Poverty Traps and Institutions in Ethiopia

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January, 2012

Abstract

This paper tests for nonlinearity in households' income dynamics using a decade-long rural household panel survey dataset from Ethiopia. The paper argues that non-linearity in income dynamics could arise from the historical dynamics of institutions, and supporting evidence is provided from Ethiopian history. The empirical results support nonlinearity in income dynamics and hence the existence of poverty traps. The comparative static analysis of the empirical results shows the importance of policy interventions in terms of breaking out of the poverty trap.

JEL Classification: O12, I39

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[†]The author gratefully acknowledges comments from Ola Olsson, Stein Holden, Arne Bigsten, Alemayehu Geda, Abebe Shimeles, and Måns Söderbom. Financial support from Sida is gratefully acknowledged.

1 Introduction

In the last four decades, poor economic performance, and, at times, even economic stagnation, has been one of the most salient features of the majority of the developing world, especially the sub Saharan African region. Evidence shows that while some parts of the world did transit to prosperity, the rest remained poor or became even poorer (see Azariadis and Stachurski, 2005; Collier, 2007). Many cross-country studies have examined why this is (see, e.g., Landes, 1990; Olson, 1996; Pritchett, 1997; and Canova and Marcet, 1995). The observed economic stagnation and poverty are considered to be self-reinforcing in the sense that poverty at one point in time results in poverty in the future (see, e.g., Sachs, 2005). As such, current poverty may entrap countries at low income levels.

A number of theoretical models have been used to explain different channels through which economic stagnation or a poverty trap could arise[1]. The formalization in Murphy et al. (1989) of the Rosenstein-Rodan technological poverty trap model shows that coordination failure results in the absence of increasing returns to scale technologies, which in turn would lead to low level equilibrium trap. Banerjee and Newman's (1993) occupational choice model shows that initial wealth distribution determines agents' choices to be workers, self-employed, or entrepreneurs. With low initial wealth, the ratio of workers to entrepreneurs will be high, wages will be low, and the economy will be trapped at a low-level equilibrium.

Galor and Zeira's (1993) human capital explanation of the poverty trap shows that high costs of education relative to low income and a low skill premium lead to stagnation with low human capital. Dasgupta (1997) argued that a poverty trap may arise due to childhood undernourishment. The line of thinking is that childhood undernourishment can lead to permanent reduction in a person's physical capacity to function and hence to lower adulthood income.

[1] See Azariadis and Stachurski (2005) for a detailed presentation of poverty trap models.

The rent-seeking model of Murphy et al. (1993) laid out the conditions in which predatory institutions lead to stagnation. Bourguignon and Verdier (2000) and Acemoglu and Robinson (2002) discuss the political economic factors that lead to stagnation through imposition of inefficient policies that disproportionately benefit those with political power. Nunn's (2007) multiple equilibria model, which is in line with the model in Murphy et al. (1993) model, discusses how early colonial institutions could explain the current underdevelopment in Africa.

Collier (2007) identified four macro level mechanisms for poverty traps: the conflict trap, the natural resource trap, the trap of being landlocked, and the bad governance trap. These factors entrap countries through their adverse effect on capital accumulation, political and economic institutions, international trade, and economic policies. The mechanisms share the characteristics of Murphy et al.'s (1993) rent-seeking model and the political economic models of Bourguignon and Verdier (2000) and Acemoglu and Robinson (2002). The empirical counterpart of Collier's analysis shows that, as of 2006, around 980 million people live in countries trapped by one or more of these factors.

In general, traps can arise due to both market and institutional failures (Azariadis and Stachurski, 2005). This complicates the identification of the main causes of stagnation as many factors may operate concurrently. However, there are some empirical studies that test specific routes for poverty traps, and the results are, at best, mixed (see, e.g., Barret et al., 2001; McKenzie and Woodruff, 2003; and Dercon and Christiaensen, 2007). In addition, these types of empirical studies disregard the underlying causes of poverty traps and focus on characterizing households in persistent poverty in terms of their risk-taking ability or access to credit. Though such characterization is important in discerning the correlates of poverty traps, it does not illuminate the reasons why households are trapped to begin with.

The alternative approach to the direct testing of the specific route is testing for non-linearity in household income dynamics as in Lokshin and Ravallion

(2004). In this framework, when household income dynamics follows a stationary linear autoregressive process, households can recover from adverse shocks over time and hence current poverty need not be entrapping. Conversely, when income dynamics exhibits non-linearity, adverse shocks may be entrapping. The present paper follows this route to test for a poverty trap in Ethiopia.

This paper contends that the source of economic stagnation cannot be explained by a single factor. Nevertheless, if it is possible to single out a persistent stagnating force, it can be considered as the "structural" cause of stagnation. In the literature, past historical events are recognized to have a persistent long-term economic effect even after those are long gone (see Acemoglu, 1995; Nunn, 2007). One of the contributions of the present paper is thus to provide a historical account of institutional dynamics that may explain the underlying causes of a poverty trap in Ethiopia. The Ethiopian case provides a good opportunity as predatory institutions[2] have persisted since the fourth century.

Predation and rent seeking have been landmarks of Ethiopian history. The documented history of soldiers' predatory acts goes back as far as to 325 AD – 350 AD (see Caulk, 1978). Farmers and traders bore the cost of predation as soldiers were granted free provision of goods and services. This continued for a long time with increasing intensity until it ended in the mid-20th century. The rural peasant farmers were also subjected to another type of predation by the rent-seeking landlords until the advent of the 1975 land reform. Though the land reform obliterated landlord predation, in the 1980s the state assumed the role of a predator by introducing a compulsory grain delivery system that coerced farmers to sell a certain proportion of their output at a fraction of the market price. Although the regime change in 1991 halted the state predation, the incidence of poverty still lingers around the same level.

[2]The significance of predatory and rent-seeking institutions in explaining economic malaise in Africa is also supported in detailed case studies of twenty-five African countries (see Ndulu et al., 2007 & 2008).

The present paper considers the above historical dynamics of institutions to motivate an empirical test for a poverty trap. Predatory institutions adversely affect saving, accumulation, and investment, which in effect lowers output and income. Such low levels of output and income serve as initial conditions at the start of a non-predatory era, and hence determine the level of investment and output from then on. Better initial conditions could lead to higher future incomes, while bad initial conditions could result in stagnation due to lack of adequate investible resources. The institutional dynamics can thus lead to non-linear household income dynamics. The empirical section tests for existence of non-linearity in household income dynamics using the decade-long (1994-2004) Ethiopian Rural Household Survey panel dataset. The empirical results give some support for the existence of a poverty trap in the Ethiopian rural economy. The poverty trap hypothesis is not rejected at the macro level either, as Easterly's (2006) type of test for a poverty trap in the agricultural sector could not reject the hypothesis.

Following Matsuyama's (1997) suggestion on the policy relevance of results from multiple equilibria models, two policy experiments are considered in view of past institutional dynamics. An important observation of the dynamics of Ethiopian institutions is that the early institutions were built on predation and rent seeking, which discouraged investment and asset accumulation. It is thus worth examining the impacts of policy interventions aimed to battle the adverse effects of early institutions by encouraging investment in land improvements and supporting asset accumulation. The comparative static results show that these policies could lift households out of the poverty trap. At a higher level of asset value and better land fertility, the income dynamics do not show any evidence of a poverty trap.

The rest of the paper is organized as follows. The next section gives some background on the Ethiopian economy and the historical evolution of Ethiopian institutions. Section 3 lays out the empirical framework to test for a poverty trap. Section 4 contains the empirical tests for the existence of a poverty trap and some experiments on the likely impacts of policy intervention in lifting households out of a poverty trap. Section 5 concludes the paper.

2 The Setting

The Ethiopian economy shows the characteristics of a stagnant economy given that per capita income had been almost constant for the last four decades. The PCI[3] of 474 USD in 1950 increased to USD 671 in 1983 before it fell to USD 446 in 1992 and then rose to USD 631 in 2000. The real per capita agricultural output fell from USD 173 in 1961 to USD 96.4 in 2003, implying an annual growth rate of -1.1%. Though the total agricultural output has shown some growth during the post-1991 period, the 2003 level of real per capita agricultural output was lower than in the 1960s as it was only 55.7% of the 1961 level.

In terms of welfare indicators, the incidence of consumption poverty did not decline from 1990 to 2004- i.e., even after 15 non-predatory years (World Bank, 2005). Shimeles (2006) reported that 41% of rural Ethiopian households are sustained with a per capita consumption level that is below the poverty line. Abebe and Nijamu (2006) reported a high rate of persistence in poverty from 1994 to 2000. In addition, Bigsten and Shimeles' (2008) results based on the Ethiopian rural and urban survey data for the period o 1994–2004 showed high rates of re-entering into poverty among both urban and rural households and a low probability of exit.

The institutional dynamics are also daunting. Historically Ethiopia can be considered as a militarist state. Geda (2008) summarized the historical heritage as

> "Ethiopia's modern history reflects the institutional legacy of centuries of internal conflict and external threat. Internally, religion, regional location, ethnicity, and nationality have each, at various times and in varying combinations, served as focal points in the contest for power and control over economic resources. ...

[3] Source: Penn World Tables. The PCI is given by a Laspeyres index of real GDP per capita at a constant price.

> Externally, although the country was never colonized, hostile and powerful colonial forces encircled it from the last quarter of the 19th century and rendered its independence a besieged one. The country fought three times with the Egyptians, four times with the Dervishes, five times with the Italians and once with the British in the period from 1868 to 1896."

This had resulted in a buildup of a huge military force that is financed by extracting peasants' surplus through looting and predation.

As far back as 325-350 AD, "Professional armies in Ethiopia have usually been predators living off their lords' other subjects while raiding his enemies for booty" (Caulk, 1978: 460). Not so much changed until the mid-20th century. Up until this period, the Ethiopian army can be labeled as a disorganized force lacking proper organizational channels for basic supplies. As a result, the army was sustained by voluntary and involuntary support of peasant farmers even during peacetime. Farmers' produce and live animals were subjected to open looting to feed the army. The predation strongly discouraged farmers from producing more than to cover their subsistence need. In addition, as predation became more attractive, many farmers joined the army. In this context, Gebrehiwot's (1912) observations deserve a full quotation.

> "In our country, it is shameful to earn your bread by the sweat of your brow... The highest prestige is attached to being called a soldier, carrying an old gun, and following the chief like a dog...They call themselves soldiers, but they spend their time loitering in the streets, living like parasites on the produce of the peasantry. In civilized societies, a soldier is someone who protects the peasant... In our country, however, we are nearer to the truth if we define the soldier as the sworn enemy of the peasant. Hence, our fertile land lies fallow. And hence our poverty." (Gebrehiwot, 1912; cited in Bahru, 2002)

This observation indicates how entrenched the predatory institutions are in Ethiopia. As the army was at the core of the power and resource struggle, institutions that supported rent-seeking were tolerated and hence sustained.

The land tenure institutions of the pre-1974 period also strengthened the rent-seeking activities. Specifically, when Emperor Menlik expanded to today's southern part of Ethiopia in the mid-19th century, all land was declared state property. The expropriated lands were distributed to various groups based on services rendered during the conquest or in compensation for continued service, and to the clergy and settlers who migrated to the region (Markakis, 1974). The peasants lost their indigenous rights and become tributaries of the state and its beneficiaries. This transformed the peasants into tenants obliged to surrender a quarter to a third of their produce to the landholder as a tribute, and a tenth of their produce as a tithe. The tenants were also required to provide labor services to the landholders.

The 1974 socialist revolution abolished the land tenure system and the related rent-seeking activities. A major land reform policy that nationalized all land took place followed by land redistribution that entitled the peasants to a piece of land. However, the extraction of rents from the peasantry continued in a new form. The socialist ideology along with the establishment of the peasant associations enabled the state to extract economic rents from the peasants. The government introduced a system of forced quota supply of output to the public organization at a price as low as 22% of the market price (see Chole, 2004: 131), which squeezed the households' savings in favor of the rent-seeking public sector.

In another wave of regime change, the state predation ended in 1991 and many economic and institutional reforms took place. As the new regime did not address issues related to land tenure insecurity, investment in land improvements did not take place at the desirable rate (see, e.g., Deininger and Jin, 2006). In addition, investment in land improvements has been quite low due to the crippling initial level of poverty. Coupled with population pressure, this has resulted in significant land degradation. Shiferaw and

Holden (2000) estimated the productivity loss due to soil erosion in the northern highlands of Ethiopia to be around 2.2% per year. The negligible growth of the agricultural productivity (see World Bank, 2005) attests to this fact.

3 Empirical Framework and Data

3.1 Empirical Framework

In line with the rent-seeking model of Murphy et al. (1993) and the dynamic extension in Acemoglu (1995), it is possible to show that the predatory and rent-seeking institutions in Ethiopia could lead to a non-linear dynamics in household income. Akin to the theoretical work of Murphy et al. (1993), the rural society is classified into peasants and rent-seekers. Peasants are further classified as surplus producers and subsistence producers. A priori, it is assumed that all peasants prefer to be surplus producers. However, due to the predatory institutions, surplus production is not attractive and hence a certain proportion of peasants turn to subsistence production. Moreover, depending on the relative attractiveness of the rent-seeking activity, some peasants may switch to rent-seeking. With severe expropriation, subsistence production becomes the basin of attraction and hence the economy bends up in a poverty trap.

From an intergenerational perspective, the following generation inherits subsistence technology with low or no accumulated wealth. Assuming that surplus production requires a certain level of wealth and capital, the new generation can choose between subsistence production and rent-seeking. As a result, the economy stabilizes at the subsistence level of output with sizable rent-seekers. This mechanism would thus lead to non-linear income dynamics where the future trajectory of income is determined by the initial level of income.

The main prediction of the rent-seeking model is that predatory institutions

discourage savings, accumulation, and investments as expropriation transfer surplus to the rent-seekers. The extent of the fall in savings and investments depends on the proportion of rent-seekers in the society (or the magnitude of rent extracted). With a high enough proportion of rent-seekers, the economy would gravitate toward a subsistence level of income as the entire surplus would be absorbed by the rent-seekers.

Using the historical dynamics of Section 2, it can be shown that the proportion of rent-seekers and the magnitude of rent extracted are high enough to lead to stagnation at the subsistence level of income in Ethiopia. First, until the mid-20th century, the army, which survived on looting the peasants, was very large. Pankhrust (1963) documented that, by 1853, the regular armies assembled under chiefs reached about 200,000 men excluding the large number of followers that is estimated to be about half a million. For a population of 10 million and a labor force of around 5 million, the conservatively estimated more than 1 million soldiers (rent-seekers) constitute a quite large proportion that is able to absorb the entire surplus of the peasant economy. Second, the magnitude of rent extracted by the landlords is quite excessive even in times of distress (Markakis, 1974). Third, the quota supply system introduced during the military period (1974-91) levied a very high quota requirement on peasants, and failure to comply led to denial of land rights. The quota requirement was so high that there were cases that peasants sold their assets and livestock to be able to fulfill their quota requirement (Chole, 2004). Thus, the predatory institutions and the accompanying high intensity of rent extraction can certainly explain the Ethiopian economic stagnation.

Once an economy stabilizes at the subsistence level, innovation and technical progress become retarded, investment in human and physical capital are held up, and investment in land improvements may not take place. Such an economy is characterized by a low level of technical progress, a low level of education, shortage of skilled labor, a low level of capital accumulation, and a high level of land degradation. Moreover, with a rising population level and subsistence level of output, malnutrition is a natural outcome. These factors perpetuate the low-equilibrium trap either individually or by arising

simultaneously.

Following the regime change in 1991, the predatory institutions came to an end. However, the initial condition in the post-1991 period is characterized by a low or no saving, asset, and capital stock; degraded land due to intensive farming without adequate investments in the land; land tenure insecurity due to periodic land redistribution; and retarded agricultural technology with limited potential for surplus production. Even in the absence of expropriation, these initial conditions are certain to limit agricultural investment due to lack of investible resources and technical knowledge. The financial market cannot adequately supply the required finance owing to the apparent lack of savings in the economy. In addition, farmers' access to credit is limited as a consequence of lack of collateral, and land cannot be used for this purpose since the land policy prevents such practice. Under such initial conditions, past levels of output are good predictors of the current level of output as current investment depends on own past income. In the absence of predatory institutions, relatively better initial condition could lead to higher future incomes, while bad initial conditions could result in stagnation due to lack of adequate investible resources.

Thus, in the absence of predatory institutions, households' current income-generating process can be specified as the nonlinear difference equation $Y_{it} = f(Y_{it-1}, \ X_{it})$, where Y_{it} is household $i\prime s$ current income, Y_{it-1} is household $i\prime s$ lag income, which depends on the past predatory institutions, and X_{it} is exogenous household characteristics. f is assumed to be continuous and vanishing for $Y < Y_0$ and the function is increasing and concave in Y_{it-1} for all $Y > Y_0$, where Y_0 is the threshold income which must be reached for households to be productive in the future. For the function f to give two equilibria in a positive quadrant, a quadratic specification would suffice. However, a third degree polynomial would give better flexibility in allowing the curvature to switch (Lokshin and Ravallion, 2004). Thus, the third

degree polynomial specification for a T year panel dataset is given as

$$Y_{it} = \gamma_0 + \sum_{m=1}^{3} \alpha_m Y_{i,t-1}^m + X_{i,t}\beta + \eta_i + \varepsilon_{i,t} \qquad (t = 2, ...T) \quad , \qquad (1)$$

where α, β and γ are unknown parameters to be estimated, η_i is household specific effects, and $\varepsilon_{i,t}$ is the error term. Due to the presence of the lagged dependent variable in the set of the explanatory variables, $\varepsilon_{i,t-1}$ is correlated with Y_{it-1}, leading to a problem of endogeneity. As a result, we used the Arellano-Bond (1991) and Arellano-Bover (1995)/Blundell-Bond (1998) difference GMM and system GMM dynamic panel estimators.

To address this concern, we can first difference [1] to eliminate the individual effects to get

$$Y_{it} - Y_{it-1} = \sum_{m=1}^{3} \alpha_m (Y_{i,t-1}^m - Y_{i,t-2}^m) + \beta(X_{i,t} - X_{i,t-1}) + \varepsilon_{i,t} - \varepsilon_{i,t-1} \quad ,$$

where $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ is MA(1) with unit root. As this transformation does not remove the correlation between the lagged dependent variable and the error term, we need valid instruments to get consistent results. For period T, $(Y_{i1}, Y_{i2}, \ldots, Y_{iT-2})$ would be the set of valid instruments for $(Y_{iT} - Y_{iT-1})$ since they are not correlated with $(\varepsilon_{i,T} - \varepsilon_{i,T-1})$ as long as the $\varepsilon_{i,t}$ are not serially correlated. However, the instrumental variable estimation does not account for the MA nature of $(\varepsilon_{i,T} - \varepsilon_{i,T-1})$. Arellano-Bond (1991) derived their GMM estimator utilizing the moment conditions between the instrumental matrix Z and $\Delta\varepsilon_{i,t}$-i.e. $E(Z_i \Delta\varepsilon_i) = 0$.

For $T > 3$, the model is overidentified and a Sargan test can be used to test the overidentifying restrictions. Moreover, the key identifying assumption that $\varepsilon_{i,t}$ disturbances are not serially correlated can be tested by testing for no second-order serial correlation in the first-differenced residuals (Bond,

2002).

One important problem that should be addressed in relation to the validity of the Arellano-Bond GMM estimation is the issue of measurement errors. In the absence of non-correlated measurement errors, the Arellano-Bond GMM approach gives consistent estimates of a linear dynamic panel model. Yet with our non-linear specification, this approach may give inconsistent estimates even if the measurement errors are not correlated (Antman and McKenzie, 2007; Dercon and Shapiro, 2007) unless we assume independence between income and measurement errors. This can be seen by rewriting equation (1) without the other control variables as

$$Y_{it} = \alpha_1 Y_{it-1} + \alpha_2 Y_{it-1}^2 + \alpha_3 Y_{it-1}^3 + \varepsilon_{it} \ . \tag{2}$$

The observed income $Y_{it} = Y_{it}^* + \eta_{it}$, where Y_{it}^* is the true income and η_{it} is the measurement error, and equation (2) is modified as

$$Y_{it} = \alpha_1(Y_{it-1} - \eta_{it-1}) + \alpha_2(Y_{it-1} - \eta_{it-1})^2 + \alpha_3(Y_{it-1} - \eta_{it-1})^3 + \varepsilon_{it} + \eta_{it} \ . \tag{3}$$

Expanding and rearranging equation (3) gives

$$Y_{it} = \alpha_1 Y_{it-1} + \alpha_2 Y_{it-1}^2 + \alpha_3 Y_{it-1}^3 + \mu_{it} \ , \tag{4}$$

where $\mu_{it} = \varepsilon_{it} + \eta_{it} - \alpha_1 \eta_{it-1} - \alpha_2(2\eta_{it-1} Y_{it-1} - \eta_{it-1}^2) - \alpha_3(3\eta_{it-1} Y_{it-1}^2 - 3\eta_{it-1}^2 Y_{it-1} + \eta_{it-1}^3)$.

In this case, due to the structure of the error term μ_{it}, the further lags of income cannot be valid instruments for lagged income unless we assume independence between income and the measurement errors. Our estimation of equation (1), thus, imposes this assumption.

As measurement error in income cannot be ruled out and the assumption of independence may be a strong one, we used a nonparametric local polynomial estimation method to further test for nonlinearity in income dynamics. Dercon and Shapiro (2007) noted that the Nadaraya-Watson type bivariate kernel regression method that has been used in the literature (e.g., by Lybbert et al., 2004) is sensitive to discontinuities and hence may lead to biased results.[4] As a result, a local polynomial estimator, which is not sensitive to discontinuities and outliers (Härdle et al., 2004), is used. This estimator is also the best smoother among all linear smothers (Fan, 1992). Thus, local polynomial of order three is estimated for ΔlnY_{t+10} (*i.e.*, $lnY_{2004} - lnY_{1994}$) as a function of lnY_t (lnY_{1994}) using a Gaussian kernel function.

Another alternative to address the problem of measurement error is to use instrumental variable estimation technique where the lagged income is instrumented by some other variable; not by its further lags. Dercon and Shapiro (2007) used the lag of rainfall interacted with household specific variables[5] as an instrument for lagged income and found robust results using data from India. In our case, the interacted rainfall instruments appear to be weak instruments for lack of correlation with income. This may be partly because the effect of rainfall on income does not vary with household specific characteristics and hence the interacted variable does not capture income variability.

[4] "In the case of Nadaraya-Watson estimates we typically observe problems due to the one-sided neighborhoods at the boundaries. The reason is that in local constant modeling, more or less the same points are used to estimate the curve near the boundary. Local polynomial regression overcomes this by fitting a higher degree of polynomial here." (Härdle et al., 2004: 97)

[5] Such as land and household size to generate some variability in the instruments as rainfall is measured at village level and hence fixed within the villages. Interacting rainfall with household characteristics assumes that the effect of rainfall on income depends on household characteristics.

3.2 Data

We used data from a survey of 15 rural Ethiopian villages covering 1,470 households during 1994, 1995, 1997, 1999, and 2004.[6] The data collection was initially started in 1989 with six villages and expanded in 1994 to 15 villages. The data was collected by the Department of Economics at the Addis Ababa University in collaboration with the Center for the Study of African Economics at Oxford University and the International Food Policy Research Institute, Washington.

The surveys were conducted in six rounds- two in 1994 and the remaining in 1995, 1997, 1999, and 2004. In each village, households are selected randomly and in proportion to the population of the village (for a detailed discussion of the sampling framework, see Dercon and Hoddinott, 2004). The attrition rate is as low as 3% mainly because of low mobility as households cannot acquire land when moving to other places. Table 3.1 in the appendix presents descriptive statistics on the variables used in the analysis.

[6] Given the dynamic specification, the time gap in the data may pose practical problems for estimation. However, since the gap between two periods is quite small because of the nature of the rural economy, it may be valid to assume $y_{it-1} \approx y_{it-p}$ as in Dercon et al. (2006).

4 Results

4.1 Testing for Non-Linear Income Dynamics

4.1.1 GMM Results

Table 4.1 below gives the estimates of the nonlinear dynamic equation. As the Sargan overidentification test shows, while both the 1-step and 2-step difference GMM pass the Sargan overidentification test, the system GMM specification does not. However, in all specifications, the AR (2) test does not detect second order autocorrelation in the residuals as required for validity of the GMM estimation.

The estimated parameters of the control variables show that gender of the household head, land fertility, and the type of crop the household produces significantly affect income levels. The result shows that male-headed households are better off than female-headed households. Households with fertile land and those who produce *teff* and coffee tend to enjoy higher long-run income. Large households and households with older heads tend to have lower long-run income though the results are not statistically significant. Education of the household head, land size and number of oxen seem to have a positive effect on income, though they are statistically insignificant.

Table 4.1: GMM Estimation Results

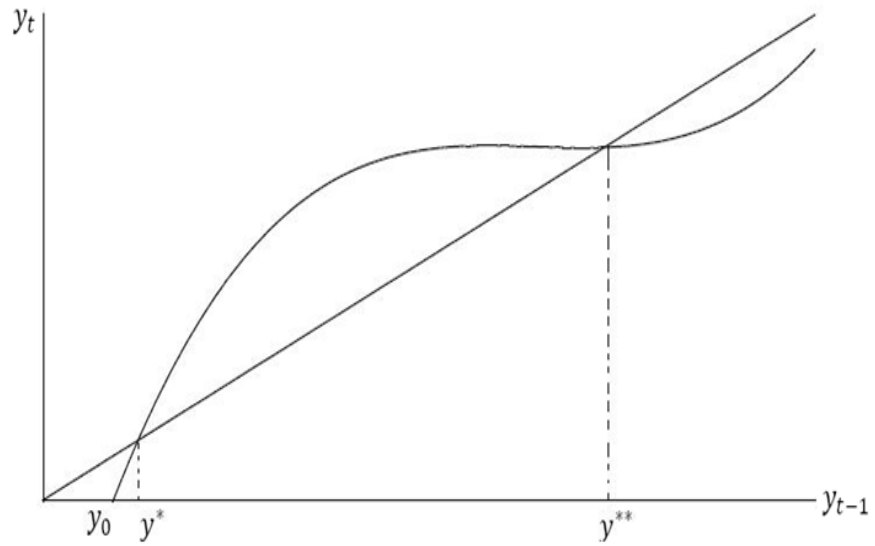
	Difference GMM		
	One-Step	Two-Step	System GMM
y_{it-1}	5.591*	6.551*	1.585**
	(0.0829)	(0.0976)	(0.0446)
y^2_{it-1}	-0.885*	-1.059*	-0.291**
	(0.0929)	(0.0949)	(0.0283)
y^3_{it-1}	0.0462*	0.0564*	0.0179**
	(0.0956)	(0.0852)	(0.0143)
Age of the Household Head	-0.007	-0.006	0.004
	(0.394)	(0.582)	(0.439)
Gender of the Household Head	0.524*	0.500***	0.511**
	(0.0882)	(0.000)	(0.0232)
Household Size	-0.001	-0.006	0.0154
	(0.966)	(0.751)	(0.288)
Education Level of the Head	0.005	0.006	0.009
	(0.844)	(0.730)	(0.629)
Land Size	0.02	0.023	0.048**
	(0.417)	(0.223)	(0.0103)
Land Fertility	0.109**	0.0954*	0.0968***
	(0.024)	(0.051)	(0.008)
Number of Oxen	0.026	0.0207	0.0343
	(0.412)	(0.398)	(0.160)
Crop Type: Teff	0.365***	0.420***	0.352***
	(0.000)	(0.000)	(0.000)
Crop Type: Coffee	0.373***	0.382***	0.323***
	(0.004)	(0.001)	(0.000)
Crop Type: Chat	0.229	0.184	0.313***
	(0.130)	(0.199)	(0.006)
Value of Asset	0.002**		
	(0.019)		
Round Dummy:r2	-0.382***	-0.369**	-0.301***
	(0.001)	(0.0105)	(0.000)
Round Dummy:r3	-0.139	-0.116	-0.134*
	(0.163)	(0.176)	(0.0559)
Round Dummy:r4	-0.183**	-0.165**	-0.173***
	(0.0410)	(0.0312)	(0.006)
Constant	-5.568	-6.739	2.860*
	(0.375)	(0.370)	(0.069)
Observations	2198	2225	3486
Sargan Test: Chi-Square (Prob)	7.004 (0.6366)	12.03 (0.2116)	57.03 (0.000)
AR(2) Test: Prob	0.2971	0.2775	0.2007

p values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Both the Sargan and the second order autocorrelation tests support the GMM results.

To interpret the results of the nonlinear dynamics, the parameters of the 1-step difference GMM are used and the roots of the polynomial are solved. That is, we take $Y_{it} = 5.591Y_{it-1} - 0.885Y_{it-1}^2 + 0.0462Y_{it-1}^3 - 5.568$; set all the other exogenous variables at their mean, and derive the roots of the polynomial. The polynomial has one real root and two complex roots. Plotting this relationship (Figure 4.1) shows that there are two stable equilibria, at y_0 and y^{**}, while there is one unstable equilibrium, at y^*. The result supports the classic poverty trap case where households with income below y^* are trapped in poverty while households with incomes greater than y^* converge to a higher level of long-run income.

Figure 4.1: Income Dynamics



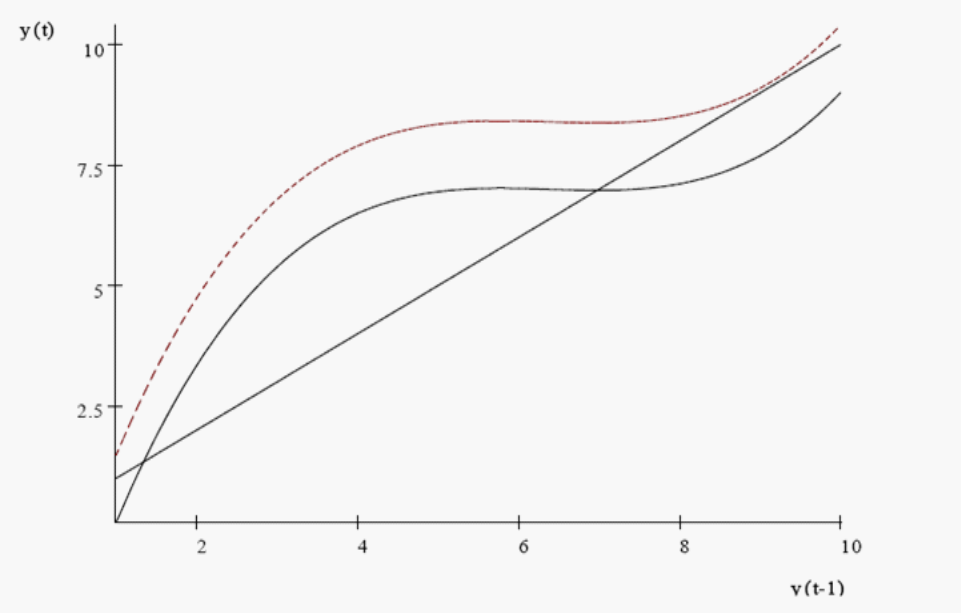
An important question at this point concerns the role of institutions. We noted that the early predatory institutions discourage asset accumulation and investment in land improvement. Two policy interventions that address the adverse effects of the early institutions, i.e., increase in the value of asset and increase in land fertility, are considered under the income dynamics presented in Table 4.1. Given the income dynamics, setting the mean asset

value to its maximum results in the income dynamics (the broken line) shown in Figure 4.4. As the income dynamics lie above the 45^o line, there is no evidence of a poverty trap at this level of asset value. Similarly, setting the mean value of the land fertility indicator at its maximum gives a higher level of equilibrium income.

The comparative static results also show that policy interventions that support land fertility- enhancing mechanisms and facilitate household's asset accumulation have a positive impact on breaking out of the poverty trap. In the case of Ethiopia, strengthening land tenure security is found to be a significant factor in influencing investment in land improvements (see Ayalew, Dercon and Gautam, 2005; Deininger and Jin, 2006, among others). Given that land fertility is a positive function of land investment, policies that strengthen tenure security may be good candidates for lifting households out of the low-equilibrium trap. A related area of intervention may be access to credit. Investment in land improvements requires substantial investments that subsistent producers cannot finance. Access to credit eases the financial constraints and hence facilitates investment in land improvements.

Supporting asset accumulation has two effects: a credit effect and a shock absorbing effect. It serves as collateral for credit and absorbs adverse shocks. Government intervention to support asset accumulation could thus have a broad impact. For instance, one form of intervention may be public spending on animal disease control and eradication. This would reduce households' risk of livestock holding and hence encourage asset accumulation, especially when livestock is the main asset.

Figure 4.2: Income Dynamics with Positive Asset Shock

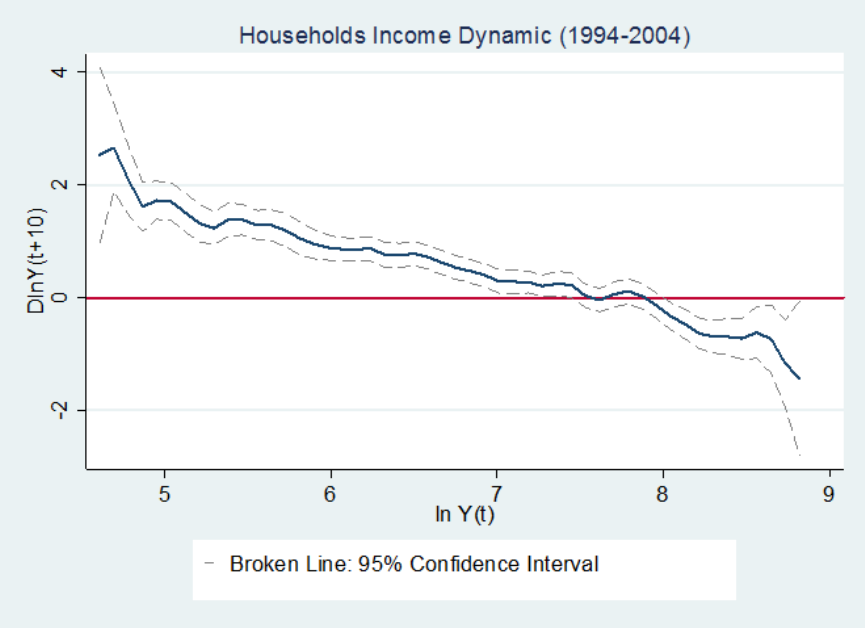


4.1.2 Local Polynomial

The results of the local polynomial estimation are shown in Figure 4.3. The dynamics of income in 1994-2004 supports the existence of some non-convex income dynamics.[7] The income dynamics curve crosses the zero growth line twice from above and once from below. The two points where it crosses the zero growth line from above constitute two stable equilibrium points while the other crossing point is the unstable equilibrium point. The result is consistent with the findings of Lybbert et al. (2004), who showed the existence of non-convex wealth dynamics among the pastoralists of southern Ethiopia.

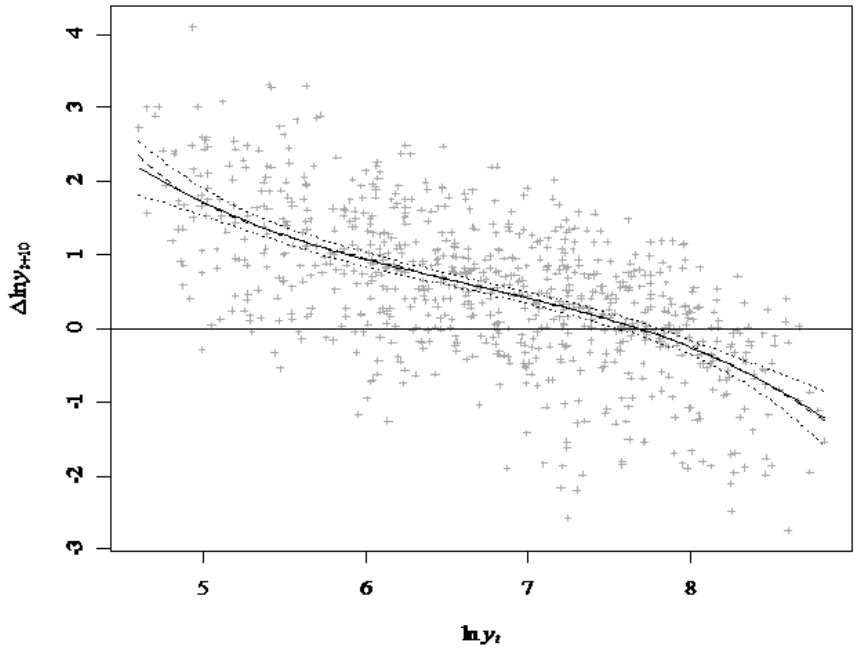
[7] It is, regrettably, difficult to see the crossings clearly in the figure presented due to its low resolution.

Figure 4.3



However, the above result is sensitive to the bandwidth of the kernel function. For instance, doubling the bandwidth over smoothes the function and gives only one equilibrium point at around *log* 7.8 (see Figure 4.4). In this case, there is no evidence of a poverty trap. Rather, there appears to be convergence toward a lower equilibrium household income of around 2,440 birr (USD 355) per year. For an average household of five, the equilibrium per capita income becomes 488 birr (USD 71), which is much lower than the per capita income at the national level. This may indicate that households converge to different equilibrium points depending on their income levels. Following Kruger (2009), the income dynamics is estimated for different quantiles of income growth.

Figure 4.4: Household Income Dynamics (1994 to 2004) Smoothed

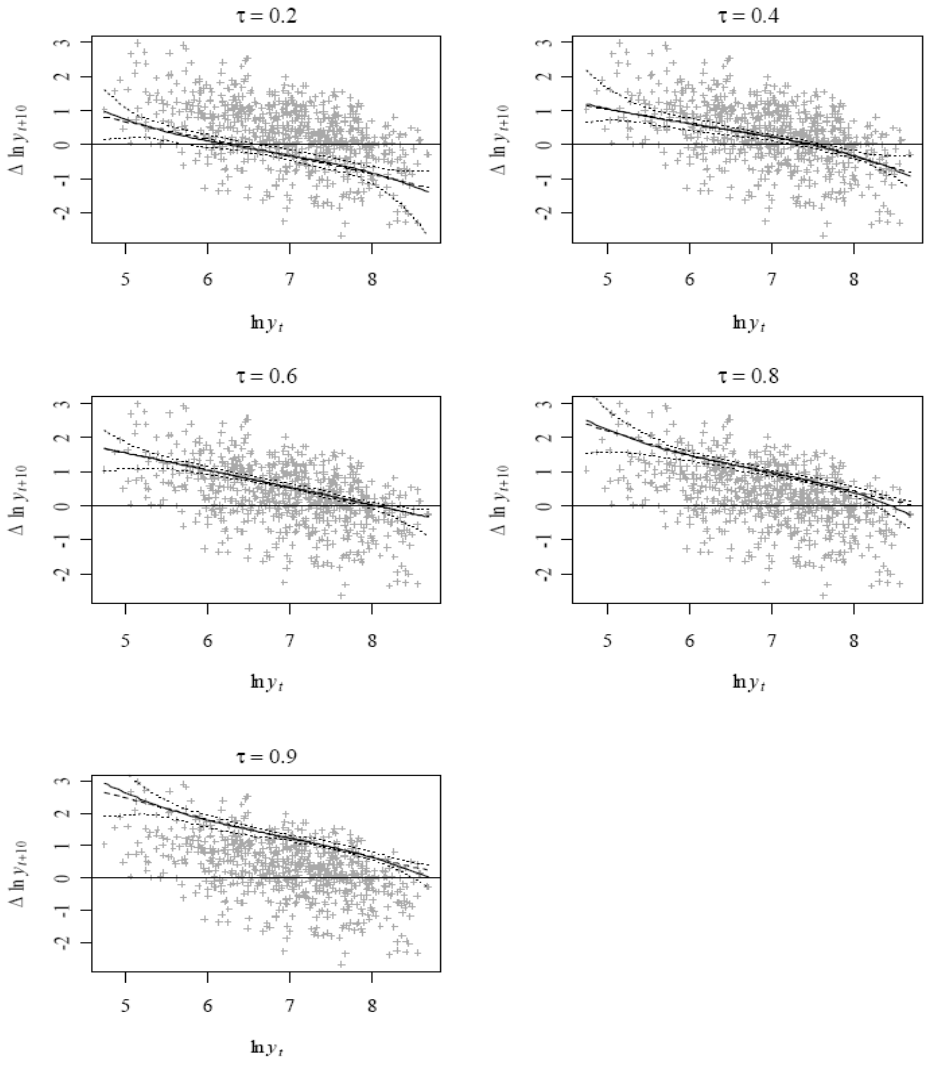


The nonparametric quantile regression of $\Delta \ln Y_{t+10} = f(lnY_t, lnY_t^2, lnY_t^3)$ is estimated using a nonparametric quantile regression with splines smoothing as suggested in Koenker et al. (1994). The results for different quantiles (0.2, 0.4, 0.6, 0.8, and 0.9) are given in Figure 4.5. The dotted lines indicate bootstrapped 95% confidence intervals from 10,000 bootstrap repetitions of the quantile fit while the solid line is the third degree polynomial fit of the nonparametric quantile estimates. The results suggest that convergence to a lower equilibrium point is a feature observed in the lower growth quartiles (0.2 and 0.4), and the equilibrium income seems to be rising with the higher growth quartiles. At the highest quantile (0.9), there is neither evidence of a poverty trap nor a convergence to low level equilibrium income.

The overall result of the nonparametric quantile regression supports the existence of poverty traps in the sense that households with low initial incomes converge to a low equilibrium income while households with higher initial income converge to a higher equilibrium income. That is, initial conditions

matter and hence, even after the factors that triggered stagnation are no longer present, households may still be trapped at a lower level of income due to the dynamic effects of the initial factors that once led to stagnation.

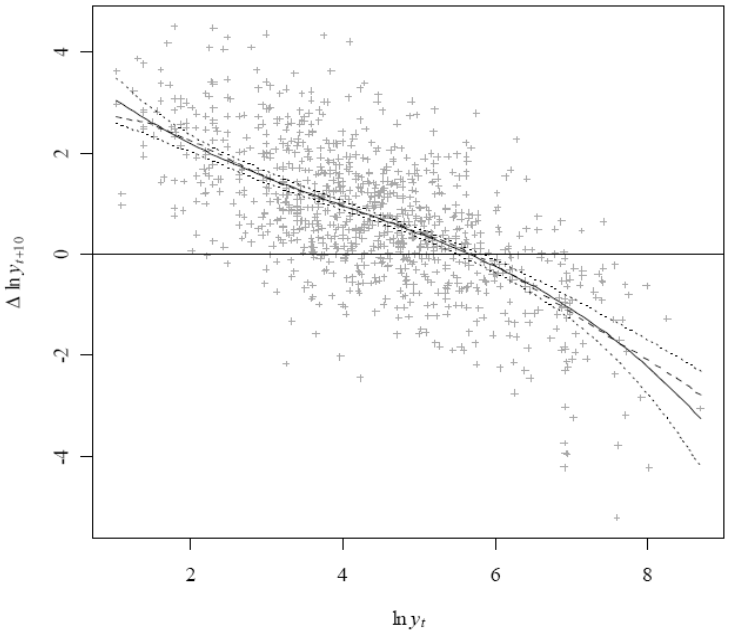
Figure 4.5: Nonparametric Quantile Regression Results



4.2 Asset-Based Test for a Poverty Trap

As a robustness check of the results, an asset-based[8] approach is used to test for a poverty trap. Carter and Barrett (2006) suggested an asset-based approach because of its desirable features. They argued that the asset-based approach is more suited to differentiate between transitory income shocks and structural changes. While transitory income shocks that leave the asset base intact would not lead households into poverty trap, structural changes that degrade the asset base would. We followed this approach and used a local polynomial estimation of asset dynamics to test for non-linearity.

Figure 4.6: Asset Dynamics 1994-2004



Despite the problems related to this approach,[9] the local polynomial esti-

[8] Asset is measured as the total value of a household's asset at a constant price. Household assets include items such as furniture, farming equipment, jewelry, and firearms.

[9] "First, not only is the relationship potentially highly non-linear, but also the dynamic asset poverty threshold is an unstable equilibrium, away from which households move

mation results show convergence to a low level equilibrium (see Figure 4.6). Dercon (2003) estimated that 75 to 137.5 percent[10] of this equilibrium asset value is required to start profitable nonagricultural business activities to supplement the low agricultural income. However, the equilibrium asset value is too low to serve as collateral for loans or to finance the working capital required to enter into such profitable activities.

4.3 Macro Approach: Testing for Stagnation of the Agricultural Output Per Capita

As a further examination of the poverty trap hypothesis, a macro level test of the hypothesis is provided following Easterly (2006). The theory of a poverty trap predicts that agricultural output per capita would be stationary with no drift term in the presence of a trap in the sector. One important problem in testing for stationarity is the presence of structural breaks since the unit root tests are sensitive to breaks. As the data (1960/61 to 2002/3) covers three different regimes with different agricultural policies, structural breaks are expected to be an important feature of agricultural output per capita. To address the issue of structural breaks, the Clemente, Montañés and Reyes (1998) tests for unit root are used. These tests allow for two structural breaks and also account for both innovative outliers and additive outliers.

The test results presented in Table 4.2[11] suggest stationarity of agricultural output per capita, supporting the existence of a trap in the agricultural sector. That is, agricultural ouput per capita is a mean-reverting process

over time. This means that we would expect few observations in the neighborhood of the threshold itself in any data set and an unstable equilibrium can easily be mistaken for heteroskedastic errors (Barrett, 2005). The second problem is that most households possess a portfolio comprised of multiple assets. Estimation of asset dynamics must somehow deal with this dimensionality problem." (Carter and Barrette, 2006: 193).

[10] 300 to 550 birr

[11] The Clemente, Montañés and Reyes (1998) unit root tests accommodate both additive outliers (AO) and innovational outliers (IO). The results presented in Table 4.2 are based on the IO model; but the AO model gives similar results.

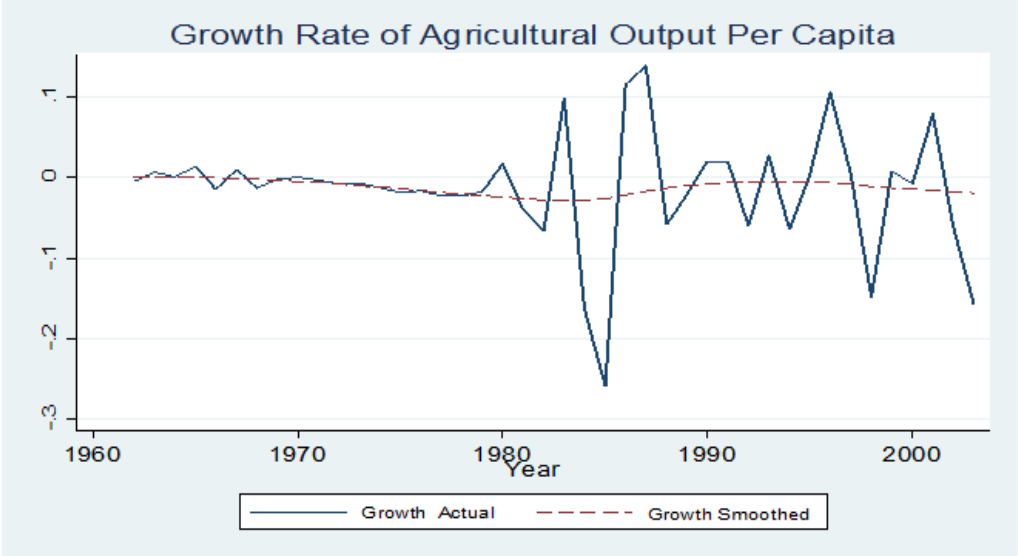
that fluctuates randomly around a certain stationary level, implying that its growth is zero over a long period of time. Figure 4.7 shows the trends in the growth of the actual and smoothed levels of agricultural output per capita. Once the structural breaks and the erratic fluctuations are filtered out, the growth in agricutral output per capita flattens out as shown by the broken line. This is consistent with the results in Table 4.2.

Table 4.2: Testing for a Poverty Trap: Macro Approach

Clemente-Montañés-Reyes unit-root test of real per capital agricultural output				
Log of Agricultural output per capita	T = 39	optimal breakpoints : 1975/6 , 1982/3		
AR(1)	du1	du2	(rho - 1)	const
Coefficients:	-0.17	0.18	-1.65	-0.02
t-statistics:	-3.593	3.672	-10.88	
P-values:	0.001	0.001	-5.490 (5%	crit. value)
The null of unit root is rejected.				
Note: The test is based on double mean shifts innovative outlier model.				

Another interesting result is that the structural breaks tally with the regime change in 1975/76 and the period just after the policy changes, i.e., 1982/83, that introduced incentive non-compatible policies such as compulsary grain delivery and socialization of production in the form of producers' cooperation. However, though the major regime shift in 1991 resulted in many pro-agricultural policies, the tests do not show any structural break following the regime change (see Figure 4.8 in the appendix). This indicates an absence of a persistent innovative shock that changed agricultural output per capita substantiallyin the post-1991 period. The results may suggest that ending rent-seeking institutional arrangement is not enough to get out of stagnation unless its adverse hangover effects are addressed.

Figure 4.7



5 Conclusions and Implications

Economic stagnation and persistent poverty define most of the developing world. The current paper looks at whether the existence of a poverty trap can explain this phenomenon, taking Ethiopia as a case. Using a rural household survey panel dataset, the paper examines households' income dynamics during 1994-2004 period. The empirical results suggest the existence of a low-level equilibrium trap. At the macro level, the stationarity of agricultural output per capita also supports this result. In addition, the comparative static policy experiment results show that interventions that support land fertility-enhancing mechanisms and facilitate asset accumulation among households may have a significant effect in unlocking the low-equilibrium trap.

Though the post-1991 reforms have facilitated surplus production, the observed low-equilibrium trap may indicate a severe slack in productive ca-

pacity, which requires long time to fill. Easterly's (2002) evaluation of the post-1991 (1992-2002) Ethiopian economy reached a similar conclusion. The main findings of Easterly (2002:2) allude that

> "...increases in Ethiopia's growth potential would require a second generation of reforms that address some of the poor initial conditions... (due to the binding nature of the initial conditions) Ethiopia's current predicament fits well with theoretical and empirical descriptions of a 'poverty trap'. Only a significant 'big push' in the fundamentals through a program of institutional reform... would make possible an acceleration of growth..."

The poverty trap hypothesis states that initial conditions determine the future income trajectory. In the words of Hoff and Stiglitz (2001: 394), "It is not necessarily true that the impact of past events erodes over time. Those events may set the preconditions that drive the economy to a particular steady state." We, thus, consider the case of Ethiopia and posit that predatory institutions may be the initial cause for stagnation. As predatory institutions dominated the country from the fourth century until recently, their effect on the growth of the agricultural sector has been quite deleterious. The adverse influences of predatory institutions on the incentive to invest, accumulate assets, and innovate facilitated conditions that favor production only at a subsistence level. As a result, agricultural investment and technical progress are limited to meet only the subsistence level of output.

With centuries-old slack in agricultural investment, lag in technical progress, and low levels of wealth accumulation due to the subsistence nature of production, institutional reforms alone may not be enough to transit out of a poverty trap. The slack in productive capacity dwarfs the positive roles of the institutional reforms by serving as the starting condition in the post-reform era. To the extent that bridging the centuries-old slack takes time, the observable effects of institutional reforms can be expected to accrue over

a long period. Easterly (2002) also notes that it takes time to implement reforms; hence, their effect are observable long after their completion.

Briefly, in order to address the problem of the low-equilibrium trap, it is important to understand the productive capacity rift created by the early institutions. Policy interventions should be informed by the depth of the rift, as marginal action may be ineffective in breaking out of low equilibrium trap. Sachs' (2005) suggestion for a massive expenditure boost seems to be predicated on this reasoning.

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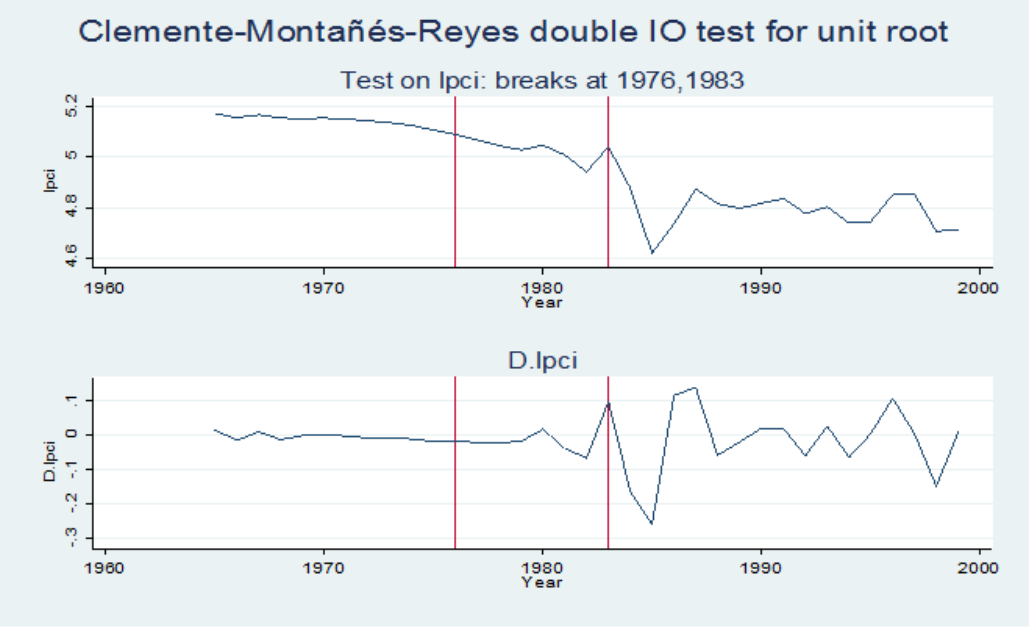
Appendix 1. Tables and Figures

Table 3.1: Descriptive Statistics

Year	1994		1995		1997		1999		2004	
N=1015	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Farm Income	1551	2119	1806	2283	2300	2744	2001	2055	2239	2819
Off Farm Income	51	155	61	280	53	194	67	246	57	170
Household Head Age	46	16	47	16	49	15	50	15	53	15
Household Size	6.5	3.0	6.4	3.0	7.9	3.3	7.8	3.3	5.0	2.3
Land Size	2.03	2.29	2.04	2.05	2.12	2.01	1.22	1.05	2.12	2.01
Land Fertility Index	2.2	0.66	2.3	0.67	2.2	0.72	2.4	0.64	2.4	0.64
Number of Oxen	0.30	0.77	0.31	0.78	1.03	1.14	1.09	1.10	.92	1.09
Value of Asset	209	425	271	515	260	394	310	423	313	480
Illiterate Household Head	0.67	0.47	0.67	0.47	0.67	0.47	0.66	0.47	0.59	0.49

Figure 4.8



Appendix 2. Note on Land Fertility Index

On average, households own more than one plot of land with different characteristics. The survey asks households to identify their plots as fertile (Lem), somewhat fertile (Lem-Teuf), or infertile (Teuf). To capture the characteristics of the total land owned by a household, the land fertility index (LFI) is computed as:

$$LFI = \sum_{i=1}^{n} f_i w_i \quad ,$$

where w_i is the ratio of each type of land to the total land owned; and f_i is the land fertility indicator. f_i takes the value 3, 2 and 1 for fertile (Lem), somewhat fertile (Lem-Teuf), and infertile (Teuf), respectively. Thus, the LFI ranges from 1 to 3, where a higher values indicates better land quality.