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Land Reform and Farm-Household Income Inequality: The Case of Georgia

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Abstract

The income inequality implications of land reform are examined for the case of Georgia using regression-based inequality decomposition techniques. An egalitarian land redistribution is likely to equalize per-capita income among farm households, implying that continuing the land reform process in Georgia is likely to benefit poorer households, relatively speaking. However, land fragmentation was found to be disequalizing, and therefore land market developments that enable plot consolidation are not less important for inequality than the land redistribution itself. Both landholdings and farm assets have favorable inequality implications not only through farm income but also through non-farm income, implying that these productive assets increase the economic opportunities of rural households in the non-farm sector as well, perhaps by easing borrowing constraints.

Key words: income inequality; land reform; inequality decomposition.

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Introduction

Land reform is intuitively associated with lower income inequality. Throughout history, the mere essence of land reforms was to redistribute productive assets from the rich to the poor. However, land reforms often involve creating land markets, which allow more productive farmers to acquire land from less productive farmers. This could lead to higher landholdings inequality and income inequality. On top of that, allocating land to poor households in order to increase income is not necessarily sufficient. If those households are subject to binding constraints on farm credit, market access, knowledge and information, they may not be able to translate the newly allocated land into income, consumption and well-being. In this sense, even a perfectly egalitarian land redistribution could increase income inequality.

It is important to understand the inequality implications of land reforms, because these reforms are not a one-shot policy. Their implementation may take years, and they are not independent of other agricultural and rural policies that target farm household income, directly or indirectly (Deininger, 2003). The purpose of this paper is to study this issue in the context of Georgia. Georgia is suitable for this purpose because despite the fact that land individualization started as early as 1992, not long after independence, the implementation of the reform has been slow.[1] As of 1995, almost 80% of agricultural land was still state-owned (Lerman, 1998). A law enabling buying and selling of land was passed in 1996, but the administrative burden of land transactions remained high (Csaki and Lerman, 1997). Perhaps this is why the structure of agricultural holdings is still over-fragmented (Lerman, 2000).

[1] The "Land Privatization Decree" was passed in January 1992, the "Law on Agricultural Land Ownership" was passed on March 1996 and amended on May 1997, the "Law on Land Leasing" was passed on June 1996, and the "Law on Land Registration" was passed on November 1996 (Lerman et al., 2004).

The approach that is taken in this paper is regression-based inequality decomposition. This approach encompasses inequality decomposition by income sources and by population sub-groups (Cowell and Fiorio, 2009), and can be used to simulate the impact of changes in the distribution of landholdings as well as other characteristics of the land market on income inequality among the population of farm households (Arayama et al., 2006).

A description of these decomposition methods is provided in the next section. After that, some existing interpretations of these methods are critically discussed. This is followed by an empirical study using data collected by means of a farm-household survey in Georgia. The last section contains a summary and some concluding comments.

Inequality decomposition methods

Three interrelated inequality decomposition methods are presented in this section. The decomposition by income sources measures the impact on inequality of a uniform increase in income from a particular source, such as farm income, non-farm income, etc. The regression-based decomposition measures the impact on inequality of a uniform change in a variable that explains income, such as landholdings, education, etc. The third method is combining the first two methods. It is augmenting the regression-based decomposition method to the case where explanatory variables are allowed to have different impacts on income from different sources. We will now explain each of these methods in detail.

Decomposition by income sources

Shorrocks (1982) was the first to offer a unified approach to inequality decomposition by income sources. Earlier, Fei et al. (1978) and Pyatt et al. (1980), among others, offered a decomposition of the Gini index of inequality by income sources, but this happens to be a special case of Shorrocks' (1982) approach. Specifically, Shorrocks (1982) suggested focusing on inequality measures that can be written as a weighted sum of incomes:

(1) $I(\mathbf{y}) = \Sigma_i a_i(\mathbf{y}) y_i$,

where a_i are the weights, y_i is the income of household i, and $\mathbf{y}$ is the vector of household incomes. These include as special cases the Gini index as well as the class of Generalized Entropy indices. If income is observed as the sum of incomes from k different sources, $y_i = \Sigma_k y_i^k$, the inequality measure (1) can be written as the sum of source-specific components S^k:

(2) $I(\mathbf{y}) = \Sigma_i a_i(\mathbf{y}) \Sigma_k y_i^k = \Sigma_k [\Sigma_i a_i(\mathbf{y}) y_i^k] \equiv \Sigma_k S^k$.

Dividing (2) by (1), one implicitly obtains the "proportional contribution" of income source k to overall inequality as:

(3) $s^k = \Sigma_i a_i(\mathbf{y}) y_i^k / \Sigma_i a_i(\mathbf{y}) y_i$,

so that $\Sigma_k s^k = 1$.

Shorrocks (1982) noted that the decomposition procedure (3) yields an infinite number of potential decomposition rules for each inequality index, because in principle, the weights $a_i(\mathbf{y})$ can be chosen in numerous ways, so that the proportional contribution assigned to any income source can be made to take any value between minus and plus infinity. In particular, Shorrocks (1983) used three decomposition rules that are commonly used in empirical applications, and are based on the following measures of inequality: (a) the Gini index, with $a_i(\mathbf{y})=2(i-(n+1)/2)/(\mu n^2)$, where i is the index of observation after sorting the observations from lowest to highest income, n is the number of observations and μ is mean income; (b) the squared coefficient of variation with $a_i(\mathbf{y})=(y_i-\mu)/(n\mu^2)$; and (c) Theil's T index with $a_i(\mathbf{y})=\ln(y_i/\mu)/n/\mu$. Indeed, several authors (Morduch and Sicular, 2002; Paul, 2004; Kimhi, 2007) reported that the decomposition results vary quite a bit across these different decomposition rules.

Podder and Chatterjee (2002) claimed that this is not surprising because it is not at all clear what the decomposition results measure and whether results of different decomposition rules measure the same quantities. Alternatively, they suggest focusing on the inequality elasticities of income sources, which measure the percentage change in inequality resulting from a uniform percentage increase in income from each source, holding the other sources of income fixed. Shorrocks (1983) noted, in this regard, that comparing s^k and α^k, the share of income from source k in total income, is useful for knowing whether the k^{th} income source is equalizing or disequalizing. More formally, Lerman and Yitzhaki (1985) showed that the elasticity of the Gini inequality index with respect a uniform percentage change in $\mathbf{y}^k$ is s^k-α^k, which supports the logic of Shorrocks (1983). Paul (2004) derived equivalent elasticities for other decomposition rules. These "marginal effects" are more informative than the proportional contributions to inequality s^k when one wants to know whether a particular income source is equalizing or disequalizing (Podder, 1993).

Regression-based decomposition

Morduch and Sicular (2002) and Fields (2003) extended the decomposition procedure (3) to a regression-based inequality decomposition by determinants of income. They suggested expressing household income (or log-income) as $\mathbf{y}=\mathbf{X}\boldsymbol{\beta}+\boldsymbol{\varepsilon}$, where $\mathbf{X}$ is a $(n\text{x}k)$ matrix of explanatory variables (including a constant), $\boldsymbol{\beta}$ is a $(k\text{x}1)$ vector of coefficients, and $\boldsymbol{\varepsilon}$ is a $(n\text{x}1)$ vector of random error terms. Given a vector of consistently estimated coefficients $\mathbf{b}$, income can be expressed as a sum of predicted income and a prediction error as:

(4) $$\mathbf{y} = \mathbf{X}\mathbf{b}+\mathbf{e}.$$

Substituting (4) into (1) and dividing by (1), the share of inequality attributed to explanatory variable m is obtained as $s^m = b_m\Sigma_i a_i(\mathbf{y})x_i^m/\Sigma_i a_i(\mathbf{y})y_i$.[2] Wan (2004) showed that this method can also be applied to nonlinear income-generating equations. Using the regression coefficients, it is possible to compute the "income shares" of the explanatory variables as $\alpha^m = b_m\Sigma_i x_i^m/\Sigma_i y_i$, and evaluate the marginal effect on the Gini index of inequality of a uniform increase in an explanatory variable m, as in Lerman

[2] Morduch and Sicular (2002) suggested a simple procedure to compute standard errors of s^m, but the procedure turns out to be incorrect. They claimed that since the components are linear in the regression coefficients, i.e. $s^m=b_m\Sigma_i a_i(\mathbf{y})x_i^m/I(\mathbf{y})$, standard errors can be computed as $\sigma(s^m)= \sigma(b_m)\Sigma_i a_i(\mathbf{y})x_i^m/I(\mathbf{y})$. This ignores the fact that $\Sigma_i a_i(\mathbf{y})x_i^m/I(\mathbf{y})$ is itself a random variable that is not independent of b_m (through the dependence of b_m on $\mathbf{y}$). Hence the true standard errors cannot be computed in such a simple way (which, in fact, results in t-statistics that are identical to those of the regression coefficients). As suggested by Cowell and Fiorio (2009), bootstrapping is used to obtain standard errors in the empirical application below.

and Yitzhaki (1985), by computing s^m-α^m. Marginal effects for other decomposition rules can be computed numerically.

Source-specific regression-based decomposition

Because certain explanatory variables are associated with specific income sources (e.g., land and capital are associated with farm income while education is associated with non-farm income), estimating an overall income-generating equation as in (4) may be too restrictive. In addition, it might be useful to know to what extent given explanatory variables affect income inequality through each of the income sources. Arayama et al. (2006) specify the k^{th} source-specific income-generating function as $\mathbf{y}_k = \mathbf{X}\boldsymbol{\beta}_k+\boldsymbol{\varepsilon}_k$, where $\boldsymbol{\beta}_k$ could include zero elements corresponding to explanatory variables that do not affect the k'th source of income. Since $\mathbf{y} = \Sigma_k\mathbf{y}_k$, it can also be written as $\mathbf{y} = \mathbf{X}\Sigma_k\boldsymbol{\beta}_k + \Sigma_k\boldsymbol{\varepsilon}_k$. Using consistent estimates $\mathbf{b}_k$ of $\boldsymbol{\beta}_k$ and substituting into (1), the proportional contribution of explanatory variable m to overall income inequality can be derived as:

$$(5) \qquad s^m = (\Sigma_k b_{km})\Sigma_i a_i(\mathbf{y})x_i^m/I(\mathbf{y}) = \Sigma_k[b_{km}\Sigma_i a_i(\mathbf{y})x_i^m/I(\mathbf{y})] = \Sigma_k s^{mk}.$$

where s^{mk} is the proportional contribution of explanatory variable m to overall income inequality that operates through income source k.

Data

The data were obtained from a farm-household survey conducted in 2003 in four districts surrounding the capital city of Tbilisi: Dusheti, Mtskheta, Sagarejo, and Gardabani. The survey included a total of 2,520 individual farms. In each district, ten villages (Sakrebulos) were selected randomly, and sixty-three households were surveyed in each village using the "random walking" procedure.[3] The survey questionnaires were designed to collect information about the demographic profile of the household, household income and its sources, land resources and other farm assets, farming activity and related activities (finances, investments), and social aspects (Gogodze et al. 2008).

Income was divided into three main components. Farm income was the largest component, consisting of almost 70% of total income on average. Non-farm income was the second largest component, about a quarter of total income. Other income (5.5%) consisted of social assistance payments and private remittances. The computation of inequality and its decomposition was performed over per-capita annual income, which had a sample mean of 1,226 Lari, equivalent to US$560 at the time of the survey.

Results

Table 1 shows the results of inequality decomposition by income sources, based on (3). It is easy to see that farm income, the main single source of income of these households, contributed to inequality proportionately more than its income share. On the other hand, non-farm income contributed to inequality less than its income share, and the same is true for other income. These results are qualitatively consistent across the three decomposition rules, although the numbers vary. According to the intuition of Shorrocks (1983), this implies that non-farm income and other income are equalizing sources of income, while farm income is disequalizing. This can be

[3] In principle, the first house in the village is chosen randomly; the interviewer then walks to the end of the street, turns right or left at a toss of a coin, and picks the first house on that street.

verified by computing the elasticity of inequality with respect to uniform increases in each of the income sources, using the Lerman and Yitzhaki (1985) formula in the case of the Gini inequality index, and using numerical derivatives for the other two inequality indices.[4] The results are in the bottom part of table 1. The three inequality indices give qualitatively similar results, confirming the intuitive prediction that a uniform increase in farm income increases inequality while a uniform increase in either non-farm income or other income reduces inequality.

The literature shows mixed results with respect to the equalizing role of non-farm income (Reardon et al., 2000). On one hand, it may improve the income of the poor who need it the most. On the other hand, it may benefit those with better labor market qualifications and richer households, especially when there are barriers to entry into the non-farm sector. Off-farm income was found to be an equalizing income source in the U.S. (see El-Osta et al., 1995, and references therein), Egypt (Adams, 2001), Taiwan (Chinn, 1979), and the Philippines (Leones and Feldman, 1998). It was found to be disequalizing in Vietnam (Adger, 1999; Gallup, 2004) and Ecuador (Elbers and Lanjouw, 2001). For China, Kung and Lee (2001) found that off-farm income increased inequality, while Zhu and Luo (2006) found the contrary. de Janvri and Sadoulet (2001) found that in Mexico, non-farm income as a whole reduced household income inequality, but non-agricultural wages in particular increased inequality. Adams (1994) found that in Pakistan, non-farm income as a whole was equalizing, but this was mainly due to the impact of unskilled wages, while government wages were disequalizing. Canagarajah et al. (2001) found that in Ghana and Uganda, non-farm self-employment income was much more disequalizing than non-farm wages. Estudillo et al. (2001) found that non-farm income changed from an

[4] The analytical elasticities of Paul (2004) came out different from the numerical elasticities, and we have more confidence in the numerical elasticities.

equalizing to a disequalizing source as it became a major income source in Philippine rice villages. Overall, the evidence varies widely across countries and years.

We now move to the regression-based decomposition procedure. The variables used to explain per-capita income and their descriptive statistics are presented in table 2. Age of the head of household and its squared value are included to account for life-cycle effects. Years of schooling are also included, as well as family size. The economic resources of the household are represented by landholdings and the value of fixed farm assets (both expressed in log-form, to reduce the impact of outliers), the number of plots of land (to account for land fragmentation effects), and a dummy variable for households who raise livestock. Livestock is potentially an important determinant of farm income, because it is responsible for about two thirds of farm income, on average (Gogodze et al, 2008). A dummy variable for Gardabani region is also included. Other regional dummies, as well as several other explanatory variables, did not come out significant in preliminary regressions and were excluded, without significant changes in the results.

Table 3 shows the coefficients of the per-capita income generating equation (4) and the proportional contributions to inequality of the explanatory variables. All regression coefficients are statistically significant and most of them have the expected sign. Age has a nonlinear effect, first negative and subsequently positive, on income. This is not a common result; perhaps income from sources other than labor is increasing with the age of the head of household, or labor income of young household members is a dominant source of income. Other coefficients have the expected signs. Schooling has a positive effect, while family size has a negative effect. Per-capita income is increasing with landholdings, but decreasing with the number of plots, indicating that land fragmentation is costly at least in terms of expected income.

Income is higher in households that raise livestock, and is increasing with the value of farm assets. Income is higher in Gardabani region than in the neighboring regions.

Turning to the decomposition results, we note that that Gini and squared CV decomposition rules give qualitatively similar results, while the Theil's T decomposition rule give very different results. This is in contrast with earlier results of Shorrocks (1983) and Morduch and Sicular (2002). For example, the number of plots has a negative inequality contribution under the Gini and squared CV decomposition rule and a positive inequality contribution under Theil's T decomposition rule. On the other hand, the livestock dummy and the value of farm assets have positive inequality contributions under the Gini and squared CV decomposition rules and negative inequality contributions under Theil's T decomposition rule. The regression residuals contribute 65% of income inequality under the Gini decomposition rule and 79% of inequality under the squared CV decomposition rule. The decomposition results of Theil's T decomposition rule are difficult to explain: the intercept, as expected according to Morduch and Sicular (2002), has a negative inequality contribution, but its magnitude is suspiciously large. The regression residuals, on the other hand, have a positive contribution of more than 100% of the total. Finally, under both Gini and squared CV decomposition rules, landholdings seem to have the largest proportional contribution to inequality among the explanatory variables. This is consistent with the fact that landholding is particularly important to farm income and that farm income was found to be an inequality-increasing income source.

It can be claimed that the decomposition results are not too informative because the explanatory variables account for only 21% to 35% of income inequality. However, this is similar to claiming that wage regressions are useless because age and schooling explain only 10% to 20% of wages. In fact, the results are useful for showing how the explained part of income inequality is attributed to the different explanatory variables. The empirical results of Morduch and Sicular (2002) showed a better fit. Cowell and Jenkins (1995) also found that explanatory variables explained a relatively small fraction of income inequality, using two different methodologies.

We now move to the derivation of marginal effects. Marginal effects of explanatory variables are not always interpretable, though, and the logic behind this is similar to the case of marginal effects in nonlinear econometric models (i.e. probit). An obvious example is the case of age and age squared: one cannot increase one without increasing the other, hence marginal effects of age alone or age squared alone are meaningless, and one can only use a simulation exercise in which both age and age squared are increased. Another case involves dummy explanatory variables such as livestock and Gardabani region. These variables only take the values of zero and one, and hence one may claim that marginal effects based on percentage changes in their values are meaningless. However, a one-percent increase in the value of a dummy explanatory variable in an income equation is equivalent to increasing the fraction of the population in the selected group (for which the value of the dummy variable is one) by one percent without changing the average values of the other explanatory variables in that group; hence the conventional marginal effects are still useful in this case. Finally, the meaning of percentage changes in integer explanatory variables such as schooling, family size, and number of plots could also be challenged. The alternative is to use simulations and add one unit to each variable at a time. However, for the case of inequality decompositions this is not advised, because adding a unit to an explanatory variable changes not only the size of the variable but also its distribution (in most cases it would reduce the variance), and hence the marginal effects derived in this way are not comparable to the marginal effects of continuous explanatory variables. We therefore use percentage changes in these variables to obtain marginal effects.

Therefore, the conventional marginal effects are derived for the present empirical application, with the exception of the age variable.[5] The results are in table 4. The marginal effects are mostly consistent in signs and levels of significance across the three inequality measures, although the absolute sizes are different. In fact, the marginal effects of the squared CV and Theil's T inequality indices are very similar, while the marginal effects of the Gini index are about half of those. In particular, the results imply that uniform increases in schooling, landholding, raising livestock or farm assets reduce income inequality, while uniform increases in family size or number of plots increase inequality. The effect of a uniform increase in age on inequality is not statistically significant.

The largest (in absolute value) marginal effects are related to family size and landholding. While family size cannot be altered dramatically by policy measures, at least not in the short run, landholding is one of the variables affected by the on-going land reform, and hence is of particular interest for this paper. The practical interpretation of the negative marginal effect is that an egalitarian (in percentage terms) allocation of land from the state to farm households will reduce income inequality among farm households. Moreover, a perfectly egalitarian (in absolute terms) allocation of land will have an even stronger negative effect on inequality, because it will also reduce landholdings inequality. This last corollary stems from the positive proportional contribution of landholdings to inequality (table 3).

[5] We have also computed marginal effects of adding one unit to the integer explanatory variables, and the results were of course quantitatively different, but did not change sign or lose significance.

Another variable that may be related to the land reform is the number of plots. The positive marginal effect of the number of plots implies that, holding everything else equal, plot consolidation will reduce income inequality among farm households. It is not clear whether farmland consolidation may be practically targeted in the context of the ongoing land reform process in Georgia, but the adverse inequality implications of land fragmentation should definitely be taken into consideration.

Some other marginal effects also have interesting policy implications. The negative marginal effect of schooling implies that enhancing schooling of the rural population in Georgia is likely to have an equalizing effect on income. The same is true for farm assets. Increasing farm assets through, for example, extension of credit to small farmers, is also likely to reduce income inequality. It is interesting to note that the equalizing effects of landholdings and farm assets hold despite the fact that landholdings and farm assets operate mostly through farm income, which is inequality-increasing. This demonstrates the usefulness and the complementary nature of inequality decompositions by income sources and by income determinants.

At this point we move to the third and final decomposition exercise, in which we differentiate the proportional contributions and marginal effects of explanatory variables by income sources. The first step is to estimate source-specific income generating equations. The regression results are in table 5. It is evident that the coefficients vary considerably by income source. Age and schooling affect non-farm and other income significantly, but do not affect farm income significantly. On the other hand, the number of plots and the livestock dummy have significant effects only on farm income. Interestingly, land and farm assets have significant effects on non-farm income as well as on farm income, although their effects on non-farm income are quantitatively smaller. This implies that farm assets can be utilized to generate non-farm income, perhaps as collateral to non-farm business loans. Both schooling and farm assets have negative effects on other income, perhaps reflecting negative wealth and income effects on transfers.

The source-specific proportional contributions to inequality are presented in table 6. The bottom line shows that almost 90% of the contributions of the explanatory variables to income inequality come through farm income. Recalling that the proportional contribution of farm income to inequality is only around 75%, this implies that the contribution of other income sources operate mostly through the unexplained regression residual. Therefore, when we discuss the sensitivity of income inequality to changes in the distributions of explanatory variables, we should focus on farm income considerations.

The source-specific marginal effects of the explanatory variables can be seen in table 7. As expected from the discussion above, most of the effects come through farm income, with one exception which is schooling. The equalizing effect of schooling comes mostly from non-farm income. Schooling also has a negative marginal effect through farm income, but it is not statistically significant. The marginal effect of schooling through other income is positive and significant, but it is small in absolute value compared with the equalizing effects. The marginal effect of age through other income is also statistically significant, but negative. Altogether, the income source-specific inequality decomposition results do not alter our earlier conclusions about the effects of explanatory variables, and landholdings in particular, on income inequality.

It is interesting to examine the possible changes in the landholdings distribution that are needed to increase income inequality. In table 8, we report the results of several simulation exercises. We simulate farm income and non-farm income following particular changes in the landholdings distribution, using the source-specific regression results in table 5. We assume that the effect of landholdings on other income is zero, given the small and insignificant coefficient of landholdings in the other income regression. The first row reports the impact of a one percent uniform increase in landholdings, and therefore the results are identical to the marginal effects of landholdings in table 7. In the second row, we also add one percent of the square of landholdings, and the effect on income inequality remains negative and becomes larger in absolute value. Adding a one percent of landholdings raised to the third degree (third row) increases inequality through farm income but still decreases inequality through non-farm income, making the total effect on inequality close to zero. The remaining rows report some sensitivity results around the changes made in the third row. The conclusion is that it takes a fairly disequalizing change in the landholdings distribution to increase per-capita household income.

Summary and conclusions

This paper studied the income inequality implications of land reform in Georgia. Using regression-based inequality decomposition techniques, the paper showed that an egalitarian land redistribution is likely to equalize per-capita income among farm households. Even a moderately-disequalizing land redistribution does not change this result. This implies that continuing the land reform process in Georgia is likely to benefit poorer households, relatively speaking. However, it should be noted that land fragmentation has an opposite effect on income inequality. Therefore, the favorable inequality implications of land redistribution can be offset unless land plots can be consolidated. This requires advances not only in land privatization but also in land registration and the overall performance of the land market.

It was also found that a uniform increase in landholdings or in farm assets is expected to reduce income inequality not only through farm income but also through non-farm income (although to a much lower extent), implying that these productive assets increase the economic opportunities of rural households in the non-farm sector as well, perhaps by easing borrowing constraints. A uniform increase in schooling is also expected to reduce income inequality, but in this case most of the effect comes through non-farm income.

It would be interesting to study, in further research, the inequality implications of land reforms in other transition countries as well, especially if longitudinal data can be used for this purpose.

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Table 1. Income Inequality Decompositions for Farm Households in Georgia*

	Income share (%)	Gini	Squared CV	Theil's T
Inequality index		0.5189	2.5880	0.5729
Proportional contributions				
Farm income	69.83	0.7658 (45.06)	0.8685 (38.71)	0.8832 (31.81)
Non-farm income	23.56	0.1756 (14.81)	0.1018 (6.06)	0.0790 (4.12)
Other income	6.61	0.0585 (7.91)	0.0297 (3.36)	0.0378 (3.09)
Total	100.00	1.0000	1.0000	1.0000
Inequality changes due to a one percent uniform increase in income (%)				
Farm income		0.0683 (8.82)	0.3407 (10.64)	0.1850 (9.53)
Non-farm income		-0.0605 (-10.81)	-0.2675 (-10.30)	-0.1563 (-11.15)
Other income		-0.0078 (-2.18)	-0.0731 (-6.13)	-0.0284 (-3.26)

* Bootstrapped t-values (200 repetitions) in parentheses.

Table 2. Explanatory Variables and Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Age	45.165	11.422	20	89
Schooling (years)	11.735	2.658	0	16
Family size	3.9377	1.5435	0	12
ln(land)	-0.428	1.0158	-4.6	5.95
Number of plots	2.4266	1.299	0	8
Livestock (dummy)	0.8024	0.3983	0	1
ln(farm assets)	8.0428	3.3806	0	13.6
Gardabani region (dummy)	0.25	0.4331	0	1

Table 3. Regression-Based Inequality Decomposition Results

Variable	Regression Coefficient	Inequality Contribution		
		Gini	Squared CV	Theil's T
Intercept	2134.6	0.0000	0.0000	-1.4710
	(4.02)**	(0.08)	(0.45)	(-3.74)**
Age	-69.683	-0.1613	-0.0318	1.9430
	(-3.37)**	(-2.98)**	(-2.23)*	(3.18)**
Age squared	0.742	0.1702	0.0366	-0.8696
	(3.55)**	(3.02)**	(2.15)*	(-3.37)**
Schooling	31.256	0.0019	0.0027	-0.2504
	(2.16)*	(1.04)	(1.80)	(-2.65)**
Family size	-187.8	0.0543	0.0110	0.5830
	(-6.90)**	(4.18)**	(1.73)	(5.08)**
ln(land)	773.1	0.2203	0.1163	0.5650
	(17.52)**	(6.20)**	(4.67)**	(7.17)**
Number of plots	-96.82	-0.0202	-0.0036	0.1377
	(-2.66)**	(-2.10)*	(-1.99)*	(2.04)*
Livestock	687.5	0.0734	0.0168	-0.2795
	(7.06)**	(6.04)**	(4.64)**	(-8.53)**
ln(farm assets)	85.36	0.0161	0.0114	-0.4396
	(14.01)**	(2.43)*	(3.26)**	(-8.32)**
Gardabani region	1291.6	-0.0054	0.0472	-0.2001
	(4.89)**	(-0.45)	(5.15)**	(-9.75)**
Residual		0.6507	0.7937	1.2820
		(22.45)**	(28.43)**	(23.36)**

Notes:
2,451 "clean" observations.
t-values in parentheses (asymptotic for the regression coefficients, bootstrapped for the inequality contributions).
R^2=20.6%.
* significant at 5%.
** significant at 1%.

Table 4. Marginal Effects of Explanatory Variables on Inequality

Variable	Gini	Squared CV	Theil's T
Age	0.1196	-0.0476	0.1374
	(0.87)	(-0.20)	a
Schooling	-0.2960	-0.5898	-0.5462
	(-3.06)**	(-3.06)**	(-3.06)**
Family size	0.6635	1.2430	b
	(5.83)**	(5.71)**	
Land	-0.6221	-1.2400	-1.1430
	(-7.51)**	(-7.53)**	(-8.02)**
Number of plots	0.1732	0.3797	0.3319
	(2.09)*	(2.09)*	(2.11)*
Livestock	-0.3764	-0.8648	-0.7256
	(-10.4)**	(-10.3)**	(-10.3)**
Farm assets	-0.0691	-0.1381	-0.1275
	(-6.60)**	(-6.61)**	(-6.94)**
Gardabani region	-0.2688	-0.4367	-0.4593
	(-10.2)**	(-10.0)**	(-11.6)**

Notes:

Bootstrapped t-values (200 repetitions) in parentheses.

a standard errors of marginal effects of Theil's T inequality index with respect to age could not be computed because for some observations the simulations resulted in negative incomes.

b marginal effects of Theil's T inequality index with respect to family size could not be computed because for some observations the simulations resulted in negative incomes.

* Significant at 5%.

** Significant at 1%.

Table 5. Source-Specific Income Generating Regression Results

Variable	Farm Income	Non-Farm Income	Other Income
Age	-34.9151	-19.5480	-16.1770
	(-1.85)	(-3.99)**	(-6.05)**
Age squared	0.3423	0.2015	0.2094
	(1.80)	(4.08)**	(7.75)**
Schooling	16.7927	20.0930	-5.4258
	(1.27)	(5.86)**	(-2.90)**
Family size	-151.7800	-28.0464	-8.1237
	(-6.11)**	(-4.33)**	(-2.31)*
Land	731.8073	50.1944	-8.8726
	(18.18)**	(4.79)**	(-1.55)
Number of plots	-89.5393	-11.1081	3.3762
	(-2.70)**	(-1.28)	(0.72)
Livestock	668.7049	11.6987	3.1931
	(7.53)**	(0.51)	(0.25)
Farm assets	76.1672	13.5303	-4.2671
	(7.79)**	(5.33)**	(-3.08)**
Gardabani region	1105.9020	110.5631	71.3860
	(13.15)**	(5.06)**	(5.98)**
Intercept	1187.8560	513.1137	455.5555
	(2.45)*	(4.08)**	(6.63)**
R^2	0.2030	0.0531	0.1128

Asymptotic t-values in parentheses.

* Significant at 5%.

** Significant at 1%.

Table 6. Source-Specific Proportional Contributions to the Gini Inequality index

Variable	Farm Income	Non-Farm Income	Other Income	Total
Age	-0.0808	-0.0430	-0.0375	-0.1613
	(-2.01)*	(-2.75)**	(-3.16)**	
Age squared	0.0785	0.0436	0.0480	0.1702
	(1.93)	(2.63)**	(3.46)**	
Schooling	0.0010	0.0012	-0.0003	0.0019
	(0.95)	(1.31)	(-1.03)	
Family size	0.0439	0.0081	0.0023	0.0543
	(4.59)**	(4.02)**	(3.41)**	
Land	0.2085	0.0143	-0.0025	0.2203
	(6.47)**	(3.23)**	(-1.29)	
Number of plots	-0.0187	-0.0022	0.0007	-0.0202
	(-2.01)*	(-1.49)	(0.86)	
Livestock	0.0714	0.0017	0.0003	0.0734
	(8.04)**	(0.68)	(0.22)	
Farm assets	0.0144	0.0025	-0.0008	0.0161
	(2.46)**	(1.99)*	(-1.62)	
Gardabani region	-0.0046	-0.0005	-0.0003	-0.0054
	(-0.39)	(-0.29)	(-0.41)	
Total explained	0.3136	0. 0257	0. 0100	0.3493

Bootstrapped t-values (200 repetitions) in parentheses.

* Significant at 5%.

** Significant at 1%.

Table 7. Source-Specific Marginal Effects on the Gini Inequality index

Variable	Farm Income	Non-Farm Income	Other Income	Total
Age	0.1486	0.0551	-0.0873	0.1164
	(1.40)	(1.56)	(-5.17)**	
Schooling	-0.1593	-0.1886	0.0516	-0.2963
	(-1.78)	(-6.50)**	(2.60)**	
Family size	0.5354	0.0981	0.0285	0.6620
	(5.81)**	(4.78)**	(3.56)**	
Land	-0.5891	-0.0406	0.0072	-0.6226
	(-7.23)**	(-3.42)**	(1.29)	
Number of plots	0.1601	0.0190	-0.0060	0.1731
	(2.04)*	(1.50)	(-0.86)	
Livestock	-0.3662	-0.0086	-0.0018	-0.3765
	(-11.0)**	(-0.67)	(-0.18)	
Farm assets	-0.0616	-0.0109	0.0035	-0.0691
	(-6.04)**	(-4.45)**	(1.87)	
Gardabani region	-0.2306	-0.0241	-0.0150	-0.2697
	(-8.38)**	(-3.87)**	(-4.73)	

Notes:

Bootstrapped t-values (200 repetitions) in parentheses.

* Significant at 5%.

** Significant at 1%.

Table 8. Simulated Effects of Changes in Landholdings on the Gini Inequality index

Change in landholdings	Farm Income	Non-Farm Income	Total
0.01*land	-0.5891	-0.0406	-0.6297
0.01*land+0.01*land^2	-0.7958	-0.0560	-0.8518
0.01*land+0.01*land^2+0.01*land^3	0.0235	-0.0209	0.0026
0.01*land+0.01*land^2+0.008*land^3	-0.0074	-0.0195	-0.0269
0.01*land+0.01*land^2+0.009*land^3	0.0097	-0.0201	-0.0104
0.01*land+0.01*land^2+0.011*land^3	0.0347	-0.0218	0.0129

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