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Regional Inequality in India in the 1990s: A Further Look·

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Abstract

This paper examines changes in regional inequality in India in the 1990s, using data for 59 of India's 78 agro-climatic regions from the National Sample Survey. It extends the work of Singh et al. (2003) in two ways. First, it allows for differences in baseline growth performance across individual states. It confirms the relatively poor performance of eastern states in the 1990s. Second, it also analyzes economic performance using NSS consumption expenditure data. In this case, it finds that there was conditional convergence for urban households, but not for rural households in that period.

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1. Introduction

It is unsurprising that, in a country as large and heterogeneous as India, regional inequality is a persistent concern. Studies of trends in regional inequality continue to be produced on a regular basis.[1] Most of these studies use some version of the neoclassical growth model to specify a regression equation to be estimated,[2] and seek to establish if growth rates across states are such that per capita state domestic products are converging (mitigating regional inequality) or diverging (worsening it). Almost always, statistical analysis of this issue is conducted with state level data, albeit sometimes disaggregated by sectors.[3] The availability of data makes this a convenient choice, while the political salience of the states increases the relevance of the exercise. On the other hand, India's states are still very large entities (as populous as typical countries), and they are quite heterogeneous in size. Working with data in per capita terms helps address purely econometric issues created by size heterogeneity, but it remains the case that observations of entities of very different sizes receive equal contributory weight in estimating "average" effects.[4]

Singh et al. (2003) implemented a growth convergence exercise using data from the National Sample Survey (NSS), which is at the level of agro-climatic regions. There are 78 such regions in India, but complete data for 59 regions was available. Regions do not cut across state boundaries. The advantages of using data at this level are greater homogeneity in size and internal characteristics, a larger cross-section, and a sense of variation in performance within states. In the absence of per capita product or income data, they used five alternative measures of economic activity, following an earlier analysis of Bhandari and Khare (2002).[5] These variables were petrol sales, diesel sales, bank credit, bank deposits and cereal production.[6] Singh et al. (2003) found no strong evidence of convergence or divergence using each of the five variables as indicators of economic activity, but it was clear that western and southern states had done better over the 1990s.

This paper extends the Singh et al. (2003) results in two directions. First, we include state-level dummies in the conditional convergence regressions, giving a finer-grained understanding of regional variation as opposed to using dummies for "zones" (north, west, south, east) as in the earlier paper. Second, we add per capita consumption

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[1] For brief surveys of this literature, see, for example, Singh et al. (2010) and Kar et al. (2011).

[2] In an alternative approach, Ahluwalia (2002) used the Gini coefficient and finds that interstate inequality, after being stable for most of the 1980s, increased, starting from the late 1980s, and even more in the 1990s. He added some simple regressions but these do not change the conclusions: these were effectively restricted versions of convergence regressions, with the parameter of initial income level set to zero.

[3] See, for example, Kar and Sakthivel (2007).

[4] Most state-level studies mitigate this problem by focusing on the major states, excluding smaller, typically special category states. However, this reduces an already small cross-section sample size.

[5] Those authors constructed an economic performance index based on five variables and used the index to compare performance across two years, rather than estimating growth convergence.

[6] Results on cereal production have some bearing on other analyses disaggregating performance by sector. Singh and Srinivasan (2006) explored the role of credit in growth convergence regressions at the state level.

expenditure as a measure of economic activity at the regional level, giving a more complete view as compared to the five indicators used in the earlier work.

2. Theoretical Framework and Empirical Methodology

Our basic framework comes from the neoclassical economic theory of growth, which explains growth in terms of factor accumulation. If growth is expressed in per capita terms, and absent continual technical progress, diminishing returns to factor accumulation ensure that there is a long run steady state with constant per capita output, i.e., asymptotically, there is no growth in per capita output. Thus, economies starting with different factor endowments will converge to the same steady state, as long as there are no differences in technologies or other productive opportunities. If, instead, there is exogenous technological progress, then economies will grow at the rate dictated by this technological change. Typical neoclassical growth models yield a log-linearization around the steady state of the form:

$$ln \ y(t) - ln \ y(0) = - (1 - e^{-\lambda t}) ln \ y(0) + (1 - e^{-\lambda t}) ln \ y^*$$

Here y is the measure of income or output per capita, and the parameter λ is the rate of convergence to the common steady state of the system, y^*.

If there are persistent differences in technologies, then long run convergence to a steady state still takes place, but these steady states can differ, their characteristics being conditional on the differences in productive potentials. Where faster growth is also affected by other variables besides initial income levels, the convergence is said to be conditional: in other words, a poorer country or region may converge to a steady state that is different from that of the richer country or region. Thus, one can identify three possible scenarios: absolute convergence, where different entities are moving toward the same steady state, conditional convergence, where they are converging to (possibly very) different steady states, and divergence, where there is no evidence of convergence. The last case is inconsistent with neoclassical growth models, but conceivably fits some endogenous growth models. Conditional convergence is quite consistent with increasing disparities across entities. Variables such as literacy, health and physical infrastructure, as well as measures of the economic policies followed, can be used as conditioning variables. The conditioning variables themselves may be endogenous, but if one uses these variables at their initial values, they are predetermined over the growth period being studied, and one can posit a causal relationship. The empirical implementation of a convergence regression, allowing for the impact of different initial conditions, then takes the following form:

$$ln(y_{i,t}) - ln \ (y_{i,t-\tau}) = \gamma \ ln \ (y_{i,t-\tau}) + \Sigma^k_{j=1} \pi^j \ x^j_{\ it-\tau} + \mu_i + \varepsilon_{it}$$

Here, i denotes the cross-sectional units (countries, states, regions), τ the initial time period, t the final time period, the x^j are the various conditioning factors, and μ_i are possible additional fixed effects not captured by those factors. The parameter γ is approximately equal to the theoretical parameter λ, and therefore measures the rate of

convergence if negative, or divergence if positive. The final term is an error component, reflecting unobservable factors. All our empirical estimations are of this form, replacing per capita output with other per capita measures of economic performance: in a balanced growth scenario, these other measures will move together with output.

3. Results

We present results for conditional convergence regressions. Table 1 extends Table 10 in Singh et al. (2003) by replacing zonal dummies by individual state dummies. Andhra Pradesh is used as the base state, and its dummy variable is therefore omitted. The results are summarized in Table 1, with heteroskedasticity-robust standard errors reported in parentheses below coefficient estimates. All variables are changes in logarithms. Statistically significant coefficients are marked with asterisks. Of the five variables used to measure economic activity, two, namely petrol consumption and cereal production (each in per capita terms), indicate statistically significant evidence of conditional convergence. In each of the regressions, none of the economic variables used for conditioning are statistically significant, indicating that initial conditions measurable at the region level do not influence growth performance. These results match those in Table 10 of Singh et al. (2003).

The chief variables of interest, however, are the state level dummies. In a cross-section regression with state-level data, there is no scope to include such dummies. Here, we are able to examine the entire pattern of base-level growth differences across the states with dummies. We use Andhra Pradesh as the control state, as it is a state with an intermediate growth performance in the period under examination. Hence, each state dummy represents growth performance compared to Andhra Pradesh, controlling for all measurable effects with the data available. According to this criterion, we see that Assam, Odisha and Bihar are by far the worst performers among the states in the sample. All these states are in Eastern India. Odisha has statistically significant (at least at the 5% level) negative coefficients for all five of the variables, while the other two states have statistically significant coefficients for four of the variables – excluding deposits for Assam and cereal production for Bihar – though in each case the coefficients are still negative.

For each of Madhya Pradesh, Rajasthan and Uttar Pradesh, petrol consumption and credit are both negative and significant. Diesel and petrol consumption are both negative and significant for West Bengal. Gujarat, Haryana and Maharashtra each have a single negative and significant dummy coefficient among the five regressions, without any positive and significant coefficients. In the case of Kerala, the dummy in the cereal production regression is negative and significant, while the coefficient for the petrol consumption regression is positive and significant. The only other positive and significant coefficients are for Punjab in the cereal production regression, and for Himachal Pradesh in the diesel and petrol consumption regressions and the deposits regression. Overall, therefore, the picture that emerges from these regressions is consistent with the view of the Eastern states and the BIMARU states as the worst performers in terms of economic growth for the 1990s, as measured by our five partial indicators of activity.

Table 1: Regional convergence of development indicators with state dummies

Dependent Variable Independent Variable	Diesel Consumption	Petrol Consumption	Deposits	Credit	Cereal Production
Constant	0.28	0.21*	0.52***	0.70***	-0.21
	(0.16)	(0.11)	(0.15)	(0.18)	(0.45)
Diesel Consumption 1991	-0.11	0.14	-0.085	-0.17	-0.12
	(0.12)	(0.10)	(0.072)	(0.11)	(0.21)
Petrol Consumption 1991	0.059	-0.16***	-0.0068	0.13	-0.15
	(0.052)	(0.045)	(0.048)	(0.077)	(0.15)
Deposits 1991	-0.035	-0.027	0.029	0.049	0.043
	(0.11)	(0.046)	(0.079)	(0.11)	(0.38)
Credit 1991	-0.024	0.021	-0.070	-0.078	0.035
	(0.12)	(0.053)	(0.082)	(0.12)	(0.40)
Cereal 1991	-0.018	0.046	-0.044	-0.062	-0.28**
	(0.046)	(0.047)	(0.041)	(0.054)	(0.14)
Assam	-0.67***	-0.60***	-0.14	-0.41***	-0.70*
	(0.12)	(0.077)	(0.10)	(0.13)	(0.35)
Bihar	-0.35***	-0.53***	-0.35***	-0.55***	-0.59
	(0.11)	(0.069)	(0.096)	(0.15)	(0.39)
Gujarat	0.17	-0.020	0.058	-0.21**	-0.57
	(0.12)	(0.050)	(0.090)	(0.092)	(0.41)
Haryana	0.13	-0.35**	0.071	-0.18	0.42
	(0.13)	(0.15)	(0.12)	(0.17)	(0.29)
Himachal Pradesh	0.63***	0.36***	0.59***	0.025	-0.052
	(0.13)	(0.074)	(0.11)	(0.14)	(0.42)
Karnataka	0.049	-0.049	0.16	-0.028	0.065
	(0.082)	(0.068)	(0.091)	(0.11)	(0.24)
Kerala	0.023	0.19**	0.20	-0.079	-0.88***
	(0.087)	(0.080)	(0.10)	(0.11)	(0.30)
Madhya Pradesh	-0.18	-0.30***	-0.10	-0.25**	-0.075
	(0.10)	(0.052)	(0.084)	(0.097)	(0.21)
Maharashtra	-0.11	-0.16***	0.021	-0.11	-0.49
	(0.059)	(0.045)	(0.088)	(0.10)	(0.27)
Odisha	-0.24**	-0.21**	-0.50**	-0.80***	-0.41**
	(0.12)	(0.087)	(0.20)	(0.20)	(0.20)
Punjab	0.082	0.0054	-0.055	-0.22	0.89**
	(0.17)	(0.15)	(0.20)	(0.26)	(0.41)
Rajasthan	0.044	-0.16**	-0.086	-0.22*	-0.21
	(0.11)	(0.073)	(0.078)	(0.11)	(0.23)
Tamil Nadu	0.052	0.14	0.14	0.14	0.14
	(0.060)	(0.11)	(0.071)	(0.082)	(0.21)
Uttar Pradesh	-0.19	-0.40***	-0.15	-0.47***	-0.22
	(0.10)	(0.057)	(0.099)	(0.12)	(0.38)
West Bengal	-0.23**	-0.50**	-0.15	-0.18	-0.12
	(0.091)	(0.057)	(0.090)	(0.11)	(0.31)

Note: Standard errors are in parentheses; Significance levels: ***1%, **5%, *10%

Further understanding of the growth performance of regions comes from examining the residuals for the different regressions. Table 2 summarizes the five best and worst performing regions in terms of magnitudes of positive and negative residuals. A large negative residual indicates that a region does worse than would be predicted by the explanatory variables in the regressions. There is some degree of pairing among regions within states, for best and worst regions. This is a consequence of the inclusion of state level dummies in the regressions. However, the presence of certain states and not others within these extreme residuals is possibly indicative of greater disparities within these states relative to other states. Other possible factors are the size of the state (larger states being more heterogeneous, with more regions) and greater heterogeneity independent of size (e.g., Maharashtra may be especially heterogeneous in terms of urbanization and climatic variety). Perhaps the most important observation is that some regions are among the worst performers, *even controlling for the states they are in*. In particular, Odisha is the worst performer in terms of credit and deposits, with the largest negative dummy coefficients, and Coastal Odisha is the worst performer, even beyond the state average. Other cases of extreme outliers are Southern Odisha for diesel consumption and Western Haryana for petrol consumption.

Table 2: Five largest positive and negative residuals

Dependent Variable	Diesel Consumption	Petrol Consumption	Deposits	Credit	Cereal Production
Best Regions					
	Northern Madhya Pradesh	Southern Tamil Nadu	Northern Odisha	Northern Odisha	Inland Eastern Karnataka
	Plains Southern Gujarat	Inland Eastern Karnataka	Northern Punjab	Jharkhand	Saurashtra Gujarat
	Southern Rajasthan	Coastal Odisha	Coastal Maharashtra	Northern Punjab	South Western Andhra Pradesh
	Malwa Madhya Pradesh	Central Madhya Pradesh	Inland Northern Andhra Pradesh	Coastal Maharashtra	Inland Western Maharashtra
	Northern Odisha	Eastern Haryana	Plains Southern Gujarat	South Madhya Pradesh	Inland Northern Maharashtra
Worst Regions					
	South Madhya Pradesh	Chhattisgarh	Coastal Odisha	Coastal Odisha	Inland Eastern Maharashtra
	Plains Northern Gujarat	Coastal Northern Tamil Nadu	Southern Punjab	Uttarakhand	Plains Southern Gujarat
	Chhattisgarh	Inland Northern Karnataka	Inland Northern Karnataka	Coastal and Ghata Karnataka	Southern Uttar Pradesh
	North Eastern Rajasthan	Western Rajasthan	Central Madhya Pradesh	Southern Punjab	Inland Southern Andhra Pradesh
	Southern Odisha	Western Haryana	Plains Northern Gujarat	Chhattisgarh	Inland Northern Karnataka

In another extension of Singh et al. (2003), we now use data on personal consumption expenditure from the 50th and 55th rounds of the NSS, for rural, urban and all households.[7] While these data are for 1993-94 and 1999-2000, and not a decade apart, they can be used to perform convergence regressions with the same conditioning variables that were used above.[8]

Table 3: Convergence Regressions for Consumption Expenditure

	All Households	Rural Households	Urban Households
	2001 consumption expenditure (all)	2001 consumption expenditure (rural)	2001 consumption expenditure (urban)
1993 Consn. Exp. (all)	-0.00078* (0.0004)		
1993 Consn. Exp. (rural)		-0.00063 (0.0005)	
1993 Consn. Exp. (urban)			-0.0011** (0.0004)
1991 Deposit	-0.000038 (0.0002)	0.00032** (0.0002)	-0.00025 (0.0002)
1991 Credit	-0.00014 (0.0003)	-0.00095*** (0.0003)	0.00028 (0.0003)
1991 Cereal	-0.24* (0.1)	-0.28* (0.2)	-0.15 (0.1)
1991 Petrol	0.30*** (0.1)	0.32** (0.1)	0.28*** (0.10)
1991 Diesel	0.023 (0.02)	0.026 (0.02)	0.0087 (0.03)
Constant	0.24** (0.1)	0.17* (0.10)	0.52*** (0.2)
Observations	59	59	59
R-squared	0.28	0.29	0.38
F (6, 52)	4.75	8.19	3.77

Notes: All variables are per capita. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3 presents results without state dummies. The dependent variable is the change in the logarithm of per capita consumption expenditure. For rural and urban households combined, the conditional convergence coefficient is negative and statistically significant, but small in magnitude, indicating slow convergence. The financial variables are insignificant, while the measures of economic activity captured in petrol and diesel

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[7] There are issues with respect to differences in data collection methodology across rounds, but we believe the analysis is still valid, since we are examining cross-sectional variation, rather than time trends.

[8] We also ran regressions with credit and deposits as ratios of consumption expenditure instead of in per capita terms. This is more in line with typical measures of financial development as used in the literature on cross-country growth convergence. Our results were essentially the same. See Singh et al. (2010).

consumption are the expected sign, and, in the case, of petrol, significant. The coefficient of cereal production has the opposite sign, and is marginally significant.[9] For rural households alone, the evidence of conditional convergence is statistically insignificant. The financial variables have the opposite signs to what would have been expected (though this may be consistent with overall credit in a region being more reflective of urban credit). The other variables have coefficient signs, magnitudes and significance similar to the regression for all households. For urban households, the evidence for conditional convergence of consumption expenditure is somewhat stronger, and the financial variables have signs more in keeping with expectations.

Table 4 presents results corresponding to Table 3, but now including state-level dummies as well. The conditioning variables have effects roughly similar to the previous regression. As one would expect, now the conditional convergence speeds are somewhat higher, as a result of controlling for different base growth rates through the state dummies. The omitted dummy is again for Andhra Pradesh. Only one of the state dummies is significant for urban households, but several are significant for rural households, and that holds true even more for the combined data. This is suggestive that differences across states in growth of per capita consumption expenditure – controlling for initial conditions – were greater for rural households in the 1990s. However, the pattern of negative state dummies for eastern and BIMARU states does not show up in Table 4 as it did in Table 1, so that from the perspective of household consumption, the 1990s did not seem to exhibit increasing regional disparities.

We again examine the outliers in terms of residuals, to see if there is any discernible pattern among the regions, *after* controlling for the measured factors we have used. These results are presented in Table 5. Comparing this with Table 2, we see that the pattern of best and worst districts is quite similar for consumption expenditure as for the other variables measuring economic activity. In this case, one has the additional finding that the overall results are driven in most cases by the performance of the rural economy – this is exactly what one would expect at this level of geographic aggregation, and is a result that is difficult or impossible to obtain with state-level data.

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[9] This result is consistent with that of Ghate and Wright (2011), which suggests the agricultural sector has been a drag on growth. They use a very different methodology and state-level data, however.

Table 4: Convergence Regressions with State Dummies

	All Households	Rural Households	Urban Households
	2001 consumption expenditure (all)	2001 consumption expenditure (rural)	2001 consumption expenditure (urban)
1993 Consn. Exp. (all)	-0.0018***		
	(0.0004)		
1993 Consn. Exp. (rural)		-0.0020***	
		(0.0004)	
1993 Consn. Exp. (urban)			-0.0021***
			(0.0003)
1991 Deposit	-0.000091	0.00029**	-0.00021
	(0.0001)	(0.0001)	(0.0002)
1991 Credit	0.00016	-0.00078***	0.00024
	(0.0003)	(0.0003)	(0.0003)
1991 Cereal	-0.46	-0.28	-0.22
	(0.3)	(0.3)	(0.3)
1991 Petrol	0.29**	0.26**	0.44***
	(0.1)	(0.1)	(0.1)
1991 Diesel	0.033	0.048***	0.010
	(0.02)	(0.02)	(0.02)
Assam	0.048	0.13	0.12*
	(0.08)	(0.09)	(0.07)
Bihar	0.041	0.11	-0.090
	(0.08)	(0.1)	(0.06)
Gujarat	0.065	0.13	0.011
	(0.09)	(0.09)	(0.08)
Haryana	0.36*	0.36	0.074
	(0.2)	(0.2)	(0.2)
Himachal Pradesh	0.40***	0.48***	0.64***
	(0.07)	(0.09)	(0.1)
Karnataka	0.11	0.21**	-0.028
	(0.08)	(0.1)	(0.07)
Kerala	0.27**	0.44***	0.025
	(0.1)	(0.1)	(0.1)
Madhya Pradesh	0.042	0.056	0.0077
	(0.08)	(0.10)	(0.06)
Maharashtra	0.070	0.11	-0.0088
	(0.07)	(0.09)	(0.08)
Odisha	-0.045	0.0026	-0.077
	(0.1)	(0.1)	(0.08)
Punjab	0.29	0.20	0.0055
	(0.3)	(0.3)	(0.2)
Rajasthan	0.14*	0.18**	0.057
	(0.07)	(0.09)	(0.07)
Tamil Nadu	0.17**	0.19**	0.14
	(0.08)	(0.08)	(0.09)
Uttar Pradesh	0.16*	0.20*	-0.010
	(0.09)	(0.1)	(0.06)
West Bengal	0.13*	0.19**	0.13
	(0.08)	(0.09)	(0.08)
Constant	0.47***	0.34**	0.84***
	(0.1)	(0.1)	(0.1)
Observations	59	59	59
R-squared	0.62	0.67	0.70
F (20, 37)	4.75	8.19	3.77

Notes: All variables are per capita. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Five largest positive and negative residuals (consumption regressions)

Dependent Variable	Consumption expenditure All households	Consumption expenditure Rural households	Consumption expenditure Urban households
Best Regions			
	Coastal Andhra Pradesh	Coastal Andhra Pradesh	Southern Tamil Nadu
	Coastal Odisha	Coastal Odisha	Eastern Maharashtra
	Central Madhya Pradesh	Inland Eastern Karnataka	Southern Rajasthan
	Southern Tamil Nadu	Southern Uttar Pradesh	Plains Southern Gujarat
	Plains Southern Gujarat	South Western Madhya Pradesh	Southern Kerala
Worst Regions			
	Eastern Gujarat	Southern Odisha	Inland Central Maharashtra
	South Madhya Pradesh	South Madhya Pradesh	South Eastern Rajasthan
	Southern Odisha	Eastern Gujarat	Inland Tamil Nadu
	South Western Andhra Pradesh	Chhattisgarh Madhya Pradesh	Northern Kerala
	Chhattisgarh Madhya Pradesh	Inland Southern Andhra Pradesh	Himalayan West Bengal

4. Conclusions

Recent economic policy in India has emphasized the idea of inclusive growth. In some ways, this is a return to the pre-liberalization conceptual framework, in that equity across the country and reduction of rural poverty have been receiving greater attention. There has always been a governmental apparatus for addressing these issues, but they became more pressing when market-oriented economic reforms seemed to exacerbate inequalities, including regional inequalities. Much of the evidence for these trends came from very micro studies, or alternatively from comparisons across states through growth convergence regressions. While the states are important political and policy-making entities, they are also large enough that focusing on state-level trends can miss out on more localized problems of relative or even absolute economic stagnation.

Examining growth at the levels of NSS regions allows one to identify more closely the areas of good and poor performance within India. We can summarize the results for the region-level data as follows. We estimated convergence regressions using various measures of economic activity: petrol and diesel consumption, bank deposits and credit, and cereal production. These partial measures indicate no strong evidence of conditional convergence or divergence across the 59 agro-climatic regions in the sample, for the period of the 1990s. However, several states have significantly negative dummy coefficients, indicating that their performance is markedly below that of the benchmark state (Andhra Pradesh), and these states are chiefly the poorer ones (Bihar, Odisha and Uttar Pradesh). We are also able to identify regions which are the worst performers in the sense of being furthest below the regression line (and therefore doing worse than would

be predicted based on initial conditions as measured): these are chiefly, though not exclusively, in poorer states, or likely to be poorer regions of states.

We also examined economic performance as measured by per capita consumption expenditure. Consumption expenditure is an appealing measure of well-being, though it is not the outcome variable that fits with the standard growth model – that would be income, which includes saving as well. In contrast to simple inequality measures, which suggest that urban inequality has been increasing, here we find that the strongest conditional convergence effect occurs for urban households in the 1990s. Conditional convergence for rural households is statistically insignificant, but for all households combined, the convergence result is still quite strong.

Of the conditioning variables, the only strong and clear effect comes from initial petrol consumption, which may plausibly be an indicator of the quality and quantity of road infrastructure in the regions. The financial variables are either insignificant, or sometimes have the wrong signs (compared to what would be expected) for rural households – this might be an indication of problems with channeling credit to rural areas for improving standards of living, or it may simply be an indicator that bank credit is not meant to improve rural consumption outcomes. Nevertheless, the negative and significant coefficient bears further investigation. With regard to state-level performance relative to the benchmark, the signs of the dummy coefficients are now actually less of a cause for concern: there are no negative and significant coefficients, and some of the poorer states have positive dummy coefficients. The worst regions in terms of residuals, however, do seem to be similar to the regressions using partial measures of economic activity.

The results in this paper extend those of Singh et al. (2003), but for the same time period as the earlier study. A natural future extension will be to consider more recent data, to understand the effects of policy changes and possible catching up in the later period. Another topic for future research should be to reconcile the results reported here with studies that use approaches other than that of estimating convergence regressions.

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