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DISENTANGLING THE POVERTY EFFECTS OF SECTORAL OUTPUT, PRICES AND POLICIES IN INDIA

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FOREWORD

The Development Papers series of the ESCAP Subregional Office for South and South-West Asia (SRO-SSWA) has been launched to promote and disseminate policy-relevant research on the development challenges facing South and South-West Asia. It will feature policy research conducted at the SRO-SSWA as well as by outside experts from within the region and beyond. The objective is to foster an informed debate on development policy challenges facing the subregion and sharing of development experiences and best practices.

This paper by Dr. Sushanta Mallick presents new analysis on how growth influences poverty reduction in the subregion. It is now widely accepted that economic growth is necessary, but not a sufficient condition for poverty reduction in developing countries. The sectoral composition of growth is an important factor determining the extent of poverty reduction from growth. With more than two-thirds of the world's poor living in rural areas, where livelihoods depend primarily on agriculture, it is often argued that agricultural growth should reduce poverty more than other types of growth. Dr. Mallick's paper on the sectoral compostion of poverty reduction in India demonstrates that this is not always the case.

Dr. Mallick finds that growth in non-agricultural sectors has mattered more for rural poverty than agricultural growth, particularly over recent decades. Employing econometric time-series methods more commonly used in the analysis of financial markets and empirical macroeconomics, this paper brings an innovative approach to the analysis of poverty. Using a long series of data available for India, Dr. Mallick's results suggest that internal migration and anti-poverty programs may have had a stronger role in reducing poverty in rural areas, than traditional policies promoting agricultural growth. Manufacturing and service-led growth in India can help reduce rural poverty. The paper's findings, given their implications for policies, need to be extensively discussed and debated.

We hope that the paper will contribute to the ongoing debate on poverty reduction policies in the subregion.

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DISENTANGLING THE POVERTY EFFECTS OF SECTORAL OUTPUT, PRICES AND POLICIES IN INDIA

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ABSTRACT

This paper attempts to disentangle the poverty effects of key policy variables that directly affect the poor (namely the government-led channel of development spending and financing) in both agricultural and non-agricultural sectors after accounting for the effect of respective sectoral per capita income and prices, using data from India over five decades. The paper emphasizes the sectoral composition of income and prices as mechanisms influencing the level of poverty and establishes empirically that it is the rise in non-agricultural per capita income that reduces rural poverty via the channel of internal migration, after having controlled for the variation in key components of fiscal spending and monetary/financial policy via the availability of credit. Uneven sectoral growth pattern explains why urban poverty becomes a spill-over of persistent rural poverty when the agricultural sector shrinks. While checking for robustness, there is evidence that the rise in non-agricultural income alone may not reduce rural poverty, when measured in terms of rural infant mortality rate as a non-income indicator of well-being.

JEL code(s): E6, I3, O2, Q1
Keywords: Poverty reduction; Capital spending; Development finance; Infant mortality

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DISENTANGLING THE POVERTY EFFECTS OF SECTORAL OUTPUT, PRICES AND POLICIES IN INDIA

I. INTRODUCTION

Understanding the relationship between macroeconomic policies related to agriculture and rural poverty reduction remains a key policy issue in development debates. While urban poverty has been relatively lower than rural poverty due to high-speed growth in the modern sector following rapid urbanization in the recent decades, the lack of modernization in traditional economic activity has left people in rural areas, with little non-farm sources of income, more vulnerable to poverty. Poverty is still a predominantly rural phenomenon (Dercon, 2009). The problem of poverty in India is severe and most acute in rural areas, where there is a dependence on the agricultural sector. Poor performance in agriculture, e.g. due to drought, which frequently happens, can be responsible for higher poverty in these areas. Those who are chronically poor are also predominantly rural, making rural poverty persistent and entangled with agriculture. Furthermore, the urban poverty rate rises slowly relative to the rural rate (Ravallion, 2002). Historically, the urban poor were better protected through the urban-biased public distribution system, along with better essential public services, as opposed to the rural poor. Thus urban poverty could be a spill-over of persistent rural poverty; and with high growth of urban centres, there could be massive migration of people from rural to urban areas, which could help reducing rural poverty.

India's population in poverty – measured in terms of the number of people who are below a critical or threshold level of income (or 'poverty line') as a proportion of the total population – has declined from its peak of 54.1% in 1973–74 to 27.5% in 2004–05 (see Table 1), although the number of poor has stagnated at around 300 million over this period with a big proportion relying on agriculture for their livelihood. According to Planning Commission estimates, the number of poor stood at 301.7 million in 2004-05, marginally declined from 321.3 million in 1973-74. As a majority of them (73.2% of total number of poor in 2004-05 declined from 81.3% in 1973-74) live in rural areas, poverty there is usually deeper than urban poverty, with the rural poor often being landless or having very little land, still they can benefit in terms of employment opportunities if the agricultural sector experiences continued growth. Rural poverty declined substantially in the late 1970s and 1980s, which was attributed to agricultural growth, food price changes and expansion of government poverty

alleviation and employment programs as important contributing factors (See Fan *et al*., 2000 and the references cited therein). Given that the agricultural sector has been shrinking in size in the recent decades with little growth either due to the neglect of agriculture by the government as shown in declining public investment namely irrigation infrastructure or due to decline in the importance of agriculture as a sector of economic activity in the process of development, the question then arises as to how the standard of living of people in the rural areas has improved as reflected in declining poverty rates. Is there an alternative channel of rural-urban poverty dynamics, given the fact that the number of rural poor has declined as mentioned above when the number of urban poor has increased to 26.8% of total number of poor in 2004-05 from 18.7% in 1973-74? This is the subject matter of this paper.

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***	***1999–2000***	***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; NSSO, Government of India.									

Twenty years of India's economic reforms show that growth is necessary, as a lack of it can produce an even worse outcome, though it may not be sufficient for poverty reduction when there is an uneven sectoral shift in the growth process (see, for example, Loayza and Raddatz, 2010; Montalvo and Ravallion, 2010; and Ray, 2010). The mechanisms by which an improvement in general economic performance promotes poverty reduction are by no means universally agreed (see Agenor, 2004). Using a cross-country dataset on absolute poverty, Hasan and Quibria (2004) find that the poverty-growth linkage is essentially driven by growth in the industrial sector, which suggests that it is important to capture this sectoral effect while examining the determinants of poverty dynamics. Besides, some specific policies could be correlated with poverty reduction in rural areas (such as irrigation policies and bank credit policies). While the direct impact of macroeconomic policy on poverty 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), the indirect impact works through its effect on growth [see Agenor (2005) for an exhaustive survey of issues related to the macroeconomic focus on poverty analysis and also see Granville and Mallick (2005), who

incorporate poverty within the Fund-Bank framework]. This channel is potentially important because often researchers find that anti-poverty policies do not seem to be particularly effective at reducing poverty in developing countries; the most famous example being Dollar and Kraay (2002), who find no evidence that the policies help the poor (e.g. public spending on health and education or formal democratic institutions). Given the well-known difficulties of drawing conclusions from large cross-country samples with poor quality data on poverty, there is a need for an individual country study with sectoral and policy variables that might otherwise have been ignored due to data limitations in a cross-country exercise.

Focusing on a single country over a long time horizon and considering the impact of each sectoral variable within a multivariate dynamic approach, this paper finds that the sectoral pattern of uneven growth reduces poverty differently, with rise in non-agricultural income and policies for the rural sector contributing to rural poverty reduction, while urban poverty is largely due to a spill-over of persistent rural poverty. Rural poverty is found to have declined with a rise in per capita non-agricultural real income, combined with the policy variables. On the other hand, a rise in relative prices of agriculture may lead to higher rural poverty as the negative impact on net buyers of food outweighs the benefits to net sellers. Fiscal spending, namely government current (consumption) and capital spending, has a poverty-reducing effect in the long run. While government consumption can reduce poverty via the demand-side effect, government capital spending can have a supply-side effect on poverty reduction. These results have been further tested for robustness by employing a dynamic OLS method due to Stock and Watson, who consider leads and lags in order to derive a long-run relation.

In addition, applying a structural VAR approach to identify unexpected transitory shocks, a similar poverty-reducing effect is found in the sense that an unexpected rise in non-agricultural per capita income reduces rural poverty in the long-run while an unexpected rise in agricultural income reduces rural poverty only in the short-run, given the large fluctuations in agricultural output over time. With regard to an increase in credit supply to the agricultural sector, the effect turns out to be significant in reducing rural poverty which was not significant in Johansen's approach, but in line with Stock-Watson's cointegration result. Such extension of bank credit to agriculture and more irrigated areas on the back of higher government capital spending can offset any adverse impact due to rising relative prices and a higher average capital-output ratio (ACOR) in the agricultural sector. To sum up, using alternative modelling techniques (Stock-Watson's dynamic OLS, Johansen's maximum

likelihood, and structural VAR), rural poverty reduction via the channel of internal migration becomes more prominent along with distributional and allocational channels when an economy experiences a decline in its traditional sector leading to adverse relative prices. While a strategy of government-led spending and financing does matter for poverty alleviation, a rise in relative price in favour of agriculture may not reduce poverty, because the income effect could be insufficient to offset the decline in purchasing power of the poor due to the rise in food prices that constitutes a big part of the consumption basket of most poor people, who are largely agricultural labourers and tenants.

In Section 2 I analyse the debate on poverty discourse, while in Section 3 a theoretical setting is developed to test the key hypotheses. Sections 4 and 5 provide the empirical analysis of poverty, and in Section 6 I conclude.

II. ANALYTICAL NARRATIVES ON POVERTY DISCOURSE: A BRIEF REVIEW OF THE LITERATURE

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 output, the relative prices, government spending and the policies financing development at the sectoral level—making the mechanism a subject of debate. The evidence in the poverty literature remains dominated by a paradigm of growth thought to be necessary for poverty reduction, with claims that the economic growth path in developing countries has been pro-poor (see Dollar and Kraay, 2002, and the references cited therein), irrespective of the nature of growth [see Datt and Ravallion (1998) and Palmer-Jones and Sen (2006a) for a detailed survey of issues on rural poverty in India with strong support for the trickle-down hypothesis]. On the other hand there are studies that report the role of redistributive policies leading more directly to poverty reduction, whenever it 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 growth pattern and rebalancing policies can make it most effective for the poor. In the absence of policy intervention, it is possible that people will migrate to cities in search of income opportunities which can explain reduction in rural poverty when the rural sector itself is experiencing a decline in activity. Further, in rural areas, more households are net food buyers than sellers, and among the poor, most households are net food buyers rather than sellers. High food prices are likely to hurt net-food-buying households even in the rural areas.

In recent years, the contribution of agriculture to the economy has started declining rapidly in many low-income countries (see, for example, Rao, 2010) when a large part of the population (in India this is 71% of total population in 2006) rely on agriculture for their livelihood. As the size of the agricultural sector declines during the process of development, relative wages 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 the demand for labour does not increase in line with the supply of labour (see Stiglitz, 2004). With policy reforms being directed towards the development of non-agricultural sectors, the share of agriculture in the economy can decline. In other words, there is some degree of substitution between the two sectors. Either the expansion of the non-agricultural sector can reduce rural poverty through internal migration or sectoral imbalances can worsen poverty through economic contractions/ food price inflation, raising unemployment. 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, namely investment in irrigation infrastructure and watershed development in rural areas. So policy intervention may be driving poverty reduction when growth is not pro-agriculture. Besides considering the aggregate per capita income as an indicator of the standard of living, it is important to examine the sectoral composition of total income, distinguishing the traditional from the modern sector when there is a shift towards non-agriculture.

Dasgupta (1997, 1998) examines the 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. 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 unemployment. 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 mainstream market activities. On the contrary, a basic idea underlying policy packages of international financial institutions has been that the fruits of economic growth trickle down to the bottom levels of society and

reduce poverty and inequality. But there is a danger with 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. Krishna *et al*. (2005) also argue that growth alone is hardly sufficient to achieve poverty reduction, as different reasons account for escaping poverty than those for falling into poverty.

Fiscal policy constitutes one of the key distributional channels for identifying a pro-poor growth pattern for poverty reduction, namely by decomposing public spending in terms of capital expenditure and operational spending, while, from the monetary side, channelling non-bank credits to the rural borrowers can work as an allocational mechanism for reducing poverty. So there are policies that alleviate poverty above and beyond their impact on growth. These include increased public spending (Squire, 1993) and increasing access to assets, through land reform, and opportunities (Birdsall and Londono, 1997), which have been emphasized as the logical extension of the argument that growth does not ensure the elimination of poverty. 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 a 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; Deininger et al., 2009; Gersbach and Siemers, 2010). In other words, giving property rights to slum dwellers can help them to acquire collateral and borrow and invest to improve their well-being. Thus growth associated with progressive distributional changes will have a greater impact on poverty than growth that leaves the income distribution unchanged (Ames *et al*., 2001). Using National Sample Survey data for rural India, Jha *et al*. (2011) show the positive effect of the Rural Public Works and the Food for Work Programs for 1993-1994 and 2004-2005 respectively on incidence of poverty in rural India.

In recent years, there has been significant amount of technical research either looking at how to measure poverty or at emphasizing micro rather than macro-issues, with little research on the direct connections between macroeconomic/financial policies and poverty reduction. To the extent that it 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. In this context, Burgess and Pande (2005) show that the

geographical spread of banks had a significant impact on rural poverty in India, primarily in areas where they were required to establish new branches. Using aggregate time-series data, they argue that the bank nationalization programme brought about by rural branch expansion in India significantly reduced rural poverty. As credit rationing is present in most developing economies including India, a country's monetary policy can be used to expand credit supply 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. As the credit needs of the rural sector are not met adequately by the formal credit market, there is a distributive role of monetary policy by allocating credit to the priority sectors. In recent years, the financial needs of the poor have been partly taken care of in the microcredit market, which is growing in size and staying outside the mainstream financial system. Delivering financial services to the poor is therefore important for poverty reduction. In this context, extending agricultural credit promises to be an effective method for channelling 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 channelled by the banking sector for productive economic activities in the rural sector. Thus there is a need to distinguish sectoral allocation of credit, namely priority sector lending, from aggregate credit (as a percentage of GDP) as normally used in this literature.

Because macroeconomic policies, that is, public expenditure and development financing policies, can affect people differently as individuals face different incentives and constraints at the microlevel (see Galor and Zeira, 1993), in this paper I put together a two-sector setting, namely agriculture and non-agriculture, to examine the rural sector performance with reference to the urban economy—by using annual time series data from India over five decades. As in most developing countries, the incidence of poverty in India has been historically higher in rural areas than urban areas (Datt and Ravallion, 2002). Ravallion and Datt (2002) argue that poverty measures have responded more to rural economic growth than to urban economic growth. Thus it is important to examine the extent to which the intensification of both rural and urban poverty has been influenced by sectoral

GDP composition and relative prices, along with other conditioning variables, namely the impact of macroeconomic policies.

III. A THEORETICAL SETTING TO INCORPORATE SECTORAL COMPOSITION OF OUTPUT AND PRICES

During different Five-Year Plans in India, the poverty alleviation agenda has gone through different phases: first, land distribution and food security through the Green Revolution (the 1950s and 1960s respectively); second, income and employment generation (the 1970s and 1980s); third, market-led growth and structural adjustment with a focus on basic needs (the 1990s). All these intervention strategies relate more to the rural sector than the urban areas. Conceptually the poor can be identified through flow variables like expenditures or income. In this paper therefore I analyse the problem of poverty primarily from a macroeconomic perspective, tracing the rural and urban poor's economic status in their respective sectors, that is, rural economic growth with agriculture as the main source of GDP which most poor people depend on for their livelihood, can have a greater impact on reducing rural poverty than growth in the non-agricultural sector, in the absence of inter-sectoral migration. 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. De Janvry and Sadoulet (2010) show that GDP growth originating in agriculture induces income growth among the 40% poorest, which is of the order of three times larger than growth originating in the rest of the economy. Decomposing the aggregate decline in poverty into a rural contribution, an urban contribution, and a population shift component, they show that rural areas contributed more than half the observed aggregate decline in poverty. The economic activities therefore can be classified in terms of the agricultural sector employing unskilled people and the non-agricultural or skilled sector. Non-agricultural goods include industrial products and services. Unskilled workers are endowed with labour only, and no human or financial capital. The macroeconomic setting can be characterized by these two production sectors, as in dual economy models (see Temple, 2005).

At the aggregate level, the poverty (*POV*) relation can be written as a function of the aggregate real per capita income (GDP_{pc}) in absolute sense, sectoral output ratio in relative sense, and the cost-of-living or relative prices (P_A/P_N):

$$POV = f\left(\bar{GDP}_{pc}, \frac{\bar{\bar{GDP}}_A}{GDP_N}, \frac{\bar{\bar{P}}_A}{P_N} \right), \qquad (1)$$

where the subscripts *A* and *N* denote the agricultural (where most unskilled/uneducated poor labourers are engaged) and non-agricultural (where most skilled/educated workers are involved) sectors respectively, and P_A and P_N denote respective prices of agricultural and non-agricultural goods. While higher per capita income can reduce poverty in an absolute sense, a relative income measure capturing sectoral pattern can have an unambiguous effect depending on whether the relative indicators have helped rural or urban economic activity. Besides, a higher relative agricultural price might benefit net sellers but harm net buyers. So what might happen to rural poverty (often taken to be synonymous with poverty in the farm sector) is an empirical question. For example, better terms-of-trade would be favourable if there is a net sale rather than a net purchase of agricultural commodities. The above poverty equation can be rewritten at a sectoral level as follows:

$$\begin{aligned} POV &= \alpha + \beta\left(GDP_{pc}\right) + \mu\left(\frac{GDP_A}{GDP_N}\right) + \theta\left(\frac{P_A}{P_N}\right) \\ &= \alpha + \beta_1 GDP_{pcA} + \beta_2 GDP_{pcN} + \mu\left(\frac{GDP_A}{GDP_N}\right) + \theta\left(\frac{P_A}{P_N}\right) \end{aligned} \qquad (2)$$

where GDP_{pcA} and GDP_{pcN} refer to per capita real GDP in agricultural and non-agricultural sectors respectively; $\beta_1, \beta_2 < 0$, $\mu <$ or > 0 and $\theta <$ or > 0.

Aside from the changing sectoral distribution of aggregate GDP, the effect of sectoral prices is considered to reflect the purchasing power of people engaged in the agricultural sector and to assess its impact on poverty. Changes in agricultural terms of trade (the ratio of agricultural to non-agricultural prices) have consequences for the intersectoral transfer of resources, rural welfare, rural–urban migration and farmers' resource allocation decisions.

The prices of the agricultural goods in relation to non-agricultural goods can capture the change in relative prices against the non-agricultural or change in favour of the agricultural sectors. The two different price deflators for the two groups of labour (uneducated largely involved in the agricultural goods sector and the educated mainly in the non-agricultural goods sector) can reflect different consumption bundles. People who are poor mainly demand essential commodities to survive, although the maximum level of such consumption will vary between the two groups of workers. The poor workers are concentrated more in agricultural sectors and 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). 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 that, if food prices rise above the 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 the agricultural and non-agricultural sector, via the relative prices, can reveal whether the intersectoral terms of trade have been favourable to the agricultural sector.

In addition, as growth is driven by private sector capital accumulation, there is a need to consider (in equation 2) the effect of such stock variables as are driven by private sector investment. Aghion and Bolton (1997) formalize 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 the later stages, reduces them, generating a Kuznets curve. So it is the capital accumulation of the rich, which lowers the interest rate on loans, that allows the poor to take on high yielding ventures (also see Blackburn and Bose, 2003). In what follows I introduce a standard capital stock equation in which investment (I_A) can raise capital accumulation in agriculture:

$$K_A = (1-\rho)K_{A0} + I_A, \qquad (3)$$

where ρ is the rate of depreciation of capital stock and K_{A0} is the initial capital stock. As in Mallick (2001), total real investment is decomposed into real private investment (I_{Ap}) and real public investment (I_{Ag}) in agriculture:

$$I_A = I_{Ap} + I_{Ag}. \qquad (4)$$

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 and pump sets), and livestock. Public investment is concentrated in irrigation infrastructure, public services (research and extension), conservation and commodity development programmes. 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. It is in this context that macroeconomic policies need to be identified, which can play a role in poverty reduction. Agricultural growth and public capital formation may have been the important contributing factors for poverty reduction in rural India in the recent decades. 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 that spatial variations in irrigation development at the state level can explain the differences in the decline in poverty. 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 1990s, investment in the agricultural sector in India received inadequate attention. The need to free up funds for badly needed investment in infrastructure and social development requires the government to curtail its huge operational expenditure in order to help finance the desired 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:

$$I_{Ap} = \omega_0 + \omega_1 I_{Ag} + \omega_2 CD_{ps} + \omega_3 DE_g , \qquad (5)$$

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 development expenditure by the government that can stimulate private investment in agriculture. Budgets that include more expenditure directed at helping the poor are more pro-poor than other types of fiscal spending. 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 a higher potential to reduce rural poverty. Capital spending by government augments real public capital formation, whereas government consumption can have a direct impact on private consumption behaviour, which in turn can foster investment activity in the private sector. 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. The current (or consumption) and capital development expenditures are included as control variables for the size of the government, along

with financing to agriculture by the banking sector. By adding capital in Equation (2) and substituting Equations (3–5), the reduced form poverty equation can be written as follows:

$$POV = \alpha + \beta_1 GDP_{pcA} + \beta_2 GDP_{pcN} + \mu\left(\frac{GDP_A}{GDP_N}\right) + \theta\left(\frac{P_A}{P_N}\right) + (1-\rho)K_{A0} + (1+\omega_1)I_{Ag} + \omega_2 CD_{ps} + \omega_3 DE_g, \quad (6)$$

where *POV* could be rural or urban poverty, and I_{Ag} refers to public investment. Total government size is also considered to check robustness through government total consumption (current) expenditure and government capital expenditure. ACOR in agriculture is used as a proxy for initial capital (K_{A0}). Also the impact of irrigation on agricultural performance is captured via a proxy on gross irrigated area (*GIA*), replacing I_{Ag}. The more the irrigated area, the less reliant farmers will be on rainfall and, thus, the higher will be the agricultural production and poverty reduction. Rainfall is a critical input in the agricultural production. The deviation of actual rainfall from normal rainfall (*DRAIN*) has been used to control for this exogenous factor, as the persistent deficit rainfall in the recent years has led to crop failure and consequently the government's reluctance to battle crop failure has contributed to spate of farmer suicides. So the neglect of agriculture has led many farmers in a state of despair. This explains why irrigation in Indian agriculture plays an important role. The higher the investment in a new irrigation facility, the higher will be the return from agriculture, even if one discounts for increases in capital and production costs (see Mallick (1993)). So *GIA* can be a proxy for total capital spending, as it can also be driven by private investment.

As sectoral relative price and income effects are considered here, both supply- and demand-side effects are effectively captured in a macroeconomic sense. Besides, these two key sectoral policy instruments are considered to link poverty from the fiscal and monetary sides. 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, although it helps stabilize price inflation. The credit availability rather than the cost of credit is important in the context of a rural economy. However credit supply per unit of cost has also been used to check for robustness. Besides, the credit channel can take account of the gradual process of financial reforms with regard to the bank (loan) market. The sectoral allocation of credit is emphasized by considering lending to the priority sectors, in particular the agricultural sector, instead of aggregate credit (as a percentage of GDP) in India, where 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 policy, which is now restricted to high employment-intensive sectors such as agriculture, small industry, educational loans for students and low cost housing (www.rbi.org.in). Scheduled commercial banks 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 only changed in favour of a leading service sector and a skill-intensive, rather than labor-intensive, manufacturing (see Kochhar *et al*., 2006). The sectoral importance of the agricultural and allied sectors, which provide the majority of the population's livelihood, was largely left untouched by the reform measures (see Kalirajan and Sankar, 2001). In this paper therefore I am attempting to analyze the poverty-reducing impact of absolute GDP and the relative sectoral GDP and prices, along with the effect of different policies as formulated in this section using data from India.

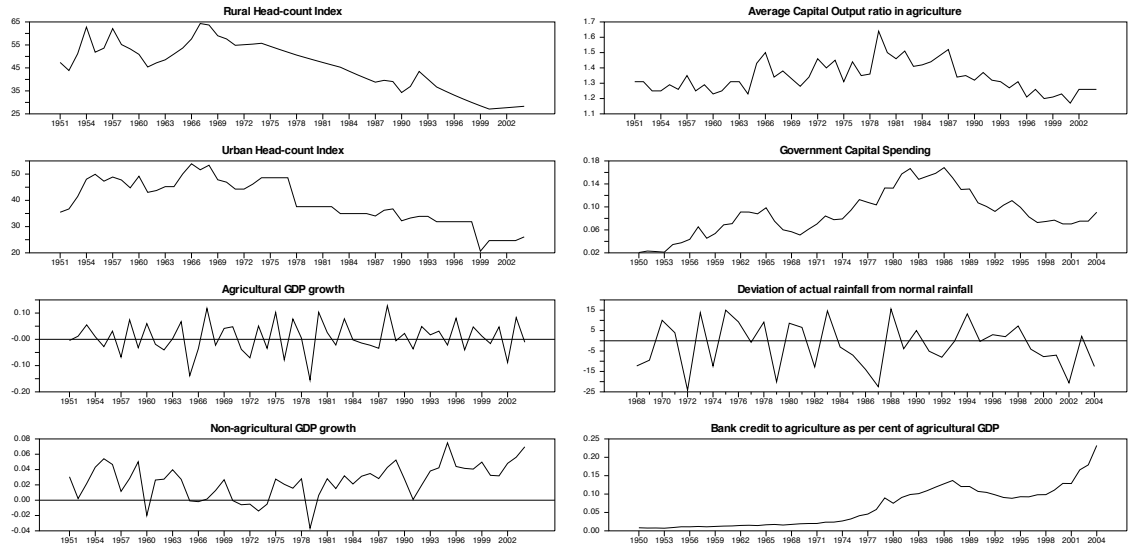
IV. THE DATA, EMPIRICAL STRATEGY AND RESULTS

The definition of poverty and its measurement in India has been the source of intense debate in the literature (see Zheng, 1997; Deaton and Kozel, 2005; Banerjee and Duflo, 2007; Kumar *et al*., 2009). 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*), as a standard indicator of the extent of income poverty, has been employed here, and the effect of policies that directly influence poverty is examined after accounting for the effect of sectoral distribution of output and intersectoral terms of trade. Data sources and definitions of variables used in this paper are discussed in detail in the Appendix. The time span covers the period 1950 to 2004 with a total of 54 annual observations. Since poverty data come from household surveys which are not conducted every year, the linear interpolation method has been employed to fill in the missing data. The years for which interpolated data have been used are mentioned in the Appendix.

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 time series graphs (see Fig. 1) confirm that non-stationarity is apparent in all the series (in levels). The starting point is to test for integration properties of data by applying Augmented Dickey-Fuller (*ADF*) and Kwiatkowski–Phillips–Schmidt–Shin (*KPSS*) unit root tests to the variables in levels. The

ADF tests assume that a series is I(1) under the null, as against the alternative that it is I(0); whereas under the KPSS test, the null is stationary.

Figure 1: Time series plots of variables



These results, which are reported in Table 2, clearly show that the null of a unit root cannot be uniformly rejected, suggesting that the series is non-stationary or integrated of order I(1). As 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, indicating the need for instrumental variable (IV) methods. However, IV approaches, although better than OLS in terms of efficiency, do not provide asymptotically efficient estimators. The fully modified OLS (FM-OLS) procedure due to Phillips-Hansen can be an asymptotically efficient estimator without the use of instruments which corrects for endogeneity in the regressors and contemporaneous correlation, through semi-parametric corrections with transformations involving the long-run variance and covariance of the residuals. Nevertheless, this single-equation cointegration procedure does not involve dynamics. Hence the well-known Johansen–Juselius cointegration technique has been implemented here, allowing for an unrestricted constant and trend in the VAR, to uncover the implied structural relationship for the determinants of poverty. Moreover, given that most of the series involved are I(1) and some could be endogenous, a multivariate reduced rank approach employing maximum likelihood method is a more appropriate test for a long-run relation. These estimations have been carried out using 'CATS in RATS' software.

Table 2: Unit root test for the model variables

Variable	*ADF test statistic*	*Integration order*	*KPSS test statistic*	*Integration order*
Rural Poverty	0.3797	I(1)	0.9301**	I(1)
Urban Poverty	–0.4419	I(1)	0.9275**	I(1)
Agricultural GDP	–1.4096	I(1)	1.0307**	I(1)
Non-Agr. GDP	3.3940	I(1)	1.1032**	I(1)
Agricultural Price	6.4104	I(1)	0.9930**	I(1)
Non-Agr. Price	11.2043	I(1)	1.0141**	I(1)
ACOR	–3.3230*	I(0)	0.2518	I(0)
Public spending	–1.1261	I(1)	0.8986**	I(1)
CD to agriculture	2.3242	I(1)	1.0767**	I(1)
Per capita income	2.2436	I(1)	1.4035**	I(1)
GIA	0.1395	I(1)	1.4536**	I(1)

* Rejection of the null at 5%; ** rejection of the null at 1%.
Notes: Under the KPSS test, the null is stationary. Both ADF and KPSS test results indicate that all the variables are integrated of order one, I (1), except ACOR. The optimum lag is one, selected on the basis of the Schwartz Bayesian criterion (BIC). Critical values for the ADF test are: 1% = –3.559; 5% = –2.918; 10% = –2.596. Critical values for the KPSS test are: 10% = 0.347; 5% = 0.463; 1% = 0.739. *ACOR* is average capital output ratio in agriculture; *CD* is bank credit to agriculture as a proportion of total agricultural GDP; *GIA* is log of gross irrigated area as a proxy for public capital formation in agriculture.

Table 3 presents parameter estimates of the different variants of the long-run cointegrating relation. Trace test statistics allow us to reject the null hypothesis of no cointegration at the 1% level. For models 1 and 5, the rank test statistics are reported in Tables 4 and 5 respectively, implying a valid cointegrating relation. The likelihood ratio test of cointegration rank, with a small sample correction (Johansen, 2002), is used. Model 5 in Table 3 is a well-specified long-run model and no other variables are required to capture its long-run stochastic trend, as indicated in the log-likelihood statistic. Overall, the coefficient estimates are of the correct sign and of plausible magnitude, and the tests confirm strongly that the variables are cointegrated. Besides, the standard tests for cointegration presume that the cointegrating vector is time invariant under the alternative hypothesis and hence have low power in detecting a regime shift (Gregory and Hansen, 1996). Following Gregory and Hansen, the null of no cointegration for Model 5 is tested against the alternative of cointegration with a regime shift at an unknown point in the sample. Allowing for a full structural break (a shift in intercept and slope coefficient), the test confirms a cointegrated relationship with a full break achieved at 1975 (see Fig. 2). 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 and discussed in Section 1. Further tests are carried out for parameter stability by using recursive cointegration for Model 5 to detect non-constancy of the coefficients, which broadly confirms a declining trend in the 1990s, compared to the earlier period (see Fig.3).

Table 3: Long-run Parameter estimates using Johansen's method of cointegration

	INCOME POVERTY - RURAL					INCOME POVERTY - URBAN	NON-INCOME RURAL IMR
	Model 1	Model 2	Model 3	Model 4	Model 5		
Agricultural GDP			-1.420 (0.630)	-0.541 (-1.006)	0.449 (0.933)	1.481 (1.502)	-0.479 (- 0.730)
Non-Agr. GDP			2.237** (2.981)	-1.561** (-6.550)	-2.502** (-6.463)	0.441 (0.761)	1.349** (5.050)
Agricultural Price			-1.171 (-0.410)	-1.125* (-2.317)	-0.746 (-1.300)		
Non-Agr. Price			-0.289 (-0.099)	1.974** (3.260)	2.305** (3.236)		
Per capita aggr. GNP	-2.017** (-6.111)						
Output ratio	0.187 (0.285)	2.469 (1.713)				-3.235 (-1.936)	
Price ratio	2.633** (6.312)	4.118** (6.550)				-0.352 (-0.609)	-0.173 (-0.757)
Investment spending	-0.349 (-0.179)		-5.188** (-2.600)		-1.603 (-1.430)	-2.377 (-1.531)	-5.578** (-3.380)
Current spending		0.629 (1.006)	0.495 (1.072)		0.255* (2.015)	-0.842** (-2.692)	
Credit to agriculture	1.626 (1.380)	-1.514 (0.635)	-5.504** (-2.280)		1.055 (1.756)		-2.396** (-2.821)
ACOR		3.295** (5.180)	1.603 (0.926)	-0.967** (-3.097)	-0.511 (-1.473)		1.001* (2.069)
GIA		0.036 (1.869)		0.011* (2.409)			
DRAIN				-0.004** (-5.936)	-0.004** (-4.570)		
RPGR				-0.268** (-3.027)	-0.198 (-1.756)	2.323** (7.369)	0.643** (3.256)
Credit per unit of cost				0.126** (4.727)			
UPGR						0.497** (7.283)	
FLR							-0.056** (-3.499)
Trend	0.012 (0.680)	-0.063 (-1.372)	-0.073 (-1.825)	-0.052** (-7.056)	-0.055** (-4.823)	0.029 (1.007)	0.007 (0.664)
Log-Likelihood	1204.636	1078.655	1874.666	952.186	1351.936	1330.674	1067.701

* Significant at the 5% level; ** significant at the 1% level.

Notes: Figures in parentheses under the estimated normalized coefficients are t-values. The residuals of the above estimated equations have been tested to be stationary. DRAIN refers to deviation of actual rainfall from normal rainfall; RPGR is rural population growth; UPGR denotes urban population growth; and FLR is female literacy rate.

Figure 2: Gregory–Hansen cointegration tests involving the variables in Model 5

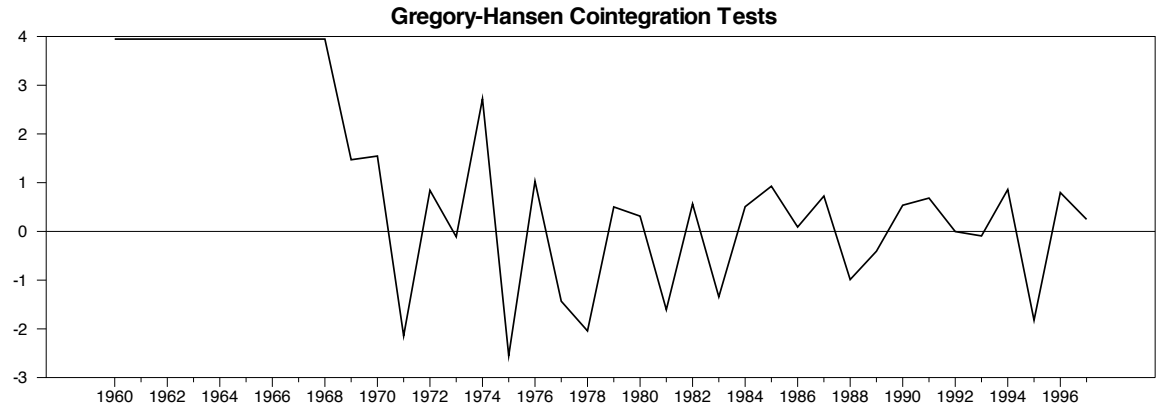


Table 4: I(1) analysis: rank test statistics with variables in Model 1

Rank	***Eigen value***	***Trace***	***Trace****	***Frac95***	***p-value***	***p-value****
0	0.681	151.996	142.316	117.451	0.00	0.00
1	0.539	91.389	86.711	88.554	0.03	0.068
2	0.34	50.372	48.401	63.659	0.401	0.49
3	0.239	28.377	27.596	42.77	0.604	0.65
4	0.19	13.9	13.673	25.731	0.67	0.688
5	0.051	2.762	2.746	12.448	0.891	0.892

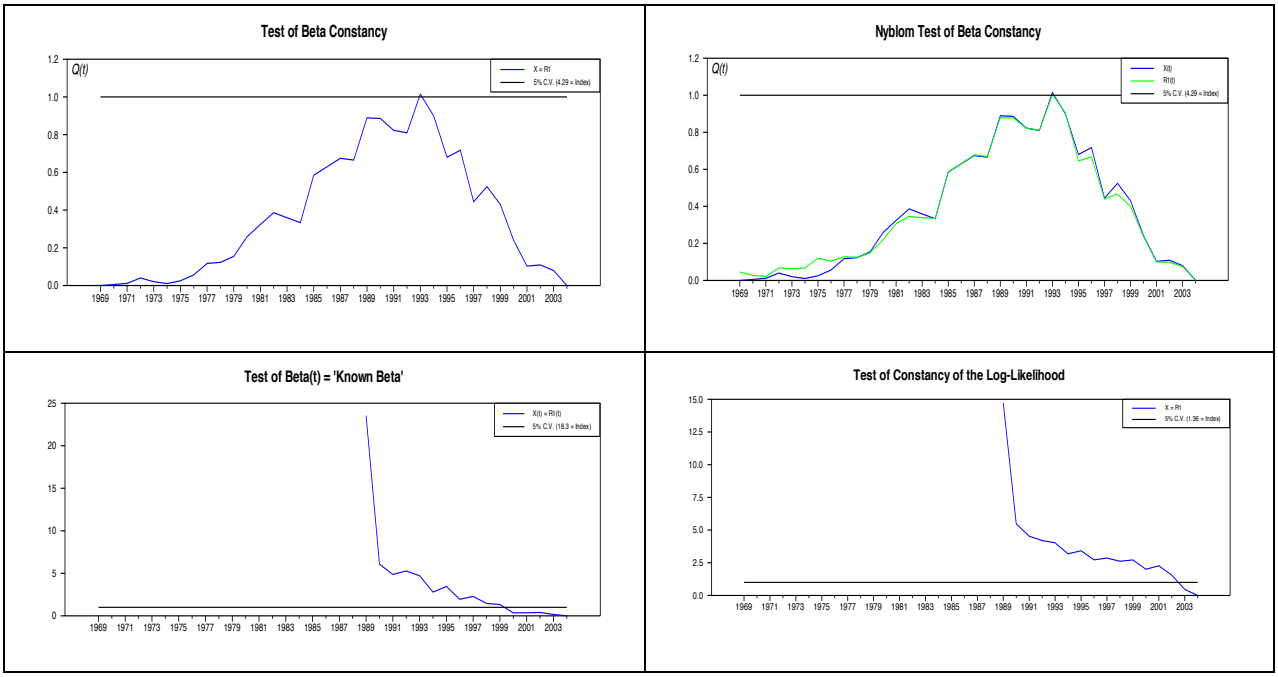
* Small-sample corrected test statistic and corresponding approximate p-value.
Note: Frac95 is the 5% critical value.

Table 5: I(1) analysis: rank test statistics with variables in Model 5

Rank	***Eigen value***	***Trace***	***Trace****	***Frac95***	***p-value***	***p-value****
0	0.947	430.447	336.218	321.943	0.000	0.011
1	0.884	324.367	261.289	273.044	0.000	0.143
2	0.816	246.792	204.704	228.145	0.005	0.36
3	0.693	185.839	158.478	187.246	0.059	0.55
4	0.652	143.359	125.494	150.348	0.118	0.525
5	0.593	105.386	94.551	117.451	0.232	0.558

* Small-sample corrected test statistic and corresponding approximate p-value.
Note: Frac95 is the 5% critical value.

Figure 3: Parameter constancy tests using recursive cointegration with Model 5



The aggregate per capita income having significant negative impact on poverty in Model 1 in Table 3 suggests that growth is good for the poor as in the literature, while GDP ratio and policy variables are not significant in Model 1. Aggregate per capita income has been excluded in Model 2 to check whether policy variables can have a different impact. Since log-likelihood is lower in Model 2, this is not a better specified model. In Model 3, agricultural and non-agricultural output have then been included separately, which shows that agricultural per capita GDP does not have significant impact on rural poverty, whereas two key policy variables significantly reduce poverty. And an increase in non-agricultural GDP reduces rural poverty indirectly via the trickle-down effect, via possible income transfer to rural areas by the migrant workers in the urban sector. Although policy variables are significant in Model 3, they become insignificant after rainfall and rural population growth have been controlled for in Models 4 and 5. An insignificant coefficient associated with ACOR in Model 5 could suggest little adverse effect on poverty, which means there is no declining employment effect due to capital-labour substitution (i.e. labour saving technological progress).

In Model 5 (Table 3), a negative sign associated with per capita GDP in non-agriculture indicates that the current expansion of the non-agricultural sector is able to absorb

a part of the excess supply of labour from the traditional sector leading to a decline in rural poverty, given the decelerating agricultural sector. Intuitively, a reduced share of agriculture in the economy can partly explain why the agricultural GDP is less significant in influencing poverty. As the coefficient associated with agricultural GDP turns out to be insignificant (see Models 4-5, Table 3), the mechanism through which rural poverty has declined in India must have been via the channel of internal migration and the government led channel of development spending and financing. Besides, the increase in per capita income in the non-agricultural sector might capture the effect of trade openness in reducing poverty. Trade reforms can help reduce poverty via higher real wages and employment—the so-called static effect, with the dynamic argument that higher trade promotes economic growth, which in turn reduces poverty (see Bhagwati and Srinivasan, 2002). As a majority of the poor live in rural areas where there is an 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. In addition, the impact of different monetary (credit to agriculture as a proportion of total bank credit) and fiscal policy (government spending) instruments has been examined to uncover the policy effects. In Model 5, as the preferred model which includes all the key variables improving the log-likelihood, policy variables are not significantly influencing rural poverty in the long-run, while the non-agricultural output remains the key determinant.

Besides, the positive coefficient associated with non-agricultural prices suggests that higher non-food prices can adversely affect the poor eroding their purchasing power, whereas agricultural prices do not significantly influence rural poverty because the income effect on the back of high food prices is possibly offsetting the expenditure effect due to higher prices. Although in theory an increase in food price can be favourable to agriculture, in reality the supply response being weak in agriculture may not allow this possibility to occur, thereby leading to neutral effects on the rural poor as in Table 3. This might seem counter-intuitive, but it is still possible, given that food prices were controlled via an administered pricing mechanism during a big part of the sample period, because price volatility can have an adverse impact on people below the poverty line.

Poverty being a long-term issue, deriving a long-run statistical relation makes a better sense, since 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 look at the short-run impact

in the next section to see whether an unexpected rise in agricultural per capita income contributes to reduction in rural poverty, as the impact is insignificant in the long-run.

V. ROBUSTNESS CHECKS

Urban Poverty

The cointegration exercise is carried out again by replacing rural poverty with urban poverty to check whether the uneven sectoral growth pattern is favourable to the non-agricultural sector, contributing to a greater degree of reduction in urban poverty relative to rural poverty. For urban poverty, there is no direct urban-biased intervention strategy of development contributing to higher non-agricultural growth as there is for rural poverty. So it is assumed that urban economic expansion will take care of poverty in cities. It is for this reason both sectoral population growth variables are included to capture the possible effect of internal migration directly, along with the sectoral GDP and policy variables. The long-run relation for urban poverty is derived in Table 3. The coefficient associated with agricultural output being insignificant suggests that agricultural income does not significantly reduce urban poverty suggesting that there is no reverse migration of people from urban areas, and urban poverty is largely due to the spill-over effect of persistent rural poverty, which is obvious when one looks at the effect of urban and rural population growth variables as shown in Table 3 possibly due to internal migration of labourers from rural areas.

It is worth mentioning here that the informal sector remains decoupled from the rest of the economy (Patel and Srivastava, 1996), and hence it is hard to uncover the effect on people engaged in the informal sector, given the fact that much of this informal activity takes place in urban areas. Overall, rural poverty reduction has been led by the rise in non-agricultural output, which more than offsets the negative impact due to rise in non-food prices, whereas urban poverty appears to be a spill-over of rural poverty.

Non-income Poverty

Although income poverty is used as a key indicator of incidence of poverty, an attempt is made here to show whether higher income poverty coexists with multidimensional deprivation or capability-poverty. There is evidence that some non-monetary indicators are more persistent and can go together with monetary indicators of chronic poverty (see Mehta and Shah, 2003). Klasen (2008) argued that relying on income growth to solve the non-

income deprivation problem is unlikely to be the most effective approach to addressing non-income poverty. In the 1980s and 1990s, Sen pioneered the capability approach, which rejects monetary income as a measure of well-being. This notion of capability poverty was operationalized by the UNDP, in the form of human development index (HDI), looking beyond income/consumption.

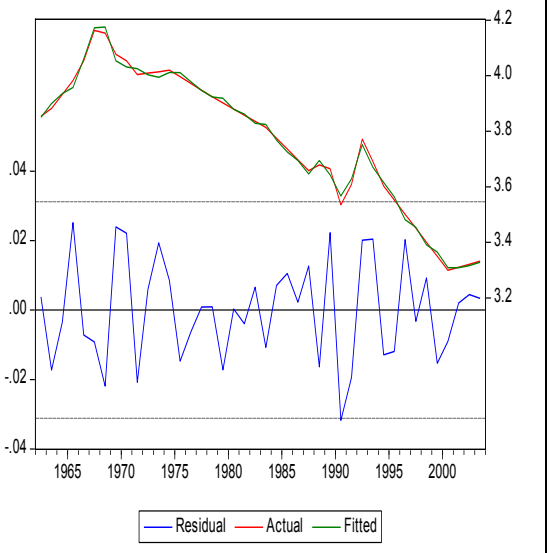
Among other dimensions of living standards, poor health is an important aspect of non-material or non-monetary dimension of poverty. Infant mortality rate (IMR) as a stock variable is one such broad welfare indicator that can reflect whether overall well-being has improved on average with development in terms of per capita income and other unobservable factors that can be captured through a time trend. Health outcomes like IMR are perceived to be the key indicators of inclusiveness of economic growth (see Sen, 1998). Intuitively, variations in the IMR could reveal persistent deprivation of the means of accessing good health due to: lack of ability to pay for health care; non-availability of health care facilities in the rural areas; poor quality of drinking water leading to water borne diseases that cause mortality; and poor infrastructure, such as the lack of roads and public transport that can enable conveyance to hospitals in towns or cities in case of emergency. Peltzman (2009) notes that unequal longevity was once a major source of social inequality, perhaps even more important in some sense than income inequality, for a long time. But over the last century, this inequality has declined drastically in high-income countries and is now comparatively trivial. But Bhalotra (2010) finds that rural infant mortality is counter-cyclical, as opposed to mortality at most ages, which is pro-cyclical as per the literature. As it is possible to find a continuous time series for IMR in India, this variable has been used instead of HCI as a robustness check. Female literacy as a proxy for mother's literacy has been used to identify the infant mortality equation. The long-run relation using Johansen's cointegration approach is derived (see Table 3, last column). Non-agricultural income not being able to reduce rural poverty measured in terms of IMR could suggest the possibility of mobility cost. This long-run relation for the rural IMR shows that female literacy rate along with policy variables (spending on scientific innovations) have translated into improved health outcomes, although there could still be regional variations within the country. However, this aggregate improvement in IMR in the rural areas has been reflected in the overall Human Development Index for India, showing a steady rise from 1975 (see Nathan and Mishra, 2010).

Checking Robustness via Dynamic OLS

An alternative parametric approach, which has advantages over both the static OLS and the maximum likelihood procedures, has been proposed by Stock and Watson (1993) for estimating long-run equilibrium in systems which may involve variables integrated of diverse orders but still cointegrated in a dynamic sense. Given the presence of cointegration among these variables, the intuition exposed by the earlier results does tend to hold in a long-run relationship between sectoral per capita incomes and rural poverty. Stock-Watson (DOLS) parameter estimates of the long-run parameters with all variables appearing in levels are presented in Table 6, along with their t-values derived from approximate asymptotic standard errors. The DOLS estimates confirm that both non-agricultural GDP and policy variables significantly reduce poverty, while rural population growth and non-agricultural prices increase poverty. As shown in the table, increase in non-agricultural income by 1% leads to decline in poverty by 1.3%. On the other hand, a 1% increase in rural population growth increases poverty by 0.67 per cent. The size of the coefficients being different here does suggest that the estimates from DOLS are super-consistent as the specification considers both lags and leads for all variables and possibly avoids any multicollinearity problem and overcomes the possibility of more than one cointegrating relation as in Johansen's approach. Hence DOLS estimates are more reliable than the Johansen's estimates. As the agricultural per capita GDP still remains insignificant, it clearly shows that internal migration and policy intervention contribute significantly to alleviating rural poverty. In reality, the existence of a larger proportion of the economically most backward scheduled caste (SC) and scheduled tribe (ST) households in the population attracts more developmental resources from the government. It is well known that the incidence of poverty in SC and ST households is much higher than among non-scheduled households (Gang et al., 2008). This, in turn, engages other sections of the community through spill-over activities and, as a result, developmental spending could contribute to increasing the pace of poverty reduction.

Table 6: Stock-Watson Dynamic OLS estimates of Rural Poverty

	DEPENDENT VARIABLE: LOG (RURAL INCOME POVERTY)
Agricultural GDP	-0.549 (-1.848)
Non-agricultural GDP	-1.239* (-2.729)
Agricultural Price	-5.044** (-4.589)
Non-agricultural Price	6.413** (4.241)
Average Capital-Output Ratio	0.343 (1.353)
Investment spending	-3.702** (-11.595)
Credit to agriculture	-4.517** (-6.522)
Rural Population Growth	0.669** (4.587)
C	19.522** (3.893)
Adjusted R^2	0.985
SE of Regression	0.031
DW statistic	2.341



Notes: Dynamic Least Squares (DOLS) Method has been used with fixed leads and lags specification (lead=1, lag=1); HAC standard errors are estimated for statistical significance; t-values in parentheses; * and ** indicate statistical significance at the 5 and 1 percent levels, respectively; SE is the standard error; The residuals of the estimated equation plotted here show clear indication of stationarity.

Checking Poverty Effects in the Short-run

Furthermore, a structural VAR model is estimated to represent the effects of unexpected shocks involving the six key variables in Model 5 (Table 3) and to derive structural innovations of poverty. With these six variables, which could be endogenously related to each other, the following SVAR model is estimated: $B_0 X_t = a + B(L)X_{t-1} + \varepsilon_t$. The reduced form is: $A(L)X_t = \alpha + u_t$, where $A(L) = I_n - A_1 L - \ldots - A_p L^p$, in which $A_1 = B_0^{-1}B(L)$, and $u_t = B_0^{-1}\varepsilon_t$, u_t is the vector of VAR residuals and ε_t is the vector of structural shocks. The impulse-response functions will be given by $A(L)^{-1}B_0^{-1}$ and, to make B_0 invertible, at least $\left(n \times (n-1)\right)/2$ restrictions need to be imposed to identify the system exactly. The derived impulse-response functions describe the response of a variable to a one-time shock to one of the elements of u_t. Cholesky decomposition has been used to identify the orthogonalized disturbances u_t, which imposes a recursive ordering in the sense that shocks to

variables higher in the ordering affect variables lower in the ordering contemporaneously. A recursive identifying restriction on the matrix of contemporaneous effects, B_0, is imposed as follows:

$$\begin{bmatrix} u_{cd} \\ u_{inv} \\ u_{rpr} \\ u_{agy} \\ u_{nay} \\ u_{pov} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_{cd} \\ \varepsilon_{inv} \\ \varepsilon_{rpr} \\ \varepsilon_{agy} \\ \varepsilon_{nay} \\ \varepsilon_{pov} \end{bmatrix}.$$

The recursive system orders variables from the more exogenous to the less exogenous using the economic rationale as follows: agricultural credit (*CD*), agricultural investment (*INV*), sectoral relative prices (*RPR*), agricultural GDP per capita (*AGY*), non-agricultural GDP per capita (*NAY*) and rural poverty (*POVR*) as the benchmark ordering: $X_t = [CD_t, INV_t, RPR_t, AGY_t, NAY_t, POVR_t]$. The ordering has been mainly motivated by the priority sector lending policy of the monetary authority making such bank credit as a mandatory requirement for banks, and hence is an exogenous shock, which can contemporaneously influence both private and public investment in agriculture. The best proxy to reflect both types of investment in agriculture is GIA. This in turn will influence relative prices and sectoral GDP, and thereby poverty. The impulse responses of the six shocks from the estimated SVAR model with the above recursive structure are presented in Figs 4–9. With this multivariate approach in which all the variables are endogenous, robust correlations are established between key policies and rural poverty to show that credit allocation to the rural sector and agricultural investment on the back of public capital spending have a direct trickle-down effect on poverty, via higher economic activity. Rural poverty reduction is found to be significantly driven by agricultural credit, agricultural investment and non-agricultural GDP shocks rather than relative prices and agricultural GDP shocks in the long-run (see Figs 4–9, Panel E). The length of the poverty response to a positive credit shock lasts roughly 8 years and then becomes insignificant, while a positive investment shock has permanent effect on poverty alleviation. This suggests that the favourable effect of macroeconomic policies on poverty is partly in line with the endogenous growth literature that policies can affect growth and thus poverty in the long run. The non-agricultural growth along with pro-rural policies does seem important for rural poverty reduction in the long run. As in Fig. 10, two episodes of increase in poverty can be identified, one in the mid-1960s (a supply shock due to drought and famine) and one in the early-1990s (a policy shock owing to stabilization and structural

adjustment). This is also supported by a multiple break procedure, following Bai-Perron, with two break points being found in 1964 and 1991.

Figure 4: SVAR impulse responses to agricultural credit shock

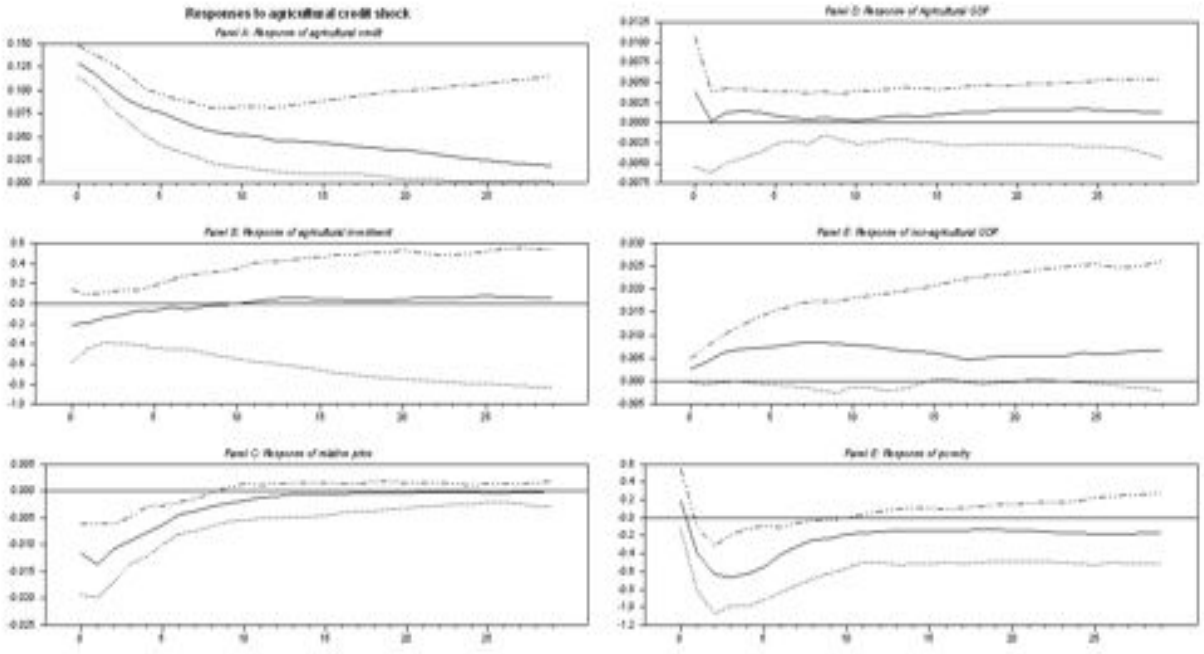


Figure 5: SVAR impulse responses to agricultural investment shock

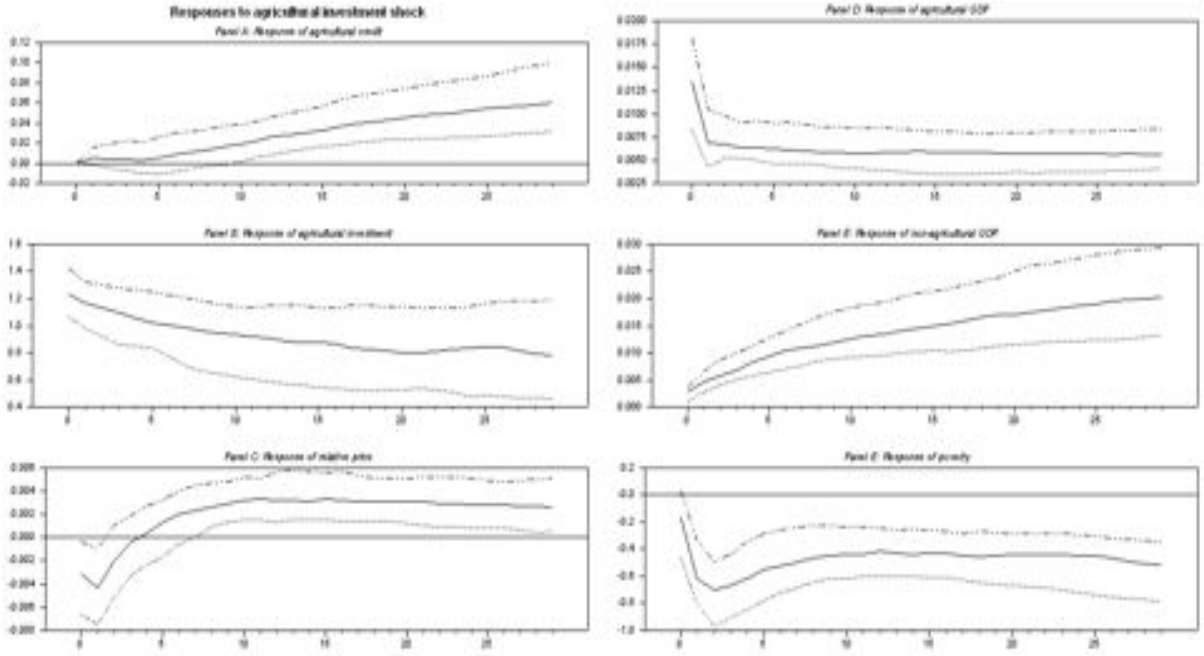


Figure 6: SVAR impulse responses to relative price shock

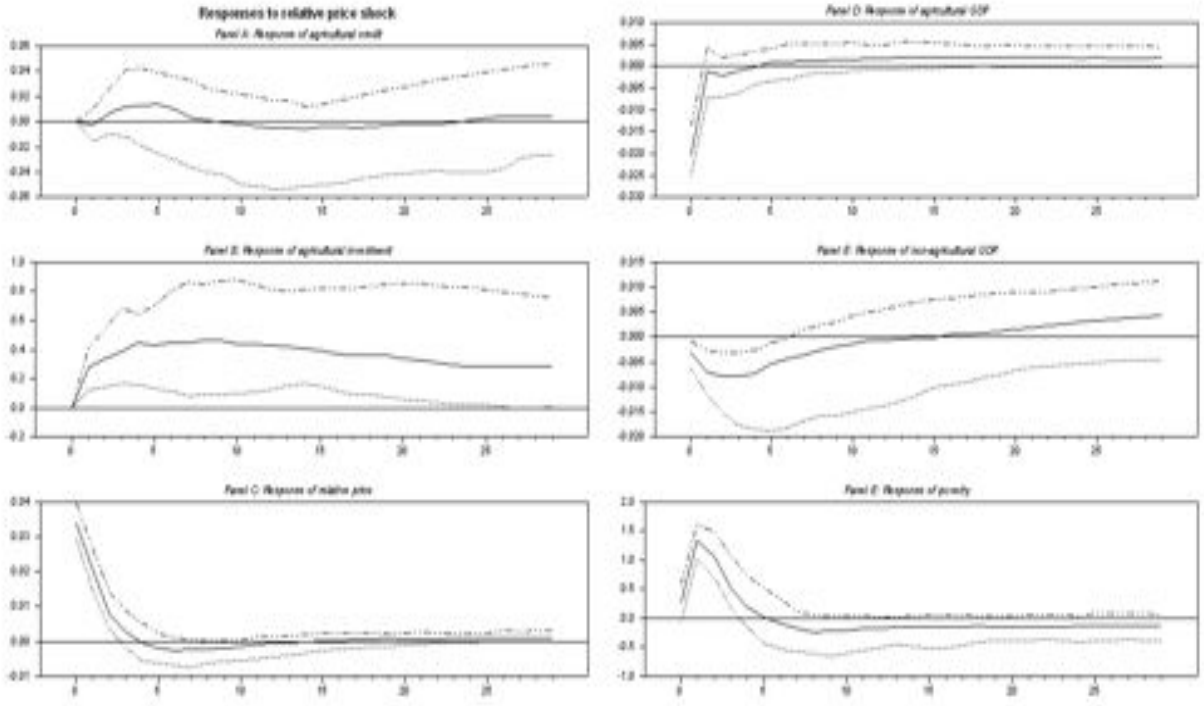


Figure 7: SVAR impulse responses to agricultural GDP shock

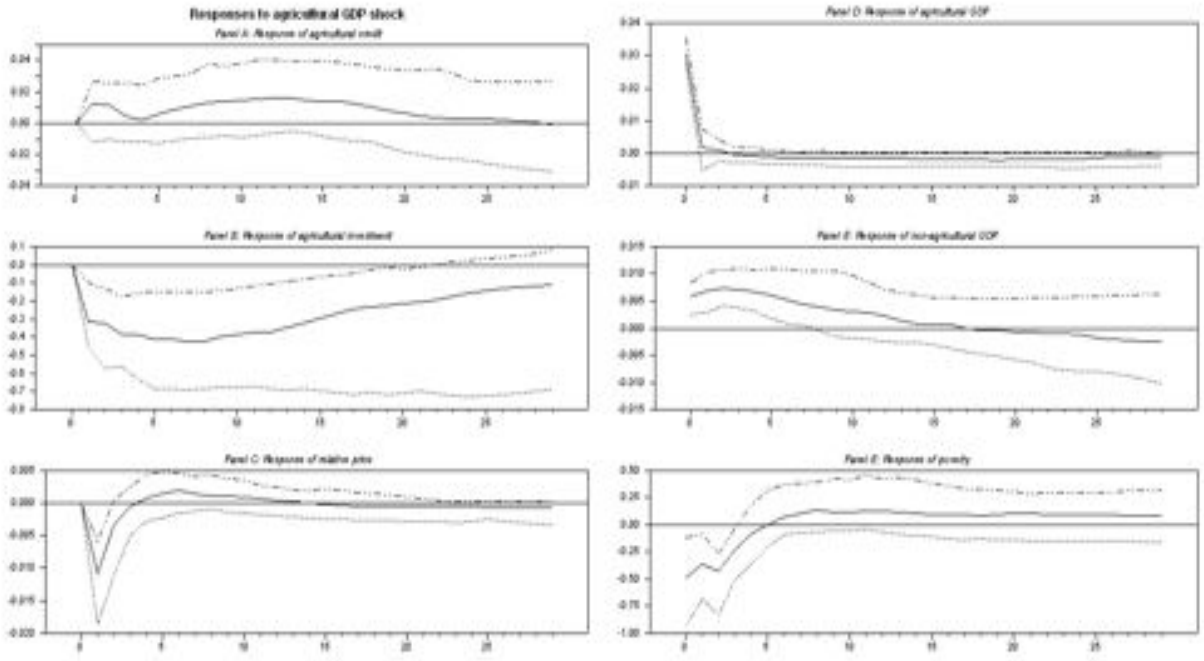


Figure 8: SVAR impulse responses to non-agricultural GDP shock

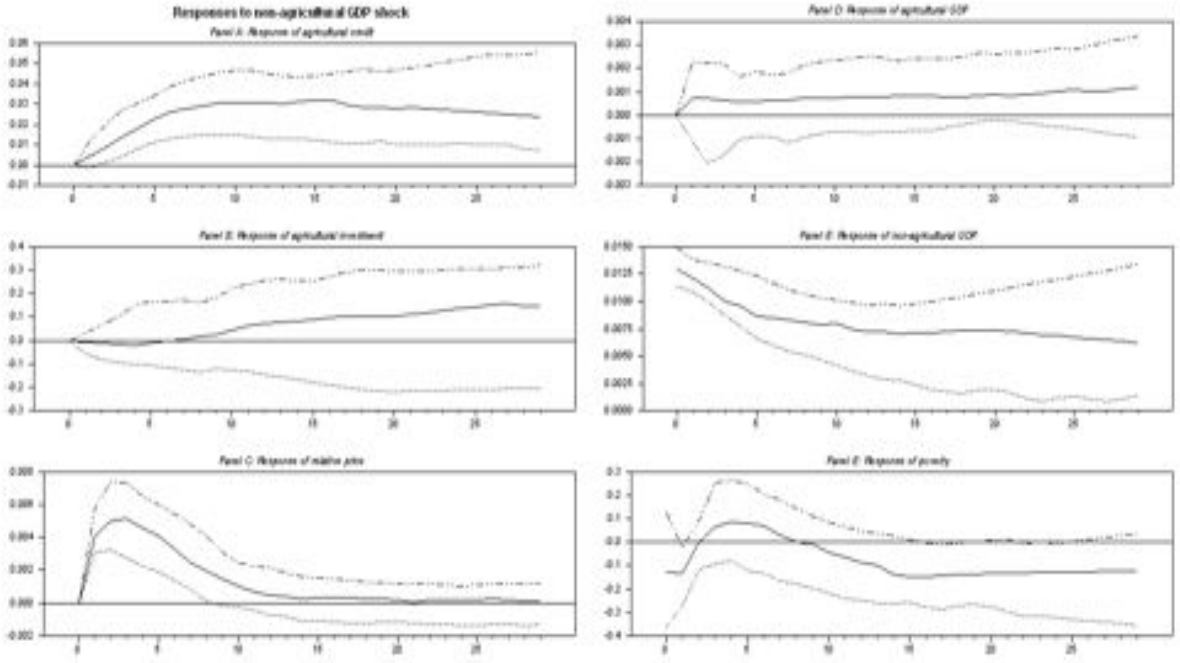


Figure 9: SVAR impulse responses to rural poverty shock

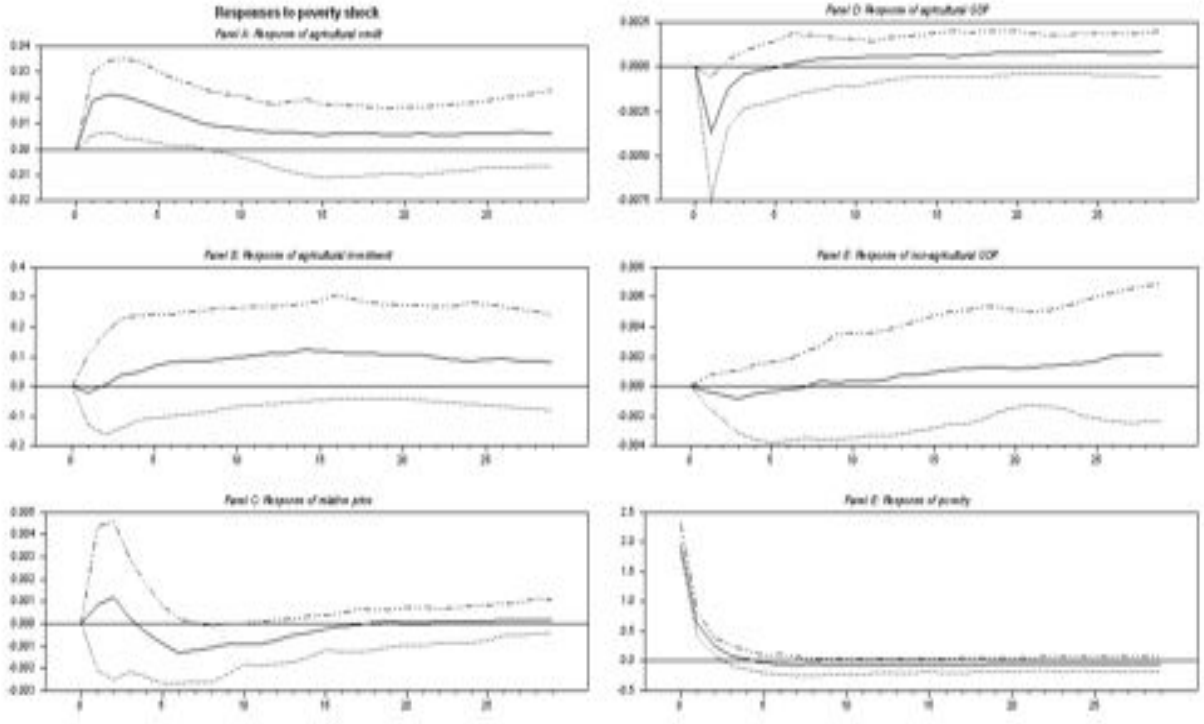
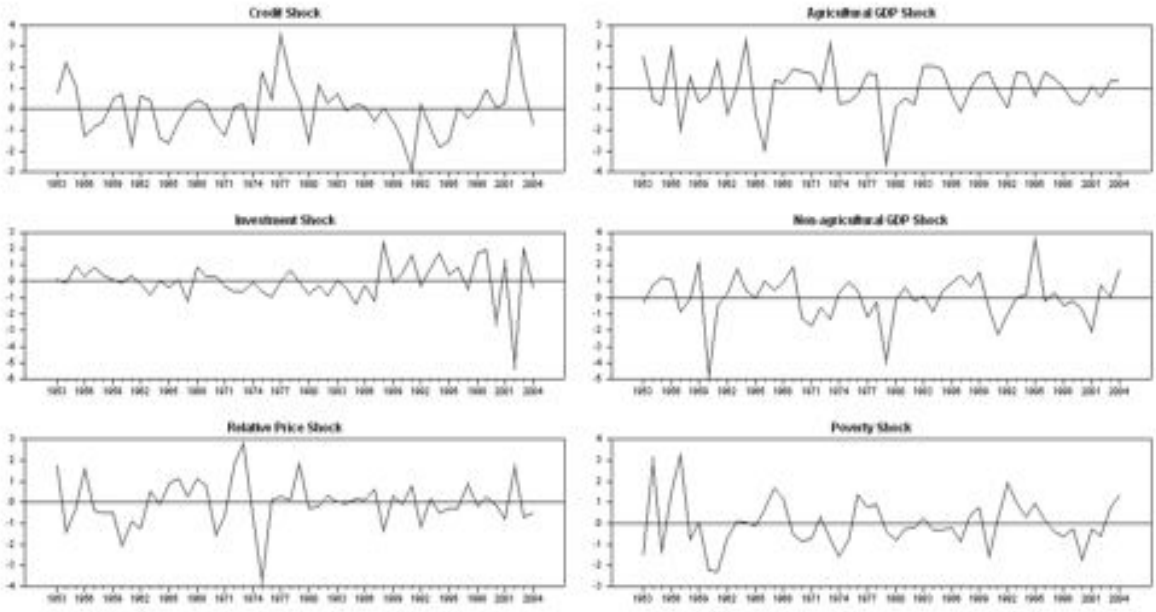
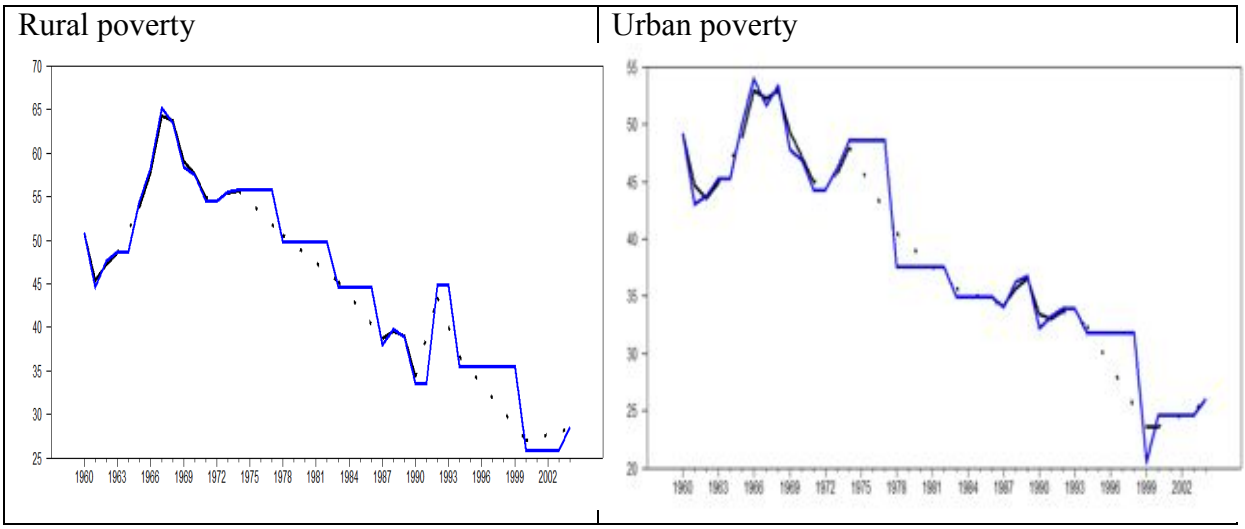


Figure 10: SVAR impulse derived structural shocks



As the agricultural per capita GDP is not significant in influencing poverty in the previous dynamic exercise, the SVAR results make it apparent that a positive shock in agricultural GDP reduces rural poverty significantly in the short run and turns insignificant after 2 years, leading relative prices to move upwards with the expenditure (or living cost) effect offsetting any income effect from the rise in prices (see Fig. 7, Panel E). The positive response of poverty to a relative price shock suggests that, even with higher relative prices of agriculture, poverty may not be reduced because many farmers may find it hard to increase output as they are not equipped to gear up production in the short-run. 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. This is in line with earlier evidence in Bell and Rich (1994) that unanticipated inflation increased rural poverty. Finally, an alternative poverty series has been constructed via exponential smoothing (see Fig. 11), as the original poverty series was based on interpolated data. Employing this alternate poverty series, the SVAR exercise was carried out again and the results however remained unchanged.

Figure 11: Generating poverty time series via exponential smoothing



Notes: The dotted line indicates actual poverty estimates; the continuous series is generated via exponential smoothing to fill up missing data points.

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 to reduce poverty. There is however evidence that the allocational channel can be less effective in increasing agricultural output, if government-owned bank lending tracks the electoral cycle (see Cole, 2009). Thus, to improve the livelihood of people engaged in low-growth sectors such as agriculture, there is either a need to modernize agriculture via higher infrastructural investment in the sector or to industrialize the rural economy to create jobs that can in turn improve the income of the poor. Agriculture and the rural non-farm sector complement each other in the process of rural development. Lanjouw and Lanjouw (2001) summarize the literature in this context, emphasizing 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 (see also Mukherjee and Zhang, 2007).

As in Demery and Addison (1987), the labour market is ultimately the key channel through which policy changes are transmitted to poverty groups. As majority of the labour force in India are 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. The different subgroups of rural people will benefit differently from government policies. First, there are people who are non-viable and unlikely to be absorbed in agriculture

even with the right policies; second, there are those who are viable and upwardly mobile but unable to face the uncertainties typical of agriculture in India—these are the farmers committing suicide and spreading panic among others in the subgroup; finally, there are affluent farmers fishing for subsidies rather than growth-oriented entrepreneurs. Policies are rarely designed to promote agricultural sustainability by tailoring them to the situation of each subgroup for growth-oriented impact. So a fuller understanding of rural poverty needs a careful look at the agrarian crisis with a focus on sustainable agriculture in terms of rural endowments and resources from a broader societal perspective.

VI. CONCLUDING REMARKS

Designing macroeconomic and financial policies for poverty reduction is indeed a challenging task. This paper has expanded the literature on poverty from a macroeconomic perspective with a sectoral composition of GDP that allows a disentanglement of the mechanisms by which agricultural and non-agricultural per capita incomes along with distributive and allocative channels can be poverty reducing. I have shown here that non-agricultural output does play an important role in reducing rural poverty, establishing a channel of internal migration along with government intervention, while rise in non-agricultural prices and rural population growth increase the level of rural poverty. A strategy of public investment in infrastructure and in human development can aid private investment and growth, along with improving access to formal credit markets in rural areas to encourage or 'crowd in' private investment, growth and poverty reduction. As evidenced here, job creation by industrial expansion is clearly the way forward along with redistributive policies to solve poverty problems.

It can be argued that income may be partially correlated with broader non-monetary measures, like HDI and human poverty index (HPI), but these indices are only available from 1990, thereby making it hard to use these broader indicators for the empirical analysis. Thus by using IMR as a non-income indicator of poverty, this paper shows that female literacy rate is a crucial determinant of improvement in health outcomes along with fiscal spending. Aside from the traditional measure of head-count poverty, there is still 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 then linked to the key macroeconomic policy variables.

In summing up, the emphasis on rural-based policies towards generating economic activity will reduce poverty more rapidly alongside the trickle-down effect via expansion of the non-agricultural sector. In this context, it is worth comparing China and India. While China has been investing heavily in 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. So the issue that raises concerns is whether there is a market (or demand) for the goods produced in the rural sector. Without access to markets, the rural economy may not be integrated into the wider economy, 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. Given the favourable effect of non-agricultural output expansion on rural poverty reduction, India could focus on a greater degree of industrial production in the rural areas to reduce poverty further, as has been the case in China in reducing its rural poverty, along with internal migration. Policy reforms, such as access to irrigation, that encourage investment in agriculture and raise incomes, will effectively expand the market for manufacturers, which in turn has the potential to reduce urban poverty as shown in the urban poverty equation. In addition, social capital formation (universal primary education and health care) can help accumulate human capital and thereby reduce poverty. As poverty is a complex multidimensional problem, it involves intertemporal issues of consumption, saving, asset allocation, wage and income policies. Different connections or channels in this context are worth exploring in future research.

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ANNEX: VARIABLES AND DATA SOURCES

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

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

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

GDP: Data on GDP at factor cost by industry of use at 1999–2000 prices are published by the Central Statistical Organisation (CSO), India, and taken from the *RBI Handbook*. Per capita real income is used to capture purchasing power at the aggregate level for India.

GIA: Gross irrigated area (expressed in terms of area in millions of hectares) is used as a proxy for irrigation for reasons discussed in Section 3. The data are compiled from patterns of land use and selected inputs for agricultural production in the *RBI database*. Deviation of actual rainfall from normal rainfall (*DRAIN*) is obtained from CMIE database related to agriculture.

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, which are taken from Table 2.3 in *Economic Survey*, 2006–07.

Poverty rate: Historical Poverty statistics until 1992 have been taken from the World Bank's India site on poverty (http://go.worldbank.org/SWGZB45DN0). Head count index (HCI) has been used as a proxy for the poverty rate, which is 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 years for which the series was interpolated are 1964, 1972, 1975–77, 1979–82, 1984–86, 1993, 1995–99 and 2001–03. The HCI data for the three quinquennial surveys since the early 1990s (1993–94, 1999–2000 and 2004–05) have been taken from the respective household surveys. Information on IMR as an alternative non-income poverty measure is available from the vital statistics collected by the Registrar General of India under the Sample Registration Scheme from 1970.

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.

Priority sector lending: Scheduled Commercial Banks credit to agriculture has been used, as loans to agriculture account for around 40% 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.

Public investment: Gross capital formation in the public sector at the new series base 1999–2000 is compiled from Table 13 in the *RBI Handbook*, 2007. As this data is for the aggregate

public sector, I used the ratio of investment in agriculture and allied activities out of the total public investment at the 1993–94 base from the CSO and then extracted the agricultural public investment at the 1999–2000 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*. We have used the ratio of public investment in agriculture to total development expenditure in order to check robustness of our results.