Macroeconomic Policy and Poverty Reduction in India

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Abstract: *Understanding the relationship between macroeconomic policies and poverty still remains a key policy challenge. This paper develops a framework to link key macroeconomic variables with poverty and tests the effect of policies namely the government-led channel of development spending and financing that directly influence poverty after accounting for the effect of sectoral output and price ratios using data from India spanning over the last five decades. First, the policy-driven model emphasises the sectoral income distribution and intersectoral terms of trade as a mechanism in determining the level of poverty. Second, the paper considers key components of fiscal spending and monetary or financial policy via availability of credit rather than the cost channel to show that a strategy of government-led development spending and financing is a precondition for growth with poverty alleviation. A rise in relative price of agriculture does not reduce poverty, as the income effect is not sufficient enough in offsetting the decline in the purchasing power of poor due to rise in food prices that comprise big part of the consumption basket of most poor who are largely agricultural labourers and tenants, whereas more irrigated area on the back of higher government capital spending on the other hand offsets the adverse impact, along with the extension of bank credit to agriculture, contributing significantly to poverty reduction.*

Keywords: macroeconomic policy, India, China, development spending, development finance, poverty reduction

1. Introduction

Linking macroeconomic and financial sector policies to poverty reduction is a difficult and challenging task from the policy perspective. The evidence in the poverty literature is mixed with claims that economic growth path in developing countries has been pro-poor (see Dollar and Kraay, 2002).[1] On the contrary there are studies reporting the role of re-distributive policies aiding more directly to poverty reduction whenever poverty skyrocketed including in the aftermath of a crisis (see, for example, Alesina and Rodrik, 1994; Dagdeviren *et al*., 2002; Agenor, 2004). The policy issue is not whether growth is or is not good for the poor, but what

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policy measures can make it most effective for the poor. The macroeconomic impacts can be both direct and indirect. The direct impact works through prices, and public spending on the poor (supply of public goods directly targeting the poor; opportunities provided for the poor such as education), whereas the indirect impacts of macroeconomic policy on poverty work through its effect on growth. So the literature remains dominated by a paradigm of growth being necessary for poverty reduction but it may not be sufficient if the relevant development policies are not in place. Economic growth can contribute to the reduction of poverty as no growth is even worse, but the mechanisms by which an improvement in general economic performance promotes poverty reduction are by no means universally agreed (see Agenor, 2004).

Although there exist many studies on the measurement and definitions of poverty, there is still limited focus on policy measures on how best to reduce poverty.[2] So evaluating what kind of policies may reduce poverty and the channels of transmission are interesting. In general, macroeconomic policies primarily contribute to maintaining macroeconomic stability, which in turn help economic growth and hence may contribute to poverty reduction. The objective of macroeconomic policies is to overcome permanent shocks and to weather temporary shocks. When it comes to economic development as a long-term goal, there is a need to identify macroeconomic policies that have distributional and allocational properties. Macroeconomic policies refer to contractions in public expenditure and restrictive monetary policy, usually designed to create conditions for stability with growth, but these policies can have negative consequences on poor households. Short run macroeconomic policies and longer term growth strategies are inextricably linked. Thus there is a need for making

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[1] See Datt and Ravallion (1998) and Palmer-Jones and Sen (2006a) for a detailed survey of issues on rural poverty in India, providing strong support for the trickle-down hypothesis.
[2] See Agenor (2005) for an exhaustive survey of issues related to the macroeconomic focus on poverty analysis. Also see Granville and Mallick (2005) who incorporate poverty within the Fund-Bank framework.

macroeconomic policies growth-inducive and employment-generating so as to identify a pro-poor growth pattern for poverty reduction. On the fiscal side, macroeconomic adjustment can be growth-oriented through decomposing public spending (Mallick, 2001) and from the monetary side, channelling non-bank credits to the lower-end of the private sector is the key to growth-oriented adjustment. Fiscal policy constitutes one of the key distributional channels which can work to the benefit of the poor. As contractionary fiscal policies can affect the poor adversely, it is important to think in terms of a target level of development expenditure for the goal of poverty reduction. Similarly, monetary and financial sector policies can work in improving the allocation of resources in order to foster access of the poor to credit. Besides increased government spending (Squire, 1993), access to assets and opportunities (Birdsall and Londono, 1997) has been emphasized to be the logical extension of the argument that growth does not ensure the elimination of poverty. Poverty results either due to permanent non-availability of two square meals a day because of lack of work and income, or due to shocks such as ill health or crop failure. These shocks can be temporary if the households have assets to sell or access to credit,[3] otherwise these households can eventually be pushed below the poverty line.

Growth alone is not sufficient for poverty reduction – growth associated with progressive distributional changes will have a greater impact on poverty than growth that leaves distribution unchanged (Ames et al., 2001). Policies that improve the distribution of income and assets within a society, such as land tenure reform, pro-poor public expenditure, and measures to increase the poor's access to financial markets, should form essential elements of

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[3] Carter and Barrett (2006) develop an asset-based approach to poverty for the design of persistent poverty reduction strategies. This implies that poverty can be explained in terms of deficiency of assets, both human and non-human. Land reforms in developing countries are often aimed at improving the poor's access to land, which can contribute to poverty reduction (see Besley and Burgess, 2000). In other words, giving property rights to the slum dwellers can help them to possess collateral and borrow and invest to improve their well-being.

a country's poverty reduction strategy. Because macroeconomic policies, i.e., public expenditure and development financing policies, can affect people differently as individuals face different incentives and constraints at the micro level (see Galor and Zeira, 1993), we put together a two sector model namely agriculture and non-agriculture to examine possible linkages between rural and urban economy. We examine the relationship between poverty rate and macroeconomic performance and policies using annual time series data from India over the last five decades on several macroeconomic sectoral and policy variables.

The implications of sectoral GDP and price ratios and different macroeconomic policies on poverty are discussed here in the Indian context. We use rural poverty rate, as there is higher concentration of poverty in the rural India where there is higher dependence on agricultural sector. Poor performance in agriculture appears to be responsible for still significant poverty in many parts of rural India. In a basic setting, we find that rural poverty has declined with rise in aggregate per capita real income and the sectoral distribution of such aggregate output. Once we combine this basic model with policy variables, the impact of such aggregate variables are no longer important with the ratio of sectoral outputs and the relative prices of agriculture being insignificant in influencing poverty. In addition, both types of fiscal spending, namely government current (consumption) and capital spending have a poverty-reducing effect. While government consumption can reduce poverty via the demand-side effect, government capital spending can have a supply-side effect on poverty reduction. Similar poverty-reducing effect is found with higher credit supply to the agricultural sector. To sum up, poverty reduction via distributional and allocational channels can be more permanent when an economy experiences a decline in its traditional sector leading to higher relative prices.

The organisation of the paper is as follows: Section 2 analyses the debate on poverty and change in the macro economy. Section 3 provides the empirical analysis of poverty where the rate of poverty is presumed to depend upon GDP ratio, terms of trade, and changes in development spending and financing. Section 4 concludes.

2. A Sectoral Model with Pro-Poor Macroeconomic Policy

The success of economic growth in reducing poverty cannot be taken for granted as it depends on a number of factors, in particular, the sectoral composition of growth, sectoral terms of trade, government spending and development financing policies. These are the key factors that can contribute to improving standard of living of the poor. Although growth is undoubtedly necessary for poverty reduction, it may not be sufficient if other policies are not in place. As the mechanisms underlying these processes remain a subject of debate,[4] some intervening factors may be driving the association between poverty and growth, namely macroeconomic policies over time to address negative consequences of growth following stablisation and structural reforms.[5]

As rural poverty is usually deeper than urban poverty and poor are often landless or have very little land, the question is to examine whether the prospects for the people depending on agricultural income have improved in terms of their standard of living. Besides considering the aggregate per capita income as an indicator of standard of living, it is also important to examine the sectoral distribution of total income. Dasgupta (1997, 1998) examines the

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[4] Basu and Mallick (2008) explore the mechanism of capital-labour substitution that might be contributing to more unemployment and thus preventing economic growth from reducing poverty owing to possible adoption of labour-saving technology. All types of capital however are not labour-displacing and hence there can be labour-augmenting neutral technical progress.
[5] For an early review of the literature, see Demery and Addison (1987) who show the labour market to be a key determinant of how policy changes are transmitted to poverty groups.

possible poverty traps in poor countries, where certain identifiable groups of people in an economy can get caught even when the economy in the aggregate experiences economic growth. This is where there is a need to look at the distribution of growth with a sectoral composition when there is a shift towards non-agriculture.[6] In the context of India, Gupta (2000) finds weak links between economic growth and poverty alleviation taking into account some socio-economic and demographic variables, and concludes that no macro policy of market-led growth will be successful in dealing with the problem of either poverty or employment. This finding is based on the argument that appropriate social, demographic and economic policies will have to be developed to upgrade the skills of the poorer sections of the population to a reasonable level to enable them to enter the mainstream market activities.

On the contrary, a basic idea underlying policy packages of international monetary and development institutions has been that the fruits of economic growth trickle down to the bottom levels of the society and reduce poverty and inequality. Hence there is a danger of this "trickle-down" view (see Deaton, 2006), as growth at the bottom levels of income distribution may not be as rapid as the overall growth. There is little research on any direct connections between macroeconomic and financial policies and poverty-reduction. In the recent years, there has been significant amount of technical research either looking at how to measure poverty or emphasize on micro rather than macro issues. For example, it is important to eliminate child labour, so that such children go to school and accumulate human capital, which in turn can help improve the standard of living of the members of their household. Before that happens, it is equally important to improve the standard of living of the household

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[6] It is worth mentioning that as the informal sector remains decoupled from the rest of the economy (Patel and Srivastava, 1996), it is hard to uncover the effect on people engaged in the informal sector, given the fact that much of the informal activity takes place in the urban areas.

by providing work opportunities for the adult members of the household who can then decide the future of their children by allowing them to go to school. This issue on opportunity to work can be addressed by macroeconomic policies and hence poverty reduction can be dealt with at the macro level. In this context, the current trend of globalization may open the door for some new opportunities, but it remains a macro issue. So what we need is economic growth with redistribution that can in part be addressed via government spending and development financing policies.

To the extent the poverty impact of financial development policy has been considered, it has been assumed that the contribution of financial development to poverty reduction will occur indirectly, through the 'trickle-down' effect of economic growth. Jalilian and Kirkpatrick (2002) find evidence of a connection but do not identify the channels through which financial development reduces poverty, other than indirectly through economic growth. Burgess and Pande (2005) show that the geographical spread of banks had a significant impact on rural poverty in India primarily in areas where banks were required to establish new branches. Using aggregate time-series data, they argue that the bank nationalization program brought about by rural branch expansion in India significantly reduced rural poverty. With regard to bank (loan) market, there is a need to distinguish sectoral allocation of credit, namely priority sector lending, from aggregate credit (as a % of GDP) as normally used in this literature.

Further, as credit rationing is present in most developing economies including India, a country's monetary policy can be used to expand supply of credit to the private sector. Such expansionary monetary policy can be seen as a way of reducing the extent of credit rationing, for example, the use of priority sector lending to inject credit in India. Espinosa-Vega *et al*. (2002) show that such a government-led credit policy increases long-run production if and only

if the economy is in a development trap. Stiglitz and Greenwald (2003) suggest a new paradigm for the conduct of monetary policy focusing on the role of credit in facilitating economic activity, as opposed to a monetary theory based on transactions-demand-for-money. Bennett and Dixon (2001) within a three-sector general equilibrium model showed that policies that boost industrial exports tend to reduce welfare in the agricultural sector, where poverty is concentrated. As the poor remain de-linked from the formal credit market, higher incomes for the poorest quintile cannot be guaranteed, even with prudent monetary policy. In the recent years, the financial needs of the poor, once left to the informal system, are partly taken care of in the micro-credit market which is growing in size. One could argue that by locking the poor into the micro-credit system, they are being excluded from the mainstream macro-financial system. So delivering financial services to the poor is important in order to reduce poverty. In other words, there should be a distributive role of monetary policy by allocating credit to the priority sectors, as financial markets do not cater to the credit needs of the rural sector. In this context, extending agricultural credit promises to be an effective method for channeling much needed production credit to small farmers (see Mallick, 1993). Such credit can act as a crucial input in the production process if it gets channeled by the banking sector for productive economic activities in the rural sector.

This paper therefore analyses the problem of poverty primarily from a macro-economic perspective, tracing the poors' economic status to their low share in the low growth sector, i.e., rural economic growth with agriculture as the main source of GDP is more important to poverty reduction than urban economic growth with the non-agricultural sources of GDP. Thus in order to capture poverty in a macro model, there is a need to identify the poor in relation to output of the rural sector, where most poor are engaged. It is in this context that macroeconomic policies need to be identified, which can play a role in contributing to

poverty reduction. We classify the economic activities in terms of skill levels required by the labour employed in production. Let y_A, and y_N denote the outputs produced in the unskilled (agricultural) and skilled (non-agricultural) sectors respectively. It is a common knowledge that the agricultural sector employing unskilled people distributes less income to the workers than the non-agricultural or skilled sector. Unskilled workers are endowed with labour only, and no human and financial capital. First we characterize the macroeconomic setting by assuming that there are two production sectors as in dual economy models (see Temple (2005)): agricultural-goods (y_A) and non-agricultural goods (y_N). Non-agricultural goods include industrial products and services. The aggregate output can be written as follows:

$$y = \theta y_A + (1 - \theta) y_N$$

By considering y_N as a numeraire, we write the above equation as follows:

$$\frac{y}{y_N} = (1 - \theta) + \theta \frac{y_A}{y_N} \qquad [1]$$

where the subscripts A and N denote agricultural sector with uneducated (poor) labour and non-agricultural sector with mainly educated labour respectively.

In the recent years, the contribution of agriculture to the economy has started declining rapidly in many low-income countries, when big part of the population (600 million out of over one billion people in India) rely on agriculture for their livelihood. As the size of the agricultural sector declines in the process of development, relative wage may not increase given the excess supply of labour. At the core of growth and poverty reduction, job creation is the key channel, but jobs are not created automatically or instantaneously, and demand for labour does not increase in line with the supply of labour (see Stiglitz, 2004). With policy reforms being directed towards development of non-agricultural sectors, the share of agricultural goods producing sector in the economy can decline. In other words, there is some

degree of substitution between the two sectors. Thus sectoral imbalances can worsen poverty through inflation, and economic contractions or downturns can raise unemployment and thus poverty. So besides the changing sectoral distribution of aggregate GDP, we intend to consider the effect of sectoral prices to reflect the purchasing power of people engaged in the agricultural sector and assess its impact on poverty. Changes in agricultural terms of trade (the ratio of agricultural to non-agricultural prices) have ramifications for the intersectoral transfer of resources, rural welfare, rural-urban migration, and farmers' resource allocation decisions.

We assume that P is the weighted cost-of-living index in the form of a Cobb-Douglas function:

$$P = \alpha P_A + (1-\alpha) P_N \qquad\qquad [2]$$

where P_A and P_N are the respective money prices of agricultural and non-agricultural goods. By normalizing against non-agricultural goods prices, the above equation can be written as:

$$\frac{P}{P_N} = (1-\alpha) + \alpha \left(\frac{P_A}{P_N} \right) \qquad\qquad [3]$$

The prices of the agricultural goods in relation to non-agricultural goods can capture the change in relative prices against the non-agricultural sectors or in favor of the agricultural sectors. The poor workers are concentrated more in agricultural sectors and concentrated among the less educated. Thus any change in relative prices can have important redistributive effects. A positive correlation with poverty cannot be considered as a distributional effect, as higher agricultural prices can have the potential to reduce the real agricultural income, when supply elasticity of agricultural output with respect to price changes is zero (see Ravallion, 2000). To control for this effect, we take account of both sectoral GDP and price ratios in this paper. Ghatak (1975) provides a survey of the early literature on this issue, showing that any excess of agricultural

production over consumption will be conditional upon the relative dominance of income and substitution effects. Khusro (1967) illustrated that demand for food exceeds the supply of food at prices below equilibrium level, and only if food prices rise above equilibrium level, then it can be beneficial for an individual household. The appropriate terms of trade between industrial and agricultural sectors has been traditionally known as the 'scissors problem', as a price squeeze can lead to a decrease in the welfare of both peasants and industrial workers (Sah and Stiglitz, 1984). Thus the interdependence between agricultural and non-agricultural sector via the relative prices can reveal whether the intersectoral terms of trade has been favourable for the agricultural sector. The poverty (H) relation can therefore be written as a function of the two ratios derived above:

$$H = f\left(\frac{\overset{-}{y}}{y_N}, \frac{\overset{+}{P}}{P_N}\right). \qquad [4]$$

Substituting (2) and (3) in (4), the poverty equation can be written as follows:

$$H = (1-\theta) + \theta\left(\frac{y_A}{y_N}\right) + (1-\alpha) + \alpha\left(\frac{P_A}{P_N}\right) \qquad 0 < \alpha, \theta < 1 \qquad [5]$$

As it is common with a Cobb-Douglas production technology, there is a need to consider the effect of capital in equation [5]. Also Aghion and Bolton (1997) formalise a mechanism through which increased wealth accumulation by the rich can have a trickle down effect on the poor in the sense that as more capital is accumulated in the economy, more funds may be available to the poor for investment purposes. They illustrate that the process of capital accumulation initially has the effect of widening inequalities but in later stages it reduces them, generating a Kuznets curve. So it is the capital accumulation of the rich, which can lower the interest rate on loans, thus allowing the poor to take on high yielding ventures (also

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see Blackburn and Bose, 2003). In what follows we introduce a standard capital stock equation in which investment (I) can raise capital accumulation in agriculture:

$$K = (1 - \rho)K_0 + I \qquad\qquad [6]$$

where ρ is the rate of depreciation of capital stock and K_0 is the initial capital stock. As in Mallick (2001), total real investment is decomposed into real private investment (I_p) and real public investment (I_g) in agriculture:

$$I = I_p + I_g \qquad\qquad [7]$$

Investment in agriculture takes place by both public and private sectors. Private investment in agriculture is predominantly in groundwater development, land improvement, machinery and equipment (including tractors & pump sets), and livestock. Public investment is concentrated in irrigation infrastructure, public services (research and extension), conservation and commodity development programs. As there has been a deceleration in agricultural investment during the 1980s (see Mallick, 1993) and also in the 1990s, the impact of such investment and growth in agriculture on rural poverty needs to be examined. Agricultural growth and public capital formation may have been the important contributing factors for poverty reduction in rural India in the recent decades.[7] There has been a general consensus in the literature that the split between public and private components of investment can exert a differential impact on economic growth (see for example, Khan and Kumar, 1997). Storm (1994) found that, in achieving growth, public investment in irrigation is more effective than fertilizer subsidization and procurement pricing. Even in the nineties in India, investment in the agricultural sector received inadequate attention in the macroeconomic policy formulation. As there is need to free up funds for badly needed investment in infrastructure and social development by the

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[7] Palmer-Jones and Sen (2006b) examine the spatial patterns of rural poverty in India and find that agricultural growth is the key determinant of rural poverty reduction, and spatial variations in irrigation development at the state-level can explain the differences in the decline in poverty.

government, it is important to curtail government's huge operational expenditure that in turn can help finance public capital spending.

The private investment function can be assumed to depend on exogenous public investment in agriculture and allied sectors that can have a growth enhancing or poverty reducing effect, including other policy variables.

$$I_p = \omega_0 + \omega_1 I_g + \omega_2 CD_{ps} + \omega_3 DE_g \qquad [8]$$

where ω_0, ω_1, ω_2, and ω_3 are the parameters; CD is the credit supply to the so-called priority sector including agriculture, and DE is the current development expenditure that can stimulate private investment. Budgets that include more expenditures directed at helping the poor are more pro-poor than other types of fiscal policies. Fan *et al.* (2000) estimated the effects of different types of government expenditure on rural poverty and productivity growth in India over the period 1970-93 and found that greater infrastructural spending has higher potential to reduce rural poverty. Capital spending of government augments real public capital formation, whereas government consumption can have direct impact on private consumption behaviour,[8] which in turn can foster investment activity in private sector. Thus government current development expenditure or government consumption expenditure is included as control variables for the size of the government. Finally we include financing to agriculture by the banking sector to take account of its possible effect on improving standard of living.

By adding capital in equation [5] and substituting equations [6-8], the reduced form poverty equation can be written as follows:

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[8] Although Ghatak and Ghatak (1996) find significant crowding-out effects of government total consumption spending on private consumption, government non-operational current expenditure can have a positive impact.

$$H = \phi + \theta\left(\frac{y_A}{y_N}\right) + \alpha\left(\frac{P_A}{P_N}\right) + (1-\rho)K_0 + (1+\omega_1)I_g + \omega_2 CD_{ps} + \omega_3 DE_g \qquad [9]$$

where, $\phi = \omega_0 + (1-\theta) + (1-\alpha)$.

We have two different price deflators for two groups of labour (uneducated largely involved in agricultural goods sector and educated mainly in the non-agricultural goods sector), as their consumption bundles are different. People those who are poor mainly demand essential commodities to survive, although the maximum level of such consumption will vary between the two groups of workers. As we consider both sectoral relative price and income effect, we are effectively capturing both supply- and demand-side effects respectively in a macroeconomic sense. Besides, we now consider two key policy variables from fiscal and monetary sides – the key policy instruments to address poverty. Mallick (2006) provides evidence on the role of credit as a factor of production and its role in affecting the supply side of a developing economy, suggesting that a restrictive credit policy can have greater adverse effects on output growth and less effect on price inflation. The credit channel can also take account of the gradual process of financial reforms with regard to bank (loan) market in India. We emphasise on the sectoral allocation of credit, by considering lending to the priority sectors, in particular agricultural sector, instead of aggregate credit (as a % of GDP). In India, the objectives of monetary policy have been not only to maintain price stability, but also to ensure provision of adequate credit for productive purposes. India's sectoral focus in credit flow is emphasised in its so-called 'priority sector' lending, which is now restricted to highly employment intensive sectors such as agriculture, small industry, educational loans for students and low cost housing (www.rbi.org.in). Thus the focus is on the availability of rural credit rather than cost *per se*, as cost of credit is less important in the context of a rural economy (see Ghatak and Sanchez-Fung, 2007). Scheduled commercial banks (SCBs) constitute the predominant segment of the credit market in India.

Despite the economic reforms that have removed many policy impediments, the pattern of development has not changed with a leading service sector and a skill-intensive rather than labor-intensive manufacturing (see Kochhar et al., 2006). The sectoral importance of the agriculture and allied sectors, which provide the majority of the population's livelihood, were largely left untouched by reform measures (see Kalirajan and Sankar, 2001). During different Five-Year Plans in India, the poverty alleviation agenda has gone through different phases, namely first, land distribution and food security through Green Revolution (1950s and 1960s respectively), second, income and employment generation (1970s and 1980s), and the last phase (1990s) of market-led growth and structural adjustment with a focus on basic needs. This paper attempts to analyse the effect of different policies alongside the poverty-reducing impact of sectoral GDP distribution via considering the ratio of the agricultural and nonagricultural GDP in order to assess its relative impact on poverty in the rural sector. The idea is to develop channels through which the model can be estimated with alternative policy variables. We will be using data from India to test the hypotheses formulated in this section.

3. The Data, Empirical Strategy and Results

The definition of poverty and its measurement has been the source of intense debate in the literature (see Zheng, 1997; Banerjee and Duflo, 2007). The most important tool for monitoring poverty has been the Household Consumer Expenditure Surveys conducted by the National Sample Survey (NSS) Organization. Among the various methods used to measure poverty with this NSS data, the head count index (HCI) has been commonly used as the standard indicator of the extent of income poverty. We employ this index as a proxy for poverty in order to examine the effect of pro-poor policies that directly influence poverty

after accounting for the effect of sectoral distribution of growth and terms of trade. Data sources and definitions of variables used in this paper are discussed in detail in the appendix 1. Estimation is carried out on the basis of a sample of 54 annual observations pertaining to the period 1950 to 2004.

The magnitude of rural poverty is larger compared to urban poverty in India (see Table 1). As in most developing countries, the incidence of poverty in India has historically been higher in rural areas than urban areas (Datt and Ravallion, 2002). Since poverty measures have responded more to rural economic growth than to urban economic growth (Ravallion and Datt, 2002), we focus on how rural poverty has been influenced by sectoral GDP ratio and relative prices, with other conditioning variables. One can assess the impact of these two macroeconomic policies after having controlled for the impact on GDP distribution into GDP_A and GDP_N, as urban-biased strategy of development seems to have contributed to higher non-agricultural growth. Hence it is important to consider the GDP ratio and relative price ratio to examine the intensification of rural poverty.

Given time series data on GDP in agriculture, GDP in non-agriculture, and policy variables, the following relation is estimated:

$$POV_t = \alpha + \beta \left(\frac{GDP_A}{GDP_N} \right)_t + \gamma \left(\frac{P_A}{P_N} \right)_t + \delta ACOR_t + \lambda PK_A + \mu GE_D + \omega CD_A + u_t$$

where POV is rural poverty, GE is the government current development expenditure, and PK refers to public investment. We also include total government size reflected in government total consumption expenditure and government capital expenditure (all expressed in real terms). Average capital-output ratio (ACOR) in agriculture is used as a proxy for initial capital. Also we control for the impact of irrigation on agricultural performance via using a proxy on gross

irrigated area (GIA). Higher the irrigated area, less reliant farmers will be on rainfall and thus higher agricultural production in poor areas and thus poverty reduction. The importance of irrigation in Indian agriculture has been emphasized in Mallick (1993). Higher the investment in new irrigation facility, higher will be the return from agriculture even if one discounts for increases in capital and production costs. So GIA can be a proxy in the place of government capital expenditure, although GIA can also be partly driven by private investment.

To verify that whether the included variables yield valid long-run equilibrium relations, we would subject the equation to univariate cointegration analysis and test whether they yield economically plausible parameters. The cointegration approach of Phillips and Hansen (1990) and Hansen (1992) is used to obtain consistent estimates of the parameters, employing the fully-modified OLS (FM-OLS) procedure. The Phillips-Hansen FM-OLS procedure is chosen over the much well-known, Johansen-Juselius cointegration technique, because the FM-OLS cointegration procedure corrects for endogeneity and contemporaneous correlation. Further, from a theoretical point of view as discussed in the previous section, the implied economic structural relationship for the determinants of poverty requires the use of a single-equation cointegration procedure.

An informal examination of the data through plotting the series may be useful to give a preliminary idea of the time series properties of the variables. The Graphs of the series in levels (see Figure 1) confirm that non-stationarity is apparent in all the series. Figure 1a shows that rural poverty has followed a normal distribution, and figure 1b exhibits a scatter plot showing that poverty tends to rise against sectoral GDP and price ratios; while credit and fiscal policy variables could help reduce such poverty. The starting point is to test for integration properties of the individual series by applying the Augmented Dickey-Fuller

(ADF) and KPSS unit root tests to the variables in levels. The ADF tests allow us to test formally the null hypothesis that a series is I(1) against the alternative that it is I(0), whereas under the KPSS test, the null is stationary. These results, which are reported in Table 1, clearly show that the null hypothesis of a unit root cannot be uniformly rejected. We therefore conclude that the variables under consideration are well characterised as non-stationary or integrated of order I(1). Based on the unit root tests for all the variables, the existence of long-run cointegrating equilibria can be tested in the next stage.

As the series are I(1) and some of the regressors can be endogenous, the OLS estimator is asymptotically second order biased, which implies that the estimation in finite samples is biased and hypothesis testing over-rejects the null, suggesting the need for instrumental variable (IV) methods to be used. However, IV approaches, although better than OLS in term of efficiency, do not provide asymptotically efficient estimators. The FM-OLS method of Phillips-Hansen has specially been developed to deal with the presence of endogeneity in the regressors. The Phillips-Hansen estimator is asymptotically efficient (i.e., the best for estimation and inference) and does not require the use of instruments. The semi-parametric corrections used in the FM estimator, with transformations involving the long run variance and covariance of the residuals, deal with endogeneity of the regressors and potential serial correlation in the residuals. In other words, Phillips-Hansen method is the best method that should be used in estimating a single cointegrating relation. Estimation has been carried out using RATS econometric software.

Employing fully-modified Phillips-Hansen Method of estimation, we have obtained the cointegrating relations that use the estimate of the long run variance by transforming the data, and then used OLS to derive the long-run estimates. Table 3 presents parameter estimates of

the long run cointegrating regressions. The residuals from these regressions are interpreted as disequilibrium terms measuring the discrepancies between actual values of the variables and their long-run equilibrium values. Such residuals are tested for stationarity or cointegration by employing ADF tests, which are reported in Table 3. These test statistics allow us to reject the null hypothesis of no cointegration at 1% levels. These results suggest that the variables under study form a valid cointegrating system. In other words, the FM-OLS cointegration estimates suggest that the final equation (Model 5) is a well-specified long-run model and no other variables are required to capture its long-run stochastic trend. In model 5, as bank credit to agriculture is a mandatory requirement, we consider credit to agriculture as a proportion of total bank credit in order to explore any sensitivity of our results. Overall, the coefficient estimates are of correct sign and of plausible magnitude and the tests confirm strongly that the variables are cointegrated (see Figure 2).

We also test for parameter stability as outlined in Hansen (1992), following the procedure implemented by Carstensen (2006). Hansen (1992) provides three test statistics (supF, meanF and Lc) that test for parameter stability in cointegrated relationships based on the residuals of a FM-OLS regression. The results reported in Table 3 indicate that while the supF, the meanF and Lc tests reject the null of cointegration at 5% level of significance against the alternative of cointegration with one time regime shift in 1959 for Model 5 relation (only two of the three tests for Model 4), whereas all the tests in the Models 1 to 3 fail to reject the null of cointegration against the alternative of random walk type variation in parameters in these regressions, which Hansen (1992) suggests as evidence in favour of the null of cointegration against the alternative of no-cointegration. We carry out further tests for stability and homoscedasticity by using recursive least squares (RLS) for the final estimated equation (Model 5 in Table 3). We adopt recursive technique for the detection of non-constancy of the

coefficients, which broadly confirm a structural break in the early 1970s (see Figures 3 and 4). Because recursive least squares cannot detect the exact breakpoint, we undertake Gregory-Hansen cointegration test,[9] allowing for full structural break (a shift in intercept and slope coefficient), which suggest a cointegrated relationship with a break in 1971 (see Figure 5). This seems reasonable as poverty went up till the early 1970s and then there has been a steady decline in poverty as reflected in official statistics, although the number of people living below poverty line still remains around 300 million.

The sectoral GDP ratio and per capita income having significant negative impact on poverty in Models 1 to 2 in Table 3 suggest that growth is good for the poor. If agricultural income rises, rural poverty will decline. As we know that agricultural sector has been decelerating, this will be reflected in a rise in rural poverty. A rise in agricultural GDP directly contributes to reduction in rural poverty, whereas an increase in non-agricultural GDP can reduce rural poverty indirectly provided it is accompanied by an increase in employment. A negative sign associated with the GDP ratio indicates that lower the ratio, higher the rural poverty, which means the current expansion of the non-agricultural sector is not able to absorb the excess supply of labour from the traditional sector. Hence the mechanism through which rural poverty has declined in India must have been via the government led channel of development spending and financing, as the coefficient associated with GDP ratio turns out to be insignificant when different policy variables are integrated into the empirical model. So with the policy variables (as in Models 3 to 5 in Table 3), the sectoral growth pattern has a neutral impact on poverty on average over the entire sample period, with both per capita income and GDP ratio becoming insignificant, whereas the policy variables have a pro-poor effect. We

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[9] The standard tests for cointegration presume that the cointegrating vector is time-invariant under the alternative hypothesis and hence have low power in detecting the regime shift (Gregory and Hansen, 1996). Following Gregory-Hansen, we test for the null of no cointegration against the alternative of cointegration with a regime shift at an unknown point in the sample.

have carried out a number of robustness checks in support of Model 5 as the best model as discussed earlier. Intuitively, a reduced share of agriculture in the economy can partly explain why the agricultural sector is unable to play an important role in poverty alleviation. So we have looked at the impact of different components of monetary and fiscal policy instruments to uncover the pro-poor policy effect on poverty reduction.

Besides, much empirical evidence suggests that inflation hurts the poor, as obvious from the coefficient associated with relative price. As agricultural prices increase relative to non-agricultural prices, poverty does not decline significantly because the income effect on the back of high food prices can offset the expenditure effect due to higher prices thus eroding the purchasing power of poor. Although relative prices leading to a neutral effect on poverty might seem counter-intuitive, it is still possible given that food prices were controlled or followed an administered pricing mechanism during big part of the sample period. If one takes account of price volatility, it will still have an adverse impact on the people below the poverty line. So controlling inflation at the policy level should receive highest priority. As poverty is a long-term issue, we only need to derive the long-term relations between poverty and policy variables. Policy decisions cannot be based on short-term movements in welfare indicators (Datt and Ravallion, 1997). So there is no economic rationale behind deriving short-run dynamics underlying the long-run poverty relation.

However, we estimate a structural VAR model to understand the effects of unexpected shocks involving five key variables in Model 5 and derive structural innovations of poverty (see Figure 6), which show two episodes of increase in poverty, in the mid-1960s (a supply shock due to drought and famine) and early-1990s (a policy shock owing to stabilisation and

structural adjustment). This is also supported by multiple break procedure due to Bai-Perron with two break points being found in 1964 and 1991.

Higher fiscal spending and credit allocation to the rural sector seem to have a direct trickle-down effect on poverty, via higher economic activity and employment. This suggests that the favourable effect of macroeconomic policies on poverty is partly in line with the endogenous growth literature that macroeconomic policies can affect growth and thus poverty in the long-run. The per capita GDP and the sectoral ratio in Models 1 to 2 (in the absence of policy variables) with negative effects might capture the effect of trade openness in reducing poverty in India. Trade reforms can help reduce poverty via higher real wages and employment – the so-called static effect, with the dynamic argument that trade promotes growth, and growth in turn reduces poverty (see Bhagwati and Srinivasan, 2002). As the vast majority of the poor live in the rural areas where there is excess supply of labour, the static effect does not seem to have occurred, although it is hard to reject the dynamic argument of a possible knock-on effect via growth. We find that the pattern of growth does seem important in the long-run. As the sectoral GDP ratio in the final model (Model 5) is not significant, with a continued decline in the GDP ratio, relative prices appear to be moving upwards thus the expenditure (or living cost) effect is offsetting any income effect from the rise in prices (with an insignificant coefficient) that can only be addressed via different sets of policies. Even with higher relative prices of agriculture, we cannot reduce poverty because many farmers cannot increase output as they are not equipped to gear up production. Also due to market distortions, they may not benefit from higher food prices, leading to a rise in poverty as higher food prices further reduce their purchasing power, pushing more people below the poverty line. So in order to make the growth pattern pro-poor, the distributional and allocational channel of macroeconomic policy should be strengthened so as to contribute

more in reducing poverty. In other words, to improve the livelihood of people engaged in low-growth sectors such as agriculture, there is either a need to modernise agriculture via higher infrastructural investment in the sector or industrialise the rural economy[10] to create jobs that can in turn improve the income of the poor.

4. Concluding Remarks

This paper expands the literature on poverty from a macroeconomic perspective with a sectoral composition of GDP that allows to disentangle the mechanisms by which agricultural growth with distributive and allocative mechanisms can be poverty reducing. Designing macroeconomic and financial policies for poverty reduction is a challenging task. We find that macroeconomic and development policies in India play a much bigger role in reducing poverty, after having controlled for the sectoral income and terms of trade effects. Finally, a strategy of investment in infrastructure and in human development can aid private investment and growth, along with improving access to formal credit markets or strengthening the currently emerging link between formal banks and informal microfinance institutions in rural areas to encourage or 'crowd in' private investment, growth and poverty reduction. Although job creation by industrial expansion along with distribution policies is necessary to solve poverty problem, it also depends on skill, entitlement and overlapping generation issues of poor farmers. As we have used the traditional notion of poverty in this paper, there is room for replacing the subjective official poverty line with an objective measure in terms of consumption deprivation as suggested in Kumar *et al.* (2009), which can be linked to the key macroeconomic policy variables.

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[10] Lanjouw and Lanjouw (2001) summarise the literature in this context emphasising that the rural non-farm sector can, and often does, contribute to economic growth, rural employment, poverty reduction, and a more spatially balanced population distribution.

As urban poverty is a spill over of rural poverty and about 65% of the labour force is still working in the agricultural sector, Kalirajan (2004) argues that policies directly targeting the agricultural sector, namely promoting investment and technological progress along with efficient use of technology in agriculture are central to reducing rural poverty. As urban centres grow and mechanisation of agriculture gains momentum, we are likely to see massive migration of people from rural to urban areas in coming decades. Therefore, the emphasis on pro-poor policies towards generating economic activity in the rural areas will reduce poverty more rapidly than simply relying on the trickle down effect. In this context, it is worth comparing China and India; while China has been investing heavily on fixed physical capital namely on infrastructural development, India has been concentrating only on policy reforms without creating a strong infrastructure base that can help sustain the current pace of growth. The next issue arises about whether there is a market (or demand) for the goods produced in the rural sector. Without access to markets, rural economy cannot be integrated with wider markets, thus keeping this sector at a low-level equilibrium. This is where a need for government intervention is required to create institutions and markets to coordinate a linkage between the bigger markets in the urban areas with the goods produced in the rural sector. Rather than relying on the current trend of service sector expansion, India needs to focus on a greater degree of industrial production in the way China has done. This creates more employment that can help reduce poverty, as has been the case in China, which has succeeded in reducing its level of poverty. Policy reforms that encourage investment in agriculture and raise incomes will effectively expand the market for manufactures, which in turn has the potential to reduce urban poverty as well. In addition, social capital formation can help accumulate human capital, which can contribute to pro-poor growth and thus poverty reduction. As poverty is a complex multidimensional problem, it involves intertemporal

issues of consumption, saving, asset allocation, wage and income policies. Different

connections/channels in this context are worth exploring for future research.

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Appendix 1

*Variables and Data Source*s

The dataset used in this study spans over the time period 1951-2004 from India.

Poverty rate – Historical Poverty statistics until 1992 have been taken from the World Bank's India site on poverty. Head count index (HCI) has been used as a proxy for the poverty rate, which are only available for the years in which the survey was conducted. The gap between surveys has been filled by interpolating from the observed values to get a continuous series. The HCI data for three quinquennial surveys since early 1990s (1993-94, 1999-00, 2004-05) have been taken from respective household surveys.

GDP ratio – Data on GDP at factor cost by industry of use at 1999-2000 prices, published by the Central Statistical Organisation (CSO), India, are taken from Reserve Bank of India (RBI) handbook of statistics on the Indian economy, and then the ratios have been calculated.

Price ratio – The price deflators have been calculated for agricultural prices by dividing nominal and real values for agricultural GDP. Similarly the non-agricultural price deflators have been derived and then the price ratio has been calculated.

ACOR – Average net fixed capital to output ratio (ACORs) for agriculture, forestry and fishing at constant prices has been taken from Table 46A in National Accounts Statistics of India published by EPW Research Foundation.

Public investment – Gross capital formation in the public sector at new series base 1999-2000 (Table 13) is compiled from *RBI Handbook of Statistics on Indian Economy*, 2007. As this data is for the aggregate public sector, we used the ratio of investment in agriculture and allied activities out of total public investment at 1993-94 base from CSO, and then extracted the agricultural public investment at 1999-00 base from the total public investment. This nominal data was then expressed in real terms with investment deflators being derived from the nominal and real values of total gross domestic capital formation taken from Table 12 of the RBI Handbook.

Development expenditure – Developmental expenditure of the central government on the revenue account has been taken from the budget documents of Government of India. From 1980 onwards, the data was taken from the RBI Handbook. This has been expressed in real terms using aggregate GDP deflator and then divided by population to get per capita development expenditure.

Government consumption and capital expenditures – Final outlays by the central government and transfer payments to the rest of the economy are added to get total government current and capital expenditures. All the variables are taken from Table 2.3 in *Economic Survey*, 2006-07.

Priority sector lending – Scheduled Commercial Banks (SCBs) credit to agriculture has been used, as loans to agriculture account for around 40 per cent of the total priority sector loans. This has been expressed in real terms using the investment deflator as used in the case of public investment. The investment deflator is more appropriate here compared to the aggregate GDP deflator.

GIA – Gross irrigated area (expressed in terms of area in million hectares) is used as a proxy for irrigation for reasons discussed in section 3. The data are complied from pattern of land use and selected inputs for agricultural production in the RBI database.

PCGNP – Per capita real income is used as a control variable capturing purchasing power at the aggregate level for India.

Table 1: Official Poverty in India (proportion of population below poverty line)

	1951-52	1961-62	1973-74	1977-78	1983	1987-88	1993-94	1999-00	2004-05
Rural India	47.4	47.2	55.7	53.1	45.7	39.1	37.3	27.1	28.3
Urban India	35.5	43.6	48.0	45.2	46.8	38.2	32.4	23.6	25.7
National	45.3	46.5	54.1	51.3	44.5	38.9	36.0	26.1	27.5
Sources: World Bank Poverty Database; and NSSO, Government of India									

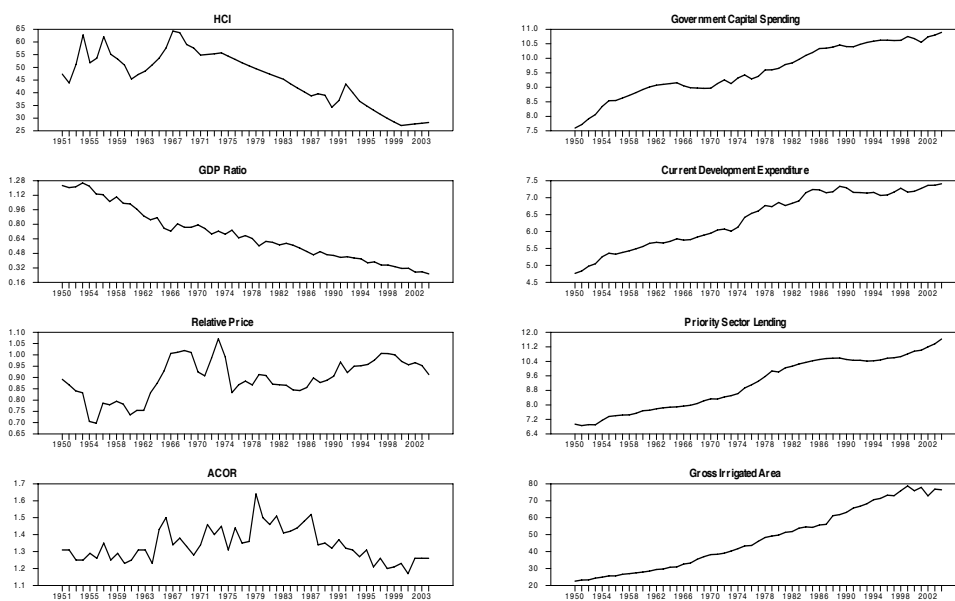**Figure 1:** *Time series plots of variables*

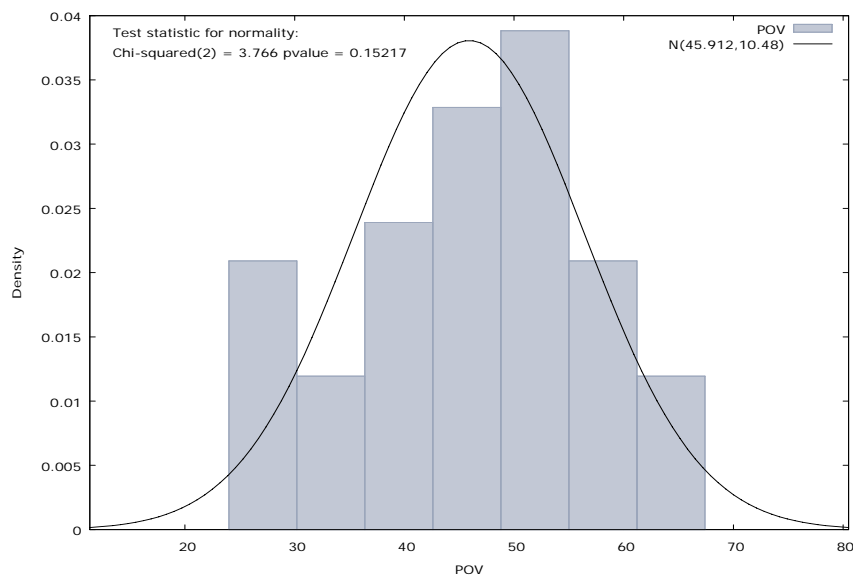**Figure 1a: Frequency plot of poverty against normal distribution**

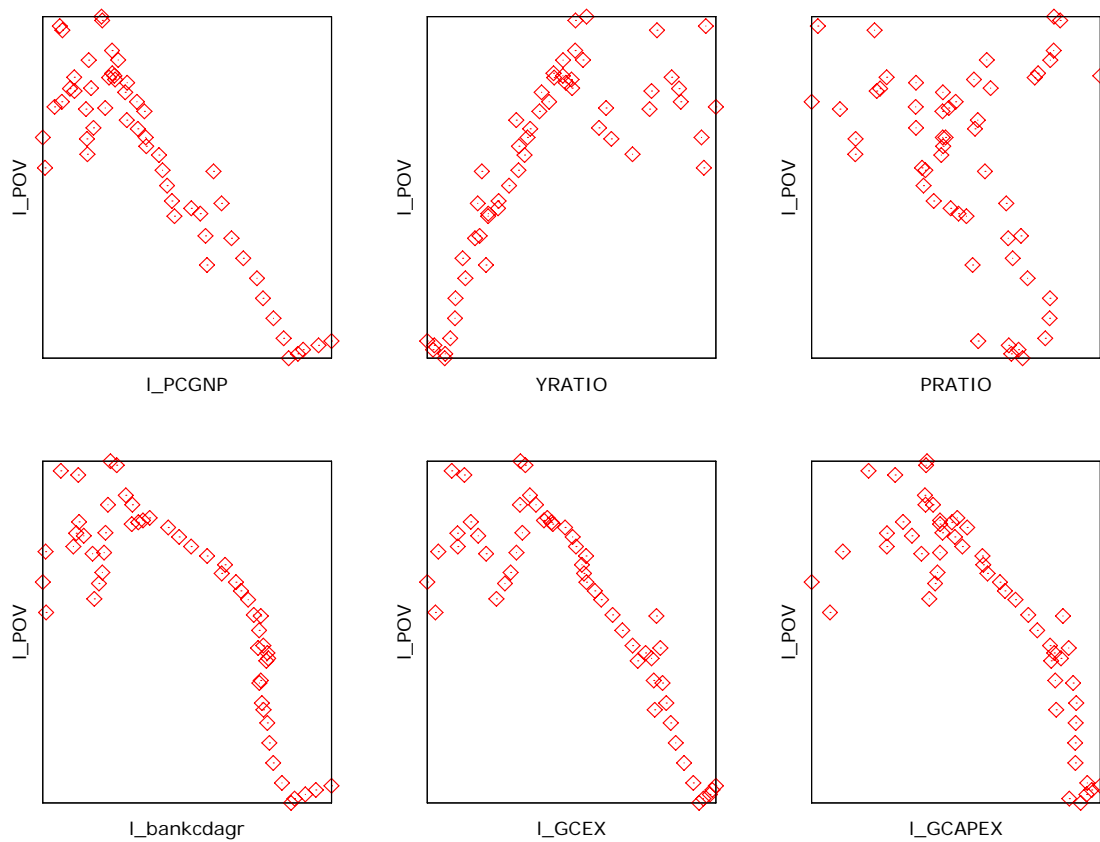**Figure 1b: Scatter plot of poverty against other key factors**

Table 2: *Unit root test for the model variables*

Variable	ADF Test Statistic	Integration Order	KPSS Test Statistic	Integration Order
LPOV	–0.2809	I(1)	1.1287**	I(1)
GDPR	–1.1608	I(1)	1.4175**	I(1)
PRICE	–2.0216	I(1)	0.5554*	I(1)
ACOR	–3.3230	I(0)	0.2962	I(0)
LGCEX	–0.8922	I(1)	1.4696**	I(1)
LGCAPEX	–2.2841	I(1)	1.4381**	I(1)
LDEVEX	–2.0712	I(1)	1.4562**	I(1)
LBANKCD	–0.1095	I(1)	1.4504**	I(1)
LPUBCAP	–2.6750	I(1)	1.2461**	I(1)
LPCGNP	2.2436	I(1)	1.4035**	I(1)
GIA	0.1395	I(1)	1.4536**	I(1)

Note: Under KPSS test, the null is stationary. *, ** indicate rejection of the null at 5% and 1% respectively. Both ADF and KPSS test results presented above indicate that all the variables are integrated of order one, I (1), except ACOR. The optimum lag is one, selected on the basis of Schwartz Bayesian criterion (BIC). Critical values for ADF test are: 1%= -3.555, 5%= -2.916, 10%= -2.595; Critical values for KPSS test are: 10% = 0.347, 5% = 0.463, 1% = 0.739.

Table 3: *Estimates of the equations*

Model	Philips-Hansen Fully-Modified Cointegration	
1	$LPOV_t = 12.92 - 0.345\,YR_t + 0.552\,PR_t - 1.017\,LPY_t$ $(1.035)^{**}\ (0.132)^{**}\quad (0.194)^{**}\quad (0.097)^{**}$ Anderson-Darling Test for Normality = 0.32471 [P-value 0.91365] SupF test: 13.31 [0.75]; MeanF test: 4.93 [0.25]; Lc test: 0.27 [0.12]	SEE=0.089 ADF=-5.17
2	$LPOV_t = 14.66 - 0.514\,YR_t + 0.477\,PR_t - 1.154\,LPY_t - 0.219\,ACOR_t$ $(2.305)^{**}\ (0.241)^{*}\quad (0.198)^{*}\quad (0.193)^{**}\quad (0.256)$ Anderson-Darling Test for Normality = 1.38621 [P-value 0.19834] SupF test: 13.27 [0.95]; MeanF test: 5.99 [0.45]; Lc test: 0.48 [0.14]	SEE=0.089 ADF=-4.72
3	$LPOV_t = \ \ 4.23\ +\ 0.127\,YR_t\ -\ 0.240\,PR_t\ -\ 0.002\,LDE_t$ $(4.241)\ \ (0.377)\quad (0.319)\quad (0.001)^{**}$ $-\ 0.449\,CRED_t\ +\ 0.001\,LPY_t\ +\ 0.579\,ACOR_t$ $(0.173)^{**}\quad (0.452)\quad (0.361)$ Anderson-Darling Test for Normality = 0.46154 [P-value 0.77494] SupF test: 149.10 [0.62]; MeanF test: 50.32 [0.25]; Lc test: 1.67 [0.10]	SEE=0.083 ADF=-5.61
4	$LPOV_t = \ \ 4.17\ +\ 0.179\,YR_t\ -\ 0.187\,PR_t\ -\ 0.002\,LDE_t$ $(0.577)^{**}\ (0.332)\quad (0.253)\quad (0.001)^{*}$ $-\ 0.428\,CRED_t\ +\ 0.558\,ACOR_t\ -\ 0.002\,GIA_t$ $(0.114)^{**}\quad (0.162)^{**}\quad (0.007)$ Anderson-Darling Test for Normality = 0.26388 [P-value 0.96006] SupF test: 719663 [0.20]; MeanF test: 19153 [0.05]; Lc test: 1.24 [0.00]	SEE=0.083 ADF=-5.66
5	$LPOV_t = \ \ 9.324\ -\ 0.512\,YR_t\ -\ 0.618\,PR_t\ -\ 0.521\,CRED_t$ $(2.451)^{**}\ (0.609)\quad (0.372)\quad (0.115)^{**}$ $-\ 0.476\,LGC_t\ -\ 0.064\,LDE_t\ -\ 0.01\,GIA_t\ +\ 0.373\,ACOR_t$ $(0.219)^{*}\quad (0.083)\quad (0.005)^{*}\quad (0.178)^{*}$ Anderson-Darling Test for Normality = 0.92006 [P-value 0.38517] SupF test: 3581.9 [0.007]; MeanF test: 172.3 [0.00]; Lc test: 1.77 [0.00]	SEE=0.084 ADF=-6.12

Notes: standard errors in parentheses and p-values in brackets. * and ** indicate statistical significance at the 5% and 1% levels, respectively. SEE is the standard error of estimate. ADF is the augmented Dickey-Fuller test for stationarity; L: Logarithm. The residuals of the five estimated equations have been tested to be stationary. ADF test critical values are: 1%= -3.560 5%= -2.918 10%= -2.596. LPOV – log of HCI, YR – GDP ratio, PR – Price ratio, LPY – log of per capita income, ACOR – Average capital output ratio in agriculture, LGC – log of government current (consumption) expenditure, LDE – log of government current (development) expenditure, LPK – log of public capital formation in agriculture (from national accounts), CRED – bank credit to agriculture as a proportion of total bank credit. In Model 5, LDE denotes the ratio of public investment in agriculture (LPK) in total development expenditure, in order to check for sensitivity of our results.

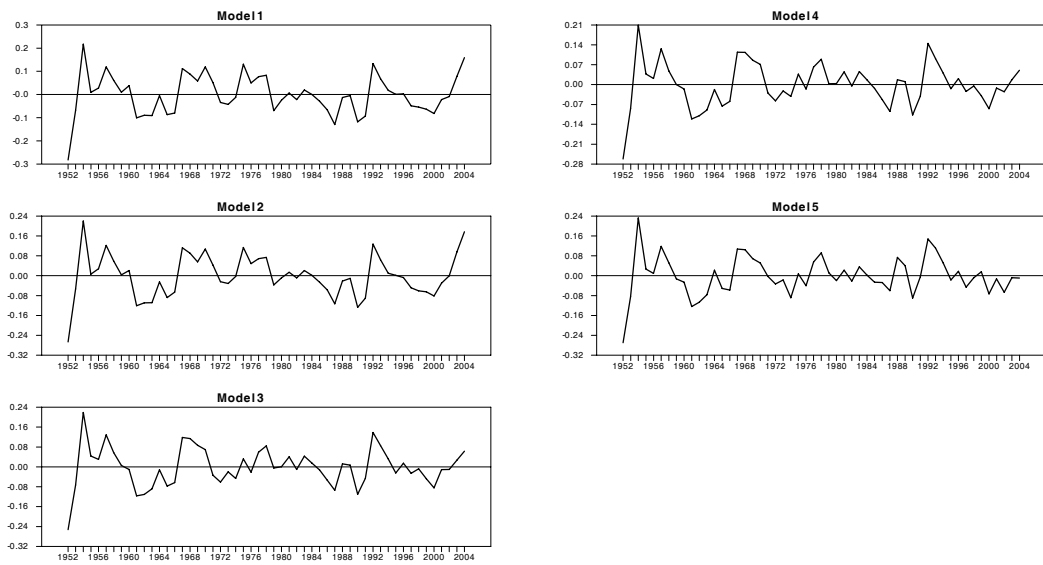**Figure 2: Stationarity of Cointegration Errors**

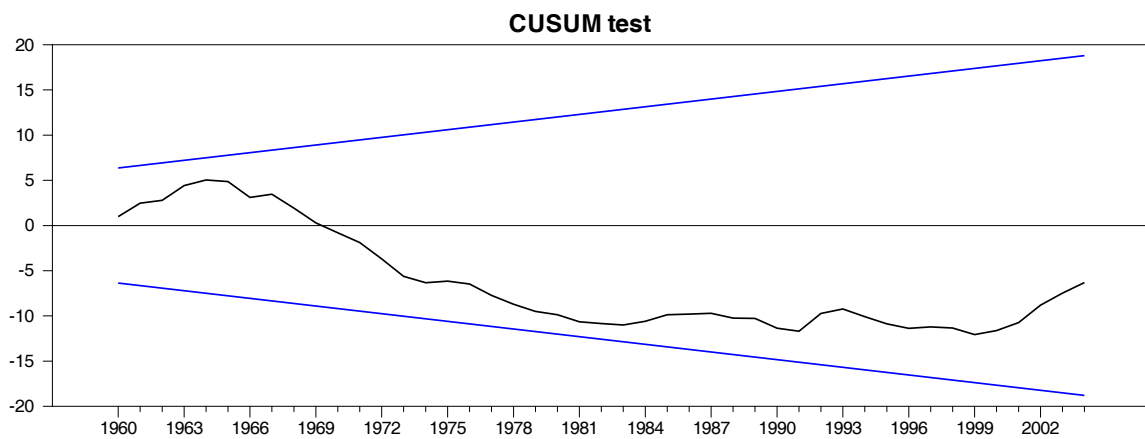Figure 3: Structural Break test from Recursive Least Squares for Model 5

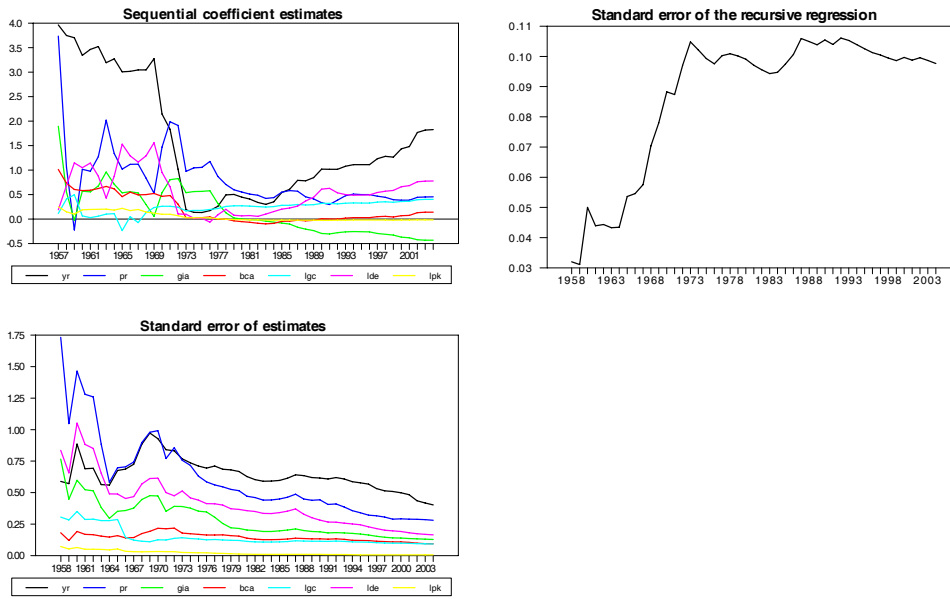Figure 4: Recursive estimates and standard errors of regressors in model 5

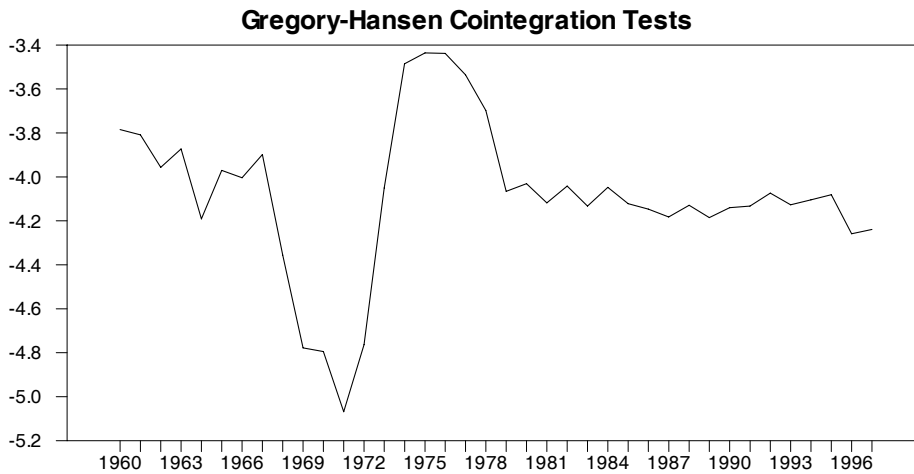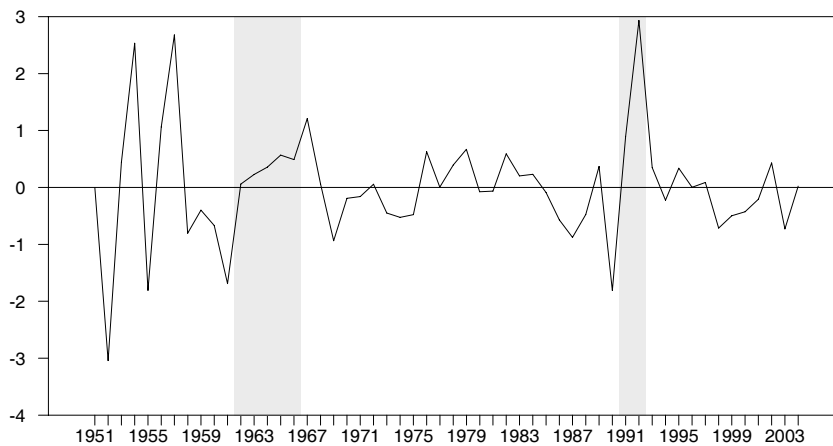Figure 5: Gregory-Hansen Cointegration Tests for Model 5

Figure 6: Structural poverty shocks of a VAR involving the variables in model 5

Appendix: SVAR Impulse Responses

Responses to agricultural credit shock

Responses to agricultural investment shock

Responses to relative price shock

Panel A: Response of agricultural credit

Panel D: Response of sectoral GDP

Panel B: Response of agricultural investment

Panel E: Response of poverty

Panel C: Response of relative price

Responses to sectoral GDP shock

Panel A: Response of agricultural credit

Panel D: Response of sectoral GDP

Panel B: Response of agricultural investment

Panel E: Response of poverty

Panel C: Response of relative price

Responses to poverty shock

Panel A: Response of agricultural credit

Panel D: Response of sectoral GDP

Panel B: Response of agricultural investment

Panel E: Response of poverty

Panel C: Response of relative price