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Life is Unfair in Latin America, But Does it Matter for Growth?

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Abstract

I analyze the effect of inequality on economic growth in Latin America, where inequality is measured as the area of family farms as a percentage of the total area of agricultural holdings. Using data from 18 Latin American countries between 1960 and 2004, I find that inequality has a nonlinear effect on economic growth. Overall, for the countries included in this analysis, the share of family farms has a positive significant effect on economic growth. These findings are robust to controlling for several factors, using a different indicator of inequality (land Gini), and addressing for endogeneity.

JEL Categories: D63, O13, O40, O54
Key Words: Inequality, agriculture, economic growth, Latin America

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1. INTRODUCTION

Many researchers have attempted to determine the effects of inequality on economic growth. While Kuznets (1955) stated that an increase in inequality in the early stages of development was a pattern in developed countries (DCs), others have argued that inequality is detrimental to growth (Easterly, 2007). Inequality in opportunities is relevant to economic development since the well-being of society is not only considered a function of income, but also a function of the access that individuals have to education, health, and other services (Sen, 2000). Therefore, the analysis of the persistence and the effects of inequality in less developed countries (LDCs) is important for policymakers.

Latin America is the second most unequal region of the world (World Bank, 2006) and income inequality increased during the 1990s (Sáinz, 2006). The average Gini coefficient in the region between 2000 and 2005 was 54.2, which is considerably higher than the Gini coefficients of a sample of five DCs.[1] In Latin America, between 2000 and 2005, the richest tenth of the population received on average more than 42 percent of the total income, while the poorest 10 percent received between 0.25 and 1.46 percent. On the other hand, in DCs, such as the United States, Canada, United Kingdom, France, and Italy, the richest tenth received on average between 22 and 30 percent, while the poorest received between 1.80 and 4 percent (Table 1).[2]

Table 1 here

Engerman and Sokoloff (2002) argue that inequality in Latin America can be explained by initial factor endowments, such as soil, climate, and the density of native population. Because Latin American countries have soils and climates suitable for the production of crops that require economies of scale and are labor intensive, there was an agricultural organization based on concentrated ownership of land in the colonial period. This early inequality led to the establishment of institutions that were detrimental to growth. Hence, the unequal distribution of assets could be an important factor that keeps this region underdeveloped.

Recently, Easterly (2007) tested the Engerman and Sokoloff (ES) hypothesis by analyzing the effects of inequality on growth. He uses an instrument for income inequality that is related to initial factor endowments: the abundance of land suitable for growing wheat relative to that for growing sugarcane. He shows that this instrument is correlated with the share of family farms, where suitability to grow wheat is associated with a more equal distribution of resources. Easterly finds support for the ES hypothesis by showing that inequality has a negative effect on economic growth, schooling, and institutions.[3]

Most studies on the effect of inequality on growth are cross-sectional or use inconsistent measures of inequality, and it is easy to see why. To obtain a measure of inequality that is available over time for a large set of LDCs is difficult. For Latin American countries, Gini coefficients on income and land distribution are not available consistently, and taking a panel approach to analyze the effects of inequality on growth in the region with these measures would be impossible.[4] Nonetheless, to determine the effects of inequality on growth in a panel framework, the area of family farms as a percentage of total area of agricultural holdings can be used.

In this paper, I analyze the effects of inequality on economic growth in a panel of 18 Latin American countries from 1960 to 2004.[5] I test the ES hypothesis by using a measure of inequality that is related to resource distribution, the area of family farms as a percentage of the total area of agricultural holdings. The share of family farms is an important measure of inequality because access to land has been associated with the degree to which people participate in the economic and political systems. Even after rapid urbanization, access to land is an important determinant of wealth and social mobility in Latin America (Torche and Spilerman, 2006). Individuals who have access to land are also more likely to participate in the political process and receive an education.[6]

I find that equality has nonlinear effect on growth, where the effect of the share of family farms on growth is increasing up to a certain level, once this level is reached the effect of an increase in the family farms share on growth is decreasing. This finding is robust after controlling for different factors (urbanization, technology and climate), and using an alternative measure of resource inequality (land Gini). Based on the family farm shares in 1998, all the countries in this analysis would benefit by increases in the share of family farms since they have family farm shares at which the effect of family farms on growth is increasing. The positive effect of equality on growth is robust to addressing for endogeneity of inequality.

This paper is organized as follows: Section 2 reviews the literature on the effects of inequality on growth and discusses the importance of analyzing the effects of resource distribution on economic growth in Latin America; Section 3 presents the methodology; Sections 4 and 5 discuss the results and the robustness tests; and Section 6 concludes.

2. LITERATURE REVIEW

(a) The effect of inequality on growth

There are several theoretical models which explain why inequality may negatively affect economic growth. First, the imperfect capital market model states that, with high inequality, it will be difficult for poor people to invest in physical and human capital. In a society where wealth is not equally distributed, the poor face credit constraints, and this leads to a vicious cycle of low productivity and economic growth (Banerjee and Newman, 1991; Galor and Zeira, 1993).

Second, in the political economy framework, the model of redistribution states that as inequality increases the median voter will be more likely to vote for redistributive policies. These policies deter economic growth since they discourage investment (Benabou, 1996; 2000). Third, in the social conflict model, high inequality is associated with lower economic growth because it precedes social unrest and political instability. Economic growth in this model is hampered by inequality because instability discourages investment (Benhabib and Rustichini, 1996). Fourth, inequality can have a negative effect on growth through its effect on institutions. Highly unequal societies may be unable to achieve democracy since the distribution of resources determines the distribution of political power (Acemoglu and Robinson, 2006; Vanhanen, 2003a). Furthermore, in highly unequal societies, there are institutions that promote the persistence of inequality and hamper economic growth in the long run (Engerman and Sokoloff, 2002).

There is empirical support for the idea that inequality negatively affects growth. In a sample of 64 countries, Deininger and Squire (1998) find evidence in favor of the imperfect capital model. Alesina and Rodrick (1994) and Persson and Tabellini (1994) find empirical support for the political economy model of redistribution, both in a broad sample of 46 countries and in one restricted to DCs. Alesina and Perotti (1996) and Rodrick (1999) show that inequality decreases growth through its effects on instability using cross-sectional samples. Vanhanen (2003a) presents empirical support for his resource distribution theory of democratization, where the distribution of resources determines the distribution of political power. He finds, in an analysis that includes 170 countries, that the distribution of resources determined the average level of democracy between 1999 and 2001. Keefer and Knack (2002) and Easterly et al. (2006) show empirically that high inequality leads to institutions that deter growth, such as weak property rights and low governance.[7]

On the other hand, there is also theoretical and empirical work showing that inequality is beneficial to growth and supporting the Kuznets' (1955) inverse U shaped relationship between inequality and growth.[8] Barro (2000) argues that the imperfect capital market model can explain the positive effect of inequality on growth. In equally distributed societies, there are low levels of investment because firms tend to be small. Small firms have less incentive to invest since they face low returns on investment. Furthermore, since the rich will have less incentive to save in an environment with less redistribution, lower levels of inequality are associated with lower savings rates. Partridge (1997), Li and Zou (1998), and Forbes (2000) show empirically that inequality leads to higher economic growth. Alternatively, Barro (2000) finds that inequality has a positive effect on growth only in rich countries; in poor countries increases in inequality produce a negative effect on growth. Nonetheless, Banerjee and Duflo (2003) challenge previous empirical and theoretical work by arguing that inequality has a nonlinear effect on economic growth. According to them, the nonlinear effect of inequality on growth, measurement bias, and endogeneity of inequality explain why there are different empirical results.

There is no general consensus on the effect of inequality on growth and measurement issues have been blamed for that. Obtaining a measure of inequality that is consistent through time and that is comparable across countries is difficult. Because Gini coefficients of income distribution are usually estimated from different surveys that cover different populations and different sources of income (income, earnings, consumption, or expenditure), using them in the analysis of the effects of inequality on growth can be problematic.[9] In fact, Atkinson and Brandolini (2001) show, using a sample of DCs, how the distribution of income differs from one source to another and how this leads to misleading empirical results in the analysis of the effects of inequality on growth.[10] In addition, Perry et al. (2006) argue that Gini coefficients based on income surveys are biased since surveys reflect short term income but not lifetime income.

In the analysis of the effects of inequality on growth, an alternative approach is to use a measure of inequality that is related to resource distribution. Since the income of individuals depends significantly on the access to the means of production, we could use a measure related to the access that individuals have to land to quantify inequality. According to Easterly (2007) an indicator like this will reflect structural inequality, which has been universally associated with underdevelopment.

(b) Resource distribution in Latin America

Resource distribution is a key determinant of long run economic growth according to the ES hypothesis (2002). Engerman and Sokoloff (2002) posited that factor endowments determined the distribution of resources in the colonial period in Latin America. In highly unequal environments, institutions that precluded the participation of a large fraction of the population in the economic and political systems and promoted the persistence of inequality were created. On the other hand, in more equally distributed societies, the institutions established allowed the majority of the population to take advantage of economic opportunities and to participate in the political process. According to Engerman and Sokoloff (2006a, p.74) "economic institutions shape opportunities", and these opportunities were important for the early industrialization process of Latin American countries. In the ES hypothesis, levels of inequality determined the type of economic institutions, and consequently the prospects of long run economic growth.

A number of empirical and theoretical analyses attempted to test the ES hypothesis. Acemoglu and Robinson (2006) and Acemoglu (2007) argue that in unequal environments, there is more likely to be an oligarchic political system that does not allow for democratization. Rajan and Zingales (2006) argue that within an oligarchic system there are institutions that promote the persistence of inequality and barriers to entering the market and the political process.[11] To account for resource distribution in the analysis of the effects of inequality on growth, some have used the Gini coefficient of land distribution (Birdsall and Londono, 1997; Deininger and Squire, 1998; Easterly, 2001; Engerman and Sokoloff, 2006b). These analyses find that inequitable ownership of land depresses growth through its effect on the political environment, institutions, investment, and schooling.

An alternative measure of inequality related to resource distribution is the area of family farms as a percentage of the total area of agricultural holdings. This measure has been associated with the distribution of income in North America and Latin America (Przeworski and Curvale, 2008).[12] Easterly (2007) shows, for a large sample of countries, that the share of family farms in early periods has a significant negative effect on the average of the income share of the top quintile from 1960 to 1998. Because the control of land has been unequally distributed in Latin American since the colonial period (Birdsall and Londono, 1997; Morley, 2001; Justino et al. 2003; Perry et al. 2006; Torche and Spilerman, 2006), the share of family farms seems a reasonable measure of inequality.

Few have attempted to test the effect of inequality on growth in Latin America. De Gregorio (1992), in a growth equation for 12 Latin American countries from 1950 to 1985, finds that income inequality has no significant effect on growth. De Gregorio and Lee (2004), using a sample period from 1970 to 2000, find that income inequality has no significant effect on growth, but that it has a significant negative effect on schooling and institutional quality and a positive effect on fertility.[13] To measure inequality these analyses use the share of income received by the highest and lowest 20 percent (De Gregorio, 1992) and the income Gini coefficient (De Gregorio and Lee, 2004). While both analyses use a panel framework, De Gregorio's (1992) measure of inequality is time invariant. Furthermore, there are measurement issues related to the measure of inequality used by De Gregorio and Lee (2004). My paper differs from these previous analyses by using the share of family farms, which is consistently available for Latin American countries and for a larger sample period that accounts for current changes in economic growth and inequality.

3. METHODOLOGY

The countries included in this analysis are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. I construct 10 year averages from 1960 to 1999, except for the last observation which is only a five year average from 2000 to 2004. There are 5 observations per country for a total of 90 observations.

I use is the share of family farms constructed by Vanhanen (2003b) to measure equality. Vanhanen (2003a) defines a family farm as any farm that employs no more than four people, including family members. The benefit of using the family farms share is that it accounts for "holdings that are mainly cultivated by the holder family itself and are owned by the cultivator family or held in ownerlike possession" (Vanhanen, 2003a, p. 84). The share of family farms used as a measure of equality helps us to avoid the problem of not including in our measure those individuals who have control of land but may not have legal ownership, have communal ownership, or tenancy rights. According to Vanhanen (2003a) those individuals should be considered socially and economically independent and they should be accounted for when measuring inequality.

When using the share of family farms as a measure of equality, there are some caveats. The concept of family farms has been kept fixed by Vanhanen (2003b), but it is possible that it differs across countries and across time due to differences in technology and geographic conditions. The share of family farms is estimated mainly from agricultural censuses provided by the Food and Agriculture Organization (FAO) of the United Nations, but other sources were used when agricultural holdings were not available from the FAO reports. Furthermore, this indicator does not make a distinction between those who accessed the land in different ways, such as owner-operator, share tenant or pure tenant. According to theory and empirical evidence, land tenure status is an important determinant of the claims to the returns to land cultivation (i.e. income). Thus, countries that have a similar share of family farms, could have a different composition of tenure status, and this results in a different patterns of income distribution.[14]

Other caveat of using the share of family farms as a measure of equality is that it ignores the distribution of land that does not fall in this category, such as unutilized land, and does not account for landlessness. These two factors are taken into account in this measure only if a certain area of unutilized land becomes a family farm and if a landless rural household gets access to land in the form of family farm. Therefore, the share of family farms may underestimate inequality.

Furthermore, many LDCs have experienced fast urbanization that has decreased their agricultural activity, and it could be argued that the share of family farms is not relevant for the distribution of income today. However, the access to land reveals the initial conditions that individuals face in the urbanization process. According to Easterly (2007), access to land reflects structural inequality that is associated with a certain type of institutions and capital accumulation, and these transcend from the rural sector to the urban sector.

Although these caveats are relevant, the share of family farms is the only measure of inequality that is available consistently through time for a large sample of Latin American countries in the period of analysis. While the share of family farms is not a perfect measure of inequality, it is the most reasonable proxy of inequality that can be used to test empirically the ES hypothesis due to its correlation with factor endowments. Through robustness tests, it is expected to diminish some of the problems associated with this measure of inequality.

To analyze the effect of inequality on growth, I estimate a version of the augmented Solow model:

$$\ln(Y)_{i,t} - \ln(Y)_{i,t-1} = \alpha_0 + \alpha_1 \ln(Y)_{i,t-1} + \alpha_2 \ln(I/Y)_{i,t} + \alpha_3 \ln(school)_{i,t} + \alpha_4 \ln(n + g + \delta)_{i,t} + \varepsilon_{i,t} \quad (1)$$

In equation (1), the dependent variable is the period average of the difference of the natural log of real GDP per capita (average GDP growth). I control for initial conditions by using the average of the natural log of real GDP per capita in the previous period (initial GDP). The natural log of investment as a share of GDP (I/Y) and the natural log of schooling (school) are included as independent variables. I also include a term that controls for population growth (n), technology advancement (g), and depreciation (δ). In this model, n is measured as the growth rate of the working age population and g + δ is assumed to be equal to 0.05 (Mankiw et al., 1992).

Since inequality is measured as the area of family farms as a percentage of the total area of agricultural holdings, increases in this variable represent increases in equality. Because inequality may be correlated with unobservable factors associated with growth, I use the first lag of the family farms share. Banerjee and Duflo (2003) argue that changes in inequality are more costly in terms of growth at either very high or very low levels of inequality. Hence, in addition to including the linear term of the equality indicator, I also test for the nonlinear effect of equality on growth by including the square of the lagged family farms share. This leads to the following equation:

$$\ln(Y)_{i,t} - \ln(Y)_{i,t-1} = S_{i,t,t-1} + \Phi(Equality_{i,t-1}) + T_{it}\lambda + \varepsilon_{it} \qquad (2)$$

In equation (2), $S_{i,t,t-1}$ represents the variables from the augmented Solow model specified in equation (1), $\Phi(\cdot)$ is a function that can be estimated with flexibility (linear or quadratic specification), and T is a vector of four time dummy variables that account for variation across time. The measure of equality is the share of family farms. The variables used in this analysis and their sources are described in Table 2; Table 3 shows the summary statistics.

Table 2 here

Table 3 here

4. RESULTS

Column 1 of Table 4 shows the results of estimating the basic growth model with the linear term of inequality (lagged family farms share) using ordinary least squares (OLS).[15] In this estimation, initial real GDP per capita has a significant negative effect at the 10 percent level, which supports the idea of conditional convergence. Investment has a significant positive effect at the 1 percent level, which is expected as well. The coefficients for human capital and (n + g + δ) are not statistically significant.[16] The lagged family farms share is statistically significant at the 5 percent level. Column 1 shows that the effect of the level of family farms on growth is small since an increase of the share of family farms by one standard deviation (10.25) increases growth by 0.31 percent. Column 2 shows the results of adding the square of the lagged family farms share. I find that the level and the square of family farms share are statistically significant at the 1 percent level. These estimates support the argument that inequality has a nonlinear effect on growth.

Table 4 here

Using the coefficients from column 2 of Table 4, Figure 1 shows how economic growth varies with changes in the family farms share. The effect of the family farms share on growth is increasing up to the point where the family farms share is equal to 50 percent. After the share of family farms reaches 50 percent, any further increase in family farms have a decreasing effect on growth. This result supports Banerjee and Duflo's (2003) finding that growth is hampered at very high and very low levels of inequality.

Figure 1 here

Figure 1 shows an inverse U shaped relationship between equality and growth and this finding is relevant for policymakers in Latin America. The latest available observations for the share of family farms (shown in Table 5) show that all countries in the sample would benefit by an increase in the family farms share. The sample mean of the share of family farms is 26 and all the countries have current family farm shares in the left hand side of the curve in Figure 1. Figure 2 shows a close up of the effect of increases of the share of family farms up to the point where the effect of an increase on the share of family farms on growth is increasing (50 percent). The countries with the lowest family farms share are Honduras, Paraguay, Venezuela, and Panama (with family farm shares below 20 percent), and those with the highest family farms share are Colombia, Mexico, Costa Rica, Ecuador, and El Salvador (with family farm shares between 32 and 36 percent).

Table 5 here

Figure 2 here

It is important to note that the right hand side of the curve shown in Figure 1 was constructed as an extrapolation, since no observation on the share of family farms above 54 percent (maximum observed during the sample period) was available. While the shape of the curve is likely to have this form based on other theoretical and empirical analyses, we should refer to the right hand side of the curve with caution. A possible explanation of why it is likely that as the share of family farms increases above 50 percent, the effect of equality on growth is diminishing, is that countries with a high share of family farms will be more likely to adopt protectionist policies with the purpose to increase farm income.

5. ROBUSTNESS TESTS

(a) Adding other control variables

To determine whether previous results are robust, it is necessary to show that the nonlinear effect of inequality on growth is not picking up the effect of other variables. For this reason, I use different model specifications that include other variables that are commonly used in the analysis of inequality and growth (share of government spending and polity growth), account for specific country conditions (urbanization), and could be correlated with the share of family farms (rural spending, technology, and geography).

In Table 4, columns 3 and 4 show the estimates obtained when two other variables commonly used in analyses of the effect of inequality on growth are added. Column 3 shows that the nonlinear effect of inequality on growth is significant when controlling for government expenditure (measured as the natural log of government consumption as percentage of real GDP). I find that, although the coefficient of the natural log of government consumption share has a significant negative effect at the 1 percent level, the family farms share still has a significant nonlinear effect on growth. Political regime type has been also considered as an important determinant of growth. Following Perotti (1996) and Barro (2000), I add the growth rate of the period average of the polity score to the growth equation to account for changes on the political regime. The polity score is the combined score of the democracy and autocracy scores and goes from -10 to 10, where 10 is assigned to high democracies and -10 to high autocracies. Estimates in column 4 show that the growth of the polity score has a significant positive effect at the 1 percent level, and inequality has a significant nonlinear effect on economic growth. It is important to note that the coefficients' magnitude and significance on the level and square of the lagged family farms share are very similar when these control variables are added (columns 2 to 4).[17]

It is also necessary to determine whether the nonlinear effect of inequality on growth is relevant for Latin American countries after controlling for urbanization. It could be argued that results may be driven by certain countries that are less urbanized, and that the share of family farms has no impact on growth in highly urbanized countries. Therefore, I include in the growth equation the first lag of a dummy variable that is equal to one if a country has a period average of urban population as a percentage of total population equal or greater than 50 percent and an interaction term of the first lag of the share of family farms and this urban dummy. Table 5 shows the decade in which a country had for the first time an average of urban population share of 50 percent or above. The countries that started the period of analysis with a urban population share higher or equal to 50 percent were Argentina, Chile, Colombia, Mexico, Peru, Uruguay, and Venezuela. In Table 4, column 5 shows that the nonlinear effect of equality on growth persists and, while the urban dummy has a significant negative effect at the 1 percent level, the interaction term has a significant positive effect at the 1 percent level, meaning that highly urbanized countries benefit the most with larger family farm shares in the previous period. Without taking into consideration the nonlinear effect of inequality on growth, an increase of the family farms share by one standard deviation in highly urbanized countries in the previous period causes an increase on growth of 1 percent.

Additionally, to determine the impact of inequality on growth when controlling for urbanization, I estimate the growth equation with inequality only for the sample mentioned above (countries that reached urban population share higher or equal to 50 percent in 1960). Interestingly, I find that while the nonlinear effect does not hold for this sample, an increase on the share of family farms has a positive significant effect on GDP growth (Table 4, column 6).

To determine the robustness of the effect inequality on growth, it is also important to control for factors that may be correlated with the family farms share and that they may have a significant effect on growth. Since distribution of land may be correlated to government spending on agriculture, it is important to account for that. Anriquez (2006) shows that the composition of rural spending, where there is a distinction between private transfers (mostly subsidies) and public investment (roads, electricity, schools, etc…), has an impact on agricultural output. He finds that those countries with higher spending on public goods have higher rural income. Lopez (2003, 2005) supports this finding. Since countries with high inequality tend to observe more spending on private transfers, the family farms share variable may be picking up not only the effect of inequality on growth, but also the effect of the composition of government spending on agriculture. For this reason, following Anriquez (2006) methodology, I include in the regression two variables that account for private and public rural spending. These variables are constructed as the average of private and public rural spending for the available observations between 1985 and 2001, using data from GPRural (FAO, 2005). Estimates adding these two variables are shown in Column 1 of Table 6. Both variables, while having a coefficient sign different than the one expected, have no significant effect. In this estimation, the linear and square terms of the lagged share of family farms are significant at the 1 and 10 percent level respectively.

Table 6 here

To account for technology in the agricultural sector, irrigated land as a percentage of cropland (irrigated land) and the natural log of the number of tractors per 100 squared kilometers of arable land (agricultural machines) are added as controls variables, one at the time. Estimates in Columns 2 and 3 (Table 6) show that inequality has a significant nonlinear effect on growth at the 5 percent level when these control variables are added. While irrigated land does not have a significant effect, the variable of agricultural machines has a significant positive effect at the 10 percent level. It can also be argued that because inequality is highly correlated to factor endowments (ES hypothesis), the effect of the family farms share on growth may just reflect the effect of geography. Hence, I include in the estimation as control variable the natural log of the percentage of land area in the geographical tropics. While this indicator has a significant negative effect on growth at the 5 percent level, inequality has a significant nonlinear effect on growth at the 1 percent level.

To sum up, previous results have shown that the nonlinear effect of inequality on growth is robust to different model specifications that control for different factors. It is also important to note that for the sample included in the analysis, an increase on equality (i.e. increase on the share of family farms) has an increasing effect on growth. Based on the latest observation of the family farms share, an increase in the share of family farms will be beneficial in terms of economic growth for the countries in this analysis.[18]

(b) Using another measure of inequality

Since the share of family farms represents a proxy of inequality that is related to the distribution of land, it is necessary to determine if previous results are robust to using a different measure of inequality. To do this, the land Gini coefficient constructed by Frankema (2008) is useful. Frankema's (2008) land Gini is a good indicator of the access to land as a factor of production since it is constructed by looking at land holdings, where land holdings refers to disposable amount per farm. This indicator is not available for all countries in the sample consistently over time, but it is available for 16 countries either in 1950 and 1960.[19] In fact, the initial land Gini coefficient and the share of family farms 1968 have a significant correlation equal to -0.69. Estimates using the land Gini coefficient as an indicator of inequality show the land Gini coefficient has a significant negative effect on growth at the 5 percent level (Table 6, Column 5). While the non linear effect does not hold when using this indicator, the previous finding that equality has an increasing effect on growth for the countries in the sample holds.[20] These estimates show that if the land Gini decreases by one standard deviation (5.15), economic growth increases by 0.26 percent, which is similar to the effect found when including only the linear term of family farms (Table 4, column 1).[21]

(c) Controlling for the endogeneity of inequality

In the previous estimations, which are all OLS with robust standard error, it was intended to address for endogeneity by using the lagged family farms share. However, it could be argued that because the share of family farms is estimated later on the decade, this variable still endogenous in Equation 2 since it may be correlated to the error term. The endogeneity of inequality in the growth equation can be due not only to simultaneity, but also to omitted variable and measurement error biases. For this reason, it is important to determine whether previous results are robust to controlling for endogeneity. To address for endogeneity, I use the General Method of Moments (GMM) and Arellano and Bond (AB) estimators.[22] In this part of the analysis, I focus on testing whether the share of family farms has a robust significant positive linear effect on growth. I do not consider testing the nonlinear effect due to the difficulty of instrumenting for it.

When instrumenting for inequality, it is necessary to find a variable that is partially correlated with the share of family farms but uncorrelated with the error term in the growth equation. Easterly (2007) suggests using an indicator related to factor endowments as an instrument of inequality. Based on the ES hypothesis, he constructed the wheat-sugar ratio, which represents the ratio of the share of arable land suitable for wheat and the share of arable land suitable for sugar cane. Easterly (2007) shows that wheat-sugar ratio is significantly correlated with the share of family farms. In this analysis, the wheat-sugar ratio has a positive significant effect on the share of family farms in late 1950s, which goes according with Easterly's (2007) findings.[23] In order to be able to identify the equation and test whether the instruments are uncorrelated with the error term, it is necessary to have at least two instruments for inequality. For this reason I use the second lag of the share of family farms as an additional instrument. For the GMM estimation, I also address for the endogeneity of investment by using the lagged investment share as instrument.

For the GMM estimaton, all variables are estimated using the set of instruments in the first stage, where this set includes all exogenous variables in the growth equation (including the time dummy variables) and three additional instruments (wheat-sugar ratio, the second lag of the share of family farms, and the first lag of the investment share). Then, the fitted values from the first stage regressions are used to estimate the growth equation with inequality in the second stage. Estimates in Table 7, column 1 show that the lagged share of family farms has a significant positive effect at the 1 percent level. Furthermore, according to the overidentifying restrictions test shown in column 1 (J-test), I cannot reject the null hypothesis that the overidentifying restrictions are valid even at the 10 percent level.[24]

Table 7 here

Since the measure of inequality varies over time in this analysis, an instrument that varies over time could is preferable. For this reason, following Easterly's (2007) approach, I construct a factor endowment indicator that varies over time. The yield obtained per hectare of certain crops accounts for the suitability of land and can vary over time. Therefore, I estimate the average period of the yield of sugarcane in every country for which there was available data for the period of analysis and calculate the natural log of the inverse of this yield.[25] While a better instrument will also account for the yield of wheat per hectare, many countries missed data on this variable, and that is why only the yield of sugarcane was taken into consideration. I also find that the sugar yield ratio has a positive significant effect on the share of family farms in late 1950s. When the sugar yield ratio is used as an additional instrument (instead of Easterly's wheat-sugar ratio and in addition to the second lag of the share of family farms), estimates in column 2 (Table 7) show that the share of family farms has also a positive significant effect on economic growth. For this estimation, I cannot reject the null hypothesis that the overidentifying restrictions are valid even at the 15 percent level.[26]

The AB estimator can also be used to address for endogeneity. For the AB estimator, I include a lagged dependent variable on the right-hand side is included and first difference the growth model with the linear term of inequality to eliminate individual effects.[27] The AB uses lagged levels of the variables as instruments, where lagged levels of inequality instrument for the difference of inequality.[28] Using the two-step AB estimator and including time dummies, estimates show that the share of family farms has also a positive significant effect on economic growth at the 5 percent level (Table 7, column 3). For this estimation, I also cannot reject the null hypothesis that the overidentifying restrictions are valid even at the 15 percent level.[29]

6. CONCLUSION

The results obtained in this empirical analysis are relevant for the analysis of the effect of inequality on growth and for policymakers in Latin America. This analysis benefits significantly from using a measure of inequality that is observable through time for a large sample of Latin American countries. The empirical results show a robust nonlinear effect of inequality on growth in Latin America. From this analysis, it can be concluded that countries in Latin America could benefit from more equality up to a certain level. After equality reaches this level, the effect of increases in equality on growth will be decreasing. Based on current values of the measure of inequality used, the family farms share, I find that all countries would benefit with increases in the share of family farms. The positive effect of the share of family farms was robust to several model specifications (different control variables), using a different measure of inequality (land Gini) and addressing for endogeneity (GMM and AB estimators).

A possible explanation of the positive effect of the share of family farms on economic growth is the inverse farm size productivity relationship. It has been posited that one of the advantages of a more equal distribution of land is that farms that are primarily operated with family labor tend to be more productive on average. Vollrath (2007) shows that the land Gini has a significant negative effect on agricultural productivity. Thus, it can be argued that one of the channels through which the share of family farms affects economic growth positively in Latin America is through its effect on productivity.[30]

Since an increase in the percentage of family farms seems to be beneficial in Latin America, programs that promote agricultural activity on a small scale, such as the creation of microfinancing and support institutions, could benefit the region significantly. A more developed financial system, in which individuals have greater access to private credit could also promote an increase in the percentage of family farms. In fact, credit markets play a central role on the expansions of agricultural activity at a small scale since the poor lack the capital required for this type of activity. Access to credit through microcredit can help to sustain the existing family farms, but also increase the number of individuals that can have access to land. In addition, programs that allow farmers to insure themselves against natural disasters or bad weather conditions could also promote more equality in Latin America. These programs can significantly help to avoid poverty traps in agricultural areas.

Land reform that focus on improving the efficiency of land markets may be required in order to make access to land more equitable in Latin America. Since land rights are "social conventions that regulate the distribution of the benefits that accrue from specific uses of a certain piece of land", stronger property rights are necessary in order to promote not only more investment on agriculture, but also more exchanges (Deininger, 2004, p.4). With stronger property rights, transfer of land use rights from the less productive to the more productive individuals will take place more often and at lower transaction costs (Deininger, 2003). It is important to emphasize that even tough Latin American countries share some common characteristics, the programs to improve the efficiency of land markets may be country-specific.

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[1] See Table 1 for an explanation of how this average was estimated and the source of the data.

[2] See De Ferranti et al. (2004) for a comprehensive study of inequality in Latin America.

[3] Replicating his estimation in a sample restricted to 20 Latin American countries, I find similar results. I use the average of the Gini coefficients from 1960 to 2000 provided by the World Institute of Development and Economics Research (WIDER, 2007) and Easterly's (2007) instrument for income inequality in a cross-sectional framework. I find that income inequality has a negative effect on growth and the percentage of secondary enrollment. These estimations are not included for reasons of space, but the results are available upon request.

[4] If a minimal criterion was specified for the Gini coefficient of income distribution, only 6 of the 18 Latin American countries included in this analysis would have observations from 1960 to 2000 (minimal criteria for Gini coefficient: sample covers the whole population and area of the country, the income share unit is the household or family, and it is estimated based on the income concept, where the income concept could be different across countries and across time). Gini coefficients of land distribution for Latin American countries are not available consistently over time.

[5] I use equality and inequality interchangeable along the paper since the main indicator used in this analysis is a measure of equality (share of family farms).

[6] Vanhanen (2003a) makes this argument and presents empirical evidence supporting this. In theory, this argument to Latin American countries. However, there are exceptions, since there are some societies in which access to land have not led to participation in the political process and access to education (e.g. China).

[7] Benabou (1996) presents a review of the theoretical models that explain the negative effects of inequality on growth and a table with the results of a large number of empirical analyses. Thorbecke and Charumilind (2002) present a figure showing all the different channels through which inequality affects growth negatively. Birdsall (2007) reviews the negative effects of inequality on growth in LDCs.

[8] Fields (2001) presents a review on the Kuznets hypothesis and on empirical analyses that test this hypothesis.

[9] See Deininger and Squire (1996) for an explanation on these measurement issues.

[10] Panizza (2002) also shows empirically that the effect of inequality on growth in the United States varies depending on the method used to measure inequality.

[11] See Easterly (2007), Hoff (2003), and Levine (2005) for a good review on the theoretical and empirical work on this hypothesis.

[12] Przeworski and Curvale (2008) show, in a sample that includes 15 Latin American countries, Canada, and the United States, that there is a negative correlation between the family farms share and the income Gini coefficient.

[13] Some have found that income inequality has deterred the accumulation of physical and human capital in the region (Grier, 2002; De Gregorio and Lee, 2004; Motiram and Nugent, 2007). Others argue that education is unequally distributed in Latin America, and this has contributed to the perpetuation of high levels of inequality (Altimir, 1997; Frankema and Bolt, 2006).

[14] Hayami and Otsuka (1993) present an overview of the different types of contracts for agrarian activities (fixed or shared rent) and how do they vary across countries.

[15] All estimations are OLS with White's standard errors and period fixed effects, unless specified otherwise.

[16] Schooling becomes statistically significant with a positive sign in other estimations.

[17] The size and significance of the coefficients on the level and square of lagged family farms share do not change if I include in the growth equation the natural log of the government share and the polity growth at the same time. Results were not included for reasons of space.

[18] Tables 1 and 2 present a detailed description of how these control variables were estimated and their sources and their summary statistics. When only the linear term of the share of family farms is included and all these control variables are added one at the time, I found that the share of family farms has a significant positive effect on economic growth in most of the cases (6 out of 8) at the 5 percent level. The linear effect of the share of family farms is insignificant when private and public rural spending are added, but private and rural spending are insignificant (F test shows that these two variables do not add to the model). When the share of land in the tropics is added, the linear term of the share of family farms has a positive significant effect at the 10 percent level. Estimates not included for purpose of space.

[19] Only for Ecuador and Honduras, it is needed to use observations in 1950 since observations in 1960 are not available. Frankema's (2008) land gini coefficient is not available for Mexico and Bolivia.

[20] Estimates including the linear and squared land Gini coefficient show no significant effect and are not included for purpose of space.

[21] The statistically negative significant effect of the land Gini is robust to the inclusion of other control variables at the 5 percent level in most cases.

[22] Estimates obtained use White's robust standard errors and period fixed effects.

[23] This finding was obtained when the share of family farms is regressed on the wheat-sugar ratio including time dummy variables and using White's robust standard errors.

[24] The critical value for this test is 2.71 at the 10 percent level with 1 degree of freedom.

[25] I use data from ProdSTAT (FAOSTAT, 2008) to estimate the sugar yield ratio. Data is available for all countries but Chile

[26] The critical value for this test is 3.84 at the 15 percent level with 1 degree of freedom.

[27] Time dummies are also included in the AB estimation.

[28] Refer to Arellano and Bond (1991) and Baltagi (1995) for further explanation on the AB estimator.

[29] The critical value for this test is 13.30 at the 15 percent level with 9 degrees of freedom.

[30] Using Vollrath's (2007) model, where agricultural output per hectare is regressed on the share of family farms and other control variables, I find that the share of family farms has a positive significant effect on agricultural productivity. Results not included for purpose of space but are available upon request.

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Table 1. Average Gini Coefficients and Income Share of Lowest and Highest Deciles [a] (2000 – 2005)

	Gini Coefficient	Income share of lowest 10^{th}	Income share of highest 10^{th}
Bolivia	61.69	0.25	48.01
Brazil	58.51	0.90	46.84
Chile	56.42	1.21	46.66
Colombia	56.95	0.75	45.36
Costa Rica	48.76	1.30	37.18
Dom. Republic	51.09	1.36	40.19
Ecuador	56.02	1.03	45.34
El Salvador	51.68	0.78	38.63
Guatemala	54.12	1.03	42.70
Honduras	54.35	0.96	41.82
Mexico	52.36	1.19	41.19
Nicaragua	54.42	1.22	44.10
Panama	56.32	0.73	43.16
Paraguay	56.86	0.77	44.76
Peru	51.69	1.17	40.61
Venezuela	45.91	1.46	34.22
Latin American sample average	*54.20*	*1.01*	*42.55*
United States	44.36	1.80	29.47
Canada	33.01	2.71	24.75
United Kingdom	27.6	4.0	22.0
France	34.1	2.4	25.2
Italy	33.6	2.9	26.5
Developed countries sample average	*34.53*	*2.76*	*25.58*

[a] Averages are obtained from available observations that meet the three criteria: coverage is the whole population and area, the income share unit of analysis is the household , and the definition is based on the income concept. Argentina and Uruguay are not included in this table since the gini coefficients available did not meet these criteria. Gini calculated using the methods developed by Shorrocks and Hua Wan, which estimate the Gini coefficient from decile data almost as accurately as if unit record data were used. Source: World Income Inequality Database (WIDER, 2007).

Table 2. Description of Variables

Variable	Description
Economic growth (Average GDP growth)	Period average of the difference of the natural log of real GDP per capita (constant prices: Laspeyres). Source: Penn World Tables 6.2 (Heston et al., 2006).
Real GDP (Y)	Period average of the natural log of real GDP per capita (constant prices: Laspeyres). Source: Penn World Tables 6.2 (Heston et al., 2006).
Investment share (I/Y)	Period average of investment share of real GDP (constant prices: Laspeyres). Source: Penn World Tables 6.2 (Heston et al., 2006).
Population growth (n)	Period average of the growth rate of the working age population (15 to 64). Source: World Development Indicators (2008).
Technological growth and depreciation ($g + \delta$)	Technological growth is represented by g and depreciation by δ. $g + \delta$ is equal to 0.05. Source: Mankiw et al. (1992).
School Attainment (school)	Years of schooling of population (who is not studying) between 15 and 64 years old. (10 year frequency). Source: Cohen and Soto (2007).
Family farms share (equality)	The area of family farms as a percentage of the total area of holdings (10 year frequency). Source: Vanhanen (2003b).
Land gini (inequality)	Gini coefficient of land distribution in 1950 or 1960 (time invariant, use observation in 1950 if there is no observation available in 1960). Source: Frankema (2008).
Government share (G/Y)	Period average of the government share of real GDP (constant prices: Laspeyres). Source: Penn World Tables 6.2 (Heston et al., 2006).
Polity growth	Growth of the period average of the combined polity score (polity2) computed by subtracting the autocracy score from the democracy score. Source: Polity IV Project (Marshall and Jaggers, 2003).
Urban dummy	Dummy equal to 1 if a country has a period average of the percentage of the population that lives in urban areas of 50 percent or above. Source: World Development Indicators (2007).
Private and public rural spending	Average of the available observations between 1985 and 2001 of private and public rural spending in 1995 U.S. dollars (time invariant). Source: GPRural (FAO, 2005)

Table 2. Description of Variables (Continued) [a]

Variable	Description
Irrigated land	Period average of irrigated land as a percentage of cropland. Source: World Development Indicators (2007).
Agricultural machines	Period average of the natural log of agricultural machinery (tractors per 100 sq. km of arable land). Source: World Development Indicators (2007).
Land tropics	Natural log of the percentage of land area in the geographical tropics (time invariant). Source: Gallup et al. (1999)
Wheat-sugar ratio (instrument)	Ratio of the suitability of land for wheat and sugarcane. Equal to ln[(1+arable land suitable for wheat)/(1+arable land suitable for sugar cane)] (time invariant). Source: Easterly (2007)
Sugarcane yield ratio (instrument)	The natural log of the inverse of the period average yield of sugarcane in hectogram per hectare. Source: ProdSTAT (FAO, 2008)

[a] All variables are estimated as the 10 year average from 1960 to 1999 and as the 5 year average from 2000 to 2004, unless stated otherwise.

Table 3. Summary Statistics (1960 – 2004) [a]

	Mean	Med.	Std. Dev.	Obs.
GDP growth	0.013	0.013	0.019	90
Ln(Y)	8.494	8.501	0.438	90
Ln(I/Y)	2.531	2.514	0.398	90
ln(n + g + δ)	-2.591	-2.564	0.109	90
ln(school)	1.621	1.667	0.394	90
Family farms share $_{t-1}$	23.333	23.000	10.249	90
Land gini	79.006	78.900	5.151	80
ln(G/Y)	2.894	2.876	0.280	90
Polity growth	-0.656	-0.028	2.131	90
Urban dummy	0.656	1.000	0.478	90
Private rural spending	177468.3	100851.4	231904.9	80
Public rural spending	288829.0	158239.1	349361.3	80
Irrigated land $_{t}$	12.518	5.808	13.684	90
Agricultural machines $_{t}$	4.037	4.061	0.961	90
Land tropics	0.226	0.177	0.187	90
ln(wheat-sugar ratio)	-0.031	-0.096	0.205	90
ln(1/sugar yield)	-13.327	-13.338	0.328	85

[a] Observations for the family farms share are from 1958 to 1998.

Table 4. OLS Estimates (dependent variable: average GDP growth) [a]

	1	*2*	*3*	*4*	*5*	*6*
Constant	0.062	0.057	0.087 *	0.068	0.041	0.041
	(0.048)	(0.052)	(0.050)	(0.048)	(0.071)	(0.052)
$\ln(Y)_{t-1}$	-0.010 *	-0.009 *	-0.010 *	-0.009	-0.009	-0.020 ***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)	(0.007)
$\ln(I/Y)_t$	0.014 ***	0.015 ***	0.016 ***	0.016 ***	0.019 ***	0.029 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.002)
$\ln(n + g + \delta)_t$	0.008	0.012	0.012	0.015	0.004	-0.020
	(0.016)	(0.016)	(0.016)	(0.016)	(0.019)	(0.024)
$\ln(\text{school})_t$	0.005	0.006 *	0.008 ***	0.006 **	0.002	0.005
	(0.003)	(0.003)	(0.002)	(0.003)	(0.005)	(0.010)
Family farms $_{t-1}$	0.0003 **	0.001 ***	0.001 ***	0.001 ***	0.001 *	0.0003 ***
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0005)	(0.0001)
Family farms$^2_{t-1}$		-0.00001 ***	-0.00002 ***	-0.00001 ***	-0.00002 ***	
		(0.000004)	(0.000004)	(0.000004)	(0.00001)	
$\ln(G/Y)_t$			-0.010 ***			
			(0.004)			
Polity growth $_t$				0.001 ***		
				(0.0001)		
Urban dummy $_{t-1}$					-0.027 ***	
					(0.005)	
Urban dummy $_{t-1}$ * family farms$_{t-1}$					0.001 ***	
					(0.0002)	
R-squared	0.490	0.496	0.515	0.504	0.550	0.705
Observations	90	90	90	90	72	35

[a] White's robust standard errors in parentheses. *, **, and ***, represent statistical significance at the 10, 5, 1 percent respectively. Estimations include time dummies but coefficients are not shown for space purposes.

Table 5. Resource Inequality and Urbanization in Latin America [a]

	FF rank	Family farms share (1968)	*Land Gini rank*	Land Gini coefficient (1960)	*FF rank*	Family farms share (1998)	Average urban population rate reached 50 %
Argentina	10	22	5	81.4	6	22	1960
Bolivia		20			13	31	1980
Brazil	7	18	9	78.7	5	20	1970
Chile	2	7	1	86.5	7	23	1960
Colombia	8	20	6	80.5	14	32	1960
Costa Rica	13	27	14	73.9	16	33	1990
Dom. Rep.	11	24	13	74.5	12	30	1980
Ecuador	12	25	7	80.4	17	36	1980
El Salvador	16	34	10	78.3	18	36	1990
Guatemala	14	29	11	77	11	29	- -
Honduras	15	30	15	70.6	1	13	- -
Mexico		43			15	32	1960
Nicaragua	5	17	12	75.9	9	25	1980
Panama	6	17	16	69.9	4	18	1980
Paraguay	3	7	2	86.3	2	15	1990
Peru	4	8	4	85.4	8	24	1960
Uruguay	9	21	8	79.1	10	27	1960
Venezuela	1	5	3	85.7	3	15	1960
Mean		19.44		79.01		25.61	59.34
Median		20.50		78.90		26	57.93
Std. Dev.		8.93		5.29		7.32	17.15
Maximum		34.00		86.50		36	92.02
Minimum		5.00		69.90		13	25.44

[a] The ranking for the share of family farms in 1968 does not include Bolivia and Mexico with the purpose to make it comparable to the ranking obtained from the land gini coefficient. Land gini coefficients are those estimated by Frankema (2008) in any year of 1960 for all countries but Ecuador and Honduras. The land Ginis for Ecuador and Honduras are those available in 1950. The ranking goes from 1 to 18, where 1 is the most unequal (highest land Gini and lowest family farms share) and 18 the most equal (lowest land Gini and highest family farm share). Guatemala and Honduras did not reach 50 percent of urban population by the period between 2000 and 2004.

Table 6. OLS Estimates (dependent variables: average GDP growth) [a]

	1	2	3	4	5
Constant	0.059	0.060	0.093 *	0.086 *	0.100
	(0.064)	(0.048)	(0.054)	(0.047)	(0.061)
$\ln(Y)_{t-1}$	-0.010	-0.009 *	-0.015 **	-0.008	-0.012 *
	(0.007)	(0.005)	(0.008)	(0.005)	(0.007)
$\ln(I/Y)_t$	0.013 ***	0.013 **	0.015 ***	0.016 ***	0.013 ***
	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)
$\ln(n + g + \delta)_t$	0.006	0.010	0.011	0.026 **	-0.001
	(0.019)	(0.016)	(0.016)	(0.011)	(0.018)
$\ln(\text{school})_t$	0.007 **	0.004	0.002	0.006 **	0.009 **
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Family farms $_{t-1}$	0.001 ***	0.001 ***	0.001 ***	0.001 ***	
	(0.0003)	(0.0002)	(0.0003)	(0.0002)	
Family farms$^2_{t-1}$	-0.00001 *	-0.00001 **	-0.00001 **	-0.00001 ***	
	(0.000005)	(0.000004)	(0.000004)	(0.000004)	
Private rural spending	0.00000001				
	(0.00000001)				
Public rural spending	-0.000000003				
	(0.00000001)				
Irrigated land $_t$		0.0002			
		(0.0001)			
ln(Agricultural machines) $_t$			0.005 *		
			(0.003)		
ln(Land tropics)				-0.014 **	
				(0.006)	
Land gini					-0.0005 **
					(0.0002)
R-squared	0.494	0.507	0.532	0.508	0.466

[a] White's robust standard errors in parentheses. *, **, and ***, represent statistical significance at the 10, 5, 1 percent respectively. All estimations have 90 observations. Only the estimations in columns 1 and 5 have 80 observations due to data unavailability. Estimations include time dummies but coefficients are not shown for space purposes.

Table 7. GMM and AB Estimates (dependent variable: average GDP growth) [a]

	1	*2*	*3*
Constant	0.102 ***	0.095 ***	
	(0.038)	(0.037)	
$\ln(Y)_{t-1}$	-0.011 ***	-0.010 **	-0.050 ***
	(0.004)	(0.004)	(0.007)
$\ln(I/Y)_t$	0.004	0.006	0.025 ***
	(0.004)	(0.004)	(0.007)
$\ln(n + g + \delta)_t$	0.007	0.006	0.043 *
	(0.006)	(0.005)	(0.022)
$\ln(\text{school})_t$	0.010 ***	0.007 **	-0.027 ***
	(0.003)	(0.003)	(0.007)
Family farms $_{t-1}$	0.0002 ***	0.0003 ***	0.001 **
	(0.00003)	(0.00005)	(0.0003)
Avg. GDP growth $_{t-1}$			-0.369 ***
			(0.067)
Observations	90	85	72
J-test	2.599	0.919	8.160
J-test probability	0.108	0.338	0.418

[a] White's robust standard errors in parentheses. *, **, and ***, represent statistical significance at the 10, 5, 1 percent respectively. All variables in column 3 are first differences. Estimations include time dummies but coefficients are not shown for space purposes.

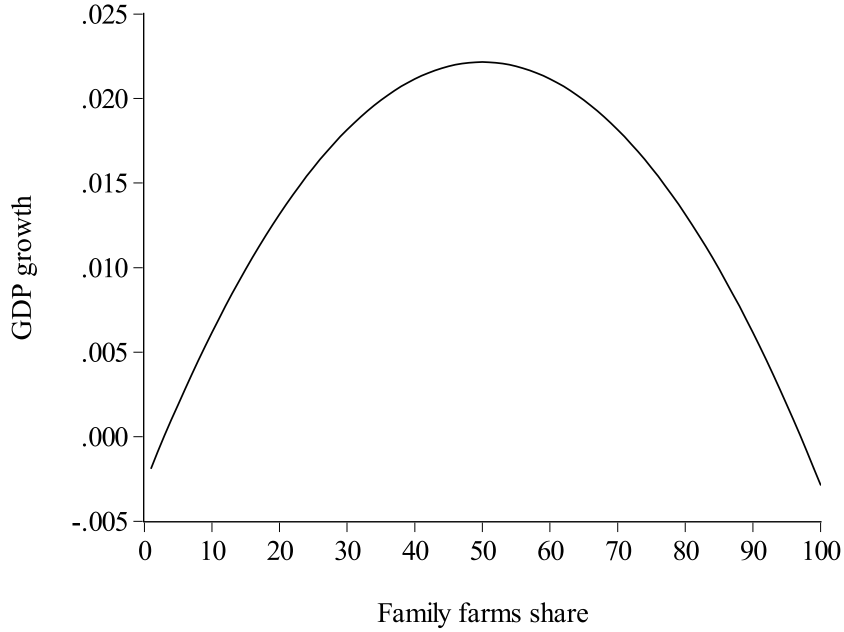

Figure 1. Nonlinear Effect of Family Farms Share on Growth (Range 1 to 100)

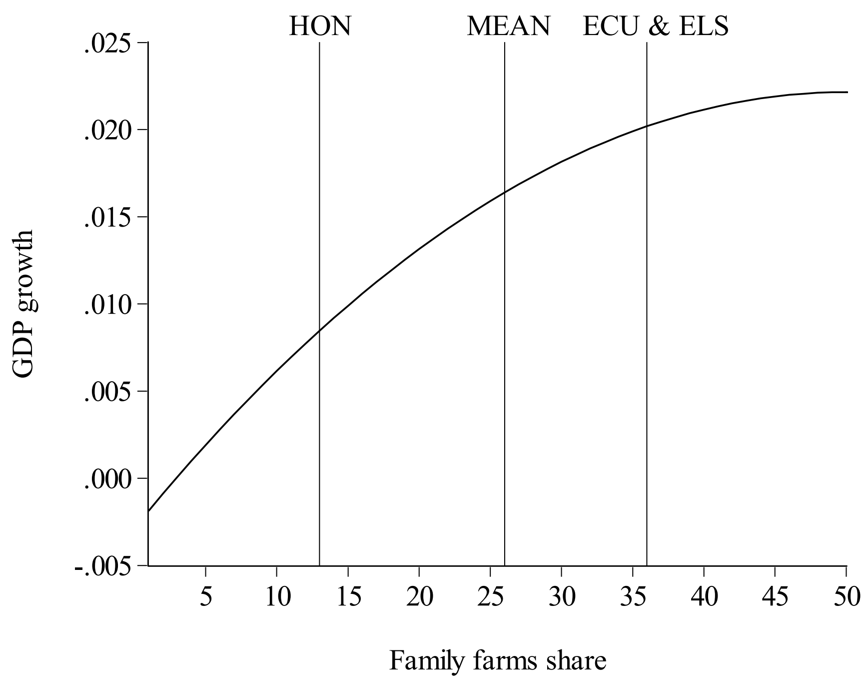

Figure 2. Nonlinear Effect of Family Farms Share on Growth (Range 1 to 50)