1 Introduction

In 2004, the Congress-led United Progressive Alliance (UPA) government came to power after defeating the BJP-led National Democratic Alliance (NDA) government. This defeat for the NDA government came in spite of the fact that Indian economy grew rapidly, at 8.5% in 2003-04. A popular perception explaining the ouster of the then ruling NDA government was its inability to check rise in regional income inequality and slow rate of poverty reduction.

How true is this perception about economic reforms enhancing regional income disparity? In this paper we examine whether income disparity across regions (districts) has changed during post-reform, and effectiveness of growth in reducing absolute poverty, as measured by head count ratio (HCR). We use district-level per-capita income data spreading across agriculture, manufacturing, services and various constituent sub-sectors, and examine the connection between growth and poverty. To our knowledge no attempt has been made to examine the dynamics of income distribution, and growth-poverty interaction using district-level income data. The goal of this paper is to fill this gap in the literature.

If pan-India growth process is not uniform, then we would see the emergence of twin peaks in the underlying income distribution function: clustering of the rich income districts, and clustering of the poor income districts with pockets of economic growth pulling-up the national average income. On the other hand, a uniform growth process at a pan-India level would lead to a disappearance of such clusters. This idea is in the spirit of works done by Quah (1993, 1996), who introduces the notion of twin peaks in the cross-country distribution of incomes. Quah (1993, 1996) finds evidence of persistence, and stratification of income density functions.[1] Emergence of twin peaks implies polarization of the cross-country income distribution into rich and poor convergence clubs.

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[1] Quah (1993) considers log of per-capita income data for 118 countries between 1962 and 1985. Although our analysis contains data for a shorter span, we argue that given India's fast growth experience within this short span (average annual growth rate exceeding 7% between 1999 and 2005) might make it possible to capture emergence of any cluster in the underlying income distribution function, especially, at a sub-regional level.

Our results suggest that between 1999-00 and 2005-06 there is no evidence supporting an emergence of twin peaks in the underlying income distribution function: clustering of the rich and poor income districts.[2] The growth process is uniform. There has been a reduction in income disparity among districts and a fall in poverty. Considering income, although there has been an increase in per-capita district-level income but when we look at the disaggregated income data from agriculture, manufacturing, and services, we find that the growth of per-capita income is predominantly driven by the growth of services sector alone.[3] Agriculture and manufacturing sectors have contributed marginally to the growth of per-capita income. We do find evidence of bimodal density function especially for the banking and insurance sector, and telecommunication sectors. However, the overall per-capita income density function remains unimodal.

We find evidence of first order stochastic dominance suggesting that faster growth has helped to reduce poverty.[4] Evidence from our disaggregated (district-level) analysis aligns well with macro-level evidence. At a pan-India level Head Count Ratio (HCR),[5] has fallen from 36% in 1993-94 to 27.5% in 2004-05.[6] Our findings suggest that agricultural income growth and access to finance are important for reducing district-level poverty (both urban and rural). The rest of the paper is organized as follows. Section 2 discusses the literature survey. In Section 3 we state our empirical model. Section 4

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[2] We are referring to distribution of per-capita income across districts, and not within a particular district.

[3] At a pan-India level, during the Tenth five years plan (2002-2006) compound annualized growth rate of agriculture, manufacturing, and services, were 2%, 8%, and 9.5%, respectively (Central Statistical Office (CSO), Government of India).

[4] During the Seventh five years plan (1985-1989), India's annual growth rate of gross domestic product (GDP) was around 5.5%. During the Eighth five years plan (1992-1996) the GDP growth rate has increased to 6.5%, and during the Tenth five years plan (2002-2006) the GDP growth rate has increased further to 7.7% (CSO, Government of India).

[5] HCR is measured as proportion of the population living below the poverty line. India's official poverty lines in 1993-94 were Rs 205.84 and Rs 281.33 for rural and urban India, respectively. In 2004-05, poverty lines were Rs 356.30 and Rs 538.60 for rural and urban India, respectively.

[6] Ministry of Rural Development, Government of India.

contains a brief description of the data. Section 5 discusses results from our analysis. Section 6 concludes.

2 Related literature

There are a number of studies that indicate India is spatially heterogeneous in terms of level of development. Singh et al. (2010) give a detailed account of this literature. These studies merely stop at classifying districts and/or states on the basis of some development indicators without quantifying the linkages between the growth and development indicators. For instance, on the basis of the 1991 Census (Government of India, 1991), Kurian (2000) finds evidence of widening regional disparities in India when measured in terms of sex ratio (females per 1000 males), female literacy, infant mortality, and level of infrastructure development. He finds that the forward group of states (Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab, and Tamil Nadu), with higher per-capita income, have moved ahead in terms of performance on the aforementioned parameters relative to the backward group of states (Assam, Bihar, Rajasthan, Uttar Pradesh, and West Bengal), that is, the states with lower per-capita income. On the basis of data obtained from Planning Commission (Government of India, 2000), Mehta (2003) finds spatial inequalities exist at all level of disaggregation – a given state may perform extremely well on all indicators but there may be districts within that state that are among the most deprived in the country, or a state may have very high levels of attainment on certain specific development indicator(s) but not on all of them.

More specifically, as to whether economic reforms in India has widened the gap between the richer, and the poorer states, here we find mixed evidence. While examining the growth performance of 14 major states during the pre-reform period (from 1980-81 to 1990-91) with the post-reform period (from 1991-92 to 1998-99), Ahluwalia (2002), finds that not all the rich states have become richer relative to the poorer states. Except for the three poorer states (Bihar, Uttar Pradesh, and Orissa), all the other states have narrowed the distance between themselves, and two of the richest states (Punjab and Haryana) during the nineties. Middle-income states such as Karnataka, Kerala, Tamil Nadu, and West Bengal, actually grew faster during the post-reform period relative to their growth rates during the pre-reform period.

However, Bhattacharya and Sakthivel (2004) find evidence in favor of increasing regional inequality, with the state domestic product (SDP) widening more drastically during the post-reform period. They argue that the comparison in Ahluwalia (2002) is based on two different sets of SDP data.[7] Bhattacharya and Sakthivel (2004) extend the new SDP data series backward to compare growth and regional variation across states with a common database. Their results show that the coefficient of variation in the per-capita SDP growth rate has increased from 0.19 during the eighties to 0.29 during the nineties, and the correlation coefficient between the average growth rates of SDP between the eighties and the nineties across states is 0.50. This implies that the states with higher SDP growth rates in the eighties continued to experience higher growth rates in the nineties.

Our study fits well to this strand of literature. We analyse whether during the post-reform period (that is, between 1999-00 and 2005-06) the district-level income density function has changed uniformly, and the factors responsible for reducing district-level poverty.

3 Empirical model

The empirical analysis has two parts. In the first part of the analysis we examine how per-capita district-level income distribution (absolute and median (relative) adjusted) has changed between 1999-00 and 2005-06. To examine the dynamics further, we draw density of district per-capita income for the fiscal years, 1999-00 and 2005-06.[8] We run Kolmogorov-Smirnov (KS) test to ascertain whether there is any statistically significant difference in the median adjusted per-capita income distribution between different fiscal years: 1999-00 and 2005-06. KS test is a nonparametric test which tests whether two samples are drawn from the same population. To explicate, 'KS statistic is the maximum

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[7] The new 1993-94 base year SDP data series used for doing post-reform period analysis is different than the old 1980-81 base year SDP data series used for analyzing performance of states during pre-reform period. There has been a change in product classification in the new SDP data series, with more sectors included from the financial services, the real estate and the agricultural allied services, than there were in the old SDP data series (See, Bhattacharya and Sakthivel, 2004).

[8] We compute the density estimates using the Epanechnikov kernel. Compared to other kernels (Gaussian, Uniform, Triangular, and Bi-weight), Epanechnikov kernel minimizes the asymptotic mean integrated square error (MISE), and hence is chosen for this analysis.

absolute value of the difference between the two sample cdf's' (Higgins 2004: 57). In other words, it is a far more general distribution free test with continuous common population distribution. (Gibbons and Chakraborti 2003: 241) We repeat this exercise for major constituent sectors agriculture, manufacturing, services, and their sub-sectors.

The second part of our analysis is a follow-up from the first part. District-level per-capita income data indicate that poverty has fallen between 1999-00 and 2005-06. We examine the factors responsible for reduction in poverty both in urban and rural areas. In particular, we consider the following two equations:

$$HCR_u = \alpha_u + \Delta Y_0 \gamma_1 + Y_0 \gamma_2 + X_0 \beta_1 + \varepsilon_u \ \dots \ (1)$$

$$HCR_r = \alpha_r + \Delta Y_0 \gamma_1 + Y_0 \gamma_2 + X_0 \beta_1 + \varepsilon_r \ \dots \ (2)$$

where, HCR_u and HCR_r indicate head count ratios in the urban and rural areas respectively. Y_0 is a matrix of per-capita district-level income in 1999-00 for three sectors, namely, agriculture, manufacturing, and services. ΔY_0 is a matrix representing growth rates of per-capita income from these three sectors between 1999-00 and 2005-06. X_0 is a matrix of baseline development indicators obtained from the 2001 Census (Government of India, 2001).[9] All the data are at district-level, and are measured at a per-capita level.[10] Additionally, we conduct sensitivity analysis a la Levine and Renelt (1992) to test robustness of our key results.

4 Data

The data on district-level per-capita income, both at sectoral[11] (agriculture, manufacturing and services) and sub-sectoral level are taken from Planning Commission

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[9] It is to be noted that Census of India 2001 was conducted in two phases. Information related to the development indicators were collected during April and September, 2000. Hence, our model does not have any endogeneity problem.

[10] Except for the variables, such as literacy rates and percentage of household with banking access, which are reported in percent.

[11] We follow standard definitions of agriculture (primary), manufacturing (secondary) and services (tertiary) sectors as defined by CSO. We verified reliability and accuracy of the district-level figures in the following way. We summed up the DDP estimates at constant prices for all the districts in a particular state in a particular year, and compared the aggregate figure with the SDP figure provided by CSO at the same constant prices for the state in question for the same year. Ideally the aggregate figure should be close enough to the SDP estimate and likewise we found negligible difference between the aggregate figure and the SDP estimate.

(2010), Government of India.[12] We include districts from 29 states in India. We consider the time period between 1999-00 and 2005-06. For Bihar and Orissa, we use sectoral and sub-sectoral data for 2004-05 whenever data for 2005-06 are not available. This was done to make number of data points same across all relevant regressions. Data for the years after 2005-06 are not available for all the districts, resulting in significant drop in the number of observations.[13] Also many districts are newly formed, and information about per-capita income for them is not available for the earlier years.[14] Therefore, to maintain uniformity, and to get a more robust result, we consider the aforementioned time period. For the fiscal year 1999-00 an important omission in the Planning Commission data is district-level income for the State of Gujarat. During 1999-00, we have 508 income data points (out of 585 districts) in India. For the latter fiscal year (2005-06), we have income data for 536 districts. This increase in number of observation is due to the inclusion of per-capita district income data from Gujarat, which are not available for 1999-00. The per-capita district income data for Gujarat are taken from Indicus Analytics, Delhi.[15]

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[12] According to National Accounts Statistics Manual (2008: 92), 'broadly the methodology of computation of [district-level] sectoral estimates is the same as adopted for estimates of State Domestic Product (SDP).' Hence, the assumptions made for the computation of District Domestic Product (DDP) are the same as in the case of SDP. It is pertinent to note here that 'the estimates of State Domestic Product (SDP) are compiled through a combination of production and income approaches, depending on the data availability at the state level. The expenditure approach SDP estimates are not compiled, as detailed data required for such compilations, particularly on the inter-state movement of goods and services and exports and imports, are not available at the state-level.' (National Accounts Statistics Manual 2008: 44)

[13] Planning Commission does not report data on district-level per-capita income data for the period after 2006-07.

[14] In 2000 there are 585 districts, and in 2011 there are 627 districts in India. Many of these districts are newly formed, and for some of them information about the income variable is not available. The case in point is Delhi. The Census 2001 contains information about many variables related to north, north-east, north-west, south, south-west, west, east, and central Delhi. However during 2001, when it comes to per-capita income we find information only relating to Delhi as a whole, and not its constituent districts. Source: Planning Commission, Government of India<http://districts.nic.in/dstats.aspx>. Accessed on (02/04/2011).

[15] Indicus Analytics collect data from the Central Statistical Organisation (CSO), Ministry of Statistics and Programme Implementation, Government of India. CSO collate data from respective state governments. Planning Commission database also uses the CSO database. Therefore introducing per-capita district-level income data for Gujarat and Delhi for 2001/02 and 2004/05 is not going to affect (bias) our results.

The development indicators[16] that we use for this study are: literacy rate (for both rural and urban areas), life expectancy at birth (LEB), and proportion of households with access to banking services. We have used HCR data (for both urban and rural areas) from Chaudhuri and Gupta (2009).[17] To merge the data suitably across indicators missing observations for certain districts are dropped from the final data set. In total, we have 439 observations for HCR-urban (equation 1) and 434 observations for HCR-rural (equation 2). The results are generated using statistical software package Stata.

5 Results

5.1 Overall analysis of growth and income

First, we do not find evidence in support of twin peaks: clustering of the rich and low income districts, across India. There has been uniform increase in income across all the districts.

(TABLE 1 and FIGURE 1a, here)

We notice from Table 1 that there is an increase in the mean and median per-capita district income. We also notice that there is an increase in standard deviation, skewness, and kurtosis measures of income. In fact, as kurtosis has become high during the latter period, that is, during 2005-06, the assumption of normality may not be valid. So we use the non-parametric sign-test to test for the increase in income across different time periods.

(TABLE 2, here)

The results in Table 2 show that there is a significant increase in the mean and median per-capita district-level income between 1999-00, and 2005-06. Since, the income distribution is skewed and has a high kurtosis as well (evident from Table 1), we perform the same set of tests for the log per-capita income. Here also, we get similar results, indicating that there is an overall increase in the level of per-capita income.

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[16] For a description of these variables see, Table A in the Appendix.

[17] Chaudhuri and Gupta (2009) use Consumer Expenditure Data obtained from 61st Round of National Sample Survey (2004-05) conducted by Ministry of Statistics and Programme Implementation, Government of India. The design of the stratified random sampling was modified in the 61st Consumer Expenditure Survey (2004-05) where 'the sampling design defined rural and urban parts of districts as strata for selection of sample villages and urban blocks respectively. This had paved the way for generating unbiased estimates of important socio-economic parameters at the district-level adequately supported by the sample design.' (Chaudhury and Gupta 2009: 94)

Since, there has been an increase in the mean and median per-capita income; does it indicate that districts with high per-capita income have become well-off relative to the districts with low per-capita income? In other words, do we find any evidence in favour of cluster, or divergence of income between the richer and poorer districts? To analyse this we plot income density function for 1999-00, and 2005-06.

We observe that considering districts income data there is definitely no evidence of twin peaks emerging in any of these periods. There is a shift in the per-capita income density function between these two time periods. This is due to a significant increase in the mean, and the median per-capita income, from 1999-00 to 2005-06.

(FIGURE 1b, here)

The income distribution functions also show evidence of first-order stochastic dominance: income distribution function for 2005-06 lies everywhere below (that is, to the right of) income distribution function for 1999-00 (evident from Figure 1b).[18] This implies that between 1999-00 and 2005-06, poverty has fallen. This result is not surprising. It is widely documented that when economic growth happens absolute poverty falls.[19] What is more interesting is to examine whether among districts there is any significant change in the median adjusted per-capita income distribution function between 1999-00 and 2005-06? This is relevant, especially, because we observe income density function for 2005-06 has become more platykurtic (with fewer extreme values) than it was during 1999-00.[20] We run KS test to ascertain this.

(TABLE 3, here)

Results suggest that between 1999-00 and 2005-06 there is no statistically significant difference in the median adjusted income distribution functions.[21] In fact, a glance at the median adjusted per-capita income densities drawn for 1999-2000 and 2005-06, suggest that these distribution functions are more or less similar (Figure 2).

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[18] An income distribution function stochastically dominates another if the percentage of people below any given income is higher in the first (1999-00) than in the second (2005-06). The income distribution function that stochastically dominates the other also has higher poverty than the other.

[19] For an excellent discussion on this topic see, Fields (2001) pp.102-104, and pp. 122-126.

[20] We do not find evidence suggesting that there has been a statistical significant increase in standard deviation.

[21] Running KS test on per-capita income data also yielded similar results as log per-capita income data.

(FIGURE 2, here)

The finding suggests that both the rich and poor districts have equally become well-off. There has been no increase in income disparity among districts. Analysis of district-level per-capita income does not tell us what has happened at the sectoral level. For this we construct per-capita income densities for three constituent sectors, namely, agriculture, manufacturing, and services.

(FIGURE 3, here)

5.2 Sectoral analysis of growth and income

As is evident from Figures 3.1 to 3.4, for agriculture and manufacturing there has been no change in income density function (both, median adjusted and median unadjusted). We infer that between 1999-00 and 2005-06, which was a period of high income growth, these two sub-sectors did not contribute much to the overall growth process. On contrary, as is evident from kernel density plot (Figure 3.5 and Figure 3.6) of log of per-capita service sector (median unadjusted) there has been a significant increase in income for the people engaged in the services sector. Services sector has been the major contributor for growth in India.[22] The non-parametric sign test also confirms this (Table 4).

(TABLE 4, here)

We did four non-parametric tests (see, Table 4) to check robustness of our findings: standard median test, Wilcoxon signed ranksum test, KS test, and Kruskal-Wallis (KW) test. Wilcoxon signed ranksum test is a nonparametric test which examines difference in medians of two sampling distributions. Since median is not sensitive to the presence of extreme values in the sample we used this test for testing differences in medians (Gibbons and Chakraborti, 2003: 215). To explicate, it tests whether each of the observed differences between two paired sample come from a continuous population symmetric about a common median but the underlying distributions may not be the same. KW test is a natural extension of the Wilcoxon signed ranksum test to k-(k≥2) samples. We used this test as an additional robustness test (Gibbons and Chakraborti 2003: 363). Both the median and Wilcoxon tests suggest marginal increase in per-capita median

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[22] This evidence is further corroborated by the macro-level (aggregated) data. Share of services sector in GDP in 2005-06 was 54.1% (Economic Survey, 2005-06).

income of agriculture and manufacturing sectors, and large and significant increase in per-capita median income of the services sector. However, the KS and KW tests suggest that there has not been any statistically significant change in the distribution of agriculture, manufacturing, or services in terms of other higher order moments.

Next we focus on constituent sub-sectors of agriculture (Figures 4.1 to 4.4),[23] manufacturing (Figures 4.5 to 4.8),[24] and services[25] (Figures 4.9 to 4.18). For these sectoral and sub-sectoral descriptive statistics see, Tables B and C, in the Appendix.

(Figure 4, here)

5.3 Sub-sectoral analysis of growth

Except for three services sub-sectors − banking and insurance sector, telecommunication, and real ownership business services − all the other sub-sectoral density functions are unimodal.

The bimodal density function for the banking and insurance sector is a reflection of the fact that the existing guidelines of Reserve Bank of India (RBI) requires 40% of the demand and time liabilities of the commercial banks to be allocated for priority sector finance such as agriculture.[26] The bimodal density reflects lending pattern to both rich and poor cohorts of customers. The rich such as large business houses are getting credit because of preference by the bankers. The poor such as in agriculture are getting credit because of compulsion arising from RBI guidelines. However, there are the middle ones such as small and medium scale manufacturing units who are being deprived. A recent study by The Associated Chambers of Commerce and Industry of India (ASSOCHAM) finds that about 25% of small and medium manufacturing units have either closed their business or are struggling for survival due non availability of easy credit and delayed payments by large firms. Out of 500 manufacturing units surveyed from different states

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[23] Agricultural and allied activities (primary sector) comprise of agriculture, forestry and logging and fishing.

[24] Manufacturing (secondary sector) comprises of manufacturing (both registered and unregistered), mining, electricity, gas and water supply.

[25] Services (tertiary sector) comprises of construction, trade and hotels. railways, transport, storage, communication, banking and insurance services, real ownership of dwellings, business and legal services, public administration and other services.

[26] Reserve Bank of India (2008).

such as Uttar Pradesh, Haryana, Punjab, West Bengal and Bihar, over 70% of the respondents have said that they do not have access to institutional credit to operate competitively.[27] A uniform density in the banking and insurance sector will require removing imperfection in the capital market, with more loan and insurance products targeted toward small and medium enterprise finance.

For the communication sector,[28] we find emergence of twin peaks for the fiscal year 2005-06. Between 1999-00 and 2005-06 communication has spread more to the richer districts in comparison to the poorer districts. Between 2000 and 2005, some radical reform measures were undertaken for the telecommunication sector. Factors such as privatising the operation of Department of Telecommunication Services, Government of India, and increasing stake of foreign investors from 49% to 74% in the telecommunication services has led to increased competition, and reduction in telephone call charges. Many private operators emerged. Number of telephone handsets sold increased from 19 million in 2003 to 32 million in 2005.[29] This sudden spurt in reform-led activities has resulted in per-capita income originating from the telecommunication sector grow faster for the richer districts in comparison to the poorer districts. This has led to emergence of twin peaks. Jones (1997) observes that such emergence of twin peaks can be a temporary phenomenon, and can happen because of high frequency growth miracles data, or because of sudden spurt in economic activities as stated above.

In fact, for the real ownership business services[30] we find disappearance of cluster, indicating real ownership business type services have spread from the richer to poorer districts. This might be because private sector (without depending too much on the government) is taking the lead in moving capital and labour to areas with lesser input costs (that is, investing more in backward districts, or second and third tier cities), contributing to uniform growth.

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[27] Source: http://www.thehindubusinessline.com/industry-and-economy/credit-scarcity-hits-small-units-hard-says-assocham/article4027901.ece. Accessed on 24 October 2012.

[28] Communication includes telecom and related services, and posts.

[29] Telecom Regulatory Authority of India (2006).

[30] Real ownership and business services consists of real estate services, IT and IT enabled services (ITeS), accounting and auditing services, R&D Services, legal services, and consultancy services.

5.4 Poverty and growth

As the growth process has been uniform it is necessary to examine whether this growth has been "pro-poor". Before undertaking the regression analysis (equation 1 and 2) we look at the correlation matrix (see, Table 5) involving sectoral income growth and poverty. The correlation matrix brings out some important observations. First, correlation coefficients between growth of services, manufacturing, and agriculture sectors, are positive and significantly related.[31] Growth in one sector is expected to help growth in the other two sectors. Second, among the sub-sectors, degree of association between manufacturing and services sector growth is the strongest. As the economy develops (with rising per-capita income), the growth linkages between manufacturing and services sectors become stronger because of high income elasticity of demand for services. Third, correlation coefficient between urban and rural poverty is positive and significantly related. Poverty in urban and rural areas co-exist because of free movement of labourers from rural to urban areas, and vice versa. Fourth, correlation coefficients between growth of services, manufacturing and agriculture, are negative and significantly related to HCR – suggesting economic growth reduces poverty. As to what are the factors which reduce poverty we take note from various growth models,[32] and existing literature on India's growth and development dynamics. For instance, Rosenzweig (1990) finds that schooling has positive effect on income. Burgess and Pandey (2004) find that the rural bank branch expansion program in India has a significant effect on reducing rural poverty, and to increase non-agricultural output. Accordingly, we consider literacy rate (proxy for human capital), life expectancy at birth (proxy for health), access to banking (proxy for access to finance), growth rates of log of per-capita income for agriculture, manufacturing and services between 1999-00 and 2005-06, and initial level of per-capita income from the these three sectors as independent variables. The dependent variables that we consider for our study are HCR-rural and HCR-urban (proxy for poverty). Results from equation (1) and (2) are reported in Table 6.

(TABLE 6, here)

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[31] Significant, henceforth, refers to statistical level of significance at a 5% level.

[32] Solow growth model, endogenous growth models, or models dealing with micro-foundation of macroeconomics like rational expectation type models.

Our results suggest growth of agriculture is an important factor for reducing urban and rural poverty. With the majority of the Indian population still earning their livelihood from the agricultural sector (close to 58% of the population in 2010-2011),[33] it will be difficult to reduce rural poverty without improving agricultural productivity. With a lower contribution of agricultural sector to the national income, labourers from rural areas migrate to urban areas in anticipation of higher expected income (Harris and Todaro, 1970). And, with limited employment opportunities in the organised manufacturing and services sector in the urban areas, migration is also contributing to urban poverty. We also find that districts with higher initial level of services per-capita income in 1999-00 continue to have lower poverty (both urban and rural). Similarly, higher initial level of per-capita income from agricultural sector is responsible for reducing rural poverty, and higher initial level of per-capita income from manufacturing sector is responsible for reducing urban poverty.

The other finding from our study is access to banks reduces poverty. Increasing access to credit in the form of microfinance can help rural enterprises and urban informal sector (comprising of small manufacturing units) to emerge and grow, thereby reducing poverty. We get a counter-intuitive result for urban literacy rate. Our sensitivity analysis (that we report later) shows that this relationship between urban literacy rate and poverty is not robust. Also, literacy rate-rural and life expectancy at birth are not able to explain reduction in poverty. This is not surprising. For education and health variables to have any discernable impact on poverty we require data over a longer time horizon, which are unfortunately not available in our case.

5.6 Sensitivity analysis

To check robustness of our results we perform sensitivity analysis as outlined in Levine and Renelt (1992). The idea is to see whether inclusion of additional explanatory variables affect the regression outcome. The coefficient of a variable originally considered is robust if its sign and level of significance do not change with inclusion of additional explanatory variables.

The regression models reported in Table 6 are the original regressions. To do the robustness check we re-estimate the original regression models with additional

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[33] Economic Survey (2011-2012), Ministry of Finance, Government of India.

explanatory variables. The sensitivity analysis is done both for the HCR-rural and HCR-urban. The results are reported in Table 7 and Table 8.

(TABLE 7 and 8, here)

The additional control variables that we consider for sensitivity analysis are population growth rate between 1999 and 2001, number of factories per one lakh population (in rural and urban areas) and proportion of households using electricity as a source of light (in rural and urban areas). According to Harrod-Domar model, higher population growth rate dampens rate of growth of per-capita income, and hence adversely affect poverty (Ray, 2004). Khandker et al. (2012) find evidence of rural electrification reducing poverty. Number of factories is considered to be a proxy for level of industrialisation. The effect of industrialisation on poverty eradication can go either way. If large numbers of households who are marginally above poverty line are displaced because of industrial expansion without commensurate rehabilitation and compensation packages, then industrialisation may lead to a rise in HCR. On the contrary, if industrial expansion is labour intensive where Below Poverty Line (BPL) households find employment, then such industrial expansion will be "pro-poor", and may reduce poverty.[34]

We refer the original regression as the base regression, and the model with newly added explanatory variables for sensitivity analysis as the augmented regression. To check robustness we add two additional variables at a time to our base regression. Since actual magnitudes are of little interest to us we report only the sign and statistical significance of the coefficients. The results from the augmented regressions are no different from the original regressions, showing that our results are robust. Results from Table 7 indicate, districts with higher initial per-capita agricultural income have lower rural poverty. From Table 8 we find that agricultural growth rate is also important for

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[34] Because of lack of labour market reforms most labourers in India fail to get jobs in the organized manufacturing sector. In fact, all the successful manufacturing businesses in India employ capital intensive mode of production (Panagariya, 2008). Prominent names in India's manufacturing sector – Reliance Industries in the petrochemical sector; TATA motors, Bajaj, and Mahindras in the automobile sectors; or even Godrej, Birlas, and Videocon, in the consumer durables sector – rely on capital intensive mode of production.

reducing urban poverty. Districts with higher initial level of per-capita manufacturing and services income have lower incidence of poverty. Access to banking reduces both urban and rural poverty. All these results are robust as the sign and level of significance of the coefficients are not affected by addition of new explanatory variables. Effect of urban literacy rate on urban poverty is counterintuitive but as the sensitivity analysis shows this relation is fragile. Among the variables added for sensitivity analysis, we find rural electrification and number of factories reduce both rural and urban poverty.

5.7 Policy implications

Policymakers in India can reduce poverty better by concentrating on the agricultural sector. The share of agricultural sector that supports livelihood of 57% of the Indian population in 2009-10 has fallen from 56.90% during 1950-51 to 14.7% during 2009-10. On the other hand, services sector (excluding construction) supporting livelihood of around 24% of the population in 2009-10 has increased from 29.80% during 1950-51 to 54.7% during 2009-2010.[35] Since India has leapfrogged into skill-intensive services sector bypassing the manufacturing sector there are three obvious policy choices. First is to increase agricultural productivity so that return to the people dependent on the agricultural sector increases. Second is to remove capital market imperfections so that small entrepreneurial activities, agriculture and agriculture related allied activities such as fishing, dairying, etc., can grow and flourish. The results from our study highlight these two factors, namely, growth of agricultural sector and access to finance, as important factors for reducing poverty. The third choice is about longer term policy prescription which is imparting skills so that excess labours from the agriculture and allied sector can be meaningfully absorbed in the services sector.

6 Conclusion

This paper finds that during post-reform period India witnessed a period of high income growth, and the regional growth process has been uniform. By analyzing district-level data for the period between 1999-00 and 2005-06, we find no divergence in inter-district income disparity. The income dynamics provide no evidence in support of the twin peaks hypothesis: clustering of the rich income districts, and clustering of the poor income districts at a pan-India level. There has been a reduction in income disparity

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[35]Source: Economic Survey 2011-12, Ministry of Finance, Government of India.

among districts. Although there has been an increase in per-capita district-level income but when we look at the disaggregated income data from agriculture, manufacturing, and services, we find that growth of this per-capita income is predominantly driven by the growth of services sector alone. Agriculture and manufacturing sectors have contributed marginally to the growth of per-capita income. We do find evidence of bimodal density function especially for the banking and insurance sector, and telecommunication sectors. However, the overall per-capita income density function remains unimodal. Along with growth there has been also a reduction in poverty. Faster growth during post-reform period has helped to reduce poverty. We find that increase in agricultural income (productivity) and access to finance, are the important variables that have contributed to reduction in poverty.

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