Urbanisation, inequality and economic growth: Evidence from Indian states and towns

Background note for the World Development Report 2009

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I empirically address three important aspects of the urbanisation process in India: rural-urban disparities and their relation with economic development; the relation between urbanisation and growth; and the convergence hypothesis in cities' growth. The results support the idea of a U-shaped relation between rural-urban disparities in socio-economic indicators and the level of economic development. Also although the level of urbanisation and that of economic development go hand in hand across Indian states over time, this relation is not strong. On the other hand, the rate of urbanisation (i.e. how fast a state urbanises) and the rate of growth appear to be negatively correlated. Finally, using a large dataset of Indian towns for the 20th century, I find that there is a tendency towards convergence in growth rates among Indian towns across all decades of the century. Other things being equal smaller towns grow faster than large ones. This somewhat contrasts the fears of urban concentration with large towns growing too quickly relative to the other towns.

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1. Introduction and scope of the work

The structural transformation of an economy during the process of development is a well established fact. In this process a rural population mainly employed in agriculture turns into an urban one shifting towards industry and eventually services. Such a process has some clear association with the rural-urban distribution of income within countries as well as with their rate of growth. This paper is concerned with both of these macro aspects of the urbanisation. It also aims to describe the nature of the urbanisation process by testing for convergence as well as for persistence in growth rates of cities. This provides a complementary view of the urban transformation of a country to that of the macro-analysis.

1.1. Rural-urban inequality and economic development

The relationship between income distribution and economic development was first identified by the seminal work of Kuznets (1955). His work hypothesised an inverted U-shaped relationship between income and inequality: the initial stage of a country's economic development would be associated with rising inequalities up to a point (during the middle-income stage of development), after which inequalities would decrease with income per capita.

Following the decomposition of income inequality along a spatial dimension into a within group and a between groups components, Kuznets' hypothesis can be divided into a *within-sector* and a *between-sector* and inequality (Frankema, 2006). The former relates to rural-urban income inequality while the latter refers to intra-urban and intra-rural inequalities. Rural-urban inequality usually explains the majority of a country's inequality in the early stages of the development process. Kanbur and Zhang (1999) find for instance that over 70% of overall inequality in China was explained by the rural-urban component over the period 1983-1995.[2] Kuznets' hypothesis holds that this component of inequality mimics the relationship between overall inequality and income growth. In the initial phase of development the urban sector expands due to rapid urban labour productivity growth. This widens the rural-urban income gap as increase in rural productivity is more sluggish. After peaking,

[2] This share was over 80% for inland areas.

rural-urban dualism declines and eventually dissolves in the long run as rural labour productivity catches up following rural-urban migration and technology and demand spill-overs from the urban sector.

This relation has important similarities with the one between regional inequality and economic development within a country. The work in this area has been inspired by the analysis of Williamson (1965), who found that regional disparities would bear a typical inverted U shaped relation with income per capita. The theoretical intuition for this pattern is related to the tension between centripetal forces towards concentration of economic activity and centrifugal forces towards dispersion. The former, driven by agglomeration economies, would prevail in the early stages of development, causing a process of cumulative causation which reinforces the initial advantage of the more advanced region/location. This concentration process would continue until the level of economic activity reaches a threshold, after which the congestion costs from agglomeration (centrifugal forces) would offset the centripetal forces, dispersing economic activity again. The two models appear to be complementary with the latter providing some micro-fundamentals for explaining the divergence-convergence hypothesis of the former.

While the relationship between regional inequalities and development has been matter of an increasing interest, little empirical evidence is available on the rural-urban inequality-income relation.[3] The lack of such evidence may help explain why the overall Kuznets' hypothesis has never reached an empirical consensus, although it seems to fit a number of countries' development processes, including the recent growth experience of China. The failure to separate the sub-components of the inequality-income relationship may lead to overlook countervailing forces hidden in the catch-all income inequality variable. A vivid illustration of this point is provided by Frankema (2006), who finds that the persistent personal income inequality of Latin America in the 20th century is also associated to declining rural-urban inequality.

The first section of this paper focuses on a specific component of inequality, namely rural-urban inequality. In particular, it analyses the relationship between rural-urban

[3] Bourguignon and Morrison (1998) note for instance that recent development literature has by and large ignored the analysis of rural-urban dualism.

inequality and economic development in Post-Independence India. The analysis uses particular measures of rural-urban inequality, by and large based on poverty indicators. Although such measures are obviously inter-related with more traditional measure of inequality (calculated on absolute incomes), they add a further interesting angle to the debate: that is essentially that policy should be more concerned with poverty than with inequality per se. For instance, transfers among those above the poverty line that "reduce inequality without touching poverty should be of second-order concern" (Eastwood and Lipton, 2000, p. 21). Moreover, unlike most literature concerned with rural-urban inequality, which has primarily looked at the evolution of this inequality over time, this study tries to identify the relationship between income per capita and rural-urban differences in poverty indices. Understanding the nature of this relation would be important *inter alia* in order to assess whether the economic development process has an urban, a rural or a neutral bias.

1.2. Urban growth and economic growth

A complementary question concerns the extent to which urbanisation is related to the process of economic development. The literature has so far quite clearly established that economic development is almost invariably associated with the expansion of the urban sector (e.g. Henderson, 2004 and Davis and Henderson, 2003). But the evidence is much thinner on the question of what type of relationship exists between economic development and the speed of urbanization. Do the two processes map one to one so that faster urbanization is systematically associated with faster economic growth? Answers to this question are important from a policy standpoint as they are related to how efficient the reallocation of resources from the rural to the urban sector is in the short-run. This reallocation is inherent to the long-term process of development, but in the short-run too slow (or too rapid) rural-urban migration may cause imbalances reflected in slower economic growth. Au and Henderson (2006) find that migration restrictions in China have been associated with smaller than optimal cities' size, which in turn has entailed average labour productivity losses of 30% relative to the optimal size.[4]

[4] The optimal size is defined as the size at which the net output per worker is maximised. This is only an indicative figure derived from a statistical exercise, it is still suggestive of some potential substantial productivity losses from undersized cities.

Another related implication of this analysis is that it can shed some light on the net effects of increased productivity and increased congestion in the process of cities' growth. These two effects drive the dynamics of urban productivity and net wages as urban areas expand. Standard urban economics literature shows that agglomeration economies increase productivity and wages but these effects are counterbalanced by increased costs of congestion as the city grows (see Combes et al., 2005). As a large part of the urbanisation process is accounted for by the growth of existing urban areas, the speed of urbanisation indicates how quickly these areas are growing. If rapid urbanisation is associated with faster economic growth, this may suggest that the agglomeration benefits from larger cities' size are likely to be larger than the diseconomies from increased congestion. Section 3 will examine this question with Indian states' data.

1.3. Size and growth of cities

Finally, I consider the micro-counterpart of the macro analysis described above, by inspecting the nature of the urbanisation process. The analysis tries to explore the determinants of the growth (in size) of Indian cities, focusing in particular on the question of convergence growth rates. This question links back to the copious literature on convergence in economic growth in the tradition of Baumol (1986) and Barro (1991). The findings from this literature suggest that convergence in growth rates between sub-national units (e.g. US States) is quite undisputed (Quah, 1996), while the evidence on cross-country convergence is much weaker. In a neoclassical world, these results may be explained by limited mobility of factors of production, and capital in particular, across countries.[5] Analysing convergence across cities in one country, where capital and labour are quite mobile, provides an interesting testing ground to the convergence hypothesis. As argued by Glaeser et al. (1995), the growth rate of cities' population may capture the extent of urban success more precisely than income growth. The authors develop a model showing that income growth captures

[5] In a seminal paper Lucas (1990) provides two sets of explanations for the apparent paradox that capital doesn't flow to countries where it is relatively scarce. One has to do with differences in fundamentals between countries that influence the production function, e.g. technology, institutions, human capital; the other is related to imperfections in international capital markets (e.g. asymmetric information, risk of expropriation). These differences are usually much smaller within a country.

not only productivity growth, but also declines in quality of life. Therefore population growth appears to be a particularly appropriate variable to test for convergence across cities. In an urbanisation setting the analysis of convergence is important as it answers the question of whether larger cities grow slower than smaller ones. To the extent that observers and policy-makers fear that large cities especially in developing countries are growing too large, the absence of convergence, or even the presence of divergence may support the idea of the state's intervention to tilt the balance of the urbanisation process in favour of smaller cities.[6] This has been for example the rationale for the Integrated Development of Small and Medium Towns programme (IDSMT), implemented by the Indian government since 1979.
Despite the potential importance of the question of convergence, not much empirical evidence has examined it. This has not yielded any empirical consensus so far. Using a cross-section of US cities Glaeser et al (1995) find little evidence of convergence in population growth rates between 1960 and 1990 (and somewhat more robust for the period 1950-1970). On the other hand da Mata et al. (2007) find some evidence of convergence for a sample of Brazilian cities between 1980 and 2000.

Alongside convergence, it is interesting to examine some other determinants of city growth as well, such as geography, climate and proximity to large agglomerations. Section four will explore these features using a panel of Indian cities in the 20th century.

1.4. Indian context

I investigate the different questions of the empirical analysis using Indian states over the Post-Independence period and Indian towns over the 21st century as the units of analysis. In this way I can exploit the richness of contexts within the Indian sub-continent, controlling for many of those countries' unobservables that undermine the robustness of inferences from cross-countries studies.

India has a number of features that make it particularly amenable to this type of

[6] Scott and Storper (2003: 581) argue for instance that urbanisation patterns in developing countries have generated "macrocephalic urban systems consisting of a few abnormally large cities in each country".

empirical verification. First, it is a federal country composed of several states with a fairly high degree of political autonomy, which allows for some state-wise variability in policy variables. Second, the size of the major states is similar in terms of both population and geographical extension to that of medium-large countries. The average population of the 16 major states considered for the analysis in 2001 was 61,921,484 (Government of India, 2001).[7] If it were a country, it would rank number 20 (between Thailand and United Kingdom) out of 236 (CIA, 2003). Even the least populous state, Jammu & Kashmir with 10,069,917, would rank above the median country (number 70). The average size of the 16 states is 189,573 Km^2 which would rank number 88 among the largest countries in the world between Senegal and Syria (CIA, 2003). The smallest state is Kerala that with 38,863 Km^2 would rank number 137 (slightly below the world's median). Finally, Indian urbanisation experienced an important growth over the Post-Independence period with its rate increasing from 17 percent in 1950 to 27.8% in 2001 (Government of India, various years). Lall et al. (2006) estimate that over 20 million people moved from rural to urban areas in the 1990s accounting for 30% of national urban growth. These estimates are consistent with the ones presented below, according to which up to a third of urban population growth over the nineties is accounted for by rural-urban migration. As a comparison, migration from rural areas accounted for about 25% of urban growth in the 1980s and 1990s in Africa.

2. Rural-urban disparities

The basic idea of this section is to test whether a relationship exists between economic development and rural-urban inequality, and if so what shape it has. I use three families of indices to measure the disparities in welfare between rural and urban areas across Indian states over time:

1) Poverty based measures
2) Consumption based measures
3) Health based measures

[7] The states considered for the analysis are: Andhra Pradesh, Assam,, Bihar, Gujarat, Haryana, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. Together they represent over 97% of Indian population.

I construct two different indicators of rural-urban disparity based on poverty measures: the difference in *headcount index* between rural and urban areas ($H_1=H_{rur}-H_{urb}$); and the difference in *poverty gap* ($PG_1=PG_{rur}-PG_{urb}$) – Appendix 1 describes the construction of the indices. Eastwood and Lipton (2001) argue that indicators using the poverty gap index are better at capturing relative rural poverty than those using the headcount index.[8] This is because the latter does not capture any movement in poverty of persons below the poverty line unless they overcome it. I find it useful to use both indicators as they convey slightly different insights. The results are fairly different between the two, as shown above.

I use the ratio of the rural to the urban mean per capita monthly expenditure as the consumption measure ($ME_2=ME_{urb}/ME_{rur}$). Unfortunately there is no direct measure of rural and urban access to health services (including also preventive health services) readily available at the state level. I proxy it with the rural-urban difference in death rates per 1000 people ($D_1=D_{rur}-D_{urb}$). This is a far from ideal indicator of access to health services, as the range of its determinants is likely to be very wide. However, I try to control for some of the main factors (other than access to and quality of healthcare) likely to influence this difference. All of these indicators are constructed in such a way that they are increasing in the rural-urban welfare gap.

The basic approach is to estimate the following panel data model:

$$h_{st} = \alpha_s + \gamma_t + \beta_1 y_{st} + \beta_2 y_{st}^2 + \beta_3 (\Delta y_{st} / y_{st-1}) + \Gamma X_{st} + \varepsilon_{st} \qquad (1)$$

where h_{st} is some measure of rural-urban disparities as described above in state s at time t, y_{st} is real income per capita, X_{st} is a vector of socio-demographic controls, α_s is state fixed effects and γ_t is year effects. I estimate it using a fixed effects model. In such a context fixed effects estimation appears to be more appropriate than random effects, as the states considered are very close to the entire population (accounting for over 95% of total Indian population in 2001).[9] Moreover the Hausman test rejects the null of non-systematic difference between fixed and random effects estimators. I also

[8] Eastwood and Lipton (2001) actually use ratios instead of differences in indices. When I tried to use ratios the results are similar to those with differences although slightly less robust.

[9] I obtain similar results to those detailed in the main text estimating the model through GLS modelling the error term as an AR(1) process allowing for state-specific autocorrelation. Results are available upon request.

run state-level regressions (without controls) to test whether the relationship holds for all states.

2.1. Data

The data for the income and consumption based measures come from the World Bank dataset prepared by Ozler, Datt and Ravallion (1996), and further updated by the same authors (see Appendix 1 for a description of the methodology to construct those indices). The same dataset provides also state-wise income data, which have been updated until 2002.[10] Data for death rates come from various years of the Indian Census, and so do demographic data.

Table 1 presents the summary statistics for the rural-urban disparity and income variables. Interestingly, not all welfare indicators are worse in rural than urban areas at any point in time. But the average difference in poverty rates between rural and urban areas is 8 percentage points, indicating a substantial although very variable gap between rural and urban areas across Indian states.

2.2. Graphical evidence

Figure 1 shows the relationship between rural-urban disparities (using the headcount index) and income per capita for each Indian state over the period 1958-2002. A quite clear U-shaped relationship emerges, although a few states have the opposite inverted-U shape pattern (i.e. Jammu & Kashmir, Madhya Pradesh and Karnataka) and Orissa, Rajasthan and Tamil Nadu have linear patterns. This U-shaped pattern emerges quite vividly when using the other consumption and health based measures of inequality (Figures 2 and 3). These stylised facts may suggest a pattern of economic development accompanied by a reduction in rural-urban inequalities over time (with an eventual slight increase for certain states). However, if we plot the evolution of GDP per capita and rural-urban disparities over time, the increasing trend appears evident in virtually all states for the former but not for the latter (Figure 4). This calls for a more formal scrutiny of the relationship.

[10] The data has been updated by the Economic Organisation and Public Policy Programme at the London School of Economics.

As there is a fairly wide cross-states variability in the relation between rural-urban disparities and economic development, it seems useful to group states according to their level of economic development (as measured by the mean of real GDP per capita over the entire period for which data are available).[11] I divide the states into 4 groups in decreasing order of GDP per capita (Leading, Upper-Middle, Lower-Middle and Lagging states).[12] Figure 5 shows a tendency of disparities to increase in *lagging* regions as GDP increases (top-left quadrant). In fact there is some evidence of a decreasing pattern of disparities with increases in GDP for very low levels of income. The *middle* income states show a clear inverted U-shaped pattern, with rural-urban inequalities first increasing (for lower-middle income states) and then decreasing (for upper-middle income states). The *leading* states show a U-shaped pattern, with inequality first decreasing (a trend that continues that of middle income states) and then increasing for high values of incomes. The same pattern holds for the other measures of rural-urban disparities considered (not shown here). In a nutshell, the rural-urban inequality trend with respect to ascending level of incomes can be summarised as follows: slight convergence (phase I) -substantial divergence (phase II) - substantial convergence (phase III) - slight divergence (phase IV). It is open to question whether phase IV is likely to continue as GDP grows or not.

2.3. Regression analysis

Table 2 presents the results of regressions based on equation (1), which provide support for the U-shaped relation emerging from the graphs. In particular the difference in the headcount index decreases as income rises up to a point after which it starts increasing again. In particular in the baseline regression (column 1) a 10% increase in real per capita GDP is associated with a reduction of 0.5 percentage points in rural-urban difference in the headcount index. The trough in this difference is reached for a value of real GDP per capita of 26.2 Rs. after which the difference starts rising. However, only 3 out of 16 states had income per capita higher than this level in 2000. Rural-urban inequality increases in the speed of income growth, although the

[11] The results presented are robust to other income based classifications of states, e.g. real GDP per capita in 1990.

[12] The results are robust to using a different classification with 3 groups (Leading, Middle and Lagging states).

coefficient is significant only at the 10% level. These results are robust to the inclusion of socio-demographic controls (column 2), with the share of the population in working age in urban (rural) areas being positively (negatively) associated with rural-urban difference. The opposite is true for the share of population over 60. The female/male ratio in rural areas has a negative effect on the difference, although it is not significant at conventional levels, and so is the log of total population.[13] In column 3 it appears that the Indian trade liberalisation of 1991 is associated with an increase in rural-urban inequalities, although the inequality reducing impact of income growth is accentuated after this period.[14] All of these results are unaffected by the inclusion of the share of urban population in the controls, whose effect on rural-urban inequality is not significantly different from zero (not shown here). This means that urbanisation per seems to affect neither rural-urban disparities, nor their structural relation with economic development.

These results are robust to the use of the other measures of rural-urban disparities, i.e. the difference in poverty gap and the ratio of real mean consumptions (columns 4 and 5). It the latter regression the age composition controls lose some significance, while the female/male ratio in rural areas is positively and significantly (at the 10% level) associated with an increase in the gap in mean consumption (urban over rural), suggesting that women consume less than men across Indian states.

When I test the disparity-income relation using the death rate as the dependent variable, the results are consistent with the previous ones in the model without year effects (column 6), while the introduction of year effects reverse the sign of income (although not statistically significant) – column 7.[15] This could be the effect of omitted variable bias, which may be particularly relevant in the case of death rates, as other factors may be crucially determining death rates. As a matter of fact the U-shaped relation between disparities and income emerges again once the age and

[13] Note that due to data availability the rural female/male ratio is referred to the population in the cohort 15-34 years of age. This share is likely to be a good proxy for the female/male ratio in total rural population.

[14] Note that this result is obtained without the inclusion of year effects, thus it could only be signalling a generalised increase in rural-urban inequalities (i.e. urban poverty being reduced faster than rural poverty), which has occurred in the last two decades in Indian states. However, the results are not as neat when I run the same regressions using earlier years (i.e. 1988, 1989 and 1990) as break points (not shown here).

[15] The results are different for random effects estimation, but the Hausman test of random vs. fixed effects estimator, strongly rejects the null of no systematic difference between coefficients estimated using the two methods. Therefore RE estimation may yield biased coefficients.

gender composition variables are included, column 8 (with the share of elderly - over 59 – increasing the death rate and the share of young – below 15 – reducing it). Also, ceteris paribus a higher share of female in the rural population reduces the disparities in death rates. This can be related to females having higher life expectancy than males and possibly to the role of women in improving children's healthcare provision by tilting household spending towards social expenditures and health services in particular. Interestingly, the share of urban population is positively and significantly associated with death rates differentials. This can be related to the pattern of rural-urban migration fuelling the urbanisation process. Rural-urban migrants are likely to be relatively young and in good health conditions as these conditions increase their return to urban jobs. These characteristics are positively associated with higher survival rate in urban areas (and lower in rural areas).

The results support the idea of a U-shaped relation between rural-urban disparities in socio-economic indicators and the level of economic development. These disparities decrease as income per capita grows for low levels of economic development until they reach a trough and then they start to increase again. Only a few state-year observations in our dataset appear to lie on the right of this trough.

3. Urbanisation and growth

I next investigate whether and how the process of urbanisation is linked to that of economic development. As in the case of income and rural-urban inequality, it is appropriate to think about this link as a structural correlation rather than a causal relationship. The basic specification to test this correlation is similar to the one in (1), and is defined as:

$$\ln(y)_{st} = \alpha_s + \gamma_t + \beta_1 \ln(y)_{st-1} + \beta_2 (\Delta u_{st} / u_{st-1}) + \delta x_{st} + \varepsilon_{st} \qquad (2)$$

where $\Delta u_{st} = u_{st} - u_{st-1}$ and u_{st} is the urban population of state s at time t. In this way I try to capture the relationship between the growth in income and the proportionate growth in the urban population. I estimate it both by fixed effects and by GLS with state-specific disturbances modelled as an AR(1) process.

3.1. Data and results

The urban population data come from various publications of the Indian Census (between 1951 and 2001) and have a ten-year frequency, thus the number of observations is limited relative to the other analysis.

Table 3 presents the results of the estimation of (2). By and large the results suggest that urban growth tends to be negatively related to income growth, although this finding is not statistically very robust especially when other controls are included. This is evident in column 2, where the low significance of β_2 in the basic specification (column 1) is further reduced by the addition of demographic controls (i.e. the share of population above 59 in total population and its square term, the log of total population and the female/male ratio as described above). These results are stronger when I estimate (1) through GLS AR(1), as in column 3, where the negative relationship between income growth and urban growth is significant at the 5% level. This suggests that time invariant state characteristics capture some of the relationship between urban growth and GDP growth. The negative relation between the two variables appear to hold across states other than within states.

When I use proportionate income growth ($\Delta y_t/y_{t-1}$) as the left-hand side variable, the intensity of the relationship with urban growth is the same as with GDP per capita for the FE model (column 3) and it is only slightly reduced in the GLS model (column 5). Further, there is some evidence of mean reversal in income, i.e. higher income in one period is associated with lower growth in the subsequent one.

Next I test the correlation between the share of urban population and growth using log of urban population and log of total population as explanatory variables. For a given of urban population, the total population tends to be negatively associated with GDP growth, indicating a positive relation between the level of urbanisation and growth. However, the negative sign of the coefficient of urban population, although insignificant, reduces this effect.[16] And this positive association disappears altogether when the demographic controls are added (column 7).

Finally, I address the issue of whether urbanisation is positively associated with the level of economic development. In the last two columns I regress real GDP per capita on the share of urban population, finding a positive and significant relationship, as expected. However, the significance of the relation drops below standard levels once the set of controls is added (column 9). This suggests that the relation between urbanisation and income per capita is not a strong one when we consider it within an individual state over time. This relation is much stronger across states, as it emerges from the results of the regressions without state fixed effects (not reported here).

The level of urbanisation and that of economic development seem to go hand in hand across Indian states over time, but this relation does not appear to be a very robust one. On the other hand, it emerges quite clearly that the rate of urbanisation (i.e. how fast a state urbanises) and the rate of growth are negatively correlated (if anything). This finding is somewhat surprising: in the 'average' Indian state, periods of faster urbanisation tend to be associated with periods of slower growth. Whether such a result points towards an urbanisation driven by push rather than pull factors could be interesting matter of further research.

4. Convergence and the determinants of towns' growth

In order to analyse the determinants of the growth of Indian cities over time, I compiled a dataset of Indian towns and urban agglomerations' population for the 20th century (from the Indian Census). It is important to understand the distinction that the Census makes between towns and urban agglomerations (UAs), as this will feature prominently in the analysis. UAs are groups of towns that belong to the same urban area as defined it by the Census. These agglomerations usually comprise a core large town, surrounded by a number of smaller towns. Sometimes the difference in population between the main town and the UA may be substantial. For example the Calcutta UA had a population of 13.2 million in 2001 while the town of Calcutta had

[16] In line with this finding, when I use urban share as the main regressor instead of log of urban and total population, its coefficient is positive but not significant.

4.6 million. The former comprises over 100 towns, many of which have been incorporated to the UA over time. The incorporation of a new town may bias the analysis as it provides a source of growth which is lumpy and has little relation with socio-economic characteristics of the UA. Therefore throughout the analysis I try to focus on towns (which are not subject to this problem), while analysing separately UAs.

All towns and urban agglomerations with a population over 10,000 in 1991 are included, while the coverage for urban areas below 10,000 is patchy. This translates into an average of almost 2,500 observations per period for a total of 11 periods (i.e. 1901-2001 with a ten-yearly frequency). Table 4 provides summary statistics for the two main variables used in the analysis: population and ten-year population growth rate. The latter is computed using the formula: $g = (u_t / u_{t-10})^{1/10} - 1$ where u_t is population at time t. Both the number of towns and urban agglomerations and their average population increase over the century following India's urbanisation process. Interestingly, the process intensifies over time, as it is indicated by the increase in the mean growth rate of urban areas over the 20th century, at least until 1981, after which there is a slight drop in the growth rate.

The analysis concentrates on testing whether the Indian urban system has evolved towards more or less concentration during the 21st century. Glaeser et al. (1995) assume a linear influence of city's size on subsequent rate of growth. This is the approach experimented in Table 5 – column 1, where I regress the town's growth rate on its size at the beginning of the period, controlling for district effects and a bunch of geographical control for the period 1991-2001.[17] The linear effect of town's size is not significantly different from zero. Adding the squared term of town's size (column 2) makes the variable significant, suggesting the non-linearity of the relationship between town's size and its subsequent growth rate. This is the case also for 1981-91 and 1971-81, although in the former case the linear term is already significant.

[17] The geographical variables are distance to the state capital, a dummy for the presence of a river in the town, and a dummy for being close to a large town (i.e. above 100,000).

Following these results with cross-section data, I use a non-linear specification for testing for convergence. In particular, two main specifications are used. The first focuses on the effect of city size of its subsequent rate of population growth:

$$g_{it} = \alpha_i + \gamma_t + \beta_1 \ln(u)_{it-10} + \beta_2 [\ln(u)_{it-10}]^2 + \varepsilon_{it} \qquad (3)$$

where g_{it} is the annual rate of growth (as defined above) of town (or UA) i at time t. The test for concentration is captured by β_1 and β_2 coefficients. In particular a negative sign on the former indicates a tendency towards concentration (i.e. larger towns grow faster), while the latter coefficient captures eventual non-linearity in the relation. I complement this analysis which tests for the population-growth relation at the town level, with one focusing on groups of towns, which are aggregated in classes according to their size:

$$g_{it} = \alpha_s + \gamma_t + \mathrm{B} \sum_{j=1}^{5} c^i_{jt-10} + \varepsilon_{st} \qquad (4)$$

where c^i_{jt-10} takes the value of one if the town (or UA) i belongs to the class j at time t-10 and zero otherwise, and α_s are state effects. The Census identifies six classes of towns that I find useful to re-aggregate for two reasons. First, the Census classes are based on the availability of data for all towns, so the lowest two classes cover towns below 10,000 (while my data cover mainly towns above 10,000 in 1991). Second, these classes do not provide an accurate representation of the upper tail of the town distribution, which is all lumped in class I (including all towns above 100,000). I find it useful to re-aggregate these classes as follows: class VI: below 19,999; class V: 20,000-49,999; class IV: 50,000-99,999; class III: 100,000-299,999; class II: 300,000-999,999; class I: above 1,000,000. I also change this classification to test its robustness to subjective division.[18]

The results from equation (3) are presented in Table 6 and support the hypothesis of convergence in cities' size over time. City size exerts a significant negative influence on subsequent growth, although the intensity of the effect diminishes with size. In particular, a 1% increase in population determines a reduction 0.15% in the average

[18] In particular, I also use another classification which gives a more balanced allocation of towns across classes: class VI: below 9,999; class V: 10,000-29,999; class IV: 30,000-79,999; class III: 80,000-199,000; class II: 200,000-699,999; class I: above 700,000.

annual rate of growth of (from the average value of 2.1% - column 1). These results are robust to the exclusion of influential observations (column 2)[19] and they are valid for both the pre- and pos-Independence periods (columns 3-4). The results hold also when considering only UAs (column 5), only towns belonging to UAs (column 6) and only the larger UAs (over 50,000 – column 7). In the last three cases the inverse size-growth relationship appears to be even more marked than in the baseline case. The non-linearity seems to fade away for very large towns (over 500,000) – column 8. In this case the negative effect appears to be linear.[20]

The main interpretation of these results is that as a town (or UA) grows in size, its rate of growth slows down relative to the rate of growth experienced when its size was smaller. This result is statistically more important than the cross-sectional one, i.e. larger towns grow more slowly than smaller ones, as it is evident from two facts. First, the FE regressions (in the first seven columns) explain a much larger part (by over 100 times) of the within group than the between groups variation; second the intensity of the size effect diminishes significantly in the OLS relative to the FE estimation, as shown in column 9. However, the estimation without town effects confirms the validity of the U-shaped relationship between growth and size, even when I include district effects to control for local conditions likely to influence urban growth (column 10).

This relationship is less evident at the cross-sectional level. It is valid but significant only at the 5% level, when I regress the 1991-2001 annual growth rate on towns' size (including district effects and geographical controls) – column 11. And the significance of the β coefficients disappears when I consider the 1991-2001 growth rate (column 12), although the signs remain the same. The results from the last two columns suggest that the strength of the growth convergence effect across towns may not be as significant as that over time. The cross-sectional analysis further highlights that the distance from the state capital negatively affects the town's growth prospects, and so does the presence of a navigable river.[21] The negative coefficient on distance to the state's capital may have two non-mutually exclusive interpretations: it can indicate

[19] I exclude those observations, for which the town either shrunk by more than 5% in any ten-year period or grew by less more than 20%.
[20] I regress the growth rate on the linear term, which is significant at the 1% level (not reported here).
[21] This is a dummy variable which takes the value of 1 if the town has a navigable river.

the positive impact for a city's prospects of being close to the seat of the political power; it could also represent the effect of market potential on cities' growth, as state capitals are usually large markets as well. The latter effect is more clearly driving the positive coefficient on the dummy for being situated within 20 kilometres from a large town (over 100,000). The negative effect on a town's growth prospects of being situated by a river is more difficult to understand. It could be related to the physical constraints to growth imposed by the presence of the river or to the danger of flooding which may induce people to settle in towns without rivers. However, these explanations would need further research to be verified. Thus geographical location does seem to matter for cities' growth in India, although further analysis would be needed to draw more robust conclusions. Another significant finding is that there seems to be no persistence in growth rates. The coefficient on past growth rate is negative and significant in all FE specifications. On the other hand, the cross-sectional analysis reveals a positive coefficient, which is in line with what found by Glaeser et al. (1995) for a cross-section of US cities. This suggests that there is some sort of mean reverting process in growth rates over time for individual cities, but persistence does occur across the sample of cities (i.e. cities which have grown faster in the previous decade continue to do so in the following one relative to the other cities).

Importantly, these reults are robust also to the inclusion of state-year effects, which allow controlling for time varying state-specific urban systems.[22] Calì (2007) argues that Indian states could approximate national urban systems due to their vast size and population as well as to their differences in terms of languages, culture and social norms, which have limited the mobility of labour across states. Cashin and Sahay (1995) find that the response of migration to income differentials across states was similar to the weak responsiveness of population movements to income differentials across the countries of Europe. Similarly, Topalova (2005) finds extremely limited labour mobility across Indian regions between 1983 and 2000. Finally, the findings are equally valid using a balanced panel, i.e. conditional on the existence and the statistical reporting of towns in every year between 1951 and 2001.[23]

[22] Results available from the author upon request.
[23] This generates a sample of 1665 towns. Results of these regressions are available upon request.

The analysis using the classes of cities instead of the initial population confirms the tendency of towns to slow down their growth as they become larger (Table 7). The growth rate of towns is increasing in their class size. When a town becomes Class I (i.e. the largest size), its rate of growth turns lower than when it was Class II, and so on (column 1). This is the case also for UAs (column 2), and the results are robust to using a different classification of towns as described above (column 3). Things change when I include state effects but not town effects suggesting that town-level characteristics are crucial in defining the size-growth relationship (column 4). A town in class II (medium-large sized) is more likely to grow than any other town (controlling for the state), while a town in class II (medium-small) is likely to grow the least. Towns in class V (small towns) also grow slower, while the growth rates for the other classes are not statistically different from towns in class III. These broad results hold fairly well when considering only growth in 1991-2001 (column 5), but in the 1981-1991 period class I towns have been the ones experiencing the lowest growth (column 6). The results are unclear for the 1971-81 period (column 7) while they indicate a bias against small towns in the pre-Independence period – column 8 (although this may just be the product of a classification which is less meaningful for a period in which most towns would be classified in class VI and V). The interpretation of these last results would require further scrutiny.

5. Conclusions

This paper has analysed three important aspects of the urbanisation process in India: rural-urban disparities and their relation with economic development; the relation between urbanisation and growth; and the convergence hypothesis in cities' growth.

The results support the idea of a U-shaped relation between rural-urban disparities in socio-economic indicators and the level of economic development. Such disparities decrease as income per capita grows but at the diminishing rate until they reach a trough and then there is some indication that they may start to rise again. This is the mirror-image to the U-shaped inequality-income curve hypothesised by Kuznets (1955). Dynamics in intra-rural and intra-urban inequalities may reconcile these rural-urban results with national ones a la Kuznets.

I also found that although the level of urbanisation and that of economic development go hand in hand across Indian states over time, this relation is not a very strong one. On the other hand, it emerges quite clearly that the rate of urbanisation (i.e. how fast a state urbanises) and the rate of growth appear to be negatively correlated. This finding is somewhat surprising: in the 'average' Indian state, periods of faster urbanisation tend to be associated with periods of slower growth. This may be related to urbanisation patterns driven by push rather than pull factors, which are not favourable to growth if not accompanied by the required investments in the urban sector.

Finally using a large dataset of Indian towns for the 20th century, the analysis has shown that there is an important tendency towards convergence in growth rates among Indian towns across all decades of the century. Other things being equal smaller towns grow faster than large ones. This somewhat contrasts the fears of urban concentration with large towns growing too quickly.

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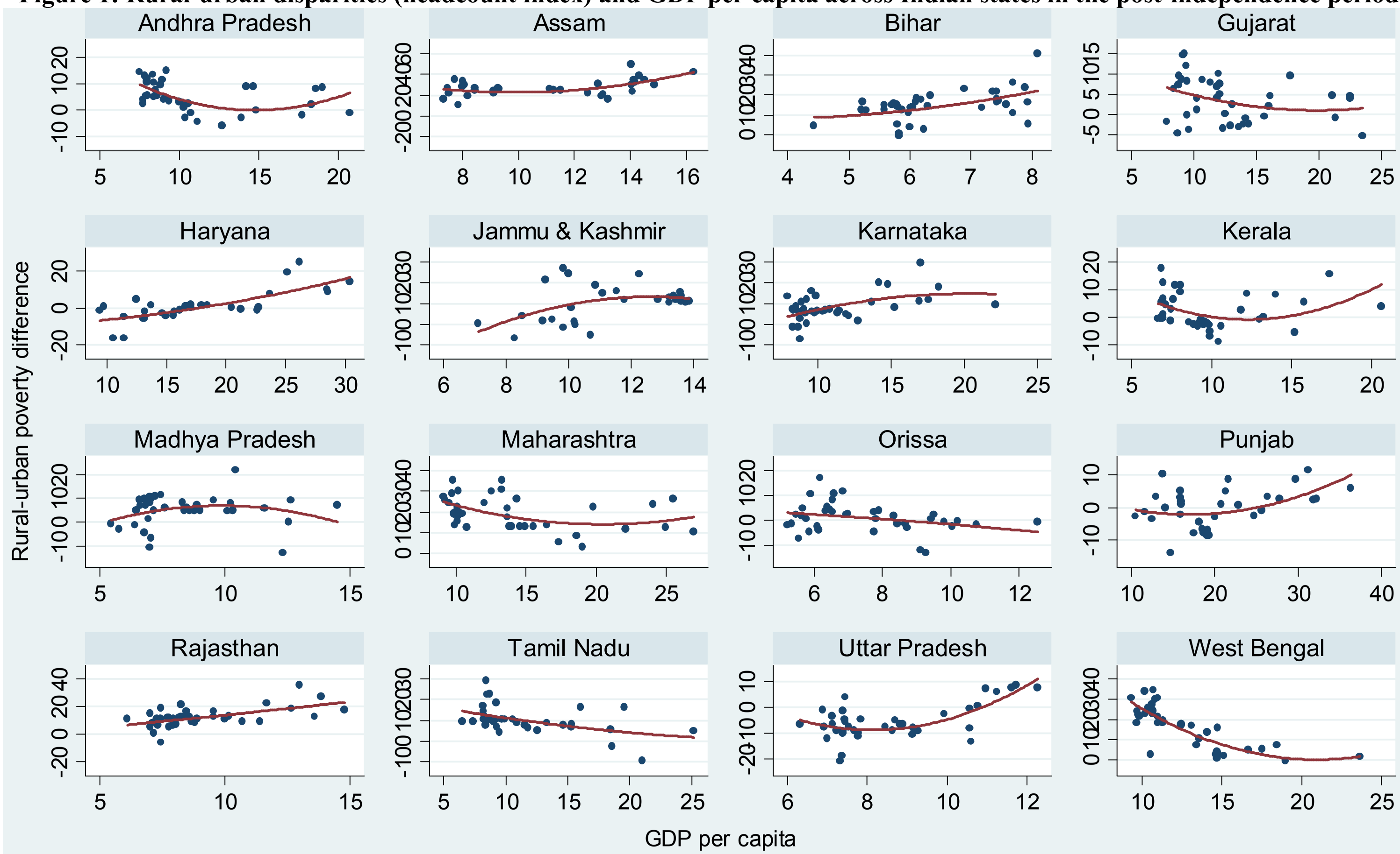
Figures and Tables

Figure 1: Rural-urban disparities (headcount index) and GDP per capita across Indian states in the post-independence period



Note: Poverty difference is measured as the difference between the poverty headcount index in rural areas and that in urban areas

Figure 2: Rural-urban disparities (Mean consumption) and GDP per capita across Indian states, 1958-1994

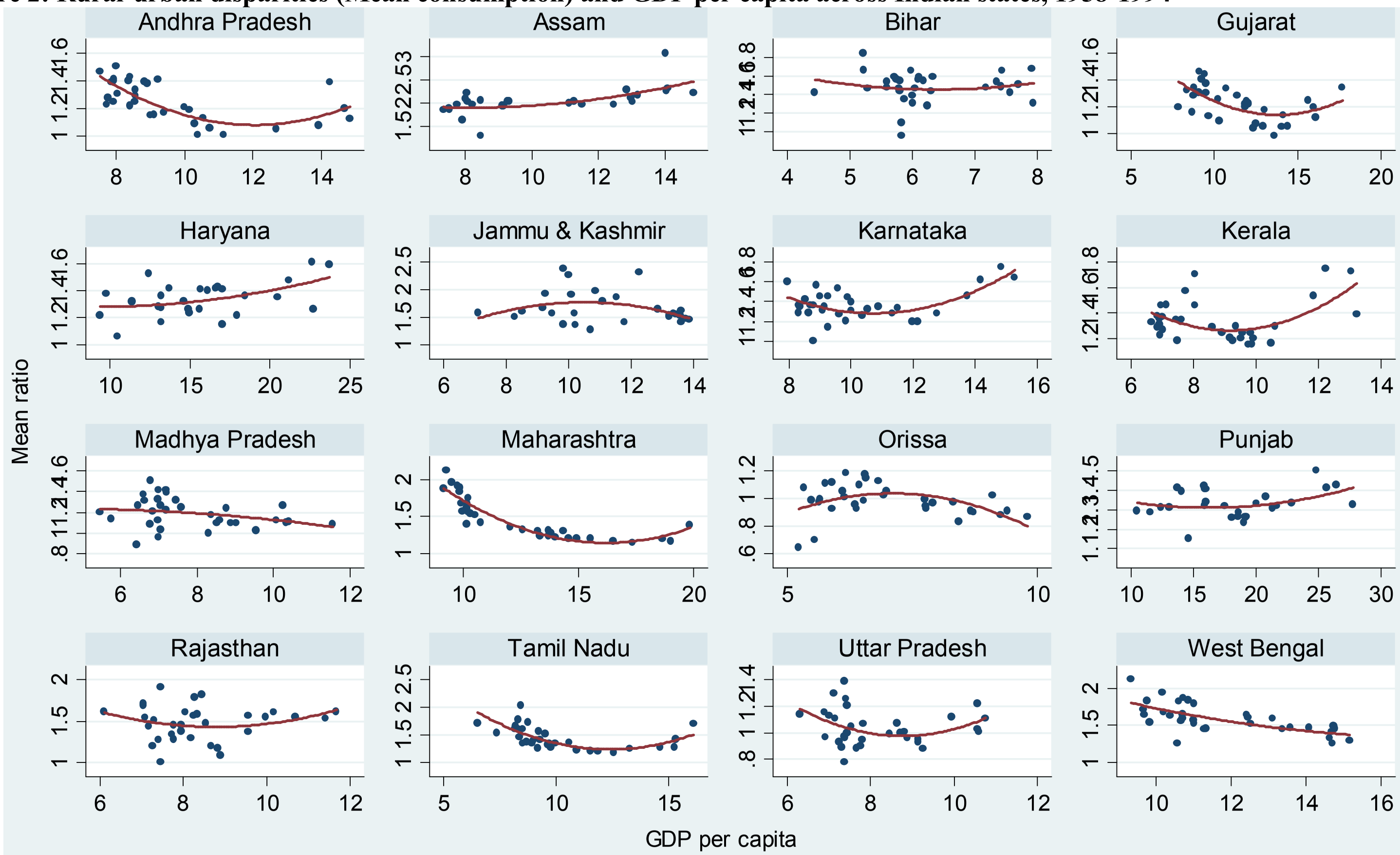


Figure 3: Rural-urban death rates disparities and GDP per capita across Indian states, 1971-2001

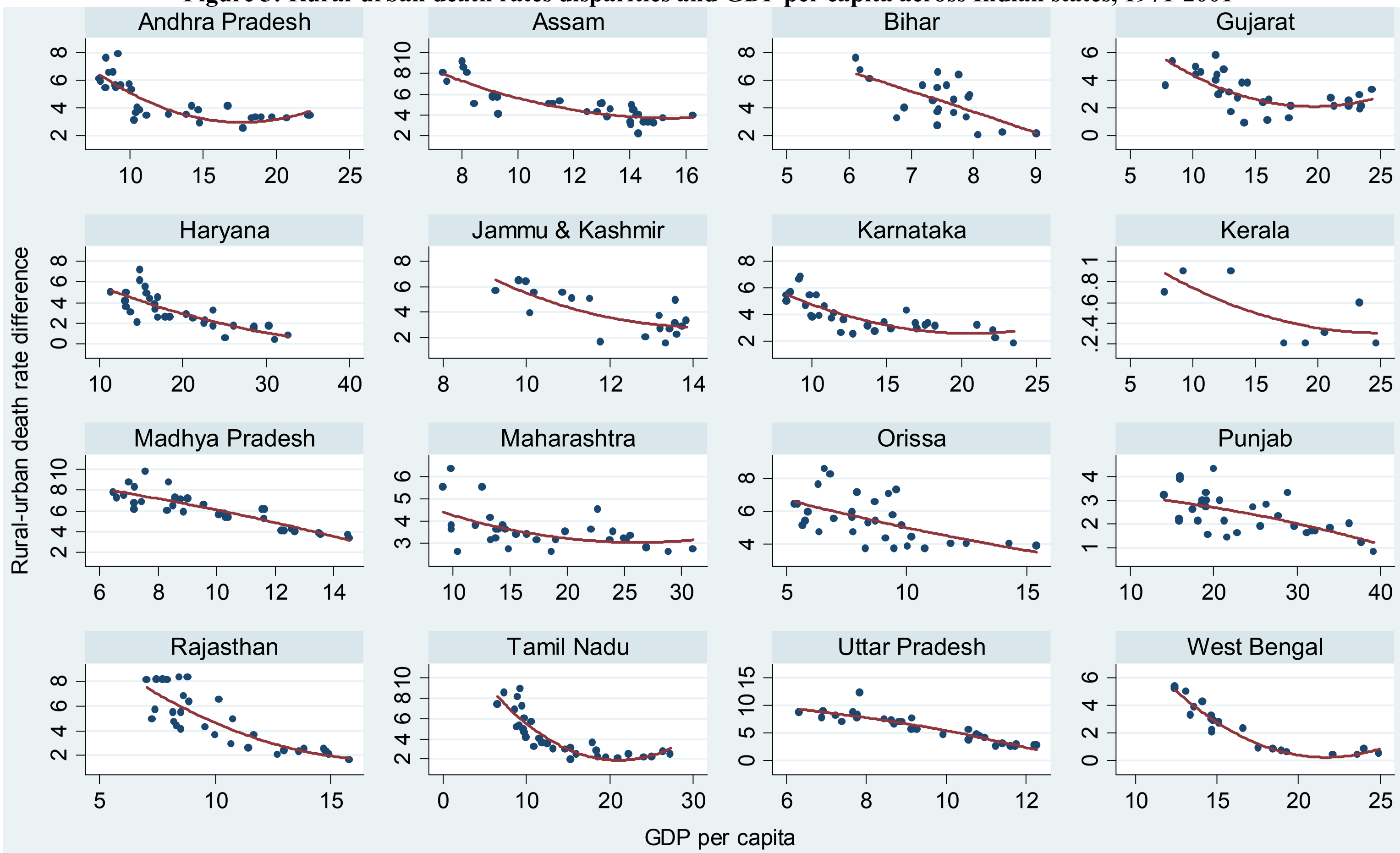


Figure 4: Evolution of rural-urban disparities and real income across Indian states over time, 1958-2002

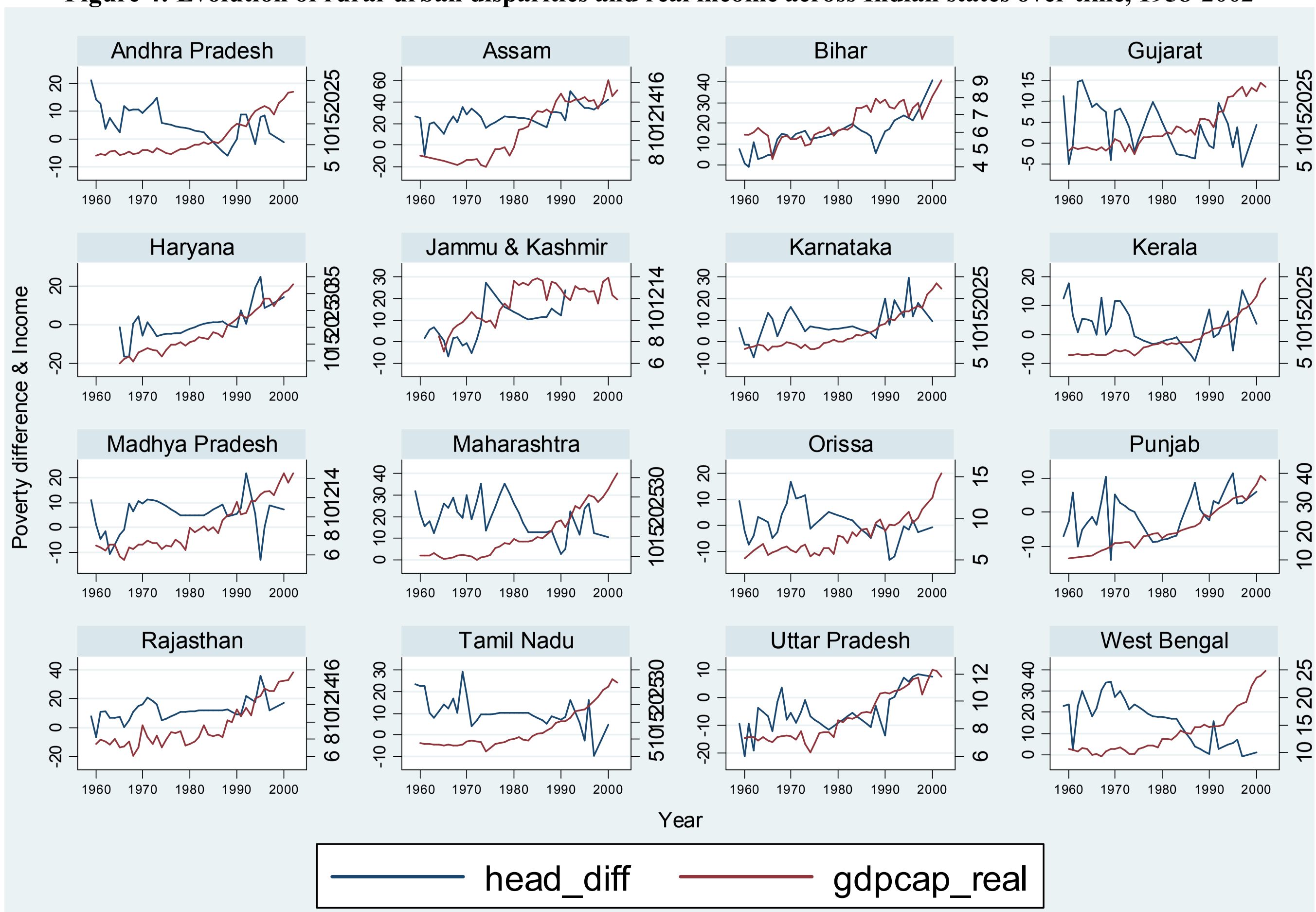
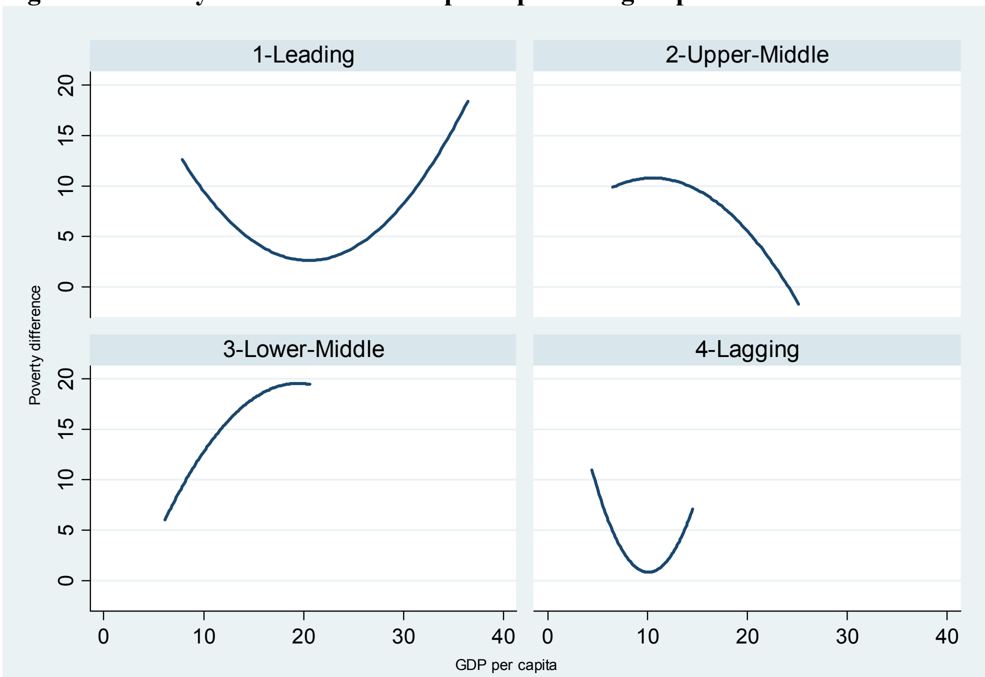


Figure 5: Poverty difference vs. GDP per capita in 4 groups of states - trend line



Leading States: Punjab, Haryana, Maharashtra and Gujarat
Upper-Middle States: West Bengal, Tamil Nadu, Karnataka, Andhra Pradesh
Lower-Middle States: Jammu & Kashmir, Assam, Kerala and Rajasthan
Lagging States: Madhya Pradesh, Uttar Pradesh, Orissa and Bihar

Table 1: Summary statistics for the main variables

	Head diff	PG diff	Mean ratio	Death rate diff	Per capita GDP (Rs)	Annual GDP growth
Mean	8.06	2.42	1.39	4.13	12.29	0.05
Std. Dev.	10.79	4.03	0.31	2.04	5.82	0.08
Min	-21.14	-11.03	0.64	-3.90	4.44	-0.27
Max	50.06	14.73	3.08	12.30	39.27	0.43

Table 2: Rural-urban disparities and income per capita across Indian states, 1958-2002

	(1) Head diff	(2) Head diff	(3) Head diff	(4) PG diff	(5) Mean ratio	(6) Death diff.	(7) Death diff.	(8) Death diff.
GDP pc	-2.465	-2.090	-1.382	-0.567	-0.070	-0.698	0.109	-0.144
	(4.54)**	(3.75)**	(2.65)**	(1.81)	(3.18)**	(11.60)**	(1.59)	(1.69)
GDP sq.	0.047	0.038	0.042	0.016	0.001	0.013	0.001	0.004
	(4.37)**	(3.73)**	(3.24)**	(2.58)*	(2.80)**	(8.01)**	(0.64)	(2.39)*
GDP growth	6.820	8.733	5.406	2.902	0.165	2.805	0.379	1.270
	(1.76)	(2.44)*	(1.76)	(1.73)	(1.52)	(4.04)**	(0.53)	(1.69)
Rural 15-59		-0.549	-1.306	-0.613	0.004			
		(1.57)	(3.68)**	(4.40)**	(0.36)			
Urban 15-59		0.561	0.418	0.164	0.013			
		(3.65)**	(2.78)**	(2.12)*	(2.89)**			
Rural 60+		2.362	1.499	1.311	0.019			0.424
		(1.70)	(1.06)	(2.01)*	(0.45)			(1.87)
Urban 60+		-5.287	-3.674	-1.336	-0.103			-0.991
		(2.90)**	(2.18)*	(1.45)	(1.92)			(3.77)**
Fem/male		-30.806	-8.449	3.363	1.874			-9.680
(15-34 rur)		(1.10)	(0.29)	(0.25)	(1.88)			(2.13)*
Ln pop.		1.023	1.105	-7.112	-0.485			-0.266
		(0.08)	(0.28)	(1.05)	(1.19)			(0.11)
Rural 0-14								-0.465
								(6.60)**
Urban 0-14								-0.036
								(1.40)
Urban share								17.936
								(2.48)*
GDP*1992			-0.414					
			(1.67)					
1992			16.504					
			(4.14)**					
Year effects	YES	YES	NO	YES	YES	NO	YES	YES
State effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	564	522	522	462	462	448	448	403
R-squared	0.64	0.71	0.68	0.68	0.79	0.64	0.81	0.86

*Robust t-statistics in parenthesis; * significant at the 5% level; ** significant at the 1% level.*

Table 3: Economic growth and urban growth across Indian states, 1961-2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Ln GDP	Ln GDP	Ln GDP	ΔGDP	ΔGDP	Ln GDP	Ln GDP	Ln GDP	Ln GDP
	FE	FE	GLS AR(1)	FE	GLS AR(1)	FE	FE	FE	FE
$Ln(GDP_{-1})$	0.986	0.765	0.958	-0.242	-0.036	0.920	0.748		
	(14.40)**	(9.24)**	(59.57)**	(2.81)**	(1.98)*	(12.56)**	(9.01)**		
Urban growth	-1.261	-0.895	-0.963	-0.876	-0.861				
	(1.38)	(1.09)	(2.27)*	(1.03)	(1.66)				
Ln urban pop						-0.075	-0.070		
						(0.70)	(0.73)		
Urban share								2.418	0.965
								(2.76)**	(1.35)
Share 60+		-0.154	-0.176	-0.169	-0.113		-0.156		-0.082
		(1.43)	(3.56)**	(1.50)	(1.84)		(1.43)		(0.46)
Share 60+ sq.		0.015	0.014	0.016	0.010		0.015		0.014
		(2.05)*	(3.89)**	(2.10)*	(2.16)*		(2.05)*		(1.19)
Ln tot pop		0.049	-0.025	0.051	-0.029	-0.303	0.028		0.011
		(0.31)	(3.02)**	(0.30)	(3.18)**	(1.97)	(0.18)		(0.04)
Fem/male (15-		-0.197	-0.172	-0.251	-0.087		-0.164		0.718
34 rural)		(0.52)	(2.08)*	(0.64)	(0.98)		(0.43)		(1.16)
1971	-0.025	-0.038	-0.019	-0.035	-0.019	0.062	-0.014	0.013	0.008
	(0.98)	(0.90)	(1.55)	(0.81)	(1.17)	(1.21)	(0.26)	(0.26)	(0.11)
1981	0.014	0.004	0.024	0.008	0.022	0.199	0.057	0.096	0.092
	(0.46)	(0.05)	(1.58)	(0.10)	(1.11)	(1.99)	(0.58)	(1.45)	(0.64)
1991	-0.024	0.001	-0.002	0.005	0.006	0.276	0.093	0.286	0.290
	(0.57)	(0.01)	(0.11)	(0.04)	(0.27)	(1.83)	(0.64)	(3.46)**	(1.37)
2001	0.017	0.087	0.042	0.092	0.049	0.415	0.213	0.567	0.604
	(0.28)	(0.56)	(1.89)	(0.56)	(1.96)*	(2.11)*	(1.11)	(5.46)**	(2.24)*
Observations	76	70	70	70	70	76	70	76	70
Number of state	16	15	15	15	15	16	15	16	15
R-squared	0.97	0.98		0.43		0.98	0.98	0.89	0.95

*Robust t-statistics in parenthesis; * significant at the 5% level, ** significant at the 1% level; Jammu is the state excluded in the columns with demographic variables, as data are not available.*

Table 4: Summary statistics for cities' population and population growth, 1901-2001

	Population			Growth rate		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
1901	1,445	22,661	67,757			
1911	1,487	23,148	76,908	1,390	-0.17%	2.93%
1921	1,580	23,357	80,792	1,462	0.38%	2.53%
1931	1,716	25,739	86,651	1,561	1.41%	2.04%
1941	1,893	31,975	128,275	1,703	1.88%	2.32%
1951	2,213	39,025	173,995	1,861	2.21%	3.00%
1961	2,382	48,829	222,716	2,003	2.49%	2.91%
1971	2,762	59,226	284,855	2,369	2.86%	2.54%
1981	3,294	71,098	357,531	2,714	3.27%	2.27%
1991[a]	4,428	72,771	402,377	3,287	2.75%	2.56%
2001[b]	3,943	96,539	544,474	3,936	2.17%	2.17%

a. The mean value for 1991 is not strictly comparable to that of the other years due to the wider cities' coverage; b. the distribution of town for the year 2000 is slightly skewed towards larger towns due to data availability.

Table 5: The effects of population size on subsequent growth, cross section

	(1)	(2)	(3)	(4)	(5)	(6)
Periods	1991-2001	1991-2001	1981-91	1981-91	1971-81	1971-81
$\ln(pop)_{-10}$	0.0012	-0.021	-0.019	-0.025	-0.016	-0.049
	(0.25)	(2.38)*	(2.24)*	(1.25)	(1.57)	(1.77)
$\ln(pop)_{-10}$ sq.		0.0010		0.0011		0.0023
		(2.46)		(1.19)		(1.78)
Observations	3818	3818	3029	3029	2460	2460
Dist. effects	YES	YES	YES	YES	YES	YES
Geo. controls	YES	YES	YES	YES	YES	YES
Adj. R-sq.	0.11	0.11	0.17	0.18	0.10	0.13

*Robust t-statistics in parenthesis; * significant at the 5% level, ** significant at the 1% level*

Table 6: Convergence in growth rates across Indian cities in the 20th century?

	(1)	(2)	(3)	(4)	(5)	(6)
Periods	All	All	Post-Ind	Pre-Ind	All	All
Sample	All towns	No infl. obs.	All towns	All towns	UA only	UA outgrown
Model	FE	FE	FE	FE	FE	FE
$Ln(pop)_{-10}$	-0.051	-0.036	-0.056	-0.197	-0.066	-0.077
	(8.93)**	(9.18)**	(7.35)**	(5.32)**	(4.86)**	(5.47)**
$Ln(pop)_{-10}$ sq.	0.001	0.001	0.001	0.006	0.001	0.002
	(4.76)**	(4.06)**	(2.23)*	(3.25)**	(3.00)**	(3.95)**
Growth $rate_{-10}$	-0.097	-0.040	-0.072	-0.039	-0.177	-0.063
	(4.39)**	(3.82)**	(2.69)**	(1.75)	(3.46)**	(1.35)
Year Effects	YES	YES	YES	YES	YES	YES
Observations	16097	16014	12182	3915	2507	2907
No. of groups	2991	2989	2989	1411	364	639
R-squared	0.46	0.49	0.55	0.69	0.44	0.47

	(7)	(8)	(9)	(10)	(11)	(12)
Periods	All	All	All	All	1991-01	1981-91
Sample	UAs > 50,000	Towns > ½ mln	All towns	All towns	All towns	All towns
Model	FE	FE	OLS	Distr. eff.	Distr. eff.	Distr. eff.
$Ln(pop)_{-10}$	-0.127	-0.055	-0.024	-0.021	-0.034	-0.029
	(6.37)**	(1.21)	(7.00)**	(5.05)**	(1.87)	(1.81)
$Ln(pop)_{-10}$ sq.	0.004	0.001	0.001	0.001	0.002	0.001
	(4.82)**	(0.79)	(7.16)**	(5.26)**	(1.92)	(1.78)
Growth $rate_{-10}$	-0.143	-0.235	-0.001	-0.057	0.148	0.209
	(3.20)**	(2.69)**	(0.04)	(2.22)*	(4.25)**	(5.12)**
Distance state capital					-0.005	-0.003
					(2.73)**	(1.61)
River					-0.004	-0.003
					(3.43)**	(2.45)*
Vicinity to large town					0.003	-0.002
					(1.93)	(0.94)
Year Effects	YES	YES	YES	NO	NO	NO
Observations	994	200	16097	16089	2680	2460
No. of groups	193	68		455	432	424
R-squared	0.69	0.82	0.11	0.17	0.28	0.35

*Robust t-statistics in parenthesis; * significant at the 5% level, ** significant at the 1% level; dependent variable: annual growth rate in population.*

Table 7: Class city size and population growth across size classes, 1901-2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Periods	All	All	All	All	2001	1991	1981	Pre-Ind
Sample	Towns	UAs	Towns	Towns	Towns	Towns	Towns	Towns
Model	FE	FE	FE (diff. classif.)	State effects	State effects	State effects	State effects	State effects
Class 1	-0.017	-0.026	-0.021	0.000	0.004	**-0.008**	-0.001	0.003
	(4.99)**	(4.99)**	(7.68)**	(0.05)	(1.19)	(1.71)	(0.11)	(0.33)
Class 2	-0.008	-0.016	-0.008	0.003	**0.005**	0.006	-0.002	0.005
	(3.91)**	(4.36)**	(4.83)**	(2.29)*	(1.89)	(2.23)*	(0.73)	(0.94)
Class 4	0.008	0.012	0.014	-0.002	-0.002	-0.002	-0.001	**-0.005**
	(6.15)**	(5.14)**	(10.26)**	(2.28)*	(1.31)	(1.42)	(0.63)	(1.92)
Class 5	0.018	0.027	0.029	-0.002	-0.002	-0.000	-0.002	**-0.004**
	(11.37)**	(6.20)**	(14.86)**	(2.15)*	(1.57)	(0.22)	(1.03)	(1.93)
Class 6	0.030	0.043	0.043	-0.001	-0.002	0.002	-0.000	-0.005
	(14.31)**	(6.30)**	(15.95)**	(1.15)	(1.12)	(1.59)	(0.16)	(2.81)**
Year effects	YES	YES	YES	YES	NO	NO	NO	YES
Observations	20526	2887	20526	20526	3845	3061	2490	5486
No of groups	4207	374	4207	31	27	31	30	23
R-squared	0.16	0.17	0.18	0.14	0.03	0.09	0.06	0.13

*Robust t-statistics in parenthesis; * significant at the 5% level, ** significant at the 1% level; figures in bold indicate significance at the 10% level; dependent variable: annual growth rate in town's population.*

Appendix 1

Methodological note to the construction of poverty measures

The poverty headcount ratio and the poverty gap index are two standard Foster Greer Thorbecke (FGT) measures of poverty. FGT poverty measure for a given population is defined as:

$$H_{\alpha}^{i} = \int_{0}^{z_i} \left(\frac{z_i - y}{z_i} \right)^{\alpha} f(y)dy$$

where z_i is the poverty line in the area i (with i = [rural, urban]), and $f(y)$ is the distribution function of monthly per capita expenditure (in this case), with the population ordered in ascending order of y (i.e. starting from the poorest).

Headcount Index

The headcount ratio is computed by setting α=0, thus it represents the proportion of the population below the poverty line in a certain geographical unit (poverty rate). The poverty lines used by the dataset are those recommended by the Planning Commission (1993) and are as follows. The rural poverty line is given by a per capita monthly expenditure of Rs. 49 at October 1973-June 1974 all-India rural prices. The urban poverty line is given by a per capita monthly expenditure of Rs. 57 at October 1973-June 1974 all-India urban prices (see Datt (1995) for further details on the rural and urban cost of living indices and the estimation of poverty measures).

Poverty Gap Index

This is computed by setting α=1 and is defined as the mean distance below the poverty line as a proportion of the poverty line where the mean is taken over the whole population, counting the non-poor as having zero poverty gap. That is the mean shortfall from the poverty line (counting the non poor as having zero shortfall), expressed as a percentage of the poverty line.

Appendix 2
Rural-urban migration and city growth

How much of cities' growth is actually generated by rural-urban migration. Table A1 tries to address this question by detailing the share of rural-urban migrant (in the previous ten years) in total rural and urban population. For example 11.6% of Andhra Pradesh urban population has moved from rural to urban areas in the previous ten years. The number of rural-urban migrants for each state has been calculated using data on urban population, birth and death rates (and assuming inter-state immobility of labour) in the following way:

$$M_{st} = U_{st} - \sum_{i=t-9}^{t} [(bu_{si} - du_{si})U_{si}]$$

where U_{st} is total urban population in state s at time *t*, bu_{st} and du_{st} are birth rate and death rate of the urban population respectively. For most states this share decreases between 1981 and 1991 (with Jammu & Kashmir, Orissa and Assam having the highest shares in 1991). In 2001 this trend is reversed in half of the states, suggesting that the opening up of the Indian economy in the early nineties may have spurred some internal migration from rural to urban areas. However, the data is patchy and the evidence is not robust enough to make more rigorous inferences for the time being.

Table A1: share of rural-urban migrants in the population across Indian states, 1981-2001

	Share of urban pop			Share of rural pop		
	1981	1991	2001	1981	1991	2001
Andhra Pradesh	11.6%	11.6%	4.6%	3.5%	4.3%	1.7%
Assam	14.0%	12.2%	12.4%	1.5%	1.5%	1.8%
Bihar		4.4%	5.4%		0.7%	0.8%
Gujarat	9.0%	7.2%	7.8%	4.1%	3.8%	4.7%
Haryana	14.8%	11.9%	13.0%	4.2%	3.9%	5.3%
Jammu & Kashmir	17.2%	14.8%		4.6%	4.5%	
Karnataka	14.4%	9.6%	6.5%	5.8%	4.3%	3.4%
Kerala	7.2%	11.1%	19.2%	1.7%	4.0%	6.7%
Madhya Pradesh	14.7%	11.9%	9.7%	3.7%	3.6%	4.9%
Maharashtra	11.1%	10.0%	10.0%	6.0%	6.3%	7.4%
Orissa	21.0%	13.8%	9.4%	2.8%	2.1%	1.6%
Punjab	10.2%	6.8%	8.8%	3.9%	2.9%	4.5%
Rajasthan	16.2%	10.8%	6.8%	4.3%	3.2%	2.1%
Tamil Nadu	7.3%	3.2%	10.9%	3.6%	1.6%	8.5%
Uttar Pradesh	16.3%	11.9%	6.8%	3.6%	2.9%	1.8%
West Bengal		10.2%	8.7%		3.9%	3.4%

Source: Author's calculations based on Statistical Census of India (various years)