On Regional Inequality and Growth : Theory and Evidence from the Indian States

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Abstract

This paper examines the nature of the inequality-growth relationship among the sub-national states in India. The theoretical basis of this relationship is derived from endogenous growth within an OLG set-up, where growth of the regional economy is driven by productive public investment in the provision of health and education services financed by a linear output tax, and the optimum tax rate is determined by the median voter rule. Unlike the existing results, we obtain an ambiguous relationship between initial inequality and economic growth. State-level data for the period 1960-94 from sixteen major states in India suggest that rural inequality may influence growth of total output more than urban inequality. There is also evidence of rural-urban dichotomy.

Keywords: Endogenous growth, public investment, optimum tax rate, regional inequality, Indian states.

JEL Classification: E62, H21, H54, O53

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INTRODUCTION

Existing studies for developing countries (see, for example, Ravallion, 1995; Ravallion and Dutt, 1996) have often emphasized the need to boost economic growth in an attempt to reduce poverty. Some authors have, however, been more cautious about this policy prescription. The relationship between growth and poverty is complex and depends, to a large extent, on the relationship between growth and inequality (Datt and Ravallion, 1992). If there is a rise in inequality while the economy is growing, this may not only offset the poverty-reducing effects of growth, but may also retard subsequent growth through an increased emphasis on redistribution in favour of non-accumulable factors.

The literature on the effect of inequality on growth[1] has gained momentum since the influential work of Alesina and Rodrik (1994), Persson and Tabellini (1994) (hereafter we abbreviate these authors as AR and PT respectively). The difference between AR and PT[2] arises from the fact that AR consider infinitely lived agents, while PT consider an overlapping generations (two-period) model. However, they share the underlying logic that there is a redistributive role for the government to combat inequality within a democratic set-up. In AR, government investment in productive services financed primarily through taxation of *capital* will interact with the growth-enhancing policies. With a tax on capital, there is the well-known incentive and disincentive effects on capital income, where a 'pure' capitalist (who has no labour income) would prefer the growth-maximising tax rate. Higher inequality (defined in terms of distribution of labour endowment relative to capital in the cross-section of population) will, however, induce the median voter (who has some labour income) to prefer a tax rate that is *greater* than the growth-maximising tax rate, thus lowering growth. Similar result is obtained in PT where taxes are used only for redistribution; thus a higher rate of capital tax unambiguously depresses the incentive for private investment and growth. In other words,

[1] While in Kuznets (1955) inverted U-hypothesis growth causes higher or lower inequality depending on the level of development, the direction of this causality has been reversed in the recent endogenous growth literature.

[2] Similar work has been done by Perotti (1993) and Saint-Paul and Verdier (1992) where growth is driven by investment in education. We, however, focus on AR and PT for the obvious similarity with the problem under investigation.

initial inequality has also a role to play in this process of growth convergence. Both models analyse the effects of the political outcome[3] (by assuming a voting process on the level of the tax rate) generated by a given income distribution. This suggests that countries with greater economic inequality experience lower future economic growth. Their empirical work closely follows the Barro growth regression framework to model economic growth in terms of initial inequality among a cross-section of countries, controlling for other exogenous factors.

Suggesting that there is heterogeneity among the cross-section of countries, Partridge (1997) empirically examines the validity of the arguments put forward by AR and PT for the states *within* the US and finds that there is a *positive* relationship between initial inequality and subsequent growth. This is the only study that considers the inequality-growth relationship at a sub-national level, but for a developed country. The author hypothesizes that a number of factors (e.g., free inter-regional mobility of physical and human capital, effect of non-political considerations on income distribution and growth, characteristics specific to sample countries in AR or PT) may be responsible for this positive relationship, though he does not formally examine the validity of any.

In this respect, the present paper examine the inequality-growth relationship for a developing country like India and modifies the theoretical model developed by AR or PT to include features that resemble the sub-national Indian states. Among the innovations of the theoretical model are: a continuous time OLG model *a la* Blanchard (1985) involving a non-zero probability of death (p) of agents, and more importantly, an output tax (instead of a capital tax as in AR or PT). In the context of a less developed country, the rate at which the population decreases (which is also p) could be significant: hence its inclusion. Secondly, output taxes closely resemble the taxes on sales and purchases which are the primary source of *state* revenues in India. We also consider the provision of public services in health and education at the state-level which is entirely under the jurisdiction of the Indian states, as enumerated in the 'state list' of the Indian constitution. In section 2, we consider an endogenous growth model where growth is driven by productive investment in the provision of such public services financed by an output tax, and the optimum tax rate is determined by the political process (median voter rule) as in a democratic set-up like India. As the tax is on output, it affects both labour and capital income. Since the median voter has both kinds of

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[3] There have also been studies that focus on growth with non-political considerations of redistribution. For example, Galor and Zeira (1993) assume that there are both credit market imperfections and indivisibilities in human capital investments. Parental wealth determines whether an individual is able to invest in education which in turn determines the bequest to the next generation and hence their investment opportunities as well as earnings abilities.

income, the effect of an output tax on the median individual's utility is ambiguous. Consequently, the median voter will choose an optimum tax that may be higher or lower than the growth-maximising tax rate depending on whether the redistribution raises or lowers his/her net labour income.

Using the state-level data for the period 1960-1994 compiled by the World Bank (see Ozler, Datt and Ravallion, 1996), the second part of the paper empirically examines the nature of the inequality-growth relationship for the Indian states: section 3 describes the data while section 4 reports the econometric analyses. We perceive that there is some value-added in our empirical exercise: first, most existing empirical studies for developing countries examine the effect of growth on ensuing inequality (e.g., Ravallion, 1995; Ravallion and Dutt, 1996). The only study that considers the two-way relationship between growth and inequality is that by Deininger and Squire (1998). Using data from a cross-section of countries, they find little support for the Kuznets hypothesis while there is a strong negative relationship between growth and inequality. There are obvious problems with the cross-country comparisons because of heterogeneity among national economies. The problem is minimised if one considers the sub-national states instead.

India is an interesting case in point, as the importance of economic growth has long been emphasized to fight poverty. Within the federal set-up, Indian states are also sufficiently diverse in terms of geographic, demographic and economic characteristics. Existing empirical studies consider inter-country comparisons (see AR, PT, Deininger and Squire) or inter-regional comparison for a developed country (Partridge), while we focus on the inter-state comparison for a developing country India. Also given the pronounced dichotomy between rural and urban areas within an Indian state, it is interesting to examine if the nature of this relationship differs between rural and urban sectors, something that has not been explored before. The paper concludes with a brief summary of our findings.

2. THEORETICAL FRAMEWORK

In this section we consider a theoretical model of growth with redistribution at a regional level. Key features of our model are as follows. We consider (a) a representative sub-national region of a national economy (unlike the national economy as modelled by AR and PT among others), (b) public investment in health and educational services which has positive externality effects on the individual producer, which (c) is financed through an output tax, and (d) a Blanchard (1985) type perpetual youth model where agents have a constant probability of death that is independent of age. (e) The equilibrium is characterized not only by economic considerations, but also by the political process of majority voting which determines the optimal rate of taxation for financing such public investment.

Suppose the national economy consists of n similar sub-national regions (or 'states' within a country). A single representative region is denoted by 'a'. For each region, we characterize the behaviour of the producers, consumers and the government.

Producers in region a comprise of a large number of individuals. The output of individual i in region a is:

$$y^i_a = A_1(k^i_a)^{g_1}(l^i_a.G_a)^{g_2}(l^i_a.K_a)^{1-g_1-g_2},\quad A_1 > 0\ ,\ 0 < g_1 + g_2 < 1 \qquad \textbf{(1)}$$

where k^i_a is his capital stock endowment and l^i_a is the number of units of labour supplied. G_a is the region-wide public investment in health and educational services and K_a is the capital stock of the regional economy. The inclusion of G_a and K_a in the production function which exhibits constant returns to scale (CRS) to a broad concept of capital, represents externality effects arising out of public investment in the region *à la* Barro (1990) and 'knowledge' effects from the capital stock of all firms in the regional economy *à la* Romer (1986), respectively. G_a enhances the skill of each labourer, and being complementary to private capital, raises its marginal productivity.

Aggregating over all individuals in region a, given CRS, and noting that all individuals face the same input prices which are determined competitively, we have:

$$Y_a = A_1 K_a^{1-g_2} G_a^{g_2} \qquad (2)$$

In deriving (2), the aggregate labour endowment L_a is normalised to unity.

The government budget constraint in region a is:

$$G_a = T_a = \tau_a Y_a \qquad (3)$$

As in Barro (1990) and Alesina and Rodrik (1994), the government balances its budget in every period. However, unlike Alesina and Rodrik, we consider output taxes (rather than capital taxation).

The objective of the individual in region a is to maximize profits. With a tax per unit of output, after-tax profits are given by the expression within square brackets given below.

$$[\ (1-t_a)y^i_a - w_a l^i_a - r_a k^i_a\ ] \qquad (4)$$

w_a and r_a are returns to labour and capital respectively. The individual who has both labour and capital endowments chooses l^i_a and k^i_a to maximise (4). The first order condition for a maximum yields:

$$w_a = (1-\tau_a)(1-\gamma_1)\, A_1\left(\frac{l^i_a}{k^i_a}\right)^{-\gamma_1} \tau_a^{\gamma_2} Y_a^{\gamma_2} K_a^{1-\gamma_1-\gamma_2} \tag{5}$$

$$r_a = (1-\tau_a)\gamma_1 A_1\left(\frac{k^i_a}{l^i_a}\right)^{\gamma_1 -1} \tau_a^{\gamma_2} Y_a^{\gamma_2} K_a^{1-\gamma_1-\gamma_2} \tag{6}$$

On the consumption side, we consider the perpetual youth model of Blanchard (1985) as the building block of our analysis, as this enables us to aggregate over individual agents of different ages and different levels of wealth, but with a common life expectancy. The economy in region *a* consists of a large number of identical households born at different points in (continuous) time, each with a constant probability of death, p (p > 0). At any instant s, a large cohort (i.e. generation) whose size is normalised to p is born: this is also the rate at which the cohort decreases.[4] A household born at time zero is alive at t with probability e^{-pt}.

The possibility of leaving unanticipated bequests (given uncertainty[5] about death) is eliminated by assuming that there are competitive insurance companies which offer contracts to agents, whereby agents receive a premium p times their wealth in each period that they are alive, and all their lifetime wealth is returned to the insurance company when they die.

The utility function that individual *i* in region *a* born at instant *s* as of time *t* (= 0) seeks to maximize is logarithmic, and is given by:

$$u_a^{\,i}(c_a^{\,i}(s,0)) = \int_0^\infty \ln\left(c_a^{\,i}\right) e^{-(\theta+p)t}\, dt \tag{7}$$

The above utility function is maximised subject to a dynamic budget constraint—which is expressed in terms of the only good—as:

$$\dot{k}_a^{\,i} = (r_a + p)\, k^i_a + \omega^i_a - c^i_a, \tag{8}$$

In the budget constraint, k^i_a denotes private asset wealth which includes the private capital stock. ω^i_a is labour income and r_a is the real interest rate.

The optimisation for the representative individual in region *a* then gives:

[4] The assumption of a constant population is also present in Persson and Tabellini (1994). But unlike us, they consider a two-period overlapping generations model.

[5] Although there is *individual* uncertainty about the timing of death, there is no *aggregate* uncertainty as regards the population size at any particular instant, because the size of a cohort decreases through time at the deterministic rate p.

$$\frac{d}{dt} c_a^i = (r_a - \theta)\, c_a^i$$

i.e., $c^i{}_a(s,t) = c^i{}_a(s,s).e^{(r_a-\theta)(t-s)}$ (9)

for an individual i born at time s as of time t.

Integrating (8) and (9) and appropriately combining them yields:

$$c_a^i = (p+\theta)(k_a^i + h_a^i) \quad (10)$$

where h_a^i is human wealth, i.e. the present discounted value of future labour income accruing to those currently alive, i.e. $h_a(s,0) \;=\; \int_0^{\infty} \omega_a(s,t) e^{-\int_0^t [r_a(\mu)+p]d\mu} dt = \dfrac{\omega_a^i}{r_a + p}$. (11)

We now consider the political process of majority voting through which preferences of the median voter as regards the optimum (i.e. utility-maximising) tax rate are determined. According to this mechanism, the government chooses that tax rate which maximises the well-being of the median voter.

Substituting (9) and (10) into the utility function (7), and then integrating by parts, we have an expression for the indirect utility function[6] for the i-th individual (u^i_a) which can be written as follows:

$$u_a^i = \left(\frac{1}{p+\theta}\right)[\ln\ (p+\theta) + \ln\ \ \omega_a^i - \ln\ \ (r_a + p)] + \frac{r_a - \theta}{(p+\theta)^2} \qquad (12)$$

In order to find the optimal tax policy, i.e. individual i's most preferred tax rate $\tau_a = \tau_a{}^{i*}$, we differentiate u^i_a with respect to the policy variable τ_a and set this equal to 0 (and check that the second order condition holds).

$$\frac{\partial u^i{}_a}{\partial \tau_a} = \frac{1}{w_a}.\frac{\partial w_a}{\partial \tau_a} + \frac{r_a - \theta}{(p+\theta)(r_a + p)}.\frac{\partial r_a}{\partial \tau_a} = 0 \qquad (13)$$

The expressions for $\partial w_a/\partial \tau_a$ and $\partial r_a/\partial \tau_a$ are obtainable from equations (5) and (6).

This enables us to obtain the optimal tax rate $\tau_a{}^{i*}$ which will depend on σ^i, where σ^i is defined as $\sigma^i = \dfrac{y_a^{Li} / Y^L{}_a}{y_a^{Ki} / Y^K{}_a} = \dfrac{y_a^{Li} / y_a^{Ki}}{Y_a^L / Y_a^K}$, where y_a^{Li}, y_a^{Ki} are the individual i's income from labour and capital respectively; Y_a^L , Y_a^K are respectively aggregate incomes of region *a* from labour

[6] This derivation is available upon request.

and capital. Thus the choice of $\tau_a^{i}*$ will depend on the value of σ^i.[7] Given an initial distribution of labour and capital income (corresponding to a certain value of τ_a), a higher τ_a ought to change the individual's labour-capital income ratio and also that of the region (i.e., both the numerator and the denominator of the above expression will change). It is therefore not clear how σ^i will change with respect to τ_a, and consequently the median voter's optimum tax rate $\tau_a^{i}*$ will be ambiguously related to σ^i .

The intuition for this comes from the fact that here the tax is on *output*, so there are incentive as well as disincentive effect on *both* labour and capital income. This is in contrast to AR where labour income responds positively to a higher tax rate (which is on capital). Consequently, in our case, the median voter – who has both labour and capital income – responds ambiguously to higher τ_a. The 'pure' capitalist (as in AR) prefers the growth maximising tax rate ($\tau\hat{}_a$),[8] but here the median voter's ideal τ_a ($\tau^{i*}{}_a$) could be greater or less than $\tau\hat{}_a$. Therefore, the effect of initial inequality on growth could be negative or positive.

In order to derive the growth-maximising tax rate, we use the goods market equilibrium condition for region *a* in per-output (Y_a) terms:

$$\dot{k}_a + k_a\varepsilon_a = 1 - g_a - c_a, \quad \text{where} \quad \dot{k}_a = \frac{d}{dt}\left(\frac{K_a}{Y_a}\right), \ \varepsilon_a = \frac{\dot{Y}_a}{Y_a}, \ g_a = \frac{G_a}{Y_a} = \tau_a, \ c_a = \frac{C_a}{Y_a}. \tag{14}$$

ε_a is the (endogenous) growth rate for the region. Y_a and G_a are given by (2) and (3) respectively. dc_a/dt is given by

$$\dot{c}_a = (r_a - \theta - \varepsilon_a)c_a - p(p+\theta)k_a \tag{15}$$

which follows from the Blanchard aggregation (across generations) mechanism.[9]

In the steady state, $dk_a/dt = 0$, and also $dc_a/dt = 0$ by definition.

Combining equations (14) and (15) by eliminating c_a, and then using the balanced budget constraint (3) in per output terms gives us:

$$[1 - \tau_a - \varepsilon_a k_a](r_a - \theta - \varepsilon_a) = p(p+\theta)k_a \tag{16}$$

from which the Barro (1990)-type hump-shaped relation[10] between ε_a and τ_a emerges – here with finite horizons. The growth-maximising tax rate ($\tau\hat{}_a$) is the one that satisfies $d\varepsilon_a / d\tau_a = 0$.

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[7] The government's optimal policy is to choose the optimal tax rate of the i-th individual, which is constant over time.

[8] This is discussed in detail in the next paragraph.

[9] This derivation is available upon request.

[10] This is clear from simulations with different values of τ_a, and using parameter values consistent with the Indian case. These simulations are available upon request.

We next consider the case where a portion (λ) of the total tax revenues T_a is used by the government as redistributive transfers to the labour component of individual income. This means that the proceeds of the tax revenue augment an individual's *labour* income by the amount $\lambda\tau_a y^i_a$. Labour income after the transfer is therefore $(1-\tau_a)w_a l^i_a + \lambda\tau_a y^i_a$, and capital income is $(1-\tau_a)r_a k^i_a$. Also, the government spends $(1-\lambda)\tau_a y^i_a$ on health and education schemes, which means that we now have the government budget constraint as $G_a = (1-\lambda)\tau_a Y_a$.

By retracing the steps as before, we can find the tax rate that maximises the utility of the median individual. Once again, it is unclear whether the median voter prefers a tax rate (τ_a^*) higher than the growth-maximising tax rate ($\hat{\tau}_a$).

What we can say, however, is that with redistributive transfers from the output tax revenue, the median voter's utility-maximising tax rate ought to be *higher* than without the redistribution scheme. In this sense the possibility of initial inequality having a negative impact on growth (as in AR) is increased, but it is still not certain that this would be the case.

3. A CASE STUDY OF INDIAN STATES

The final part of the paper will now examine the nature of the relationship between inequality and growth, using state-level data from India over 1960-94.

The Indian constitution of 1950 identifies India as a federal sovereign democratic republic with a strong unitary bias. The constitution gave strong economic/financial powers to the national government (centre) as regards industry, defence, railways, post and telegraph, atomic energy, arms and ammunition etc., while states have primary control in health and education. The relative financial strength of the centre is reflected in a number of facts: most elastic sources of tax revenue, namely income, excise and customs taxes are levied by and accrue to the centre, while primarily taxes on properties, purchases and sales (most important source of state tax revenue) are levied by the states. The centre can borrow from domestic and international sources while states need permission from the centre to borrow from abroad. However, most expenditures are incurred at the state-level. Given this imbalance in the economic and financial powers between the centre and the states in India, the constitution also provides different mechanisms (e.g., through Finance Commision, Planning Commission etc.) of transfer of resources from the centre to the states. Table 1 shows the revenues of states from state and central taxes. While these shares vary across the states generally it suggests the importance of state taxes in state revenue. Proportion of state expenditure on different developmental items (e.g., health, education, community services) is significant in state budget; again an inter-state variation in noteworthy.

The theoretical model makes an attempt to capture the important characteristics of the the Indian federal states within an optimising endogenous growth framework. For example, a proportional output tax closely resembles taxes on sales and purchases which is the main source of state taxes in India. Also, public expenditure in the provision of social and economic services features prominently in most less developed countries and India is no exception; inclusion of public expenditure in the provision of health and education services in the production function thus captures an important characteristic of the Indian sub-national economy where states have absolute jurisdiction. Finally, we consider the political process of majority voting to determine the optimum tax rate, which reflects the democratic nature of the process in line with the Indian practice.

3.1.Testable Hypotheses

We now analyse the nature of the inequality-growth relationship among the Indian states. For given values of the probability of death (p), rate of time preference (θ) (which are taken to be identical for all regions under consideration), growth of output in any state a, a = 1,2,..,n is given by:

$$\varepsilon_a = g(Y_a, K_a, \lambda_a) \qquad (17)$$

In view of our analysis of the determination of the optimal tax rate, it can be argued that the tax rate (that finances public spending on health and education) depends on the initial distribution of labour and capital income, and is captured by some inequality index, say, λ_a.

The primary hypothesis of our concern is that other things remaining unchanged, economic growth ε_a in any state *a* depends on initial inequality λ_a in the state: initial inequality may have a negative or positive effect on growth, depending on whether the median voter desires a tax rate that is higher or lower than the growth-maximising tax rate.

The dichotomy between rural and urban areas within a state may also be of some significance in the Indian context. There has been a long tradition to rationalise the rural-urban dichotomy often observed in many less developed countries in terms of technological differences in production in the two sectors (e.g., see Lewis, 1954, Banerjee and Newman, 1998). In these models, the rural sector is characterized by traditional subsistence production with lower productivity and, therefore, lower wage than the more modern technology prevailing in the urban sector, thus giving rise to higher productivity and higher wages in that sector. Given the technological difference, e.g., in terms of the technological parameter A_1 or

γ_2 in the production function specification, growth effects of public investment (financed by the same type of taxes) and, therefore, the nature of inequality-growth relationship may differ between rural and urban areas. This hypothesis will be empirically examined in section 4.

Inclusion of Y_a as the level of output or income in the initial period allows us to test the validity of the hypothesis of growth convergence as advocated by Barro (1991)[11] : for a given level of initial capital, Y_a is expected to have a negative influence on growth in the cross-section analysis (see further discussion in section 4). So far as capital K_a is concerned, one can consider indices of both physical and human capital (also see discussion in section 4), both of which are expected to exert a positive impact on growth.

3.2. Description of Data

The data used for our purpose are obtained primarily from various government sources like the National Sample Survey, Government Accounts, and compiled by the World Bank (Ozler, Datt and Ravallion, 1996). This is a unique data-set comprising of information on net sown area (for all crops), net state domestic product (sdp) including sectoral sdp for agriculture, manufacturing etc., population, rural and urban Gini coefficients in the distribution of consumer expenditure[12], various measures of poverty (e.g., head count ratio, PG, SPG etc.), state-level expenditure on the public provision of social and economic services including health, and education for sixteen major states in India over the period 1960-1994. This basic data-set has been supplemented by the information on literacy (source: Reports of the Census and the Education Department, Government of India, various issues) for these states over this study period.

Given the nature of the data at our disposal we need to make some adjustments to the growth equation (17). First, most relevant variables are taken in per capita terms and not in per output terms as in the theoretical model; for example, without much loss of generality, we define state domestic product, its growth and also capital as proportion of total population to express these magnitudes in per capita terms. Secondly, the theoretical model considers the distribution of income while for the Indian economy the size distribution of income is not readily available. What we observe is the inequality in the distribution of per capita monthly consumer expenditure, available from the National Sample Survey (NSS) reports. Accordingly, we use Gini coefficients in the distribution of per capita monthly consumer expenditure for

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[11] In neo-classical growth models, if countries are similar with respect to structural parameters for preferences and technology, poorer countries tend to grow faster than the richer ones. Given diminishing returns to reproducible capital, there is thus a force that promotes convergence in levels of per capita income across countries. If, however, one considers endogenous growth models with externalities, this convergence holds only if measures of initial human capital are held constant : a poor country tends to grow faster than a rich country, but only for a given quantity of human capital (Barro, 1991).

[12] These Gini coefficients are estimated using parameterized Lorenz curves; see Datt and Ravallion (1992) for details on methodology.

rural and urban areas[13]. In fact, the distribution of income and consumption per capita is quite highly correlated – it is 0.31 for the rural sector and 0.35 for the urban sector in our sample where both coefficients are significant at 1% level.

3.3. Inter-regional Profiles

India is a country of striking diversity. Even broad comparisons among its states suggest spectacular variations in socio-economic indicators. At the one end, there are states like Punjab and Haryana with very high rates of growth while at the other end states like Bihar, Uttar Pradesh (UP), Madhya Pradesh (MP) and Rajasthan have rather low growth, low literacy and high birth rates. Although growth rate in Kerala is rather modest, it is the state with the highest literacy, and lowest infant mortality rates.

Table 2 summarises the disparity in terms of annual growth rate of per capita output, rural and urban inequality in terms of Gini coefficients (RGINI, UGINI) and poverty Head Count ratios (RHCR, UHCR) among sixteen major Indian states over 35 years of sample periods (1960-94). Among the six *most initially unequal* rural regions (Rajasthan, MP, Karnataka, Kerala, AP and Gujarat), annual rate of growth has been low (less than 1%) in five (exception being AP). Among the states with high urban inequality in 1960, Karnataka, MP, UP and West Bengal have low growth (less than 1%) while Maharashtra and Orissa have high growth (around 4% per annum). Among the states with *low* rural inequality in 1960, Bihar, Jammu and Kashmir (J&K), West Bengal have low growth below 1% while Maharashtra, Orissa and Tamilnadu have high annual growth rates around 4%. On the other hand, considering the states with low urban inequality in 1960, three out of four, namely, Rajasthan, J&K and Gujarat have low growth rates. Punjab has witnessed one of the highest rates of growth among the Indian states and levels of initial rural and urban inequality have been seventh largest among the Indian states. Thus these preliminary observations cannot suggest any specific pattern (positive or negative) in the relationship between initial inequality and growth per capita in the subsequent period among the sample Indian states.

Next we calculate the bivariate correlation coefficients between growth of output per capita and rural and urban Gini indices (Table 3). Annual growth rate per capita output is negatively and (statistically) significantly related to both rural and urban inequality Gini indices. We also calculate the bivariate correlation coefficients between rural/urban Gini indices, per capita state development expenditure and state-level tax rates (defined as state-level tax revenue as a proportion of state domestic product). There is a significant and positive

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[13] The importance of distinguishing long-run income inequality from inequality associated with transitory components of income has been emphasized in studies of inequality. It has been suggested that consumption can help in this respect since it is well insulated from transitory movements (see, e.g., Blundell and Preston, 1998).

correlation not only between per capita development expenditure and inequality Gini indices for both rural and urban areas, but also between per capita development expenditure and state-level tax rates. In other words, one can argue that inequality indices, tax rate and public development expenditure are significantly correlated in our sample as assumed in our theoretical model.

The bivariate correlation analysis, however, assumes that the states under consideration are identical in all respects other than growth and inequality. Hence, we next compare these states in terms of other available characteristics like state domestic product, net sown area (measured in hectares for all crops taken together), state expenditure (measured in Indian Rupees) in the provision of social and economic services per capita and also total literacy rates in the initial year 1960. Figures for income and expenditure have been adjusted in terms of 1960-61 prices. Table 4 is suggestive of significant inter-state variation in these characteristics in terms of initial income per capita, literacy rates and net sown area. Thus an assessment of the inequality-growth relationship needs to be performed in a multiple regression framework, after controlling for all possible factors affecting the relationship.

4. ECONOMETRIC ANALYSIS

This section uses a multivariate regression framework to determine growth of state domestic product per capita over 1960-94 in terms of values of the explanatory variables including output, inequality Gini indices, and some measures of physical and human capital prevailing in the initial year 1960, within a single cross section framework. Given pronounced rural-urban dichotomy, we shall also examine if there is a significant rural-urban differences in the nature of inequality-growth relationship between these two sectors. It is assumed here that the rate of growth of rural and urban output can be instrumented respectively by the rates of growth of state agricultural and manufacturing output per capita over the period 1960-88[14].

4.1. Determinants of growth of total output per capita

It takes a considerable amount of time for initial inequality to have any impact on growth through the political process as laid down in the theoretical model. Accordingly, following the growth equation (17), we consider the rate of growth of per capita state domestic output

[14] The period has been decided by the availability of data on agricultural and manufacturing output in the World Bank data-set.

GRPCINC over the 35-year period 1960-94 as our dependent variable. All the explanatory variables refer to the initial year of observation, 1960. Choice of the explanatory variables is guided by the theoretical model as summarised by equation 17 (section 3.1). In particular, the set of explanatory variables includes per capita state domestic product (PCSDP60), Gini coefficients for the rural (RGINI60) and urban (UGINI60) areas in the initial period, 1960. In view of the difficulty to obtain an overall index of aggregate capital at the Indian state-level (see Loh, 1995), we consider three instruments to represent capital per capita: literacy rate (LITRT60) as proxy for human capital; per capita sown area (PCAREA60) and per capita state expenditure on the provision of social and economic services (PCEXP60) in the year 1960 as proxies for aggregate physical capital. We also include regional dummy variables EAST, WEST, CENTRAL and SOUTH (reference group is north and northwest) to account for regional variation. These estimates are shown in column (1) of Table 5A.

There is, however, a potential problem in this kind of analysis. If there is a systematic relationship between inequality and growth, it may give rise to the simultaneity/endogeneity problem. Accordingly, questions may arise if our estimates relating to the effect of initial inequality on growth is affected by the simultaneity bias. In case of single cross-section analysis, we, however, consider the effect of initial inequality on growth over the next thirty five years where initial inequality is considered as predetermined relative to growth. Therefore, direct reverse causation is ruled out. However, a systematic relationship between inequality and growth may generate correlation between inequality and output in the initial period which will make the residual of the regression specified above serially correlated. However, the correlation between inequality and initial output is found to be insignificant in our sample.

Table 5A shows the estimates of GRPCINC. Using White's method, these estimates are corrected for the presence of heteroscedasticity. R^2 and F statistics describe the goodness of fit of each specification. Estimates for three different specifications are shown here. Estimates shown in column (1) describes the full model[15]. However, given significant correlation between inequality indices and per capita development expenditure, we have dropped PCEXP60 from our regression in an alternative specification. These estimates are shown in column (2). Finally coefficients shown in column (3) replaces RGINI60 and UGINI60 by an overall measure of inequality index (GINI60), derived from an average of rural and urban Gini indices.

The coefficient of initial output PCSDP60 is negative and significant, implying that states with a lower level of initial output per capita in 1960 have a significantly higher growth over the period 1960-94 compared to states with a higher level of initial output. However, the rate of convergence is quite low and these estimates are comparable with those provided by

[15] We have also tested the inequality growth relationship in an alternative specification, by including the tax rate variable in specification (1) in Table 5A. We find that the tax rate is insignificant while initial rural inequality continues to have a negative impact on growth. The coefficient of urban inequality is still positive but insignificant. These estimates are available on request.

Cashin and Sahay (1996) for the period 1961-1991. Second, we consider the effects of physical and human capital (PCAREA60, PCEXP60 and LITRT) in 1960 on growth per capita over 1960-94. Coefficients of all three types of capital are positive and significant so that both physical and human capital per capita significantly enhance growth of total output per capita, thus confirming our expectation. More importantly, the coefficient of RGINI60 is negative and significant while that of UGINI60 is positive (but insignificant). Thus initial rural inequality has a negative relationship with economic growth per capita in the ensuing period: in terms of our theoretical argument a negative relationship between initial rural inequality and growth suggests that a majority of the rural population seeks a tax rate that exceeds the growth-maximising tax rate. However, initial urban inequality has a positive though insignificant impact on growth of output per capita over 1960-94 among the Indian states. We also find that higher average inequality implies lower growth of total output per capita (see estimates in cloumn (3), Table 5A)[16].

To summarise, states with lower initial rural inequality will experience higher economic growth in the subsequent period, other factors remaining unchanged. However, urban inequality does not seem to have any perceptible impact. Majority of Indians live in rural areas and Indian poverty is predominantly rural in nature. Perhaps this has induced popular governments to respond more to rural (than urban) inequality and poverty by undertaking various redistributive programmes in rural areas which lowers growth per capita through the mechanism described earlier. A comparison with existing studies suggests that our cross-section result (with respect to rural inequality) supports AR and PT (1994), but contradicts Partridge (1997).

4.2. Rural-urban Dichotomy

Secondly, given the pronounced dichotomy between rural and urban sectors of the economy, we have also examined the factors determining the rates of growth of rural and urban output per capita during 1960-88. Rural output growth is measured by the rate of growth of agricultural output per capita (GRPCAGY) while urban output growth by the rate of growth of manufacturing output per capita (GRPCMFY). GRPCAGY and GRPCMFY are determined in terms of initial rural and urban GINI indices respectively; other explanatory variables are initial agricultural output per capita (PCAGY), PCAREA and LITRT for the rural sector and initial manufacturing output per capita (PCMFY), LITRT for the urban sector. These estimates are shown in Table 5B. For each sector, there is evidence of growth convergence

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[16] We have also performed pooled regression (for three sub-periods 1960-70, 1971-80, 1981-90) to explain growth of total output per capita; however, the results are very similar to the one presented in cloumn (1) of Table 5A. We do not present these results for brevity; these will be made available on request.

and the rate of convergence is low as before. The coefficient of RGINI60 is negative and significant (see column (2)), thus suggesting higher rural inequality lowers growth of rural output per capita. However, the coefficient of UGINI60 is positive and significant in column (3) : higher rural inequality enhances growth of manufacturing output. In other words, the inequality-growth relationship differs significantly between rural and urban areas of the Indian states in our sample.

5. CONCLUDING COMMENTS

Despite the unquestionable importance of the growth-inequality relationship for poverty alleviation in India, there have been limited efforts to study the effect of initial inequality on economic growth. In terms of an endogenous growth framework this paper has examined how initial inequality affects economic growth in the ensuing period.

The theoretical model was characterized by endogenous growth within a Blanchard-type overlapping generations set-up where growth of the regional economy is driven by productive public investment, financed by linear output taxation. It is suggested that initial inequality in the distribution of income leads to the optimum rate of taxation (determined by the median voter) being different from the rate that maximises the economy's growth rate : however, the precise relationship remains ambiguous and depends on the net effect of the output tax on labour and capital income of the median voter.

Given that the key features of the theoretical model closely correspond to the Indian scenario, state-level data for the period 1960-94 from 16 major states in India were used to investigate the nature of the reverse causation, and also to analyse how our results compare with the existing studies. Empirical estimates suggest that rural inequality is more important to explain growth of total output per capita and there is an inverse relationship between the two. There is also evidence of rural-urban dichotomy: higher rural inequality lowers growth of agricultural output per capita while higher urban inequality seems to enhance economic growth of manufacturing output per capita.

APPENDIX

Definition of regression variables

PCSDP : Total output per capita in Rs. at 1960-61 prices

GRPCINC: Rate of growth of per capita total output
PCAGRIY : Total agricultural output per capita in Rs. at 1960-61 prices
GRPCAGY : Rate of growth of per capita agricultural output
PCMFGY : Total manufacturing output per capita in Rs. at 1960-61 prices
GRPCMFY: Rate of growth of per capita manufacturing output
PCAREA: net sown area for all crops taken together per capita measured in hectares
PCDEXP : state expenditure on economic and social services per capita in Rs. 1960-61 prices
RGINI : Gini coefficient for the distribution of rural per capita monthly consumer expenditure
UGINI : Gini coefficient for the distribution of urban per capita monthly consumer expenditure
LITRT : Overall literacy rate
TAXRT : State-level tax revenue as a proportion of state domestic product
EAST : 1 if the state (Assam, Bihar, Orissa, West Bengal) belongs to the eastern region
WEST : 1 if the state (Gujarat and Maharashtra) belongs to the western region
CENTRAL : 1 if the state belongs to the northern region (UP, MP and Rajasthan)
SOUTH : 1 if the state (AP, Karnataka, Kerala, Tamilnadu) belongs to the southern region.
[Reference group is north and northwest which includes Haryana, J&K, Punjab]

TABLES

Table 1. Average State-Level Revenue and Expenditure in India, 1960-94

	State-level revenue [1]		
	Share of state taxes	Share of central taxes	Share of development Expenditure in total state expenditure [2]
AP	0.4827	0.2019	0.71
Assam	0.2419	0.2311	0.6948
Bihar	0.3116	0.3751	0.5483
Gujarat	0.5496	0.1693	0.6959
Haryana	0.5201	0.1183	0.6885
Karanataka	0.4996	0.1764	0.6373
Kerala	0.4975	0.2035	0.82
MP	0.3785	0.2434	0.8739
Maharashtra	0.5709	0.1531	0.5353
Orissa	0.2519	0.2669	0.8195
Punjab	0.5949	0.1237	0.9716
Rajasthan	0.3635	0.2144	0.7915
Tamilnadu	0.5648	0.2152	0.8254
UP	0.3628	0.3094	0.6219
WB	0.5098	0.2458	0.9006

Note: Total state revenue comes from state taxes (e.g., taxes on commodities and services, taxes on property and capital taxation etc.), share in central taxes and other non-tax revenue while total state-level expenditure is divided into development expenditure (in the public provision of health, education and other social and community services) and various non-developmental expenses.

Table 2. Regional Variation in Growth, Inequality and Poverty, 1960-94

State	Annual growth	Rural Gini		Urban Gini		Rural HCR		Urban HCR	
	60-94	1960	1994	1960	1994	1960	1994	1960	1994
Andhra	0.0348	32.28	28.92	32.68	32.29	64.41	28.93	50.22	30.82
Pradesh	0.0380	30.78	17.89	22.81	28.98	43.05	48.99	18.01	9.95
Assam	0.0086	26.83	22.45	28.26	30.91	62.19	63.51	61.57	39.72
Bihar	0.0096	32.30	24.00	32.89	29.13	56.02	35.39	60.83	30.66
Gujarat	0.0697	-[1]	31.41	-[1]	28.37	-[1]	33.08	-[1]	13.98
Haryana	0.0095	27.60	27.60	28.37	28.37	37.46	37.46	35.91	35.91
J&K	0.0096	32.74	26.97	38.99	31.87	58.27	40.97	59.69	29.71
Karanataka	0.0098	33.95	30.07	30.23	34.32	71.21	31.07	53.31	23.07
Kerala	0.0099	33.33	27.96	39.12	33.00	52.24	45.36	51.27	39.83
Madya Pradesh	0.0367	29.39	30.65	39.65	35.67	67.97	47.81	46.71	36.23
Maharashtra	0.0375	27.30	24.57	39.08	30.69	62.49	40.28	64.79	40.76
Orissa	0.0511	31.37	28.14	32.44	28.08	32.79	18.32	35.51	9.63
Punjab	0.0091	37.49	26.48	23.82	29.36	40.43	47.52	46.94	29.38
Rajasthan	0.0401	29.00	31.24	32.71	34.84	70.84	36.74	48.08	31.32
Tamilnadu	0.0092	28.83	28.12	37.89	32.33	38.34	41.60	59.48	34.28
Uttar Pradesh	0.0087	27.08	25.41	33.60	33.84	50.41	27.27	26.75	22.45
West Bengal									

Note: [1] Data for Punjab and Haryana have been aggregated and have been shown against Punjab.

Table 3. Bivariate Correlation Coefficients between Growth, Tax Rate, Development Expenditure and Inequality

	RGINI	UGINI	PCDEXP	TAXRT	GRPC6094	GRAG6088	GRMF6088
RGINI60	1.00	0.741**	0.638**	0.247*	-0.654**	-0.475	-0.694**
UGINI60	0.741**	1.00	0.391*	0.304*	-0.501*	-0.298	-0.506**
PCDEXP60	0.638**	0.391	1.00	0.490*	-0.248	-0.231	-0.348
TAXRT60	0.247*	0.304*	0.490*	1.00	-	-0.286	-0.265
GRPC6094	-0.654**	-0.501*	-0.248	-	1.00	0.574*	0.641**
GRAG6088	-0.475	-0.298	-0.231	-0.286	0.574*	1.00	0.673**
GRMF6088	-0.694**	-0.506*	-0.348	-0.265	0.641*	0.673**	1.00

Note: RGINI, UGINI: Rural and urban Gini indices; PCDEXP: per capita development expenditure; GRPC6094: Annual rate of growth per capita SDP during 60-94; GRAG6088, GRMF6088: Annual rate of growth per capita SDP in agriculture and manufacturing during 60-88. * and ** denote the level of significance at 10% and 1% respectively.

Table 4. Regional Disparity Among Indian States in 1960

State	Real income per capita[2]	Net Sown Area Per capita	Per capita State expenditure in Rs. [2]	Literacy rate
AP	275	0.30	0.16	0.2080
Assam	315	-	-	0.2580
Bihar	215	0.17	0.09	0.1820
Gujarat	362	0.46	0.14	0.3030
Haryana[1]	237	-	-	-
J&K	269	0.19	0.21	0.1070
Karanataka	296	0.44	0.16	0.2530
Kerala	259	0.12	0.19	0.4620
MP	252	0.50	0.12	0.1690
Maharashtra	409	0.46	0.16	0.2970
Orissa	217	0.33	0.12	0.2150
Punjab	366	0.67	0.26	0.2370
Rajasthan	284	0.67	0.13	0.1470
Tamilnadu	334	0.18	0.17	0.3020
UP	252	0.23	0.08	0.1750
WB	390	0.16	0.13	0.2910

Note: [1] Data for Punjab and Haryana have been aggregated and have been shown against Punjab. [2] Unit of measurement is Rupees. These figures have been expressed in 1960-61 prices using the appropriate state-level consumer price indices.

Table 5A. Estimates of Growth of Total output per capita

		Coefficients (T-ratio)[1]		
Explanatory variables	Mean (standard deviation)	(1) Rate of growth of total output per capita GRPCINC	(2) Rate of growth of total output per capita GRPCINC	(3) Rate of growth of total output per capita GRPCINC
Intercept	-	4.30 (77.988)	4.17 (58.512)**	4.23 (25.558)**
PCSDP60	308.1983(82.22	-0.002 (6.950)**	-0.001 (3.460)**	-0.002 (2.927)**
RGINI60	)	-0.05 (7.178)**	-0.05 (8.392)**	-
UGINI60	28.77 (8.22)	0.01 (0.467)	0.01 (0.329)	-
GINI60	30.78 (9.76)	-	-	-0.02 (2.813)**
LITRT60		1.8 (4.452)**	1.61 (5.223)**	0.51 (1.970)*
PCAREA60	0.23 (0.10)	1.3 (9.425)**	1.23 (10.085)**	0.73 (2.184)*
PCDEXP60	0.32 (0.19)	89.52 (1.871)*	-	-
EAST	0.1589 (0.09)	-0.28 (3.524)**	-0.34 (4.650)**	-0.40 (3.438)**
WEST	0.2500 (0.44)	-0.01 (0.180)	-0.11 (1.520)	0.05 (0.283)
CENTRAL	0.1250 (0.33)	-0.14 (1.374)	-0.24 (3.485)**	-0.40 (2.698)*
SOUTH	0.1875 (0.39)	0.05 (0.150)	0.01 (0.281)	-0.02 (0.192)
	0.3125 (0.47)			
R^2	-	0.9596	0.9519	0.8017
F-statistic	-	22.0771**	13.20**	14.54**
Observations	16	16	16	16

Note. PCSDP60 : Total output per capita in Rs. at 1960-61 prices; PCAREA60: net sown area for all crops taken together per capita measured in hectares; PCEXP60 : state expenditure on economic and social services per capita in Rs. 1960-61 prices; RGINI60, UGINI60 : Gini coefficient for the distribution of rural and urban per capita monthly consumer expenditure; LITRT60 : Overall literacy rate; EAST : 1 if the state (Assam, Bihar, Orissa, West Bengal) belongs to the eastern region; WEST : 1 if the state (Gujarat and Maharashtra) belongs to the western region; CENTRAL : 1 if the state belongs to the northern region (UP, MP and Rajasthan); SOUTH : 1 if the state (AP, Karnataka, Kerala, Tamilnadu) belongs to the southern region. [Reference group is north and northwest which includes Punjab, Haryana and J&K]. '*' denotes that the variable is significant at 5% level while '**' refers to that at 1% level. All estimates use White's correction for heteroscedasticity.

Table 5B. Estimates of Growth of Agricultural and Manufacturing Output Per Capita

		Coefficient (T-ratio)	
Explanatory variables	Mean (standard deviation)	(2) Rate of growth of agricultural output per capita GRPCAGY	(3) Rate of growth of manufacturing output per capita GRPCMFY
Intercept	-	3.87 (4.463)**	2.9 (6.313)**
PCAGY60	153.4792(19.49	-0.009 (1.866)*	-
PCMFGY60	)	-	-0.001 (1.560)
RGINI60	38.1237	-0.12 (2.211)*	-
UGINI60	(24.15)	-	0.008 (1.863)*
LITRT60	28.77 (8.22)	6.71 (1.655)*	1.07 (0.707)
PCAREA60	30.78 (9.76)	3.39 (1.926)*	-
PCDEXP60	0.23 (0.10)	-	-
EAST	0.32 (0.19)	-0.002 (0.007)	-1.27 (2.342)*
WEST	0.1589 (0.09)	-0.93 (2.228)*	-0.39 (0.653)
CENTRAL	0.2500 (0.44)	0.75 (1.325)	-0.54 (1.496)
SOUTH	0.1250 (0.33)	-0.18 (0.465)	-1.5 (3.837)**
	0.1875 (0.39)		
	0.3125 (0.47)		

R^2	-	0.4511	0.49623
F-statistic	-	5.72*	3.12
Observations	16	16	16

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