impact, and net benefit, of

pricing reforms though they do not affect optimal transport prices, which depend largely on externalities. However, assumptions about the portion of the long run gasoline demand elasticity that is due to reductions in mileage affect the contribution of mileage-related externalities to the optimal fuel tax.

We assume that 80 percent of the reduction in passenger miles in response to one mode becoming more costly will be diverted onto other travel modes in proportion to their share in total passenger miles (excluding the mode whose price is increased). Taking account of vehicle occupancy rates this means, for example, that microbus vehicle miles increase by 0.06 per unit reduction in auto vehicle miles in response to the auto toll, while auto vehicle miles increase by 1.8 per unit reduction in microbus vehicle miles in response to a microbus toll.

4. Results

We take each pricing policy option in turn and discuss its optimal level. Fully optimized transportation prices are then discussed. Finally, we briefly comment on how the main results are affected by alternative assumptions about key parameter assumptions.

Yet again we emphasize the tentative nature of the optimal pricing results given the large number of assumptions underlying the parameter values. Another reason to be cautious of these results is that optimal prices are, in some cases, very different from current prices. It is difficult to judge whether parameters that may seem reasonable for the current transportation system will still be reasonable with a very different price structure—for example, the diversion between public transit and auto is more difficult to project in a situation with much higher fuel prices. Nonetheless, we can have more confidence in the *direction* of pricing reforms suggested by the results. Moreover, we emphasize that partial pricing reforms typically achieve a large portion of the estimated net benefits from full price reform.

Gasoline tax

Table 2 summarizes determinants of the optimal gasoline tax and the effects of fuel price reform. The optimal tax is \$2.21 per gallon (in years 2006\$), implying a considerable \$3.41 per gallon difference in the optimal retail fuel price compared with the current price (which is

subsidized at \$1.20 per gallon). The optimal tax is \$0.51 per gallon smaller than computed for Mexico City by Parry and Timilsina (2010).

Local pollution damages account for 72 cents, or about a third, of the optimal tax. This is in the same ballpark as estimated for Mexico City by Parry and Timilsina (2010). Although per capita income is lower in the GCMR than in Mexico City, implying a lower willingness to pay for reductions in pollution-health risks, a greater number of people are exposed to a given amount of pollution in the GCMR due to its much higher population density.

Global warming damages play a more minor role (relative to local pollution), accounting for 9 cents per gallon, or 4 percent, of the optimal tax. This is simply a reflection of the assumed social cost of carbon dioxide, \$10 per ton, and the emissions produced per gallon of fuel combustion, 0.009 tons. The social cost of carbon dioxide is highly contentious and many analysts would recommend a higher value than used here, implying a significantly greater optimal fuel tax.

Perhaps surprisingly, automobile congestion contributes “only” 32 cents per gallon, or 14.3 percent, to the optimal tax. Note that marginal congestion costs actually fall substantially, from 9.7 cents per auto-vehicle mile at current prices to 3.8 cents per mile, as the quantity of automobile and microbus traffic falls, by about a quarter, as a result of higher fuel prices. Congestion costs play a smaller role in the optimal fuel computed here than in Parry and Timilsina’s (2010) assessment for Mexico City, partly because the wage rate in Cairo, and hence the value people attach to lost time from congestion, is only 40 percent of that in Mexico City.

Traffic accidents are as important as local pollution—they contribute 71 cents per gallon to the optimal fuel tax. This reflects the relatively high rate of fatalities caused by cars and minibuses, given the relatively high ratio of pedestrian to vehicle traffic in Cairo.

Finally, reduced congestion and accident risk from minibuses together contribute 37 cents per gallon (or 17 percent) to the optimal tax or about a third of the amount from the corresponding reduction in automobile externalities. The main reason for this is that, per gallon of fuel reduced, there is a much larger reduction in auto miles than microbus miles, given that autos have a much higher fuel economy.

Table 2. Optimal Gasoline Tax
(in year 2006\$)

Components	Optimal tax \$/gallon	Contribution to optimal tax (%)
Local pollution from autos and minibuses	0.72	32.6
Global pollution	0.09	4.0
Congestion for autos	0.32	14.3
Accidents for autos	0.71	32.2
Congestion/accidents for minibus	0.37	16.8
Total	2.21	100.0
Effects of optimal gasoline tax		
% reduction in gasoline use	43.5	
% reduction in auto and minibus miles	24.8	
auto fuel economy, mpg	25.3	
net benefit, \$ per capita	10.8	
Elimination of fuel subsidy		
% reduction in gasoline use	24.4	
% reduction in auto and minibus miles	13.1	
auto fuel economy, mpg	21.9	
net benefit, \$ per capita	8.0	

Under our assumptions, removing the current fuel subsidy and imposing the optimized fuel tax would reduce gasoline use by 43.5 percent, reduce auto and minibus mileage by about 25 percent, and increase long run auto fuel economy from 19.0 to 25.3 percent. Estimated net benefits of this policy reform would be \$10.8 per capita, or 6.2 cents for each vehicle mile currently driven by car and minibus.

In sum, the current pricing system for gasoline in the GCMR appears to impose a large cost to society as a whole relative to the price that would address externalities associated with use of automobiles and minibuses. The purpose of this analysis is not to recommend a gasoline tax level for the government to implement however, as there are other criteria relevant to this decision that are beyond our scope, such as feasibility and distributional implications. It is highly

unlikely that the government would consider such a radical price change as suggested by the above calculations.

A more relevant question from policy perspective might be the implications of less dramatic reforms, like the removal of existing subsidies. In this regard, our analysis suggests that elimination of current gasoline subsidy would cut gasoline demand by about 24 percent and vehicle miles by auto and minibuses by about 13 percent (see Table 2). More interestingly, the net benefit from the elimination of gasoline subsidy is \$8.0 per capita, or 74 percent of the net benefit from implementing the optimized gasoline tax. This follows because the net benefits from successive increases in the fuel tax diminish as the tax approaches its optimal level.

Auto mileage toll

Table 3 summarizes results for the optimal toll on automobiles, taking the existing fuel subsidy as given. The fully optimized toll amounts to 21.9 cents per vehicle mile, which would be equivalent, when converted at current automobile miles per gallon, to \$4.18 per gallon.

Table 3. Optimum Mileage Toll for Autos
(in year 2006\$)

Components of tax	Optimal toll cents/vehicle-mi	Optimal gasoline tax equivalent \$/gallon	Contribution to optimal tax %
Local and global pollution from autos (with fuel subsidy)	10.5	2.01	48.0
Congestion for autos	6.1	1.16	27.8
Accidents for autos	8.7	1.65	39.5
Congestion, accidents, and pollution for microbus	-3.4	-0.64	-15.3
Total	21.9	4.18	100.0
Effects of optimal mileage tax			
% reduction in auto miles	27.4		
net benefit, \$ per capita	4.3		
Effect of 5 cent toll per vehicle mile			
% reduction in auto miles	11.0		
net benefit, \$ per capita	3.0		

Local and global pollution from autos contribute most to the optimal toll at 10.5 cents per mile, but note that these externalities are defined with the existing fuel subsidy in place. This greatly magnifies (by 150 percent) the economic efficiency gain from reducing fuel use, given that the subsidy implies a large gap between the costs of additional fuel production and the private benefits to vehicle users. If there were no fuel subsidy, the optimal auto toll would fall to 17.5 cents per mile, with pollution contributing 4.2 cents.

Accident externalities are the next largest factor, contributing 8.7 cents per vehicle mile, or 39.5 percent, to the optimal toll. Congestion contributes 6.1 cents per mile to the optimal toll—again this accounts for the falling marginal congestion costs as tolls deter people from driving. There is a downward adjustment to the optimal toll of 4.4 cents per mile to account for the diversion of people from automobiles onto microbus, which exacerbates pollution, congestion, and accident externalities from those vehicles.

Implementing the optimal toll leads to a large reduction in auto mileage of just over 27.4 percent, moderately higher than under the optimal fuel tax. However, overall road traffic (with minibuses and public buses expressed in terms of their passenger car equivalents) falls by 11 percent under the optimal auto toll and much more, 21 percent, under the fuel tax, which also reduces uses of minibuses. And gasoline use (and hence local and global emissions) falls 25 percent under the optimized auto toll, compared with 43 percent under the optimized fuel tax. The net benefit under the optimal auto toll is \$4.3 per capita. This is considerably smaller than the net benefit from optimizing fuel taxes. One reason is that the auto toll results in an increase, rather than a decrease, in minibus travel. Another is that there are large gains in economic efficiency from eliminating, and then reversing, the fuel subsidy.

Again, a large portion of the net benefit from full price reform could be obtained from a far more moderate policy. For example, an auto toll of 5 cents per vehicle mile reduces auto mileage by 11.0 percent and generates a net benefit of \$3.0 per capita, or 70 percent of that from the optimized toll.

Minibus mileage toll

Table 4 summarizes results for the minibus toll. In this case the optimal toll is 7.9 cents per vehicle mile. This is 28 percent smaller than the optimal auto toll. The difference between these two optimized policies is greater still, by far, when expressed on a per passenger mile basis, given their very different vehicle occupancies. In this case the optimal auto toll is 4.4 cents per passenger mile, while that for the minibus is 0.6 cents per passenger mile.

Table 4. Optimum Mileage Toll for Microbus
(in year 2006\$)

Components of tax	Optimal toll cents/vehicle-mi	Optimal gasoline tax equivalent \$/gallon	Contribution to optimal tax %
Local and global pollution from microbus (with fuel subsidy	10.5	0.82	131.8
Congestion for microbus	28.0	2.19	352.6
Accidents for microbus	8.7	0.68	109.4
Congestion, accidents, and pollution for automobiles	-39.2	-3.07	-493.8
Total	7.9	0.62	100.0
Effects of optimal mileage tax			
% reduction in microbus miles	7.9		
net benefit, \$ per capita	0.1		

On a per vehicle mile basis, congestion contributes a lot more to the optimal toll for microbus (28.0 cents). This is because of the higher passenger car microbuses equivalent for microbuses and the much smaller impact of the policy on reducing overall road traffic and hence lowering marginal congestion costs. On the other hand, there is a very large downward adjustment to the optimal microbus toll (39.2 cents per vehicle mile) due to the diversion of passengers onto auto. This reflects the much higher external costs associated with an extra passenger mile by car (9.1 cents) compared with a microbus (3.4 cents).

Optimal transit fares

Table 5 presents our calculations of optimal transit fares. Here in particular we caution that the estimates are extremely crude, not least because our analysis omits economies of scale, which are one of the key rationales for transit fare subsidies. The main point here is that, unlike for auto and microbus, current prices for public bus and rail do not appear to be too far out of line compared with optimal prices. Given our model assumptions, efficient transit fares are below marginal operating costs per mile because lower fares entice people away from

automobiles and microbus and hence, indirectly and albeit moderately, they reduce externalities from those vehicles. In this sense, and given the existing pricing structure for automobiles, the current practice of subsidizing transit fares is, directionally at least, correct.

Table 5. Fares for Public Bus and Rail
(in year 2006\$)

	cents per passenger mile	
	Public bus	Rail
Components of optimum fare, cents per passenger mile		
Marginal operating cost	2.6	1.8
Congestion, accident and pollution	1.3	0.0
Increase in auto congestion	-1.2	-0.9
Increase in auto accidents	-1.1	-0.8
Increase in auto pollution (including effect of fuel subsid	-1.0	-1.0
Total	1.6	0.1
Difference compared with current fare	0.8	-0.8

Fully optimized transportation prices

Finally, Table 6 summarizes the fully optimized set of transportation prices for each mode and fuel. In this case, the optimal fuel tax is 81 cents per gallon. This is much lower than in Table 2 because in this case the fuel tax addresses only the pollution externalities from fuel combustion. Congestion and accident externalities from autos and microbuses are addressed through tolls per vehicle mile, 12.1 cents for autos and 18.9 cents for microbus. Again, these tolls reflect the much lower marginal costs of traffic congestion at the reduced traffic levels at the optimized prices. Finally, the case for subsidizing public transit fares is eliminated (in our model with no scale economies) when externalities from autos and microbus fare fully internalized through other policies.

Table 6. Fully Optimized Transportation Prices
(in year 2006\$)

Gasoline tax, \$/gallon	0.81
Auto mileage toll, cents/vehicle mile	12.1
Microbus toll, cents/vehicle mile	18.9
Public bus fare, cents/passenger mile	3.8
Rail fare, cents/passenger mile	1.8

5. Conclusion and Further Remarks

This study analyzes pricing instruments that could reduce externalities from urban transportation in the Greater Cairo Metropolitan Region using a simple analytical and simulation model. The key demand side instruments focused in the study are gasoline taxes, vehicle mileage tolls for automobiles and microbuses, and price reforms in public transit. The externalities considered in the study are from local air pollution, global warming, road accidents and traffic congestion.

The optimal tax is \$2.21 per gallon, implying a considerable \$3.41 per gallon difference in the optimal retail fuel price compared with the current price (which is subsidized at \$1.20 per gallon). Although the optimal tax would reduce gasoline use by more than 40%, increasing the tax to its socially optimal level would be difficult in practice as such a change in gasoline price has significant distributional implications and is politically sensitive as current fuels prices are highly subsidized. If the existing subsidies on gasoline are eliminated, it would alone reduce the gasoline consumption by 24% in the GCMR. However, removal of subsidy or introduction of a

tax in GCMR alone might not much effective as drivers could evade such a policy by driving just outside GCMR to fill up their tank or alternatively smuggling subsidized gasoline into GCMR.

If an optimal toll on automobiles is introduced instead of gasoline tax without altering the current fuel subsidy system, it would amount to 21.9 cents per vehicle mile, which would be equivalent to \$4.18 per gallon of gasoline. It would cause higher reduction of auto mileage as compared to the optimal gasoline tax. However, the reduction in overall road traffic (including minibuses and public buses) would be just half of under the fuel tax case. The introduction of tolls is challenging from the perspective of implementation. Some potential options include imposing a tax on the annual odometer mileage of vehicles registered in GMCR, global positioning systems or other electronic tolling, though each of these would be difficult to enforce. Further studies are needed to examine how congestion charges could be implemented applied in GCMR.

One interesting caveat of the study is that even a small level of fuel tax or vehicle toll, could reduce transportation externalities significantly. For example, an auto toll of 5 cents per vehicle mile reduces auto mileage by 11% and generates a net social benefit of \$3.0 per capita, or 70% of that from the optimized toll. Ideally, a portfolio of pricing reforms would be implemented. According to illustrative calculations this would involve a fuel tax of 81 cents per gallon and a per vehicle-mile tolls of 12.1 cents and 18.9 cents for autos and minibuses, respectively.

The study also shows that, unlike for auto and minibus, current prices for public bus and rail do not appear to be too far out of line compared with optimal prices. Given our model assumptions, efficient transit fares are below marginal operating costs per mile because lower fares entice people away from automobiles and minibus and hence, indirectly and albeit moderately, they reduce externalities from those vehicles. In this sense, and given the existing pricing structure for automobiles, the current practice of subsidizing transit is correct. However, we caution that the estimates are extremely crude, not least because our analysis omits economies of scale, which are one of the key rationales for transit fare subsidies.

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Technical Appendix A: Mathematical Representation of Optimal Pricing Policies

Here we present the optimal policy formulas that are implied by our model assumptions. The model is taken from Parry and Timilsina (2009). Optimal transport prices are obtained by differentiating a household utility function with respect to fuel taxes, mileage tolls, and transit fares, accounting for induced changes in travel behavior and changes in external costs (defined below). We consider both partial tax reforms (when one instrument is optimized given current levels for other policies) and full tax reforms when all transit prices are optimized at the same time. The detail description of the model is presented below.

(i) *Household utility.* An agent, representing an aggregation over all individuals in the GCMR, has utility function $U(.)$ defined by:

$$(1a) \quad U = u(X, M, T, \bar{E})$$

$$(1b) \quad M = M(M^A, M^{MB}, M^B, M^R)$$

$$(1c) \quad T = \sum_i \bar{t}^i M^i, \quad i = A, MB, B, R$$

All variables are expressed in per capita terms, and a bar indicates a variable at the city level, perceived as exogenous by the individual traveler.

In (1a) function $u(.)$ is quasi-concave and increasing in its first two arguments and declining in the other two arguments. X is consumption of a general good, produced and sold in the formal sector. $M(.)$ is sub-utility from passenger miles of travel. In (1b), this is increasing in M^A , passenger miles traveled by automobile (including taxi); M^{MB} , passenger miles traveled by private microbus; M^B , passenger miles traveled by larger, government-provided buses; and M^R , passenger miles traveled by government-provided rail. $M(.)$ is quasi-concave, so alternative travel modes are imperfect substitutes at the aggregate level.

T is in-vehicle travel time spent in trains, buses, and cars, which implicitly lowers utility through reducing time available for leisure and activities in the informal sector. In (1c), total in-vehicle travel time is the average time per mile for mode i (the inverse of vehicle speed), $\bar{t}^i$, times total passenger miles traveled by that mode, and aggregated across all four travel modes.

Finally, E is an index of non-congestion externalities. These encompass local pollution, which harms human health, reduces visibility, corrodes buildings, etc., and greenhouse gases, which reduce (future) utility through global warming and associated climate change. E also includes external costs of traffic accidents such as injury risks to pedestrians and possibly to victims in multi-vehicle collisions,

property damages borne by third parties, etc. (some accident costs are internal, such as own-injury risks in single-vehicle crashes, and these are implicitly incorporated in $u(.)$).

(ii) *Transportation inputs.* We assume that vehicle miles change in proportion to passenger miles for all modes, that is, vehicle occupancy is fixed.¹⁶ Therefore, for analytical purposes, we do not need to distinguish between passenger miles and vehicle miles (implicitly, vehicle miles is passenger miles divided by a parameter representing vehicle occupancy).

For convenience, we specify the supply-side of the transport system on an aggregate basis. The “production functions” for aggregate miles traveled by each mode are:

$$(2a) \quad M^i = M^i(K^i, F^i), \quad i = A, MB, B$$

$$(2b) \quad M^R = M^R(K_{FC}^R, K^R)$$

In (2a), K^i represents an aggregate of non-fuel inputs needed to run vehicles of type i . For buses, these include the number of vehicles in the fleet (expressed on a capacity-equivalent basis), which can be varied fairly easily in the medium term, as well as the manpower required to drive vehicles. For private autos, K^A reflects only vehicle capital costs, as the value of motorists’ own time is incorporated via T in the utility function. For subways in (2b), we distinguish fixed factors associated with labor required to operate stations K_{FC}^R , from the variable inputs required for vehicle operation, K^R . Capital infrastructure for subways, namely track and stations, is excluded from K^i . Thus, we follow the usual practice of studying how best to price rail systems given existing infrastructure, without worrying about recovering previously sunk capital investments in current fares.

In (2a) F^A and F^{MB} denote aggregate gasoline used by autos and microbuses respectively, and F^B denotes aggregate use of diesel fuel used by public bus. In (2b) we exclude fuels (associated with the electricity consumption of trains) because environmental costs from fuel use, when expressed on a per passenger mile basis, are very small, given the very high occupancy of trains with several cars (Parry and Small 2008).

We assume the production functions in (2a) are increasing, quasi-concave, and homogeneous of degree one. Thus, there are constant returns to scale in the supply of auto and bus vehicle miles, which seems a reasonable approximation (Small and Verhoef 2007, pp. 65). For a given amount of auto or bus mileage, a reduction in the amount of fuel and increase in other inputs represents a long-run shift in the fleet towards more fuel-efficient, but more capital-intensive vehicles (e.g., due to incorporation of

¹⁶ This is reasonable for transit, given that we do not model scale economies and diseconomies from changes in vehicle occupancy. And although car-pooling may increase with higher auto taxes, we believe this would have little impact on our policy simulations.

advanced fuel saving technologies into newer vehicles). For (2b) we assume the supply of rail passenger miles is proportional to variable inputs (i.e., $dM^R / dK^R > 0$ is constant), which seems reasonable.

(iii) *Transportation prices.* The government imposes a per-mile tax of $\delta^i \geq 0$ ($i = A, MB$), which is uniform across the metropolitan area. The price of gasoline and diesel are given by p^G and p^D , respectively; these prices are set by the government via state ownership of fuel production.¹⁷ For all vehicles, we normalize the price of other market inputs K^i to unity. And for transit vehicles, we denote the fare charged per passenger mile by p^i ($i \neq A$).

Microbus is provided by a large number of competitive enterprises. In the zero-profit equilibrium, passenger fares equal (constant) variable operating costs per mile, which include fuel costs, labor costs, capital costs, and taxes. Thus:

$$(3) \quad p^{MB} = (p^G F^{MB} + K^{MB}) / M^{MB} + \delta^{MB}, j = D, C$$

(iv) *Other production.* All goods, fuels, and vehicles are produced under constant returns to scale with labor as the only primary input (implicitly, vehicle capital is an intermediate input produced with labor).

(v) *Household constraints and optimization.* Agents are subject to the following budget constraint, which equates income with spending on auto fuel, auto capital, auto taxes, transit fares, and the general market good (whose price is normalized to unity):

$$(4) \quad I + \overline{GOV} = p^G F^A + K^A + \delta^A M^A + \sum_{i \neq A} p^i M^i + X$$

Here I is exogenous income (implicitly from a fixed amount of work effort). $\overline{GOV}$ is per capita government spending on a transfer payment to households. This closes the model by requiring that any increase or decrease in government revenue from changing transportation prices be received (or paid for) by households.¹⁸

Agents choose the general good, auto inputs, transit travel (and thereby travel times), to maximize utility (1) subject to the budget constraint (4) and the auto production function in (2a), taking unit travel times and external costs as given. This yields:

¹⁷ The government is assumed to supply whatever fuel is demanded at these prices so there is no rationing of fuel.

¹⁸ Any income effects on passenger travel from changes in the transfer payment are implicitly included in the calibration of travel demand responses below. These income effects are relatively minor given that spending on auto or transit travel represents a relatively minor fraction of the household budget constraint.

$$(5a) \quad \frac{u_{M^A} + u_T t^A}{u_X} = p^G \frac{F^A}{M^A} + \delta^A, \quad \frac{u_{M^i} + u_T t^i}{u_X} = p^i, \quad i \neq A$$

$$(5b) \quad \left(\frac{u_{M^A} + u_T t^A}{u_X} - \delta^A \right) M_{F^A}^A = p^G, \quad \left(\frac{u_{M^A} + u_T t^A}{u_X} - \delta^A \right) M_{K^A}^A = 1$$

where the denominator u_X converts utils into consumption or monetary units. In (5a), the marginal private benefit from auto passenger mileage, net of the cost of travel time (i.e., the marginal value of time $-u_T/u_X$ multiplied by time per mile t^A), is equated with per mile fuel costs and any per-mile auto toll. In addition, the marginal private benefit from mass transit travel, less time costs, is equated with the per mile fare. In (5b), the extra mileage (or “marginal product”) from auto fuels and auto vehicle capital ($M_{F^A}^A$ and $M_{K^A}^A$), times the marginal private benefit from auto travel, net of travel time costs and the mileage tax, are equated with the fuel price and the price of vehicle capital, respectively.

(vi) *Per unit travel times and external costs.* We define the following:

$$(6a) \quad t^i = t^i(\tilde{M}), \quad \tilde{M} = \bar{M}^A + \beta^{MB} \bar{M}^{MB} + \beta^B \bar{M}^B, \quad i \neq R, \quad t^R = \bar{t}^R$$

$$(6b) \quad \beta^{MB} = \frac{\sum_{i \neq R} t_{MB}^i M^i}{\sum_{i \neq R} t_A^i M^i}, \quad \beta^B = \frac{\sum_{i \neq R} t_B^i M^i}{\sum_{i \neq R} t_A^i M^i},$$

where $t_{MB}^i = dt^i / dM^{MB}$, etc.

Beginning with (6b), β^{MB} and β^B denote “passenger car equivalents” for microbus and bus. These reflect the addition to congestion (i.e. the increase in travel time for all passengers of road vehicles) from one extra *passenger* mile by a microbus or bus ($\sum_{i \neq R} t_{MB}^i M^i$ or $\sum_{i \neq R} t_B^i M^i$), expressed relative to the additional congestion from one extra passenger mile by car ($\sum_{i \neq R} t_A^i M^i$). An extra *vehicle* mile by a bus adds more to congestion than an extra *vehicle* mile by a car (buses take up more road space and stop frequently). However, due to the much larger passenger occupancy of buses than autos, an additional *passenger* mile by bus may add less to congestion than an extra passenger mile by auto (in which case β^{MB} and β^B are less than one).

In (6a), average travel time per mile for a road vehicle is an increasing function of passenger car equivalent mileage $\tilde{M}$. The latter is simply the weighted sum of passenger miles across cars, microbuses,

and public buses, where the weights are passenger car equivalents. Train time per mile is taken to be constant, that is, running an additional train does not slow down other trains in the system.

Non-congestion external costs are given by:

$$(7) \quad E = E(F^G, M^A, M^{MB}, M^B)$$

where E is weakly increasing in all its arguments and $F^G = F^A + F^{MB}$ is combined gasoline consumption from cars and microbuses. The partial derivatives of this function denote various marginal external damages (in utils). For example, $\partial E / \partial F^G$ is the marginal externality from gasoline use, reflecting CO₂ and local emissions, while $\partial E / \partial M^A$ is the marginal external cost of traffic accidents from automobile mileage. Following an increase in the gasoline tax, the proportionate reduction in gasoline-related externalities exceeds the proportionate reduction in auto and microbus mileage-related externalities. This is because the former reflects both long run changes in average vehicle fuel economy, as well as reductions in vehicle mileage, while the latter reflects only changes in mileage (see Parry and Small 2005 for further discussion). In contrast, diesel fuel and public bus mileage always change in the same proportion in our analysis since diesel prices are fixed. Thus there is no need to decompose diesel fuel externalities from public bus mileage externalities; implicitly, they are both incorporated in $\partial E / \partial M^B$.¹⁹

(vii) *Government*. The government is subject to the budget constraint:

$$(8a) \quad GOV = \sum_i \delta^i M^i + \delta^G F^G - K_{FC}^R$$

$$(8b) \quad \delta^G = p^G - \theta^{FG}, \quad \delta^B = p^B - \theta^B, \quad \delta^R = p^R - \theta^R$$

$$(8d) \quad \theta^B = (\theta^{FB} F^D + K^B) / M^B, \quad \theta^R = K^R / M^R$$

In these equations, θ^{FG} and θ^{FB} denote a constant per unit cost incurred by a state-owned enterprise for producing gasoline and diesel fuel respectively (resource inputs, refinery and distribution costs, etc.). θ^B and θ^R are the (constant) marginal costs to the government of supplying a passenger

¹⁹ If new vehicles are subject to binding emissions per mile standards, then emissions of new vehicles are independent of fuel economy, because all vehicles meet the same standard regardless of their fuel economy. In practice, the decoupling of emissions from fuel economy is undermined to the extent that emissions control equipment deteriorates over the vehicle life, older vehicles (not initially subject to standards) are still in use, people can evade emissions inspections for in-use vehicles, and there are fugitive emissions from petroleum refining (Harrington 1997). We believe these factors are significant for Mexico City and therefore that assuming proportionality between local emissions and gasoline use is a reasonable approximation.

mile for public bus and rail. They include (variable) capital and labor costs and, in the case of bus, fuel costs.²⁰

δ^G is the (effective) gasoline excise tax charged to private vehicle operators. It equals the difference between the government-determined fuel price, and the unit production cost of the fuel. δ^B and δ^R reflect the difference between the fare for public bus and rail charged to passengers, and the marginal cost to the government agency of supplying passenger miles; these price wedges can be negative if transit fares are subsidized.

The budget constraint in (8a) equates the government transfer payment with revenues from policy variables, namely auto and microbus mileage tolls, profits to state-owned fuel producers, and passenger fares, less the variable and fixed costs of transit provision.

The formulas presented below represent approximations of those in Parry and Timilsina (2009) in that they exclude some terms which play a very minor role in the components of optimal transport prices. For example, the optimal taxes for gasoline, and tolls for automobiles, omit the (slight) increase in congestion, accidents, and pollution that results when some people are diverted onto public bus in response to tax increases.²¹

Optimal gasoline tax. The optimal gasoline tax in \$/gallon, denoted t_G^* , taking other policies as fixed, is given by the following approximation:

$$(9) \quad t_G^* \approx EXT_G + (EXT_A - t_M) \cdot \rho_{AG} + (EXT_{MB} - t_{MB}) \cdot \rho_{MBG}$$

EXT_G , is the environmental damage, or external cost, from combustion of an extra gallon of gasoline, reflecting damages from CO₂ and local pollution emissions.

EXT_A is the external cost from congestion and traffic accidents associated with an additional vehicle-mile by automobile and t_M is a mileage toll (equal to zero at present).

²⁰ Our model assumes the (state-run) fuel producer breaks even. More generally, if fuel is sold at a loss, there is a subsidy that partly counteracts the price-raising impact of the fuel tax. This would imply a (moderately) higher fuel tax than suggested by our calculations below. On the other hand, it is possible that microbus operators have some limited market power through market-sharing agreements. In this case, the optimum toll on microbus mileage would be (moderately) lower than suggested below.

²¹ One reason why this effect is relatively small is that, given the small modal share of public buses in the entire GCMR, only a small portion of the travelers diverted away from cars switch to buses. Another is that the congestion, accident, and pollution costs per extra passenger mile by public bus are much smaller than these costs per passenger mile by auto travel.

ρ_{AG} is the reduction in auto vehicle miles per gallon reduction in gasoline. This depends on fuel economy—the higher the fuel economy the greater the mileage reduction per gallon of fuel savings. ρ_{AG} also depends on the share of the overall gasoline reduction coming from automobiles as opposed to minibuses. And it depends on the extent to which automobile fuel savings are a result of reduced automobile driving, as opposed to long run improvements in automobile fuel economy.

EXT_{MB} is congestion and accident externalities per *vehicle*-mile by minibus and t_{MB} is a toll, expressed per vehicle mile (t_{MB} is zero at present). ρ_{MBG} is the reduction in minibus vehicle miles per gallon reduction in (total) gasoline use—it depends on the same factors that determine ρ_{AG} .

Optimal mileage toll for autos. The optimal congestion toll (for a given fuel tax), in \$/vehicle mile, for autos is given by the approximation:

$$(10) \quad t_M^* \approx EXT_A + (EXT_G - t_G) \frac{G_A}{M_A} - \left(EXT_{MB} - t_{MB} + (EXT_G - t_G) \frac{G_{MB}}{M_{MB}} \right) \rho_{MBA}$$

where G_A and G_{MB} are gasoline consumption by auto and minibus and M_A and M_{MB} are vehicle miles by auto and minibus respectively. Here the optimal toll (t_M^*) is expressed per *vehicle*-mile by auto. It has two components.

First is the external cost associated with an additional vehicle mile of auto travel, in \$/mile, including the pollution costs which depend on fuel per mile G_A/M_A . The latter are defined net of the prevailing gasoline tax, or plus the prevailing subsidy if $t_G > 0$.

Second is the product of two terms. The term in parentheses is the external costs per minibus vehicle mile, including pollution costs, net of any minibus toll and fuel tax. This term is multiplied by the increase in minibus vehicle mileage per unit reduction in auto vehicle miles (ρ_{MBA}).

Optimum toll for minibus. The optimal toll per vehicle mile by minibus (t_{MB}^*) is given by:

$$(11) \quad t_{MB}^* \approx EXT_{MB} + (EXT_G - t_G) \frac{G_{MB}}{M_{MB}} + \left(EXT_A - t_A + (EXT_G - t_G) \frac{G_A}{M_A} \right) \rho_{AMB}$$

This equation is analogous to that for the optimum auto toll. ρ_{AMB} is the increase in auto vehicle miles per unit reduction in minibus vehicle miles.

Optimum public bus fare. The optimal fare per passenger-mile for public bus is given by:

$$(12) \quad p_B^* \approx MC_B + EXT_B^M - [(EXT_A - t_M) + (EXT_G - t_G)G_A / M_A] \rho_{AB}$$

The optimal fare consists of three components.²²

First is the marginal cost to bus companies of supplying passenger miles (MC_B). This is the (variable) capital, labor costs, and fuel costs incurred in bus operation, expressed per passenger mile. This unit cost is lower the higher is the average occupancy of buses.

The second component is the external cost of bus travel (EXT_B^M), also expressed on a per passenger mile basis (hence the M superscript to differentiate from auto and microbus external costs which are defined on a per vehicle mile basis). This captures the contribution of additional bus travel (needed to accommodate more passengers) to road congestion and roadway accident risk. In addition, local pollution emissions from diesel fuel combustion are included in EXT_B^M because these emissions will vary in proportion to public bus mileage given that the policy only affects the price of bus mileage and not the price of diesel fuel.

The third component subtracts, from the optimal fare, the costs of diverting people from buses to cars in response to higher transit fares. The term in square parentheses is mileage-related auto externalities, net of any congestion toll, plus fuel-related auto externalities, net of any gasoline tax, where all of these are expressed per vehicle mile. The term in square parentheses is multiplied by the increase in automobile vehicle miles per unit reduction in passenger miles by bus (ρ_{AB}).

Optimum rail fare. This is given by:

$$(13) \quad p_R^* \approx MC_R + EXT_R^M - [(EXT_A - t_M) + (EXT_G - t_G)G_A / M_A] \rho_{AR}$$

The formula for the optimal rail fare is analogous to that for the optimal bus fare. In the notation, superscripts with B for bus in equation (12) are replaced with R for rail in equation (13). The optimum rail fare is below the cost to the transit agency of accommodating an extra passenger mile on the rail system (MC_R), and the external costs for rail expressed per passenger mile EXT_R^M , to the extent this would lead to an increase in automobile externalities.²³

²² For simplicity the formula omits components reflecting substitution from public bus to rail and microbus because they play a minor role in the optimum bus fare (Parry and Timilsina 2010).

²³ The expressions ρ_{AB} and ρ_{AR} that capture the effect of increased auto travel in response to higher transit prices implicitly take into account feedback effects on auto travel demand of greater road congestion. That is, these

Fully optimized transport pricing. The above equations imply the fully optimized set of transport prices would be:

$$(14) \quad t_G^* = EXT_G, \quad t_M^* = EXT_A, \quad t_{MB}^* = EXT_{MB}, \quad p_B^* = MC_B + EXT_B^M, \quad p_R^* = MC_R + EXT_R^M$$

Computational Details. In order to compute the above formulas, we need to specify functional forms for travel demands, fuel use, etc. that indicate how variables respond to transportation prices. In all cases we use exactly the same functional forms as in Parry and Timilsina (2009), which in turn are based on widely used constant elasticity specifications.

Fuel use and travel demand are assumed to respond to changes in prices according to the following functional relations:

$$(15) \quad G = G^0 \left(\frac{p_G}{p_G^0} \right)^{\eta_{GG}}, \quad G_A = \alpha_A G, \quad G_{MB} = (1 - \alpha_A) G$$

$$(16) \quad M_A = M_A^0 \left(\frac{p_G + t_M M_A^0 / G_A^0}{p_G^0} \right)^{\eta_{AA}}, \quad M_{MB} = M_{MB}^0 \left(\frac{p_G + t_{MB} M_{MB}^0 / G_{MB}^0}{p_G^0} \right)^{\eta_{MBMB}}$$

$$(17) \quad M_B = M_B^0 \left(\frac{p_B}{p_B^0} \right)^{\eta_{BB}}, \quad M_R = M_R^0 \left(\frac{p_R}{p_R^0} \right)^{\eta_{RR}}$$

where superscript 0 denotes an initial value. All elasticities in (15)-(17) are taken to be constant.

In equation (15), gasoline consumption (G) falls as the price of gasoline (p_G) rises above its initial level. $\eta_{GG} < 0$ denotes the own-price elasticity of gasoline demand. The gasoline price is given by the producer or supply price of gasoline plus the gasoline excise tax, which is negative in the initial equilibrium. Also in equation (15), gasoline consumption by automobiles is equal to total gasoline consumption times the initial share of gasoline consumption used by autos, α_A . The remaining gasoline consumption is usage by microbus. Thus we assume that, in response to higher gasoline prices, gasoline consumption by autos and microbus fall in the same proportion.

In equation (16), passenger mileage by automobiles decline with higher gasoline prices and with any automobile toll (expressed in per gallon terms at initial fuel economy). $\eta_{AA} < 0$ is the elasticity for

coefficients are somewhat smaller because higher congestion from transit users displaced into automobiles will now deter some other people from driving.

auto mileage with respect to the fuel price, including any fuel price equivalent from the auto toll. Also in (16), passenger miles by microbus are related to fuel prices and any per mile tolls (both of which are passed forward into passenger fares) in the same way. $\eta_{MBMB} < 0$ is the elasticity microbus mileage with respect to the fuel price, including any fuel price equivalent from the microbus toll.²⁴

Finally in (17) passenger mileage by public bus (M_B), and by rail (M_R), are declining functions of the fare per mile by bus (p_B), and by rail (p_R), respectively. $\eta_{BB} < 0$ and $\eta_{RR} < 0$ are the fare elasticities for bus and rail respectively.

As for cross-price effects, the effect on another mode k following an increase in the price of mode i is simply given by

$$(18) \quad M_k = M_k^0 - \int_{p_i^0}^{p_i} \rho_{ki} \frac{dM_i}{dp_i} dp_i, \quad \rho_{ki} = \frac{dM_k / dp_i}{dM_i / dp_i}, \quad i, k = A, MB, B, R, i \neq k$$

The absolute price coefficients $dM_i / dp_i = \eta_{ii} M_i / p_i$ can be calculated using (A1)-(A3) and assumed values for elasticities.

The optimal price formulas presented above are computed in a spreadsheet, using our functional form assumptions, and based on parameter values discussed in the next section.

²⁴ Auto and microbus travel demands are not explicit functions of time costs per mile, which decline (moderately) with less traffic. That is, the feedback effect of less congestion on stimulating latent travel demand is implicitly taken into account in our chosen values for η_{AA} and η_{MBMB} below. This is consistent with the way these elasticities are typically estimated in the empirical literature.

Appendix B. Details on Parameter Calculations and Data Sources

Mileage. We consider four modes of passenger transportation in the GCMR: auto (including taxi), private microbus, public bus, and rail. Other modes like minibuses and the Haliopolis tram account for a very small share of passenger mileage and are excluded from our analysis.

According to IAPT (2007) the average person in the GCMR travelled 1,344 miles in 2002, where modal shares were auto (28.1 percent), microbus (32.2 percent), public bus (30.0 percent) and rail (9.7 percent).

We were also able to calculate modal shares for non-rail travel for 2005 based on estimates of the number of vehicles, average daily trips per vehicle, average trip length, and average vehicle occupancy obtained by pooling data from Central Statistical Office ('CAPMAS'), Cairo Transportation Authority, and the Ministry of Finance²⁵. Assuming the same share for rail travel as in 2002, this alternative data suggests modal shares for auto (24.4 percent), microbus (33.8 percent), and public bus (32.1 percent). In Table 1, we split the difference between these two estimates, assuming the same overall per capita mileage as in IAPT (2007). The resulting modal shares are also consistent with figures in NKCL and KEI (2008). Vehicle mileage data were estimated using average daily trip per vehicle and average trip length. These information together vehicle occupancy were obtained from NKCL and KEI (2008) and personal communication with Cairo Transportation Authority.

Fuel economy. Fuel economy for different vehicle types was taken from the IAPT (2007) database.

Fuel prices. The gasoline price and subsidy were obtained from the Ministry of Finance (Personal Communication, April 2010), averaging over octane 80 and 90.

Transit fares and operating costs. Personal communication with Cairo Transport Authority.

Local pollution damages. We are unaware of any local study of pollution damages from road vehicles in Cairo. We therefore extrapolate damage estimates from Mexico City where, like Cairo, natural factors are especially conducive to pollution formation.

Parry and Timilsina (2010) assumed a pollution damage estimate of 90 cents per gallon of gasoline (in year 2005 dollars) for the Mexico City metropolitan area. This was based on pooling evidence from a local study and an estimate they extrapolated from Los Angeles, after making some

²⁵ Most of these data were obtained through personal communication with various officials of these organizations.

adjustments for local factors.²⁶ We considered three possible adjustments to transfer the Mexico City damage estimate to the GCMR.

First, we double the damage estimate because Cairo has a population density about double that of Mexico City. The GCMR has a population of 17 million living in an area of about 1,660 square miles (Nippon Koei 2010). The greater Mexico City metropolitan region has a population of 19 million in an area of 3,691 square miles.

Second, we made some adjustment for differences in people's valuation of pollution-health risks. These risks are quantified using the value of a statistical life (VSL), which measures people's willingness to pay for reduced mortality risk, expressed per life saved. Parry and Timilsina (2010) implicitly assume a VSL for Mexico City of about \$1.5 million—about one-fourth of that assumed for the United States by its Environmental Protection Agency and Department of Transportation. The VSL is commonly transferred among countries using their relative real per capita income, raised to the power of the income elasticity of the VSL (e.g., Cifuentes et al. 2005, 40-41). Typical estimates for this elasticity vary between about 0.5 and 1.0 (e.g., Viscusi and Aldy 2003, Miller 2000). Real per capita income in Egypt is approximately 40 percent of that in Mexico, where income is measured in terms of purchasing power parity equivalent (IMF 2009, World Bank 2008). Therefore, this range of elasticities suggests the VSL for Egypt should be about 40-60 percent of that in Mexico. We lean on the conservative side by assuming the VSL for Egypt is \$600,000 (or about one-tenth of that for the United States). Thus, we scale back the local damage estimate by 60 percent.

Third, we did not make any adjustment for differences in automobile emissions rates. Our estimates of average miles per gallon for autos and minibuses in the GCMR are almost the same as those for Mexico City in Parry and Timilsina (2010). It is possible that vehicle emissions control equipment, for a given level of fuel economy, differs between the two cities, but we lack the data to reliably estimate the direction, let alone the magnitude, of any difference.

The net impact of the above adjustments is therefore a local pollution damage of 72 cents per gallon of gasoline. Following Parry and Small (2010), for public buses we assume local pollution costs per vehicle mile are three times those for auto.

Marginal global pollution damages. Most estimates of the discounted (worldwide) damages from future global warming are in the order of about \$10-\$30 per ton of CO₂, though studies using below market

²⁶ Their estimate is also broadly in line with local pollution damage estimates for Mexico City in World Bank (2002) and also for Santiago discussed in Parry and Strand (2010).

discount rates (based on intergenerational ethical arguments) obtain damages as high as \$85 per ton or more (e.g., Aldy et al. 2010, Newbold et al. 2009, Tol 2009, IWG 2010). Especially contentious is the treatment of extreme catastrophic risks due to the possibility of unstable feedback mechanisms that might cause a runaway warming effect, for example, due to warming-induced releases of underground methane, itself a greenhouse gas. In theory, these risks could imply damages per ton that are arbitrarily large in expectation (Weitzman 2009). However, this consideration does not provide specific guidance on an appropriate value for the social cost of CO₂. To be conservative, we adopt a benchmark value of \$10 per ton which is an approximate lower bound estimate from the literature.

A gallon of gasoline and a gallon of diesel produce about 0.009 and 0.0011 tons of CO₂ respectively.²⁷ Thus, our benchmark damage assumption amounts to 9 cents per gallon of gasoline and 22 cents per gallon for diesel.

Passenger car equivalents. We adopt the same value for the passenger car equivalent for an extra vehicle mile by a public bus as assumed for London by Parry and Small (2010), namely 5. For minibuses, which have a size about half way between that of a car and a public bus, we assume a passenger car equivalent of 3.

Marginal congestion costs. Marginal congestion costs depend on the added to delay to other road users caused by an extra vehicle mile and how motorists value travel time.

We begin with the following commonly used functional form relating travel delay per automobile mile (T^A) to road traffic volume (V), where the latter includes microbus and bus vehicle miles in passenger car equivalents:

$$(A1) \quad T^A = T_f^A \{1 + \alpha V^\theta\}$$

α and θ are parameters and T_f^A is the time per auto mile when traffic is free flowing. A typical value for the exponent θ is 2.5–5.0 for urban centers (Small 1992, pp. 70–71). We assume $\theta = 4$, the same assumption as in the Bureau of Public Roads formula, which is widely used in traffic engineering models.

The average delay due to congestion—that is the addition to travel time per mile over time per mile at free flow speeds—is $T^A - T_f^A = T_f^A \alpha V^\theta$. From differentiating (A1) with respect to V , the

²⁷ The carbon content of these fuels is from http://bioenergy.ornl.gov/papers/misc/energy_conv.html). One ton of carbon produces 3.67 tons of CO₂.

marginal delay caused by one extra vehicle is $\theta T_f^A \alpha V^{\theta-1}$. Multiplying by V gives the added delay aggregated over all road mileage. Thus, we can see that the marginal delay is a constant multiple ($\theta = 4$) of the average delay.

We assume a free flow travel speed of 25 miles per hour for cars, which implies a free flow time per mile (T_f^A) of 2.4 minutes (Parry and Strand 2010 estimate a free flow speed of 28 miles per hour based on simulating a model of the Santiago road network). And based on averaging over estimates for average auto travel speeds from IAPT (2007), 12.4 miles per hour, and for the representative 6th of October road, 15.5 miles per hour, we assume the current auto speed (averaged across the GCMR and time of day) is 14 miles per hour, implying a time per mile (T^A) of 4.3. Thus, the average delay is 1.9 minutes per mile and the marginal delay is 7.5 minutes per mile, or 0.13 hours per mile.

The gross hourly wage rate for Cairo is taken to be \$1.55 (IMF 2007). Following US studies (e.g. see the review in Small and Verhoef 2007) we assume the value of travel time is one-half the wage rate, or \$0.78 per hour. Multiplying by the marginal delay per mile gives a marginal congestion cost for autos of 9.7 cents per vehicle mile. Marginal congestion costs for other vehicles are obtained by scaling up according to their passenger car equivalents.

Accidents. According to police-reported data, there were 730 road deaths in Cairo in 2006 (CAPMAS 2010).²⁸ Given the breakdown between pedestrian/cyclist versus vehicle occupant deaths is unavailable, we use the same share of pedestrian/cyclist deaths as reported in Parry and Strand (2010) for Santiago, namely 55 percent. We make the common assumption that all pedestrian/cyclist deaths are external. For single-vehicle accidents we make the usual assumption that fatality risks are internalized. To what extent injuries in multi-vehicle collisions are external is unsettled. All else constant, the presence of an extra vehicle on the road raises the likelihood that other vehicles will be involved in a collision, but a given collision will be less severe if people drive slower or more carefully in heavier traffic. To be conservative, we omit deaths in multi-vehicle collisions from external costs.

Multiplying external deaths (401.5) by the VSL (\$600,000) gives a total cost of \$241 million.²⁹

²⁸ We do not make any adjustment for possible under-reporting and in this regard are estimate of accident externalities may be conservative.

²⁹ To be on the conservative side, we assume the same VSL for accident deaths as for local pollution deaths. In contrast, Small and Verhoef (2007) use a higher value for road deaths to account for the lower average age of someone killed by traffic as opposed to pollution (seniors are most at risk from local pollution).

Other external costs of traffic accidents include non-fatal injuries, property damage and medical burdens borne by third parties, and the tax revenue component of productivity losses. However, for lower and middle income countries these additional costs are fairly modest relative to those from fatalities. Following detailed estimates for Chile in Parry and Strand (2010) we scale up external costs by 12 percent to make some adjustment for these broader effects, to leave an overall cost of \$270 million.

Based on Parry and Small (2010) we assume that external accident costs per *vehicle* mile are the same for cars, buses, and minibuses. Buses are larger, and therefore pose greater damage risk in a collision for a given speed. However, offsetting this is that they typically are driven at slower speeds than cars, and crash less often as they are driven by professionals. Dividing the above cost figure by total road vehicle mileage gives an external cost for all vehicles of 8.7 cents per vehicle mile.

Summary of External Costs. Relating the above discussion to externalities that determine the optimal transportation prices in (A1)-(A6), we have the following. $EXT_G = 72 + 9 = 81$ cents per gallon. $EXT_A = 9.7 + 8.7 = 18.4$ cents per vehicle mile. $EXT_{MB} = 29.2 + 8.7 = 37.9$ cents per vehicle mile. $EXT_B^M = 1.3$ and $EXT_R^M = 0$ cents per passenger mile (after adding external costs per vehicle mile and dividing by occupancy).

Elasticities. There is a large empirical literature on gasoline price elasticities for advanced industrial countries, especially the United States. Surveys by Goodwin et al. (2004) and Glaister and Graham (2002) put the long-run elasticity at around -0.6 to -0.7 , while assessments by US DOE (1996) and Small and Van Dender (2006) suggest an elasticity of around -0.4 . Limited evidence for middle and lower income countries is broadly in line with these estimates (e.g., Eskeland and Feyzioglu 1994, Galindo 2005).

The empirical literature also suggests that about a half to two-thirds of the elasticity comes from long-run improvements in vehicle fuel economy, and the remainder from reduced vehicle use. We might expect a somewhat larger mileage–fuel price response for GCMR than in the United States, given the wider availability of transit alternatives to private car use, and the greater feasibility of walking to destinations in the (compact) GCMR.

We assume that mileage–fuel price and fuel economy–fuel price elasticities are the same for autos and minibuses. And we adopt a benchmark value of -0.5 for the gasoline price elasticity, with the assumed response split equally between better fuel economy and reduced mileage.³⁰

Behavioral response coefficients for gasoline tax. The coefficient ρ_{AG} in equation (A1) has three components.

First is automobile miles per gallon, which converts costs per vehicle mile into costs per gallon of gasoline. Miles per gallon increases as fuel taxes rise. This is calculated from M_A/G_A according to equations (A7) and (A8).

Second is the fraction of any given reduction in gasoline consumption that comes from reduced automobile consumption (as opposed to reduced minibus consumption). Given our assumption that fuel use for autos and minibuses fall in the same proportion this fraction is the share of automobiles in gasoline consumption, α_A , which is 0.65.

The last component of ρ_{AG} is the portion of the tax-induced reduction in auto gasoline use that comes from reduced driving, as opposed to improvements in fuel economy. This is 0.5 given our above assumption about the decomposition of the gasoline demand elasticity.

The coefficient ρ_{MBG} in equation (A1) has analogous components. First is miles per gallon for minibuses, calculated from M_{MB}/G_{MB} according to equations (A7) and (A8), where minibus gasoline consumption falls in the same proportion as total gasoline consumption. Second is the fraction of any given reduction in gasoline consumption that comes from reduced minibus consumption (0.35). Third is the portion of the tax-induced reduction in minibus gasoline use that comes from reduced driving (0.5).

Initially, an incremental tax-induced reduction in gasoline use reduces auto vehicle miles by 6.2 and minibus vehicle miles by 1.4. These coefficients increase somewhat for non-incremental tax increases, as vehicle fuel economy rises.

³⁰ There is a potential problem with applying evidence based on nationwide fuel demand responses to a fuel tax increase that is specific to one urban center. If fuel taxes are increased substantially in the GCMR but not in neighboring regions, people might be induced to drive to lower-price regions for refueling (or smuggle gasoline into the GCMR). We do not have evidence on how this effect might increase the overall magnitude of the region-specific fuel price elasticity. This is another reason for being cautious about the welfare effects from the large fuel price increases discussed here.

Behavioral response coefficient for auto mileage toll. The coefficient ρ_{MBA} in equation (A2) is the increase in *vehicle* miles by microbus per unit reduction in *vehicle* miles by auto induced by the auto toll. We assume that 80 percent of the *passenger* mileage diverted from auto in response to an auto toll will go onto other modes and 20 percent will reflect reduced overall travel demand. Of the diverted passengers we assume that they move on to other modes in proportion to the initial share of those other modes in non-auto passenger mileage. This implies that for each passenger mile diverted off auto, microbus will expand by 0.36 passenger miles. Taking account of vehicle occupancies, this means that microbus vehicle miles will expand by $(2.5/14) 0.36 = 0.064$ per unit reduction in auto vehicle miles.

Behavioral response coefficient for microbus mileage toll. The coefficient ρ_{AMB} in equation (A3) is the increase in *vehicle* miles by auto per unit reduction in *vehicle* miles by microbus induced by the microbus toll. Again, we assume that 80 percent of the *passenger* mileage diverted from microbus in response to the toll will go onto other modes in proportion to their initial shares in non-microbus passenger mileage. This implies that for each passenger mile diverted off microbus, auto will expand by 0.31 passenger miles. Taking account of vehicle occupancies, this means that auto vehicle miles will expand by $(14/2.5) 0.31 = 1.76$ per unit reduction in auto vehicle miles.

Behavioral response coefficient for public bus and rail fares. Coefficients ρ_{AB} and ρ_{AR} in (A4) and (A5) were chosen again assuming that 80 percent of people diverted from public transit in response to higher fares would travel by other modes, with passenger miles going to those modes according to their initial shares in passenger miles for modes other than the one whose price is being increased.

Urban Status and Urban Challenges¹

Urban Egypt: an overview

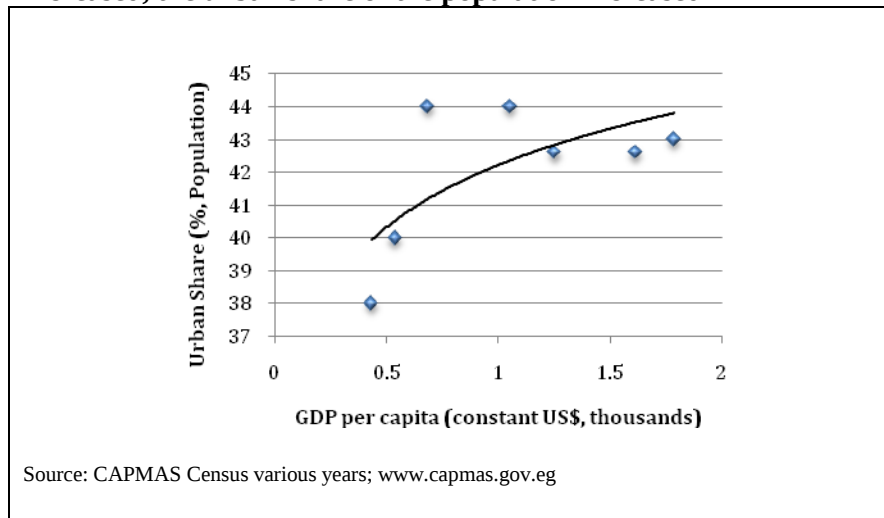
Official population numbers set Egypt at an intermediate urbanization stage², with 43³ percent of its population living in urban areas. The latest UN projections suggest that by 2050, more than 60 percent of the population in Egypt will be in urban areas; annual urban growth rates between now and 2030 are expected to be above 2 percent. Census figures suggest that from 34 percent urban, Egypt had moved to 43 percent urban in 2006, with urban shares of the population increasing as income increased (Figure 1). However, Egypt's urbanization rates have remained relatively stagnant and even slightly decreased between 1976 and 2006 (see Table 1 below).⁴

Table 1. Evolution of Urban Population (million)

Year	Urban	Rural	%Urban	%Rural
1947	6,353	12,604	34	66
1960	9,965	16,120	38	62
1966	12,033	18,043	40	60
1976	16,036	20,590	44	56
1986	21,216	27,038	44	56
1996	25,286	34,027	42.6	57.4
2006	30,950	41,631	42.6	57.4
2008*	32,324	42,772	43	57

Source: CAPMAS Census various years; www.capmas.gov.eg

Figure 1 Egypt has followed international patterns: as income increased, the urban share of the population increased



¹ This chapter authored by Nancy Lozano (FEUUR) draws heavily from previous Bank work, in particular the two volumes of the recent Urban Sector Update, Arab Republic of Egypt.

² The World Development Report defines countries with urbanization rates between 25 and 75 percent as being at intermediate stages of urbanization.

³ CAPMAS. Egypt in Figures, 2009. <http://www.sis.gov.eg/VR/egyptinnumber/egyptinfigures/e1.htm>, accessed on February 10th, 2011

⁴ Urban Sector Update. Arab Republic of Egypt, 2008. World Bank.

Alternative measures of urbanization such as the agglomeration index calculated by the World Bank, suggest Egypt is higher in the urbanization scale. Urbanization levels measured through the agglomeration index suggest more than 90 percent of the population lived in urban areas in 2006. Using data from 1996, Denis and Bayat estimated that if the urban definition were to be changed to consider urban places as those agglomerations with population levels above 10,000, then Egypt would have been considered to be already 66.8 urban in 1996 instead of the official 57.4 percent. If instead, a break of 5,000 inhabitants was used, then 86 percent of Egypt's total population would be classified as urban.

With an urban population of more than 32 million, the challenges in urban areas of Egypt are likely to be considerable in the next decades. Whether the urbanization rate is closer to 43 or 90 percent, cities are definitely to play an important role in Egypt's growth path.

Box 1: The official definition of urban places in Egypt

The official Census definition of urban areas in Egypt is purely administrative and ignores the characteristics of the place or the degree to which population are agglomerated in an specific area. An area is consider urban if it satisfies any of the following requirements.

- (1) falls within an urban governorate –limited to Cairo, Port Said, Suez and, until recently, Alexandria;
- (2) falls within an agglomeration officially declared as a “city” and has a city council
- (3) is the capitals of a rural districts (*marakaz*) or the capital of a rural governorate

As a result of this arbitrary definition, the urban population of Egypt may be largely under estimated.

Source: Urban Sector Update, Arab Republic of Egypt. 2008. World Bank

As Egypt moves into higher urbanization levels, it is important that it sets the basis right for a successful urbanization process. The WDR 2009 framework suggests that countries at incipient stages of urbanization should focus on setting the basic institutions that will support fluidity of factor markets. Land policies as well as policies that promote the provision of basic services throughout the national territory are central. Korea is a clear example of the sequence of policies that supported a successful urbanization process. In 1960, Korea was at an incipient stage of urbanization, with 75 percent of its population living in rural areas. Access to basic services was also limited, with more than 30 percent of adults with no schooling and low levels of population with access to water. By 2000, the urban composition of the Republic of Korea had dramatically changed, with about 80 percent of the population living in cities. As urbanization took place, Korea also achieved near to universal access in basic services, increased the literacy rate more than 99 percent. By focusing on providing universal access to basic services and strengthening institutions, Korea set the right grounds for a successful urbanization process.

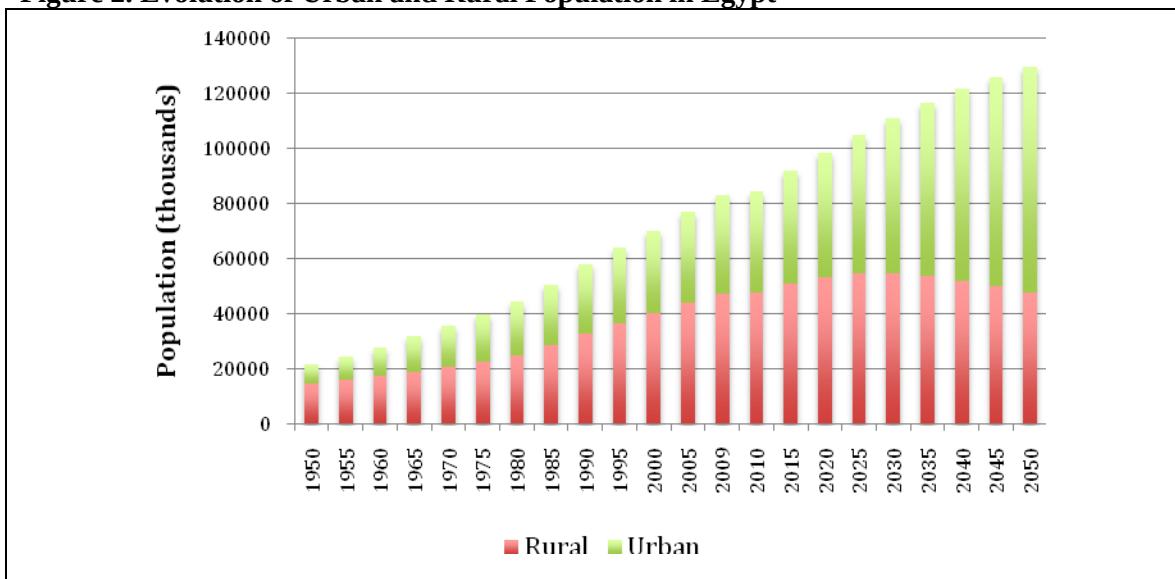
At a second stage, when urbanization takes off, connecting places becomes essential to support the efficiency of such process. Places at intermediate urbanization levels – between 25 and 75 percent, see increasing urban population in its cities, with increasing densities. As economic activity increases, goods and labor must be able to move quickly from one area to the other, so that different places can specialize in what they are most efficient. If cities are not connected to each other, and to the hinterlands, efficiency losses

will be observed, and local economies will develop as autarkies. Within urban places, the same principle holds. Cities must be integrated so that labor, other inputs, and products can move fluidly from one place to the other, allowing both firms and household to take efficient location decisions. Connective infrastructure gains importance when urbanization picks up as a way to enhance integration both across and within cities.

Finally, in what the WDR 2009 defines as advanced stages of urbanization -75 percent or more urban population, divisions become stronger within cities and targeted interventions may be required to alleviate these.

Independently of which urbanization definition is used, Egypt is today already overwhelmingly urban and at the very least, at the higher end of an intermediate urbanization stage. United Nations estimates suggest that by 2050, urban population will be almost 82 million individuals in Egypt (see Figure 2 below). Being at an intermediate stage of urbanization and with growing urban populations, the challenges that the country will face are considerable. Efforts on institutions and infrastructure are to be stressed to support a successful urbanization process. Further, in large cities like Cairo, where challenges are especially difficult targeted interventions such as slum upgrading may be necessary, however, they should be used only in conjunction the appropriate combination of institutions and infrastructure.

Figure 2. Evolution of Urban and Rural Population in Egypt



Source: World Urbanization Prospects: the 2009 Revision Population Database. <http://esa.un.org/wup2009/unup/index.asp?panel=1> accessed February 10, 2011

A salient characteristic of Egypt's urban portfolio is that it is dominated by two large cities: Greater Cairo and Alexandria. These two cities house over 65.3⁵ percent of the urban population in Egypt. More interestingly, a recent study by Demographia suggests that -using population estimates for 2010, Cairo is the eleventh largest city in the world with over sixteen million inhabitants. Alexandria takes place seventy-three in the

⁵ Following the official definition of urban areas.

world, with just over four million inhabitants. The same study has estimated that population densities in these two cities are around 14,200 and 9,800 habitants per squared kilometer. While these estimates put both Cairo and Alexandria among the 100 densest cities in the world, it is still much lower than densities in cities like Hong Kong (25,100 habitants per squared kilometer).

These two large cities not only concentrate almost 70 percent of the urban population, but they are also important drivers of the country's economy. While Cairo houses 11 percent of the national population it was estimated that in 2003 it contributed more than 20 percent of the National GDP. Alexandria on the other hand with about 5.4 percent of the total population contributed about eight percent of the national GDP.⁶ Cairo is Egypt's portal to its regional neighbors and to the rest of the world. In 2000, Denis and Vignal estimated that metropolitan Cairo concentrated 83 percent of foreign establishments in Egypt. Higher concentration of economic activity is also revealed in the high concentration of both public and private sector jobs in this city. 43 percent of public jobs and 40 percent of private jobs in Egypt are estimated to be concentrated in Cairo.⁷ With such large contribution to GDP from these two cities, it is clear that Egypt's success is strongly correlated to the success of Cairo and Alexandria. If these cities do well, so will Egypt as a nation.

Leaving aside Cairo and Alexandria, the urban portfolio of Egypt is dominated by smaller cities. Only two cities –besides Cairo and Alexandria- surpass the 500,000 threshold in 2006. A growing number of small and medium size cities is also has also emerged starting in the nineties; while there were only 20 cities (excluding Cairo and Alexandria) with more than fifty thousand individuals in 1960, forty year later this number had increased to 90 (see Table 2 below).

Table 2. City Size Distribution: 1960 to 2006

	1960	1976	1986	1996	2006
1 million plus	2	2	2	2	2
500,000 – 1 million	0	0	0	0	2
100,000 – 500,000	12	17	20	24	35
50,000 – 100,000	8	18	31	51	57
20,000 – 50,000	46	67	80	75	74
Less than 20,000	53	52	59	62	35

Source: Urban Sector Update. Arab Republic of Egypt. (2008) World Bank.

Note: The cities of Giza and Shubra el Kheima are included as part of Greater Cairo. Also, the reduction in the total number of cities over 1996-2006 is due to Census area re-definitions

In Egypt, larger population growth is observed in the areas surrounding the city boundaries, areas in many cases officially classified as rural. Suburbanization seems to be the main characteristic of the urban expansion process that large cities in Egypt, in

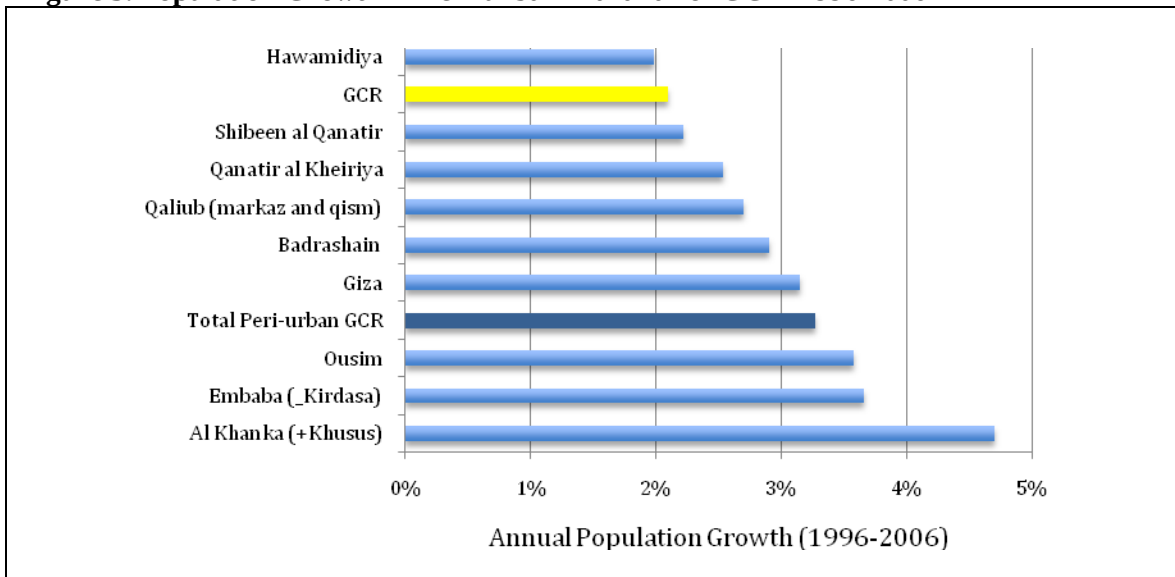
⁶ World Bank (2008)

⁷ Ibid.

particular Cairo, are experiencing. In this context, the rural-urban transformation plays a key role in shaping the city.

In 2008, the peri-urban population of Greater Cairo was estimated to be almost 25 percent of the total population in GCR. More importantly, the population growth of these areas surrounding the core city was higher than the average growth in Greater Cairo (Figure 3). While population growth between 1996 and 2006 in the region was around 2.1 percent and the national growth was 2.1 percent, peri-urban areas around the GCR grew at an average of 3.27 percent.⁸ If instead of looking at the Census *markaz* one focuses on specific villages and towns in these peri-urban areas of Cairo, the picture is more striking with some of them showing growth rates of over five percent. As an example, the rural *qism* of Khusus showed an annual growth rate of almost 7 percent between 1996 and 2006. Other villages like Abu Sir, Minta, Birqash, Al Qalag and Al Koum al Ahmar show annual growth rates of over 5.5 percent.

Figure 3. Population Growth in Peri-urban Marakaz of GCR 1996-2006



Source: World Bank (2008) Data is from CAPMAS, Censuses of 1986 and 1996 and preliminary results of 2006 Census

New towns represent a smaller percentage of the population. In contrast to the high weight peri-urban areas of the Greater Cairo Region have both in population growth and in total population, new towns only represent 3.8 of the total population of the region. Furthermore, while between 1996 and 2006 population growth in peri-urban areas represented 35 percent of the region's growth, new towns only represented 13.8 percent of the regions absolute increase in population.

Expansion of peri-urban areas of Greater Cairo has followed mainly a polycentric pattern. Old towns and villages have expanded outwards and rural-urban transformation is the signature of the urbanization process. More importantly, given the strict constraints set on conversion of rural land into urban areas, the nature of such expansion has been to

⁸ World Bank (2008) Urban Update. Volume 2.

a great extent the result of informal developments. Today, many of these peri-urban areas are still classified as rural despite their urban nature. As Table XX below shows, even in 1996, agricultural activities accounted only for 21 percent of the active population in peri urban areas of Greater Cairo. The percentage of active population dedicated to manufacturing activities was slightly higher at 22 percent.

Table 3. Distribution of Economically Active Population by Economic Sector

Economic Sector	Peri-urban GCR	All Egypt Rural	All Egypt Urban
Agriculture, hunting & fishing	21.3	47.3	8.5
Manufacturing	21.8	9.7	18.9
Construction	11.7	6.4	10.3
Commerce	12.1	5.8	13.7
Transport, storage & communications	7.7	4.2	7.8
Public admin & defense	7.1	8.4	11.9
All other sectors	18.5	18.1	28.8

Source: World Bank (2008). Data from 1996 Census

These characteristics of the urbanization process in Egypt led to the new towns policy that started in 1970s as an official attempt to drive population growth out of the largest cities, and away from the Nile valley. The new towns were supposed to attract population as well as investment flows, and create drivers of economic and industrial growth outside the Nile valley. In about 20 years Egypt built more than 20 towns and is preparing to build 45 more, becoming the world's largest program for the creation of new cities. Several industrial zones providing attractive tax incentives were also created within these new towns. The new towns required high investments, representing about 22 percent of MHUUD infrastructure investment between 1997 and 2001.⁹ Furthermore, over half of the projects under the subsidized housing program were directed to the new towns.

However, international experience suggests that new towns and cities created by governments are in general not successful for several reasons (WDR, 2009). First, existing governance problems are very likely to be extended to new cities. That is, if a government does not do well managing an old existing city, it will also perform badly as manager of the new city. Unless institutions are strong, both old and new cities will suffer. Second, new cities do not necessarily attract the appropriate mixture of people to create a successful city. Opportunity costs associated with moving from older settlements may be too high. Further, efficiency may be lost in the economy as a whole if a "bad" location is chosen for the new town. New towns that have succeeded appear to be those where governments have been able to first, set the right institutions in place, and coordinate investments in infrastructure and housing with good governance practices.

Results of the new towns policy in Egypt are consistent with international experience. By 2006, the objectives of this policy were still far away from being accomplished. After over thirty years of the implementation of the new towns policy,

⁹ Wold Bank (2009)

total population of all new towns in Egypt –over twenty towns– had not reached 800,000; the initial population target was set at five million. More importantly, population growth in new towns between 1996 and 2006 accounted for only 4.3 percent of national population growth. Furthermore, most population increases are still found within the Nile Valley and therefore the efforts to develop the desert have not been successful neither in terms of de-concentrating population nor in terms of driving population growth away of the Nile Valley and Delta. While total population increase in desert lands was just above 1 million, population increase in the Nile Valley and Delta was almost 12 million. While some new towns, such as Sixth of October, New Cairo, Tenth of Ramadan, and Fifteen May have been more successful in attracting people, the vast majority of new towns has not succeeded. Furthermore, the success of these towns can be attributed to a great extent to their proximity to a large metropolitan area. Connectivity however, is still a challenge in all cases

Basic institutions have not been put in place as new towns have been created. New towns in Egypt have been burdened with high planning standards leading to high property prices and disrupting fluidity of land markets, i.e. institutions are not in place. New towns are also in many cases at very long distances from existing markets and therefore, imply high opportunity costs both for firms and workers in terms of travel time, i.e. connectivity is deficient.

In the Greater Cairo Area the story is no different. Eight new towns were created near Cairo, with the hope of attracting population and de-concentrating the city, have not been successful. While new towns are growing faster because they started from a very low base in 1996, they only account for less than 14 percent of Greater Cairo’s population increase between 1996 and 2006. The core agglomeration absorbed over 50 percent of the total population increase in the area; even peri-urban areas absorbed a larger proportion of the absolute increase (near 36 percent) compared to the new towns.

Table 4. Population in Greater Cairo Area 1996-2006

	Population				
	1996	2006	% Annual Increase	Absolute Increase	Share of Absolute Increase
Core Agglomeration*	10,188,333	11,748,240	1.43%	1,517,102	50.3%
Peri-urban Areas (9 markaz)	2,857,468	3,942,262	3.27%	1,084,794	35.9%
New Towns (8 towns)	184,695	601,767	12.54%	417,072	13.8%
Total GCR	13,230,496	16,292,269	2.1%	3,018,968	100%

Source: World Bank (2008)

Box 2: New cities: escapes from urban jungles, or cathedrals in the desert?

New cities were attempted in Europe without much success. In the United Kingdom the Barlow

Commission Report of 1940 stimulated interest in new towns. Between 1947 and 1968, Britain created 26 new towns to control the growth of London and stimulate development in Scotland and Wales. In 1965 France followed a similar program—nine towns, five in the Paris area and four in lagging areas, were constructed. These programs soon were interrupted and put aside as unsustainable. The new towns never reached their targeted population, nor did they forestall the growth of London or Paris. The experience in developing countries has been mixed.

Success in China

China's approach recognizes the need to create cities with access to major markets and transportation networks. Shenzhen was the first special economic zone (SEZ) to be approved by Deng Xiaoping in 1980. From a small town with 30,000 inhabitants, it grew to 800,000 in 1988 and 7 million in 2000. The new residents include the best-trained professionals in the country, attracted by high salaries, better housing, and education opportunities for their children. GDP per capita increased more than 60 times. Shenzhen owes its success to its nearness to Hong Kong, China; its connectedness within the area and with other cities in China; and its urban form:

- Access to foreign markets. Locating the SEZ close to the city of Hong Kong, China, facilitated foreign investment, technical assistance, and access to foreign markets.
- Connectedness within the area. To spread the fruits of development, the boundaries of the municipality were expanded to extend the benefits of the city to all workers. The rural hukou was abolished in the municipality, and all urban services became accessible to all residents. Placing the Shenzhen city-area in the Pearl River Delta area ensured the best possible links to its hinterland and other urban nodes in the Delta regions. Complementary decisions to ease the mobility and integration include investments in transport infrastructure and a shift from a road-based to a rail-based system.
- Functional urban form. The comprehensive plan for Shenzhen envisions a polycentric metropolis that connects the SEZ to urban nodes through efficient transport.

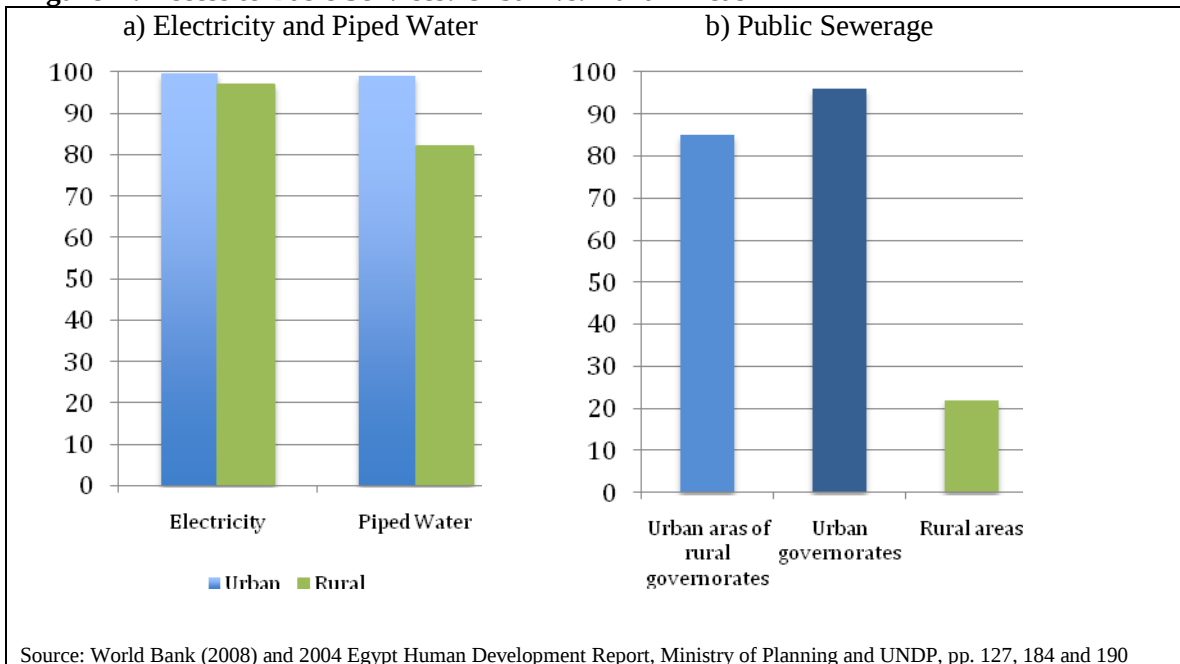
Taken from World Bank (2009) pp. 224

The challenges ahead

International experience suggests that geographical differences both in income and living standards diverge before they start converging. As countries develop, population and economic activity become concentrated and disparities across regions sharpen. Leading and lagging regions get defined and disparities in GDP per capita grow. As incomes increase, if the right policies and investments are in place, access to basic services converges, but rural-urban gaps persist. Finally, the move towards higher incomes is accompanied by the final convergence of wages and incomes (WDR, 2009).

Egypt has taken steps toward convergence of living standards. Access to basic services is high across both urban and rural areas. While rural areas are slightly behind, over 80 percent of the rural population has access to piped water. The big gap in terms of basic services seems to be in terms of access to the public sewerage system. While more than 80 percent of the population in urban areas has access to public sewerage, only 22 percent of the population in rural areas does (Figure 4). The results achieved by Egypt are commendable, but there is still work to be done.

Figure 4. Access to Basic Services: Urban vs. Rural Areas



High coverage rates are the result of high investments in the infrastructure sector over the last three decades, partly supported by foreign aid. Being wastewater and sewerage systems the most costly of all public services to extend it is not surprising that this is where larger gaps in coverage are found. Most importantly, as pointed out in previous World Bank reports, several weaknesses in water and waste water treatment management have led not only to this gaps but are also preventing the country from fully achieving convergence of access to basic services. First, the low water consumption tariffs do not cover operations or maintenance costs of potable water and wastewater systems. Second, the strong control of the central government does not allow local authorities flexibility in terms of operation and investments. Third, large numbers of staff make firms inefficient and increase operational costs, and finally, the fact that meters are not used in Egypt but rather a block rate system is used to charge very low rates for water consumption.

While urban areas lead the way to convergence of living standards in Egypt, peri-urban areas lag behind. The success of cities does not seem to be spreading beyond the core of the city. Access levels decline considerable as one moves across official city boundaries and into peri-urban areas (see Table XX below). While access to electricity and water exceeds 95 percent in peri-urban areas around Cairo, the situation in terms of wastewater and sewerage connections is quite different. Around 73 percent of peri-urban households classified as urban are connected to the public network, while only 20 peri-urban households classified as rural are connected (Table 5). This may reflect insufficient investment budget allocations, as in Egypt investment allocations tend to follow historic levels and do not necessary take into account population pressures (World Bank, 2008, pp14).

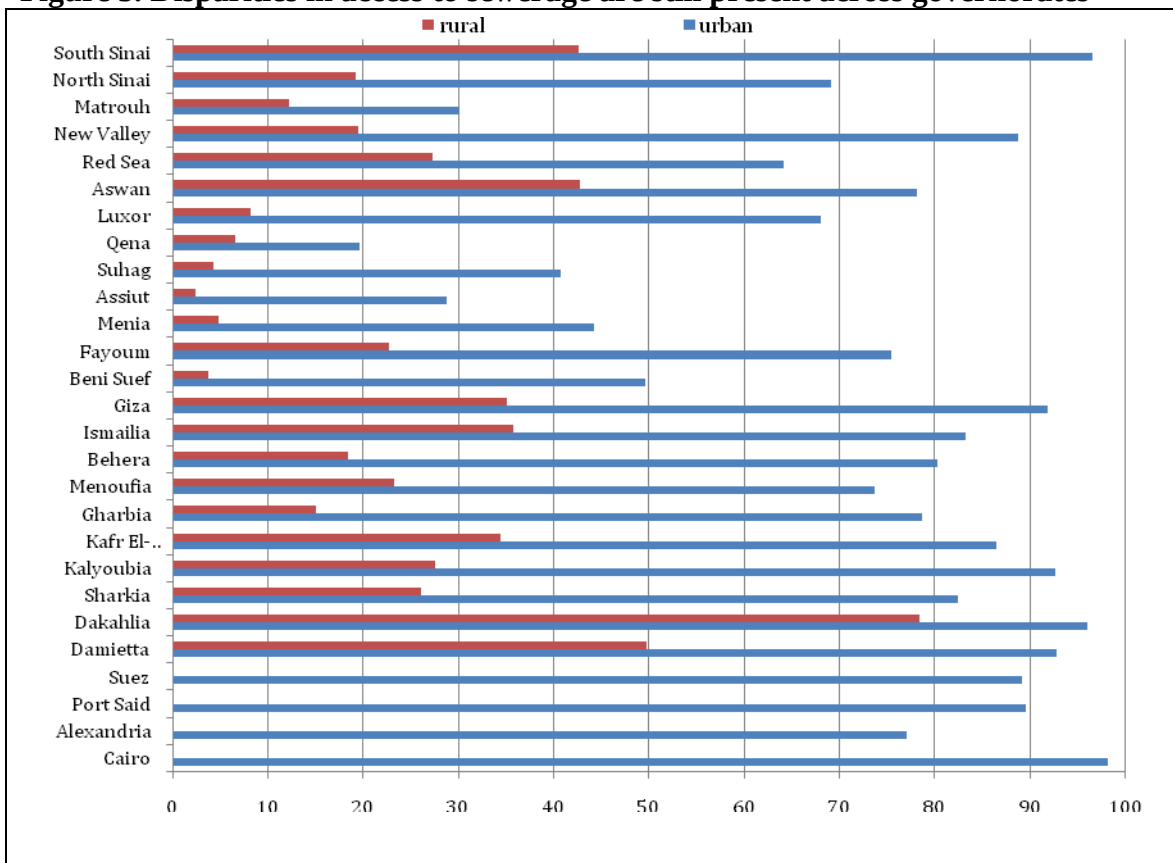
Table 5 Percentage of households with access to sewerage in peri-urban Cairo

	Urban Areas	Rural Areas
Peri-urban Areas	73	20
GCR (average)	95	31

Source: World Bank (2008)

The social landscape in Egypt varies considerably depending on which indicator is used. While almost all Egyptians are connected to electricity and water throughout the country, disparities across the territory are evident when looking at sewerage access. Variation is observed in accessibility both across governorates and between urban and rural areas. Even in urban areas of Assiut, Menia, Qena, Matrouh, Beni Suef, and Suhag, less than 50 percent of the population is connected to the sewerage system. (Figure 5) Urban areas in other governorates show access levels in all cases above 60 percent.

Figure 5. Disparities in access to sewerage are still present across governorates



Source: Egypt Human Development Report 2008

Solid waste management has been recognized for long as one of the big challenges in Egyptian cities. Currently only 70-80 percent of municipal solid waste is being collected in key urban areas (World Bank, 2009b). Solid waste collection also worsens with distance from the city center. In the Greater Cairo area, currently solid waste collection and disposal is limited to the core city and the center of the main peri-urban towns (e.g. Qaliub, Qanatir el Kheiriya, Khanka, among others). However, very limited or no collection of waste extends to the growing peri-urban areas at the fringe of urban

agglomerations. Moreover, not only improving collection should be a challenge tackled, but also disposal must be addressed. Today, a great proportion of the solid waste is dumped into irrigation canals and drains, presenting a considerable environmental hazard.

The problem of inadequate waste management manifests in high health and environmental costs. Inadequate waste management leads to pollution of air (burning of wastes), water (dumping of solid waste in waterways) and soil (solid waste accumulation). According to a study conducted by the World Bank (2006), the cost of environmental degradation in Egypt is in the range of 3.2-6.4% of GDP, with a mean estimate of 4.8%. This study also indicates that waste burning is substantial in Cairo and contributes significantly to the urban air pollution and estimates the damage cost of waste burning at 0.2-0.5% of GDP. The health damage cost has been estimated by the World Bank to be L.E. 1.3 billion/year or 1.5% of GDP. Furthermore, as solid waste is dumped into canals and irrigation drains, water quality is particularly in Delta region. Clean up cost has been estimated by The Ministry of Water Resources and Irrigation around L.E. 250 million per year.

Achieving long-term financial sustainability of the sector should be a priority. Municipal Solid waste management services are not currently cost-effective. Solid waste generation is estimated to increase by 3.2 percent per annum (METAP, 2006) and therefore it is important to provide quick solutions to this problem. Currently, most of the expenditures on solid waste are financed by central government transfers and a partial cost recovery system for SWM services on the basis of a fee collected through the electricity bill. These financing mechanisms are not adequate to address the large scale of this issue in large and growing urban areas. New instruments are needed for generating additional revenues to support the sector sustainability (World Bank, 2009b).

Another challenge that urban Egypt faces today is the definition of appropriate institutions that support and promote fluid land markets. The lack of physical planning and control in cities, has led to surge of informal settlements. Official estimates of population living in informal settlements were of about 12 million in 2006. It is also estimated that 60 percent of the population in the Greater Cairo Region lives in informal settlements. Today, most informal settlements are located in agricultural land, with only 10 percent of these settlements being in the dessert. This pattern seems to be representative of the distribution of informal settlements in other Egyptian cities.

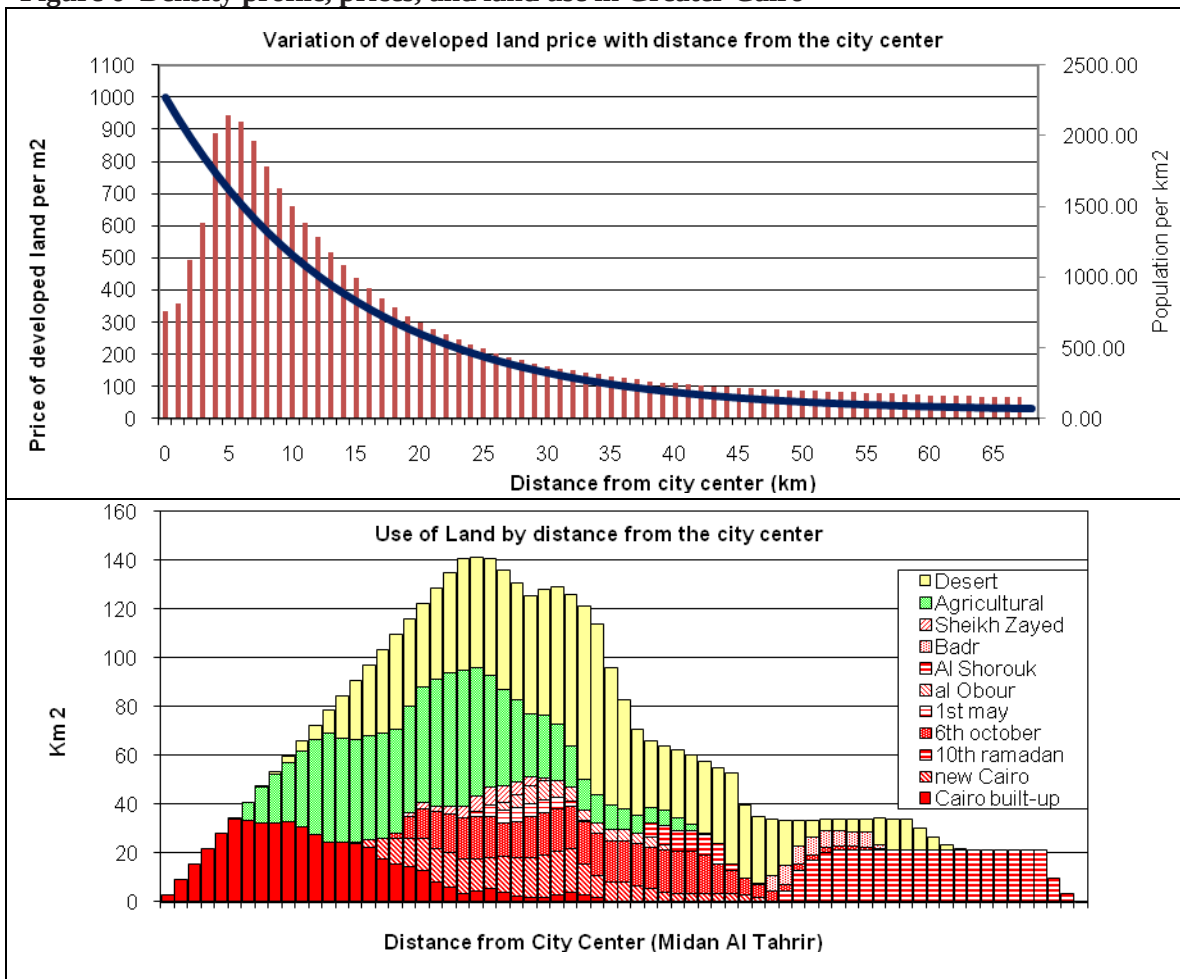
Lack of planning and physical control are major issues throughout the city. The consequences are seen clearly in the structure of informal settlements where public space is inexistent, living little or no land school or hospitals and streets are between two and four meter wide. This lack of public infrastructure and overall planning has an impact not only on quality of life but also has an effect on things like education. As no public land is available for schools and other public services, health and education in these areas suffer.

Stringent regulations on the conversion of agricultural land into urban uses have led to the surge of informal settlements and peri-urban areas that lag behind in terms of access to basic services. This, together with high congestion had led to the very steep price gradient observed in Greater Cairo (see Figure XX panel (a)). Price for developed

land is considerably higher in the city center (1000 LE\$ per m²) and decrease rapidly as one moves away from the center until a distance of about 35 km from the city center, where prices reach 100 LE\$ per m² and decrease with distance at a slower pace. When locating in a city center, individuals take the decision of substituting capital for land, but regulations reduce the possibility of making this substitution.¹⁰ Furthermore, if roads are not good and congested, and transportation systems are unreliable, individuals will not be willing to locate in the periphery and the demand pressure on centrally located land will increase, as is the case in Cairo. Strengthening land markets is essential to guarantee a successful rural-urban transformation as cities expand (see Box 3 below).

Figure 6 below shows the density profile for Greater Cairo. Comparing this to the land use profile, it is clear that very close to the city center agricultural land takes a large proportion of total land. At only 5 km from the city center, agricultural land uses start gaining importance until it becomes the predominant land use at 15 km from the city center. Interestingly, population densities are higher at this urban-rural frontier.

Figure 6 Density profile, prices, and land use in Greater Cairo



¹⁰ Bertaud (2010)

Comparing the graph above with recent estimates of households expenditures suggest that affordability is a serious concern for all areas within 25 km of the city center. International experience suggests that housing related expenditures should be between 20% and 40% depending on the quintile of the income distribution the household falls in. Table 6, provides the estimated income that households in different deciles of the income distribution would devote to house payments. Combining affordability numbers in Table 6 with the actual prices per squared meters shown in Figure 6 and Table 6 provide evidence that affordability is a serious problem. A flat of 60 m² in the city center would have a sale price of about 60,000 \$LE. If rent or bank payments are estimated at 0.5% of the property value, this would mean that households willing to live in the city center would have to pay about 600 \$LE per month. This is affordable only to the two highest quintiles, at 40 percent of their income. A similar exercise suggest an average housing payment 150 \$LE for a flat as far as 10 km from the city.

Table 6. LE per month that households can devote to housing in Greater Cairo

Income Decile	At 20% of Income	At 40% of Income
First	61.6	123.6
Second	93.2	186.6
Third	113.1	226.12
Fourth	131.2	262.4
Fifth	153.0	306.0
Median Household	160.0	320.0
Sixth	180.6	361.1
Seventh	206.2	412.4
Eighth	262.4	524.7
Ninth	355.7	711.4
Tenth	854.8	1709.6

Source: World Bank (2007)

Recent efforts by The General Organization for Physical Planning (GOPP) suggest Egypt is taking a step forward in terms of land institutions. GOPP has recently introduced a planning initiative to allow a certain amount of urban expansion on agricultural land. This is a considerable step away from the standard policy that for many years prohibited any kind of development on agricultural land. Strengthening land markets is essential to guarantee a successful rural-urban transformation as cities expand (see Box XX below). The new policy has two main objectives. The first objective is to limit the existing extension of unplanned *aashwa'i* and limiting its future expansion. The second objective is to provide alternative urban opportunities that meet the needs of

existing *aashwa'i* areas for housing and services.¹¹

The recent planning efforts are moving in the right direction; however, care needs to be taken to lay the foundations so that the objectives are met. Extending provision of basic services and enhancing land markets will be essential to warrantee the successful rural-urban transformation of these areas in the fringe of cities. Strengthening institutions for land titling and land valuation is an important step to guarantee that land conversion does not benefit the state and developers at the cost of farmers or rural households. Only 10 to 20 percent of land holdings are registered to the name of current owners.¹²

Box 3: Strengthening land market institutions for a successful rural-urban transformation

Republic of Korea's integrated cities

The Republic of Korea developed the rural- urban integrated city to overcome the shortcomings of earlier rural development initiatives. The integrated city policy incorporates rural counties with cities in a unified spatial framework. It aims to improve local public services and local administration and reduce rural-urban disparities. Starting in 1994 the government selected 49 cities and 43 counties as candidates. The selection criteria included historical homogeneity, natural topographical conditions, and the potential for balanced development within the integrated city. The selected cities and counties held public hearings and citizen surveys. After this screening, 41 cities and 39 counties were amalgamated into 40 rural-urban integrated cities. Attitude surveys suggest that residents and local councils see the benefits. Every- one agrees that the integrated city makes for better land use planning in urban areas. Areas for improvement include the equity of service provision, since rural and urban residents have different needs, and the weak rural voice, since urbanites are believed to be more organized.

Land consolidation

In Indonesia, a land consolidation program implemented in the 1990s suggests an alternative to plan the development of areas in the urban fringe. While the city mayor was given the authority to decide the location of consolidation areas, private land owners and occupiers where active players in the implementation process. Land consolidation required a minimum of 85 percent of the landowners representing at least 85 percent of the land area to agree to the process. All participants were required to provide land for infrastructure and services provision, but the amount of land that each one should provide was decided through group consensus; those who could not contribute with land, could contribute with money or labor.

Extracted from WDR (2009) pp. 220

Strengthening the mortgage market, which is now very limited in Egypt, may serve as an instrument to increase affordability. Strengthening the mortgage market is also essential as a way to increase participation of households in the formal market. The growth of informal settlements has been fueled by the high ratio of incomes and cost of new housing. Reasons for this include high regulatory constraints, e.g. high standards for new housing, the lack of an active resale market for existing housing, and high population pressures. Estimates from MOHUDD suggest that between 175,000 and 200,000 new housing units will be needed every year to cover additional needs from an increasing

¹¹ Sims, David (2008) Toward appropriate planning and building standards for urban Egypt: Guidelines for Tahzim residential areas on agricultural land. Policy Note World Bank

¹² Ibid.

population. However, only top two deciles of the income distribution can afford to buy a house in the formal sector.¹³

As Egypt embraces even higher levels of urbanization, connective infrastructure will be essential to reduce distances both within large cities and between cities. Along with the benefits of urbanization, Greater Cairo has also witnessed negative externalities associated with congestion and air pollution. The World Bank Greater Cairo Urban Transport Strategy (2006) predicts that if nothing is done to improve connectivity in the area, by 2022 the average speed will be less than 11 km per hour. The costs of pollution are not negligible either, and joint losses from pollution and congestion have been estimated to be around 4 percent of local GDP.

Egypt must recognize large and dense cities are only feasible if people are connected to labor markets. As cities grow denser, an integrated and efficient system of mass transport becomes essential. A recent congestion study for the Greater Cairo area suggests that average speeds for all corridors in the area, excluding the Ring Road, fall in the range for 20-45 km/hr for the morning peak hours. Considerably reduced speeds are observed in the evening, with average speeds being between 15 and 30 km/hr. Another informative indicator used to measure congestion in cities is the average speed index. An average speed index of 0.5 suggests that speeds on a route under uncongested conditions are reduced to half during congested hours. For the Greater Cairo area, average speed indexes are estimate to be between 0.36 and 0.71.

Congestion leads to high costs that may dampen the benefits of being in a city. Direct costs from congestion may be related to delays, unreliability, excess fuel used, and pollution. The total annual direct congestion cost in the GCA was estimated to be between 7.7 and 8.5 million LE. The main contributor to this cost is the delay cost (38 percent).

Transport conditions appear to be even worst if we focus only on new towns around Cairo. As an example, an individual living in 6th October, Obour, or New Cairo cities pays between 150 and 200 LE more in transport per month than those living within the Greater Cairo area. This difference results from low connectivity to the core city: two additional trips per destination are required by means of the more expensive private micro-buses.¹⁴

¹³ Sahar

¹⁴ UNDP (2010)

Box 4. Life in Informal Districts of Cairo

Informal areas are not inhabited only by the poor. Authorities declare that almost 17 million Egyptians live in informal areas around cities. That figure includes many more than just the very poor. Studies reveal the profile of informal areas to include a wide spectrum of socio-economic groups; its resident could include street vendors as well as judges. Residents of informal areas include government employees, workshop owners, and artisans, as well as professionals such as doctors and lawyers. A common pattern is the family-owned apartment building, with may be one or two poorer tenants renting on the ground floor. Who else lives in informal areas? Those with low car ownership (in many areas only 10% of residents own a private car); those who use mass transportation for their main means of transport; people many Egyptians meet on the street; the waiter, the taxi driver, a colleague at work or the fellow next to you at university. In short, almost any Egyptian may live in an informal area.

Housing research since the 1980s in Egypt has focused on the problems of informal areas, hardly attempting to explicitly address the advantages that have made this sector grow faster than any other housing sector in the country. Informal areas are a 100% self-financed, self-help housing mechanism. They are demand-driven, incremental in growth, compact in form, low-energy-consuming, with an efficient mixture of uses allowing work-home proximity and district self-sufficiency in terms of daily and seasonal needs. Advantages of these areas include the 'walkability,' the convenience, safety, social solidarity, and resident participation. Outcomes of such things have great significance, where for example, the non-chaotic distribution of commercial uses allows people to walk where they need to (decreasing pollution from vehicles, saving money spent in transportation costs, and increasing social inclusion/co-existence of various groups in the public domain which is the seed for community building). Consequently, safety comes in the form of social solidarity, appropriation of space and self-policing (which saves the government money in the decreased need for administration), and resident participation gives rise to feelings of ownership, self-empowerment, and purpose. Inhabitants of these informal areas also describe them as 'popular districts' that are lively and friendly, however they are not oblivious to the want in quality of self-provided services such as private un-regulated collective transportation means. What they want from the government is acknowledgement (of those private initiatives) and partnership in domains where they cannot help themselves, such as solid waste management and infrastructure maintenance; "pick up where I leave" sort of partnership. What are missing are regulations that respect such private initiatives, that enable those working solutions to continue yet with improvements, instead of abolishing them in the name of modernity and development.

Source: Extracted from UNDP 2010, pp. 200

Current government efforts are focusing on extending the underground metro with a third line, which should be completed by 2017. This will increase the share of underground km per million habitants; currently, in Cairo the share is only 4 km / million inhabitants compared to cities like Bangkok (20 km), Sao Paulo (31 km) and Paris (150 km).

Supply side efforts in terms of transport investments are more successful when paired with demand-side policies. It is undeniable that additional investments are important to improve both quality and quantity of roads so that labor markets and residential areas are connected. However, together with supply-side efforts, demand-side policies may be a way to amplify the effects of additional investments in infrastructure. There are several demand side instruments that could be consider such as pricing mechanisms like permits for private cars or tolls, and regulations or traffic plans that reduce traffic at certain hours/areas. Singapore, London and Oslo are pioneer cities in implementing this kind of policies. The recent decision to establish the Greater Cairo Regional Transport Management Authority to be the main entity responsible for traffic management over the whole region is an important move towards finding alternative traffic management policies that work for the region as a whole.

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Reshaping Economic Geography in Egypt

Agglomeration-Based Urbanization and Balanced Social Development for All Egyptians

Sahar Tohamy

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I. Introduction

Egypt, not unlike many developing countries, has embarked on achieving sustainable economic growth to enhance the standard of living of its citizens. Despite a move toward more private sector-led economic growth and integration in the global economy, Egypt has failed to produce the institutional environment for pro-growth agglomeration, urbanization and concentration of economic growth without the ills of urban informality, and pressures on land use and housing market especially in the Greater Cairo Region. At the national level, Egypt did not focus on producing a place-oriented strategic investment plan that gears human and capital resources towards natural economic tendencies of attracting labor (migration) and capital accumulation outside the greater Cairo region as well as eliminate pockets of informality in the Greater Cairo region itself representing poverty pockets in the capital where most of the country's economic activity is concentrated.

Some of these factors are natural market forces attracting economic activity to a major "agglomeration" center; others can be attributed to the absence of a clear and coherent national investment strategy that guides economic activity towards creating the necessary scale, specialization, and expanding growth potential in other parts of the country. Migration, as a means of connecting to better services or employment opportunities through attempting to relocate towards economic activity has continued for the past 40 years in Egypt, primarily towards the greater Cairo region (GCR) at first, with migration towards smaller urban centers picking up later on. Government policies, implicit and explicit, intentional or unintentional to concentrate economic activity in and around the GCR combined with an inefficient urban planning and housing policy that is not consistent with natural market forces, let alone with the government's own concentration-inducing policies around the GCR.

Seen as crucial structural imbalances in the country's efforts to achieve economic growth and poverty reduction on one hand and to enhance its capacity to produce balanced social development for its citizens, this section utilizes the conceptual framework of the 2009 World Development Report on Reshaping Economic Geography to :

- 1- Overview migration patterns and attempt to understand the underlying factors and the relationship between economic activity and evaluate how these patterns contribute to needed connectivity of individuals and factors of production to economic agglomeration centers
- 2- Evaluate slum areas, informal housing development
- 3- Overview urban development and planning strategies that address both housing and land management and use.

II. Current Economic Geography of Egypt: Selected Topics

The concept of economic geography stretches to comprise a wide range of topics encompassing all “blind” institutions that ensure that geography does not discriminate against, or hinder the development of particular regions. In addition, it emphasizes that government policy is utilized to support the natural tendencies of economic activity to develop secure and stable and “agglomeration” patterns that create economic mass for efficient production and access to markets. Covering all these aspects of current economic geography for Egypt is beyond the analysis in this section and is covered under other studies conducted under the umbrella of this project, hence this section will focus primarily on three specific areas: 1) housing informality and slum areas, 2) rural-urban migration dynamics and patterns, and 3) urban development strategy and its impact on industrialization and land management in general.

1. Housing informality and slum areas

The importance of the distinction between informal housing and slums is crucial in addressing informal housing and slum area problems in urban Egypt, and in proposing recommendations for each of these housing categories. Informal housing comprises housing units that are typically constructed in areas that have developed outside proper urban plans applying detailed zoning, sufficient areas designated for roads, recreation and green areas, service locations, etc. These, housing units, while typically established without building permits, they nonetheless comprise mainly acceptable concrete structures built on privately owned agricultural land which becomes consolidated over time and fed with infrastructure and services. As a result, for example, all housing in rural areas is informal in that sense (no official planning of villages). In unplanned areas where existing land uses or building conditions are not suitable, partial or complete redevelopment may be required. This redevelopment primarily focuses on the creation of areas to be utilized for public service provision (example: private land to be donated or purchased from the community for establishing primary schools, health clinics, etc.) Formal housing on the other hand, comprises housing units that are constructed in pre-planned and zoned neighborhoods and that have acquired all the necessary permits and abided by all regulations imposed by various government bodies.

The proliferation of informal housing in Egypt is directly related to several government policies that have distorted the housing market. These include: (i) rent control (which distorted the rental market and diverted new formal private sector supply to higher-end segments of the market and for sale only); (ii) heavily subsidized public housing programs which have prevented scaling up in a way that could address increasing demand/needs for affordable housing; (iii) the inefficiency of direct public sector supply of housing; (iv) complex unwieldy building regulations and a very bureaucratic, costly process for building permit issuance; (v) unrealistically high planning regulations and standards; (vi) a dysfunctional urban land market due to the lack of secure property rights and the many difficulties associated with acquiring public land; (vii) limited mortgage market and lack of re-finance services; (viii) cumbersome registration procedures that

are necessary conditions for mortgage acquisition; (ix) absence of serious property taxation that creates incentives for owners to rent out unoccupied units; and (x) uncompetitive practices that characterize the real estate market in general.

The discrepancy between incomes and the price of housing units is also a function uncompetitive behavior in the real estate market in general; starting from the first phases of utility and service provision and government procurement requirements, lack of transparency in government procurement of contracting company services, delayed payment for government contracts, followed by uncompetitive behavior in the construction industry sector, followed by poor information available for real estate projects, lack of consumer protection mechanisms for real estate purchases and lack of insurance coverage etc. All these factors produce a highly uncompetitive sector where units are over-priced, consumers are poorly protected and real estate production, management, as well as finance are lumped together with limited room for competition due to bundled services.

These combined government interventions and monopolistic practices in many stages of the unit production chain have greatly increased the cost of formal housing supply, which meant that the informal sector became the only channel to cater to the needs of a large number of low, moderate and even middle-income families who could not afford formal housing options in the absence of a functioning rental market. By contrast, the informal market allowed freedom from the high costs and unwieldy regulations associated with formal construction, especially since families could build their houses progressively according to their needs and affordability level.

The formal land development/subdivision process has proven totally incapable of capitalizing on the dynamism of small scale informal owner-builders and enabling them to formalize and expand their activities. Unrealistically high land subdivision and building standards, in addition to the significant costs and bureaucratic hassles associated with formality, shut out small scale land developers.

Thus, the dysfunctional formal housing market remains a primary source of new informality in urban housing that attempts to evade the added cost of dealing with the both government bureaucratic requirements and highly monopolistic formal private real estate developer market. Conversely, slum areas in the sense of shanty-towns and dangerous housing conditions are limited compared to the magnitude of structurally-sound housing units that are produced in areas that were not properly-planned. However, slums also include deteriorated inner-city slums, squatter shanty towns and the parts of cemeteries used for living purposes. Under the new approach, conditions on the ground dictate whether residents will be relocated or the area upgraded without their relocation. While, not necessarily representing the worst cases of human deprivation and poverty concentration in the world, these pockets of poverty remain to be evidence of the government's lack of strategic planning and sequencing of policies and its inability to rely on ex-ante policies to solve various problems. The approach of ex-post and reflexive containment of symptoms continues to produce an un-necessarily high human cost to

households and individuals and high financial cost to the government in its attempt improve living conditions in these regions.

In terms of quantifying the magnitude of informal housing and slum areas there has been a continued debate on the size of “slums” and estimates varied widely because of the lack of distinction between the two categories until recently; informal housing one hand and slum areas and housing in deteriorated conditions on the other. For example, using the MDG Expert Group slum criteria, it was estimated that slum areas throughout Egypt reached 1210 areas. In its 2008 MDG Midpoint Assessment report, the Egyptian government noted, ‘If this trend persists it will limit Egypt’s ability to contribute to the MDG target of achieving a significant improvement in the lives of at least 100 million slum dwellers by year 2020’.

In 2008, however, the Informal Settlements Development Facility (ISDF) was established by presidential decree to specifically address the problem of slums in Egypt. To do so, it revisited the definitional criteria to present a more accurate account of existing slums and categorize them according to the severity of risk they pose to human life and to property, as a means of prioritizing interventions. Using the authority of the new Unified Construction Law, the ISDF classified urban areas into two main types for interventions and action: ‘unplanned’ and ‘unsafe’ areas. In early 2009, the definition of unsafe areas formed the basis of a national ISDF survey, which prioritized redevelopment in areas where at least 50 per cent or more of the inhabitants are affected by the following criteria:

First Priority: Buildings in locations that form threats to human life, including areas in danger of rock slides, flooding or train accidents.

Second Priority: Buildings that are constructed with recycled or reused material for walls, roofs, floors and the like; buildings of low resistance to natural disasters and deteriorated buildings.

Third Priority: Threats to the health of inhabitants, as in the case of the lack of clean water, improved sewerage, location within the influence zone of high voltage cables or building on unsuitable, unstable soil.

Fourth Priority: Threats to stability of inhabitants, such as the lack of ownership or the lack of freedom in dealing with the inhabitants’ properties

The results of the ISDF survey identified just 404 ‘unsafe’ or ‘slum’ areas in Egypt as compared to previous estimates of over 1200 areas nationwide. ISDF provided also a target and a road map to complete their work within a short timeframe of eight years (2009 to 2017). The results of the ISDF survey have redefined the problematic nature of dealing with the slum area problem in Egypt, and therefore shown ‘substantial discrepancies between previous statistics concerning the size of slums and the more recently produced ones.

Areas which are considered unsafe are estimated to contain 1.1 million inhabitants (nation-wide), representing the number of people in great need of immediate action to save lives or

improve their living conditions. Such statistics would change the position of Egypt on the world map of slums’.

Using their new criteria adapted from UN-HABITAT’s standards, the ISDF estimates that approximately 0.8 per cent of the nation’s population lives in slums. UN-HABITAT estimates that in 2007 the proportion of urban population in Egypt living in slum areas was 17.1 per cent with the urban population at around 32 million, suggesting almost 5.5 million urban Egyptians lived in slum areas. Eight percent of “unsafe” areas are concentrated in the Greater Cairo Region.

Construction law and slum areas: The new law also sets operational procedures for dealing with slums, informal settlements, downtown areas, industrial zones and historic urban areas and is the legal backbone for the new operations and mandate of the ISDF, charged with the removal of slums from Cairo and the whole of Egypt by 2017. It is a key piece of policy that has direct impact on the poorest socioeconomic groups in so far as new informal residential construction is severely proscribed and the most uninhabitable residences (classified as ‘unsafe’) will be demolished and their residents relocated and re-housed.

While the growth of informal housing characterizes all urban centers in Egypt, details of the physical and social characteristics in informal areas are only available for the Greater Cairo Region.¹ UNHABITAT, *Cairo: A City in Transition* presents the main features of large informal settlements in Cairo. These features include:

- 1- They are home to millions of poor, low and middle-income households;
- 2- They are primarily expansions on privately-owned agricultural land that the government prohibited its use for non-agricultural purposes to preserve agricultural land area;
- 3- Wide-scale, independent but illegal construction of multi-level, durable housing by informal developers;
- 4- Despite strict laws and regulations, growing informal settlements gain strong footholds throughout Greater Cairo;
- 5- The subsequent government involvement in the development and upgrading of ‘mature’ and populous informal settlements, including a degree of formalization of some informal areas;
- 6- Local initiatives to provide services through charitable NGOs as well as extended government welfare programs to assist informal residents.

A comprehensive survey conducted by the UNHABITAT and the American University in Cairo, Social Research Center was conducted in 2007-2008. The focus of the survey was to analyze physical deprivation characteristics of households in the GCR and disparities in these characteristics between low, medium and high regions. (Box 1: has a summary of the methodology of the survey). The main results and conclusions by indicator are detailed in the report, however, the most important results that the survey and the study (Cairo: A City in Transition) relate to three important issues:

¹ De Soto/ECES studies in 1997, 2004 analyzed Tanta and Alexandria in addition to Cairo, but only focused on the issues related to property registration and titling.

- 1- The distribution of poor and non-poor households across low-, mid-, and high quality “mantiqas”:
 - a. The population of low and mid-quality mantiqas, the distribution of households between poor and non-poor is almost split 50-50.
 - b. Only in high quality mantiqas, is the incidence of poor households much lower (12%).
- 2- The severity of gap between various socio-economic characteristics between poor and non-poor households is not general and across the board, it appears only in a subset of long list of characteristics that were examined (See Box 1).
- 3- The survey results suggest that the most appropriate social analysis lens to use in Cairo is that of poor and non-poor rather than slum versus non-slum, as low- and middle-low income households make up the majority of households in informal areas but their dwellings may not to fit the UN-HABITAT criteria for ‘slums’.

Box 1: Background on the The UNHABITAT, SRC 2007-2008 Survey:

Using the Area-based Physical Deprivation Index (APDI) methodology, the SRC survey took Cairo governorate's some 300-plus *shiakh*as (official census districts) and subdivided some of these to come up with 638 *mantiqas* (small urban areas) that formed the basis of their analysis. These were then categorized as high, medium or low quality, depending on their ranking following the SRC/UN-HABITAT deprivation analysis; 50 *mantiqas* were ultimately selected for the household survey.

The survey found a significant level of heterogeneity among poor and non-poor residents of the low- and medium-quality *mantiqas* in Cairo. UN-HABITAT recognizes that the criteria for classification of medium *mantiqas* may be weak in so far as 'medium' often represents a transition category between low and high *mantiqas*. The separation of low from medium may also be questioned in a city where historic diversity, the prevalence of a merchant economy and cultural norms and lifestyle have resulted in an unusually strong spatial integration of mixed socioeconomic groups.

This diverse social and urban fabric makes separation of groups into discrete and meaningful categories problematic. Nevertheless, the findings suggest that the index used for separation of the area types reflects reality, with many data differentials following a gradient from high to low *mantiqas*. The medium *mantiqas* reveal characteristics between the two extremes.

In both low- and medium-quality *mantiqas*, more than 48 per cent of residents were found to be poor, with just over 50 per cent of the residents being non-poor in terms of the household asset analysis used.

In the high-quality *mantiqas*, just 12 per cent of the residents were poor, suggesting that in terms of segregation, it is only in the highest *mantiqas* where poor and non-poor are not well mixed. These findings concur with other analyses that suggest Cairo is an unusually heterogeneous city with regard to socioeconomic proximity. Income stratification through more modernist city planning has relatively recently replaced the earlier spatial distribution in Cairo, which was based on a variety of non-income factors.

Even in the lowest *mantiqas* category, the non-poor are well represented (average 28 per cent) in former desert and agricultural areas (now informal settlements), as well as in cemeteries.

In the core and historic areas of Cairo where physical decay, dereliction and dilapidation is most evident along with mixed uses (i.e., commercial and residential), the bulk of the residents are non-poor (62 per cent) despite the *mantiqas* categorization as low.

Source: UNHABITAT and SRC, p. 39-40

The assessment is based on the severity of the difference of a particular issue between poor and non-poor households (irrespective of the difference in *mantiqas*), according to the results of the SRC/UN-HABITAT survey. The differences are categorized as low, moderate and severe depending on the significance of the differences found between socioeconomic groups, and as assessed by the author.

The starkest contrasts in Cairo, as seen in the SRC/UN-HABITAT survey results, were between the poor and the non-poor living in the better-off (high-quality) *mantiqas*. This category of 'poor' often reported a lower quality of life on a range of variables than poor households living in the most physically deprived areas of the city. The least dramatic findings from the survey have to do with the similarity of findings between low and medium *mantiqas* on some variables. This may point to the heterogeneity and richly mixed social, historical and cultural factors that have led to the spatial positioning and intermingling of different socioeconomic groups in Cairo. In terms of housing issues and the key criteria used by UN-

HABITAT to understand the extent of slum areas and prevalence of slum dwellers, the data from this survey looks positive. It suggests that despite other struggles and deficiencies people experience in their living conditions, relatively few live in overcrowded conditions. Access to water and sanitation is high and most homes are durable; residents enjoy a high sense of security of tenure even if their dwelling's status remains extra-legal by government criteria. The relatively small proportion of Cairo's population that met the slum criteria have been identified by the Informal Settlements Development Facility and are being addressed as Egypt commits itself to eliminate slums throughout the country in the next decade or earlier.

The important result of the UNHABITAT-SRC survey conducted for the GCR and the analysis of characteristics of families living in informal areas is the fact that these informal areas are inhabited by both poor and middle income families, and there are poor families living in well-off areas as well. Socio-economic characteristics of poor families whether they live in formal or informal areas exhibit severe differences when compared to non-poor. Hence the importance of studying the areas where the gaps are higher and addressing these discrepancies through 1) improving the delivery of public services in both formal and informal areas whose beneficiaries are primarily poor families and 2) do not exclusively rely on targeting informal areas as proxies for areas where poor people live, because poor and non-poor live in informal areas AND there are poor families even in formal high income neighborhoods.

Table 1: Living conditions at household (HH) level between poor and non-poor (selected results) Differential assessment*

HH Characteristics: Dependency ratios (looking after children and older family members)	Moderate
HH Characteristics: Nature of family relationships (tightly knit or detached)	Low
HH Characteristics: Having personal identification card and election card	Moderate
HH Characteristics: Sense of security (exposure to violence and crime)	Moderate -
HH Characteristics: Social cohesion and cooperation among Cairenes	Moderate -
HH Density/overcrowding: Household with a density of 3 persons per room	Severe
HH Density/overcrowding: Sleeping arrangements (shared: children / parents / siblings)	Severe
Housing quality & durability: Type of housing (building / apartment / rooms)	Low
Housing quality & durability: Walls and ceiling structure of the housing unit	Moderate
Housing quality & durability: Floor quality / Windows and painted walls	Moderate to Low
Housing quality & durability: Bathroom ownership and / or access	Low to None
Housing quality & durability: Availability of kitchen	Moderate
Water: Access to improved water for the households	Low to None
Water: Frequency of fresh water cutoff affecting the household	Severe
Sanitation: Access to flush or traditional toilet for the household	Low
Sanitation: Sink next to the toilet	Moderate
Secure Tenure: Type of housing unit (ownership / rental / other)	Severe
Secure Tenure: Documents for land ownership	Moderate
Secure Tenure: Ways of acquiring building (built with, or without license / purchased etc)	Severe
Secure Tenure: Household perception of security of tenure	Moderate to Severe
Secure Tenure: Duration of residence in the housing unit (by years)	Moderate
Secure Tenure: Feeling insecure in current rented accommodation	Moderate to Severe
Education: Educational attainment for household population	Severe
Education: Sufficiency of income for all educational expenses	Severe
Solid waste management: Disposal of household rubbish	Moderate to Severe
Solid waste management: Positive impact of cleaning project on collection service	Low
Solid waste management: Accumulation of rubbish	Severe
Solid waste management: Availability and frequency of street sweeping	Moderate to Severe
Transport Issues: Sufficiency of income for transport	Severe
Transport Issues: Means of transportation serving the neighborhood	Moderate to Severe
Transport Issues: Relation between income, residence and use of transport modes.	Severe
Work: Adult (aged 25-59) labor and work stability	Severe
Work: Youth (aged 15-24) labor for household population	Severe
Work: Child (aged 6-14) labor for household	Severe
Work: Unemployment among adults (aged 25-59) for household population	Severe
Work: Older adult (60+) labor for household population	Severe
Health Issues: What household members do when sick (physician / pharmacist / other)	Moderate to Severe
Health Issues: Receiving governmental medical expenses exemption	Severe
Health Issues: Sufficiency of income for medical expenses	Severe
Health Issues: Being sick within the last six months by age group	Low
Health Issues: Average number of sick HH members by the age group of the members	Low to Moderate
Health Issues: Having health insurance	Moderate to Severe
Health Issues: Prevalence of psychological disorder	Moderate to Severe
Income & Expenditures: Sufficiency of income for food	Severe
Income & Expenditures: Sufficiency of income for all housing expenses	Severe
Income & Expenditures: Average per capita expenditure	Severe
Income & Expenditures: Sources of income (especially in terms of assets)	Moderate to Severe
Income & Expenditures: Sources of income.(in terms of male or female)	Moderate
Income & Expenditures: Changes in income in recent years (increased / decreased / same)	Moderate to Severe
Income & Expenditures: Changes in household's expenditure (more / less / same)	Low to Moderate
Income & Expenditures: Household's ability to raise 2000 EGP within a week (managing shocks)	Severe
Income & Expenditures: Receiving support and its type (material / financial)	Severe

* By 'differential assessment', the low, moderate and severe categories are expressions of difference between the poor and non-poor on the particular survey issue. It is a 'relative assessment', therefore, and not an absolute one. This summary is only indicative.)
Source: UNHABITAT-SRC (2011), Cairo: A City in Transition

These results are important in suggesting that many of the socio-economic characteristics of the poor (whether in low-, medium, or high-quality areas) need to be addressed in terms of social provision of basic services, access to human capital development, employment generation opportunities that cut across areas classified according to physical characteristics only. (Link this issue, public expenditure efficiency).

2. Rural-urban migration

People have been migrating towards employment opportunities in urban centers and settling for mostly informal employment and housing in peri-urban areas. Failure of the administrative definition to capture this spontaneous population growth in the urban-rural definition gives the impression that rural-urban migration is small and possibly slowing down in some areas. It also gives the impression that there is reverse urban-rural migration, which is counter-intuitive to factors pushing Egyptians out of primarily agricultural regions towards urbanizing regions small and large for employment in services and informal SMEs.

Migration is happening towards employment opportunities that are available around economic activity. , however because of failure of economic policy (SME, clustering, industrial policy that relies on different sizes of firms) and of urbanization and housing policy (that allows for mobility and overall housing market reform), migration is directed towards a growing informal sector both in employment and in informal areas in and around major cities.

Migration: prima facie patterns due to rigid administrative boundary definitions

Migration of Egyptians, or more generally relocation, is one of the most confusing and complex issues that influences and is influenced by a multitude of national and international factors and has interacted with domestic housing and urban sector development policies on the one hand as well as well as Egyptian workers' employment in the Gulf countries.² In the middle decades of the twentieth century, and especially after industrialization efforts in the main cities, Egypt witnessed high migratory flows from rural areas to the cities and in particular to Greater Cairo, Alexandria, Mahalla el Kubra, and Aswan.

These were patterns that accompanied the command economy producing large industrial compounds in these cities and providing housing for workers in those areas. Following this period and with the adoption of the open-door economic policy in 1974, migration patterns were

² The dynamics of Egyptian workers in the Gulf countries and how that impacted domestic migration is beyond the scope of the current analysis. It can only be assessed in terms of the pressure that income generated from Gulf employment exerted on demand for housing and land that the government slow servicing and infrastructure could not meet in new cities. And with restrictive building standards in cities and complete bans in villages leaving many Egyptians, the government left many Egyptians with only the informal option to fulfill both housing and savings needs.

less government produced and in many instances against government policies to reduce migration toward the already congested regions of Cairo and Alexandria in particular. Despite government policies unwelcoming migration to urban areas in general and to the Cairo region in particular, migration continued (according to official figures) until 1986, when Census figures showed that net rural-to-urban migration had diminished greatly (net in migration almost zero).

Despite official statistics suggesting halting of migration from rural to urban communities, informality in housing and encroaching on agricultural and desert land primarily for building houses continued and continues with estimates of informally developed areas around Cairo reaching 40% of the total area of the city. This growth of informality is not at all explained by the natural growth of population in Cairo and other main urban centers (refer to the section on the this definition in the urban planning section as it also impacts other aspects of the problem)

Around that time, and because of definitional issues and lack of flexibility of identifying rural vs. urban areas and conducting census, a diversion started to widen between official classification of urban communities and actual on the ground features of communities especially around major cities creating grey areas of what is currently called “peri-urban” locations that are primarily areas developed informally around these centers with mostly urban features but that may continue to be classified as rural. This informality, which will be discussed in more detail in the following section on slum and informal areas produces two pictures, one according to the official census definition, and the other is a picture that is more in line with de-facto migration patterns that are more dynamic and consistent with an agglomeration around economic activity (primarily informal) around growing urban centers and dwindling rural activity. The urbanization trends that are consistent with economic development in the whole world. In the following two sections, we present official migration trends based on the ELMS of 1990, 1998 and 2006 followed by deeper counter-official patterns that produce a different picture.

Migration patterns relying strictly on official administrative definitions of urban/ rural areas:

Wahba (2007, and 2010) use data from the ELMPS to analyze migration patterns in the period between 1990 and 2006. The period is split according to the years in which the surveys were conducted, 1988, 1998 and 2006, with comparisons in migration rates for continuing and new respondents.³

Generally the numbers are small (but increased between 1990 and 1998) in all four categories classified; rural-urban, urban-rural, urban-urban, and inter governorate (Table 2). The highest rate of migration between 1998 and 2006 is for the category of urban-to-rural, which most likely corresponds to individuals moving from strictly urban areas to peri-urban areas around agglomeration of economic activities since close to 80 percent of those moves are within the

³ Some respondents are participants from 1998 survey that were questioned also in 2006, refresher respondents and splits in families completing the sample were asked about previous residence locations at the date when the surveys were conducted.

same governorate (informal area growth). Furthermore, rural-urban migration represents the highest increase between the two intervals (over 6-fold increase), with almost 80 percent of rural-urban migration also within the same governorate, up from 52 percent for the period 1990-1998. Rural-urban migration to Cairo decreased slightly from 44 percent to 40 percent over the two intervals.⁴

Table 2: Internal Migration Rates (%) between 1990-98 and 1998-2006

	1990-1998	1998-2006
Rural-urban migration	0.24	1.51
Urban-Rural migration	1.07	4.26
Urban-Urban migration	0.95	1.64
Inter-governorate migration	0.89	1.57

Source: Wahba (2007)

Furthermore, Wahba shows that both measures of migration have increased; short distance increased by almost 6 times from 1.3 percent to 8.6 percent and migration between different agglomerations by 4 times from 1 percent to 5 percent (Table 3). This suggests that short distance migration has increased by more than long distance migration. This may suggest that the same pattern of migration that was observed in the GCR in previous decades has started to develop for other urban centers within governorates creating the same pattern of peri-urban developments around major cities in other governorates. Hence, the importance of ensuring that urban planning to receive migrants into urban centers precedes actual migration movements that add further to the size of slum/informal areas.

Table 3: Short-Distance Movements versus Migration across Different Agglomerations

	1990-1998	1998-2006
Short distance movements*	1.25	8.61
Different Agglomeration movements**	0.99	5.01

Source: Wahba (2007)

Notes: *Short distance movements: across governorates within the same agglomeration or between urban and rural areas of a district.

** Different agglomeration movements: migration across governorates or districts in different agglomerations.

Even with rigid administrative definitions of what is considered urban vs. rural, and with some speculation about particular numbers, there are patterns of migration that are picking up despite dysfunctional housing and urban planning and land allocation policies. Unfortunately, these patterns, while consistent with economic growth and agglomeration patterns of development and urbanization, they have nowhere to go except towards increasing the size and

⁴ Would have been interesting to document rural-rural migration, which is most likely the corresponding number for earlier patterns of rural-urban in the 1950s and 1960s, but with individuals now moving from rural to peri-urban rather than core-city urban, adding further to the pressures on informal areas around cities: moves out of the city exhibited in the urban-rural migration numbers, and rural-rural migration which is likely to pour in informal areas as well.

magnitude of informality in all levels of city growth, and not being limited to major metropolitan areas anymore. Ideally, government investment, transport, urban planning, and housing strategies would combine to absorb such migration tendencies.

Dynamics of Migration

Even if administrative boundaries are adjusted and become more responsive to population growth and density, what is important is analyzing the dynamics and factors responsible for producing particular migration patterns and using this information to guide migrating tendencies in a way that 1- emphasizes people's right to mobility in their pursuit of better employment or access to social services; 2- is conducive to achieving national economic objectives of sustainable economic growth; and 3- that guarantees a process that reduces the waste and timing issues that result in unnecessarily high public finance cost for service provision and urban development.

So despite the fact that there are clues from migration numbers that can capture housing and economic activity factors responsible for migration patterns in the past 20-30 years, it is important that qualitative analysis backs these numbers and be able to clarify, predict and direct migration future behavior. In addition to the fact that mobility of Egyptians has been historically very low, government restrictive and dysfunctional housing policy has restricted mobility in the formal market even further, starting from rent control laws in the 1960s, followed by limited expenditure on infrastructure during the war years (till 1973), then followed by segmented land and urban development policies. Mobility in informal areas, however, is high indicating that Egyptians, if given the right incentives, can be a lot more mobile than their historical tendencies.

While still mobility of Egyptian families is low by international standards, there has been evidence that this pattern is changing slightly, possibly because of new policies such as liberalized rent law, and the increasing share of informal housing, which is by definition not subject to government regulations, also is owned by lower income households who cannot hold units vacant. As a result, in the past fifteen years, housing mobility has increased significantly from roughly 0.6 percent per year on average in 1986-1996 to over 3 percent in 2005-2008 (Urban Housing Survey, USAID for the Ministry of Housing). Around half of the moves, however, have been to new housing units in what the respondents perceived as informal areas. This means that with further liberalization of the housing market, it could be expected that housing mobility increases further. Thus, historic migration patterns may soon be irrelevant towards predicting future migration patterns.

Also, movements in population have had, until recently, no or little relationship with government urban planning policies and expansion in new cities, and were contradictory to government policies of restricting village area expansion. These also are likely to change, if urban planning and regulations become more in line with economic policy and people's rational response to employment generation opportunities.

World Bank (2008, vol 1) gives a list of what is known about recent migration patterns and their causes which will have to be taken into consideration when shaping Egypt's future urban structure:

1. The bulk of migration to cities is urban – urban, usually step-wise from smaller to larger towns. Rural-urban migration is limited, mostly occurring very locally to small emerging towns and markaz centers from nearby rural areas. This fact is, surprisingly, unrecognized by some policy makers who still see massive rural to urban migration as a problem.
2. Urban dwellers are leaving older urban cores in large numbers, mostly for fringe and outlying informal settlements. The causes are mainly the increasing commercialization of downtown space, the slow deterioration of much of the older housing stock, and urban core families seeking better accommodation. Such a trend was noticeable in Cairo as far back as 1966. The trend continued in the 1996-2006 period, with many core and historic districts having lost significant populations: The same movement out of city cores can be seen in Alexandria, Mansoura, Tanta, Mahalla el Kubra, and other secondary towns, although the scale is smaller.
3. Informal settlements in Egyptian cities (mostly peripheral) are huge and growing rapidly. A recent study shows that in 2006, the population of informal areas of Greater Cairo was growing at an average of 2.57 percent per annum, compared to less than 0.4 percent per annum for “formal” Cairo. Informal settlements were estimated to represent 66 percent of the Greater Cairo Region's population (with 10.7 million people). Over the 1996 – 2006 period, the following very large informal areas of Greater Cairo registered very high annual growth rates: Waraq (2.6 percent), Imbaba markaz (including Kirdasa) (3.7 percent), el Umranniya (3 percent), Manshiet Nasser (4.5 percent), Markaz Qaliub (3.3 percent), Markaz Ousim (3.6 percent), El Khanka-including El Khusus (4.7 percent).
4. Migration to the new desert urban communities has been practically insignificant. For example, the total population of all the new towns and settlements in Cairo's desert in 1996 did not exceed 150,000 persons, and 66,000 of this population was in 15th May; a public housing project which was grafted onto the Helwan suburb. For comparison, over the 1986-1996 period, the population of Greater Cairo grew by over 2.1 million persons. In other words, by 1996 all the new towns and settlements around Cairo had not absorbed the equivalent 6 months of Cairo's growth. The 2006 Census recorded only 602 000 people living in the new towns around Cairo, representing an absorbing of 451 000 persons or only 13.8% of the 3 million people added to all Greater Cairo over the 10 years. At the national level, the new desert communities have had even less a demographic impact. In 2006 the population of all Egypt's new towns (20 towns as recorded by the Census) did not exceed 766,000 persons, or only 1.06% of Egypt's total population. And over the 1996-2006 period, all new towns only absorbed 4.3% of the

nation's population increase. Current estimates of the total population of new cities, according to NUCA authorities is 3.5 million (but this is highly questionable)

5. Certain secondary towns seem to be attracting significant number of migrants, especially the cities of the Canal Zone (Port Said, Suez, and Ismailia, where there are free zones industrial estates, and perhaps most important, near-by desert land to expand upon), but also smaller frontier towns like Marsa Matrouh and Hurghada (where tourism is booming).

Therefore, migration which is happening in larger magnitudes than previous trends and its channels are different, but consistent with urbanization patterns. A healthy urbanization strategy by the government would be a realistic vision that accepts migration tendencies towards existing urban centers and pre-empts informal area growth (more importantly than re-habilitation of existing non-hazardous slum areas), and an even more realistic urban planning strategy that is consistent with geographic distribution of a pro-agglomeration private and public investment strategy that utilizes sequencing and government leadership role in the development of areas that are economically and financially suitable for development.

3. Urban development

Analysis of the underlying factors responsible for patterns of informality and slum area development on the one hand and evaluation of economic and urban development patterns that can be managed to facilitate people's access to better employment opportunities on the other is necessary to address informality in both housing and economic activity. Without a coherent urban development strategy that utilizes the country's human, land and capital resources to create sustainable economic growth, current patterns of migration to informal areas around cities, divisions in social service provision, and poor economic performance will continue to characterize Egypt's economic development progress. This section focuses on the regional distribution of urban economic activity in Egypt, highlights the main strengths and weaknesses of the system of industrial zones, evaluates the new urban communities authority (NUCA) and its authorities in features of industrialization, and weaknesses in the urban planning setup that fails to gear urban development plans towards the creation of economic critical mass and agglomeration.

Regional distribution of economic activity and its concentration in the GCR

While targeted economic growth in Egypt was translated into output and investment specific targets in public sector establishments under central planning, targeted economic growth under open door policy and market-economy orientation was projected at the whole-economy level with no geographic distribution, focus on the development of particular regions, or promotion of a particular cluster or industrial, agricultural, or other sector. The resulting outcome currently is that while the public spending component of the five-year plan and annual plans is defined (spatially distributed or not), the economic component of the five year plan is not well-defined and does not link economic growth targets to specific operational policies adopted and

encouraged in particular regions of the country. Individual economic ministries set their own targets (growth, exports, employment, etc.) but because of the interdependence of implementation with other government agencies, major overlap, redundancies, contradictions, etc. are apparent, despite the ability to achieve some of these objectives at the national level. Furthermore, governorates are not involved (from the bottom) up in defining their role and contribution to achieving various economic indicators (employment, economic growth, domestic or international investment, etc.).

Therefore, the five-year plan does not give a strategic direction for private investment either in terms of sectors or regions to be targeted. As a result, economic growth that materializes is the outcome of individual sector or ministry plans to achieve particular objectives (foreign investment, output growth, export performance, employment, share in GDP, etc.) or primarily purely demand-driven and accommodating to investors (especially large local and foreign) pursuing particular activities that serve their narrow private interests with limited guidance from government authorities on how to maximize the returns from a comprehensive strategic economic growth and development strategy.

As a primary tool for employment creation outside agriculture as well as a vehicle for expanding Egypt's export performance, industrialization is necessarily the backbone for economic growth, employment generation, and trade performance of the country. For Egypt, a country that is not naturally endowed in agriculture, and with the country's thirty-plus years of encouraging opening up of the economy to private sector activity, it appears that the establishment and management of industrial zones in Egypt can be seen the primary mechanism for achieving the country's economic objectives, especially if industrialization is properly synchronized with a comprehensive strategic positioning of the country's local geographic distribution of industrial zones with its strategic positioning of the country in global and regional markets. (Although the agricultural sector has been an important segment of the national economy, a recent study reveals that the demand for labor in the agriculture was projected to account for only 5% of total national demand for labor over the period 2001-2005, a strong indication of the sector's relative labor saturation. (Source: Urban Sector Study, vol 1, p.4))

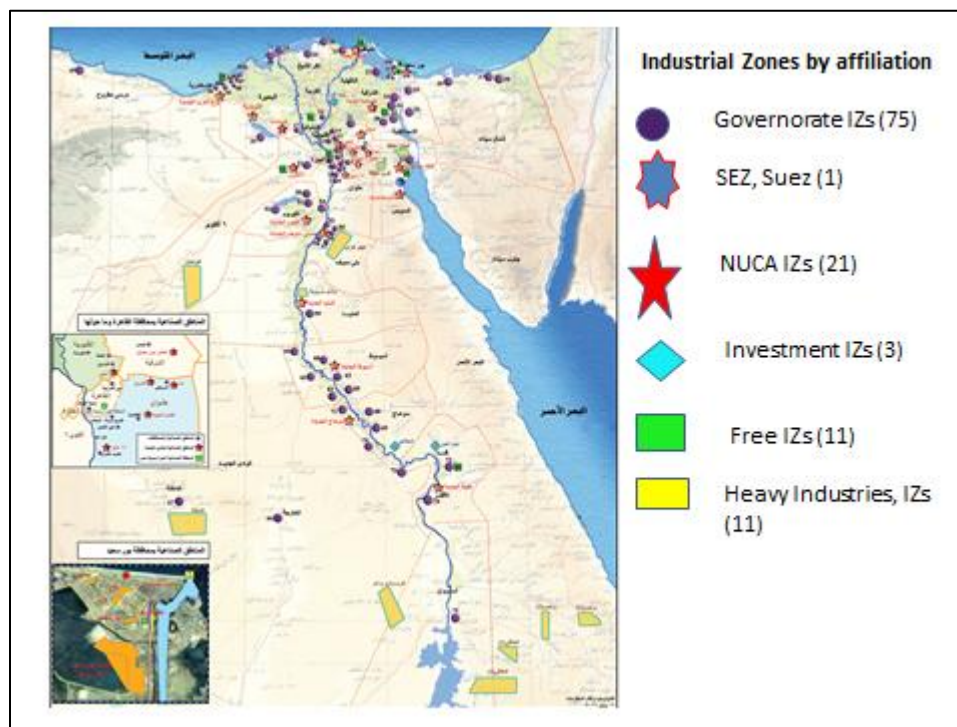
In this context, the distribution of industrial zones can be analyzed from the perspective of a national distribution of industrial zones all over the country and how the spatial distribution of these zones serves an overall economic perspective that is geographically rational. Simultaneously, the other perspective is that the location of industrial zones and their size is analyzed in reference to a comprehensive urban development strategy where each industrial zone fits as part of the overall urban plan that incorporates industrial activity in such a way that it is designed and managed with the objective of improving the overall urban fabric in conjunction with new and existing urban centers. Analyzing the distribution of industrial zones from these two perspectives follows; first through analyzing the nature and distribution of industrial zones and their ability to create the necessary scale, specialization, and economic concentration necessary for achieving sustainable economic growth. Second, industrial zones are analyzed from the perspective of the country's ability to use such tool to enhance the urban development objectives of spreading urbanization, solving housing problems including the spread of

informality and slum area growth, in addition to reducing regional divisions and disparities between the GCR and other parts of the country.

Geographic distribution and institutional affiliation of industrial zones is not conducive to achieving economic targets:

Industrial zones in Egypt belong primarily to six categories depending on the law governing them and the authority with jurisdiction over their development and/or management. These categories are NUCA industrial zones (21), governorate zones (75), free industrial zones (11), a specialized economic zone (1), and heavy industry zones (11) (Figure 1). Each category of zones differs according to historical origin, the authority with the jurisdiction for its establishment and management and in some cases the incentives offered to investors producing under their auspices. The following is a summary of the main characteristics of each type of zones.

Figure 1: Geographic distribution of industrial zones



NUCA industrial zones:

The New Urban Communities Authority (NUCA), through its development of industrial zones in the new cities, also has some capacity to support industrial property development. NUCA was created by Law 59 in 1979 as an administrative body under the Ministry of Housing, Utilities and Urban Development (MHUUC). Industrial land is only a part of NUCA's mandate, which more broadly includes the development, planning, management and growth of Egypt's new

cities. In 2006, NUCA transferred jurisdiction of industrial zones to IDA. Many of the lands allotted were not services, however, NUCA's authorities, however, remain responsible for the provision of services and sometimes urban planning for IDA, with IDA financing the cost and recovering it from sale of land to investors.

Governorate industrial zones:

The Governorate controls industrial land within its boundaries under laws 43/1979, 106/1987, 9/1989 and 84/1996. (Check if these laws are only for Alex or all governorates). The Governorates are centrally coordinated through the Ministry for Local Development. Under this legal framework, the Governorate can designate inland industrial zones and in practice often serves as the coordinating entity for the land designation, infrastructure financing, and utility provision for these zones. Governorate provides two primary services: issuing a range of permits and licenses, generally in coordination with national Ministries. This includes permits for site planning, building and subdivision, and commercial and industrial licenses; and coordinating connections with infrastructure providers.

Free industrial zones:

Free zones are authorized under the Investment Incentive Law and are established by a decree from GAFI. Free zones are located within the national territory but are considered to be outside Egypt's customs boundaries, granting firms doing business within them more freedom on transactions and exchanges. Companies producing largely for export may be established in free zones and free zones are open to investment in any sector, by foreign or domestic investors.

Special economic zones:

These are zones established according to Law 83/2002 for the purpose of industrial, agricultural or services activities that emphasize export orientation. The law allows firms operating in these zones to import capital equipment, raw materials, and intermediate goods duty free. Companies established in the SEZs enjoy a number of exemptions especially in terms of tax and labor regulations. The first SEZ was established in the northwest Gulf of Suez, though little development has taken place to date. Jurisdiction of the Gulf of Suez SEZ was transferred to the Ministry of Investment and private developers were invited to participate. Contractual problems related to infrastructure cost started which hindered the smooth development and marketing of the strategically-located project.

Investment industrial zones:

Law No. 19/2007 issued in 2007 authorized creation of investment zones, which require Prime Ministerial approval for establishment. The government regulates these zones through a board of directors, but the zones are established, built and operated by the private sector. The government does not provide any infrastructure or utilities in these zones. Investment zones enjoy the same benefits as free zones in terms of facilitation of license-issuance, ease of dealing with other agencies, etc., but are not granted the incentives and tax/custom exemptions enjoyed in free zones. Projects in investment zones pay the same tax/customs duties applied throughout Egypt.

Heavy industry industrial zones:

Presidential Decree 358/2008 established 10 heavy industry industrial zones distributed over six Upper Egypt and Red Sea governorates. According to the Industrial Development Authority website, another 11 heavy industry zones are currently designated for establishment by Presidential Decrees. Again these are earmarked for Sinai and Upper Egypt governorates. It is not clear which entity (Ministry of Investment or IDA has the authority over these heavy industry zones)

Data on NUCA industrial zones are the most readily available on IDA with details on zone size, map of location within city, the area designated for factories in each zone, allocated plots, whether infrastructure services have been completed, etc. (Table 4). As can be seen from the table, completion of infrastructure development is still underway in most cities even for the ones around Cairo. The rationale for these cities, despite the allocation of industrial zones in all but one new community (Sheikh Zayed), is primarily releasing urban pressures on Cairo housing. Thus, the bulk of land is allocated for housing and real estate development. Some cities such as Shorouk and Sheikh Zayed, and New Cairo until recently were initially planned as “dormitories” for Cairens employed in the capital and commuting to their residences. Furthermore, industrial zones initially planned in these cities are not necessarily allocated closer to major roads connecting the zone to local markets or ports for exporting. Thus, it appears that the establishment of these zones came as a secondary objective, where the primary objective was more related to solving housing problems in Cairo.

The only factor working in favor of the location of these industrial zones in new cities around Cairo relates to the large local market that the Capital offers especially for food products and consumer goods in general. The same argument could not be made for the case of basic metal, chemicals, construction and building materials, where a location closer to ports would have been more suitable for imported intermediates as well as being close to potential export markets. In addition to the added benefit of being away from primarily-residential regions, which plans for the new cities considered as the primary objective. At the same time, the establishment of industrialized zones in New Cairo, for example, was not in the initial city design and had to be added (as a small fraction of the city’s total area) in an updated urban plan.

Yet, and despite the fact that original plans did not seem to produce economically independent cities that are capable of producing both housing and employment opportunities for their targeted populations, roads and public transport plans between Cairo and its satellites were not sufficiently developed to support the initial dormitory model. As a result, updated urban plans for these cities emphasize the dire need for roads to connect these cities to economic activity in Cairo and the need for internal transportation public networks within cities. Plans to connect satellite cities to the GC transport and road-networks are currently incorporated in the Cairo 2050 strategic plan.

In terms of the size of industrial zones, the larger zones are primarily the ones around the GCR in addition to Borg El-Arab and Nubariya in the north western region (Alexandria hinterlands) with significantly smaller-sized industrial areas in Upper Egypt's new cities. Many reasons could underlie this size dichotomy including topological reasons affecting the availability of easy-to-service land in Upper Egypt away from the narrow valley, the low expected demand from investors without serious infrastructure and transportation development between new cities and close urban centers, and small local markets and negligible export-competitiveness potential due distant location away from Egyptian ports in the north and eastern coasts of the country. Table 5 shows the limited contribution of these cities to capital formation and employment. The largest three industrial zones in 10th of Ramadan and 6th of October and Obour employ collectively less than 250,000. The contribution of the remaining cities to employment and capital formation is negligible.

Table 4: NUCA Industrial Zones, area and infrastructure status

Industrial Zone	Total Area in feddans (a)	services area (b)	area designated to factories	Allocated		Unallocated		
				total (c) = (d) + (e)	served (d)	Un-served (e)	served	Un-served
<u>Greater Cairo Region</u>								
10th of Ramadan	9524	3810	3786	n/a	3548	n/a	238	5738
6th of October	8902	3561	5082	5341	n/a	n/a	0	3820
Obour	2864	1146	2281	1718	2261	n/a	20	583
Badr	2316	926	1390	1390	939	451	462	915
Madinat 15 May	371	148	305	223	171	52	134	66
New Cairo	1090	436	654	n/a	137	n/a	0	953
Shorouk	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Eastern Region:</u>								
Ataqa and extensions	1168	467	701	701	558	143	445	165
New Salhiya	722	289	433	n/a	366	n/a	356	n/a
New Damietta	608	243	365	367	367	0	153	88
Petrochemicals, south of sumeed line	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
East Port Said Industrial zone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Western Region:</u>								
Borg El Arab	5464	2186	2729	n/a	1230		1499	2736
Sadat	4395	1758	2095		1024		1071	2300
Nubariya	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Upper Egypt:</u>								
Ne Beni Suef	664	266	634	398	634	n/a	0	30
New Fayoum	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Minia	192	77			36		0	156
New Assiut	91	serviced	n/a	n/a	n/a	n/a	n/a	n/a
New Sohag	188	Unserviced	n/a	n/a	n/a	n/a	n/a	n/a
New Tiba	400	serviced	n/a	n/a	n/a	n/a	n/a	n/a
38959 ⁺		20455 ⁺		11271 ⁺		21928 ⁺		

Source: IDA at www.ida.gov.eg , Sept 2011. VH: may need to think about using the data on serviced vs. unallocated data (last 2 columns in analysis)

The interesting feature of these NUCA cities is that they belong to “three generations” as per their year of establishment and/or beginning of construction of infrastructure. According to NUCA (Figure 2), the first generation of cities comprises eight cities including the authority for touristic villages. These are the cities roughly inaugurated in the late 1970s and early 1980s. The second generation is a group of nine cities, spanning the time between 1982 and 1995, with five of the cities around the greater Cairo belonging to this generation. The third generation is primarily Upper Egyptian new cities established in the year 2000 onwards with as the authority for the City of Luxor established as late as 2010. When examining the areas that are still unserved in industrial cities belonging to the three generations, it is interesting to observe that even in the first generation of cities (1977-1982), there remains a large amount of land where infrastructure has not been completed. This is especially apparent for the cities of 10th of Ramadan, 6th of October and Borg El-Arab despite their early establishment and unlikely lack of interest from investors in establishing in these locations.

Figure 2: NUCA generations of NUCs



Source: NUCA, unpublished information

Table 5: NUCA industrial Zones, Number of Factories, capital, employment

Industrial Zone	No of Factories				Capital (LE million)				Employment			
	operating	under construction	planned	total	operating	under construction	planned	total	operating	under construction	planned	total
<u>Greater Cairo Region</u>												
10th of Ramadan	1133	524	206	1863	15780	970	787	17537	132336	9514	7716	149566
6th of October	672	362	143	1177	6290	1746	700	8736	77092	33393	1300	111785
Obour	237	460	541	1238	3300	1061	812	5173	23339	28264	8656	60259
Badr	135	203	81	419	391	419	91	901	5291	9573	3253	18117
Madinat 15 May	70	28	94	192	70	30	0	100	3715	250	0	3965
New Cairo	16	0	0	16	46	0	0	46	512	0	0	512
Shorouk	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Eastern Region:</u>												
Ataqa and extensions	40	68	23	131	951	n/a	n/a	n/a	3390	n/a	n/a	n/a
New Salhiya	59	39	13	111	499	61	56	616	4747	2055	1252	8054
New Damietta	167	132	19	318	126	76	0	202	5179	3250	0	8429
Petrochemicals, south of sumeed line	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
East Port Said Industrial Zone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Western Region:</u>												
Borg El Arab	411	149	29	589	2938	4657	0	7595	30993	5456	0	36449
Sadat	258	161	0	419	2087	1123	0	3210	18775	6469	0	25244
Nubariya	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Upper Egypt:</u>												
New Beni Suef	57	46	43	146	60	57	n/a	n/a	1553	1910	n/a	n/a
New Fayoum	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Minia	6	19	56	81	32	24	n/a	n/a	106	566	n/a	n/a
New Assiut	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Sohag	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Tiba	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Source: IDA at www.ida.gov.eg , Sept 2011.

Even within each NUCA industrial zone, there appears to be no vision for creating a specific-sector or specific-industry concentration. As a result, in each of the NUCA industrial zones, factories producing different types of products ranging from food to textiles to building materials, etc. co-exist and in most cases the number of factories is evenly distributed among all economic subsectors (Table 6). With the exception of New Damietta where a relative concentration of wood products due to the proximity of the city to the famous old Damietta city with a large concentration of furniture producers, all NUCA cities are planned and operated without a particular specialization in a particular industry or sector in order to create the necessary scale, logistic services and clustering needed.

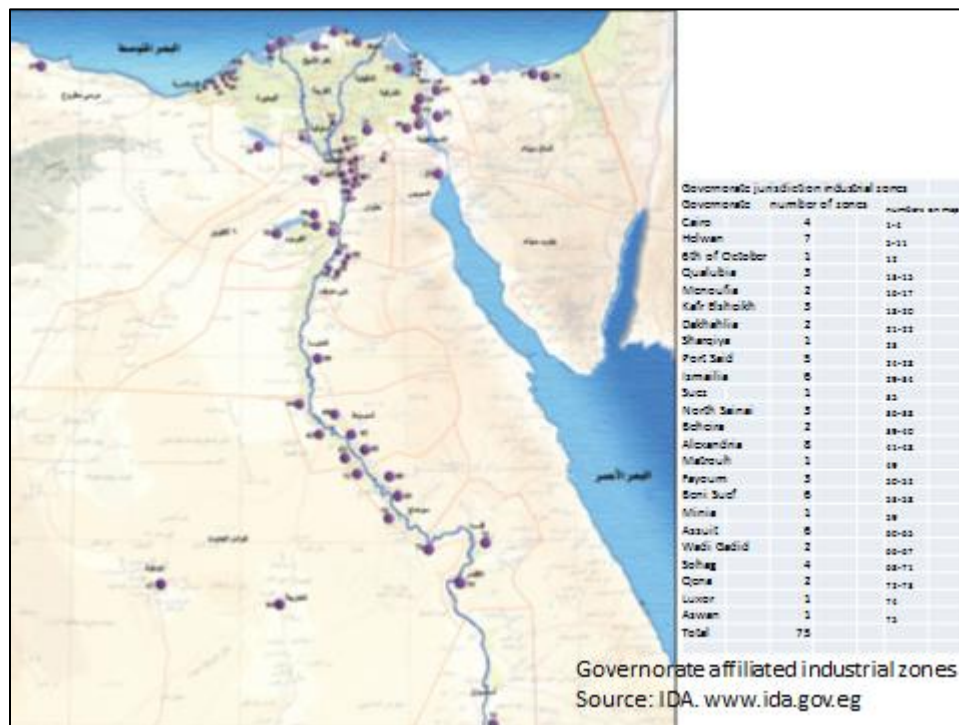
Table 6: NUCA Industrial Zones, distribution of factories by subsector

Industrial Zone	Food and drinks	Textiles and clothing	Wood and products	Chemicals	Construction and building	Basic chemicals	Engineering and electrical	Other	Total
<u>Greater Cairo Region</u>									
10th of Ramadan	121	201	54	144	48	93	127	345	1133
6th of October	110	50	31	133	73	72	94	109	672
Obour	41	27	11	41	8	39	14	55	236
Badr	17	7	4	21	19	17	8	42	135
Madinat 15 May	10	3	9	24	3	13	4	4	70
New Cairo	0	0	0	0	16	0	0	0	16
Shorouk	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Eastern Region:</u>									
Ataqa and extensions	10	2	1	8	5	6	5	3	40
New Salhiya	14	3	1	17	4	3	9	8	59
New Damietta	25	7	47	32	9	3	2	42	167
Petrochemicals, south of sumeed line	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
East Port Said Industrial Zone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Western Region:</u>									
Borg El Arab	17	7	4	21	19	17	8	42	135
Sadat	44	22	8	56	15	56	20	37	258
Nubariya	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<u>Upper Egypt:</u>									
New Beni Suef	15	3	5	9	11	6	0	8	57
New Fayoum	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Minia	1	0	0	1	0	1	1	2	6
New Assiut	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Sohag	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
New Tiba	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Source: Industrial Development Authority at: www.ida.gov.eg, accessed on Sept 8th, 2011

As for governorate zones, the total number of zones are 75 zones spread over 24 governorates with as many as eight governorate-affiliated zones in Alexandria, seven in Helwan, six in each of Ismailia and Assuit and Beni Suif, five in Port Said, and fewer numbers for the remaining governorates (Figure 3). While enough data is not available on these industrial zones through the IDA website, two features characterize them. First they are significantly smaller in size (on average a quarter of the size of NUCA industrial zones). Second, and despite the small size, they are also not dedicated to a particular subsector or industry. Maps available for governorate industrial zones show areas designated to different sectors within each region, which results in an even more acute degree of fragmentation that does not lend these zones to any particular critical mass in a specific industry or activity. It appears that the purpose of the establishment of these zones is to create pseudo-zoning of industrial activity in governorates, with no particular focus on creating the necessary logistic or service linkages to develop a particular industry. This pattern is clearer in a number of governorates, especially in Upper Egypt where industrial zones in Assuit, Fayoum and Sohag for example are not concentrated in a geographic location.

Figure 3: Governorate industrial zones



Source: IDA website, at www.ida.gov.eg, accessed October, 2011.

Problems characterizing public sector investment allocation have been reflected in the development of new communities. Despite the share of public expenditures going to new cities reaching close to a third or all public expenditures nationwide, crucial transportation, electricity,

water and sanitation funds were not necessarily allocated to these cities, especially in the industrial zones.

The main problems related to industrial zones in general (governorates, GAFI, NUCA, SEZs, Heavy Industry) are licensing, infrastructure development and developmentally inconsistent pricing of land and service provision. Revenue-seeking practices from governorates are also prevalent to compensate for cash-strapped local finances. These revenues are generally utilized to fill gaps between central government transfers to local government and uses, although mismanagement of these funds is also a possibility.

Failure of public authorities to finance or arrange for infrastructure completion with other agencies prior to allocation/sale of land creates a pattern that appears in almost all zones. Limited investment facilitation services, which are typically provided in industrial zones worldwide, are non-existent to limited in all types of zones in Egypt despite the creation of the one-stop-shops by GAFI and IDA. While all types share these common problems, type-specific issues, however, characterize each group. This pattern is summarized as follows:

- For governorate-affiliated zones, which started their history of development in the mid-1990s, they were developed as a local planning tool used to assemble planned industrial land in some of Egypt's traditional industrial and port locations;
- For NUCA industrial zones, which saw their start in the 1970s, vary widely in size and location and despite highly subsidized prices, until recently, some are unable to attract investors due to site location decisions not grounded in market factors. However, they do benefit from a central administrative framework and infrastructure networks which was the NUCA city authority until their management was transferred to IDA in 2006;
- GAFI's centrally managed zones (Free zones, most of which also date back to the 1970s), tend to be better located in port cities and in proximity to existing industry. Their impact is, however, constrained by the lack of integration opportunities with the domestic market that would occur through hybrid zones and greater harmonization between the industrial estates and free zones regimes; and
- The new SEZ and the Heavy Industry zones programs, the former has had contractual problems between public authorities and private investors, while regulations for the latter are yet to be defined.

An important reason behind the problems faced by industrial zones of all types can be attributed to the numerous institutions and agencies involved in their establishment, regulation and management (Table 7). No clear hierarchy or leadership exists that ensures streamlining of all agencies activities towards contributing to achieving the overall economic and/or urban development objectives of each zone.

Table 7: Government authority participation in zone development and management

		New City Industrial Zones	Governorate Industrial Zones	Free Zones	Special Economic Zones	Heavy Industry Zones	Investment Zones
regulator	Designation of Zone Area/Planning	NUCA	Governorate	Cabinet or Law	President, by Decree	President, by Decree	Law/Prime Minister Approval
	Land Pricing/ Apportionment	NUCA/Currently IDA	Governorate	GAFI	SEZ Authority		Board, Private Developer
	Business Licensing	GAFI, companies dept	GAFI, companies dept	GAFI	SEZ Authority	GAFI /IDA?	GAFI /IDA?
	Building/Operating Permits	New city authority	Governorate district office	As many as 18 entities	Unclear	Unclear	Unclear
	Monitoring/ Inspections	<i>Various nat'l and local agencies</i>					
Developer/Operator	Coordination of External Connections	NUCA/IDA	No one entity	GAFI	SEZ Authority	GAFI /IDA?	GAFI /IDA?
	Develop Internal Infrastructure	IDA, with assistance from NUCA	None	GAFI	SEZ Authority	GAFI /IDA?	GAFI /IDA?
	Market Site/ Facilitate Investment	NUCA (local licensing/ permitting) GAFI (One-stop-shop, promotion)	Governorate (local licensing/ permitting) GAFI (One-stop-shop, promotion)	GAFI	SEZ Authority	GAFI /IDA?	GAFI /IDA?

Source: FIAS, World Bank, Alexandria, various other sources for heavy industry and investment zones

There are weaknesses that are not unique to a particular type which include lack of specialization, poor sequencing of infrastructure provision vs. allocation of land, and the numerous and conflicting jurisdictions over which agencies have in their establishment and management. While there are weaknesses that are particular to specific types of zones such as the limited size of governorate-affiliated zones and the objective they serve (collation of industrial activity within the city in one place). Finally, GAFI zones that are located near ports to serve export industry are not necessarily integrated in a national industrialization strategy that connects the zone to a cluster of economic activity around it.

In terms of investment promotion, which is primarily directed to large and foreign investors, GAFI has been the agency responsible for this activity, with IDA creating a department for promotion of industrial activity various industrial zones under its jurisdiction. As part of its mandate, GAFI has prepared an “investment opportunities” study that guides investors to the strengths and weaknesses of particular sectors. The study covers 11 sectors outlines all relevant information related to the activity from the perspective of promoting the sector. Each study shares with investors the regulations governing the sector, the main players, the likely markets and sources of inputs, etc. As a promotion function, GAFI does not favor investor interest in particular sector. Apparently neither does NUCA or governorate authorities when it comes to allocation of land for industrial use.

Cities and towns in Egypt generate most contributions to national GDP, and the potential for economic growth in Egypt is found mostly in and around urban agglomerations. Thus existing cities, especially Greater Cairo, Alexandria, and key secondary towns, need to be made more efficient and work better, to reinforce their role of engines of growth of an expanding national economy. An assessment of the economic performance of leading cities in the Delta and Upper Egyptian governorates and their de facto economic relationships with lower level urban and rural centers is key to formulation of a successful economic growth strategy that is spatially rational and that has its urban plan requirements attached to it.

Urban planning and land management

Even if there is a multitude of agencies involved in the design and operation of the network of industrial zones in Egypt, there should not be a problem of incoherent policies, direction and sequence of infrastructure and services provision, connectivity of zones to markets and sources of inputs etc. This leads to the discussion of the role of the General Organization for Physical Planning and the Center for Land Use. Also, with proper strategic planning that fits economic policy direction by the government with the requisite urban plans and the financial, managerial, and regulatory coordination and enforcement of market-enhancing regulations there will not be a problem of gearing urban planning towards utilizing the country physical, locational, natural and human resources towards achieving economic growth and higher standard of living for Egyptians. This is the role of urban planning (and plans) in the context of providing the right foundation for growth and social development. We start by highlighting the functions of the two organizations, whose job is to conduct the urban strategic direction of the country: The General

Organization for Physical Planning (GOPP) and the National Center for Planning the Use of State Lands.

General organization for physical planning (GOPP)

The GOPP was established by Presidential Decree No. 1093 of 1973 under the Ministry of Housing, Utilities and Urban Development. According to Law No. 3 of 1982 on urban planning, the mandate of GOPP is to formulate national urban development strategies and undertake itself and/or oversee and provide technical assistance to local Government in urban/land use planning activities. Included in its mandate, GOPP is responsible for the following:

- Setting the general policies for urban planning;
- Cooperating with all concerned Governmental departments and local government units, including the provision of technical assistance;
- Recommending new or complementary legislation in the field of urban planning; and
- Following up projects in each Governorate to ensure their compliance with plans prepared by the organization in association with other organs.

In the past few years, GOPP was also responsible for the design and implementation for a national for re-defining village boundaries and the development of schemes to produce strategic and detailed physical plans for all Egyptian villages. The purpose of the program is to allow expanding village boundaries in accordance with on-the-ground expansions of built-up as well as create possible plots for needed public services to accommodate the growing population as well as the improved quality of service that is planned in villages. In addition, GOPP, initiated a similar program for updating/initiating new urban plans for all Egyptian cities, foremost among these plans is the responsibility to develop a strategic urban plan for Cairo, which has been known as the Cairo 2050 project.

GOPP was also assigned by Law 119/2008 to act as the secretariat for the High Council for Urban Planning, which is headed by the Prime Minister to devise and coordinate planning and regulations and guidelines that extent not only to urban planning, but also to deal with issues such as regularizing the status-quo for any of encroachments and use change of public lands, for example for the Cairo-Alex dessert road stretch that was intentionally allocated to agricultural projects then converted to housing projects.

While steps in the right direction, there are many features of continued segmentation and divide between urban planning (theoretical) and actual management, finance, and regulation (practical) of urban development in Egypt. The following points highlight these features:

- 1- Focus on the strategic plan for Cairo 2050 with absolute lack of incorporation of transportation plans to neighboring regions
- 2- The slum area strategic upgrading plan, with no conjunction to critical reform in housing policies, affordability, reducing building standards, reform of local government offices producing licenses, etc

- 3- Despite recognition of practically all government bodies related to service provision, planning, finance, etc. of the problematic nature of rigid administrative rural-urban definition, no collaborative or leading role is presumed to solve this problem. What is even more problematic is that new urban plans for cities are being prepared before addressing this problem.
- 4- Dealing with new urban planning in segmented way. Not dealing with administrative boundaries of urban and rural communities. The issue of transport sector strategy. Fragmented land allocation use and no strategic vision that links economic activity with urban and housing plans.
- 5- Upgrading of urban plans for NUCA cities do not benefit from hindsight in terms of investing in road connections between NUCA cities in Upper Egypt and main cities close by.

National Center for Planning the Uses of State Lands

The National Center for Planning the Uses of State Lands was established by Presidential Decree No.153 of 2001. The Center works with GOPP in identifying land needs and appropriate uses including urban planning, agriculture, tourism, industry, etc. The center's responsibilities include:

- To coordinate with Ministry of Defense and Military Production (MODMP) on land use planning for lands outside of the *zimam*, the urban and village areas and cordons;
- Prepare land use maps for State lands outside the *zimam* after coordination with MODMP;
- Prepare for each Ministry a map with the lands earmarked for its activities, which only the Ministry will be in position to allocate and oversee their use, development and disposal; and
- Coordinate between the Ministries in issues of land pricing, disposition mechanisms, collection of sales proceeds, and protection of State lands, and ensure that the State treasury has received the net revenues from each Ministry's land development.

A draft law for consolidation of allocation and use of public lands:

Starting in 2009 and with verdicts issued by the Administrative Court nullifying a number of land disposal by NUCA and other government bodies managing and disposing of public land, there was significant pressure for the issue of a unified land disposal law to be enacted to govern and streamline allocation and pricing decisions made with respect to public lands in general. The purpose of the draft law which was prepared for Parliamentary approval before the January 25th 2011 Revolution, in addition to unifying the process for the disposal of public lands, was also to find mechanisms of adjusting the status of public lands currently de facto in private hands.

Thus, the land management law is a draft law that addresses the need to align the disposal of all public lands owned by the state under the auspices of one entity that ensures that there is consistency in parameters of disposal, pricing, transparency, overlapping of jurisdiction, etc. It also attempts to find ways of "formalizing" the status of encroachment of private citizens on

state lands (after the fact, ex post dealing with the problem). The draft law, which has not been discussed or studied yet and most probably will be studied heavily in Parliament has not addressed them other more important and sizable informality on private land (urban built up on agricultural land that developed under Martial Decree prohibiting building on agricultural land). This phenomenon, which is unlikely to have stopped despite the new wider new urban boundaries for villages, cannot be addressed without addressing formal land management in the context of a more comprehensive and coherent economic- urban development-housing strategy that utilizes all tools and works with and not against economic activity and housing market forces (Refer to section above on informal housing and slum areas).

Rigid administrative boundaries for urban versus rural areas:

The Census records urban and rural populations according to an arbitrary administrative definition of what is an urban place. The official Census definition of urban areas in Egypt is purely administrative and thus is problematic. Urban areas considered to be either:

- 1- urban governorates – limited to Cairo, Port Said, Suez and, until recently, Alexandria;
- 2- agglomerations which have been declared “cities” and have a city council, or
- 3- the capitals of rural districts (marakaz) and capitals of rural governorates.

This definition has no relation to the size of the agglomeration’s population or its importance as an urban area. As a result, the urban population of Egypt has been located largely in the same geographic space for decades. The redrawing and reclassifying of Census areas by CAPMAS are rarely carried out, and the Ministry of Local Development is less likely to decree new urban areas for administrative purposes.

As Denis and Bayat have documented in 2000, such administrative definitions have led to a gross underestimation of urbanization, one which is progressively more and more out of touch with reality. By any definition, Egypt is already overwhelmingly urban, with estimates varying widely depending on the definitions adopted. Denis and Bayat carried out an analysis of the 1996 Census and, using the definition of urban places as settlement agglomerations of more than 10,000 inhabitants, calculated that Egypt was at least 66.8% urban, residing in 628 urban places. It could be argued, on this basis, that the urban population was 39.8 million in 1996, which if projected to 2006 would represent an urban population of at least 49 million inhabitants, or 67.5% of the national population.⁵

There are two main types of recent urbanization patterns that have been missed by Census enumerations: 1- Overspills from urban centers into village agglomerations in the agricultural hinterland and 2- emerging small towns.

Overspill from urban centers into village agglomerations in the agricultural hinterland: This could also be called spontaneous urbanization of agglomerations on the periphery of the large cities, in larger villages and in small towns. The phenomenon can be traced, for example, in the

⁵ Just applying the estimates of urban population calculated for the 1996 Census to the new population census figures.

significantly higher annual growth in population in rural areas surrounding secondary towns in the recent past, as shown in Table 8.

Table 8: Population Growth of Secondary Cities and their Rural Hinterlands (1986-1996)

Secondary City	City Population Growth Rate	Rural Surrounding Growth Rate
Mahall al-Kubra	0.93%	2.25%
Tanta	0.98%	2.17%
Mansora	1.53%	2.22%
Beni Suef	1.23%	4.02%
Minia	1.18%	2.48%
Assuit	2.32%	2.49%
Aswan	1.42%	1.97%

Source: Derived from Bayat and Denis, 2000 (based on 1986 and 1996 census), through UNHABITAT (2011).

Three factors have contributed to the phenomenon. First, commuting into towns from outlying agglomerations has been made considerably easier by the appearance in Egypt in the 1990s of private, informal microbus “service/shared” taxis, which are increasingly becoming the reliable mode of collective transport in Egypt. Secondly, residential accommodation in these surrounding areas has become relatively much cheaper than similar housing found within cities. Third, there has been for three decades a trend of out-migration from older city cores as commercial and other non-residential activities crowd out housing possibilities, and most of these end up in fringe and satellite settlements which are defined as rural under the Census definition.

Emerging small towns: Many small agglomerations in dense rural areas throughout Egypt have begun growing to reach well over 10,000 inhabitants, and their economic functions have begun to diversify away from purely agricultural activities. In fact, these “urban villages” or small towns can be considered market towns and the loci of trade, petty manufacturing, and services for the larger rural hinterlands, as well as the location for certain footloose enterprises. The phenomenon of these emerging towns underscores an important point about the economics of Egypt’s countryside. Even in the most “rural” governorates non-agricultural activities predominate. For example Census figures for 1996 show that in all of rural Egypt, only 50.5% of working persons aged 15+ (8.40 million persons) were engaged in agriculture, fishing, and related activities.

Medium-sized urban centers: A closer examination of needed to remove barriers and unlock potential of these cities, each according to its particular features

Medium size cities range from Port Said (571,000) to El Bayadeya, Luxor (15,500). Medium sized cities, which remain the backbone of urban systems, providing the localization economies that producers with more specialized needs seek. Table 9 shows the distribution of cities by size in 2006, excluding the GCR and Alexandria.

Table 9: Distribution of major cities by population size excluding GCR and Alexandria, 2006

400,000- 600,000	port said	suez	Mahalla	mansoura	tanta	
200,000 - 400,000	Assuit	Fayoum	Zagazig	Ismailia	Khosous	Aswan
	Damanhur	Minia	Damietta	Luxor	Qena	
100,000 - 200,000	Beni Suef	Sohag	Shebin Elkom	Hurgada	Benha	Kafr Elsheikh
	Mallawi	Areesh	Bilbays	Marsa Matrouh	Meet Ghamr	Kafr Eldawar
	Desouk	Abu Kbeir	Gerga	Akhmim	Mataria	
Source: www.citypopulation.de						

Smaller cities and towns continue to serve and to depend on surrounding rural settlements. But they will grow rapidly only in areas where farms and village economies are doing well. As an example, when taking Sharqiya Governorate, one of the most populous governorates (app. 5000 km² and 5.4 million inhabitants in 2006), we find that, the urban population is spread over 17 cities with the largest, the capital Zagazig is over 300,000 inhabitants and the smallest is Salehya slightly under 19,000. The total urban population in Sharqiya is 23% of the governorate's population (rural and urban). Possible agglomeration planning for this region can be at the governorate level, with the right transport and road linkages between Sharqiya's 1.2 million urban inhabitants and the remaining 4.2 million in its rural areas.

For other regions, especially in some governorates in the hinterland of coastal cities on the Mediterranean Sea, such as for example Beheira where the "economic area" may take a wider perspective that oscillates in conjunction with Alexandria. The total combined area is around 12,000 km² and total population is 4 million for Alex and 5 million for Beheira.

Conversely, developments of new cities that were designed to absorb population growth and pressure from existing cities are producing mixed, if not disappointing results. According to the World Bank analysis and the 2006 census results, the 20 listed new cities had only absorbed approximately 1.06 per cent of Egypt's total population. In the 10 years between 1996 and 2006, all new cities country-wide only absorbed 4.3 per cent of the nation's population increase. NUCA claims the numbers are rapidly increasing as the idea of living in these new communities gains traction. They claim that in , 2.7 million people lived in the eight new cities (around GC), based on active electricity and telephone connections. If accurate, these figures suggest a spectacular and remarkable rise from the CAPMAS census data from the same locations. If NUCA statistics are to be believed, not only has occupancy soared in the three years between 2006 and 2009 by fantastic amounts, but those living in the desert cities now comprise 15.4 per cent of the total Greater Cairo population. This means that the combined population of the eight cities rose on average 444 per cent in three years after taking many decades to reach approximately 602,000 in 2006. Caution has to be exercised when dealing with these statistics especially if a serious evaluation of the cost-benefit analysis of public expenditures on these cities is to be conducted.

Planned for the next five years are the following planning exercises. Samples of city plans remain conventional and not necessarily expanding the perspective to creating clusters of

industry and supporting services. These planning projects are spread from a strategic 2050 urban development plan for Egypt, strategic and detailed urban plan for Cairo (2050), a strategic and detailed Urban Plan for Alexandria (2030), strategic plans for four new million+ cities: New Alamein (Western Desert), East Port Said City, New El Ayat, West of Sadat. The names of two other new cities were mentioned in this context. These are New Mansoura City and Amal City. Also planned is the development of strategic plans for governorates, strategic urban plans for all 227 cities (underway), completed strategic plans for all villages (completed), with detailed plans for villages currently being developed. Boundaries for even small hamlets and tiny settlements around villages (27,000 of them) are being initiated and planned to be completed in the next five years.

All this is happening in complete dissociation with projected/planned regional economic growth patterns, implementation limitations, financial requirements and institutional streamlining at various hierarchies of administration. Thus, it appears that current urban planning and urban development will not be very different from several urban planning strategies which have been developed for different parts of Egypt over the past 30 or so years.

Past strategic urban plans were typically not defined; many of them focused on housing and expansion in the desert without a solid economic development foundation that ensures that the plans are consistent with market forces or with announced government economic policy direction. For example, open door policy, ERSAP adopted in 1991 targeting economic liberalization global integration and signing of free trade agreements with the EU and Arab countries, for example. Because the spatial component of a clear national investment strategy does not exist, it appears that current urban plans being developed will continue to be detached from an economic development strategic direction that links all these levels of urban plans together.

There is a multidimensional challenge in this context which requires the following: (a) improve the efficiency and economic environment of cities to generate needed employment opportunities and promote national development, (b) examine past and evolving GOE urban sector policies – specifically those of spatial planning, management, and investment – to assess to what extent these have achieved intended objectives and have spawned unintended consequences (c) assess the institutional and regulatory frameworks governing the urban sector, and the responsibilities, roles, and capacities of local government to ensure that implementing and managing agencies have the capacity and authority to play their roles in initiation and operation of economic activity.

III. Reshaping of Economic Geography

Reshaping the current features of economic geography of Egypt can be addressed at two levels:

1. Ensuring that sector strategies are synchronized and support an overall economic development policy that is conducive to creating sustainable growth and development, and 2. Present sector- or issue-specific recommendations that are consistent with the overall synchronized strategy

approach needed to produce the momentum needed for movements in all aspects of this complicated approach. This section starts by addressing the issue of the importance of adopting the synchronized approach, and then it focuses on presenting specific recommendations for the issues analyzed in Section II: migration and mobility, informal housing and slum areas, and investment and urban development strategy.

1- Overall Direction and Synchronization

International experiences presented in the 2009 WDR on reshaping economic geography show that economically successful nations both facilitate the concentration of production and institute policies that make people's living standards- in terms of nutrition, education, health and sanitation- more uniform across space. These two policy directions can be grouped under the terms integration or inclusive urbanization.

Introduce spatial and geographic dimensions in economic policy dialogue in the context of a market-based, private sector economy and eliminate the association between such direction and public sector dominance and socialist economies. Countries that have achieved substantial progress in outward orientation to global market and foreign investment played a clear role in directing these activities in particular geographic locations to enhance economic concentration and competitiveness. To achieve these benefits require concentrated government policy aimed at economic integration with its two parallel components, the creation of economic concentration to maximize growth potential for the country as a whole, as well as invest in social convergence that aims at minimizing gaps in the provision of services between urban and rural, capital and small towns, and between centers of economic activity and distant areas that may be divided socially or physically from vibrant economic activities and associated opportunities.

We propose for Egypt that the government's approach to development includes "all the instruments of integration—institutions that unify, infrastructure that connects, and interventions that target". Integration challenges will differ from one place to another within Egypt; the challenge will be different for the Greater Cairo Area compared to urban centers in either Lower or Upper Egypt.

Upper Egypt in general (urban and rural) might require an inclusive strategy that extends beyond connectivity and re-enforcing or creating economic scale and concentration. This will not be clear except after efforts to reform urbanization, investment policy, transportation, and the provision of public services are addressed. Targeted interventions in Upper Egypt before such reforms are completed may be wasteful.

Principles that need to be adopted in economic agglomeration design and urban planning to support it have been catalogued in the WDR 2009 and some of the important principles that should govern Egypt's economic reshaping exercise are the following:

The unit for deliberating government action: an area

Different parts of a country urbanize at different speeds. Unevenness is the rule, not an exception. And there are synergies and economic interdependencies among settlements of different sizes. Reframing urbanization policies to better meet the economic imperatives at all stages of the rural-urban transformation requires rethinking the spatial scale for deciding policy priorities and design. Policy consideration has to be made at an appropriate geographic scale: an “area,” or state or province, generally the middle tier of government between the central and municipal. The scale should be big enough to permit both rural-urban and interurban linkages. An area approach does not rule out the aggregation of urbanization strategies to a national level. High-density areas tend to have populations concentrated in metropolitan cities, intermediate-density areas in medium-size cities, and low-density areas in small towns and villages. In the same way, more urbanized countries have more of their people in high-density areas, and less urbanized countries have some high-density areas, but most people are in low-density areas. Urbanization policies should incorporate this unevenness of economic development.

Spatially blind “institutions” to facilitate economic density

The responsibility for building institutions that will be the bedrock for urbanization in all parts of the country lies mainly with the central government. Chief among them are those governing the management of land. “Institutions” encompass three broad sets of measures: law and order (especially the definition and enforcement of property rights), the universal provision of basic services, and macroeconomic stability. “Institutions” encompass three broad sets of measures: law and order (especially the definition and enforcement of property rights), the universal provision of basic services, and macroeconomic stability.

The principle: maximize agglomeration economies across the portfolio of places Concentration, associated with rising density, and brings potential benefits from “thick” markets. But it also brings congestion and squalor. The main aim of urban policy is to help settlements deliver agglomeration economies while reducing the grime, crime, and time costs that come with rising concentration.

The policy rule: sequence and calibrate

In areas where urbanization has gathered momentum, the challenge is two dimensional. It incorporates the need to promote density and overcome problems of distance caused by congestion. In areas of advanced urbanization, the challenge is three dimensional. For metropolises, again, there is a need to encourage density and overcome distance. To this should be added the need to eliminate divisions within cities, which segregate the poor in informal slums from the rest, in formally settled parts.

Rural-urban transformations are best facilitated when policy makers recognize the economic interdependence among settlements.

Within a country’s hierarchy of cities, towns, and villages, each specializes in a different function and has strong interrelationships with others. So the policy discussion should be framed not at the extremes of the national level or the individual settlement. Instead, it should be framed

at the level of what is termed an “area,” usually a state or province. Policy makers should see themselves as managers of the portfolio of places in such an area. An area approach can also inform national urbanization strategies.

The debate should not be mainly about the pace of urbanization, the amount of rural-urban migration, or the ways to eradicate slums with targeted interventions. Instead, it should be about the efficiency and inclusiveness of the processes that transform a rural economy into an urban one. And it should be about how policy can best address the coordination failures that arise at each stage of urbanization. “The poor are gravitating to towns and cities, but more rapid poverty reduction will probably require a faster pace of urbanization, not a slower one—and development policy makers will need to facilitate this process, not hinder it.” And because a rural-urban transformation involves both the urban and the rural, urbanization strategies must include measures to improve rural lives and livelihoods. Debates about urbanization often evoke images of overcrowded cities, visible concentrations of poverty, and appalling environmental degradation. This can result in a general policy stance to control urban growth and curb rural-urban migration. Geographically targeted interventions to clear or clean up slums that proliferated during low- and middle-income stages of development can end up dominating the discussion.

Shifting the approach and perspective from dealing with issues in isolation to a comprehensive overall agglomeration and growth strategy accompanied by a strong urban development function to guide, manage the behavior of public and private entities in the direction (and not against) the collective achievement of economic objectives is the key to choosing the right policies at all geographic, organizational, and stakeholders levels.

2- Issue-specific policy recommendations

In addition, to the overall direction of coordination between investment policy, urbanization, housing strategy, etc. specific policy recommendations could underlie reform efforts in each policy component. The following sections highlight the most important recommendations in the areas of 1) investment strategy and urbanization, 2) migration, 3) informal housing and slum area development.

a. Informal housing and slum area development

Informal housing and slum area development will have to focus on two directions: first is formulating policies to reduce further additions to informality by adopting comprehensive housing policy reform. The second direction relates to dealing with the stock of existing informal areas through formalization, elimination of elements of “division” and integration in city physical and social landscape.

Policy recommendations to reduce additional flows of informality

Enabling land and housing markets remains a cornerstone of the urban policy framework. But where formal markets have failed to reach a majority of citizens due to land scarcity and affordability issues, practical measures include microfinance for incremental housing solutions,

low-cost building technologies, and rental housing. Most important, to anticipate future urban growth, urban planning audits are recommended to ensure that urban regulations are not set arbitrarily, preventing cities from achieving higher densities and causing land and housing scarcities that can drive up prices.

Affordable housing market comprehensive strategy is needed. The focus would be on making housing options available to households in the country as a whole and for the migrants to urban centers in particular. Stringent restrictions on land use conversion produce shortages of affordable housing, hurting migrants to a city. Informal areas that are not dangerous or degraded in inner cities and peri-urban growth around cities will have to be treated with more flexibility. In addition, special rules for housing finance in such areas will have to be devised to accompany formalization efforts that take into account facts on the ground and produce administratively and financially feasible models for housing finance, injecting this huge stock of housing in the currently miniscule mortgage market.

As for formal housing new construction, transparent, predictable and periodic allotment of land for affordable housing has to be a priority, in addition to making housing finance and mortgage services country priority by simplifying registration requirement, devising various housing insurance services, whether for default, construction delays, and others.

Ensuring land and real estate speculation is cut to a minimum is absolutely essential in exerting downward pressures on housing prices. This will be accomplished through the steady flow of serviced land for private development in new and existing community as well as application of the real estate annual as well as windfall and property appreciation taxes.

Proper sequencing and ensuring stable and timely supply of serviced land is needed in all new communities. Vacancy rates, especially in new cities remain high due to lack of coordination in the timing of making different services available.

Implementation of the real estate property tax, especially in new communities where vacancy rates are high is a necessary mechanism for better utilization of the real estate stock in these cities as well as better utilization of units subject to fixed-rent laws concentrated in old urban center in Cairo, Giza and Alexandria.

Mortgage market development, re-finance of mortgages can break the link between housing acquisition and full payment of price through stretching payment over up to 20 years according the mortgage law.

Speed up registration and cadaster reform

Apply consumer protection laws to the real estate sector and ensure transparency of contracting

Particular attention has to be paid to social service provision in new communities around Cairo and in new urban communities in general. Housing combined with transportation for areas to be targeted for locally oriented or regionally oriented urbanization and agglomeration (refer to transport strategy recommendation section).

Fixed-rent system needs to be abolished, but only in the context of a comprehensive housing reform program that provide alternatives and options for fixed-rent unit occupants with limited/fixed income such as lower tier government employees and pensioners. Schemes of gradually raising rents in upper and middle class neighborhoods have to be initiated as soon as possible with possible special arrangements for a limited percentage of occupants qualifying for government assistance.

Liberalized rent is not without problems, discouraging both landlords and tenants to rely on it for solving housing solutions. Hence, it is recommended those consumer protection agencies or other government bodies in local government or the ministry of housing produce lease agreement templates that protect both sides, ensure enforcement of contractual obligations on both sides and resort to a clear dispute settlement mechanism that eliminates the risk that continues to exist in entering these agreements for both leaser and leasee. The establishment of property management companies can also play an important role in becoming a crucial intermediary in these arrangements.

Government or real estate associations' help in this regard by producing rent-market information and intelligence in various areas can be useful in creating a pseudo indexation mechanism for market rents.

Policy recommendations to reduce urban divisions and variations in the quality of public services within cities

Based on the UNHABITAT/SRC Survey conducted for the greater Cairo region's informal and poverty pockets even in formal areas, the UNHABITAT study (Cairo: A City in Transition) reached the following important conclusion:

Understanding Cairo's informality and the context and policy regime in which it exists will offer significant insights into the urban divide in the city. It is clear that many urban and social problems associated with unplanned (informal) areas, as well as problems in deteriorating planned areas need to be addressed by government (and governorate) intervention and sound municipal management in terms of services and infrastructure and regulating mechanisms.

At the public level, Cairenes from all socioeconomic strata are affected by the congestion, traffic, pollution and noise of a megacity bursting at the seams and struggling to keep up with a growing population. But at a household and individual level, it is clear that people experience Cairo very differently according to their socioeconomic status and where they live. As such, Cairo has significant challenges to face to make the city more inclusive.

The study produced the following recommendations for "inclusive" social policies that integrate these areas' inhabitants in the overall social network of the city, with limiting drastic intervention to only hazardous housing conditions. These recommendations are:

- *Inclusive policies to narrow the urban divide:* Acknowledge the divide that exists between the poor and non-poor households and areas, and encourage adequate and sufficient investment in informal areas towards an inclusive city where services, amenities opportunities and resources are available on a more equitable basis.
- *Divided spaces- promoting urban planning policies to enhance opportunities:* The proliferation of informal and squatter settlements needs to be managed through more comprehensive implementation of existing legislation and increased alternative housing options for the poor as well as increased availability of affordable serviced land for the poor. Reforms in financial mechanism to produce social or low-cost housing are urgently needed in order to offer loans and credits accessible to the middle class and the urban poor.
- *Promoting Governance to bridge the urban divide:* To bring the ‘urban advantage’ to all citizens, local authorities working closely with national government bodies and civil society, should implement inclusive policies in areas such as land use, planning, housing, etc, supported by less bureaucratic urban management and more ambitious reforms in favor of the urban poor.
- *Governing in a “city of cities”:* To respond to the growing demands of the expanding city, such as transport, pollution, crime, poverty and exclusion effective metropolitan governance arrangements are needed. As long as Cairo does not have a metropolitan governance system, addressing fundamental challenges such as territorial isolation, fragmentation of technical and political interests, legal restrictions on municipalities to intervene beyond the politico-administrative jurisdictions, the capacity to govern in a “city of cities” will be limited and many of these challenges will not be addressed in an integrated territorial perspective.

While primarily developed for the GCR, some of them may be applicable to problems of informality and social division in other urban centers of the country. It may be necessary to study sample urban centers in the Delta and Upper Egyptian main cities so as to capture patterns of within-city informality and divisions that may be different from the ones detected in Cairo. That applies most importantly to the central government-local government relationships cities other than Cairo as well as the likely stronger linkages between urban and rural communities surrounding Delta and Upper Egypt urban centers.

b. Migration

The importance of analyzing migration is to follow patterns of people’s mobility in their pursuit of employment opportunities and quest for access to better social services. Migration is not necessarily the only solution to connecting people to either work or services; connectivity through an efficient transportation system can help bridge the gap between individuals and leading centers of economic and social activity. Thus, in terms of migration policy the emphasis has to be more on policies that strengthen mobility and connectivity of people, ensure universal access and consistent quality of basic services, and eliminate remaining divisions after comprehensive coverage of “blind institutions”.

Urban areas have to be hospitable to investors in general and in particular to investors interested in activities promoted by the government in a specific economic area. Furthermore, and to ensure that economic agglomeration and concentration to be achieved does not come with informal activity, housing, congestion, and so forth, urban planning and land use regulations have to ensure that housing and basic services are consistently planned and delivered in line with the strategic economic growth and investment direction both for urban “leading” areas and for “secondary” rural and small towns, together with roads and transportation necessary for connecting people and goods to the main economic activity center.

This will ensure that “premature” migration to cities and towns which produces informality is managed through pull factors maintaining residence for some workers or suppliers in the rural areas as long as they have reasonable access for their labor services and goods to the center and push factors to spokes whenever land use and housing options reach close to saturation stages in over-urbanized economic areas. Adequate, comparable to city standards, water, sanitation, schools, and health care in rural areas, will ensure that “push” factors for migration do not stem from access to basic services.

Recommendations related to migration policy:

- Increase housing mobility through a comprehensive housing market reform strategy that expands housing affordability (refer to the section on housing sector policy)
- Revise administrative boundaries that produce an inaccurate depiction of rural-urban migration trends and utilize “adjusted trends” to predict and accommodate natural migration seeking opportunities in economic activity centers (refer to the section on urban development).
- Develop a coherent transport policy that focuses on “economic connectedness” of workers and factors of production to centers of economic activity and ports linking production to international markets (refer to the section on transportation, mobility, and connectedness)
- Ensure the proper sequencing of service provision in new cities and new cities’ “connectedness” to existing centers of economic activity and vice versa (connectedness of workers living in existing cities to industrial zones established in new communities)
- Pre-empt “push-driven” migration from rural areas through ensuring even-quality provision of basic services to enhance the efficiency of public service provision (refer to the section on the public spending mechanisms)
- Utilize housing sector reform on affordability and mobility to ensure that migration or mobility in general does not target informal housing in peri-urban areas around main economic activity center especially in the GCR

c. Investment and urban planning

The main features of the recommended investment and urban planning strategy will have to focus on designing and managing a pro-agglomeration and economic concentration investment and economic growth strategy without supported by an urban development strategy that guides

and binds the numerous government entities that will have to be involved in implementation of various aspects of this strategy.

Recommendations related to the role of urban planning institutions:

The role of urban planning institutions has to be developed in such a way so as to allow these institutions to design and manage a pro- economic growth and agglomeration urban development strategy that is consistent with the country's economic growth and investment strategy. This role includes:

- 1- Receive a coherent national investment strategy that is consistent with economic policy goals and objectives and is conducive to the creation of critical economic mass in particular locations that are strategically chosen to capture domestic and international economic opportunities.
- 2- Utilize the new institutional and regulatory tools embedded in Law 119/2008 and the responsibilities of GOPP and The national Center for Public Land Use to translate the objectives of this investment strategy in the urban planning strategies for different levels (National, GCR, cities, even villages), emphasizing how the objective of each urban level fits towards achieving the overall spatial/geographic component of the urban development/investment strategy.
- 3- Ensure that the draft land management law to be presented to Parliament soon addresses the current fragmentation, overlapping jurisdictions, lack of sufficient infrastructure finance and/or recourse to clear PPP alternatives, etc. that are consistent with the implementation of national growth and investment policies of the country

The dynamics of successfully reshaping the economic landscape of a country will focus on creating the opportunities of production (of goods and services) to concentrate in cities for scale economies (internal and external). In that context people will have to be connected to these centers either through management of successful migration toward urban activity centers (pro-urbanization policies) together with a strategic transportation strategy that aims at reducing “economic distance” between centers and spokes for economic concentration. People have to be connected to concentrated production, either through facilitating migration or through efficient transportation.

One of the main insights from economic thinking on geography and economic development is that firms in many industrial and business service industries value agglomeration. This economic concentration accelerates when countries liberalize and open to trade. In India, liberalization in the early 1990s led to greater concentration of industry in port cities and metropolitan areas.⁶

⁶ Recent evidence suggests that just 20 cities—with good market access—accounted for some 60 percent of private manufacturing investment in India between 2000 and 2005. Similarly in China, foreign firms entering after the “open door” policy in 1978 have preferred to locate in cities with a large industrial base and a history of foreign investment.

Unless governments realize that the interaction between leading and lagging places is the key to economic development, they will continue to produce less than optimal economic growth either by forcing investment into places that are not naturally receptive to economic activity, or they will continue to force movement of workers and business activity away from “over-crowded” centers, fueling informality in these places. Simultaneously, failing to understand this interaction between leading and lagging places typically produces a pattern where regions are developed in isolation with emphasis placed on within-institutions and infrastructure solutions rather than “connective” tools that unify all places and put in place infrastructure that connects some places to others.

Recommendations related to the content of the national urban development/ investment strategy:
These include:

- *Re-evaluate the Desert Development Strategy and Increase Attention on Guiding Growth in Existing Cities.* At the same time, more institutional focus and resources are clearly needed to guide/manage urban growth where it is actually occurring, namely in existing cities.
- *Improve Public Land Management Mechanisms.* State-owned land conversion will remain important for urban development. It is particularly critical to revisit the sectoral public land management model with the aim, in the short term, of improving its functioning through a more rational use of the significant public land stock currently controlled by various government authorities.
- *Emphasize the network of old and new urban centers* and how they fit with surrounding small towns, rural areas and major industrial zones will be needed. New Towns and particularly allocations in near-desert areas which are close to existing urban agglomerations in the Nile Valley and Delta, particularly in Upper Egypt.
- *Re-evaluate the strategic direction and reposition existing and newly-established industrialized zones* to produce integrated “clusters” producing the necessary scale and linkages for fortifying rather than redundant capital and employment creation potential.
- *Create enforcement mechanisms to ensure that financing infrastructure* is addressed in a timely manner across all levels of government to support the complete and coherent implantation of the overall direction.
- *Develop a transportation strategy has to fit the vision of connecting “economic areas”* of different sizes and roles (centers and spokes) with efficient roads and efficient transport regulatory policy capable of producing the necessary inter-dependency between different layers of economic activity and players, both public and private.
- *Re-assess the economic foundation of particular industrial zones* in the context of the national investment /urban planning strategy, with greater emphasis on adopting the right sequencing of infrastructure development and guaranteeing resource availability for financing infrastructure, specialization in economic activity to create economic mass, the provision (public or private) of logistic services, and create leading-lagging relationships with existing urban and rural regions. Obvious among these locations are the north

western region south of Alexandria, the North Eastern region including Damietta and Canal Cities and Sinai, and the Eastern Coastal Region extending from Suez southward.

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Internal migration in Egypt: levels, determinants, wages, and likelihood of employment

Version Date: March 2012

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Introduction

Although Egypt (pop. 83 million in 2011) experienced striking economic growth alongside a variety of developmental improvements from 2004 till 2010, spatial inequality and poverty persist. Egyptians in urban and Lower Egypt enjoy higher living standards than those in rural and Upper Egypt, yet internal migration rates are surprisingly low compared to other countries.

This paper offers three explanations for the low migration rates: 1) low educational level, 2) labor is tied up in agricultural activity either as paid workers or unpaid family workers, and 3) rural households' ability to raise a portion of their food offsetting the impact of soaring food prices and reducing the incentive to migrate. The paper also finds two telling characteristics of internal migrants: 1) they are more likely to find employment than non-migrants; and 2) they earn higher wages, in particular the more educated individuals.

Literature Review

All existing studies address the issue of internal migration in Egypt without, however, suggesting why the rates are comparatively low:

Wahba, "An Overview of Internal and International Migration in Egypt" (2007) used the Egypt Labor Market Panel Survey (ELMPS 06) to demonstrate that while internal migration increased in 1998 -2006, the rate remained very low. The author notes that both rural-to- urban and urban-to- rural migration increased in that period as did commuting patterns.

Zohry, "The Development Impact of Internal Migration: Findings from Egypt" (2009) discussed the main motivations behind internal and international migration in Egypt drawing on field work in two governorates (Cairo and Beni Suief). Zohry suggested that migrants were more often forced to move by dire economic necessity rather than the wish to seek a better living situation.

Stylized Facts

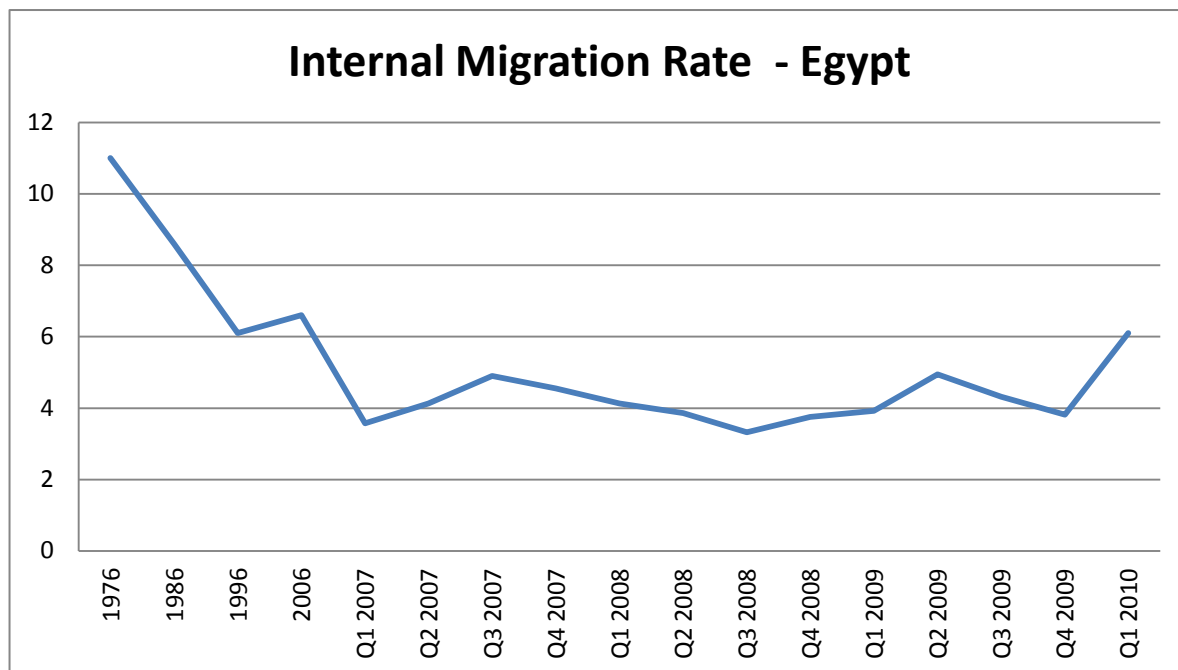
Data

This study used the Labor Force Survey conducted by the Central Agency for Public Mobilization and Statistics (CAPMAS) for the first quarter of year 2010. The survey has over 60 questions, clustered in three sections: 1) demographic and professional status (28 questions); 2) Employed characteristics (26 questions); and 3) unemployed characteristics (5 questions). The survey has 88,000 respondents.

An internal migrant is defined as an individual who has left the governorate of residence since birth in order to live in another region/governorate.¹ The Internal migration rate is calculated as a ratio of the number of migrants to that of the total population.

Although Egypt's economy is in a transitional phase, internal migration has lessened rather than increased. Internal migration rates declined during the 1970s, but stabilized since the mid 2000's, oscillating around 4% between 2007 and 2009, and reaching 6.1 percent in Q1 2010 (see Figure 1).

Figure 1 – Internal Migration Rate in Egypt

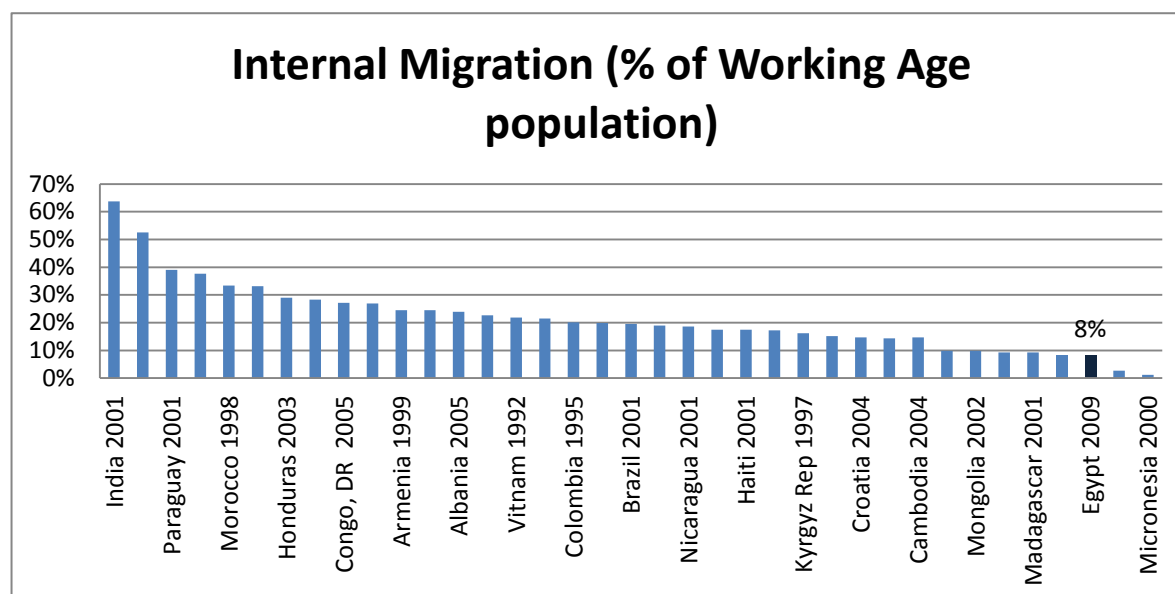


Source: CAPMAS and authors' calculations using Labor Force Survey

¹ Egypt is divided into 28 governorates.

Egypt's internal migration rates have not only declined over time, they are low by international standards. The world average internal migration rate as a share of working-age population is around 15 percent, while in Egypt it is 8 percent (see Figure 2).

Figure 2- Internal Migration Rate by Country



Sources: World Development Report 2010; Egypt: Authors' calculations using Labor Force Survey 2009; India: Bahgat, Ram B. 2009.

Men and women show similar migration rates, with the rate of migration among males (6 percent) slightly lower than that of females (6.2 percent) (see Tables A1 and A2 in the appendix). However, the reasons for migration greatly differ between men women, as described later in the paper.

Direction of Migration

Whether from urban or rural areas, most migrants prefer cities and towns as destinations. Rural migrants have a somewhat higher tendency to choose a rural locality (18.2 percent) compared to urban migrants (13.5 percent). In other words, urban migrants have a higher preference for cities and towns (86.5 percent) than rural migrants (81.7percent) (See Table 1).

Table 1 – Direction of Migration – Urban/Rural (classified according to place of origin)

Previous Location	Current Location		
	Urban	Rural	Total
Urban	86.5	13.5	100
Rural	81.7	18.3	100
Total	84.6	15.4	100

Sixty-one percent of migrants currently residing in cities and towns came from other urban areas, while 47.8 percent of migrants living in rural areas came from the countryside (see Table 2).

Table 2 – Direction of Migration - Urban/Rural (classified according to destination)

Previous Location	Current location		
	Urban	Rural	Total
Urban	61.0	52.2	59.6
Rural	39.0	47.8	40.4
Total	100	100	100

Source: Authors' calculations using Labor Force Survey

Migration by Regions

We considered seven regions in Egypt: 1) Cairo governorate 2) urban Lower Egypt, including three metropolitan governorates (Alexandria, Port Said and Suez) 3) rural Lower Egypt. 4) urban Upper Egypt including urban Giza, 5) rural Upper Egypt (including rural Giza) 6) urban Frontier governorates 7) rural Frontier governorates.

Lower Egypt is the preferred destination for migrants (64 percent), followed by Cairo (17 percent), as shown in Table 3. The majority of migrants from Cairo (70 percent) chose Lower Egypt as a destination, as did 46.5 percent of people migrating from Upper Egypt. Additionally 74.9 percent of migrants from Lower Egypt moved to different localities in the same region.

Direction of Migration

Table 3 – Direction of Migration- Region and Urban/Rural (classified according to origin)

Previous Region	Cairo	Current Region						Total
		Lower Urban	Lower Rural	Upper Urban	Upper Rural	Frontier Urban	Frontier Rural	
Cairo	3.3	54.8	15.5	20.5	4.5	1.3	0.1	100
Lower Urban	26.5	45.1	15.7	6.3	1.4	4.2	0.7	100
Lower Rural	9.5	60.7	24.9	2.9	0.5	1.2	0.3	100
Upper Urban	30.7	34.9	6.7	18.9	4.1	4.6	0.1	100
Upper Rural	20.6	41.9	10.3	15.2	6.4	4.6	1.1	100
Frontier Urban	16.9	12.7	4.2	7.0	5.6	49.3	4.2	100
Frontier Rural	10.5	26.3	31.6	0.0	0.0	5.3	26.3	100
Total	17.0	48.4	15.6	11.8	3.1	3.5	0.6	100

Source: Authors' calculations using Labor Force Survey

Most migrants now living in Cairo were born either in Upper Egypt (49.1 percent) or Lower Egypt (45.4 percent), as shown in Table 4. Migrants to Lower Egypt arrive mainly from other governorates in Lower Egypt (53.75 percent). The majority of migrants now living in Upper Egypt came from either the same region (48.5 percent) or from Cairo (34.1 percent).²

Table 4 – Direction of Migration – Region and Urban/Rural (classified according to destination)

Previous Region	Current Region							Total
	Cairo	Lower Urban	Lower Rural	Upper Urban	Upper Rural	Frontier Urban	Frontier Rural	
Cairo	4.0	23.0	20.1	35.3	29.8	7.6	3.1	20.3
Lower Urban	30.8	18.4	19.9	10.6	9.4	23.4	25.0	19.8
Lower Rural	14.7	32.8	41.7	6.4	4.1	9.1	15.6	26.2
Upper Urban	31.1	12.4	7.4	27.7	23.4	22.3	3.1	17.3
Upper Rural	18.0	12.9	9.8	19.2	31.0	19.3	28.1	14.9
Frontier Urban	1.3	0.3	0.3	0.8	2.3	17.8	9.4	1.3
Frontier Rural	0.2	0.2	0.7	0.0	0.0	0.5	15.6	0.3
Total	100	100	100	100	100	100	100	100

Source: Authors' calculations using Labor Force Survey

Migrants now residing in Cairo came mainly from urban areas in either Lower (30.8 percent) or Upper (31 percent) Egypt. Aside from those now in Cairo, the majority of migrants stayed within their region, for example 32.7 percent of those living in Urban Lower Egypt came from different governorates in Urban Lower Egypt. Almost half (48.4 percent) of all migrants from all regions reside in Lower Urban Egypt. (See tables 3 & 4).

Urban governorates - except Cairo - absorb the highest inflows of migrants, followed by Frontier governorates (South Sinai and Red Sea) where tourism offers employment possibilities (Table 5).

Table 5– Net Migration Flows by Governorate

Governorate	Net Migration Flows	Governorate	Net Migration Flows
Port Said	36.5%	Beni Suief	-1.7%
Suez	35.7%	Cairo	-2.4%
Red Sea	19.4%	Luxor	-2.4%
6 October	18.2%	Fayoum	-3.5%
Ismailia	17.4%	Beheira	-4.0%
North Sinai	9.5%	Gharbeya	-4.8%
Qalubia	8.8%	Aswan	-4.8%
Giza	8.6%	Dakahlia	-4.9%

² The high migration rate from Cairo to urban Upper Egypt is due to the inclusion of urban Giza, which is part of Greater Cairo, within the urban Upper Egypt category.

Alexandria	7.2%	Minya	-4.9%
Helwan	6.2%	Qena	-5.0%
Matrouh	4.6%	Menoufia	-5.1%
New Valley	1.6%	Sharqia	-5.4%
Kafr el-Sheikh	0.3%	Assyut	-6.0%
South Sinai	0.0%	Sohag	-6.0%
		Damietta	-7.2%

Source: Authors' calculations using Labor Force Survey

Urban governorates, new cities, Lower Egypt and Frontier governorates are the destinations for most migrants, the majority of whom originated in Cairo and Upper Egypt governorates.

Reasons for Migration

The LFS asks respondents the reasons for migrating, and allows several possible responses: for work, for education, for marriage, to accompany others, or other reasons. Table 6 presents the distribution of migrants, by gender, according to the reason for migrating. The majority of internal migrants (40.4 percent) change localities to accompany someone. Marriage is the reason behind 27.3 percent of migrations, followed by employment (23.36 percent).

While most men migrate to work (45.5 percent) or accompany a migrant (32.2 percent), women migrate because of marriage (45.3 percent) or to accompany a migrant (48.6 percent).

Table 6 – Reasons for Internal Migration by Gender

Reason for Migration	Male	Female	Total
For Work Only	45.4	1.0	23.4
Education	1.7	0.7	1.2
Marriage	9.5	45.8	27.6
Accompany	32.3	48.7	40.4
Others	11.1	3.9	7.5
Total	100	100	100

Source: Authors' calculations using Labor Force Survey

Most migrants (40 percent), regardless of their origins and destinations, migrate to accompany someone. Marriage is the second most frequent reason for migration in any direction; with the exception of rural to urban migration where 26.6 percent migrants move to seek work.

Table 7 – Direction of Migration and Reasons

Reason of Migration	Direction of Migration			
	Urban-Urban	Urban-Rural	Rural - Urban	Rural - Rural
For work only	18.8	16.3	26.7	17.5
Education	1.3	0.3	0.7	
Marriage	33.3	33.9	23.4	28.1
Accompany	40.9	40.2	42.1	45.2
Others	5.7	9.5	7.2	9.2
Total	100	100	100	100

Source: Authors' calculations using Labor Force Survey

Most men migrate either to work or accompany another migrant (more than one third each). Employment is the reason behind migration from rural to urban localities (53 percent) as well as from one rural area to another. Women mostly migrate because of marriage or to accompany a migrant. The percentage that migrates for work is negligible (see tables A3 & A4 in the appendix).

Internal Migration – Labor Mobility

Those who migrate to work are mostly males (97.8% of migrants to work are males while 2.2% are females), and the distribution of these migrants by level of education is multimodal (Table 8) : the biggest fraction is composed by illiterate workers (26%) and starts decreasing gradually with the level of attainment until it reaches the technical secondary level (25%), and then the university level at 17%.

Table 8 – Educational Attainment of Migrants (for work only)

Education level	Percent
Illiterate	26.1
Read & write	13.0
Less than Intermediate level	10.2
General Secondary	2.7
Technical Secondary	25.3
Above Intermediate level	4.4
University	17.1
Above university	1.2

Source: Authors' calculations using Labor Force Survey

The preferred destinations for those who migrate to work are Lower Egypt (56.6 percent), followed by Cairo (22.8 percent). Those who left Cairo for work reasons went largely to Lower Egypt (70.8 percent) or Upper Egypt (19.4 percent). Lower Egypt was also the prime destination for migrants from Upper Egypt (41.4 percent), followed by Cairo (30.5 percent).

Table 9- Direction of Migration (for work only) – Regions (classified according to origin)

Previous location	Current Region				Total
	Cairo	Lower Egypt	Upper Egypt	Frontier	
Cairo	2.9	70.9	19.4	6.8	100
Lower Egypt	20.5	69.3	5.6	4.6	100
Upper Egypt	30.6	41.5	21.2	6.8	100
Frontier	14.8	14.8	11.1	59.3	100
Total	22.9	56.6	13.5	7.1	100

Source: Authors' calculations using Labor Force Survey

The majority of those migrating to Cairo for work came from Upper Egypt (55.3 percent) and Lower Egypt (41.9 percent). Migrants from Lower and Upper Egypt tend to change localities within their home region.

Table 10- Direction of Migration (for work only) – Regions (classified according to destination)

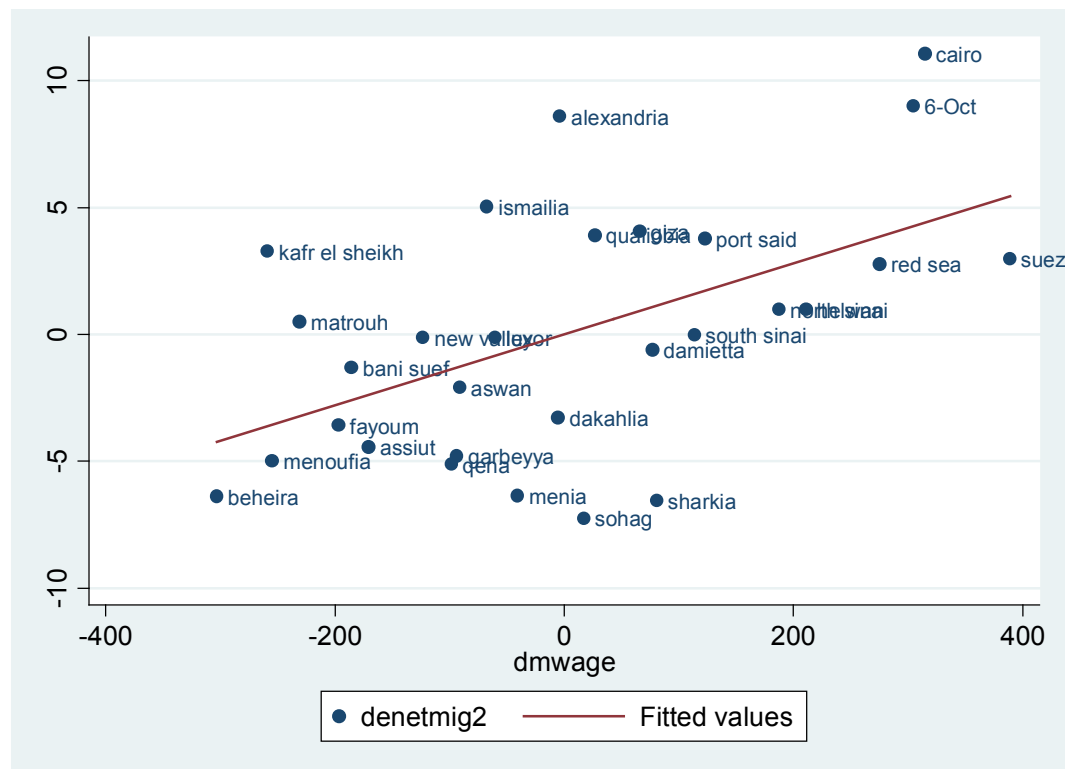
Previous location	Current Region				Total
	Cairo	Lower Egypt	Upper Egypt	Frontier	
Cairo	1.2	11.7	13.4	9.0	9.3
Lower Egypt	41.9	57.4	19.5	30.8	46.8
Upper Egypt	55.3	30.4	65.1	39.7	41.4
Frontier	1.6	0.6	2.0	20.5	2.4
Total	100	100	100	100	100

Source: Authors' calculations using Labor Force Survey

Wages and Internal Migration

There is a positive correlation between governorates with higher net migration inflows and higher average monthly wages in these governorates. The relation is more obvious when the migration rates are calculated using only those who migrate to work only (i.e> discarding those who migrate for marriage, or studying). Figure 3 shows the relationship between demeaned net migration to work against demeaned monthly wages by governorate.

Figure 3 – Demeaned Wages and Demeaned Migrants (for work only)



Source: Authors' calculations using Labor Force Survey

Do migrants earn higher wages?

Migrants receive, on average, slightly higher monthly wages (EGP1133.) than non-migrants (1033. EGP). Migrants' wage premium compared to non-migrants increases with educational attainment (see Table 11).

Table 11- Mean Wages (in EGP) by Educational Level for Migrants and Non-migrants

Education level	Non-migrants	Migrants
Illiterate	953	853
Read & Write	955	1222
Less than Intermediate	865	807
General Secondary	1005	877
Tech. Secondary	990	976
Above Intermediate	977	1030
University	1275	1422
Above university	2385	4909

An OLS model (where the dependent variable is log hourly wage) controlling for levels of education and introducing a migration dummy, reveals that migrants receive a 4.7 percent higher wage premium compared to non-migrants (see Table 12). Introducing age or experience to this model renders the migrant dummy insignificant. One explanation could be the remarkably high age (and experience) profiles to migrants compared to non-migrants, as migrants average age is 41.5 years compared to 25 years for non-migrants, and average migrants experience is around 28 years compared to 18 years for non-migrants.

Table 12 – Wages and Migration

VARIABLES	ln_hr wage
Read/Write	-0.0730*** (0.0214)
< Intermediate	-0.105*** (0.0205)
Gen. Secondary	-0.0699 (0.0443)
Tech. Secondary	-0.0399** (0.0165)
> Intermediate	0.0703*** (0.0268)
University	0.150*** (0.0192)
> University	0.839*** (0.0664)
Male	0.281*** (0.0148)
Formal Labor	0.106*** (0.0118)
Migrant	0.0473*** (0.0178)
Constant	1.046*** (0.0195)
Observations	16,652
R-squared	0.047
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

We further ran another simple wage equation model (OLS) with log hourly wage as the dependent variable, controlling for levels of education and introducing interactive dummies of migration with each level of education reveals that migrants with higher levels of education

receive higher wage premiums compared to non-migrants (see Table 13). Summary of the results are shown in graph in the appendix.

Table 13 – Wages and Migration

VARIABLES	ln_hrwage
Read/Write	-0.000343 (0.0215)
< Intermediate	0.0122 (0.0208)
Gen. Secondary	0.0669 (0.0455)
Tech. Secondary	0.0812*** (0.0166)
> Intermediate	0.181*** (0.0271)
University	0.270*** (0.0191)
> University	0.871*** (0.0710)
male	0.235*** (0.0151)
Male mig	-0.148*** (0.0337)
age	0.0281*** (0.00273)
age2	-0.000166*** (3.53e-05)
Public sec	0.200*** (0.0240)
Private sec	0.159*** (0.0133)
Other sec	-0.0959 (0.0857)
Read/Write mig	-0.123* (0.0679)
< Intermediate mig	-0.0354 (0.0624)
Gen. Secondary mig	-0.117 (0.130)
Tech. Secondary mig	0.108*** (0.0404)
> Intermediate mig	0.138* (0.0716)
University mig	0.270*** (0.0409)
> University mig	0.434*** (0.161)
Constant	0.172*** (0.0544)
Observations	16,652
R-squared	0.106

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Reasons for Low Migration Rates

Three stylized facts presented below suggest three interrelated reasons for Egypt's reduced internal migration rates. The first is low educational attainment, as migration rates tend to increase with level of education. Second, labor is absorbed by low-productivity agricultural activities, which relates to the third reason for low migration, that of households producing significant portions on their total food consumption, in what has been labeled the "food problem" (Gollin, Parente and Rogerson, 2008)

Migration and Educational Attainment

Migration rates increase with educational attainment (Table 13). The correlation may reflect both the larger numbers of workers in lower educational levels, and the greater tendency of highly-educated individuals to migrate. Migration rates among those with the least educational attainment (from illiterate to technical secondary) are low, with a maximum of 8.3 percent for graduates of technical secondary schools. As educational attainment increases, migration rates spike to reach more than 20 percent among migrants possessing post-graduate degrees.

Table 14 – Migration Rate by Educational Attainment

Education Level	Non-Migrants	Migrants	Total
Less than 6 years	99.2	0.8	100
Illiterate	91.9	8.1	100
Read & Write	94.4	5.6	100
Less than intermediate	94.6	5.4	100
General Secondary	93.1	6.9	100
Tech. Secondary	91.7	8.3	100
Above Intermediate	88.8	11.2	100
University	87.7	12.3	100
Above University	78.9	21.1	100
Total	93.8	6.2	100

Source: Authors' calculations using Labor Force Survey

Most migrants have had little education. Around 25 percent are illiterate, and 51.4 percent received less than intermediate level schooling. It is worth noting however, that a significant share of migrants (15.5 percent) possess college degrees.

Table 15 – Educational Attainment of Migrants and Non-migrants

Education level	Non-Migrants	Migrants	Total
Less than 6 years	22.8	2.7	21.6
Illiterate	19.6	26.2	20.0
Read & Write	12.6	11.4	12.6
Less than Intermediate	16.0	13.9	15.9
General Secondary	3.6	4.1	3.7
Tech. Secondary	15.9	21.9	16.3
Above Intermediate	2.0	3.8	2.1
University	7.3	15.5	7.8
Above University	0.2	0.6	0.2
Total	100	100	100

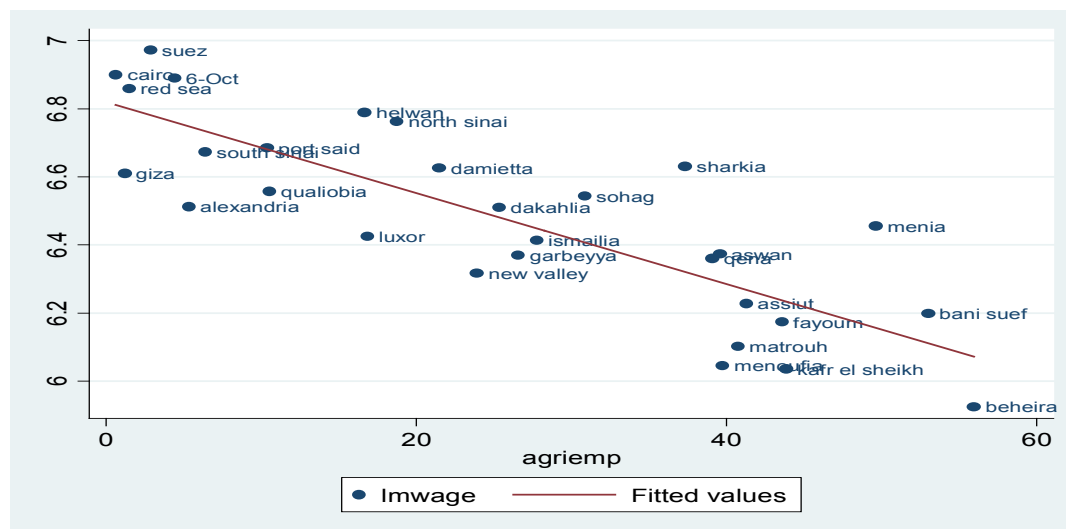
Source: Authors' calculations using Labor Force Survey

Agricultural Sector Involvement

The second stylized fact that can explain Egypt's low internal migration rate is involvement in agricultural activities that ties people to the land, often as unpaid family workers. Agricultural workers have lower migration rates than workers with other occupations (see Table 15).

Agricultural activities are typically characterized by low productivity (output per input) and lower wages (see Figure 6) than in other sectors. Using the share of agriculture in total employment as a proxy for productivity, as in Gollin, Parente and Rogerson (2008), it can be seen that governorates with high shares of agriculture, and hence lower productivity, are associated with lower wages.

Figure 4- Wages and Share of Agricultural Sector Employment by Governorate



Source: Authors' calculations using Labor Force Survey

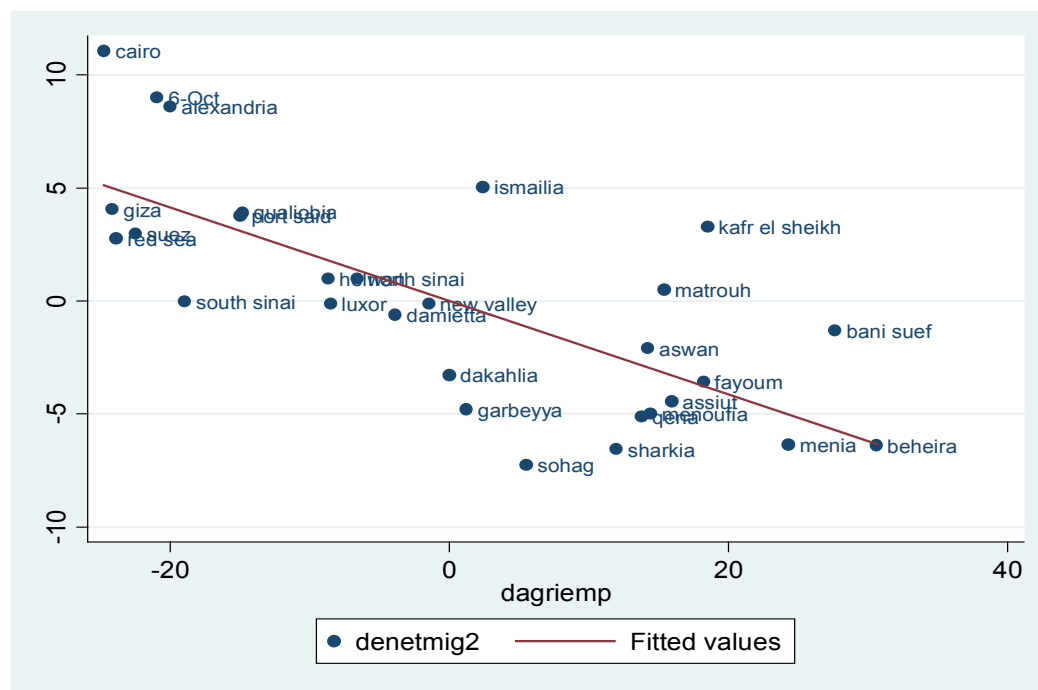
Table 16 – Migration Rate by Economic Activity

Economic Activity	Non-Migrants	Migrants	Total
Agriculture, Forestry	97.3	2.7	100
Mining and Quarrying	84.5	15.5	100
Manufacturing	89.7	10.3	100
Electricity, Gas, Steel	78.0	22.0	100
Water supply, Sewage	85.7	14.3	100
Construction	92.9	7.1	100
Wholesale and Retail	89.6	10.4	100
Transportation and Storage	89.5	10.5	100
Hotels, Accommodation, Food and restaurants	90.2	9.9	100
Information, Telecommunications	84.3	15.7	100
Financial, Insurance	87.4	12.6	100
Real Estate	92.3	7.7	100
Professional, Scientific	89.1	10.9	100
Administrative and Support Services	84.2	15.8	100
Public Administration	88.4	11.7	100
Education	90.4	9.6	100
Health and Social Work	91.1	8.9	100
Arts, Entertainment	87.8	12.2	100
Total	91.8	8.2	100

Source: Authors' calculations using Labor Force Survey

Figure 5 shows the relationship between demeaned net migration flows (to work) and demeaned agricultural employment for each governorate. Governorates with high migration rates have a lower share of agricultural employment.

Figure 5 – Demeaned Migration for Work and Demeaned Share of Agriculture Employment by Governorate

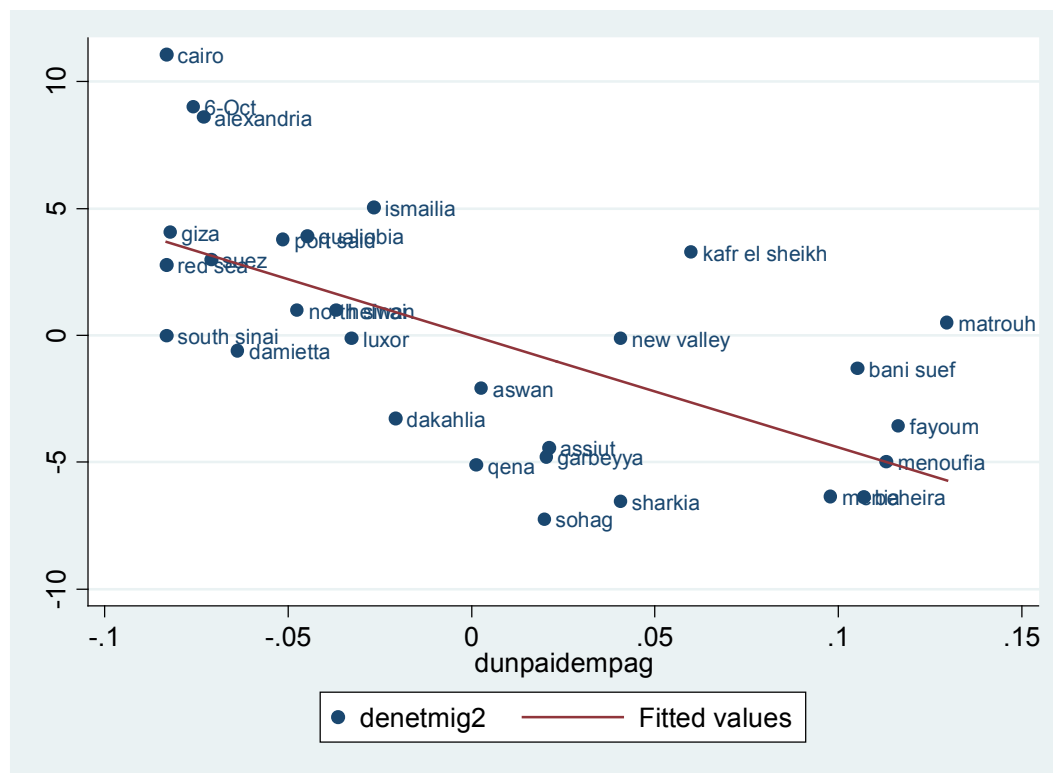


Source: Authors' calculations using Labor Force Survey

Internal migration is low in governorates with a high share of agricultural employment. Agricultural workers generally earn a low wage throughout Egypt and may be unqualified for other jobs, reducing the motivation to migrate. Additionally, unpaid family workers earn non-pecuniary benefits aside from the food they help raise (including proximity to family and the accompanying help-networks, shared rents, often more living space, cleaner air) making them reluctant to incur the additional costs of migrating to other governorates.

Figure 6 shows the negative correlation between demeaned net migration rate (to work) and demeaned share of unpaid family workers by governorate.

Figure 6 – Demeaned Net Migration Flows for Work Only and Demeaned Share of Unpaid Family Workers by Governorate



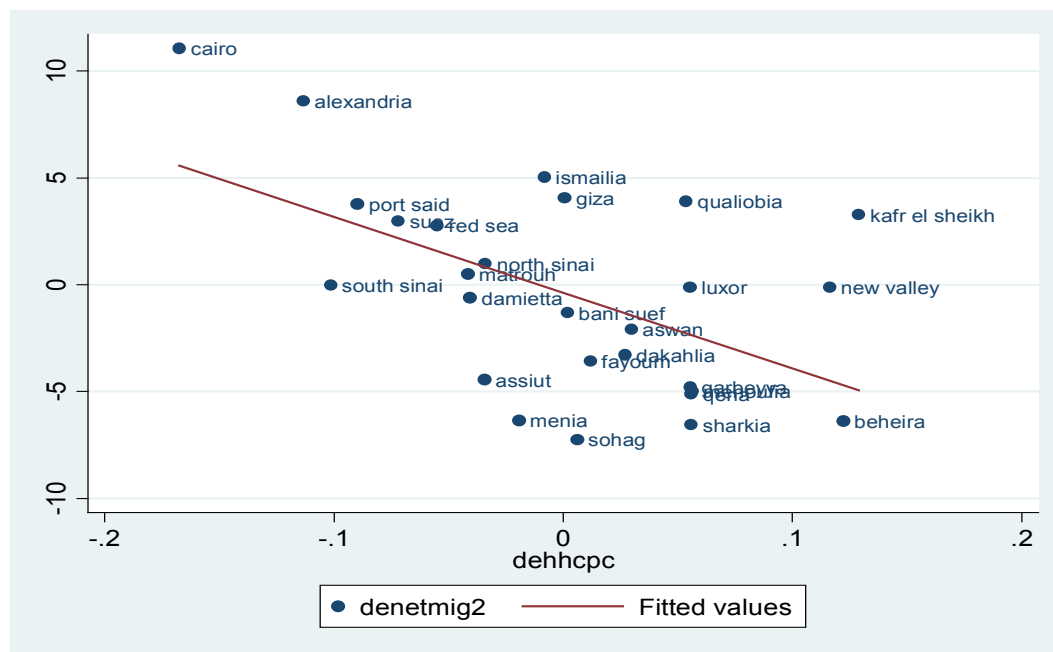
Source: Authors' calculations using Labor Force Survey

Household Food Production for Consumption

Migrants are usually motivated by a better living standard and a higher income to offset the impact of inflation and soaring food prices. Many Egyptian households produce much of their own food, reducing the incentive to migrate.

A ratio (constructed with HIECS 2005) of household food consumption from its own production over total household food consumption, plotted against net migration (to work) rates, yielded a negative correlation. Governorates where households rely on their own food production tend to have lower migration rates (see figure 7). The ability to purchase food at low prices or low opportunity cost reduces the likelihood of migration.

Figure 7- Demeaned Household Subsistence Consumption and Demeaned Net Migration for Work Only



Source: Authors' calculations using Labor Force Survey

The Model

We ran a probit model where the dependent variable is a binary taking '1' for the individual who migrated and '0' for those who did not. The independent variables are a dummy for male; regional dummies (urban areas omitted); Lower Egypt, Upper Egypt, and Frontier governorates; education level dummies (illiterate is omitted); age (a continuous variable); dummy if the individual is working in agriculture sector (agrisec); dummy if the individual is unpaid family worker (unpaidfw); governorate average for share of household food consumption from its own production (hhcpc); and GDP per capita of each governorate.

Data and Results

We used the Labor Market Survey data conducted by the Central Agency of Public Mobilization and Statistics (CAPMAS). In the regression we used the cross-section data for the first quarter of calendar year 2010. The regression results confirm the earlier analysis that individuals with higher levels of education have a higher tendency to migrate. The likelihood of migration increases with higher levels of education, except for above intermediate and university graduates.

Migrants prefer to reside in metropolitan governorates, Lower Egypt and frontier governorates rather than Upper Egypt.

People migrate to governorates with higher GDP per capita and wages.

Workers in agriculture and unpaid family workers have a lower tendency to migrate. Both have negative and significant signs (-0.16 and -0.18, respectively).

Governorates with high household food consumption from its own production have lower tendency of migration.

Table 17 – Probit Model – Internal Migration decision

VARIABLES	mig
male	-0.0351** (0.0158)
urbanarea	0.680*** (0.0190)
lowereg	-0.164*** (0.0494)
upperegyp	-0.412*** (0.0423)
frontier	0.240*** (0.0542)
married	0.397*** (0.0191)
readwrite	0.112*** (0.0266)
less_interm	0.119*** (0.0247)
gen_sec	0.184*** (0.0410)
tech_sec	0.162*** (0.0224)
abv_interm	0.128*** (0.0444)
univ	0.111*** (0.0264)
abv_univ	0.286** (0.122)
age	0.0160*** (0.000474)
agrisec	-0.164*** (0.0374)
unpaidfw	-0.188***

	(0.0680)
hhcpc	-0.958***
	(0.239)
logrgdp	0.305***
	(0.100)
Constant	-5.151***
	(0.888)
Observations	87,998
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 18 – Probit Model – Internal Migration for Work Only

We ran the same model for those who migrated to work. The dependent variable is a binary which takes '1' if the person migrated to work and '0' otherwise. The results concur with the previous model.

VARIABLES	migwrk
male	1.458***
	(0.0642)
urbanarea	0.421***
	(0.0361)
lowereg	-0.205**
	(0.0915)
upperegyp	-0.357***
	(0.0783)
frontier	0.469***
	(0.0922)
married	0.601***
	(0.0443)
readwrite	-0.00687
	(0.0490)
less_interm	-0.115**
	(0.0519)
gen_sec	-0.0353
	(0.0926)
tech_sec	0.174***
	(0.0416)
abv_interm	0.0662
	(0.0758)
univ	0.0264
	(0.0475)
abv_univ	0.396**
	(0.164)
age	0.0188***
	(0.000975)

agrisec	-0.0794 (0.0518)
unpaidfw	-0.381* (0.205)
hhcpc	-0.956** (0.437)
logrgdp	-0.0941 (0.180)
Constant	-3.592** (1.601)
Observations	87,998
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Migration and Unemployment

Unemployment is lower among migrants (6.2 percent) than non-migrants (9.5 percent) and lower still among those who migrated for work (2.6 percent). What is striking is that unemployment rates among migrants and migrants for work are consistently lower in destination governorates with the highest migration inflows (Tables 19 and 20), and even those experiencing high unemployment, such as Port Said with 25% unemployment rate. This might suggest that migrants, especially those migrated to work, have skills that enable them to find jobs.

Furthermore, migrants earn higher wages (after controlling for education level) compared to non-migrants. This may be due to migrant's matching their skills to the demand for jobs. It also reflects the significance of labor mobility and internal migration as means of achieving higher living standards.

Table 19 – Unemployment Rates of Non-migrants, Migrants and Migrants for Work

	Overall	Non-migrants	Migrants	Migrants for work
2008	9.9	10.2	3.6	0.2
2009	9.4	9.7	5.1	1.1
2010	9.3	9.5	6.2	2.6

Source: Authors' calculations using Labor Force Survey

Table 20 - Unemployment Rates in Governorates with Highest Net Migration Inflows

Unemployment rate	Overall	non-migrants	Migrants	Migrated for Work
Port Said	25	41.82	8.28	0
Ismailia	10.4	11.95	7.8	1.59
6 October	10.2	9.91	11.04	8.51
Red Sea	6.1	14.29	0	0
Suez	11.6	22.88	3.13	0

Source: Authors' calculations using Labor Force Survey

Table 21 - Unemployment Rate for Governorates with Highest Net migration for Work Inflows

Unemployment rate	Overall	non-migrants	Migrants	Migrated to work
Cairo	13.4	14.9	5.79	3.6
6 th of October	10.2	9.9	11	8.5
Alexandria	11.6	12.5	4.6	0
Ismalia	10.4	11.9	7.8	1.5
Qalubia	7.8	8.8	3.3	0

Source: Authors' calculations using Labor Force Survey

To further explore migrants' employability we ran a probit model for employment ('1' if the person is employed and '0' otherwise). The explanatory variables are educational attainment (dummies for each level of education, where illiterate is omitted), male dummy, regional dummies, age, age squared and a dummy for internal migrants.

The results, summarized in Table 21, confirm previous conjectures in the presentation of the stylized facts. The probability of being employed decreases with higher educational attainment, which concurs with higher unemployment rates found among highly-educated individuals. Males are more likely to find employment than females. Unemployment in rural areas is lower than urban areas. Probability of employment increases with age. Most importantly, migrants have a higher probability of being employed than non-migrants even after controlling for education, regions, age and gender (see table 21).

Table 22 – Probit Model – Employment and Migration

VARIABLES	Employed
readwrite	0.0996 (0.0787)
less_interm	-0.168** (0.0662)
gen_sec	-0.739*** (0.101)
tech_sec	-0.933*** (0.0456)
abv_interm	-1.039*** (0.0644)
univ	-1.090*** (0.0484)
abv_univ	-0.819*** (0.166)
male	0.916*** (0.0251)
urbanarea	-0.293*** (0.0288)
lowereg	0.0843** (0.0343)

upperegyp	0.186*** (0.0361)
frontier	0.419*** (0.102)
age	0.126*** (0.00629)
age2	-0.00118*** (8.56e-05)
mig	0.152*** (0.0501)
Constant	-1.160*** (0.113)
Observations	29,475

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusions and Direction to further Work

Given Egypt's economic growth and the regional disparity in living standards, we would expect high levels of internal migration and labor mobility to equalize returns on economic benefits. Migrants have a higher probability of employment even in governorates with high unemployment rates, in addition to earning higher wages compared to non-migrants. However, internal migration rates in Egypt were low in periods of economic growth compared to international rates.

In this paper we offered three explanations to low internal migration rate. First is the prevailing low level of educational attainment. Second, labor is tied up in low productivity agricultural activity. The third reason concerns rural households' ability to produce a significant portion of their food needs and/or offer their members other non-pecuniary benefits, thus reducing the motivation to migrate. Given inflated commodities' prices, rent and transportation costs, internal migration, unless a job is secured at the outset, is unaffordable.

Other factors beyond those analyzed and quantified in this report also contribute to low migration rates. For instance, the lack of land tenure security originated by inadequate land titling inhibits small farmers from renting their plots, which would liberate resources for non-agriculture activities or commercial agriculture. Also, the lack of affordable housing in urban centers imposes costs on labor mobility, as well as road congestion. These factors are discussed elsewhere (World Bank 2012). Social factors may also contribute to low migration rates. Although unsupported by data these include attachment to family and related help-networks (including access to small loans from a communal savings pool with benefits rotating among members and support in frequent cases of ill health); the common wisdom that urban areas are already oversaturated with the unemployed; the lack of affordable housing in urban

areas except in overcrowded slums lacking basic services and the fact that while a marginal improvement in wages may allow some small amount to be saved or sent home to help family, this is perceived as less valuable than a physical presence, for example to care for children and the elderly while others work. Finally, jobs are often found through extended family/friend/neighborhood networks, another reason for staying home (closer to the source of potential jobs).

Appendix

Table A1 – Internal Migration by Gender

	Male	Female	Total
Non-Migrants	51.1	48.8	100
Migrants	50	49.6	100
Total	51.1	48.8	100

Source: Authors' calculations using Labor Force Survey

Table A2- Gender Migration

	Male	Female	Total
Non-Migrants	93.9	93.7	93.8
Migrants	6.0	6.2	6.1
Total	100	100	100

Source: Authors' calculations using Labor Force Survey

Table A3 – Direction of Migration and Reasons for Migration - Males

Males Reason of Migration	Direction of Migration			
	Urban-Urban	Urban-Rural	Rural - Urban	Rural - Rural
For work only	38.5	32.9	53.0	39.5
Education	2.3	0.5	1.0	
Marriage	15.8	12.3	4.0	4.1
Divorce/Widowed	0.1			
Accompany	34.2	36.9	34.0	41.8
Others	9.2	17.5	8.0	14.6
Total	100	100	100	100

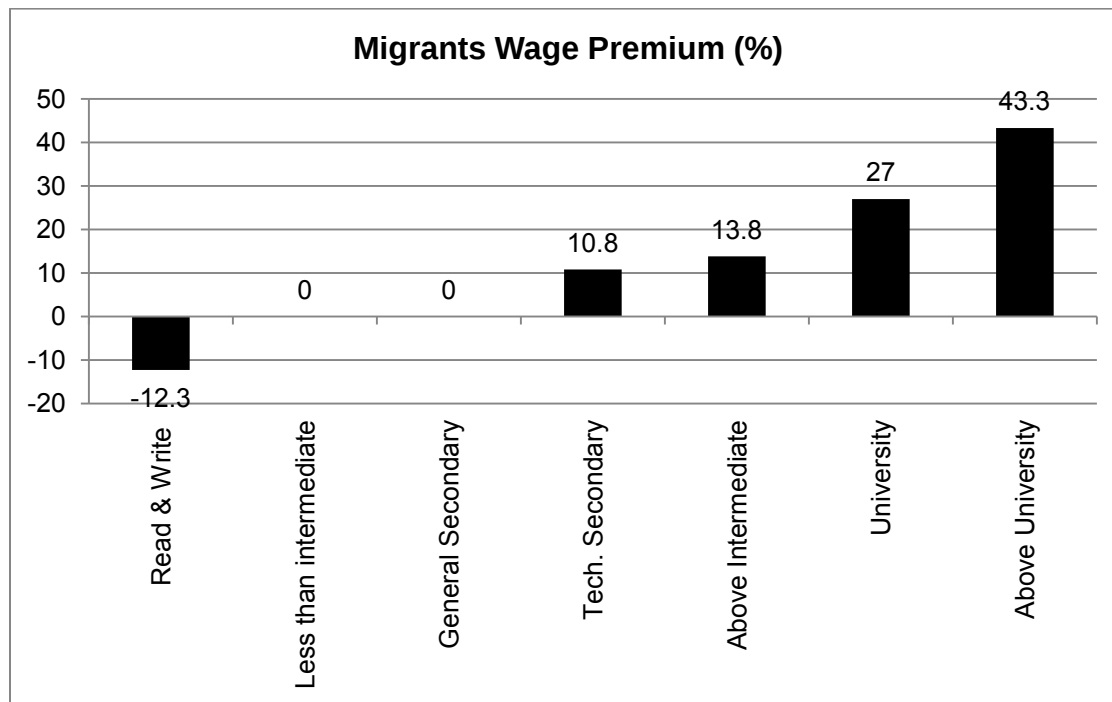
Source: Authors' calculations using Labor Force Survey

Table A4 – Direction of Migration and Reason for Migration - Females

Females Reason of Migration	Direction of Migration			
	Urban-Urban	Urban-Rural	Rural - Urban	Rural - Rural
For work only	0.9	0.5	1.6	
Education	0.5		0.5	
Marriage	48.3	53.9	41.9	47.2
Divorce/Widowed	0.8	0.5	0.1	
Accompany	47.1	43.3	49.9	48.0
Others	2.5	1.8	6.0	4.8
Total	100	100	100	100

Source: Authors' calculations using Labor Force Survey

Graph A1 – Migrants wage premium



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