

Pronatal Property Rights over Land and Fertility Outcomes

Evidence from a Natural Experiment in Ethiopia

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Abstract

This study exploits a natural experiment to investigate the impact of land reform on the fertility outcomes of households in rural Ethiopia. Public policies and customs created a situation where Ethiopian households could influence their usufruct rights to land via a demographic expansion of the family. The study evaluates the impact of the abolishment of these pronatal property rights on fertility outcomes. By matching aggregated census data

before and after the reform with administrative data on the reform, a difference-in-differences approach between reform and non-reform districts is used to assess the impact of the reform on fertility outcomes. The impact appears to be large. The study estimates that women in rural areas reduced their life-time fertility by 1.2 children due to the reform. Robustness checks show that the impact estimates are not biased by spillovers or policy endogeneity.

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Pronatal Property Rights over Land and Fertility Outcomes: Evidence from a Natural Experiment in Ethiopia[¶]

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1 Introduction

“Through marriage or, more accurately, through fathering children whom he supports, a man thus gains access to a new set of rights [to land].” (Hoben, 1973: p. 152)

After decades of research, no clear consensus has emerged on whether the nature of the relationship between population growth and economic welfare is positive, negative or neutral (Birdsall et al., 2003). However, with respect to human reproduction, as the main driver of population growth, it can be stated with somewhat more certainty that fertility is too high to be socially optimal if the social cost of children exceeds their private cost. These externalities may arise in several situations. The following examples have been widely quoted in the literature: First, the interrelation between population growth, poverty, and the degradation of the local natural resource base, which is commonly associated with village economies in developing countries, may lead to a situation referred to in the literature as reproductive externalities (Dasgupta, 1993, 1995, 2000). Second, the so called congestion problem can occur if the present value of the costs of public services, such as education, health, and infrastructure, exceed the present value of a newborn child’s expected lifetime tax contribution. This creates a condition in which each additional child dilutes the public services available to the other children (World Bank, 1984; Schultz, 1985). Third, since child and adult labor are substitutes, high fertility may lead to a low level wage equilibrium where children work and the wages of adults are depressed (Basu and Van, 1998). While such externalities are hard to observe, the case for policy makers seems to be clear. For instance, in 2013, 37 per cent of the countries in the world pursued policies to lower the rate of population growth, the majority of which can be found at the lower tail of the world income distribution (UN DESA, 2013).

However, the question whether fertility rates can actually be reduced is still open. In the long-run, the answer seems to be yes. Historically, fertility rates were observed to drop as countries began to prosper, urbanize, and structurally change during industrialization. Apparently, this observation is consistent with the fact that high fertility rates are now mainly concentrating in sub-Saharan Africa and South Asia (Maddison, 2006). In the short- and medium-term, public policies such as family planning information and services, entitlements, taxes, disincentives, and quota are being employed (Birdsall, 1988).¹ In this paper, we draw attention to another domain of public policy, the arrangement and rearrangement of property rights, in influencing fertility rates. We do this in Ethiopia, a country which has some of the highest fertility rates in the world.

We draw on a natural experiment to evaluate the impact on fertility outcomes of the abolishment of pronatal property rights. Historically, rules governing access to land in the Amhara region of Ethiopia were pronatal. In the traditional system of communal land governance, men could claim land on be-

¹These programs have, however, mixed effects in lowering fertility rates. See McQueston et al. (2012) for a systematic review of the impact of interventions targeting fertility outcomes.

half of the women they were married to. These claims could not be substantiated through marriage per se, but the children they had had in the course of the marriage (Hoben, 1973). In the wake of a military coup, land governance shifted from the communal to the state level. In 1974, a nationwide land reform nationalized and redistributed land on the basis of family size. In subsequent years, family size prevailed as the most important criterion for communal land redistributions (Rahmato, 1994).² Against this background, we evaluate the impact of a land reform implemented in 1997 in the southern part of the Amhara region, which, surprisingly and unexpectedly, discontinued the historic practice of primarily redistributing land based on family size. We consider the implementation of the 1997 reform in Amhara as a quasi-experiment during which the southern part of the region implemented the 1997 reform, but the northern part did not. The division of Amhara into reform and non-reform areas followed a process orthogonal to fertility rates and their determinants. Between September 1989 and March 1991 a rebel group who later came into power, the Ethiopian People’s Revolutionary Democratic Front (EPRDF), took control of the region of Amhara in two temporally distinct military campaigns. After the EPRDF and their allies came to power, the region of Amhara implemented a large-scale land reform in 1997. However, this reform was only conducted in the southern part of Amhara, which was conquered by the EPRDF during the second military campaign. A political decision was made that the northern part did not need another land reform as there had been occasional redistributions, using family size as the main criterion, in the areas conquered by the EPRDF during the first military campaign.

We employ a difference-in-differences approach to estimate the impact of the reform. We use panel data from the 1994 and 2007 Population and Housing Censuses and match it with administrative data from the Environmental Protection, Land Administration and Use Authority of the Amhara Regional State. For the analysis, data on 2,303,198 individuals in the region of Amhara is aggregated into 212 district–time clusters. We compare the difference between the reform and non-reform districts before and after the 1997 systematic land redistribution in the region. Our key outcome variable is the total fertility rate at the district level. We control for a variety of time varying observables as well as district level heterogeneity to average out time invariant unobservables.

Three assumptions need to be met for our estimates of the policy impact

²We would like to emphasize that the existence of pronatal property rights is not specific to this context. We have found indications for pronatal property rights in various countries around the world. In a number of countries in sub-Saharan Africa, a woman’s rights to the use of land are associated with her position as mother and wife. For instance, a woman’s rights to land may increase with the length of her marriage or with having more children. These rights may end with divorce, with widowhood, with the failure to have sons (Gray and Kevane, 1999; Guyer, 1986). In addition, it has been argued that in the Punjab, India, the caste system improves access to land for farmers with high fertility, especially for those with many sons (Mamdani, 1972). Furthermore, it was argued that granting rights to land on a usufruct basis in Mexican *ejidos* (agricultural communities) creates pronatal incentives, especially through land retention, as larger families are less likely to be affected by land redistributions (De Vany and Sanchez, 1979).

to be causal. First, in the absence of the implementation of the land reform, our estimate of the policy impact should be statistically indistinguishable from zero, i.e., no other systematic factor should explain the change in fertility patterns between reform and non-reform districts we observe in the data. Given that the division of Amhara into reform and non-reform areas follows a very specific geographic pattern, we consider it rather unlikely that our estimates actually pick up the effect of any other program, even if it was not uniformly implemented within the region of Amhara. Second, there is no contamination of the non-reform districts by the reform districts, e.g., there should be no change, due to influences from the reform districts, in aggregate fertility behavior at the district level of the districts that were unexposed to the reform. The fact that the reform varies at the district level circumvents unobserved heterogeneity in fertility behavior at the individual level, i.e., contamination is only an issue if households in non-reform districts alter their fertility behavior systematically in the same direction because of influences from the exposed districts. As a robustness check, we compare non-reform districts sharing a border with a reform district to non-reform districts not sharing a border with a reform district in a placebo differences-in-differences specification. Third, policy endogeneity may affect the adequacy of non-reform districts as a within-region control group, i.e., the selection of districts into the reform due to unobservable district characteristics. While we use fixed effects to average out time-constant unobserved heterogeneity and use the available data from the census to control for time varying factors at the district level, there may still be a bias in the estimates due to time varying unobservables at the district level which are correlated with the implementation of the reform and fertility rates. As a robustness check, we use the selection-on-observables approach (Altonji et al., 2005; Bellows and Miguel, 2008; Nunn, 2011) to assess whether the potential bias from time varying unobservables drives the selection of districts into the reform.

Our findings point towards a substantial effect of the land reform on fertility outcomes. For the full sample, we estimate a 0.99 reduction in the total fertility rate, i.e., a reduction of lifetime fertility by one child per woman. This result is clearly driven by the rural rather than the urban sample. For the rural sample, we estimate a 1.2 reduction in the total fertility rate. Looking at age-specific fertility rates, from which the total fertility rate is constructed, we find a clear reduction in fertility for virtually all age groups in the rural sample. The effect is particularly pronounced for women in the most fertile age groups, 25–29 and 30–34. With respect to the mechanism at work, we argue that the arrangement of property rights over land before the reform led to a higher economic gain from children. It derived from children’s contributing to household wealth in an environment of otherwise weakly defined property rights. More specifically, if land is redistributed according to household size, land holdings and thus wealth depend positively on the number of children. Abolishing the positive relationship between land and household size leads to a reduction in fertility. Furthermore, through robustness checks, we conclude that our impact estimates are not downward biased due to spillovers from reform districts into non-reform districts. Furthermore, using a selection-on-observables approach, we find no

indication of a selection bias from unobservables.

Our findings may also contribute to understanding a statistical oddity. The population count in Amhara was 17.2 million according to the most recent census in 2007 and clearly fell short of the official government projection of 19.6 million Amharans for that year. “The 2.5 million missing Amharans” were extensively covered in the national media and eventually resulted in fierce debates in the parliament with both opposition and ruling coalition members of parliament condemning the census as flawed, calling for a redo of the census, as Ethiopia is a federal state and population size affects the budget of its regions. A panel of international experts reviewed the census, but were not able to spot any mistakes in its design or implementation.³ We conjecture that Ethiopia’s “2.5 million missing Amharans” is due to a violation of a crucial assumption underlying the cohort component method, a method commonly used by statistical agencies to project the total population size for a future date from census data. The method assumes a constant total fertility for the projection period. However, we find a substantial reduction in the total fertility rate from 4.9 to 3.9 in the reform districts, which indicates that the statistical oddity may at least partly be a consequence of the land reform.

The next section discusses the institutional setting and the natural experiment. It also contains some theoretical considerations. Section 3 explains the data as well as the empirical strategy. Section 4 discusses the findings and Section 5 draws some conclusions.

2 Institutional setting and some theoretical considerations

2.1 Pronatal property rights and land tenure in Amhara

In this section, we argue that the rules governing access to land in the Amhara region were historically pronatal. Having children helped secure access to land in an environment of otherwise weakly defined property rights, no matter whether land governance was communal or statal. However, pronatal policies for land tenure were surprisingly abolished with the most recent land reform. We hypothesize that this policy change might have had a considerable influence on households’ fertility decisions.

During the imperial period, a communal system of land governance, known as *rist*, was widespread in Amhara.⁴ The claims of households to land culminated in *rist* through which they used to acquire usufruct rights to land. *Rist* rights derived from ancestors who formerly held land in a village.⁵ Apart from

³See, for instance, *The Ethiopian Review*, on June 23rd, June 24th and June 26th, 2009. (URL: <http://www.ethiopianreview.net>, last accessed on May 20th, 2015).

⁴It could be found in Gojjam, Gondar, Shoa and Wollo, historic provinces that, by and large, form the region of Amhara today.

⁵The inheritance of rights to land via *rist* followed cognatic descent rules, which place children (regardless of their sex) in the descent category of both their mother and father.

direct inheritance, *rist* land could be obtained through redistributive claims made in front of the descent cooperation, a group of village elders. Through marriage, a man could claim land with respect to his wife's *rist*.⁶ Interestingly enough, a man's right to a wife's *rist* did not derive from marriage per se, but the children they have together in the course of marriage.⁷

When the Derg, a military junta, came into power by overthrowing the imperial regime in 1974, land governance moved from the communal to the state level. Proclamation No. 31/1975, entitled "A proclamation to provide for the public ownership of rural lands," created a legal basis for a nationwide reform with a collectivization and redistribution of land. Peasant associations were set up to administer the redistribution down to the village level. It was the first uniform tenure system ever imposed on Ethiopia as a whole and aimed at a new agrarian order with an egalitarian allocation of wealth and land (Pausewang, 1983). The proclamation prohibited private ownership of land by individuals and organizations. Market based mechanisms for land allocation were prohibited, and thus the proclamation related usufruct rights to land to the needs of a family.⁸ Historic accounts describe how this principle was put into practice in Amharan villages:

"Allotment was made on the basis of family size and the quality of land. Each household receiving land had a share from both the good as well as the poor land available for distribution. A minimum ceiling of a unit of land (the minimum varied among PAs) was set for a household: and any addition over this was based on the number of household members. Here too, all shared from the good and the poor land in the PA land fund. Each additional member of a household had at least two parcels—good and poor quality—to add to the family." (Rahmato, 1994: p. 47)

It is estimated that the reform effectively redistributed between 1 and 1.5 *t'emad* (approximately one-fourth of a hectare) per household member (Ege,

This is opposed to unilineal descent rules, which placed children (regardless of their sex) in the descent category of parents of one sex only. Creating overlapping claims to land, the *rist* system led to weakly defined property rights in which usufruct rights to land were commonly contested. With respect to the situation in Amhara it has been noted: "With cognatic descent the situation is different. Unless there is some other way in which membership in descent groups is limited, property rights associated with each group become so widely diffused as to be meaningless." (Hoben, 1973: p. 19)

⁶Hoben (1973: p. 152) states: "From a tactical point of view, the land he may hope to obtain [through marriage] falls into two classes. The first comprises land given to him by his wife's kinsmen. The other, and statistically by far the more important, comprises land which he may claim in his wife's name from the descent cooperation."

⁷Hoben (1973: p. 136) states: "... a man can claim wife's *rist* only after his wife has given him a child and can keep it as long as he continues to support that child. In other words, a man does not have any rights to *rist* in virtue of his marriage to his wife but only as trustee or custodian for the children he has with her. For this reason, wife's *rist* is also referred as "children's *rist*"."

⁸"Without differentiation of the sexes, any person who is willing to personally cultivate land shall be allotted rural land sufficient for his maintenance and that of his family." (People's Democratic Republic of Ethiopia, 1975: Article 4.1)

1997). In the subsequent years, peasant associations were kept busy by correcting newly developing inequalities in land holdings through periodic land redistributions and reallocations. While other factors, such as the quantity and quality of the land, were taken into account for the redistribution of land through peasant associations, egalitarian norms so that every household should be able to support its members with the allocated land prevailed (Rahmato, 1994).

2.2 A natural experiment: The abolishment of pronatal property rights in land tenure in Amhara

While the 1974 land reform was nationwide, affecting Amhara and the Ethiopia's other regions alike, the 1997 reform, which is the subject of the empirical analysis in this paper, was specific to the southern half of the Amhara region. We argue that the implementation of the 1997 reform constitutes in a natural experiment suitable for assessing the impact of land reform. More specifically, it allows us to causally evaluate the impact of the abolishment of pronatal property rights on households' fertility decisions and other outcomes.

First, the implementation of the 1997 reform in the southern half of the Amhara region discontinued the redistribution of land primarily on the basis of household size as historically practiced in the region and other parts of the country. This land reform was initiated by the Ethiopian People's Revolutionary Democratic Front (EPRDF), a rebel group that ended the rule of the Derg in 1991. The 1997 redistribution, with the purpose of strengthening support for the EPRDF in rural areas, was implemented after the enactment of the 1994 constitution that gave Ethiopia a federal structure. It entailed the 1997 land proclamation, which transferred authority over land administration from the central to the regional governments. Rather than aiming at an egalitarian distribution of land in terms of household size, observers consider the 1997 reform as an attempt to establish a class basis for the regional government in rural areas (Amare, 2002; Ege, 1997, 2002; Gelaye, 1999; Teklu, 2005; Yigremew, 1997a, 1997b).⁹

Second, the change in the land redistribution policy was surprising and unexpected. Ethnographic accounts show that the Amharans clearly expected a land reform of the type they were historically used to (Ege, 1997).¹⁰ Consequently, in the preparation of the land reform, it was observed that many households

⁹It separated farmers into *birokrasi* (bureaucrats) and *ch'equm* (oppressed). The *birokrasi* were those who had held office under the Derg, while the *ch'equm* had not. Land was redistributed according to the following benchmarks: First, *birokrasi* may receive up to four *t'emad* of land (roughly one hectare). And, second, *ch'equm* may receive up to 12 *t'emad* (roughly three hectares) of land. To implement the reform, households and land holdings were registered. Then, farmers were separated into *birokrasi* and *ch'equm*. Finally, land was confiscated and reallocated via lottery, excluding *birokrasi* from the lottery.

¹⁰Ege (2002: p. 74) states: "In October 1996 it was announced on the radio that there would be a land redistribution, and the news spread immediately all over the countryside. Nothing was said about the type of land redistribution to be implemented, but the peasants clearly expected it to be an updating of the existing land tenure system, an equal distribution of land based on household size, to correct the inequalities that had developed over the years."

tried to game the redistribution process in terms of their expectations about the role of family size.¹¹

Third, the division of Amhara into reform and non-reform areas in 1997 followed a process orthogonal to fertility rates and their determinants. Between September 1989 and March 1991, the EPRDF took control over the region of Amhara in two temporally distinct military campaigns, advancing towards the capital. Infiltrating from the north, the EPRDF managed to conquer North Wollo, North Shewa, and part of North and South Gondar, between September and December 1989. The EPRDF army then remained in the initially occupied areas for more than a year. Finally, the remaining areas in Amhara were seized in two subsequent major military campaigns (i.e., operations *Tewodros* and *Dula Billisuma Welkitima*) in February and March 1991. After some years, in early 1997, the land reform was implemented only in areas that had been conquered by the EPRDF during the second military campaign (De Waal, 1991; Ege, 1997).

Fourth, the profound change in the *modus operandi* of the land redistribution was limited to the southern half of the Amhara region, overlapping with the final phase of the military campaign of the EPRDF. This raises the question why the reform closely followed this clear distinction and why there was no attempt to cover the entire Amhara region. It appears that the rebel troops, before the fall of the Derg regime, occasionally redistributed land in the northern half of the region with the objective of ensuring a “fair and equal distribution” of land in the occupied territories. These redistributions were conducted in the spirit of those implemented by the military regime, using family size as the main criterion with no consideration of earlier political affiliation or involvement of the holder family. In 1997, a political decision was made by the EPRDF that no further land redistribution was needed in this part of the Amhara region (Adenew and Abdi, 2005; Baye, 2013; Teklu, 2005).¹²

Figure 1 shows a map of the Amhara region, and the divide between the first and final waves of the EPRDF military campaigns. The red and green shaded areas show the non-reform and reform districts, respectively. The separation of the two areas coincides with the areas conquered during the two military

¹¹Ege (1997: p. 32) states: “On the basis of previous experience and peasant perception of justice, the peasants expected that land would be allocated according to household size, and they consequently tried to rearrange their households to be in the strongest position possible. Some poor peasants had hired out children as herders, and these were now called home, which will have caused strains both in the households losing the herder and in the poor households, for which the herding arrangement had served both to decrease consumption and to earn a little money. I also heard of a case where a son born outside marriage was asked by his father to move to his households, since the father currently had a small household and therefore expected to lose land. If the son refused, his father would no more consider him as his child. The same will certainly have happened to many children with divorced parents, who were pulled between the interests of different households.”

¹²In addition, informants from the North Wollo zone, who participated in the redistribution process, confirmed that political involvement was not considered at all. Some who were very active left their community during the EPRDF military campaign, but the share of their family members who stayed in the community at the time of the redistribution was not affected. Moreover, they managed to secure some land upon their eventual return to their community.

campaigns of the EPRDF.

[Insert Figure 1 about here]

We, therefore, exploit the coincidence of the boundaries between the military campaigns and the carrying out of the 1997 land redistribution in the Amhara region as a natural experiment. This allows us to address endogeneity concerns, since empirically evaluating these effects without any exogenous variation would have made it difficult to distinguish the effects of economic change on population change from the effects of population change on economic change.

2.3 Some theoretical considerations

We argue that the unanticipated change in the *modus operandi* of land governance closed down the possibility of getting access to land via family size. This affected fertility decisions. We represent these insights in a simple model. We presume that children provide a net economic benefit to a household.¹³ Dasgupta (1993) argues that such an assumption is more valid in poor than in rich countries because productivity is less tied to human capital. One channel may be that children earn more than they consume at earlier ages. Other channels may be that they provide old-age support or help diversify risk. To illustrate the mechanism at work for expositional purposes, we link household size and land ownership to household wealth. A household's wealth W depends on its land holdings, denoted by k , and children, denoted by r , and is given by a continuous function $W(k, r)$. We assume that it is strictly increasing and concave in both arguments. Raising children generates economic benefits, but is also costly. The cost function is given by a strictly convex function, $c(r)$. The objective of the household is thus to choose r in order to maximize the net benefit function

$$W(k, r) - c(r). \quad (1)$$

Now assume that land is redistributed according to household size. Land holdings then positively depend on the number of children. Assuming that they are given by the function $k(r)$, the net benefit function can be re-written as

$$W(k(r), r) - c(r). \quad (2)$$

The first-order condition is then

$$\frac{dW}{dk} k'(r) + \frac{dW}{dr} = c'(r). \quad (3)$$

Note that the term $\frac{dW}{dk} k'(r)$ is strictly positive. It captures the fact that an increase in household size increases landholdings, which ultimately leads to more

¹³This view departs from the classical literature studying the determinants of fertility, in which children generate utility as a consumption good and/or altruism (Barro, 1974; Barro and Becker, 1989; Becker, 1960; Burbidge, 1983; Eckstein and Wolpin, 1985; Razin and Ben-Zion, 1975).

wealth. Let r_1 be the unique value of r that solves the first-order condition given in Equation (3). It is straightforward that the existence of a unique solution is guaranteed by the concavity of W in both its arguments. Now consider the case where the positive relationship between land and household size is abolished. This implies that $k'(r) = 0$ and the first-order condition reduces to $\frac{dW}{dr} = c'(r)$. Assuming that r_2 is the unique value of r that solves the modified first-order condition, the convexity of the cost function ensures that r_1 will be greater than r_2 , which, in turn, implies that disentangling access to land from children will lead to a reduction in fertility.

3 Data and empirical strategy

3.1 Data and fertility measures

The empirical analysis in this paper employs panel data from the Ethiopian 1994 and 2007 Population and Housing Censuses. Census waves were collected by the Central Statistical Agency of Ethiopia with the technical and financial support of various international partners, such as the United Nations Fund for Population Activities (UNFPA), the United Nations Development Fund (UNDP), and the Department for International Development (DFID). They contain data on the demographic, economic, and social characteristics of all persons and their housing in Ethiopia. In each wave, 20 percent of the census data was collected with a long questionnaire, roughly 10 percent of which were accessible to us. It is a random sample of the full census.

We matched the Amhara sub-sample of the census data with administrative data on the 1997 land reform in the Amhara region from the Environmental Protection, Land Administration and Use Authority. The latter allows us to draw on within-Amhara variation in the empirical analysis. Data from the Population and Housing Census is aggregated at the district level, i.e., the administrative level at which the implementation of the reform varies. We used three samples for the empirical analysis: a rural sample, an urban sample, and a full sample, including all data from the rural and urban samples.¹⁴ As a consequence of changes in the administrative boundaries (typically as a result of splits), there are more districts in 2007 than in 1994. Thus the data across census waves were spatially matched if a 1997 district contains the centroid of a 2007 district. We cross-checked the spatial match by comparing whether the district names in the two census waves match. In addition, we also cross-validated the administrative land reform data with independent accounts wherever possible, i.e., there are ethnographic accounts from research operating on the ground during or shortly after the reform (see, for instance, Abate, 1997a, and Abate, 1997b, for the zone of South Wollo; Ege, 1997, for North Shoa; Gelaye, 1999,

¹⁴The rural sample was generated by aggregating data on households living in the enumeration areas classified as rural by the Population and Housing Census. The urban sample was generated by aggregating data on households living in the enumeration areas classified as urban by the Population and Housing Census. The full sample aggregates all the available data.

for East Gojam; Yigremew, 1997a, and Yigremew, 1997b, for West Gojam; and Gizachew, 2010, for Weg Hemra). For the analysis, data on 2,303,198 individuals in the region of Amhara is aggregated into 212 district-time clusters.

Using census data for the research question at hand has two major advantages vis-à-vis the Demographic Health Survey (DHS) for Ethiopia, the most plausible alternative source of data. First, it allows for a before and after comparison with a baseline (while the first DHS was collected in 2001, i.e., after the land reform in Amhara was implemented). Secondly, the large sample size allows us to generate common fertility measures with a relatively better precision at the district level, which is our primary analysis unit. The most common cohort measure of fertility is the total fertility rate, which gives a point in time estimate for the average fertility of a population (or a sub-population, such as one Ethiopian district). It is built from age-specific fertility rates and captures the average number of children expected to be born by a woman during her childbearing years (see, for instance, Demeny and McNicoll, 2003).¹⁵

[Insert Table 1 about here]

Descriptive statistics of the total and age-specific fertility rates at the district level, which are our key variables of interest, are presented in Table 1. Additional outcome variables focus on labor market participation (the proportion of women in a district who are self-employed, employed, and doing housework as main occupation) and marital status (the proportion of women in a district never yet married). Two reform indicators capturing the presence and intensity of the land redistribution in 1997, indicating whether at least one peasant association (the administrative unit subsidiary to a district) was affected, as well as the proportion of peasant associations per district being affected by a redistribution are used. Control variables include the district population in a particular age group (the number of district inhabitants in the age groups 12–17, 18–65, and greater than 65), the district population belonging to a particular religion (the number of district inhabitants who are Orthodox, Muslim or Animist) and ethnicity (the proportion of the district population being of Amharan ethnic origin). A precise definition of each variable as well as its source in the census can be found in the Appendix.

[Insert Table 2 about here]

Table 2 shows the similarity of baseline characteristics for the full, rural and urban samples by regressing the binary reform indicator on either the main fertility outcomes, additional outcomes, or controls. For all the samples we cannot reject equality, at baseline, in total and age-specific fertility rates, female labor market participation indicators, or religion and ethnicity variables. We find some differences for the population characteristics, but they seem to be non-

¹⁵ As compared to period measures of fertility such as the crude birth rate and the general fertility rate, the total fertility rate has the advantage of being independent of the age structure of the population.

systematic across age groups. The similarity across pre-reform characteristics is consistent with a non-selectivity of districts into the reform.

3.2 Empirical strategy

Given the “quasi-experimental” nature of the 1997 Amhara land redistribution and the availability of census data both before and after its implementation, we employ a difference-in-differences approach to estimate its impact on fertility and other related outcomes. A simple cross-sectional comparison would not be appropriate for identifying any causal effects as, even in the absence of the implementation of the reform, fertility rates between the 1997 reform and non-reform districts might differ as a result of persistent cultural norms (e.g., as to polygyny, the patriarchal system of family and inheritance, early marriages, and the stigmatization of unmarried and divorced women) and environmental factors (such as soil quality, land degradation, and climatic conditions). These variables are difficult to observe and hence to control for in a cross-sectional analysis. In contrast, a difference-in-differences estimation strategy taking into account district level fixed effects wipes out any persistent influences from norms and environmental factors on fertility outcomes at the level of the empirical analysis. The difference-in-differences estimation equation, with district level fixed effects, can be written as

$$Y_{jt} = \beta_1 + \beta_2 AFTERT_t + \beta_3 AFTERT_t * REFORM_j + X_{jt}b + d_j + v_{jt} \quad (4)$$

where Y_{jt} captures the fertility outcome for district $j = 1, \dots, 212$ at time $t = 0, 1$. $AFTERT_t$ is a binary indicator equal to one for the time period after the implementation of the 1997 reform and zero for the time period before the reform. We use two alternative indicators to capture the land reform represented by $REFORM_j$, in district j . The first one is a binary indicator equal to one if at least one of the peasant associations belonging to district j implemented the land reform and zero otherwise. The second one is an indicator for the intensity of the reform, defined as the proportion of peasant associations in district j that carried out the 1997 land redistribution. It should be noted that since the reform was implemented at the district level, typically almost all the peasant associations were covered in the areas where the land redistribution was implemented.

The coefficient β_3 on the interaction between $AFTERT_t$ and $REFORM_j$ estimates the average difference-in-differences between the 1997 reform and non-reform districts, X_{jt} consists of time varying control variables which may be correlated with fertility outcomes, and d_j contains district fixed effects which absorb persistent unobserved differences between reform and non-reform areas.

The inference is generally based on the standard Huber/White estimator of the variance matrix. It is valid for the within estimator controlling for cluster-specific fixed effects with data aggregated at the cluster level (Arellano, 1987; Cameron and Miller, 2015). All the main findings are robust to other specifications of the standard errors, such as clustering at the zonal level (the zone

is the next administrative unit above districts). Noting that the first entry point of the reform was the district administration, we only report results with Huber/White standard errors calculated at the district level.

Three assumptions, however, need to be satisfied for the estimate of β_3 to be causal. First, in the absence of the implementation of the land reform, this estimate should be statistically indistinguishable from zero, i.e., no other systematic factor should explain the change in fertility patterns between reform and non-reform districts. We attribute the empirical findings to the implementation of the land reform in some areas but not in others, but we also consider alternative explanations arising from public action in Amhara. The only major policy intervention on a scale similar to the 1997 land reform we became aware of is the Revised Family Code. Updating an earlier Family Code, the Revised Family Code became effective in the year 2000 (Federal Democratic Republic of Ethiopia 2000). It changed laws regarding marriage, divorce, inheritance, paternity, adoption, and child welfare. Aiming at improved access to resources and the removal of restrictions on employment, it may have helped to strengthen women’s bargaining position within the household and thus decrease fertility. It was a nationwide program even if the start of its implementation varied by region. In the Amhara region, its implementation commenced in 2000 (Hallward-Driemeier and Gajigo, 2013). While we were not able to find any data on the implementation process of the Revised Family Code within Amhara, we presume that it is plausibly orthogonal to the distinguished implementation pattern of the 1997 land reform. Given that the division of Amhara into reform and non-reform areas follows a very specific geographic pattern, we consider it rather unlikely that our estimates actually pick-up the effect of any other program, even if it was not uniformly implemented within the region of Amhara.

Second, there should be no spillover effects from reform to non-reform districts, e.g., there should be no change in aggregate fertility behavior at the district level of unexposed districts because of influences from exposed districts. The fact that the reform varies at the district level circumvents unobserved heterogeneity in fertility behavior at the individual level, i.e., contamination is only an issue if households in non-reform districts alter their fertility behavior systematically in the same direction by observing the changes in the reform districts. As a robustness check, we compare non-reform districts sharing a border with a reform district to that of non-reform districts not sharing a border with a reform district in a placebo difference-in-differences specification.

Third, policy endogeneity may affect the adequacy of using the non-reform districts as a within-region control group, i.e., there might exist a selection of districts into the reform along unobservable district characteristics. While we use fixed effects to average out time-constant unobserved heterogeneity and use the available data from the census to control for time varying factors at the district level, there may still be a bias in the estimates due to time varying unobservables at the district level that are correlated with the implementation of the reform and with fertility rates. As a robustness check, we use the selection-on-observables approach to assess whether the potential bias from time varying

unobservables drives a selection of districts into the reform.

4 Results

4.1 Unconditional differences in overall means

Table 3 presents a comparison of the means of the total fertility rate (TFR), constructed from the age-specific fertility rates (ASFRs) in 5-year intervals per 1000 women in their childbearing years, between the reform and non-reform districts and over time. Mean fertility rates from the 1994 and 2007 census data disaggregated by the 1997 land reform status at the district level are reported in columns (1) and (2), respectively. The simple differences between the two means over time show the trend between census waves for reform and non-reform districts. They are given in column (3). The mean double-difference and the relative percentage change in TFR are reported in columns (4) and (5), respectively. The latter is calculated comparing the observed difference-in-differences with a counterfactual case assuming that the non-reform districts had the same trend as the reform districts in the absence of the land reform.

The TFR substantially declined from 4.89 in 1994 to 3.96 in 2007 (a decrease by about 19 percent) in the districts covered by the 1997 land reform while it slightly increased from 4.40 in 1994 to 4.45 in 2007 (an increase by about 1 percent) in the non-reform areas. The difference in these differences, -0.989, is significantly different from zero at conventional levels, suggesting that women from the reform districts reduced their lifetime fertility by roughly one child between the two census waves as compared to those from the non-reform districts. In relative terms, this is equivalent to a decrease in total fertility by about 20 percent.

[Insert Table 3 about here]

This observed reduction in the TFR can most likely be ascribed to the 1997 land reform which was implemented in the southern half of the Amhara regional state. Although this is consistent with the natural experiment provided by the staggered military campaign of the EPRDF forces, it is prudent to be cautious as there might be other variables related to fertility rates which could systematically vary over time and administrative units. Therefore, we rechecked these findings in a multivariate regressions framework with additional controls for observable characteristics to improve the credibility of a causal inference.

4.2 Graphing means by age group

We descriptively showed that there was a substantial reduction in the TFR in the reform districts as compared to that of non-reform districts. In Figure 2, we project the difference-in-differences approach into a graphical representation, comparing the ASFR for the reform and non-reform districts. The upper and

lower graphs show the ASFRs for the reform and non-reform districts, respectively. The bars leaning leftward are the ASFRs for the 1994 census and those leaning rightward are the ASFRs for the 2007 census. The ASFRs are ordered top-to-bottom starting from older to younger age groups. The unit of observation is ASFR per 1000 women in a particular childbearing age group of a 5-year interval.

As can be seen, the ASFRs are fairly normally distributed across age groups, with women aged 25–29 being the most fertile age group but women 10–14 as well as 45–49 being the least fertile age groups. Simple visual observation of the top panel of Figure 2 reveals that the ASFR had decreased for virtually all age groups in reform districts after the implementation of the reform. On the other hand, we do not observe any systematic changes in the ASFRs of the non-reform districts between the 1994 and 2007 census. If anything, the ASFRs have slightly increased for the most fertile age groups between 20 and 29 years of age.

[Insert Figure 2 about here]

These simple observations imply that the reduction in the TFR of the reform districts is actually driven by a reduction in the ASFRs across virtually all age groups of women of childbearing age. These descriptive figures suggest that it is rather unlikely that the observed reduction in the TFR in the reform districts can be ascribed to other programs, such as the revised family code or family planning, which would target particular age groups rather than all women in their childbearing years.

4.3 Regression-based impact estimates on fertility outcomes

The correlations presented in Table 2 show some differences between the reform and non-reform districts for variables potentially affecting fertility outcomes. In this section we present the results of regressions both with and without control variables. Including controls improves on the unconditional mean differences shown above by removing the influence of other observable variables affecting fertility from the estimated impact of the implementation of the reform.

Table 4 reports our main regression results for all (columns (1) and (2)) as well as rural (columns (3) and (4)) and urban (columns (5) and (6)) enumeration areas aggregated at the district level. The policy variable of interest is the 1997 Amhara land reform, measured by a binary indicator equal to one if the reform was implemented in at least one of the peasant associations belonging to a particular district. All regressions include district fixed effects. We have 206 observations in the full aggregated data¹⁶, 198 in the rural aggregated data, and 202 in the urban aggregated data. The inference is based on Huber/White standard errors.

¹⁶Note that the administrative data has missing information on three districts. Hence six cluster-time observations are missing from the analysis.

We estimate that the TFR has decreased between 0.965 (without controls) and 0.988 (with controls) in the reform areas. All the estimates are highly significant at the 1 percent level. This effect is clearly driven by rural households, for which we estimate that the TFR has decreased between 1.224 and 1.202, depending on the specification. Again, the point estimates are highly significant at the 1 percent level. In turn, looking at the urban data, no significant effect for the TFR in the reform areas is found.

[Insert Table 4 about here]

We repeat the regression set from Table 4, replacing the binary policy indicator with the proportion of peasant associations per district implementing the reform as a measure of intensity of the reform. Doing so, we account for the fact that not all peasant associations may have fully implemented the reform. Table 5 has the results. We find the same pattern of results, with point estimates fairly close to those estimated with the binary policy indicator. For the full data, we estimate a reduction in the TFR between 0.793 and 0.822. Again, this effect is driven by the rural data, for which we estimate a reduction in the TFR between 1.045 and 1.032. All of these point estimates are significant at conventional levels. For the urban data, we do not find any significant relationship.

[Insert Table 5 about here]

The regression results show that there was a pronounced decline in the TFR in the reform districts as compared to the non-reform districts. This effect is driven by the rural data. For the following regressions, we use the same difference-in-differences specification as before but disaggregate the TFR into the ASFR used to construct it. We ran eight different regressions for each ASFR for each age group of women in their childbearing years (in 5-year intervals) for the full, rural and urban sample, separately. All regressions include district fixed effects and controls.

Table 6 has the results for the full sample. We find a significant reductions in the ASFRs for age groups between 20 and 24 years of age to 40 and 44 years of age. The strongest effect is found for women in the age groups 25–29 and 30–34. Again, the effect is clearly driven by the rural sample. Table 7 has the results. Across virtually all age groups we estimate a reduction in ASFRs for the reform districts. The effect is particularly pronounced for women in the most fertile age group (25–29), for which the ASFR is estimated to decrease by 64.97 per 1000 women, and for those 30–34, for which the ASFR is estimated to decrease by 59.41. Thus the reduction in the TFR for women in the reform districts shown above is driven by a reduction in the ASFRs in age groups where women are unlikely to be giving birth for the first time¹⁷, i.e., fertility seems to reduce at the intensive rather than the extensive margin. For the urban sample, we do not find a systematic relationship between the reform and the ASFRs across age groups. Table 8 shows the regressions from the urban sample.

¹⁷According to the Demographic and Health Survey (2000), more than 60 percent of Ethiopian women gave birth for the first time before age 25.

[Insert Table 6 about here]

[Insert Table 7 about here]

[Insert Table 8 about here]

4.4 Regression-based estimates of the impact on other outcomes

The available census data allows us to examine the impact of the land reform on two other outcomes: female labor market participation and a woman’s decision as to at what age to get married. For each outcome variable we ran one plus eight different regressions for a particular outcome variable for all women in their childbearing years as well as by age group of women in their childbearing years (in 5-year intervals). The regressions follow the same identification strategy as before. We focus on the rural sample as we have demonstrated that it is the main driver of our findings.

The impact on female labor market participation could be an indirect one. If women have fewer children, they may have more time to engage in labor market activities outside the household. The results are reported in Tables 9, 10 and 11 for self-employment, wage employment, and housework, respectively. We find some evidence for an increase in the proportion of self-employed women in the age groups between 20–25 and 45–49. However, the point estimates for all other age groups as well as for the full sample of women are not statistically significant even if they do have a positive sign. We do not find any evidence for an increase in the proportion of women participating in formal wage employment in response to the land reform. In line with these findings, our results do not show a decrease in the proportion of women reporting housework as their main occupation in the reform relative to the non-reform areas. Nonetheless, it is worth mentioning that the time trend is consistently positive for self-employment while it is consistently negative for housework, implying, for the whole of Amhara, a continual increase in female self-employment outside the house but a decrease in housework as the main activity over the two census periods.

[Insert Table 9 about here]

[Insert Table 10 about here]

[Insert Table 11 about here]

Furthermore, the land reform may have had a direct effect on the decision to get married. Table 12 has the results for the proportion of unmarried women.

[Insert Table 12 about here]

We find a considerable change in the proportion of unmarried women between reform and non-reform districts in the 10–14 and 15–19 age groups of women. For these age groups, it is estimated that the proportion of women who have never been married increased by 8.1 and 11.4 percent in reform areas. The effect is strong enough to be statistically significant in the regression for all women in their childbearing years. The effect is sizeable, but we can only speculate on the reasons. One interpretation would be that the decreasing benefits from childbearing through the reform may have resulted in delayed marriage and thus the postponement of childbearing (having children before marriage is stigmatized in rural areas and thus a rather rare occurrence).

4.5 Robustness checks

4.5.1 Spillovers

Our empirical approach rests on the assumption that there is no contamination of the non-reform districts through the reform districts, e.g., there should be no change in aggregate fertility behavior at the district level of unexposed districts because of influences from exposed districts. This may happen, for instance, through peer effects in reproductive decisions. Imitative behavior may influence the desired family size in such a way that it becomes a function of the average family sizes in relatives’ or friends’ families (Dasgupta, 1993). If family ties reach across district borders from areas affected by the reform into areas not affected by the reform, this may lead to spillovers in fertility outcomes. If this is the case, non-reform districts sharing a border with reform districts should systematically differ in their change in fertility outcomes from non-reform districts which do not share a border with reform districts. If there were spillovers, our impact estimates would be downward biased. We test for this with a placebo difference-in-difference specification in which we set a pseudo-dummy equal to one if a non-reform districts shares a border with a reform district and zero if a non-reform district does not share a border with a reform district. Table 13 has the results.

[Insert Table 13 about here]

We find no statistically significant change for either the full, the rural, or the urban sub-samples. We conclude that there are no systematic differences in the TFR between non-reform districts that share a border with a reform district and those without a shared border.

4.5.2 Using selection-on-observables to assess the bias from unobservables

Furthermore, we assume that there is no policy endogeneity, i.e., the selection of districts into the reform along unobservable district characteristics. While

we use fixed effects to average out time-constant unobserved heterogeneity at the district level and use the available data from the census to control for time varying factors at the district level, there may still be a bias in the estimates due to time varying unobservables at the district level correlated with the implementation of the reform and fertility rates. In this section, we assess the likelihood that the estimates are biased by time varying unobservables. We follow the idea that selection from observables can be used to assess the potential bias from unobservables (Altonji et al., 2005; Bellows and Miguel, 2008; Nunn, 2011), i.e., how much stronger does selection on unobservables need to be relative to the selection on observables, to explain away the estimated impact.

We consider two regressions per outcome variable: one with a full set of control variables and the other with a restricted set of control variables. The assessment on the selection of unobservables follows from a comparison of the estimated betas across regressions for the same outcomes, but with different sets of control variables. We then calculate a ratio with the estimated β_3^{full} from the model with a full set of controls, relative to the difference between the estimated β s for the restricted and the full model, $(\beta_3^{restrict} - \beta_3^{full})$, i.e., $\beta_3^{full} / (\beta_3^{restrict} - \beta_3^{full})$. The smaller (bigger) the difference between $\beta_3^{restrict}$ and β_3^{full} relative to β_3^{full} , the lower (higher) the effect of the selection-of-observables on the estimates. Put differently, a large (small) ratio implies a weak (strong) selection-on-unobservables. The ratio tells us how strong the selection-on-unobservables has to be to explain away the estimated reform impact.

We use two restricted sets of variables: one that consists of controls for the demographic composition of the district and another that includes the controls for the religious composition of the district. The full set of variables consists of the two restricted sets together. Irrespective of the control sets, all regressions include district fixed-effects. The estimated ratios for the TFR in the full, rural and urban samples are reported in Table 14.

[Insert Table 14 about here]

Across all comparisons of control sets, the selection on unobservables would need to be at least eleven times greater than the selection on observables to explain away the effect. These findings imply that the estimated impact of the implementation of the reform on fertility is unlikely to be driven by selection due to time varying unobservables.

5 Conclusions

We have studied the impact of a land reform on the fertility outcomes of households in rural Ethiopia using a natural experiment. Public policies and customs had created a situation where Ethiopian households could influence their usufruct rights to land via a demographic expansion of the family. In this paper we have evaluated the impact on fertility outcomes of the abolishment of these pronatal property rights. Matching aggregated census data with administrative

data on the reform, we compared total fertility rates for districts implementing with the rates for those not implementing the reform, both before and after the reform.

We have estimated a substantial effect of the land reform on fertility outcomes. For the full sample, we estimated a 0.99 reduction in the total fertility rate, i.e., a reduction of lifetime fertility by one child per woman, a result clearly driven by the rural rather than the urban sample: for the rural sample, the estimated reduction in lifetime fertility rate is about 1.2 children. Looking at age-specific fertility rates, which were used to construct the total fertility rate, we have found a clear reduction in fertility across virtually all age groups in the rural sample. The effect is particularly pronounced for women in the most fertile age groups, 25–29 and 30–34. Doing robustness checks, we concluded that our impact estimates are neither biased by spillovers nor by policy endogeneity.

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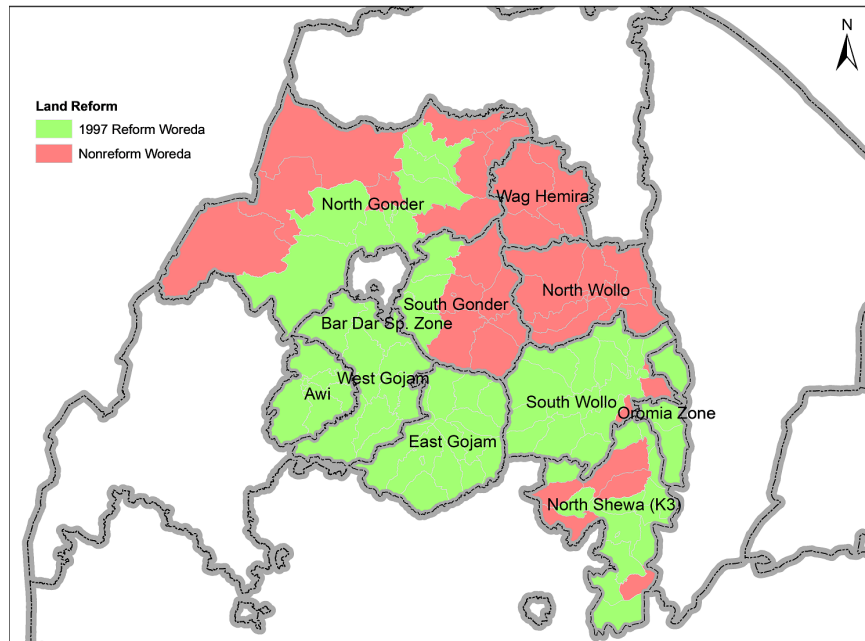
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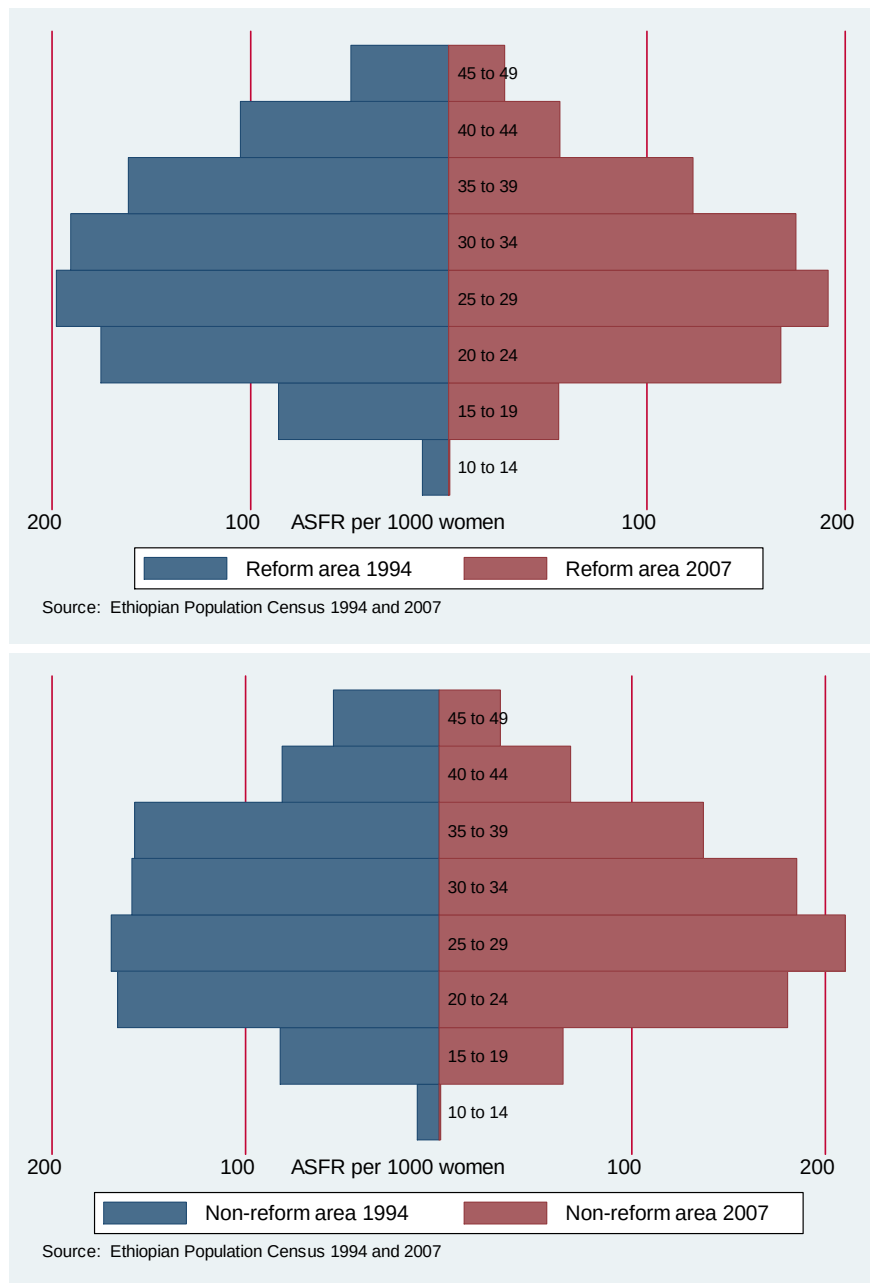
A Appendix

Figure 1: Reform and non-reform districts
Land Reform in the Amhara Region



Note: Reform districts are colored in green, non-reform districts are colored in red. Own map produced from administrative data.

Figure 2: Age-specific fertility rates by reform and non-reform areas



Note: Difference-in-differences representation of age-specific fertility rates by reform and non-reform districts.

Variable definitions

Variable name	Variable type	Description	Data source in census
Total fertility rate	Outcome	Constructed by summing age-specific fertility rates in a district multiplied by length of age groups	Q29, 2007 Q38, 1994
Age-specific fertility rate	Outcome	The number of live birth per 1000 women in a district in the past 12 months for women aged 10–49 grouped into 5-year intervals	Q29, 2007 Q38, 1994
Unmarried	Additional Outcome	Proportion of women in a district who have never been married	Q25, 2007 Q10, 1994
Self-employed	Additional Outcome	Proportion of women in a district who are self-employed as main occupation	Q24, 2007 Q30, 1994
Employed	Additional Outcome	Proportion of women in a district who are employed as main occupation	Q24, 2007 Q30, 1994
Housework	Additional Outcome	Proportion of women in a district who do housework as main occupation	Q24, 2007 Q30, 1994
Reform	Treatment	A binary indicator equal to one if at least one peasant association within a district implemented the reform, and zero otherwise	Administrative data
Reform intensity	Treatment	Proportion of peasant associations within a district implementing the reform	Administrative data
Population in age groups 12–17/18–65/>65	Controls	Total number of district population in age group 12–17/18–65/ older than 65	Q2, 2007 Q14, 1997
Orthodox/Animist/Muslim population	Controls	Total number of district population being Orthodox/Animist/ Muslim	Q7, 2007 Q19, 1997

Notes: Except for administrative data from the Environmental Protection, Land Administration and Use Authority, all data taken from 1994 and 2007 Population and Housing Census. Q refers to item in census questionnaire.

Table 1: Descriptive statistics

	(1) N	(2) Mean	(3) S.d.	(4) Min	(5) Max
<i>Outcomes: Fertility measures</i>					
Total fertility rate	212	4.37	1.16	0.93	9.02
Age-specific fertility rate (10 to 14)	212	6.66	11.42	0	61.49
Age-specific fertility rate (15 to 19)	212	70.16	36.36	0	195.12
Age-specific fertility rate (20 to 24)	212	169.20	51.87	11.90	297.62
Age-specific fertility rate (25 to 29)	212	191.23	54.75	31.25	375.00
Age-specific fertility rate (30 to 34)	212	177.05	62.04	0	347.83
Age-specific fertility rate (35 to 39)	212	142.05	59.38	21.28	333.33
Age-specific fertility rate (40 to 44)	212	78.37	48.54	0	280.00
Age-specific fertility rate (45 to 49)	212	39.06	38.88	0	333.33
<i>Outcomes: Marriage and labor market</i>					
Unmarried women (proportion of, 10 to 49)	212	0.34	0.09	0.09	0.61
Self-employed women (proportion of, 10 to 49)	212	0.19	0.11	0.05	0.51
Employed women (proportion of, 10 to 49)	212	0.03	0.04	0.00	0.23
Women in housework (proportion of, 10 to 49)	212	0.42	0.22	0.01	0.84
<i>Reform indicators</i>					
Reform	206	0.70	0.46	0	1.00
Reform intense	206	0.66	0.46	0	1.00
<i>Controls</i>					
Population in age group (log of, 12–17)	212	5.94	0.48	4.53	6.95
Population in age group (log of, 18–65)	212	7.10	0.46	5.59	8.05
Population in age group (log of, >65)	212	4.44	0.56	2.30	5.75
Orthodox population (log of)	212	7.40	1.08	3.33	8.81
Animist population (log of)	212	0.15	0.54	0	4.37
Muslim population (log of)	212	4.52	2.18	0	8.61
Amharan population (log of)	212	7.69	0.66	4.63	8.78

Notes: All variables, except for the reform indicators, are taken from the 1994 and 2007 Population and Housing Census. All variables are aggregated at the district level. Note that the proportion of women in the age group 10 to 49 being self-employed, employed or in housework as main occupation does not add up to one due to women still in school, in occupations classified as other or missing information.

Table 2: Comparison of reform and non-reform districts at baseline

	(1)	(2)	(3)	(4)	(5)	(6)
	Reform	Reform	Reform	Reform	Reform	Reform
Total fertility rate	0.0452 (0.0457)		0.0500 (0.0443)		0.0100 (0.0212)	
Age-specific fertility rate (10 to 14)		0.0024 (0.0037)		0.0032 (0.0039)		0.0022* (0.0013)
Age-specific fertility rate (15 to 19)		0.0002 (0.0015)		0.0002 (0.0014)		-0.0004 (0.0005)
Age-specific fertility rate (20 to 24)		-0.0013 (0.0012)		-0.0008 (0.0012)		0.0005 (0.0003)
Age-specific fertility rate (25 to 29)		0.0014 (0.0011)		0.0017 (0.0011)		-0.0002 (0.0003)
Age-specific fertility rate (30 to 34)		0.0013 (0.0009)		0.0006 (0.0009)		0.0000 (0.0003)
Age-specific fertility rate (35 to 39)		-0.0004 (0.0008)		-0.0004 (0.0008)		-0.0008* (0.0005)
Age-specific fertility rate (40 to 44)		0.0004 (0.0011)		0.0005 (0.0010)		0.0006** (0.0003)
Age-specific fertility rate (45 to 49)		-0.0007 (0.0011)		-0.0008 (0.0011)		-0.0004 (0.0003)
Self-employed women (proportion of, 10 to 49)	-2.4325 (1.6599)	-2.1552 (1.7221)	-2.1907 (1.6109)	-2.2071 (1.6764)	-0.0458 (0.4647)	-0.2876 (0.4613)
Employed women (proportion of, 10 to 49)	2.3905 (1.7268)	1.9768 (1.9096)	-3.2555 (4.4689)	-4.6445 (4.6646)	0.3970 (0.5992)	0.4390 (0.6021)
Women in housework (proportion of, 10 to 49)	-0.0768 (0.3980)	-0.1818 (0.4180)	0.1270 (0.3947)	0.0938 (0.4210)	0.5794 (0.5751)	0.6986 (0.6002)
Unmarried women (proportion of, 10 to 49)	-0.5943 (0.7609)	-0.4653 (0.8497)	-1.1086 (0.7525)	-0.7910 (0.8618)	0.4085 (0.4695)	0.5175 (0.4691)
Population in age group (log of, 12–17)	0.7956** (0.3091)	0.7915** (0.3212)	0.9348*** (0.3152)	0.8815*** (0.3302)	0.9082*** (0.2886)	0.9279*** (0.2891)
Population in age group (log of, 18–65)	-0.9307** (0.4257)	-0.9485** (0.4549)	-1.1841*** (0.4464)	-1.0849** (0.4764)	-1.1437*** (0.3769)	-1.2083*** (0.3769)
Population in age group (log of, >65)	0.3433** (0.1672)	0.3313* (0.1803)	0.4231** (0.1742)	0.3855** (0.1893)	0.3042** (0.1405)	0.3183** (0.1401)
Orthodox population (log of)	-0.0558 (0.0386)	-0.0523 (0.0393)	-0.0429 (0.0376)	-0.0389 (0.0396)	-0.0450 (0.0400)	-0.0236 (0.0410)
Animist population (log of)	0.1229 (0.0998)	0.1404 (0.1009)	0.1512 (0.0993)	0.1792* (0.1030)	0.1196 (0.0994)	0.0672 (0.1015)
Amharan population (log of)	0.0309 (0.1254)	0.0679 (0.1309)	-0.0344 (0.1254)	-0.0113 (0.1315)	0.0849 (0.1255)	0.0952 (0.1267)
Sample	full	full	rural	rural	urban	urban
Mean (s.d.) LHS variable	0.6990 (0.4609)	0.6990 (0.4609)	0.6893 (0.4650)	0.6893 (0.4650)	0.7087 (0.4565)	0.7087 (0.4565)
Observations	103	103	98	98	101	101
R-squared	0.1853	0.2429	0.2244	0.2670	0.1731	0.2808
F-test	1.8811	1.4969	2.2618	1.5986	1.6935	1.7790

Notes: Least squares regressions with conventional standard errors in parentheses. LHS variable is reform, a binary indicator equal to one if the land reform was implemented in a district and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 3: Comparison of reform and non-reform districts over time (full sample)

	Mean in 1994 (1)	Mean in 2007 (2)	Difference in means (2)-(1)	Difference in differences	Percentage change
Reform	4.8938 (1.2667) $N = 72$	3.9554 (0.8779) $N = 72$	-0.9384 (0.1816)		
No reform	4.3997 (0.8064) $N = 31$	4.4500 (1.1301) $N = 31$	0.0503 (0.2493)	-0.9887 (0.2043)	19.99

Notes: Columns (1) and (2) contain means for the total fertility rate by reform and non-reform districts and years. Column (3) shows the difference in means over time for reform and non-reform districts. Column (4) shows the difference in these differences. Standard deviations are given in parentheses. The percentage change is calculated by dividing the difference-in-differences by the sum of the 1994 reform mean and the 1994 to 2007 difference in means in non-reform districts (Milligan, 2005).

Table 4: Impact of reform on total fertility (full, rural, urban)

	(1) Total fertility rate	(2) Total fertility rate	(3) Total fertility rate	(4) Total fertility rate	(5) Total fertility rate	(6) Total fertility rate
After	0.0584 (0.2666)	0.0651 (0.3505)	0.3872 (0.2571)	0.2715 (0.3802)	-0.5645 (0.5590)	-0.2804 (0.6028)
After*	-1.0003*** (0.3116)	-1.0273*** (0.3455)	-1.2488*** (0.3108)	-1.2327*** (0.3645)	-0.8227 (0.6145)	-0.9468 (0.6218)
Reform		-0.0012 (0.9694)		0.2949 (1.0771)		-2.2678 (1.8294)
Population in age group (log of, 12–17)		-0.8834 (1.2565)		-0.6243 (1.3468)		-0.0053 (2.3951)
Population in age group (log of, 18–65)		0.4832 (0.7405)		0.5155 (0.8417)		0.4472 (0.9917)
Population in age group (log of, >65)		0.1164 (0.1075)		0.1803 (0.1178)		0.0422 (0.2119)
Orthodox population (log of)		0.4196** (0.1772)		0.3449* (0.1918)		0.3216 (0.3180)
Animist population (log of)		-0.2974 (0.7495)		-0.5434 (0.8337)		0.8102 (0.9085)
Anharan population (log of)						
Sample	full	full	rural	rural	urban	urban
Mean (s.d.) outcome variable	0.6990 (0.4598)	0.6990 (0.4598)	0.6990 (0.4597)	0.6990 (0.4597)	0.7038 (0.4576)	0.7038 (0.4576)
Observations	206	206	198	198	202	202
R-squared	0.2430	0.2927	0.2216	0.2796	0.1971	0.2130
F-test	17.0657	6.8228	13.2996	5.4642	15.2781	4.3817

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is total fertility rate, i.e., the expected number of children born by a woman over her lifetime. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 5: Impact of reform intensity on total fertility rate (full, rural, urban)

	(1) Total fertility rate	(2) Total fertility rate	(3) Total fertility rate	(4) Total fertility rate	(5) Total fertility rate	(6) Total fertility rate
After	-0.0899 (0.2889)	-0.1009 (0.3940)	0.2107 (0.2959)	0.0880 (0.4269)	-0.6415 (0.5324)	-0.3888 (0.5909)
After*	-0.8367** (0.3318)	-0.8685** (0.3798)	-1.0625*** (0.3433)	-1.0577** (0.4074)	-0.7503 (0.6072)	-0.8504 (0.6352)
Reform intensity		0.2462 (1.0002)		0.5714 (1.1096)		-2.1098 (1.8336)
Population in age group (log of, 12–17)		-0.9726 (1.2448)		-0.7396 (1.3341)		-0.0538 (2.3925)
Population in age group (log of, 18–65)		0.4559 (0.7464)		0.4703 (0.8505)		0.4367 (0.9886)
Population in age group (log of, >65)		0.1188 (0.1113)		0.1786 (0.1219)		0.0415 (0.2130)
Orthodox population (log of)		0.4136** (0.1666)		0.3356* (0.1768)		0.3177 (0.3152)
Animist population (log of)		-0.3658 (0.7382)		-0.6261 (0.8177)		0.7403 (0.9120)
Anharan population (log of)						
Sample	full	full	rural	rural	urban	urban
Mean (s.d.) outcome variable	0.6990 (0.4598)	0.6990 (0.4598)	0.6990 (0.4597)	0.6990 (0.4597)	0.7038 (0.4576)	0.7038 (0.4576)
Observations	206	206	198	198	202	202
R-squared	0.2186	0.2712	0.1883	0.2506	0.1937	0.2082
F-test	17.7523	7.6924	12.9289	5.6328	14.6402	4.2064

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is total fertility rate, i.e., the expected number of children born by a woman over her lifetime. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 6: Impact of reform on age-specific fertility rate (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Age-specific fertility rate (10 to 14)	Age-specific fertility rate (15 to 19)	Age-specific fertility rate (20 to 24)	Age-specific fertility rate (25 to 29)	Age-specific fertility rate (30 to 34)	Age-specific fertility rate (35 to 39)	Age-specific fertility rate (40 to 44)	Age-specific fertility rate (45 to 49)
After	-9.8722*** (2.7004)	-19.2980 (12.4606)	24.9706* (13.2018)	43.5183** (18.7599)	38.4118** (16.7362)	-13.5470 (18.6428)	-7.9584 (10.5561)	-43.2103** (21.1416)
After*	-2.9611 (2.9785)	-15.0950 (12.1120)	-28.8320** (14.2484)	-54.9822*** (19.3138)	-52.6379*** (17.6395)	-27.2101 (17.8758)	-34.9346*** (10.8804)	11.1994 (18.5314)
Reform	12.6122 (8.4225)	-10.0910 (32.2034)	28.1973 (48.5713)	-37.4116 (51.7725)	-37.4372 (58.8545)	42.4558 (60.7879)	-23.2999 (47.6731)	24.7327 (43.5474)
Population in age group (log of, 12–17)	6.5978 (10.3184)	54.6632 (33.1483)	-73.3694 (63.3193)	-11.5873 (76.4239)	-49.8639 (73.7420)	-11.4388 (57.0747)	-104.7054*** (35.1196)	13.0227 (42.3329)
Population in age group (log of, 18–65)	-13.2738** (6.0038)	-3.7720 (23.7512)	0.1887 (33.4292)	18.0678 (39.9518)	17.3387 (42.2126)	-31.7781 (35.4987)	57.1484** (26.9270)	52.7122 (32.2344)
Population in age group (log of, >65)	0.3836 (1.1768)	1.3617 (3.7719)	-2.2496 (4.6046)	10.8376* (5.7536)	7.9477 (9.8087)	-1.0095 (5.7206)	2.4091 (4.7514)	3.6091 (3.9106)
Orthodox population (log of)	-1.0531 (2.0550)	4.0435 (6.2148)	17.8607** (7.5819)	23.3937** (9.9298)	12.8610 (14.5471)	15.8383 (12.9339)	-1.2843 (8.7156)	12.2669 (7.6312)
Animist population (log of)	-5.9137 (3.9179)	-28.1480 (18.6745)	-5.1863 (29.9699)	9.1168 (36.4112)	17.1446 (61.3746)	-7.8498 (27.6172)	13.9694 (23.5109)	-52.6158** (23.6026)
Amhara population (log of)	Sample full	full	full	full	full	full	full	full
Mean (s.d.) outcome variable	6.6647 (11.425)	70.158 (36.364)	169.20 (51.871)	191.23 (54.748)	177.05 (62.042)	142.05 (59.382)	78.374 (48.539)	39.056 (38.879)
Observations	206	206	206	206	206	206	206	206
R-squared	0.4582	0.3071	0.1076	0.1494	0.0945	0.2019	0.4113	0.2573
F-test	10.8549	6.9400	2.1051	2.7657	1.8534	3.2304	7.5413	5.4060

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the age-specific fertility rate, i.e., the annual number of births per 1000 women in a specific age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 7: Impact of reform on age-specific fertility rate (rural sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Age-specific fertility rate (10 to 14)	Age-specific fertility rate (15 to 19)	Age-specific fertility rate (20 to 24)	Age-specific fertility rate (25 to 29)	Age-specific fertility rate (30 to 34)	Age-specific fertility rate (35 to 39)	Age-specific fertility rate (40 to 44)	Age-specific fertility rate (45 to 49)
After	-8.4395*** (2.6025)	-9.4114 (14.2969)	26.4093 (16.3786)	50.2109** (20.1438)	52.0566*** (16.5222)	-13.0570 (20.5798)	-10.4176 (10.7139)	-33.0504* (18.5722)
After*	-4.6089 (2.8501)	-22.3567* (13.3374)	-29.8026* (16.3355)	-64.9697*** (20.2257)	-60.0006*** (18.3218)	-32.0207 (19.5791)	-33.9401*** (11.8502)	1.1498 (16.6678)
Reform	14.4071 (8.8235)	-14.5838 (35.3106)	26.9705 (53.6384)	-10.2295 (56.2737)	-47.8298 (61.8442)	62.9348 (66.6821)	15.4496 (49.0905)	11.8666 (41.8120)
Population in age group (log of, 12–17)	6.6420 (11.0147)	71.7686** (35.3735)	-72.2661 (66.9144)	-7.5503 (83.2557)	-28.6253 (78.0502)	1.0835 (61.7619)	-135.9134*** (37.7337)	40.0065 (40.6415)
Population in age group (log of, 18–65)	-15.0081** (5.8435)	-7.0468 (28.3350)	28.5759 (38.4086)	40.3895 (44.9321)	1.8891 (44.3216)	-30.4071 (44.6247)	45.6164 (28.8320)	39.0860 (32.5977)
Orthodox	0.7140 (1.2506)	3.8337 (3.8675)	1.4103 (4.9417)	14.9881** (6.1499)	11.6709 (10.0590)	0.2569 (6.2770)	-0.3361 (5.3672)	3.5242 (4.2542)
population (log of)	-2.0708 (2.1759)	5.9241 (7.8927)	14.2618 (9.2609)	12.6460 (11.2959)	11.3581 (14.1381)	14.9420 (13.9908)	-1.7701 (11.6892)	13.6831* (8.0721)
Animist	-8.2455* (4.3458)	-23.2289 (19.5788)	-12.9384 (34.6366)	-11.5641 (42.5060)	8.6167 (65.5084)	-13.7576 (32.1197)	11.6794 (25.1262)	-59.2495** (26.7855)
population (log of)	Sample	rural	rural	rural	rural	rural	rural	rural
Mean (s.d.) outcome	6.4655	76.722	181.51	203.47	189.09	150.58	83.213	41.279
variable	(11.114)	(36.723)	(49.128)	(54.699)	(59.867)	(62.701)	(49.937)	(37.708)
Observations	198	198	198	198	198	198	198	198
R-squared	0.4886	0.2388	0.1061	0.2213	0.1125	0.1797	0.4134	0.2418
F-test	10.5345	3.9907	1.8268	3.6739	2.2035	2.5228	8.6332	5.1214

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the age-specific fertility rate, i.e., the annual number of births per 1000 women in a specific age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 8: Impact of reform on age-specific fertility rate (urban sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Age-specific fertility rate (10 to 14)	Age-specific fertility rate (15 to 19)	Age-specific fertility rate (20 to 24)	Age-specific fertility rate (25 to 29)	Age-specific fertility rate (30 to 34)	Age-specific fertility rate (35 to 39)	Age-specific fertility rate (40 to 44)	Age-specific fertility rate (45 to 49)
After	-5.7072 (4.7005)	-45.0736* (26.4971)	12.5902 (40.5609)	14.0118 (37.9560)	-30.7592 (37.5287)	21.4320 (38.1292)	40.7680 (32.8241)	-63.3401 (65.9322)
After*	-6.1327 (6.2786)	11.5107 (26.7274)	-63.6041 (41.1401)	-36.3273 (40.7529)	-11.3057 (39.7578)	-46.8859 (39.0698)	-79.2994* (41.6810)	42.6770 (57.6150)
Reform	6.8324 (16.1901)	-10.2361 (75.9642)	111.4051 (137.0856)	-342.4991** (144.7485)	28.0343 (128.4242)	-58.1191 (107.9666)	-200.8176 (167.7866)	11.8373 (119.9480)
Population in age group (log of, 12–17)	-20.8171 (22.7312)	27.0847 (80.0534)	258.8382 (200.4982)	187.5902 (123.4405)	-176.0041 (138.6033)	-36.7655 (106.8076)	76.8818 (143.2380)	-317.8674* (167.0551)
Population in age group (log of, 18–65)	-0.4295 (15.3443)	30.9142 (38.5134)	-240.7475*** (89.6070)	-101.6111 (67.1986)	71.9151 (94.4578)	39.4161 (53.3791)	99.9287 (75.2319)	190.0594** (89.3293)
Population in age group (log of, >65)	-2.7509 (6.1341)	-13.6587 (9.4889)	-8.1770 (11.3419)	10.4224 (11.3700)	1.5003 (14.1481)	1.4766 (16.5722)	-8.8574 (16.9763)	28.4790* (16.8451)
Orthodox population (log of)	-4.3035 (5.2627)	-6.9825 (13.4510)	37.5779 (33.8415)	91.1155*** (23.1356)	-30.5795 (23.7582)	1.5387 (17.1163)	-10.0015 (46.7959)	-14.0466 (13.8846)
Animist population (log of)	16.1407 (26.5170)	-34.3463 (43.5978)	-41.4950 (68.4956)	173.4731*** (48.2277)	128.2623 (77.5695)	8.2704 (47.1729)	-117.8452 (88.3963)	29.5811 (49.8870)
Amhara population (log of)	Sample	urban	urban	urban	urban	urban	urban	urban
Mean (s.d.) outcome variable	6.5861 (26.663)	35.088 (68.685)	118.34 (135.31)	127.05 (126.99)	108.12 (142.85)	65.229 (101.17)	50.224 (134.28)	31.733 (135.11)
Observations	202	202	202	202	202	202	202	202
R-squared	0.1187	0.1758	0.1289	0.1820	0.0771	0.0417	0.1270	0.0997
F-test	1.5893	2.1873	2.0377	4.3533	1.7697	1.3197	1.2907	1.1554

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the age-specific fertility rate, i.e., the annual number of births per 1000 women in a specific age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 9: Reform and share of self-employed women

	(1) Self- employ ment rate (10 to 49)	(2) Self- employ ment rate (10 to 14)	(3) Self- employ ment rate (15 to 19)	(4) Self- employ ment rate (20 to 24)	(5) Self- employ ment rate (25 to 29)	(6) Self- employ ment rate (30 to 34)	(7) Self- employ ment rate (35 to 39)	(8) Self- employ ment rate (40 to 44)	(9) Self- employ ment rate (45 to 49)
After	0.1453*** (0.0224)	0.0976*** (0.0164)	0.1319*** (0.0234)	0.1923*** (0.0308)	0.1674*** (0.0283)	0.1661*** (0.0338)	0.1920*** (0.0344)	0.1476*** (0.0321)	0.1396*** (0.0311)
After*	0.0330 (0.0223)	0.0061 (0.0162)	0.0234 (0.0232)	0.0294 (0.0303)	0.0591** (0.0293)	0.0361 (0.0332)	0.0298 (0.0334)	0.0386 (0.0321)	0.0676** (0.0312)
Reform	0.0889 (0.0674)	0.0581 (0.0552)	0.0885 (0.0649)	0.0798 (0.0983)	0.1565 (0.0948)	0.2563*** (0.0917)	0.0659 (0.1001)	0.1204 (0.1039)	0.1001 (0.1100)
Population in age group (log of, 12–17)	0.1890** (0.0732)	0.1413** (0.0681)	0.1959** (0.0771)	0.2512** (0.0970)	0.1883* (0.0983)	0.1636 (0.1151)	0.1530 (0.0932)	0.0984 (0.1196)	0.1374 (0.1154)
Population in age group (log of, 18–65)	-0.0057 (0.0461)	-0.0006 (0.0384)	0.0167 (0.0487)	-0.0145 (0.0617)	-0.0137 (0.0647)	-0.0239 (0.0701)	0.0304 (0.0731)	0.0296 (0.0680)	-0.0620 (0.0672)
Orthodox	0.0054 (0.0087)	0.0058 (0.0062)	0.0009 (0.0085)	0.0034 (0.0105)	0.0065 (0.0110)	0.0006 (0.0114)	0.0217 (0.0134)	0.0158 (0.0131)	0.0024 (0.0130)
population (log of)	-0.0141 (0.0220)	0.0050 (0.0147)	-0.0028 (0.0174)	-0.0184 (0.0297)	-0.0183 (0.0322)	-0.0358 (0.0250)	-0.0109 (0.0331)	-0.0217 (0.0271)	-0.0338 (0.0210)
Animist	-0.1795*** (0.0520)	-0.1378*** (0.0490)	-0.2036*** (0.0415)	-0.2007*** (0.0624)	-0.1883*** (0.0632)	-0.2749*** (0.0817)	-0.2417*** (0.0469)	-0.0916 (0.0900)	-0.0994 (0.0771)
Amhara									
population (log of)									
Sample	rural	rural	rural	rural	rural	rural	rural	rural	rural
Mean (s.d.) outcome variable	0.1982 (0.1214)	0.0751 (0.0816)	0.1339 (0.1116)	0.2010 (0.1516)	0.2415 (0.1567)	0.2661 (0.1537)	0.2896 (0.1583)	0.3222 (0.1490)	0.3430 (0.1498)
Observations	198	198	198	198	198	198	198	198	198
R-squared	0.8320	0.7590	0.8051	0.8128	0.8035	0.7855	0.7624	0.7370	0.7051
F-test	66.8649	40.7481	59.9328	56.1947	53.5110	46.2668	58.0638	35.1413	31.3559

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the proportion of self-employed women, for women in their childbearing years and by age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 10: Reform and share of employed women

	(1) Employ- ment rate (10 to 49)	(2) Employ- ment rate (10 to 14)	(3) Employ- ment rate (15 to 19)	(4) Employ- ment rate (20 to 24)	(5) Employ- ment rate (25 to 29)	(6) Employ- ment rate (30 to 34)	(7) Employ- ment rate (35 to 39)	(8) Employ- ment rate (40 to 44)	(9) Employ- ment rate (45 to 49)
After	0.0046 (0.0041)	-0.0096** (0.0039)	0.0046 (0.0092)	0.0259*** (0.0081)	0.0071 (0.0059)	0.0077 (0.0060)	0.0045 (0.0069)	0.0115 (0.0135)	0.0013 (0.0059)
After*	-0.0035 (0.0036)	0.0010 (0.0038)	-0.0080 (0.0079)	-0.0021 (0.0076)	0.0016 (0.0056)	-0.0092 (0.0062)	-0.0013 (0.0066)	-0.0179 (0.0117)	-0.0108* (0.0061)
Reform	0.0173** (0.0086)	0.0116 (0.0103)	0.0091 (0.0174)	0.0356 (0.0219)	0.0248* (0.0149)	0.0383** (0.0188)	0.0137 (0.0169)	-0.0048 (0.0276)	-0.0033 (0.0228)
Population in age group (log of, 12–17)	-0.0124 (0.0103)	0.0253** (0.0128)	0.0043 (0.0202)	-0.0544** (0.0242)	-0.0556** (0.0226)	-0.0447*** (0.0162)	-0.0191 (0.0219)	0.0351 (0.0285)	-0.0114 (0.0239)
Population in age group (log of, 18–65)	-0.0047 (0.0072)	-0.0071 (0.0067)	-0.0054 (0.0151)	0.0028 (0.0157)	0.0126 (0.0137)	-0.0077 (0.0096)	-0.0028 (0.0128)	-0.0304 (0.0269)	-0.0220* (0.0132)
Population in age group (log of, >65)	-0.0001 (0.0012)	-0.0022* (0.0012)	0.0009 (0.0018)	0.0011 (0.0025)	-0.0017 (0.0028)	-0.0015 (0.0024)	-0.0004 (0.0024)	0.0049* (0.0027)	0.0016 (0.0023)
Orthodox population (log of)	0.0011 (0.0013)	0.0028 (0.0019)	-0.0025 (0.0030)	0.0079* (0.0046)	-0.0010 (0.0042)	-0.0007 (0.0035)	-0.0029 (0.0033)	0.0006 (0.0038)	0.0025 (0.0028)
Animist population (log of)	-0.0040 (0.0049)	-0.0195*** (0.0070)	-0.0094 (0.0082)	0.0154 (0.0170)	-0.0012 (0.0085)	0.0098 (0.0099)	0.0075 (0.0093)	-0.0299* (0.0178)	0.0122 (0.0085)
Amhara population (log of)	Sample Mean (s.d.) outcome variable	rural 0.0177 (0.0111)	rural 0.0176 (0.0176)	rural 0.0299 (0.0248)	rural 0.0216 (0.0209)	rural 0.0173 (0.0192)	rural 0.0150 (0.0234)	rural 0.0151 (0.0238)	rural 0.0137 (0.0207)
Observations	198	198	198	198	198	198	198	198	198
R-squared	0.5896	0.4433	0.6614	0.2596	0.1190	0.1500	0.0973	0.1316	0.1367
F-test	19.5036	7.5463	25.9183	4.4238	2.2194	3.1340	1.3177	2.0925	2.0270

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the proportion of employed women, for women in their childbearing years and by age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 11: Reform and share of women in housework main occupation

	(1) House- work rate (10 to 49)	(2) House- work rate (10 to 14)	(3) House- work rate (15 to 19)	(4) House- work rate (20 to 24)	(5) House- work rate (25 to 29)	(6) House- work rate (30 to 34)	(7) House- work rate (35 to 39)	(8) House- work rate (40 to 44)	(9) House- work rate (45 to 49)
After	-0.3215*** (0.0459)	-0.3543*** (0.0402)	-0.3757*** (0.0514)	-0.3444*** (0.0491)	-0.3074*** (0.0464)	-0.2858*** (0.0627)	-0.2577*** (0.0518)	-0.2508*** (0.0677)	-0.2453*** (0.0386)
After*	-0.0014 (0.0454)	0.0127 (0.0415)	-0.0116 (0.0497)	0.0179 (0.0494)	-0.0097 (0.0480)	-0.0019 (0.0593)	-0.0282 (0.0511)	-0.0028 (0.0652)	-0.0139 (0.0409)
Reform									
Population in age	-0.1528 (0.1235)	-0.2057* (0.1090)	-0.1639 (0.1208)	-0.1711 (0.1609)	-0.0856 (0.1452)	-0.2799* (0.1437)	-0.1071 (0.1578)	-0.1348 (0.2044)	-0.0485 (0.1399)
group (log of, 12–17)	0.2774* (0.1517)	0.4493*** (0.1543)	0.1627 (0.1604)	0.1693 (0.1634)	0.2479 (0.1696)	0.3220* (0.1759)	0.3101* (0.1691)	0.3196 (0.2334)	0.1582 (0.1649)
Population in age	-0.2294** (0.0902)	-0.2329*** (0.0859)	-0.2453** (0.1011)	-0.1940** (0.0942)	-0.2495** (0.1084)	-0.1909* (0.1141)	-0.3172*** (0.1036)	-0.2381* (0.1302)	-0.1187 (0.0851)
group (log of, >65)	0.0118 (0.0139)	0.0068 (0.0125)	0.0130 (0.0134)	0.0230 (0.0170)	0.0120 (0.0160)	0.0128 (0.0169)	0.0092 (0.0173)	0.0077 (0.0176)	0.0009 (0.0154)
Orthodox									
population (log of)	0.0098 (0.0326)	0.0140 (0.0289)	0.0161 (0.0292)	-0.0207 (0.0430)	-0.0050 (0.0449)	0.0207 (0.0365)	0.0141 (0.0373)	0.0192 (0.0416)	0.0182 (0.0265)
Animist									
population (log of)	0.0982 (0.0739)	0.0360 (0.0827)	0.1642** (0.0686)	0.1250 (0.0755)	0.0909 (0.0772)	0.1414* (0.0802)	0.1447* (0.0752)	0.0534 (0.1141)	0.0542 (0.0938)
Amhara									
population (log of)									
Sample	rural	rural	rural	rural	rural	rural	rural l	rural	rural
Mean (s.d.) outcome	0.4734 (0.2168)	0.4269 (0.2219)	0.5191 (0.2498)	0.5211 (0.2337)	0.5052 (0.2301)	0.4879 (0.2210)	0.4542 (0.2160)	0.4214 (0.2072)	0.4048 (0.1883)
variable	198	198	198	198	198	198	198	198	198
Observations									
R-squared	0.8257	0.8541	0.8669	0.7853	0.7587	0.7317	0.7112	0.6240	0.7011
F-test	68.3073	83.1011	91.6994	48.6382	43.6878	45.3139	36.3673	24.5305	28.2777

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the proportion of women with housework as main occupation, for women in their childbearing years and by age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 12: Reform and share of women never married

	(1) Never married rate (10 to 49)	(2) Never married rate (10 to 14)	(3) Never married rate (15 to 19)	(4) Never married rate (20 to 24)	(5) Never married rate (25 to 29)	(6) Never married rate (30 to 34)	(7) Never married rate (35 to 39)	(8) Never married rate (40 to 44)	(9) Never married rate (45 to 49)
After	0.0340*** (0.0117)	0.0189 (0.0232)	0.0701*** (0.0265)	0.0055 (0.0166)	0.0034 (0.0080)	0.0096 (0.0125)	0.0073 (0.0076)	-0.0030 (0.0045)	0.0008 (0.0075)
After*	0.0317*** (0.0120)	0.0757*** (0.0223)	0.1083*** (0.0262)	0.0301* (0.0173)	0.0058 (0.0085)	0.0039 (0.0109)	0.0045 (0.0074)	0.0072 (0.0045)	0.0040 (0.0076)
Reform									
Population in age group (log of, 12–17)	0.0750* (0.0420)	-0.3017*** (0.0793)	0.1010 (0.0855)	0.1098* (0.0594)	-0.0111 (0.0318)	-0.0045 (0.0320)	-0.0095 (0.0206)	-0.0073 (0.0188)	-0.0202 (0.0211)
Population in age group (log of, 18–65)	-0.0696 (0.0499)	0.3146*** (0.0898)	-0.0755 (0.1087)	-0.1335 (0.0846)	-0.0124 (0.0289)	-0.0097 (0.0289)	-0.0139 (0.0213)	-0.0056 (0.0194)	0.0541* (0.0300)
Population in age group (log of, >65)	0.0312 (0.0320)	0.0802 (0.0601)	0.0046 (0.0640)	-0.0293 (0.0466)	0.0126 (0.0249)	-0.0152 (0.0237)	-0.0009 (0.0125)	0.0244** (0.0116)	-0.0083 (0.0125)
Orthodox	-0.0040 (0.0043)	-0.0089 (0.0092)	-0.0145 (0.0103)	-0.0090 (0.0062)	-0.0039 (0.0036)	0.0027 (0.0024)	-0.0007 (0.0021)	0.0031 (0.0021)	0.0010 (0.0022)
population (log of)	-0.0161** (0.0081)	-0.0387** (0.0167)	-0.0302 (0.0198)	-0.0170 (0.0112)	-0.0012 (0.0053)	-0.0037 (0.0040)	-0.0023 (0.0042)	-0.0012 (0.0025)	-0.0012 (0.0035)
Animist	0.0215 (0.0402)	-0.0172 (0.0606)	0.0964 (0.0885)	0.1146* (0.0637)	0.0427** (0.0208)	0.0319 (0.0195)	0.0122 (0.0139)	-0.0082 (0.0142)	0.0024 (0.0197)
Sample	rural	rural	rural	rural	rural	rural	rural l	rural	rural
Mean (s.d.) outcome variable	0.3133 (0.0769)	0.8657 (0.1246)	0.4919 (0.1825)	0.1556 (0.0878)	0.0521 (0.0407)	0.0278 (0.0312)	0.0172 (0.0209)	0.0127 (0.0170)	0.0109 (0.0194)
Observations	198	198	198	198	198	198	198	198	198
R-squared	0.5896	0.4433	0.6614	0.2596	0.1190	0.1500	0.0973	0.1316	0.1367
F-test	19.5036	7.5463	25.9183	4.4238	2.2194	3.1340	1.3177	2.0925	2.0270

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is the proportion of women never married, for women in their childbearing years and by age group. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 13: Comparing non-reform districts with and without a border with a reform district

	(1) Total fertility rate	(2) Total fertility rate	(3) Total fertility rate	(4) Total fertility rate	(5) Total fertility rate	(6) Total fertility rate
After	-0.0637 (0.4110)	-0.6725 (0.8168)	0.2776 (0.3742)	-1.1215 (0.6948)	-1.1737 (0.8770)	-0.9468 (1.2179)
After*	0.2537 (0.5349)	0.6007 (0.6574)	0.1732 (0.5104)	0.2814 (0.4901)	1.6583 (1.0923)	2.0223 (1.3967)
Reform		3.8149*		4.9515**		-5.6643 (4.4026)
Population in age group (log of, 12–17)		(2.2142)		(2.1534)		13.7318 (9.0119)
Population in age group (log of, 18–65)		0.0010		0.0308		1.7938 (3.2708)
Population in age group (log of, >65)		(3.8866)		(4.2768)		0.3475 (0.5146)
Orthodox		-0.4894		0.3119		0.4716 (1.2404)
population (log of)		(1.8738)		(1.4183)		-10.6304 (7.8424)
Animist		0.0495		0.3652		
population (log of)		(0.2921)		(0.2574)		
Amharan		0.4540		0.7420		
population (log of)		(0.5223)		(0.6697)		
population (log of)		-2.5158 (3.6092)		-1.7464 (4.7192)		
Sample	full	full	rural	rural	urban	urban
Mean (s.d.) outcome variable	4.4248 (0.9739)	4.4248 (0.9739)	4.6854 (0.8788)	4.6854 (0.8788)	2.7240 (2.0261)	2.7240 (2.0261)
Observations	62	66	58	58	60	60
R-squared	0.0072	0.1070	0.0638	0.3543	0.0922	0.2124
F-test	0.1659	0.6931	1.1185	2.0565	1.1725	0.5893

Notes: Within estimation with district-specific effects. Huber/White standard errors are given in parentheses. Outcome variable is total fertility rate, i.e., the expected number of children born by a woman over her lifetime. Significance level at 90(*), 95(**), 99(***) percent confidence.

Table 14: Selection on observables (robustness check)

Controls in restricted set	Controls in full set	Full sample	Rural sample	Urban sample
none	demographic	41.02	13.82	9.23
none	religious and ethnic	15.74	21.90	36.19
none	demographic, religious and ethnic	38.11	76.58	7.63
demographic	demographic, religious and ethnic	20.24	18.09	39.28
religious and ethnic	demographic, religious and ethnic	25.10	16.25	9.40

Notes: The table reports ratios of estimated coefficients from two regressions.

One includes the restricted set of controls, the other the unrestricted set of controls. All combinations of control sets are estimated for full, rural and urban.