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Shadow Economies and Corruption All Over the World: What Do We Really Know?*

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Abstract:

Estimations of the shadow economies for 145 countries, including developing, transition and highly developed OECD economies over 1999 to 2003 are presented. The average size of the shadow economy (as a percent of "official" GDP) in 2002/03 in 96 developing countries is 38.7%, in 28 transition countries 40.1% and in 21 OECD countries 16.3%. An increased burden of taxation and social security contributions, combined with a labour market regulation are the driving forces of the shadow economy. Furthermore, the results show that the shadow economy reduces corruption in high income countries, but increases corruption in low income countries. Finally, the various estimation methods are discussed and critically evaluated.

JEL: O17, O5, D78, H2, H11, H26

Keywords: shadow economy of 145 countries, tax burden, tax moral, quality of state institutions, regulation, DYMIMIC and other estimation methods

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1 Introduction

As corruption and shadow economic activities are a fact of life around the world, most societies attempt to control these activities through various measures like punishment, prosecution, economic growth or education. To gather information about the extent of corruption and the shadow economy and its relationship or who is engaged in corrupt and/or underground activities, the frequency with which these activities are occurring and the magnitude of them, is crucial for making effective and efficient decisions regarding the allocations of a country's resources in this area. Unfortunately, it is very difficult to get accurate information about the relationship between corruption and shadow economy activities on the goods and labour market, because all individuals engaged in these activities wish not to be identified. Hence, doing research in these two areas can be considered as a scientific passion for knowing the unknown.

Although substantial literature[1)] exists on single aspects of the hidden or shadow economy and a comprehensive survey has been written by Schneider (the author of this paper) and Enste (2000), the subject is still quite controversial[2)] as there are disagreements about the definition of shadow economy activities, the estimation procedures and the use of their estimates in economic analysis and policy aspects[3)]. Nevertheless around the world, there are some indications for an increase of the shadow economy but little is known about the development and the size of the shadow economies in transition, development and developed countries over the latest period 1999 to 2003.

Hence, the goal of this paper is threefold: to undertake the challenging task of estimating the shadow economy for 145 countries all over the world to provide some insights into the main causes of the shadow economy, and to explore the relationship between the shadow economy and corruption. In section 2 an attempt is made to define the shadow economy and some

[1)] The literature about the "shadow", "underground", "informal", "second", "cash-" or "parallel", economy is increasing. Various topics, on how to measure it, its causes, its effect on the official economy are analyzed. See for example, survey type publications by Frey and Pommerehne (1984); Thomas (1992); Loayza (1996); Pozo (1996); Lippert and Walker (1997); Schneider (1994a, 1994b, 1997, 1998a); Johnson, Kaufmann, and Shleifer (1997), Johnson, Kaufmann and Zoido-Lobatón (1998a, 1998b); Belev (2003); Gerxhani (2003) and Pedersen (2003). For an overall survey of the global evidence of the size of the shadow economy see Schneider and Enste (2000, 2002), Schneider (2003, 2005) and Alm, Martinez and Schneider (2004), and Kazemier (20025a)

[2)] Compare e.g. in the Economic Journal, vol. 109, no. 456, June 1999 the feature "controversy: on the hidden economy".

[3)] Compare the different opinions of Tanzi (1999), Thomas (1999), Giles (1999a,b) and Pedersen (2003), and

theoretical considerations about the reasons why it is increasing. Section 3 presents the econometric estimation results and the calculation of the size of the shadow economy in 145 countries in the period 1999/2000 to 2002/03. In section 4 two hypotheses about the relationship between the shadow economy and corruption are derived and some empirical results are shown. In section 5 a summary is given and some policy conclusions are drawn. Finally in the three appendices (chapters 6, 7 and 8) the various methods to estimate the shadow economy are presented and critically evaluated, a definition of the variables and data sources are given, and the descriptive statistics of the variables are shown.

2 Some Theoretical Considerations about the Shadow Economy

2.1 Defining the Shadow Economy[4)]

Most authors trying to measure the shadow economy face the difficulty of how to define it. One commonly used working definition is all currently unregistered economic activities that contribute to the officially calculated (or observed) Gross National Product[5)]. Smith (1994, p. 18) defines it as "market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP." Or to put it in another way, one of the broadest definitions of it includes…"those economic activities and the income derived from them that circumvent or otherwise avoid government regulation, taxation or observation"[6)]. As these definitions still leave open a lot of questions, table 2.1 is helpful for developing a better feeling for what could be a reasonable consensus definition of the underground (or shadow) economy.

From table 2.1, it becomes clear that a broad definition of the shadow economy includes unreported income from the production of legal goods and services, either from monetary or

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Janisch and Brümmerhoff (2005).

4) This paper focuses on the size and development of the shadow economy for countries and does not show any disaggregated values for specific regions. Lately some first studies were undertaken to measure the size of the shadow economy as well as the "grey" or "shadow" labour force for urban regions or states (e.g. California). Compare e.g. Marcelli, Pastor and Joassart (1999), Marcelli (2004), Chen (2004), Williams (2004a, b, 2005a, b, 2006), Williams and Windebank (1999, 2001a, b), Flaming, Haydamack, and Jossart (2005) and Alderslade, Talmage and Freeman (2006), and Brueck, Haisten-DeNew and Zimmermann (2006).

5) This definition is used for example, by Feige (1989, 1994), Schneider (1994a, 2003, 2005) and Frey and Pommerehne (1984). Do-it-yourself activities are not included. For estimates of the shadow economy and the do-it-yourself activities for Germany see Karmann (1986, 1990).

6) This definition is taken from Del'Anno (2003), Del'Anno and Schneider (2004) and Feige (1989); see also Thomas (1999), Fleming, Roman and Farrell (2000).

barter transactions – and so includes all economic activities that would generally be taxable were they reported to the state (tax) authorities. In this paper the following more narrow definition of the shadow economy is used[7]. The shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for the following reasons:

(1) to avoid payment of income, value added or other taxes,
(2) to avoid payment of social security contributions,
(3) to avoid having to meet certain legal labour market standards, such as minimum wages, maximum working hours, safety standards, etc., and
(4) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

Hence, in this paper, I will not deal with typical underground, economic (classical crime) activities, which are all illegal actions that fit the characteristics of classical crimes like burglary, robbery, drug dealing, etc. I also exclude the informal household economy which consists of all household services and production. This paper also does not focus on tax evasion or tax compliance, because it would get too long, and moreover tax evasion is a different subject, where already a lot of research has been undertaken[8].

Table 2.1: A Taxonomy of Types of Underground Economic Activities[1]

Type of Activity	Monetary Transactions		Non Monetary Transactions	
Illegal Activities	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc.		Barter of drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	**Tax Avoidance**	**Tax Evasion**	**Tax Avoidance**
Legal Activities	Unreported income from self-employment; wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbour help

[1] Structure of the table is taken from Lippert and Walker (1997, p. 5) with additional remarks.

[7] Compare also the excellent discussion of the definition of the shadow economy in Pedersen (2003, pp.13-19) and Kazemier (2005a) who use a similar one.
[8] Compare, e.g. the survey of Andreoni, Erard and Feinstein (1998) and the paper by Kirchler, Maciejovsky and

2.2 The Main Causes of Determining the Shadow Economy

2.2.1 Tax and Social Security Contribution Burdens

In almost all studies[9)] it has been ascertained that the tax and social security contribution burdens are among the main causes for the existence of the shadow economy. Since taxes affect labour-leisure choices, and also stimulate labour supply in the shadow economy, the distortion of the overall tax burden is a major concern for economists. The bigger the difference between the total cost of labour in the official economy and the after-tax earnings (from work), the greater is the incentive to avoid this difference and to work in the shadow economy. Since this difference depends broadly on the social security burden/payments and the overall tax burden, they are key features of the existence and the increase of the shadow economy.

But even major tax reforms with major tax rate deductions will not lead to a substantial decrease of the shadow economy[10)]. Such reforms will only be able to stabilize the size of the shadow economy and avoid a further increase. Social networks and personal relationships, the high profit from irregular activities and associated investments in real and human capital are strong ties which prevent people from transferring to the official economy. For Canada, Spiro (1993) found similar reactions of people facing an increase in indirect taxes (VAT, GST). This fact makes it even more difficult for politicians to carry out major reforms because they may not gain a lot from them.

Empirical results of the influence of the tax burden on the shadow economy is provided in the studies of Schneider (1994b, 2000, 2004, 2005) and Johnson, Kaufmann and Zoido-Lobatón (1998a, 1998b); they all found statistically significant evidence for the influence of taxation on the shadow economy. This strong influence of indirect and direct taxation on the shadow economy is further demonstrated by discussing empirical results in the case of Austria and the Scandinavian countries. For Austria the driving force for the shadow economy activities is the direct tax burden (including social security payments); it has the biggest influence, followed by the intensity of regulation and complexity of the tax system. A similar result has been achieved by Schneider (1986) for the Scandinavian countries (Denmark, Norway and

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Schneider (2002).

9) See Thomas (1992); Lippert and Walker (1997); Schneider (1994a,b, 1997, 1998a,b, 2000, 2003b, 2005); Johnson, Kaufmann, and Zoido-Lobatón (1998a,1998b); Tanzi (1999); Giles (1999a); Mummert and Schneider (2001); Giles and Tedds (2002) and Dell'Anno (2003), just to quote a few recent ones.

10) See Schneider (1994b, 1998b) for a similar result of the effects of a major tax reform in Austria on the shadow economy. Schneider shows that a major reduction in the direct tax burden did not lead to a major reduction in the shadow economy. Because legal tax avoidance was abolished and other factors, like regulations, were not changed; hence for a considerable part of the tax payers the actual tax and regulation burden remained unchanged.

Sweden). In all three countries various tax variables: average direct tax rate, average total tax rate (indirect and direct tax rate) and marginal tax rates have the expected positive effect (on currency demand) and are highly statistically significant. These findings are supported by studies of Kirchgaessner (1983, 1984) for Germany and by Klovland (1984) for Norway and Sweden, too.

In this study an attempt will be made to investigate the influence of the direct and indirect tax burden as well as the social security payments on the shadow economy for developing, transition and highly developed countries. Hence, for the first time this influence is investigated for developing, transition and highly developed countries for the same time period and using the same estimation technique.

2.2.2 Intensity of Regulations

Increased intensity of regulations is another important factor which reduces the freedom (of choice) for individuals engaged in the official economy[11)]. One can think of labour market regulations, trade barriers, and labour restrictions for foreigners. Johnson, Kaufmann, and Zoido-Lobatón (1998b) find significant overall empirical evidence of the influence of (labour) regulations on the shadow economy; and the impact is clearly described and theoretically derived in other studies, e.g. for Germany (Deregulation Commission 1990/91). Regulations lead to a substantial increase in labour costs in the official economy. But since most of these costs can be shifted to the employees, these costs provide another incentive to work in the shadow economy, where they can be avoided. Empirical evidence supporting the model of Johnson, Kaufmann, and Shleifer (1997), which predicts, inter alia, that countries with more general regulation of their economies tend to have a higher share of the unofficial economy in total GDP, is found in their empirical analysis. A one-point increase of the regulation index (ranging from 1 to 5, with 5 being/equalling the most regulation in a country), *ceteris paribus*, is associated with an 8.1 percentage point increase in the share of the shadow economy, when controlled for GDP per capita (Johnson et. al. (1998b), p. 18). They conclude that it is the enforcement of regulation which is the key factor for the burden levied on firms and individuals, and not the overall extent of regulation - mostly not enforced - which drives firms into the shadow economy. Friedman, Johnson, Kaufmann and Zoido-Lobaton (1999) reach a similar conclusion. In their study every available measure of regulation is significantly correlated with the share of the unofficial economy and the estimated sign of the relationship

[11)]See for a (social) psychological, theoretical foundation of this feature, Brehm (1966, 1972), and for a (first) application to the shadow economy, Pelzmann (1988).

is unambiguous: more regulation is correlated with a larger shadow economy. A one point increase in an index of regulation (ranging from 1-5) is associated with a 10% increase in the shadow economy for 76 developing, transition and developed countries.

These findings demonstrate that governments should put more emphasis on improving enforcement of laws and regulations, rather than increasing their number. Some governments, however, prefer this policy option (more regulations and laws), when trying to reduce the shadow economy, mostly because it leads to an increase in power for the bureaucrats and to a higher rate of employment in the public sector. In this study the effect of government regulation on the development of the shadow economy will be investigated for developing, transition and highly developed countries.

2.2.3 Public Sector Services

An increase of the shadow economy can lead to reduced state revenues which in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in the tax rates for firms and individuals in the official sector, quite often combined with a deterioration in the quality of the public goods (such as the public infrastructure) and of the administration, with the consequence of even stronger incentives to participate in the shadow economy. Johnson, Kaufmann, and Zoido-Lobatón (1998a/b) present a simple model of this relationship. Their findings show that smaller shadow economies appear in countries with higher tax revenues if achieved by lower tax rates, fewer laws and regulations and less bribery facing enterprises. Countries with a better rule of law, which is financed by tax revenues, also have smaller shadow economies. Transition countries have higher levels of regulation leading to a significantly higher incidence of bribery, higher effective taxes on official activities and a large discretionary framework of regulations and consequently a higher shadow economy. Their overall conclusion is that "wealthier countries of the OECD, as well as some in Eastern Europe, find themselves in the ‘good equilibrium’ of relatively low tax and regulatory burden, sizeable revenue mobilization, good rule of law and corruption control, and a [relatively] small unofficial economy. By contrast, a number of countries in Latin American and the former Soviet Union exhibit characteristics consistent with a ‘bad equilibrium’: tax and regulatory discretion and burden on the firm is high, the rule of law is weak, and there is a high incidence of bribery and a relatively high share of activities in the unofficial economy." (Johnson, Kaufmann and Zoido-Lobatón 1998a p. I). First results of the influence of corruption on the shadow economy and vice versa are reported in chapter 4 of this section.

2.2.4 Public Opinion about the Shadow Economy

The perception of citizens/voters about the shadow economy and their (moral) reaction to this phenomenon is also an important factor, i.e. under which circumstances people decide to work in the shadow economy. There are a number of empirical studies which investigate the tax morale of people and their attitudes towards the shadow economy[12]. In this short section some results for Germany are shown which clearly demonstrate that people have no bad (moral) feeling when working in the shadow economy. In table 2.2 for the year 2003 it is investigated whether people regularly work in the shadow economy or not. 25% of the German respondents say "yes", and 46% of the respondents regularly demand shadow economy activities. In table 2.3 some reasons are asked for why shadow economy activities are demanded. The most important result is, one saves money – or shadow economy activities are much cheaper than the official ones. The second most important reason is that tax and social security burden is too high (73% of the respondents) and reason number 3 is that due to the much higher labour costs in the official economy; one would not demand these activities. Especially the third answer is interesting, because this result clearly demonstrates that only 23% of the demanded shadow economy activities have substitutive character (i.e. they would be demanded in the official economy if there would be no shadow economy) and only 19% of the respondents answer that they would do it themselves. From this survey result one can conclude that roughly 60% of these activities would not take place if there were no shadow economy. In table 2.4 examples of some hourly wage rates of shadow economy activities in Germany are shown and what is surprising here is the huge range of wage rates in the shadow economy, for example the varying "price" for an hour of shadow market work by a painter ranges from € 9 to € 17. Table 2.4 clearly demonstrates also the large difference (a multiplicative factor between 4 and 5) between the wage rates in the shadow economy and in the official one.

In table 2.5 important attitudes held by Germans regarding what may be classified as a "Kavaliersdelikt" are shown[13]. These results convincingly demonstrate for the years 1996 to 2003 that roughly two thirds of the German population treat shadow economy activities as a "Kavalierdelikt", whereas only a third treats a small theft such as "stealing a newspaper from a box", as a "Kavaliersdelikt". In table 2.6 value statements of the German population with respect to the shadow economy are shown, and again, two thirds say that without shadow

[12]Compare Halla and Schneider (2005), Torgler (2002), Torgler and Schneider (2005), Feld and Frey (2005), and Feld and Larsen (2005).

economy earnings one can not keep the achieved standard of living and only a third of the population asked finds that shadow economy activities lead to great losses of tax revenues and social security payments to the state. What are most amazing in table 2.6 are the attitudes of the German population with respect to punishment of shadow economy activities: only between 9% and 3% of the asked German population questioned are convinced that shadow economy workers should be reported to the authorities and prosecuted! One gets a similarly low figure when asking whether a shadow economy worker is detected, he should be severely punished. Only between 7% and 3% of those asked say, "yes". This clearly shows that there is no bad (moral) feeling about working in the shadow economy among the German population. The results are quite similar for Austria.

[13] "Kavaliersdelikte": peccadillos

Table 2.2: Work in the Shadow Economy – Survey Results for 2003

(1) Do you work regularly in the shadow economy? (In order to earn 300 Euro and more per month)	Values in percent
No Yes No answer	72 25 (17% male) 2
(2) Do you regularly demand shadow economy activities?	Values in percent
No Yes	54 46
Representative questionnaire, Germany, May 2003, Source: Schneider (2004)	

Table 2.3: Reasons, for Shadow Economy Activities – Survey Results for Germany, May 2003

Reasons why shadow economy activities are demanded	Values in percent
(1) One saves money – or they are much cheaper than the official ones	90%
(2) The tax and social security burden is much too high	73%
(3) Due to the high labour costs in the official economy one would not demand these activities (extreme assumption: no shadow economy – 23% demand; 19% do-it-themselves)	68%
(4) The firms offer them themselves	52%
(5) It‘s so easy to get quick and reliable workers	31%
Representative questionnaire, Germany, May 2003, Source: Schneider(2004)	

Table 2.4: Hourly wage rates of shadow economy activities – Survey Results for Germany, 2004

Activity/Type of Worker	Town/Area	Wage rate in the shadow economy (in €)	Wage rate in the official economy (in €)
Painter	Berlin München Rhein/Rhur	10 – 17 9 – 15 10 – 12	42
Mechanics	Hamburg Berlin München	13 – 23 15 – 19 15 – 23	58
Cost of maintaining a household (distance 300km)	Berlin München Rhein/Rhur	300 – 380 400 – 450 350 – 420	1.800
Representative questionnaire, May 2003, Source: Schneider (2004)			

Table 2.5: Values/Attitudes of the German population regarding the shadow economy

Question: What are "Kavaliersdelikte" (negligible delicts)?

Statement	German Population (in % Yes)				
	May 1996	May 1998	May 2001	Nov./Dec. 2002	Nov./Dec. 2003
To demand activities in the shadow economy	55	64	60	68	67
To drive a car too fast	42	43	44	45	46
To undertake shadow economic activities oneself	36	41	33	36	38
To steal a newspaper from a box	28	29	31	30	28
Not to send children to school	25	27	24	18	16
To be dishonest when completing tax declarations	22	22	18	-	18
Not to go to work (e.g. to skive on a Monday)	18	17	16	13	12
To drive when drunk	9	4	7	3	4
Source: Schneider (2004)					

Table 2.6: Value Judgements/Attitudes from the German population regarding the Shadow Economy

Statement	German Population (in % Yes)				
	May 1996	May 1998	May 2001	Nov./Dec. 2002	Nov./Dec. 2003
Without shadow economy earnings one cannot keep up the standard of living	62	69	69	70	71
It's the state's/government's own fault that the shadow economy is so popular and large, because the tax and social security burden is too high	63	67	57	66	67
In the last 2-3 years I have taken advantage of shadow economic activities	26	38	34	36	39
Due to shadow economic activities the state loses a great amount of tax revenues and social security payments	29	25	30	28	26
In the neighbourhood one can observe a significant number of shadow economic activities	-	-	24	28	32
I think shadow economy workers should be reported to the authorities and prosecuted	9	4	6	3	3
If a shadow economy worker is detected he should be punished severely (high financial fines)	7	4	5	7	3
Source: Schneider (2004)					

2.2.5 Summary of the Main Causes of the Shadow Economy

In table 2.7 an overview of a number of empirical studies summarizes the various factors influencing the shadow economy. In table 2.7 two columns are presented, showing the various factors influencing the shadow economy with and without the independent variable, "tax morale". This table clearly demonstrates that the increase of tax and social security contribution burdens is by far most important single contributor to the increase of the shadow economy. This factor does explain some 35–38% or 45–52% of the variance of the shadow economy with and without including the variable "tax morale". The variable tax moral accounts for some 22–25% of the variance of the shadow economy[14], and finally there is a

[14] The innocence of this variable with respect to theory and empirical importance is also shown in Feld and Frey

third factor, "intensity of state regulation "(mostly for the labour market). In general table 2.7 shows that the independent variables tax and social security burden, followed by variables tax morale and intensity of state regulations are the three major driving forces of the shadow economy.

Table 2.7: Main Causes of the Increase of the shadow economy

Factors influencing the shadow economy	Influence on the shadow economy (in%) 1)	
	(1)	(2)
(1) Increase of the Tax and Social Security Contribution Burdens	35-38%	45-52%
(2) Intensity of State Regulations	8-10%	10-15%
(3) Social Transfers	5-7%	5-8%
(4) Specific Labour Market Regulations	5-7%	5-8%
(5) Public Sector Services	5-7%	5-8%
(6) Tax Morale 2)	22-25%	-
Overall influence	76-94%	70-90%
1) Average values of 15 studies 2) Average values of empirical results of 28 studies.		
Source: Schneider (2004)		

3 The Size of the Shadow Economy for 145 Countries

3.1 Econometric Results

In tables 3.1 to 3.3 the econometric estimations using the DYMIMIC approach (latent estimation approach) are presented for the 96 developing countries, the 28 (25) transition and 3 communist countries and the 21 industrialized (highly developed) OECD-countries of our sample[15)]. This grouping was necessary because the available data situation is different for these countries. For the 96 developing countries and the 28 transition and communist countries the estimation was done for three different points of time 1999/2000, 2001/02 and

(2002, 2002a and 2005), Frey (1997), and Torgler and Schneider (2005)

15) The classification which country is a developing country follows the one done by the World Bank (2002) using a benchmark per capita income of USD 9.265 or less. The others with a higher income are either transition or industrialized countries (here 21 OECD countries). The grouping of the transition countries is done following

2002/03 and for the 21 OECD countries I have six data points of time 1990/91, 1994/95, 1997/98, 1999/2000, 2001/02 and 2002/03. For the developing and transition countries I use as cause variables the following: share of direct and indirect taxation (including custom duties in % of GDP) as the two tax burden variables; burden of state regulation (Index of regulation, Heritage Foundation, 2005), unemployment quota and GDP per capita as three cause variables for the status of the "official" economy. As indicator values I use the employment quota (in % of the population between 18 and 64), annual rate of GDP, and annual rate of local currency per capita[16].For the OECD countries I use as additional cause variables the burden of social security payments, the tax morale, quality of state institutions and an index of the regulation of the labour market.

The estimation results for the 96 developing countries in Middle and South America, Africa, Asia and the South West Pacific Islands are shown in table 3.1. All estimated coefficients of the independent cause variables are statistically significant and have the theoretically expected signs. If one first considers the two tax burden variables, one realizes that the share of direct taxation is just statistically significant (90% confidence level) and the size of the estimated coefficient has half the size of the value of the share of indirect taxation and custom duties, which is highly significant statistically, and the estimated coefficient has a much larger size. One can interpret this to mean that direct taxation is a less important for the development of the shadow economy in developing countries, compared to indirect taxation and custom duties. If one turns to the burden of state regulation, the Heritage Foundation index, this variable is highly significant statistically, like the two variables, measuring the official economy, unemployment quota and GDP per capita. As a single independent variable, the burden of state regulation has the quantitatively largest impact on the size of the shadow economy, showing that state regulation is the most important factor for the size of the shadow economy in developing countries. But also the official labour market is quite important: the unemployment quota has the second largest estimated coefficient and influence on the shadow economy in the 96 developing countries in Middle and South America, Africa, Asia and the South West Pacific Islands. If we turn to the indicator variables, we see that the employment quota, as well as the change of local currency per capita, have the expected negative and positive influence and are highly statistically significant[17].

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the grouping in the OECD country studies (Paris, various years).

[16] Here I have the problem, that in some developing and transition countries the US-$ (or Euro) is also a widely used currency, which is not considered here, because I got no reliable figures of the amount of US-$ (Euro) in these developing and transition countries.

[17] The estimation results are in general robust, if other indicator variables are used as residuum; e.g. if the variable currency per capita is used as residuum the share of direct taxation becomes insignificant as well as the

In table 3.2 the DYMIMIC estimation results are presented for the 25 transition countries in Central and East Europe, former Soviet Union countries and 3 communist countries[18]. Again all estimated coefficients of the cause variables are statistically significant and similar: as in the case of the developing countries. The two tax burden variables have together the quantitatively largest impact on the size of the shadow economy. Contrary to the results found in the 96 developing countries, the cause variable, "share of direct taxation" (including social security payments) has a highly significant statistical influence with the expected positive effect on the shadow economy. Also the independent variable "share of indirect taxation" has now a highly significant statistical influence, but the estimated coefficient is somewhat smaller than compared to the one the share of direct taxation (including social security payments). The variable, "unemployment quota" has also the expected positive influence, is highly statistically significant, and has the second largest estimated coefficient. The indicator variables, "employment quota", and, "the annual rate of currency per capita" have the theoretically expected signs and are statistically highly significant.

Finally, in table 3.3 the results for 21 highly developed OECD countries are shown. For these countries the availability of data is somewhat better: Not only have I more data points over time, but also I have three additional cause variables, tax morale (an index), quality of state institutions and now, as a separate variable, the burden of social security payments (in % of official GDP). The additional indicator variable is the average working time (per week)[19)]. The estimated coefficients of all eight cause variables are statistically significant and have the theoretically expected signs. The tax and social security burden variables are quantitatively the most important ones, followed by the tax morale variable which has the single biggest influence; hence the tax payers' attitude towards the state institutions/government is quite important to determine whether one is engaged in shadow economy activities or not. Also the development of the official economy measured in unemployment and GDP per capita has a quantitatively important influence on the shadow economy. Turning to the four indicator variables they all have a statistically significant influence and the estimated coefficients have

variable GPD per capita.

[18] How useful it is to conclude the three communist countries in this estimation, is an open and debatable question, as these countries have only a somewhat limited market system. Hence they may not fit in this sample, which may be a point of criticism.

[19)] Using this indicator variable one has the problem that, of course, this variable is influenced by state regulation, so that this variable is not really exogenous; hence the estimation may be biased.

the theoretically expected signs. The quantitatively most important independent variables are the employment quota and change of currency per capita[20)].

Summarizing, the econometric results demonstrate that for all three groups of countries the theoretical considerations about the causes of the shadow economy in section 2 can be confirmed: The direct tax (and social security) payment and indirect tax (+ customs tariff) burden variables are the driving forces of the growth of the shadow economy for all three types of countries (developing, transition and highly developed OECD countries), followed by the measure of state (labour market) regulation and, as measures of the official economy, the unemployment quota and GDP per capita. In the developing countries has the largest influence the burden of state regulation, followed by the unemployment quota and the share of indirect taxation. In the transition countries direct taxation (including social security payments) has the largest influence, followed by the unemployment quota and share of indirect taxation. In the highly developed OECD countries, the social security contributions and the share of direct taxation wield the biggest influence, followed by tax morale and the quality of state institutions. From these results we see that there are some differences, which influence the shadow economy according to these three different country groups[21)].

[20)] The variable currency per capita or annual change of currency per capita is heavily influenced by banking innovations; hence this variable is pretty unstable with respect to the length of the estimation period. Similar problems are already mentioned by Giles (1999a) and Giles and Tedds (2002).

[21)] Due to space considerations here, it is not possible to discuss intensively why we observe these differences. The author is currently doing extensive research on these differences which will come out in a discussion paper this fall.

Table 3.1: DYMIMIC Estimations of the size of the shadow economy of 96 developing countries in Middle and South America, Africa, Asia and the South West Pacific Islands 1999/00, 2001/02 and 2002/03

Cause Variables	**Estimated Coefficients**
Share of direct taxation (in % of GDP)	$\lambda 1 = 0.16^{(*)}$ (1.77)
Share of indirect taxation and customs duties (in % of GDP)	$\lambda 2 = 0.256^{**}$ (3.34)
Burden of state regulation (Index, Heritage Foundation: score 1 most economic freedom, 5 least economic freedom)	$\lambda 3 = 0.309^{**}$ (2.84)
Unemployment quota (%)	$\lambda 4 = 0.296^{**}$ (3.96)
GDP per capita (in US-$)	$\lambda 5 = -0.151^{*}$ (-2.56)
Lagged endogenous variable	$\lambda 6 = 0.341^{(*)}$ (1.76)
Indicator Variables	
Employment quota (in % of population 18-64)	$\lambda 7 = -0.651^{**}$ (-3.45)
Annual rate of GDP	$\lambda 8 = -1$ (Residuum)
Change of local currency per capita	$\lambda 9 = 0.412^{**}$ (4.99)
Test-statistics	RMSE[1)] = 0.0004(*) (p-value = 0.952) Chi-square[2)] = 7.53 (p-value = 0.904) TMNCV[3)] = 0.042 AGFI[4)] = 0.774 N = 288 D.F.[5)] = 34

Notes:
t-statistics are given in parentheses (*); *; ** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level.

1) Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.
2) If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both are given for all three equations in tables 3.1-3.3 using a test of multi normal distributions.
3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.

4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.
5) The degrees of freedom are determined by 0.5 (p + q) (p + q + 1) – t; with p = number of indicators; q = number of causes; t = the number for free parameters.

Table 3.2: DYMIMIC Estimation of the Shadow Economy of 25 Central and East European and former Soviet Union Countries and 3 Communist Countries, 1999/00, 2001/02 and 2002/03

Cause Variables	**Estimated Coefficients**
Share of direct taxation + share of social security payments (in % of GDP)	λ1 = 0.461** (3.71)
Share of indirect taxation + customs duties (in % of GDP)	λ2 = 0.361** (3.31)
Burden of state regulation (Index, Heritage Foundation: score 1 most economic freedom, 5 least economic freedom)	λ3 = 0.192* (2.48)
Unemployment quota (%)	λ4 = 0.391** (3.91)
GDP per capita (in US-$)	λ5 = -0.221** (-3.77)
Lagged endogenous variable	λ6 = 0.284* (2.06)
Indicator Variables	
Employment quota (as % of total population 18-64)	λ7 = -0.729** (-5.49)
Annual rate of GDP	λ8 = -1.00 (Residuum)
Change of local currency per capita	λ9 = 0.432** (3.88)
Test-statistics	RMSE[1)] = 0.0003[(*)] (p-value = 0.914) Chi-square [2)] = 403.41 (p-value = 0.762) TMCV[3)] = 0.091 AGFI[4)] = 0.661 N = 84 D.F.[5)] = 33

Notes:
t-statistics are given in parentheses (*); *; ** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level.
1) Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.
2) If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to Σ (θ) (model implied covariance matrix). This test has a statistical validity

with a large sample (N ≥ 100) and multinomial distributions; both are given for all three equations in tables 3.1.1-3.1.3 using a test of multi normal distributions.
3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.
4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.
5) The degrees of freedom are determined by 0.5 (p + q) (p + q + 1) – t; with p = number of indicators; q = number of causes; t = the number for free parameters.

Table 3.3: DYMIMIC Estimation of the Shadow Economy of 21 highly developed OECD Countries, 1990/91, 1994/95, 1997/98, 1999/2000, 2001/02 and 2002/03

Cause Variables	**Estimated Coefficients**
Share of direct taxation (in % of GDP)	λ1 = 0.410* (3.41)
Share of indirect taxation (in % of GDP)	λ2 = 0.213(*) (1.92)
Share of social security contribution (in % of GDP)	λ3 = 0.523** (4.59)
Burden of state regulation (index of labour market regulation, Heritage Foundation, score 1 least regular, score 5 most regular)	λ4 = 0.203(*) (1.84)
Quality of state institutions (rule of law, World Bank, score -3 worst and +3 best case)	λ5 = -0.346** (-2.76)
Tax morale (WUS and EUS, Index, Scale tax cheating always justified =1, never justified =10)	λ6 = -0.614** (-4.06)
Unemployment quota (%)	λ7 = 0.399** (3.41)
GDP per capita (in US-$)	λ8 = -0.134** (-3.64)
Lagged endogenous variable	λ9= -0.174(*) (-1.78)
Indicator Variables	**Estimated Coefficients**
Employment quota (in % of population 18-64)	λ10= -0.713** (-3.49)
Average working time (per week)	λ11 = -1.00 (Residuum)
Annual rate of GDP (adjusted for the mean of all 22 OECD countries)	λ12 = -0.345** (-3.513)

Change of local currency per capita	$\lambda 13 = 0.384^{**}$ (4.71)
Test-statistics	RMSE[1] = 0.0002* (p-value = 0.981) Chi-square[2] = 6.54 (p-value = 0.921) TMCV[3] = 0.038 AGFI[4] = 0.814 N = 126 D.F.[5] = 61

Notes:
t-statistics are given in parentheses (*); *; ** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level.

1) Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.
2) If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both are given for all three equations in tables 3.1.1-3.1.3 using a test of multi normal distributions.
3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.
4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.
5) The degrees of freedom are determined by 0.5 (p + q) (p + q + 1) – t; with p = number of indicators; q = number of causes; t = the number for free parameters.

In order to calculate the size and development of the shadow economies of 145 countries, I have to overcome the disadvantage of the DYMIMIC approach, which is that one gets only estimated sizes of the shadow economy and one has to use another approach to get absolute figures. In order to calculate absolute figures of the size of the shadow economies from these DYMIMIC estimation results, I use the already available estimations from the currency demand approach for Australia, Austria, Germany, Hungary, Italy, India, Peru, Russia and the United States (from studies of Chatterjee, Chaudhury and Schneider (2006), Del'Anno and Schneider (2004), Bajada and Schneider (2003, 2005), Alexeev and Pyle (2003), Schneider and Enste (2002) and Lacko (2000)). As I have values of the shadow economy (in % of GDP) for various years for the above mentioned countries, I can use a benchmark procedure with the help of the currency demand estimation with figures to transform the index of the shadow economy from the DYMIMIC estimations into cardinal values.[22]

3.2 The Size of the Shadow Economies for 145 Countries for 1999/2000, 2001/2002 and 2002/2003

[22] This procedure is described in great detail in the paper Del'Anno and Schneider (2005).

When showing the size of the shadow economies over the three periods of time (1999/2000, 2001/2002 and 2002/2003) for the 145 countries which are quite different in location and developing stage, one should be aware that such country comparisons give only a rough picture of the ranking of the size of the shadow economy in these countries and over time, because the DYMIMIC and the currency demand methods have shortcomings; these are discussed in appendix (chapter 6)[23]. Due to these shortcomings a detailed discussion of the (relative) ranking of the size of the shadow economies is not conducted.

3.2.1 Developing Countries[24]

The results of the shadow economies for developing countries are divided by continent into Africa, Asia, and Central and South America, and are shown in Tables 3.2.1-3.2.3. The results for thirty-seven African countries are shown in Table 3.2.1. If we first consider the development of the shadow economies in these thirty-seven African countries from 1999-2000, we realize that shadow economies in these African nations have increased. On average, the size of these thirty-seven African shadow economies was 41.3% (of official GDP) in 1999-2000, and increased to 43.2% in 2002/2003. This is an average increase of 1.9 percentage points over four years. Turning to the latest results for 2002/2003, Zimbabwe, Tanzania, and Nigeria (with 63.2, 60.2 and 59.4% respectively) have by far the largest shadow economies, and the country in the median position is Mozambique with 42.4%. South Africa has the lowest shadow economy, with 29.5%, followed by Lesotho with 33.3%, and Namibia with 33.4%.

The large shadow economy in Africa (and in other developing countries) is only to some extent an issue of tax burdens, given the simple fact that the limited local economy means that citizens are often unable to earn a living wage in a legitimate manner. Working in the shadow economy is often the only way of achieving a minimal standard of living.

[23] See also Thomas (1992, 1999), Tanzi (1999), Pedersen (2003) and Ahumada, Alveredo, Cavanese A and P. Cavanese (2004), Janisch and Brümmerhoff (2005), Schneider (2005) and Breusch (2005a, 2005b).

[24] For an extensive and excellent literature survey of the research about the shadow economy in developing countries see Gerxhani (2003),who stresses thoroughout her paper that the destination between developed and developing countries with respect to the shadow economy is of great importance. Due to space reasons this point is not further elabourated here; nor are the former results and literature discussed. Compare Schneider and Enste (2000)

Table 3.2.1: The Size of the Shadow Economy in Thirty-Seven African Countries

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Algeria	34.1	35.0	35.6
2	Angola	43.2	44.1	45.2
3	Benin	47.3	48.2	49.1
4	Botswana	33.4	33.9	34.6
5	Burkina Faso	41.4	42.6	43.3
6	Burundi	36.9	37.6	38.7
7	Cameroon	32.8	33.7	34.9
8	Central African Republic	44.3	45.4	46.1
9	Chad	46.2	47.1	48.0
10	Congo, Dem. Rep.	48.0	48.8	49.7
11	Republic of Congo	48.2	49.1	50.1
12	Cote d'Ivoire	43.2	44.3	45.2
13	Egypt, Arabian Republic	35.1	36.0	36.9
		Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
No.	**Country**	**1999/00**	**2001/02**	**2002/03**
14	Ethiopia	40.3	41.4	42.1
15	Ghana	41.9	42.7	43.6
16	Guinea	39.6	40.8	41.3
17	Kenya	34.3	35.1	36.0
18	Lesotho	31.3	32.4	33.3
19	Madagascar	39.6	40.4	41.6
20	Malawi	40.3	41.2	42.1
21	Mali	42.3	43.9	44.7
22	Mauritania	36.1	37.2	38.0
23	Morocco	36.4	37.1	37.9
24	Mozambique	40.3	41.3	42.4
25	Namibia	31.4	32.6	33.4
26	Niger	41.9	42.6	43.8
27	Nigeria	57.9	58.6	59.4
28	Rwanda	40.3	41.4	42.2
29	Senegal	45.1	46.8	47.5
30	Sierra Leone	41.7	42.8	43.9
31	South Africa	28.4	29.1	29.5
32	Tanzania	58.3	59.4	60.2
33	Togo	35.1	39.2	40.4
34	Tunisia	38.4	39.1	39.9
35	Uganda	43.1	44.6	45.4
36	Zambia	48.9	49.7	50.8
37	Zimbabwe	59.4	61.0	63.2
Unweighted Average		**41.3**	**42.3**	**43.2**

Source: Own calculations.

In Table 3.2.2, the results for twenty-eight Asian countries are shown. It is somewhat difficult to treat all Asian countries equally, because some, such as Israel, Singapore, and Hong Kong, are highly

developed, while others, such as Thailand and Nepal, are still developing. The average shadow economy in the region increased from 28.9% in 1999/2000, to 30.8% of official GDP in 2002/2003, which is an increase of 1.9 percentage points over four years. Looking at individual countries[25)] for the year 2002/2003, with 54.1% Thailand has by far the largest shadow economy, followed by Cambodia with 52.4%, and Sri Lanka with 47.2% of official GDP. The median country is the Republic of South Korea with 28.2% of official GDP, surrounded by Yemen with 29.1% and United Arab Emirates with 27.8%. Singapore, Hong Kong and Saudi Arabia have the lowest shadow economies with 13.7%, 17.2%, and 19.7% of official GDP, respectively.

It is somewhat astonishing that the average size of the Asian shadow economies is considerably smaller than the shadow economies of African and Latin American states—this is partly due to the fact that there are a greater number of developed countries, which have smaller shadow economies located in Asia. It should be noted, however, that the average increase of shadow economies in the region is slightly more rapid than in Africa. This is not surprising, given that the size of the average African shadow economy is already more than eleven percentage points higher than its Asian counterpart. There is simply more room for growth in Asia.

[25)] The case of India has been extensively investigated by Chatterjee, Chaudhury and Schneider (2006).

Table 3.2.2: The Size of the Shadow Economy in Twenty-Eight Asian Countries

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Bangladesh	35.6	36.5	37.7
2	Bhutan	29.4	30.5	31.7
3	Cambodia	50.1	51.3	52.4
4	Hong Kong, China	16.6	17.1	17.2
5	India	23.1	24.2	25.6
6	Indonesia	19.4	21.8	22.9
7	Iran, Islamic Republic	18.9	19.4	19.9
8	Israel	21.9	22.8	23.9
9	Jordan	19.4	20.5	21.6
10	Korea, Republic	27.5	28.1	28.8
11	Kuwait	20.1	20.7	21.6
12	Lebanon	34.1	35.6	36.2
13	Malaysia	31.1	31.6	32.2
14	Mongolia	18.4	19.6	20.4
15	Nepal	38.4	39.7	40.8
16	Oman	18.9	19.4	19.8
17	Pakistan	36.8	37.9	38.7
18	Papua New Guinea	36.1	37.3	38.6
19	Philippines	43.4	44.5	45.6
20	Saudi Arabia	18.4	19.1	19.7
21	Singapore	13.1	13.4	13.7
22	Sri Lanka	44.6	45.9	47.2
23	Syrian Arab Republic	19.3	20.4	21.6
24	Taiwan, China	25.4	26.6	27.7
25	Thailand	52.6	53.4	54.1
26	Turkey	32.1	33.2	34.3
27	United Arab Emirates	26.4	27.1	27.8
28	Yemen, Rep.	27.4	28.4	29.1
Unweighted Average		**28.5**	**29.5**	**30.4**

Source: Own calculations.

In Table 3.2.3, the sizes of shadow for twenty-one Central and South American countries are shown. Averaging the figures over all twenty-one Central and South American countries, the shadow economy increased from 41.1% in the year 1999/2000 to 43.4% of official GDP in 2002/2003; an increase of 2.3 percentage points over these four years. If I turn to the size of the shadow economy for single countries for 2002/2003, Bolivia has the largest shadow economy with 68.3%, followed by Panama with 65.3% and Peru with 60.9% of official GDP. The median country is Brazil with 42.3% and at the lower end is Chile with 20.9%, Costa Rica with 27.8%, and Argentina with 28.9% of official GDP.

The sizes of the shadow economies of African and Central and South American countries are generally similar. This is partly due to the factors mentioned earlier; for the majority of citizens in many of these countries, the only way to ensure a decent standard of

living is to turn to the black market. As income inequality is much more pronounced in most Central and South American countries, compared to Africa, the rate of increase in shadow economy activity in Central and South America is higher.

Table 3.2.3: The Size of the Shadow Economy in Twenty-One Central and South American Countries

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Argentina	25.4	27.1	28.9
2	Bolivia	67.1	68.1	68.3
3	Brazil	39.8	40.9	42.3
4	Chile	19.8	20.3	20.9
5	Colombia	39.1	41.3	43.4
6	Costa Rica	26.2	27.0	27.8
7	Dominican Republic	32.1	33.4	34.1
8	Ecuador	34.4	35.1	36.7
9	El Salvador	46.3	47.1	48.3
10	Guatemala	51.5	51.9	52.4
11	Haiti	55.4	57.1	58.6
12	Honduras	49.6	50.8	51.6
13	Jamaica	36.4	37.8	38.9
14	Mexico	30.1	31.8	33.2
15	Nicaragua	45.2	46.9	48.2
16	Panama	64.1	65.1	65.3
17	Paraguay	27.4	29.2	31.4
18	Peru	59.9	60.3	60.9
19	Puerto Rico	28.4	29.4	30.7
20	Uruguay	51.1	51.4	51.9
21	Venezuela, RB	33.6	35.1	36.7
Unweighted Average		**41.1**	**42.2**	**43.4**

Source: Own calculations.

3.2.2 Transition Countries

The measurement of the size and development of the shadow economies in the transition countries has been undertaken since the late 1980s starting with the work of Kaufmann and Kaliberda (1996), Johnson et al. (1997) and Lacko (2000). They all use the physical input (electricity) method (see Appendix 7.1.2.5) and come up with quite large figures. In the work of Alexeev and Pyle (2003) and Belev (2003) the above mentioned studies are critically evaluated arguing that the estimated sizes of the unofficial economies are to a large extent a historical phenomenon and partly determined by institutional factors.

In table 3.2.4 the size and development of the shadow economy of 25 East and Central European and former Soviet Union countries are presented. Turning again first to the development of the

size of the shadow economy over time, the average size of the shadow economy of these 25 East and Central European countries was 38.1% of official GDP in 1999/2000 and increased to 40.1% in 2002/2003 which is an increase of 2 percentage points over these four years. The highest shadow economies are in Georgia, Azerbaijan and the Ukraine with 68%, 61.3% and 54.7%. The median country is Bulgaria, surrounded by Serbia and Montenegro with 39.1% and Romania with 37.4%. At the lower end are the Czech Republic with 20.1%, the Slovak Republic with 20.2% and Hungary with 26.2% of official GDP.

Table 3.2.4: The Size of the Shadow Economy in 25 East and Central European and Former Soviet Union Countries

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Albania	33.4	34.6	35.3
2	Armenia	46.3	47.8	49.1
3	Azerbaijan	60.6	61.1	61.3
4	Belarus	48.1	49.3	50.4
5	Bosnia and Herzegovina	34.1	35.4	36.7
6	Bulgaria	36.9	37.1	38.3
7	Croatia	33.4	34.2	35.4
8	Czech Republic	19.1	19.6	20.1
9	Estonia	38.4	39.2	40.1
10	Georgia	67.3	67.6	68.0
11	Hungary	25.1	25.7	26.2
12	Kazakhstan	43.2	44.1	45.2
13	Kyrgyz Republic	39.8	40.3	41.2
14	Latvia	39.9	40.7	41.3
15	Lithuania	30.3	31.4	32.6
16	Macedonia, FYR	34.1	35.1	36.3
17	Moldova	45.1	47.3	49.4
18	Poland	27.6	28.2	28.9
19	Romania	34.4	36.1	37.4
20	Russian Federation	46.1	47.5	48.7
21	Serbia and Montenegro	36.4	37.3	39.1
22	Slovak Republic	18.9	19.3	20.2
23	Slovenia	27.1	28.3	29.4
24	Ukraine	52.2	53.6	54.7
25	Uzbekistan	34.1	35.7	37.2
Unweighted Average		**38.1**	**39.1**	**40.1**

Source: Own calculations.

3.2.3 Highly developed OECD-Countries

The size and development of the shadow economies of 21 highly developed OECD countries are shown in table 3.2.5.

Table 3.2.5: The Size of the Shadow Economy in 21 OECD Countries

		Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
	Country	**1999/00**	**2001/02**	**2002/03**
1	Australia	14.3	14.1	13.5
2	Austria	9.8	10.6	10.9
3	Belgium	22.2	22.0	21.0
4	Canada	16.0	15.8	15.2
5	Denmark	18.0	17.9	17.3
6	Finland	18.1	18.0	17.4
7	France	15.2	15.0	14.5
8	Germany	16.0	16.3	16.8
9	Greece	28.7	28.5	28.2
10	Ireland	15.9	15.7	15.3
11	Italy	27.1	27.0	25.7
12	Japan	11.2	11.1	10.8
13	Netherlands	13.1	13.0	12.6
14	New Zealand	12.8	12.6	12.3
15	Norway	19.1	19.0	18.4
16	Portugal	22.7	22.5	21.9
17	Spain	22.7	22.5	22.0
18	Sweden	19.2	19.1	18.3
19	Switzerland	8.6	9.4	9.4
20	United Kingdom	12.7	12.5	12.2
21	United States	8.7	8.7	8.4
Unweighted Average		**16.8**	**16.7**	**16.3**

Source: Own calculations.

If I consider again the development of the size of the shadow economies of these 21 OECD countries, I realize for the first time that the size of the shadow economy of these countries has decreased over the period 1999/2000 to 2002/2003. The average size of the shadow economy in 1999/2000 of these countries was 16.8% of official GDP; it decreased to 16.3% in 2002/2003, a decrease of 0.5 percentage points. If I consider single countries, Greece, Italy and Spain have by far the largest shadow economy in 2002/2003 with 28.2%, 25.7% and 22.0% of official GDP. The median country is Ireland with 15.3% of official GDP surrounded by Germany with 16.8%[26)] and Canada with 15.2%. At the lower end are the United States, Switzerland and Japan with a shadow economy of 8.4%, 9.4% and 10.8% of official GDP.

[26)] Pickhardt and Sarda-Pous (2006) reach very similar values of the shadow economy for Germany using a combination of a MIMIC and Currency Demand Method.

3.2.4 South West Pacific Islands

The size and development of the shadow economies of 10 South West Pacific islands are presented in table 3.2.6.

Table 3.2.6.: The Size of the Shadow Economy in 10 South West Pacific Islands

		Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
	Country	**1999/00**	**2001/02**	**2002/03**
1	Fiji	33.6	34.3	35.1
2	Kiribati	34.1	35.0	35.3
3	Maldives	30.3	31.4	32.0
4	Marshall Islands	28.1	29.0	29.6
5	Micronesia, Fed. Sts.	31.3	32.1	33.2
6	Palau	28.4	29.2	30.0
7	Samoa	31.4	32.6	33.5
8	Solomon Islands	33.4	34.5	35.3
9	Tonga	35.1	36.3	37.4
10	Vanuatu	30.9	31.7	32.5
Unweighted Average		**31.7**	**32.6**	**33.4**

Source: Own calculations.

If I again consider the development over time, the average size of the shadow economy of these 10 South West Pacific islands countries increased from 31.7% in the year 1999/2000 to 33.4% in the year 2002/2003, which means an increase of 1.7 percentage points over these four years. The largest shadow economy (the latest estimation period 2002/2003) is in Tonga, with 37.4%, followed by the Solomon Islands with 35.3% and Kiribati with 35.3%. In the middle field is Micronesia and Samoa with a shadow economy of 33.2% and 33.5% of official GDP. The lowest shadow economy have the Marshall Islands and Palau with a shadow economy of 29.6% and 30.0%.

3.2.5 Communist Countries

In this last section the size and development of the shadow economies of three communist countries (China, Laos and Vietnam) are presented. The results are shown in table 3.2.7.

Table 3.2.7: The Size of the Shadow Economy in 3 Communist Countries

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	China	13.1	14.4	15.6
2	Lao PDR	30.6	31.9	33.4
3	Vietnam	15.6	16.9	17.9
Unweighted Average		**19.8**	**21.1**	**22.3**

Source: Own calculations.

The average size of the shadow economy in the above mentioned countries in 1999/2000 was 19.8%, and by 2002/2003 had increased by 2.5 % to 22.3%. Laos has the largest shadow economy with 33.4% and China the lowest with 15.6%. It should be clear that the shadow economy in these countries, and especially in China, which is partly a market economy and yet still a planned socialist economy, is difficult to interpret. It should be more seen as a parallel economy, where especially farmers and small firms in rural regions produce additional products to earn some (extra) money. It is an open question whether the findings of these shadow economies can be compared to others. That is one reason why they are shown in this paper in an extra section and should be interpreted with caution with respect to their size and the label "shadow" or "grey" economy.

4 Corruption and the Shadow Economy: Substitutes or Compliments?[27)]

Quite often shadow economy and corruption[28)] are seen as "twins", who need each other or fight against each other. This means for a social scientist that, theoretically, corruption and the shadow economy can be either complements or substitutes. Choi and Thum (2004) present a model where the option of entrepreneurs to go underground constrains a corrupt official's ability to ask for bribes. Dreher, Kotsogiannis and McCorriston (2005a/b) extend the model to the explicit specification of institutional quality. The model shows that corruption and shadow

[27)] This section is taken from Dreher and Schneider (2006), pages 4, 5 and 14 as well as table 4.1.

[28)] According to Dreher and Schneider (2006), corruption is commonly defined as the misuse of public power for private benefit.

economy are substitutes in the sense that the existence of the shadow economy reduces the propensity of officials to demand graft.

Johnson et al. (1998), on the contrary, model corruption and the shadow economy as complements. In their full-employment model, labour can be either employed in the official sector or in the underground economy. Consequently, an increase in the shadow economy always decreases the size of the official market. In their model, corruption increases the shadow economy, as corruption can be viewed as one particular form of taxation and regulation (driving entrepreneurs underground). Hindriks et al. (1999) also show that the shadow economy is a complement to corruption. This is because, in this case, the tax payer colludes with the inspector so the inspector under-reports the tax liability of the tax payer in exchange for a bribe[29)].

Theoretically, the relationship between corruption and the shadow economy is thus unsettled. There is, however, reason to believe that the relationship might differ among high and low income countries. In high income countries, the official sector provides public goods like the rule of law, enforcement of contracts, and protection by an efficient police. Usually, only craftsmen or very small firms have (or take) the option of going underground. In this case, the shadow economy is hidden from tax inspectors and other officials. In other words, there are no bribes necessary or possible to buy the way out of the official sector. In high income countries – typically showing comparably small levels of corruption – individuals confronted with a corrupt official always have the choice to bring the official to court. Moreover, in high income countries corruption quite often takes place, for example, to bribe officials to get a (huge) contract from the public sector (e.g. in the construction sector). This contract is then handled in the official economy and not in the shadow economy. Hence, corruption in high income countries can be a means to achieve certain benefits which make work in the official economy easier, e.g., winning a contract from a public authority, getting a licence (e.g. for operating taxes or providing other services or getting the permission to convert land into "construction ready" land, etc.). In high income countries people thus bribe in order to be able to engage in more official economic activities. As Schneider and Enste (2000) point out, at least two thirds of the income earned in the shadow economy is immediately spent in the official sector. The shadow economy and the official sector might thus be complements. The corresponding increase in government revenue and strengthened institutional quality is likely

[29)] See Dreher and Siemers (2005) for a formalization of this argument.

to decrease corruption. The prediction of a negative (substitutive) relation between corruption and the shadow economy is in line with the models of Choi and Thum (2004) and Dreher, Kotsogiannis and McCorriston (2005a).[30)]

In low income countries, on the contrary, we expect different mechanisms to prevail. Instead of working partly in the official sector and offering additional services underground as in high-income countries, enterprises completely engage in underground activity. Examples for enterprises operating completely underground are restaurants, bars, or haircutters – and even big production companies. One reason for this is that public goods provided by the official sector are, in many developing countries, less efficient compared to high income countries. Big companies, however, are comparably easy to detect and – in order to escape taxation and punishment – they have to bribe officials, thereby increasing corruption. Corruption often takes place in order to pay for activities in the shadow economy, so that the shadow economy entrepreneur can be sure not to be detected by public authorities. Here, shadow economy and corruption are likely to reinforce each other, as corruption is needed to expand shadow economy activities and – at the same time – underground activities require bribes and corruption. To get some additional income from the shadow economy entrepreneur, it is natural for public officials to ask for bribes and thus benefit from the shadow market. In low income countries, we therefore expect a positive (complementary) relationship between corruption and the shadow economy. This corresponds to the predictions of the models of Hindriks et al. (1999) and Johnson et al. (1997).

In summary, following Dreher and Schneider (2006), I expect:

Hypothesis 1: In low income countries, shadow economy activities and corruption are complements.

Hypothesis 2: In high income countries, shadow economy activities and corruption are substitutes.

These two hypotheses are tested for a cross-section of 120 countries and a panel of 70 countries for the period 1994 to 2002.[31)] Table 4.1 summarizes the empirical results of Dreher

[30)] Consequently, Dreher, Kotsogiannis and McCorriston (2005a) test their model employing data for OECD countries only.

and Schneider (2006). Overall, they show that an increase in perceived corruption over time also increases the shadow economy. This confirms the models of Johnson et al. (1998) and Hindriks et al. (1999). Across countries, however, greater perceived corruption does not lead to a greater shadow economy. To some extent this also supports the results of Méon and Sekkat (2004) showing the within-country variation to be important in their analysis of corruption on foreign direct investment and exports.

Regarding the impact of the shadow economy on perceived corruption, these results for the overall sample are similar to those for the other way round. In the cross-country regressions, all coefficients are completely insignificant. An increase in the shadow economy over time increases corruption according to the fixed and random effects estimator, but not when the endogeneity of the shadow is controlled. Turning to the sub-samples, the results show that higher perceived corruption significantly reduces the shadow economy in high income countries, confirming the models of Choi and Thum (2004) and Dreher, Kotsogiannis and McCorriston (2005a). In low income countries, on the contrary, corruption tends to increase with a higher shadow economy, again confirming the models of Johnson et al. (1998) and Hindriks et al. (1999). This is true for the impact of perceived corruption in the within-groups specification and actual corruption in all specifications.

[31)] For the description of the data, the estimation techniques used, and the various specification see Dreher and Schneider (2006, chapters 3 and 4).

Table 4.1: Empirical Results of the Relationship between the Shadow Economy and Corruption

Dependent Variable:	Shadow Economy			Corruption		
Independent Variable:	Corruption			Shadow Economy		
Estimation technique	All	Low	High	All	Low	High
ICRG index of corruption						
OLS	1.88 (1.20)	3.57 (1.34)	-0,84 (0.97)	0.00 (0.41)	0.01 (1.14)	-0.07 (3.57***)
Robust regression	1.32 (0.82)	-	-	0.00 (0.43)	-	-
IV, set 1	3.72 (1.17)	3.12 (0.86)	5.41 (1.40)	-0.03 (1.28)	-0.01 (0.42)	-0.09 (1.57)
IV, set 2	-4.04 (1.33)	5.14 (0.78)	-1.85 (1.91*)	-0.02 (0.66)	-0.02 (0.46)	-0.11 (1.45)
Panel, fixed effects	1.34 (2.63**)	1.36 (1.42)	0.69 (1.98**)	0.09 (2.88***)	0.10 (2.77***)	0.09 (0.76)
Panel, random effects	1.59 (4.81***)	-	-	0.02 (2.64***)	-	-
Panel IV	3.46 (3.48***)	-	-	0.01 (0.12)	-	-
TI index of corruption						
OLS	-	-	-	-	-	-0.06 (2.35**)
World Bank Index of corruption						
OLS	-	-	-	-	-	-0.01 (2.76**)
DKM index of corruption						
OLS	-	-	-	0.04 (1.77*)	0.06 (2.49**)	-0.10 (1.50)
Robust regression	-	-	-	0.04 (1.69*)	-	-
IV, set 1	-	-	-	0.14 (2.59**)	0.10 (2.65**)	-0.32 (1.22)
IV, set 2	-	-	-	0.12 (2.45**)	0.12 (2.50**)	0.04 (0.19)

Notes:
Higher values represent more corruption; corruption indices used: ICRG International Country Risk Guide; TI=Transparency International; World Bank Index of Corruption; and DKM-Index of Dreher, Kotsogiannis and McCorriston.
Instruments for the shadow economy are: (1) Credit Market Regulations (Fraser), Minimum Wage Regulation (Fraser), Government Effectiveness (World Bank); (2) Starting a Business (Duration), Starting a Business (Costs), Flexibility to Hire, Flexibility to Fire.
Instruments for corruption are: (1) Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy; (2) Ethnic Fractionalization, Religious Fractionalization, Latitude, French Legacy, Socialist Legacy, German Legacy, Scandinavian Legacy.

*** denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level**

Source: Dreher and Schneider (2006, table 12).

5 Summary and Conclusions

There have been many obstacles to overcome to measure the size of the shadow economy, to analyze its consequences on the official economy and the interaction between corruption and the shadow economy, but as this paper shows some progress has been made. I provided estimates of the size of the shadow economies for 145 countries for three periods of time (1999/2000, 2001/2002 and 2002/2003) using the DYMIMIC and the currency demand approach. Coming back to the question in the headline of this paper, some (new) knowledge/insights are gained with respect to the size and development of the shadow economy of developing, transition, highly developed OECD, Pacific Islands and Communist countries,[32)] and to the relationship between the shadow economy and corruption leading to five conclusions:

The first conclusion from these results is that for all countries investigated the shadow economy has reached a remarkably large size; the summarized results are shown in table 5.1.

Table 5.1: Average Size of the Shadow Economy for Developing, Transition and OECD-Countries in % of official GDP

Countries/Year	Average Size of the Shadow Economy – Value added in % of official GDP using DYMIMIC and Currency Demand method *(Number of Countries)*		
Mostly developing countries:	1999/2000	2000/2001	2002/2003
Africa	41.3 *(37)*	42.3 *(37)*	43.2 *(37)*
Central and South America	41.1 *(21)*	42.1 *(21)*	43.4 *(21)*
Asia	28.5 *(28)*	29.5 *(28)*	30.4 *(28)*
Transition countries	38.1 *(25)*	39.1 *(25)*	40.1 *(25)*
Highly developed OECD Countries	16.8 *(21)*	16.7 *(21)*	16.3 *(21)*
South Pacific Islands	31.7 *(10)*	32.6 *(10)*	33.4 *(10)*
Communist Countries	19.8 *(3)*	21.1 *(3)*	22.3 *(3)*
Unweighted Average over 145 Countries	33.6	34.5	35.2

[32)] In the appendix some critical discussion of these two methods is given; they have well known weaknesses (compare also Pedersen, 2003).

Source: Own calculations.

The second conclusion is that shadow economies are a complex phenomenon present to an important extent in all type of economies (developing, transition and highly developed). People engage in shadow economic activity for a variety of reasons, among the most important of which we can count are government actions, most notably, taxation and regulation. With these two insights/**conclusions** goes a **third**, no less important one: a government aiming to decrease shadow economic activity has to first and foremost analyze the complex relationships between the official and shadow economy – and even more important – among consequences of its own policy decisions.

Considering a public choice perspective a **fourth conclusion** for highly developed countries is that a government may not have a great interest to reduce the shadow economy due to the fact that:
(i) tax losses my be moderate, as at least 2/3 of the the income earned in the shadow economy is immediately spent in the official economy,
(ii) income earned in the shadow economy increases the standard of living of at least 1/3 of the working population, and
(iii) people who work in the shadow economy have less time for other things like going to demonstrations, etc.
Considering these three facts, it is obvious that one of the big challenges for every government is to undertake efficient incentive orientated policy measures in order to make work less attractive in the shadow economy and hence to make the work in the official economy more attractive. In a number of OECD countries this policy direction has been successfully implemented and this has led to a reduction of the shadow economy.

A final and **fifth conclusion** is that the results of the empirical analysis of Dreher and Schneider (2006) suggest that corruption and the shadow economy tend to be substitutes in high income countries, but complements in low income countries. There is thus some support for their hypotheses (1 and 2). The analysis also shows, however, that the results do to some extent depend on the method of estimation.

6 Appendix 1: Methods to Estimate the Size of the Shadow Economy

As has already been mentioned in chapters 2 and 3, estimating the size and development of a shadow economy is a difficult and challenging task. In this appendix, I give a short but comprehensive overview of the various procedures to estimate the size of a shadow economy. Three different types of methods are most widely used, and each is briefly discussed as well as critically evaluated.

6.1 Direct Approaches

6.1.1 Survey Method

These are micro approaches that employ both well designed surveys and samples based on voluntary replies, or tax auditing and other compliance methods. Sample surveys designed to estimate the shadow economy are widely used in a number of countries[33)]. The main disadvantage of this method is that it presents the flaws of all surveys. For example, the average precision and results depend greatly on the respondent's willingness to cooperate, it is difficult to assess the amount of undeclared work from a direct questionnaire, most interviewers hesitate to confess fraudulent behaviour, and responses are of uncertain reliability, which makes it difficult to calculate a real estimate (in monetary terms) of the extent of undeclared work. The main advantage of this method lies in the detailed information about the structure of the shadow economy, but the results from these kinds of surveys are very sensitive to the way the questionnaire is formulated[34)].

In order to demonstrate the difficulties of calculating a macro estimation for a whole country from survey results of shadow economy activities (from single individuals) the following example is used: in Austria the author undertook a representative questioning of the Austrian

[33)]The direct method of voluntary sample surveys has been extensively used for Norway by Isachsen, Klovland and Strom (1982), and Isachsen and Strom (1985). For Denmark this method is used by Mogensen et. al. (1995) in which they report "estimates" of the shadow economy of 2.7 percent of GDP for 1989, of 4.2 percent of GDP for 1991, of 3.0 percent of GDP for 1993 and of 3.1 percent of GDP for 1994. In Pedersen (2003) estimates of the Danish shadow economy contain the years 1995 with 3.1% up to 2001 with 3.8%. This method is also used by Williams (2004a).

[34)]The advantages and disadvantages of this method are extensively dealt by Pedersen (2003), Mogensen et. al (1995) and Feld and Larsen (2005) in their excellent and very carefully done investigations. Compare also the careful and detailed studies by Kazemier (2005a,b), who extensitively discusses the pros .and cons of this method.

population in order to estimate the size of the shadow economy in the construction and craftsman sector (including repairing) in November/December 2002 considering three groups.

1. A representative sample of the Austrian population between 16 and 65 years old,
2. 55 self-declared shadow economy workers in the construction and craftsmen sector, and
3. 320 managers (owners) of construction and craftsmen firms.

The following results were gained: (1) Among the Austrian population (potential labour force) are 918,000 Austrians who supplied shadow economy activities in the construction and craftsmen sector. Their average hourly earning in the shadow economy varies between €15.30 and €15.60, and the average yearly income from shadow economy activities varies between €1,117.00 and €1.142.00. This means that 73 hours per year were worked in the shadow economy.

(2) Among the 55 self-declared shadow economy workers I got a wage rate of €11.50 per hour and annual earnings in the shadow economy of €2,480.00 using the fact that these groups worked 245 hours per year in the shadow economy.

(3) Managers (owners) of construction and craftsmanship firms report a wage rate for shadow economy workers of €17 per hour and average earnings per year of €4,590.00, assuming that 270 hours per year were used for shadow economy activities by their employees/workers. The questioned managers also state: 21% of the managers questioned also stated that more than 50% of their employees work in the shadow economy, 41% indicated a figure of less than 50% and 34% reported that no-one in the firm works in the shadow economy. To summarize, 62% of the managers acknowledge that a large percentage of their employees work in the shadow economy. Further results are that 7% of the managers think that their employees work between 0 and 2 hours per week in the shadow economy; 29% assume that they work between 6 and 10 hours, 28% between 3 and 5 hours and 14% think that their employees work more then 10 hours per week in the shadow economy; 22% of all managers have no knowledge of this fact. In principle 39% of managers are not in favour (do not support) moonlighting by their workers and 61% are in favour (do support) - an amazingly high percentage!

Finally in table 6.1 the aggregate values of the size of the shadow economy in the construction and craftsmen sector in the year 2002 are presented, based on questionnaire findings. Table 6.1 clearly demonstrates that the size of the shadow economy in the construction and craftsmen sector varies considerably from a total value of €2.6 billion up to €4.2 billion. These differences originate from different hourly wages rates, ranging from €11.50 to €17 and from the different amount of hours worked per year in the shadow economy ranging from 245

to 270. Hence the survey method "covers" between 31.2% and 50.9 % of the value obtained by a macro approach (mimic method). These results still leave a considerable leeway, but the rather large differences may be explained by the following facts:

1. Table 6.1 contains earnings and not the value added of the shadow economy.
2. Shadow economy demanders are overwhelmingly households, the whole area of the shadow economy activities between firms (which are especially a problem in the construction and craftsmen sectors) are not considered.
3. All foreign shadow economy activities achieved by foreigners (illegal immigrants) are not considered.
4. The amount earned in the shadow economy (hourly wage rate and hours worked per year), vary considerably.

Table 6.1: Size of the supplied shadow economy in the construction and craftsmen sector, Austria 2002, based on the questionnaire findings

Variable/Indicator	Worked hours and earning in the shadow economy			
	results from declared moonlighters (1)	results from managers of construction and craftsmen firms (2)	results from declared moonlighters (3)	results from managers of construction and craftsmen firms (4)
∅ *hourly* shadow economy wage rate	€11.5	€17	€11.5	€17
∅ average *yearly* earning	€2,814	€4,165	€3,105	€4,590
∅ *amount of hours* worked in the shadow economy *per year* per worker	245	245	270	270
∅ *aggregated* yearly amount of hours worked in the shadow economy 1)	225.1 million	225.1 million	248.1 million	248.1 million
Total earnings of the shadow economy in the year 2002	€2,588.65 million	€3,826.7 million	€2,853.15 million	€4,217.7 million
Total shadow economy earnings in % of the value added of the shadow economy in the construction and craftsmanship sector (including repairing); absolute value €8,284 billion in 2002	31.2	46.1	34.4	50.9

1) Basis of the calculation: 918,864 shadow economy workers in the construction and craftsmen sector. Source: Own calculations.

6.1.2 Tax Auditing Method

Estimates of the shadow economy can also be based on the discrepancy between income declared for tax purposes and that measured by selective checks. Fiscal auditing programmes have been particularly effective in this regard. Since these programs are designed to measure the amount of undeclared taxable income, they may also be used to calculate the shadow

economy.[35] However, a number of difficulties beset this approach. First, using tax compliance data is equivalent to using a (possibly biased) sample of the population. In general, the selection of tax payers for tax audit is not random but based on properties of submitted (tax) returns that indicate a certain likelihood of (tax) fraud. Consequently, such a sample is not a random one of the whole population, and estimates of the shadow based upon a biased sample may not be accurate. Second estimates based on tax audits reflect only that portion of shadow economy income that the authorities succeed in discovering, and this is likely to be only a fraction of hidden income.

A further disadvantage of these two direct methods (surveys and tax auditing) is that they lead only to point estimates. Moreover, it is unlikely that they capture all "shadow" activities, so they can be seen as providing lower bound estimates. They are unable to provide estimates of the development and growth of the shadow economy over a longer period of time. As already argued, they have, however, at least one considerable advantage – they can provide detailed information about shadow economy activities and the structure and composition of those who work in the shadow economy.

6.2 Indirect Approaches

These approaches, which are also called "indicator" approaches, are mostly macroeconomic ones and use various economic and other indicators that contain information about the development of the shadow economy (over time). Currently there are five indicators that leave some "traces" of the shadow economy.

6.2.1 The Discrepancy between National Expenditure and Income Statistics

This approach is based on discrepancies between income and expenditure statistics. In national accounting the income measure of GNP should be equal to the expenditure measure of GNP. Thus, if an independent estimate of the expenditure site of the national accounts is available, the gap between the expenditure measure and the income measure can be used as an indicator of the extent of the black economy.[36] Since national accounts statisticians are

[35] In the United States, IRS (1979, 1983), Simon and Witte (1982), Witte (1987), Clotefelter (1983), and Feige (1986). For a more detailed discussion, see Dallago (1990) and Thomas (1992).

[36] See, e.g., Franz (1983) for Austria; MacAfee (1980) O'Higgins (1989) and Smith (1985), for Great Britain; Petersen (1982) and Del Boca (1981) for Germany; Park (1979) for the United States. For a critical survey, see Thomas (1992).

anxious to minimize this discrepancy, the initial discrepancy or first estimate, rather than the published discrepancy, should be employed as an estimate of the shadow economy. If all the components of the expenditure site are measured without error, then this approach would indeed yield a good estimate of the scale of the shadow economy. Unfortunately, however, this is not the case. Instead, the discrepancy reflects all omissions and errors everywhere in the national accounts statistics as well as the shadow economy activity. These estimates may therefore be very crude and of questionable reliability.[37)]

6.2.2 The Discrepancy between the Official and Actual Labour Force

A decline in participation of the labour force in the official economy can be seen as an indication of increased activity in the shadow economy. If total labour force participation is assumed to be constant, then a decreasing official rate of participation can be seen as an indicator of an increase in the activities in the shadow economy, *ceteris paribus*.[38)] One weakness of this method is that differences in the rate of participation may also have other causes. Also, people can work in the shadow economy and have a job in the "official' economy. Therefore such estimates may be viewed as weak indicators of the size and development of the shadow economy.

6.2.3 The Transactions Approach

This approach has been most fully developed by Feige.[39)] It is based upon the assumption that there is a constant relation over time between the volume of transaction and official GNP, as summarized by the well-known Fisherian quantity equation, or M*V = p*T (with M = money, V = velocity, p = prices, and T = total transactions). Assumptions also have to be made about the velocity of money and about the relationships between the value of total transactions (p*T) and total (=official + unofficial) nominal GNP. Relating total nominal GNP to total transactions, the GNP of the shadow economy can be calculated by subtracting the official GNP from total nominal GNP. However, to derive figures for the shadow economy, one must also assume a base year in which there is no shadow economy and therefore the ratio of p*T

[37)] A related approach is pursued by Pissarides and Weber (1988), who use micro data from household budget surveys to estimate the extent of income understatement by self-employed.

[38)] Such studies have been made for Italy, see e.g., Contini (1981) and Del Boca (1981); for the United States, see O'Neill (1983), for a critical survey, see again Thomas (1992).

[39)] For an extended description of this approach, see Feige (1996); for a further application for the Netherlands, Boeschoten and Fase (1984), and for Germany, Langfeldt (1984).

to total nominal (official = total) GNP was "normal" and would have been constant over time, if there had been no shadow economy.

This method, too, has several weaknesses, such as the required assumptions of a base year with no shadow economy, and of a "normal" ratio of transactions to nominal GNP. Moreover, to obtain reliable shadow economy estimates, precise figures of the total volume of transactions should be available, and this availability might be especially difficult to achieve for cash transactions, because they depend, among other factors, on the durability of bank notes in terms of the quality of the paper on which they are printed.[40)] Also, the assumption is made that all variations in the ratio between the total value of transaction and the officially measured GNP are due to the shadow economy. This means that a considerable amount of data is required in order to eliminate financial transactions from "pure" cross payments, which are legal and have nothing to do with the shadow economy. In general, although this approach is theoretically attractive, the empirical requirements necessary to obtain reliable estimates are so difficult to fulfil that its application may lead to doubtful results.

6.2.4 The Currency Demand Approach

The currency demand approach was first used by Cagan (1958), who calculated a correlation of the currency demand and the tax pressure (as one cause of the shadow economy) for the United States over the period 1919 to 1955. 20 years later, Gutmann (1977) used the same approach but without any statistical procedures. Cagan's approach was further developed by Tanzi (1980, 1983), who econometrically estimated a currency demand function for the United States for the period 1929 to 1980 in order to calculate the shadow economy. His approach assumes that shadow (or hidden) transactions are undertaken in the form of cash payments, so as to leave no observable traces for the authorities. An increase in the size of the shadow economy will therefore increase the demand for currency. To isolate the resulting "excess" demand for currency, an equation for currency demand is econometrically estimated over time. All conventional possible factors, such as the development of income, payment habits, interest rates, and so on, are controlled. Additionally, such variables as the direct and indirect tax burden, government regulation and the complexity of the tax system, which are assumed to be the major factors causing people to work in the shadow economy, are included

[40)]For a detailed criticism of the transaction approach see Boeschoten and Fase (1984), Frey and Pommerehne (1984), Kirchgaessner (1984), Tanzi (1982a,b, 1986), Dallago (1990), Thomas (1986, 1992, 1999), Giles (1999a), Pederson (2003), and Janisch and Brümmerhoff (2005) and Breusch (2005a, 2005b).

in the estimation equation. The basic regression equation for the currency demand, proposed by Tanzi (1983), is the following:

$$\ln (C / M_2)_t = \beta_O + \beta_1 \ln (1 + TW)_t + \beta_2 \ln (WS / Y)_t + \beta_3 \ln R_t + \beta_4 \ln (Y / N)_t + u_t$$

with $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 > 0$

where

ln denotes natural logarithms,
C / M_2 is the ratio of cash holdings to current and deposit accounts,
TW is a weighted average tax rate (to proxy changes in the size of the shadow economy),
WS / Y is a proportion of wages and salaries in national income (to capture changing payment and money holding patterns),
R is the interest paid on savings deposits (to capture the opportunity cost of holding cash) and
Y / N is the per capita income.[41)]

Any "excess" increase in currency, or the amount unexplained by the conventional or normal factors (mentioned above) is then attributed to the rising tax burden and the other reasons leading people to work in the shadow economy. Figures for the size and development of the shadow economy can be calculated in a first step by comparing the difference between the development of currency when the direct and indirect tax burden (and government regulations) are held at their lowest value, and the development of currency with the current (much higher) burden of taxation and government regulations. Assuming in a second step the same income velocity for currency used in the shadow economy as for legal M1 in the official economy, the size of the shadow can be computed and compared to the official GDP.

The currency demand approach is one of the most commonly used approaches. It has been applied to many OECD countries,[42)] but has nevertheless been criticized on various grounds.[43)] The most commonly raised objections to this method are:

[41)] The estimation of such a currency demand equation has been criticized by Thomas (1999) but part of this criticism has been considered by the work of Giles (1999a,b) and Bhattacharyya (1999), who both use the latest econometric technics.
[42)]See Karmann (1986 and 1990), Schneider (1997, 1998a), Johnson, Kaufmann and Zoido-Lobatón (1998a), and Williams and Windebank (1995).
[43)]See Thomas (1992, 1999); Feige (1986); Pozo (1996); Pedersen (2003) and Ahumada, Alvareda, Canavese A. and P. Canavese (2004); Janisch and Brümmerhof (2005); and Breusch (2005a,b).

(i) Not all transactions in the shadow economy are paid in cash. Isachsen and Strom (1985) used the survey method to find out that in Norway, in 1980, roughly 80% of all transactions in the hidden sector were paid in cash. The size of the total shadow economy (including barter) may thus be even larger than previously estimated.

(ii) Most studies consider only one particular factor, the tax burden, as a cause of the shadow economy. But others (such as the impact of regulation, taxpayers' attitudes toward the state, "tax morality" and so on) are not considered, because reliable data for most countries are not available. If, as seems likely, these other factors also have an impact on the extent of the hidden economy, it might again be higher than reported in most studies.[44)]

(iii) As discussed by Garcia (1978), Park (1979), and Feige (1996), increases in currency demand deposits are due largely to a slowdown in demand deposits rather than to an increase in currency caused by activities in the shadow economy, at least in the case of the United States.

(iv) Blades (1982) and Feige (1986, 1996), criticize Tanzi's studies on the grounds that the US dollar is used as an international currency. Instead, Tanzi should have considered (and controlled) the presence of US dollars, which are used as an international currency and are held in cash abroad.[45)] Moreover, Frey and Pommerehne (1984) and Thomas (1986, 1992, 1999) claim that Tanzi's parameter estimates are not very stable.[46)]

(v) Most studies assume the same velocity of money in both types of economies. As argued by Hill and Kabir (1996) for Canada and by Klovland (1984) for the Scandinavian countries, there is already considerable uncertainty about the velocity of

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[44)] One (weak) justification for the use of only the tax variable is that this variable has by far the strongest impact on the size of the shadow economy in the studies known to the authors. The only exception is the study by Frey and Weck-Hannemann (1984) where the variable "tax immorality" has a quantitatively larger and statistically stronger influence than the direct tax share in the model approach. In the study of Pommerehne and Schneider (1985), for the U.S., besides various tax measures, data for regulation, tax immorality, minimum wage rates are available, the tax variable has a dominating influence and contributes roughly 60-70% of the size of the shadow economy. See also Zilberfarb (1986).

[45)] In another study by Tanzi (1982, esp. pp. 110-113) he explicitly deals with this criticism. A very careful investigation of the amount of US-$ used abroad and the US currency used in the shadow economy and to "classical" crime activities has been undertaken by Rogoff (1998), who concludes that large denomination bills are the major driving force for the growth of the shadow economy and classical crime activities are due largely to reduced transactions costs.

[46)] However in studies for European countries Kirchgaessner (1983, 1984) and Schneider (1986) reach the conclusion that the estimation results for Germany, Denmark, Norway and Sweden are quite robust when using the currency demand method. Hill and Kabir (1996) find for Canada that the rise of the shadow economy varies with respect to the tax variable used; they conclude "when the theoretically best tax rates are selected and a range of plausible velocity values is used, this method estimates underground economic growth between 1964 and 1995 at between 3 and 11 percent of GDP." (Hill and Kabir [1996, p. 1553]).

money in the official economy, and the velocity of money in the hidden sector is even more difficult to estimate. Without knowledge about the velocity of currency in the shadow economy, one has to accept the assumption of "equal" money velocity in both sectors.

(vi) Ahumada, Alvaredo, Canavese A. and P. Canavese (2004) show that the currency approach, together with the assumption of equal income velocity of money in both the reported and the hidden transaction is only correct if the income elasticity is 1. As this is not the case for most countries, the calculation has to be corrected.

(vii) Finally, the assumption of no shadow economy in a base year is open to criticism. Relaxing this assumption would again imply an upward adjustment of the size of the shadow economy.

6.2.5 The Physical Input (Electricity Consumption) Method

(1) The Kaufmann – Kaliberda Method[47)]

To measure overall (official and unofficial) economic activity in an economy, Kaufmann and Kaliberda (1996) assume that electric-power consumption is regarded as the single best physical indicator of overall (or official plus unofficial) economic activity. Now, overall economic activity and electricity consumption have been empirically observed throughout the world to move in lockstep with an electricity to GDP elasticity usually close to one. This means that the growth of total electricity consumption is an indicator for growth of overall (official and unofficial) GDP. By having this proxy measurement for the overall economy and then subtracting from this overall measure the estimates of official GDP, Kaufmann and Kaliberda (1996) derive an estimate of unofficial GDP. This method is very simple and appealing. However, it can also be criticized on various grounds:

(i) Not all shadow economy activities require a considerable amount of electricity (e.g. personal services), and other energy sources can be used (gas, oil, coal, etc.). Only a part of the shadow economy will be captured.

(ii) Over time, there has been considerable technical progress, so that both the production and use of electricity are more efficient than in the past, and this will apply in both official and unofficial uses.

[47)] This method was used earlier by Lizzeri (1979), Del Boca and Forte (1982), and then was used much later by Portes (1996), Kaufmann and Kaliberda (1996), Johnson, Kaufmann and Shleifer (1997). For a critique see Lackó (1998).

(iii) There may be considerable differences or changes in the elasticity of electricity/GDP across countries and over time.[48)]

(2) The Lackó Method

Lackó (1996, 1998, 1999, 2000) assumes that a certain part of the shadow economy is associated with the household consumption of electricity. This part comprises the so-called household production, do-it-yourself activities, and other non registered production and services. Lackó further assumes that in countries where the portion of the shadow economy associated with the household electricity consumption is high, the rest of the hidden economy (or the part Lackó cannot measure) will also be high. Lackó (1996, pp.19 ff.) assumes that in each country a part of the household consumption of electricity is used in the shadow economy.

Lackó's approach (1998, p.133) can be described by the following two equations:

$$\ln E_i = \alpha_1 \ln C_i + \alpha_2 \ln PR_i + \alpha_3 G_i + \alpha_4 Q_i + \alpha_5 H_i + u_i \quad (1)$$

with $\alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 > 0$

$$H_i = \beta_1 T_i + \beta_2 (S_i - T_i) + \beta_3 D_i \quad (2)$$

with $\beta_1 > 0, \beta_2 < 0, \beta_3 > 0$

where

i: the number assigned to the country,

E_i: per capita household electricity consumption in country i in Mtoe,

C_i: per capita real consumption of households without the consumption of electricity in country i in US dollars (at purchasing power parity),

PR_i: the real price of consumption of 1 kWh of residential electricity in US dollars (at purchasing power parity),

G_i: the relative frequency of months with the need of heating in houses in country i,

Q_i: the ratio of energy sources other than electricity energy to all energy sources in household energy consumption,

H_i: the per capita output of the hidden economy,

T_i: the ratio of the sum of paid personal income, corporate profit and taxes on goods and services to GDP,

S_i: the ratio of public social welfare expenditures to GDP, and

[48)] Johnson, Kaufmann and Shleifer (1997) make an attempt to adjust for changes in the elasticity of

D_i: the sum of dependants over 14 years and of inactive earners, both per 100 active earners.

In a cross country study, Lackó econometrically estimates equation (1) substituting H_i by equation (2). The econometric estimation results can then be used to establish an ordering of the countries with respect to electricity use in their respective shadow economies. For the calculation of the actual size (value added) of the shadow economy, Lackó must, furthermore, know how much GDP is produced by one unit of electricity in the shadow economy of each country. Since these data are not known, she takes the result of one of the known shadow economy estimations carried out for a market economy with another approach for the early 1990s, and she applies this proportion to the other countries. Lackó used the shadow economy of the United States as such a base (the shadow economy value of 10.5% of GDP taken from Morris (1993)), and then she calculates the size of the shadow economy for other countries. Lackó's method is also open to criticism:

(i) Not all shadow economy activities require a considerable amount of electricity and other energy sources can be used.

(ii) Shadow economy activities do not take place only in the household sector.

(iii) It is doubtful whether the ratio of social welfare expenditures can be used as the explanatory factor for the shadow economy, especially in transition and developing countries.

It is questionable which is the most reliable base value of the shadow economy in order to calculate the size of the shadow economy for all other countries, especially for the transition and developing countries.

6.3 The Model Approach[49]

All methods described so far that are designed to estimate the size and development of the shadow economy consider just one indicator that "must" capture all effects of the shadow economy. However, it is obvious that shadow economy effects show up simultaneously in the

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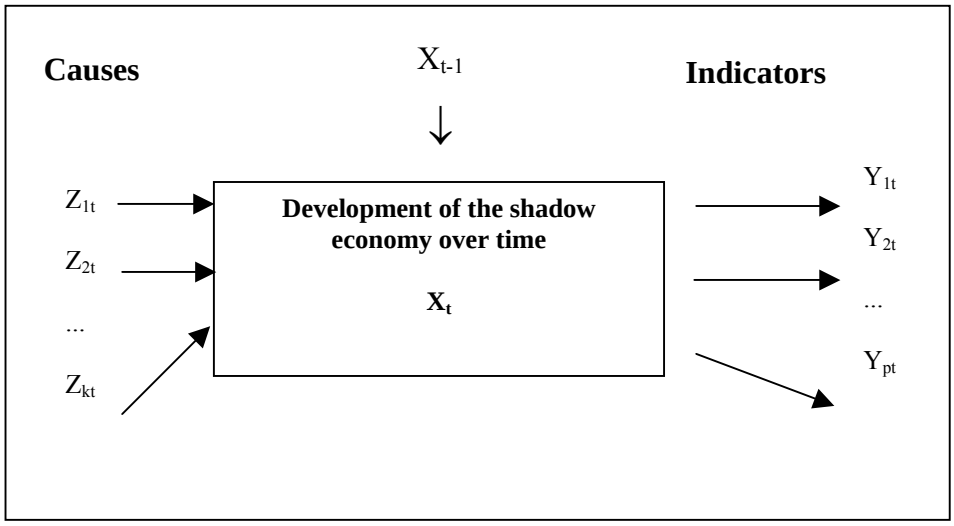
electricity/GDP.

[49] This part is derived from a longer study by Aigner, Schneider, and Ghosh (1988, p. 303), applying this approach for the United States over time; for Germany this approach has been applied by Karmann (1986 and 1990). The pioneers of this approach are Weck (1983), Frey and Weck-Hannemann (1984), who applied this approach to cross-section data from the 24 OECD countries for various years. Before turning to this approach they developed the concept of "soft modeling" (Frey, Weck, and Pommerehne (1982), Frey and Weck (1983a and 1983b)), an approach which has been used to provide a ranking of the relative size of the shadow economy in different countries.

production, labour, and money markets. An even more important critique is that the causes that determine the size of the shadow economy are taken into account only in some of the monetary approach studies that usually consider one cause, the burden of taxation. The model approach explicitly considers multiple causes leading to the existence and growth of the shadow economy, as well as the multiple effects of the shadow economy over time.

The empirical method used is quite different from those used so far. It is based on the statistical theory of unobserved variables, which considers multiple causes and multiple indicators of the phenomenon to be measured. For the estimation, a factor-analytic approach is used to measure the hidden economy as an unobserved variable over time. The unknown coefficients are estimated in a set of structural equations within which the "unobserved" variable cannot be measured directly. The DYMIMIC (dynamic multiple-indicators multiple-causes) model consists in general of two parts, with the measurement model linking the unobserved variables to observed indicators.[50)] The structural equations model specifies causal relationships among the unobserved variables. In this case, there is one unobserved variable, or the size of the shadow economy; this is assumed to be influenced by a set of indicators for the shadow economy's size, thus capturing the structural dependence of the shadow economy on variables that may be useful in predicting its movement and size in the future. The interaction over time between the causes Z_{it} (i = 1, 2, …, k) the size of the shadow economy X_t, in time t and the indicators Y_{jt} (j = 1, 2, …, p) is shown in Figure 6.1.

Figure 6.1: Development of the shadow economy over time.



[50)] The latest papers dealing extensively with the DYMIMIC or MIMIC approach, its development and its weaknesses are from Del'Anno (2003) and the excellent study by Giles and Tedds (2002), as well as Breusch (2005a, 2005b), Schneider (2005), and Pickhardt and Sarda-Pous (2006).

There is a large body of literature[51] on the possible causes and indicators of the shadow economy, in which the following three types of causes are distinguished:

Causes

(i) The burden of direct and indirect taxation, both actual and perceived. A rising burden of taxation provides a strong incentive to work in the shadow economy.

(ii) The burden of regulation as proxy for all other state activities. It is assumed that increases in the burden of regulation give a strong incentive to enter the shadow economy.

(iii) The "tax morality" (citizens' attitudes toward the state), which describes the readiness of individuals (at least partly) to leave their official occupations and enter the shadow economy: it is assumed that a declining tax morality tends to increase the size of the shadow economy.[52]

Indicators

A change in the size of the shadow economy may be reflected in the following indicators:

(i) Development of monetary indicators. If activities in the shadow economy rise, additional monetary transactions are required.

(ii) Development of the labour market. Increasing participation of workers in the hidden sector results in a decrease in participation in the official economy. Similarly, increased activities in the hidden sector may be expected to be reflected in shorter working hours in the official economy.

(iii) Development of the production market. An increase in the shadow economy means that inputs (especially labour) move out of the official economy (at least partly), and this displacement might have a depressing effect on the official growth rate of the economy.

The latest use of the model approach has been undertaken by Giles (1999a, 1999b, 1999c) and by Giles, Tedds and Werkneh (2002), Giles and Tedds (2002), Chatterjee, Chaudhury and

[51] Thomas (1992); Schneider (1994a, 1997, 2003, 2005); Pozo (1996); Johnson, Kaufmann and Zoido-Lobatón (1998a, 1998b); Giles (1997a, 1997b, 1999a, 1999b, 1999c); Giles and Tedds (2002), Giles, Tedds and Werkneh (2002), Del'Anno (2003) and Del'Anno and Schneider (2004).

[52] When applying this approach for European countries, Frey and Weck-Hannemann (1984) had difficulty in obtaining reliable data for the cause series, besides the ones for the direct and indirect tax burden. Hence, their study was criticized by Helberger and Knepel (1988), who argue that the results were unstable with respect to changing variables in the model and over the years.

Schneider (2006), Bajada and Schneider (2005), and Pickhardt and Sarda-Pous (2006). They basically estimate a comprehensive (sometime dynamic) MIMIC model to get a time series index of the hidden/measured output of New Zealand, Canada, Germany, India or Australia, and then estimate a separate "cash-demand model" to obtain a benchmark for converting this index into percentage units. Unlike earlier empirical studies of the hidden economy, they paid proper attention to the non-stationary, and possible co-integration of time serious data in both models. Again this DYMIMIC model treats hidden output as a latent variable, and uses several (measurable) causal variables and indicator variables. The former include measures of the average and marginal tax rates, inflation, real income and the degree of regulation in the economy. The latter include changes in the (male) labour force participation rate and in the cash/money supply ratio. In their cash-demand equation they allow for different velocities of currency circulation in the hidden and recorded economies. Their cash-demand equation is not used as an input to determine the variation in the hidden economy over time – it is used only to obtain the long-run average value of hidden/measured output, so that the index for this ratio predicted by the DYMIMIC model can be used to calculate a level and the percentage units of the shadow economy. Overall, this latest combination of the currency demand and DYMIMIC approach clearly shows that some progress in the estimation technique of the shadow economy has been achieved and a number of critical points have been overcome.

However, objections can also be raised against the (DY)MIMIC method, i.e.:
(1) instability in the estimated coefficients with respect to sample size changes,
(2) instability in the estimated coefficients with respect to alternative specifications,
(3) difficulty of obtaining reliable data on cause variables other than tax variables, and
(4) the reliability of the variables grouping into "causes" and "indicators" in explaining the variability of the shadow economy.

6.4 Summarizing the Critical Remarks

In table 6.2 some more general weaknesses/criticisms of the different methods of estimating the shadow economy are summarized. Table 6.2 clearly shows that each method has its strength and weaknesses and that we are far away from having an ideal or most preferred estimation method. When undertaking the difficult and challenging task of estimating the shadow economy, all methods have weaknesses and it is important to report and to consider them, and to treat the size and development of shadow economy with great care.

Table 6.2: Some critical Points of the Different Estimation Methods

1. **Surveys**
(1) Quite often only households or only partly firms are considered
(2) Non-responses and/or incorrect responses
2. **Estimations of national account statisticians (quite often the discrepancy method):**
(1) Combination of meso estimates/assumptions
(2) Often not published
(3) Documentation and procedures often not public
3. **Monetary and/or electricity methods:**
(1) Some estimates are very high
(2) Are the assumptions plausible?
(3) Breakdown by sector or industry possible?
4. **DYMIMIC method**
(1) only relative coefficients, no absolute values
(2) estimations quite often highly sensitive with respect to changes in the data.

6.5 The Size and Development of the Shadow Economies of 145 Countries over 1999/2000 to 2002/2003

Finally, the results of the size and development of the shadow economies of 145 countries are shown (and the countries are listed in alphabetical order) in table 6.3.

Table 6.3: The Size of the Shadow Economy of 145 Countries

		Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
No.	Country	1999/00	2001/02	2002/03
1	Albania	33.4	34.6	35.3
2	Algeria	34.1	35.0	35.6
3	Angola	43.2	44.1	45.2
4	Argentina	25.4	27.1	28.9
5	Armenia	46.3	47.8	49.1
6	Australia	14.3	14.1	13.5
7	Austria	9.8	10.6	10.9
8	Azerbaijan	60.6	61.1	61.3
9	Bangladesh	35.6	36.5	37.7
10	Belarus	48.1	49.3	50.4
11	Belgium	22.2	22.0	21.0

Table 6.3: The Size of the Shadow Economy of 145 Countries (cont'd)

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
12	Benin	47.3	48.2	49.1
13	Bhutan	29.4	30.5	31.7
14	Bolivia	67.1	68.1	68.3
15	Bosnia and Herzegovina	34.1	35.4	36.7
16	Botswana	33.4	33.9	34.6
17	Brazil	39.8	40.9	42.3
18	Bulgaria	36.9	37.1	38.3
19	Burkina Faso	41.4	42.6	43.3
20	Burundi	36.9	37.6	38.7
21	Cambodia	50.1	51.3	52.4
22	Cameroon	32.8	33.7	34.9
23	Canada	16.0	15.8	15.2
24	Central African Republic	44.3	45.4	46.1
25	Chad	46.2	47.1	48.0
26	Chile	19.8	20.3	20.9
27	China	13.1	14.4	15.6
28	Colombia	39.1	41.3	43.4
29	Congo, Dem. Rep.	48.0	48.8	49.7
30	Congo, Rep.	48.2	49.1	50.1
31	Costa Rica	26.2	27.0	27.8
32	Cote d'Ivoire	43.2	44.3	45.2
33	Croatia	33.4	34.2	35.4
34	Czech Republic	19.1	19.6	20.1
35	Denmark	18.0	17.9	17.3
36	Dominican Republic	32.1	33.4	34.1
37	Ecuador	34.4	35.1	36.7
38	Egypt, Arab Rep.	35.1	36.0	36.9
39	El Salvador	46.3	47.1	48.3
40	Estonia	38.4	39.2	40.1
41	Ethiopia	40.3	41.4	42.1
42	Fiji	33.6	34.3	35.1
43	Finland	18.1	18.0	17.4
44	France	15.2	15.0	14.5
45	Georgia	67.3	67.6	68.0
46	Germany	16.0	16.3	16.8
47	Ghana	41.9	42.7	43.6
48	Greece	28.7	28.5	28.2
49	Guatemala	51.5	51.9	52.4
50	Guinea	39.6	40.8	41.3
51	Haiti	55.4	57.1	58.6
52	Honduras	49.6	50.8	51.6
53	Hong Kong, China	16.6	17.1	17.2
54	Hungary	25.1	25.7	26.2
55	India	23.1	24.2	25.6
56	Indonesia	19.4	21.8	22.9
57	Iran, Islamic Rep.	18.9	19.4	19.9
58	Ireland	15.9	15.7	15.3
59	Israel	21.9	22.8	23.9

Table 6.3: The Size of the Shadow Economy of 145 Countries (cont'd)

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
60	Italy	27.1	27.0	25.7
61	Jamaica	36.4	37.8	38.9
62	Japan	11.2	11.1	10.8
63	Jordan	19.4	20.5	21.6
64	Kazakhstan	43.2	44.1	45.2
65	Kenya	34.3	35.1	36.0
66	Kiribati	34.1	35.0	35.3
67	Korea, Rep.	27.5	28.1	28.8
68	Kuwait	20.1	20.7	21.6
69	Kyrgyz Republic	39.8	40.3	41.2
70	Lao PDR	30.6	31.9	33.4
71	Latvia	39.9	40.7	41.3
72	Lebanon	34.1	35.6	36.2
73	Lesotho	31.3	32.4	33.3
74	Lithuania	30.3	31.4	32.6
75	Macedonia, FYR	34.1	35.1	36.3
76	Madagascar	39.6	40.4	41.6
77	Malawi	40.3	41.2	42.1
78	Malaysia	31.1	31.6	32.2
79	Maldives	30.3	31.4	32.0
80	Mali	42.3	43.9	44.7
81	Marshall Islands	28.1	29.0	29.6
82	Mauritania	36.1	37.2	38.0
83	Mexico	30.1	31.8	33.2
84	Micronesia, Fed. Sts.	31.3	32.1	33.2
85	Moldova	45.1	47.3	49.4
86	Mongolia	18.4	19.6	20.4
87	Morocco	36.4	37.1	37.9
88	Mozambique	40.3	41.3	42.4
89	Namibia	31.4	32.6	33.4
90	Nepal	38.4	39.7	40.8
91	Netherlands	13.1	13.0	12.6
92	New Zealand	12.8	12.6	12.3
93	Nicaragua	45.2	46.9	48.2
94	Niger	41.9	42.6	43.8
95	Nigeria	57.9	58.6	59.4
96	Norway	19.1	19.0	18.4
97	Oman	18.9	19.4	19.8
98	Pakistan	36.8	37.9	38.7
99	Palau	28.4	29.2	30.0
100	Panama	64.1	65.1	65.3
101	Papua New Guinea	36.1	37.3	38.6
102	Paraguay	27.4	29.2	31.4
103	Peru	59.9	60.3	60.9
104	Philippines	43.4	44.5	45.6
105	Poland	27.6	28.2	28.9
106	Portugal	22.7	22.5	21.9
107	Puerto Rico	28.4	29.4	30.7

Table 6.3: The Size of the Shadow Economy of 145 Countries (cont'd)

No.	Country	Shadow Economy (in % of official GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
108	Romania	34.4	36.1	37.4
109	Russian Federation	46.1	47.5	48.7
110	Rwanda	40.3	41.4	42.2
111	Samoa	31.4	32.6	33.5
112	Saudi Arabia	18.4	19.1	19.7
113	Senegal	45.1	46.8	47.5
114	Serbia and Montenegro	36.4	37.3	39.1
115	Sierra Leone	41.7	42.8	43.9
116	Singapore	13.1	13.4	13.7
117	Slovak Republic	18.9	19.3	20.2
118	Slovenia	27.1	28.3	29.4
119	Solomon Islands	33.4	34.5	35.3
120	South Africa	28.4	29.1	29.5
121	Spain	22.7	22.5	22.0
122	Sri Lanka	44.6	45.9	47.2
123	Sweden	19.2	19.1	18.3
124	Switzerland	8.6	9.4	9.4
125	Syrian Arab Republic	19.3	20.4	21.6
126	Taiwan, China	25.4	26.6	27.7
127	Tanzania	58.3	59.4	60.2
128	Thailand	52.6	53.4	54.1
129	Togo	35.1	39.2	40.4
130	Tonga	35.1	36.3	37.4
131	Tunisia	38.4	39.1	39.9
132	Turkey	32.1	33.2	34.3
133	Uganda	43.1	44.6	45.4
134	Ukraine	52.2	53.6	54.7
135	United Arab Emirates	26.4	27.1	27.8
136	United Kingdom	12.7	12.5	12.2
137	United States	8.7	8.7	8.4
138	Uruguay	51.1	51.4	51.9
139	Uzbekistan	34.1	35.7	37.2
140	Vanuatu	30.9	31.7	32.5
141	Venezuela, RB	33.6	35.1	36.7
142	Vietnam	15.6	16.9	17.9
143	Yemen, Rep.	27.4	28.4	29.1
144	Zambia	48.9	49.7	50.8
145	Zimbabwe	59.4	61	63.2
Unweighted Average		**33.6**	**34.5**	**35.2**

Source: Own calculations.

7 Appendix 2: Definition of the variables and data sources

7.1 Some general remarks

(1) All calculations and estimations are based on the software package "Intercooled Stata 8.0"
(2) All growth rates or shares as described in the following section. For example a growth rate of 2% is defined as 0.02 instead of 2.0.
(3) For some reason observations for important countries for a year are missing, we used the following formula to calculate the average growth rate for these variables:

$$(\text{variable}_{t+n} / \text{variable}_{t})^{1/n}$$

Multiplying the value of the variable from year t with the average growth rate gives the value for t+1. Formally:
(Average growth rate) x (variable_t) = variable_{t+1}

7.2 Definition of the data and sources

(1) GDP per capita on PPP basis
GDP per capita is based on purchasing power parity [PPP]. PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current dollars.
Source: World Bank, International Comparison Programme database.

(2) Annual GDP per capita Growth Rate
Out of this GDP per capita values for the observed 145 countries the independent variable annual GDP per capita Growth Rate has been calculated using the formula

$$Per\ Capita\ Growth = \frac{(GDPpc_t - GDPpc_{t-1})}{GDPpc_{t-1}}$$

Source: World Bank, International Comparison Programme database; own calculation by authors.

(3) Shadow Economy

The variable Shadow Economy is defined as the informal sector [shadow economy] in percent of official GDP. The estimations for the size of the shadow economy are undertaken using the DYMIMIC and the currency demand approaches; using the values calculated in section 3. This variable is available for three points in time namely the years 1999/00, 2001/02 and 2002/03.

Source: Own calculation by the author.

(4) Dummy Industrialized Countries

The variable Dummy Industrialized Countries is a binary variable and takes the value 0 if a country is a developing country and 1 if the country is an industrialized country. "Developing Country" corresponds to high income classification of World Bank Indicators 2002 with per capita income of USD 9,265 or less. The same applies to "Industrialized Countries" which are defined as countries with per capita GDP of USD 9,266 or more.

Source: Own calculation by authors.

(5) Dummy Transition countries

The variable Dummy Transition Countries is a binary variable and takes the value 1 if a country is a transition country from a centrally planned economy to a market economy and 0 if the country is not. This variable is used for the classification of the countries.

Source: Own Calculation by authors.

(6) Dummy OECD countries

The variable Dummy OECD countries is a binary variable and takes the value 1 if a country is member of the OECD and 0 if the country is not.

Source: Own Calculation by authors.

(7) Share of Direct Taxation (in % of GDP)

Source: OECD, Paris 2003, Taxing Wages and World Bank (Washington D.C.), 2003, Governance Indicators.

(8) Share of Indirect Taxation and Custom Duties in % of GDP

Source: See Share of Direct Taxation.

(9) Burden of State Regulation

Burden of State regulation, index of regulation, where a score of 1 signifies an economic environment most conductive to economic freedom, whereas a score of 5 signifies least economic freedom. Source: Heritage Foundation 2005, Index of Economic Freedom, Washington, D.C.

(10) Employment Quota (in % of population between 18 and 64)

Source: OECD, Paris, various years, Employment Outlook.

(11) Unemployment Quota (% of unemployed in the working force)

Source: OECD various years, Employment Outlook.

(12) Change of Currency per Capita, Annual Rate of Currency per Capita

Source: World Bank National Accounts Data and OECD National Accounts Data Files, Washington and Paris, various years.

(13) Tax Morale (Index)

Source: European Values Study, EUROPEAN VALUES STUDY, 1999/2000 [Computer file] 2003/Release 1, The Netherlands, Germany: Tilburg University, Zentralarchiv für Empirische Sozialforschung, Cologne (ZA), Netherlands Institute for Scientific Information Services (NIWI), Amsterdam [producer], 2003. Germany: Zentralarchiv für Empirische Sozialforschung, Cologne [distributor], 2003. Inglehart, Ronald et.al. World Values Surveys and European Values Surveys, 1981-1984, 1990-1993 and 1995-1997 [Computer file]. ICPSR version. Ann Arbor, MI: Institute for Social Research [producer], 2000. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2000.

(14) Quality of Institutions

index =0 lowest quality, =100 highest quality, Source World Bank, years 1999 to 2003

(15) Social Security Burden

Definition: social security payments (employers and employees) in % of GDP, Source OECD, 2003, 2004

Quality of state institutions, World Bank rule of law index, ranges from -3 to +3, with higher scores showing better environments, i.e. the higher the score the better is the rule of law in that respective country. Source: Kaufmann, D.; Kraay, A. and M. Mastruzzi, 2003, Governments Matters III: Governments Indicators for 1996/2002, World Bank Policy Research Working Papers 3106, World Bank, Washington D.C.

8 Appendix 3: Descriptive Statistics of the variables

Table 8.1: Descriptive Statistics of the Used Variables

Variable	Mean	Minimum	Maximum	Standard Deviation
Shadow Economy	31.78	6.90	68.20	12.72
Income tax rate (Fraser)	4.95	0.00	10.00	3.01
Custom duties (% of GDP)	6.44	0.00	10.00	2.34
Direct Taxes (% of GDP)	20.20	0.37	47.28	9.69
Indirect Taxes (% of GDP)	24.63	0.04	58.76	10.48
Regulation (Heritage)	3.37	1.00	5.00	0.93
Rule of law (World Bank)	0.00	-2.04	2.36	0.98
Government effectiveness (World Bank)	-0.02	-2.28	2.59	0.95
Social security burden (% of GDP)	18.3	0.00	26.3	6.42
Tax morale	4.51	1.78	8.46	2.32
Unemployment quota	9.46	3.41	24.36	3.43
GDP per capita in USD	14532.01	543.74	37541.23	10552.23
Annual rate of GDP (%)	6.62	-5.58	12.64	2.34
Change of local currency per capita	7.47	0.21	14.64	3.24
Employment quota	40.23	34.12	66.41	16.43

Source: Own calculations.

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