

A Tale of Two States: Maharashtra and West Bengal¹

AMARTYA LAHIRI

KEI-MU YI

University of British Columbia

Federal Reserve Bank of Philadelphia

October 2004

This Version: August 2007

¹ We would like to thank Satyajit Chatterjee, Hal Cole, Narayana Kocherlakota, Ayhan Kose, Andy Neumeier, as well as participants at the Iowa Development conference, Midwest Macroeconomics conference, SED conference, NBER EF&G Growth Group meeting, Drexel U., Federal Reserve Bank of Philadelphia, Georgetown U., Iowa State U., ISI Delhi, U. of Maryland, U. of British Columbia, U. of Southern California, Williams College, the World Bank, the U. of Houston, and the IMF for detailed comments and discussions. We also thank the editor and two anonymous referees for very helpful comments. Robin Burgess kindly provided the data in Besley and Burgess (2004). Behzad Kianian, Matthew Kondratowicz, Katya Vasylaky, and especially Edith Ostapik provided excellent research assistance. The views expressed here do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. Lahiri: Department of Economics, University of British Columbia, 997-1873 East Mall, Vancouver, BC V6T 1Z1; alahiri@interchange.ubc.ca. Yi: Research Department, Federal Reserve Bank of Philadelphia, 10 Independence Mall, Philadelphia, PA 19106; kei-mu.yi@phil.frb.org.

Abstract

In this paper we study the decline of West Bengal relative to Maharashtra, historically two of the most important states of India. In 1960, West Bengal's per capita income exceeded that of Maharashtra, the third richest state at the time. By 1993, it had fallen to just 69 percent of Maharashtra's per capita income. We employ a "wedge" methodology based on the first order conditions of a multi-sector neoclassical growth model to ascertain the output and factor market sources of the divergent economic performances. Our diagnostic analysis reveals that a large part of West Bengal's development woes can be attributed to: (a) low sectoral productivity, especially in manufacturing and services; and (b) sectoral misallocation in labor and capital markets between the manufacturing sector and the other sectors of the economy. We also present evidence on the labor market, the manufacturing sector, and public infrastructure that suggest a systematic worsening of the business environment in West Bengal during this period.

KEYWORDS: West Bengal, Indian states, development, wedges

JEL CLASSIFICATION: O11, O14

1 Introduction

In 1960, two of the three richest states in India were Maharashtra and West Bengal. Maharashtra, home state of Mumbai (Bombay), and West Bengal, home state of Kolkata (Calcutta), were centers of commerce and industry. In addition, West Bengal had the social and physical infrastructure that came with Calcutta's past as the long-standing capital of the British empire. Over the next three and a half decades, West Bengal significantly under-performed relative to Maharashtra. West Bengal grew at less than half the rate of Maharashtra (1.1 percent versus 2.4 percent) so that by 1993, its per capita output had fallen almost 35 percent relative to Maharashtra's.

For a pair of regions at the right tail of the state per capita income distribution – moreover, they had a similar sectoral distribution of output in 1960 – to diverge at such a rate for almost 35 years is remarkable in and of itself. What makes the experience of West Bengal and Maharashtra even more remarkable is that these two regions are located within the same country and, as such, are subject to the same national fiscal and monetary policies, as well as the same international trade and capital flow policies.

The purpose of this paper is to better understand the steep decline of West Bengal relative to Maharashtra and to shed light on the broad output and factor market forces that have been the proximate sources of the decline. In our view, this examination is a necessary step toward the ultimate goal of ascertaining the state-specific policies, institutions, and/or degree of implementation of national policies that are the root causes of West Bengal's underperformance. Viewed from the broader context of empirical research on growth, we believe that a state-level analysis delivers sharper implications for the forces that matter and the forces that do not matter than the typical cross-country analysis.¹ We investigate West Bengal's performance *relative* to Maharashtra,

¹This is primarily because more and better data are available. For example, compared to cross-country analysis, state-level analysis involves data collection methodologies that are in principle identical. This reduces the chances that measurement error is confounding the results.

because the comparison controls for any national or federal policies that were enforced similarly across the two states. This helps narrow the set of proximate sources of the decline, as well as focus the search for the root causes.

A natural approach would be to collect data on the two states' performance, as well as data on potential proximate causal factors, such as measures of investment, education, physical infrastructure, social infrastructure, institutional quality, etc., and then to run a standard growth regression. However, such a study would run into the difficulty that arises with a limited number of observations (about 35) and a large number of potential variables. In addition, as we alluded to above, a key difference between the two states may lie in differences in enforcement of national policies. This would be difficult to ascertain in the data.

Consequently, we conduct in our main analysis a model-based diagnostic exercise. We derive the optimality conditions from a frictionless, multi-sector neo-classical growth model. If optimality holds, then the ratio of the left-hand side to the right-hand side of a first order condition should be one. To the extent this ratio does not equal one, a "wedge" exists. The exercise is aimed at detecting the sources of the frictions or distortions that may have been responsible for the differential performance of the two states. The multi-sector environment allows us to measure wedges in factor allocations across sectors, in addition to intertemporal wedges.

Our methodology extends the wedge methodologies developed by Chari, Kehoe, and McGrattan (2004), Cole and Ohanian (2004), and especially Mulligan (2005).² The distinguishing features of our work are that we use a multi-sector model, and we focus on long-term trends. The other papers use a single sector framework and partially or wholly focus on the business cycle.

We find that the marginal product of capital in West Bengal's service sector and agricultural sector grew at a considerably more rapid rate than it did in the manufacturing sector - relative to the corresponding comparison in Maharashtra. Similarly, the marginal product of labor in West Bengal's

²This methodology is related to work by Ingram, Kocheerlakota, and Savin (1994) and by others.

service and agricultural sectors also grew at a more rapid rate than it did in the manufacturing sector. Hence, there was an increasingly large intratemporal misallocation of capital and labor between the manufacturing sector on the one hand and the services and agricultural sectors on the other. In addition, we find that West Bengal's productivity relative to Maharashtra's fell sharply in both manufacturing and services. By contrast, the investment wedge from the intertemporal Euler equation was much smaller and relatively stable over our sample period. Similarly, labor allocation distortions between agriculture and services were not large.

For our two states, it is difficult to find policies that correspond exactly to our wedges. Nevertheless, we provide evidence suggesting several policies or regulations that might matter. For the manufacturing sector, we examine wage data, strikes and lockout data, as well as compositional shifts between the formal manufacturing sector and the informal manufacturing sector. These data suggest that increased burdens were placed on the formal sector in West Bengal by labor and industrial regulations. In addition, we show that public investments in human capital and physical capital lagged in West Bengal; this suggests inefficient use of fiscal resources. Overall, our evidence points to a systematic worsening of the business environment in West Bengal relative to Maharashtra.

While there is a vast empirical literature on India dating back to its independence in 1947, only a small subset of it examines differences across Indian states. Perhaps the closest paper to ours is Besley and Burgess (2004) [8]³. [8] study the importance of labor regulations in the evolution of the manufacturing sector across Indian states. Based on a detailed study of state-specific amendments to national labor regulations, [8] construct an index that classifies each state as pro-labor, neutral or pro-employer. They find that pro-labor legislation reduced growth of manufacturing output, investment, and employment. While our results are consistent with the findings of [8], we note that

³Several other recent papers have also examined the differential performance of Indian states. These include Ahluwalia (2001), Bandyopadhyay (2003), Kochar *et al* (2006), and Purfield (2006). However, with the exception of Bandyopadhyay, their focus is on India's performance after 1980 or later.

their index classifies both West Bengal and Maharashtra as pro-labor. Hence, their index is not directly informative about the relation between labor regulations and the different development patterns in these two states. In addition, as stated above, we find from our multi-sector analysis that both services productivity and manufacturing productivity declined significantly.

We conclude that explanations for West Bengal's decline must simultaneously account for low productivity growth in services and manufacturing, and an intersectoral misallocation of factors associated with the manufacturing sector. In other words, explanations that focus on TFP alone or on investment frictions alone will not be sufficient. We believe our conclusions will inform the selection of driving forces for the theoretical and the empirical research that seek to explain the decline.

In the next section we document two key facts about the two states; we also show that West Bengal's decline is unusual, although not unique. In section 3, we lay out and use a multi-sector model to conduct diagnostic tests on data from the two states. Section 4 discusses our findings in light of two possible proximate explanations for West Bengal's decline. The final section concludes. Details regarding our data sources as well as on how we construct our variables are provided in the data appendix.

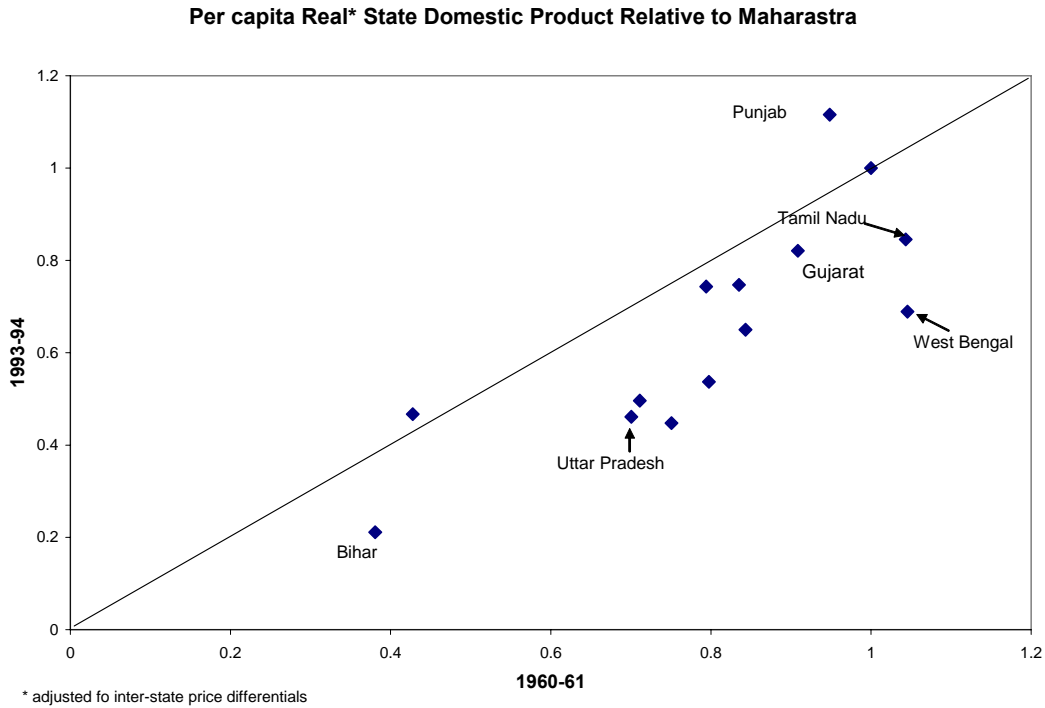
2 Two Facts

In this section we present two facts. We first illustrate the magnitude of the decline in West Bengal's per capita net state domestic product (NDP) relative to that of Maharashtra. We examine this decline relative to several other cross-state and cross-country episodes. Then, we present the time series of sectoral shares - agriculture, manufacturing, and services - of output.

Figure 1 shows the state-level distribution of per capita NDP in 1960 and 1993, expressed relative to Maharashtra.⁴ The process of putting together this data is discussed in detail in the

⁴Data from Table 27 of the OECD publication "National Accounts of Less Developed Countries" (1967) suggests that in the 1950s West Bengal was the richest state in both 1950 and 1955. Maharashtra was rich as well (data on

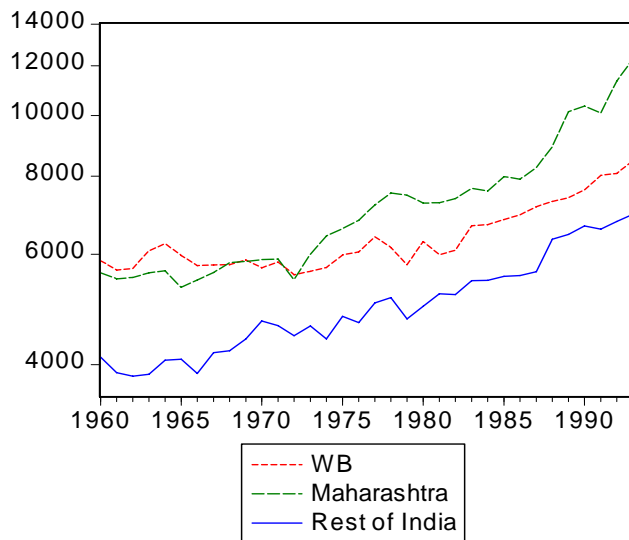
Figure 1: Real per capita income relative to Maharashtra; major Indian states, 1960 and 1993



data appendix. Broadly, there were three main steps, splicing together several overlapping real NDP series, dividing these series by population, and multiplying them by a price adjustment factor to facilitate cross-state comparisons. In 1960, West Bengal was the richest state in India, with a per capita income about five percent higher than that of Maharashtra, which was the third richest state. However, by 1993, West Bengal’s per capita income had fallen to just 69 percent of Maharashtra’s. Meanwhile, Maharashtra became the second richest state. In addition, the fall in West Bengal’s relative income was the largest drop in percentage point terms across all the states.

In Figure 2, we plot the time series evolution of the per capita NDP of Maharashtra, West Bengal, and the rest of India. The figure suggests that the decline in the relative per capita income of West Bengal has been going on for decades, and that even as West Bengal is losing relative income to Maharashtra are imputed as the state did not exist in the 1950s). This suggests that using 1960 as a starting point will not bias our findings in any significant way.

Figure 2: Per Capita NDP: Maharashtra, West Bengal, rest of India, 1993-94 prices



ground to Maharashtra, the rest of India is catching up to West Bengal.⁵

It is not easy to find similar cases involving two regions within the same country. Grouping the Barro and Sala-i-Martin (1992, 1995) U.S. states data into the nine U.S. Census "divisions", we find that, in 1963, the top three divisions in per capita income were Pacific, East North Central (Michigan, Illinois, Indiana, Ohio, and Wisconsin), and Middle Atlantic. In the ensuing 23 years, the average annual growth rates in these divisions ranged from 1.5 to 2.1 percent per year. The gap between the largest and smallest growth rates, 0.6 percent per year, is less than half of the growth difference between West Bengal and Maharashtra. China is perhaps the most natural comparison to India. Using data from the China Data Center, University of Michigan, we find that of the five richest provinces in 1985 (excluding Beijing, Tianjin, and Shanghai, which are essentially just cities - these were the three richest provinces in both 1985 and 2005), three provinces grew 9.5 to 10.0 percent per year over the next 20 years, while the other two grew only about 7 percent per

⁵It is worth pointing out that population has followed very similar paths in West Bengal and Maharashtra. West Bengal's population has been between 86 and 88 percent of Maharashtra's between 1961 and 1993. So differences in per capita NDP performance cannot be attributed to unusual population dynamics.

year. So, China exhibited divergence as well, although 7 percent growth is still a very good growth performance.

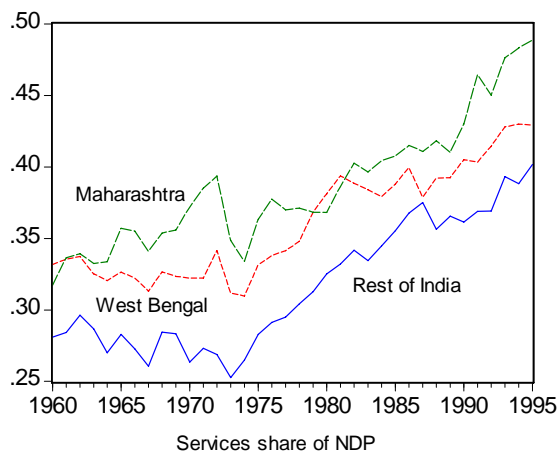
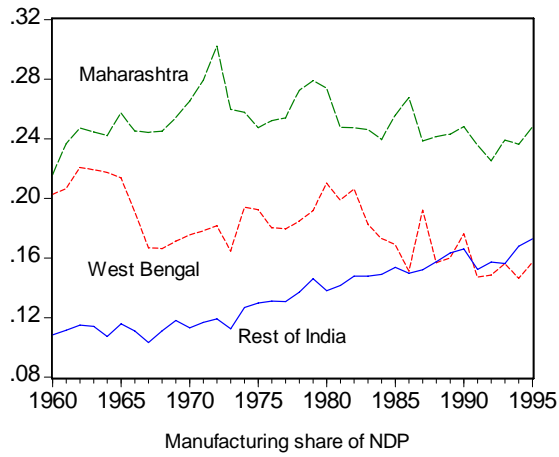
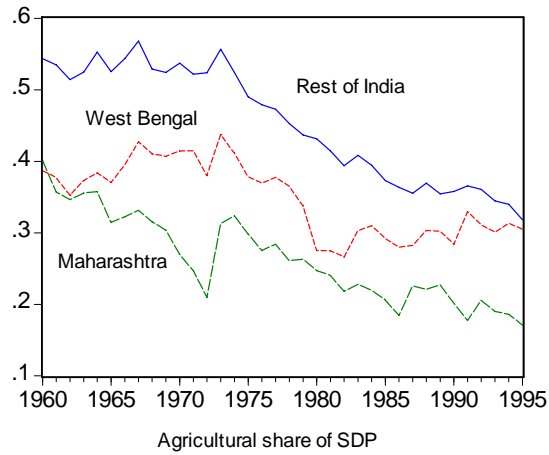
It is also not easy to find similar cases from the cross-country data. As pointed out by Kehoe and Ruhl (2003), there are a few examples like New Zealand and Switzerland which showed 40 percent declines in per capita incomes relative to the USA between 1960 and 2000. However, New Zealand (4 million people in 2000) and Switzerland (7 million) are tiny when compared with West Bengal (80 million) and Maharashtra (97 million).

In Figure 3, we present the agriculture, manufacturing, and services share of (current price) NDP for the two states, as well as the rest of India, for the period 1960-1995.⁶ There are three noteworthy patterns. First, in 1960, the two states were very similar in their sectoral composition of output. Second, the evolution of the agriculture and manufacturing shares over time was vastly different in West Bengal from Maharashtra. Thus, agriculture's share of output declined much more in Maharashtra, where it fell from 40 percent to 17 percent between 1960 and 1995. In West Bengal, on the other hand, the agricultural share declined from 39 percent to only 30 percent during the same period. The contrasting sectoral behavior of the two states is more evident in manufacturing. In Maharashtra manufacturing increased its share of output between 1960 and 1995 from 22 percent to 25 percent, while in West Bengal the manufacturing share of output declined from 20 percent to 16 percent during this period – a process of *de-industrialization*. Third, the figure makes clear that the sectoral trends of Maharashtra have been similar to the trends for the rest of India; that is, West Bengal appears to be the state whose sectoral behavior has been atypical.

To summarize, in this section we have documented that between 1960 and 1995, West Bengal's per capita income fell by about 35 percent relative to Maharashtra's (or put differently, Maharashtra gained about 50 percent relative to West Bengal). We have also seen that the two states experienced

⁶The shares of the three sectors do not add up to one, because our break-out does not include mining, forestry, fishing, construction, and electricity.

Figure 3: Sectoral share of output



sharply different evolutions of agriculture’s share of total output and manufacturing’s share of total output starting from an initial condition of very similar sectoral shares.⁷ These patterns motivate our use of Maharashtra as a control and of a model with multiple sectors.

3 Model-Based Diagnostics

We now turn to a model-based diagnostic exercise to learn more about the output and factor market forces that contributed significantly to West Bengal’s decline. We first write down a frictionless, multi-sector version of the neoclassical growth model. We derive the first order conditions of this model, and then use the West Bengal and Maharashtra data to compute the deviations from the first order conditions. We then examine the implications of these deviations.⁸

3.1 Multi-sector model

Consider an economy (country) composed of a number of states. The representative household in each state maximizes the present discounted value of lifetime utility with instantaneous utility given by:

$$u(c, l) = \log c + \psi \log(\bar{l} - l)$$

where c is consumption per person, l is labor supply (hours worked), and \bar{l} is the total endowment of labor hours available to the agent. The agent’s budget constraint each period is:

$$c_t + k_{t+1} = w_t l_t + (r_t + 1 - \delta)k_t$$

⁷We examined the sectoral composition of manufacturing, comparing 1979 to 1995. In West Bengal the composition remained relatively unchanged, suggesting that a large shock to one particular manufacturing sector did not drive the overall manufacturing performance.

⁸We should emphasize that the model is not intended to be a description of the true model for these two states. Instead, it is intended as a diagnostic tool to determine the key features of the true underlying model. The primary strength of this approach lies in the well-identified weaknesses of the frictionless environment. In particular, any measured deviation of the data from the optimal levels implied by the first order conditions of the frictionless environment identifies a well-defined market friction.

where k is the capital stock per person, δ is the depreciation rate, w is the wage rate, and r is the rental rate on capital. The final good is the numeraire good so that all prices are expressed in units of the final good.

Each state produces three intermediate, sectoral outputs – agriculture, manufacturing and services, and a non-traded final good. Labor and capital are costlessly mobile across sectors. The three sectoral outputs are produced according to the following technologies:

$$y_m = k^\alpha (x_m l_m)^{1-\alpha}$$

$$y_a = k^\nu (x_a l_a)^\mu$$

$$y_s = k^{1-\sigma} (x_s l_s)^\sigma$$

where y_j is total output of good $j = a, m, s$. x_j ($j = a, m, s$) is the level of the labor augmenting technology factor. The final good is produced by combining the sectoral goods:

$$y = \hat{y}_s^\theta \hat{y}_m^\gamma \hat{y}_a^{1-\gamma-\theta}$$

y is the output of the final good; \hat{y}_j denotes the use of good $j = a, m, s$ in producing the final good.

The non-traded final good is consumed or invested:

$$y_t = c_t + k_{t+1} - (1 - \delta)k_t$$

Perfectly competitive firms in each sector maximize profits taking prices as given:

$$\Pi_t^m = p_{mt} y_{mt} - w_t l_{mt} - r_t k_{mt}$$

$$\Pi_t^a = p_{at} y_{at} - w_t l_{at} - r_t k_{at}$$

$$\Pi_t^s = p_{st} y_{st} - w_t l_{st} - r_t k_{st}$$

$$\Pi_t = y_t - p_{mt} \hat{y}_{mt} - p_{at} \hat{y}_{at} - p_{st} \hat{y}_{st}$$

In the next section, we will use the first order conditions from the household and sectoral firm's maximization problems to develop our wedges.

3.2 Data, Wedges and Parameters

Ideally, we would have data that would enable us to make use of all of the household and firm maximization first order conditions. However, there are some data limitations. The most prominent is the absence of official data on state-level capital stocks for the agriculture and services sectors. Consequently, we impute these two capital stocks using national data on agriculture and services capital stocks, as well as the assumption that the state share of the national capital stock in a sector equals the state share of national output in that sector. Further details are provided in the data appendix. This assumption implies that capital/output ratios are essentially equated within agriculture across states, and also within services across states. In addition, we do not have measures of rental rates on capital or real interest rates at the state or sectoral level, and we have measures of wages only for the manufacturing sector. Consequently, we substitute the value marginal product of labor (VMPL) and the value marginal product of capital (VMPK) for wages and rental rates, respectively. Details on the other data we use are also provided in the data appendix.

The household's first order conditions imply that the marginal rate of substitution between labor and leisure equals the VMPL, and that the intertemporal marginal rate of substitution equal the $VMPK + 1 - \delta$. Following Cole and Ohanian (2004), Chari, Kehoe, and McGrattan (2004), and Mulligan (2005), for each first order condition, we divide one side of the equality by the other side to get a measure of the deviation of that condition from the optimum. These deviations are called "wedges":

$$\omega^{l,i} = \frac{\frac{\chi c_t}{l-l_t}}{(1-\alpha)p_{mt} \frac{y_{mt}}{l_{mt}}}$$

$$\omega_t^{I,i} = \frac{c_{t+1}^i}{c_t^i \beta} \left[\frac{1}{\alpha p_{mt+1} \frac{y_{mt+1}}{k_{mt+1}} + 1 - \delta} \right]$$

$\omega^{l,i}$ is the wedge in the optimal labor-leisure condition with values less than one indicating that the

marginal product of labor is higher than the marginal disutility from labor.⁹ $\omega^{l,i}$ is the wedge in the intertemporal Euler equation with a number below one indicating that savings are sub-optimally low.¹⁰

The firms' sectoral first order conditions imply that the VMPK and VMPL should be equated across sectors. We construct sectoral capital allocation wedges by dividing one sector's VMPK by the other sector's VMPK, and similarly for labor:

$$\begin{aligned}\omega_t^{k,as,i} &= \frac{p_{at}}{p_{st}} \frac{v y_{at}/k_{at}}{(1-\sigma)y_{st}/k_{st}} \\ \omega_t^{k,sm,i} &= \frac{p_{st}}{p_{mt}} \frac{(1-\sigma)y_{st}/k_{st}}{\alpha y_{mt}/k_{mt}} \\ \omega_t^{l,as,i} &= \frac{p_{at}}{p_{st}} \frac{\mu y_{at}/l_{at}}{\sigma y_{st}/l_{st}} \\ \omega_t^{l,sm,i} &= \frac{p_{st}}{p_{mt}} \frac{\sigma y_{st}/l_{st}}{(1-\alpha)y_{mt}/l_{mt}}\end{aligned}$$

where $i = \text{West Bengal, Maharashtra}$. $\omega^{k,sm,i}$ is the wedge in the condition for optimal capital allocation between services and manufacturing; $\omega^{k,as,i}$ is the wedge in the condition for optimal capital allocation between agriculture and services. Similarly, $\omega^{l,as,i}$ is the wedge in the condition for optimal labor allocation between agriculture and services and $\omega^{l,sm,i}$ is the wedge for labor allocation between services and manufacturing. A number less than one for the latter wedge, for example, would indicate that the VMPL in manufacturing is too high or that the VMPL marginal product of labor in services is too low. Note that the wedge in the optimal labor allocation condition between agriculture and manufacturing is given by the product of $\omega_t^{l,as,i}$ and $\omega_t^{l,sm,i}$.

⁹Note that the measurement of the wedge in the optimal labor-leisure condition, $\omega^{l,i}$, is itself sensitive to the wedges in the inter-sectoral labor allocation conditions. Thus, if $\omega^{l,sm,i}$ is systematically different from unity then the measured $\omega^{l,i}$ would depend on whether we use the value marginal product of labor in agriculture, manufacturing, or services in the denominator of the expression for $\omega^{l,i}$.

¹⁰Because we have substituted $\text{VMPK} + 1 - \delta$ for the rental rate, assessing whether or not the Euler equation holds is actually a joint assessment of the Euler equation and the manufacturing firm's optimal capital conditions holding simultaneously.

We also calculate the sectoral productivities in labor augmenting form:

$$X_{at} \equiv x_{at}^{\mu} = \frac{y_{at}}{k_{at}^{\nu} l_{at}^{\mu}} \quad (1)$$

$$X_{mt} \equiv x_{mt}^{1-\alpha} = \frac{y_{mt}}{k_t^{\alpha} l_{mt}^{1-\alpha}} \quad (2)$$

$$X_{st} \equiv x_{st}^{\sigma} = \frac{y_{st}}{k_{st}^{1-\sigma} l_{st}^{\sigma}} \quad (3)$$

Note that the productivity term captures, in addition to TFP, human capital and all other forces that are not captured by labor and our measures of physical capital. Hence, to the extent that forces like credit constraints, social networks, and lack of appropriate regulations lead to inefficiently low human capital and/or an inefficiently low capital/output ratio, it will show up in the productivity numbers for these two sectors.¹¹

We should also note that by focusing only on the wedges listed above we can be agnostic about our assumptions on trade between states. In computing the wedges, we use data on state-level sectoral prices. These are the prices that economic agents were facing when they were making their economic decisions. These prices could potentially have come from a free trade regime or from some more restricted trading regime.

We parameterize the model as follows:

¹¹See, for example, Banerjee and Duflo (2004) and Banerjee and Munshi (2004). These papers discuss how misallocation at the micro level can lead to aggregate shortfalls in investment and capital.

Parameter	Description	Value
α	Manufacturing capital share	0.3
μ	Agriculture labor share	0.45
v	Agriculture capital share	0.25
σ	Services labor share	0.7
θ	Share of services in aggregate output	0.4
γ	Share of manufacturing in aggregate output	0.2
β	Preferences discount factor	0.96
\bar{l}	Annual endowment of hours	5000 hours
ψ	Weight on leisure in utility function	2.24
δ	Capital depreciation rate	0.04

The parameter values for β and δ are standard for a calibration to annual data. ψ and \bar{l} are taken from Chari, Kehoe, and McGrattan (2004). We picked θ and γ , the shares of services and manufacturing in aggregate output based on the average shares of these sectors in aggregate output in these two states during the period 1960-95. The parameters α , μ and σ are more problematic because we do not have estimates of these parameters. We set $\alpha = 0.3$ and $\sigma = 0.7$ based on Abler, Tolley, and Kripalani (1994) who estimated the capital share of the non-agricultural sector to be 0.3. Interestingly, this number is close to the labor share computed by Gollin (2002) for India as a whole. [1] also estimated the labor share in Indian agriculture to be 0.45 and the capital share in agriculture to be 0.25; these are the parameters we chose for μ and v .

3.3 Results

Figures 4-7 show the evolution of the capital allocation wedge, the two sectoral labor allocation wedges, and the Euler equation wedge, respectively from 1960 to 1995. In all four figures we measure the state-specific wedges on the left axis and the relative wedge (measured as the ratio of the West Bengal wedge to the Maharashtra wedge) on the right axis. Because our primary interest

is the evolution of these two states between 1960 and 1995, we normalize the wedges by their 1960 values. Hence, all wedges equal one in 1960.

Figure 4 shows the wedge for optimal capital allocation between services and manufacturing. It indicates that each state's wedge and the relative wedge fluctuated over time. However, between roughly 1980 and 1995, the relative wedge increased sharply, reaching 1.81 in the final year. In other words, the ratio of the VMPK in the services sector to the manufacturing sector was 81 percent higher in West Bengal than in Maharashtra in 1995 compared to 1960. Over the entire period, the ratio was on average about 14 percent higher in West Bengal than in Maharashtra. We conclude that capital misallocation between services and manufacturing is important in understanding the differential performance of the two states, especially in the last decade.

The wedge for optimal capital allocation between agriculture and services is much smoother than between services and manufacturing. The average for West Bengal relative to Maharashtra over 1960-95 was 1.04, and in 1995, the value was just 2 percent lower than it was in 1960.¹² Note that the capital allocation wedge between agriculture and manufacturing is the product of the above two wedges. This implies that both capital allocation wedges involving manufacturing showed sharply increasing distortions over time with the VMPK of manufacturing declining relative to the VMPK in agriculture and services.

Figure 5 shows that the wedge for optimal labor allocation between agriculture and services behaved similarly in the two states for most of the period. The relative wedge in the first 10 years of our sample was 1.07, and it was 1.08 in the last 10 years of our sample. Moreover, the average value of the relative wedge during the period 1960-95 was 1.04, i.e., just 4 percent higher than the level in 1960. Thus, labor misallocation between agriculture and services does not seem to be an important factor in understanding the differential performance of the two states, especially relative to capital misallocation between services and manufacturing.¹³

¹²To save space we have not included the here. It is available from the authors on request.

¹³The un-normalized value of the agriculture-services wedge is close to 0.2 and 0.1 in 1960 for West Bengal and

Figure 4: Capital allocation wedge between services and manufacturing

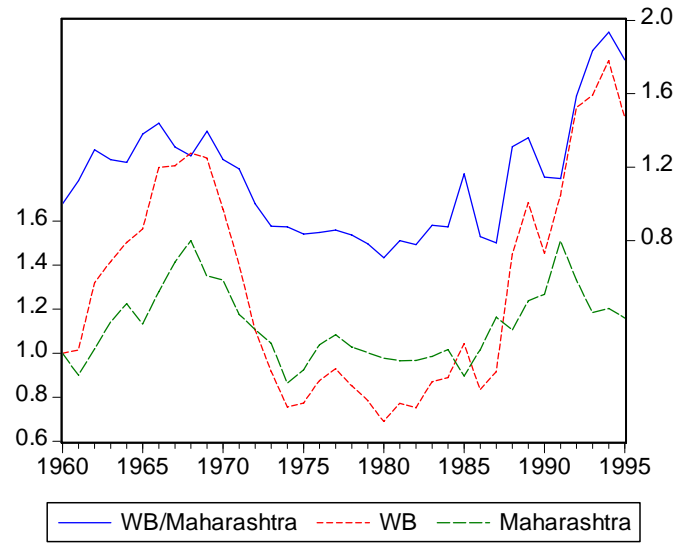


Figure 5: Labor allocation wedge between agriculture and services

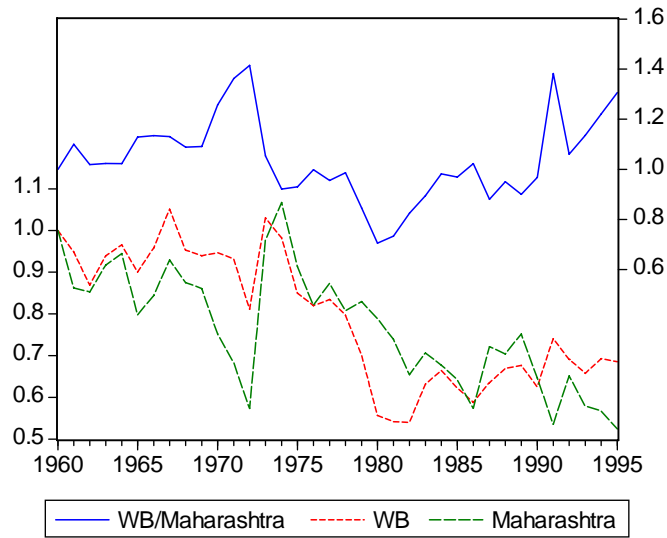


Figure 6 shows that the wedge for optimal labor allocation between services and manufacturing moved in opposite directions in Maharashtra and West Bengal between 1960 and 1995. While this wedge declined in Maharashtra, it increased in West Bengal for most of this period. That is, relative to services labor, manufacturing labor was becoming more productive in Maharashtra during our sample period, while becoming relatively less productive in West Bengal. The end result of these movements was that by 1995 the relative wedge was 42 percent above its level in 1960. In addition, the average level for this relative wedge between 1960 and 1995 was 1.28. Hence, labor productivity in manufacturing, relative to labor productivity in services, in West Bengal was significantly lower than in Maharashtra, relative to its value in 1960. This feature appears to have been an important part of the differential evolution of the two states.¹⁴

Figure 7 shows that the Euler equation held fairly well over this period, because the investment wedge was reasonably close to one for most of the time in both states. There is no apparent trend, and the average level for the relative wedge was 0.94 during this period. In light of footnote 10 above and the fact that the observed wedges in inter-sectoral labor allocations are systematically different from one, we ignore the measured labor wedge $\omega^{l,i}$.

Next, we turn to the evolution of the sectoral productivity in the two states. Figures 8-10 show the evolution of productivity, measured in labor augmenting form, in agriculture, manufacturing, and services. As before, we measure the state-specific productivities on the left axis and the relative sectoral productivity of West Bengal on the right axis. Agriculture in both West Bengal

Maharashtra, respectively. The fact that the wedge for each state is significantly lower than unity reflects a well-known characteristic of developing countries, the concentration of the workforce in agriculture, a sector with low productivity. The key point here is that the margin between agriculture and services changed little during the period until the very end, nor did it differ much across the two states.

¹⁴The relative stability of the labor allocation wedge between agriculture and services (in West Bengal relative to Maharashtra) during the period 1960-95, in conjunction with the increase in the labor allocation wedge between services and manufacturing, implies that the labor allocation wedge between agriculture and manufacturing also increased during the period.

Figure 6: Labor allocation wedge between services and manufacturing

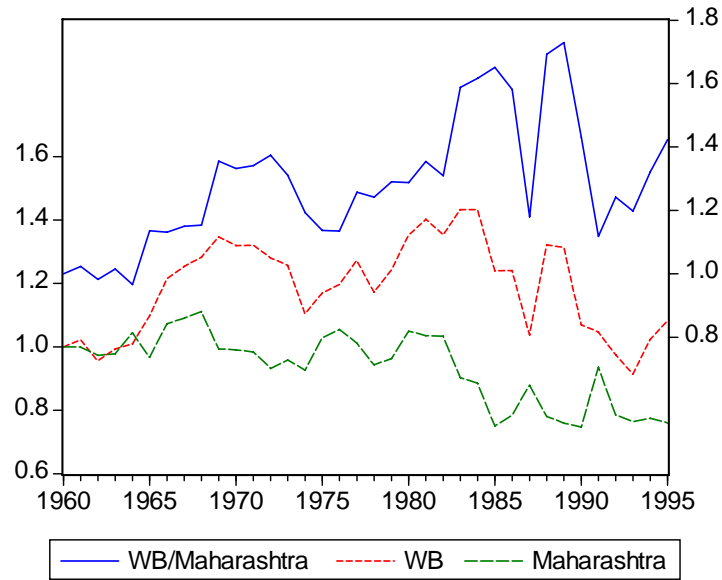


Figure 7: Intertemporal savings wedge

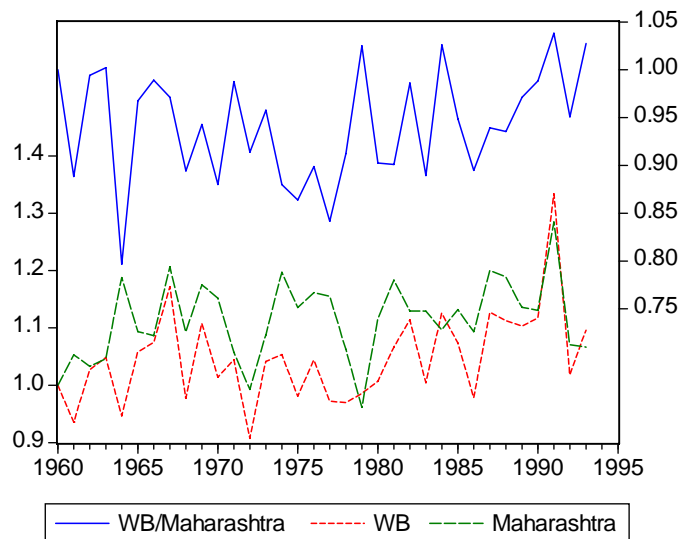
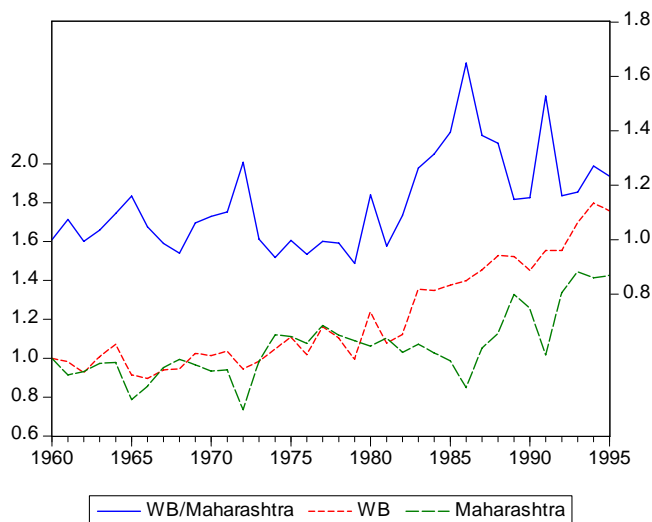


Figure 8: Agricultural productivity



and Maharashtra became more productive between 1960 and 1995. However, West Bengal’s agricultural productivity grew faster than Maharashtra’s. Hence, the relative productivity wedge increased during this period, with the average level at 1.19, i.e., 19 percent above the 1960 level. Clearly, agriculture is not the proximate cause of West Bengal’s relative decline.

The picture is quite different in the manufacturing and services sectors. In manufacturing, West Bengal’s productivity declined by almost 60 percent relative to Maharashtra between 1960 and 1995. The figure shows that West Bengal’s manufacturing productivity was essentially stagnant during this period. In the services sector, West Bengal’s productivity declined about 25 percent relative to Maharashtra during the same period. However, unlike in manufacturing, West Bengal’s productivity in services did grow; Maharashtra’s productivity grew faster, especially from the 1980s onward.

3.4 Robustness exercises

We engage in two robustness exercises. We examine the intertemporal savings wedge with our imputed capital measures. The results for agricultural capital and for services capital are very

Figure 9: Manufacturing productivity

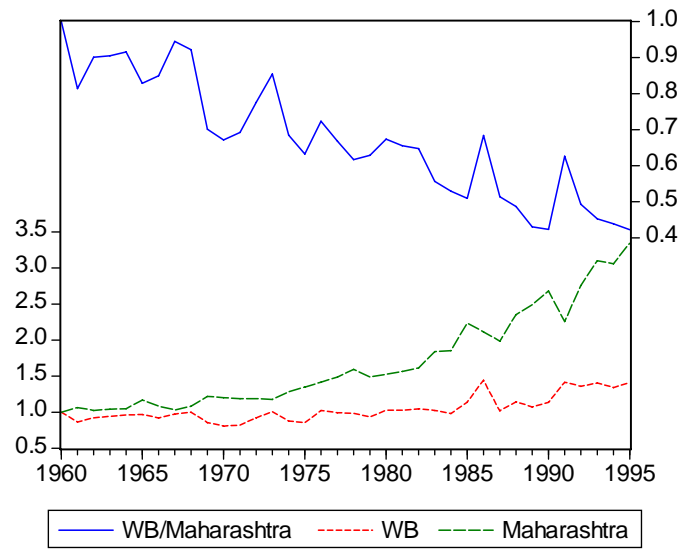
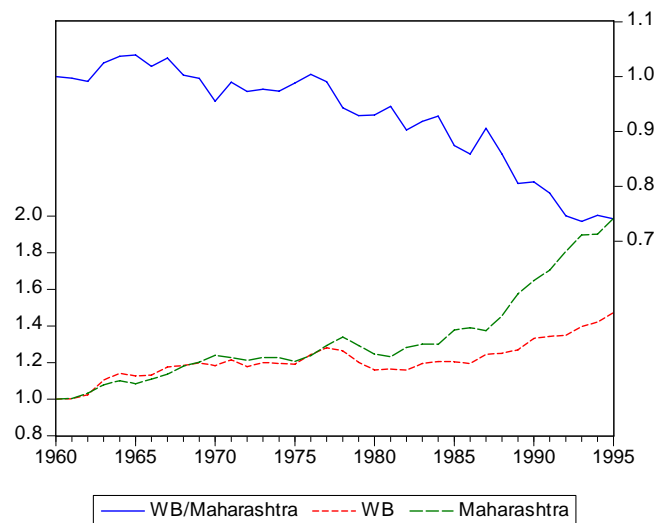


Figure 10: Services productivity



similar to our main results with manufacturing capital. The correlation coefficient between the Euler wedge with manufacturing and the other two Euler wedges are 0.90 (agriculture) and 0.87 (services).

We also create the agriculture and services capital stocks using an alternative imputation technique that assumes there is no misallocation of capital across sectors within a state. In other words, within each state, the VMPK for agriculture, for services, and for manufacturing are identical. Employing this assumption in conjunction with data on the manufacturing capital stock yields measures of services capital and agricultural capital for each state. This assumption automatically rules out any non-zero capital allocation wedges. The labor allocation wedges do not depend on the capital stock. Only the sectoral productivities are potentially affected by the use of this alternative imputed capital stock; however, we find that the evolution of both services productivity and agricultural productivity in each state is virtually unchanged relative to our benchmark imputation approach. The correlation coefficient between the two measures of services productivity is 0.85; the correlation of the two measures of agricultural productivity is 0.93.

4 Linking the Wedges to Additional Data

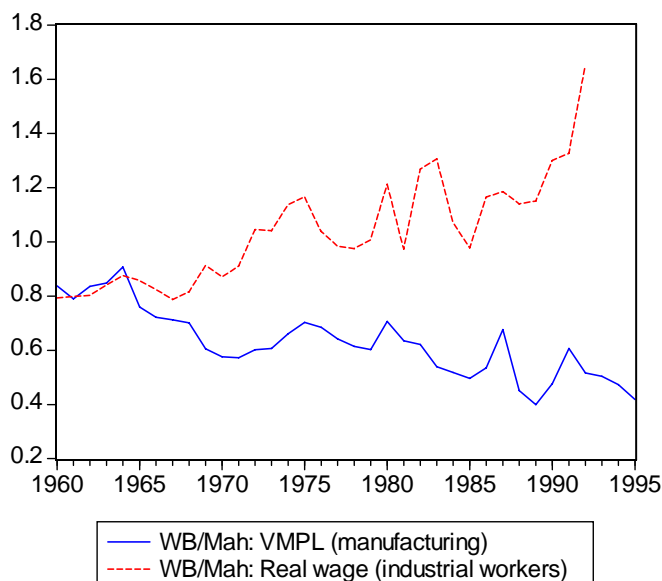
In this section, we provide two sets of evidence on West Bengal and Maharashtra that could potentially shed further light on the movements in our measured wedges.

4.1 Manufacturing and Labor

The wedge diagnostics point to the central role played by manufacturing. Among the labor wedges, the services-manufacturing wedge and the agricultural-manufacturing wedge widened substantially with West Bengal's manufacturing labor becoming significantly less productive (relative to other sectors' labor and relative to Maharashtra). Also, West Bengal's productivity in manufacturing relative to Maharashtra declined at a much greater rate than in agriculture and services. We now examine additional data that may shed light on the trends in West Bengal's manufacturing sector.

As a first step, we compare our measured VMPL in manufacturing to manufacturing real wages. Figure 11 plots both the VMPL in manufacturing in West Bengal relative to Maharashtra, as well as the corresponding relative manufacturing real wage between 1960 and 1995. The figure plots the actual values, i.e., the un-normalized values, of the series.

Figure 11: Wages and VMPL in Manufacturing

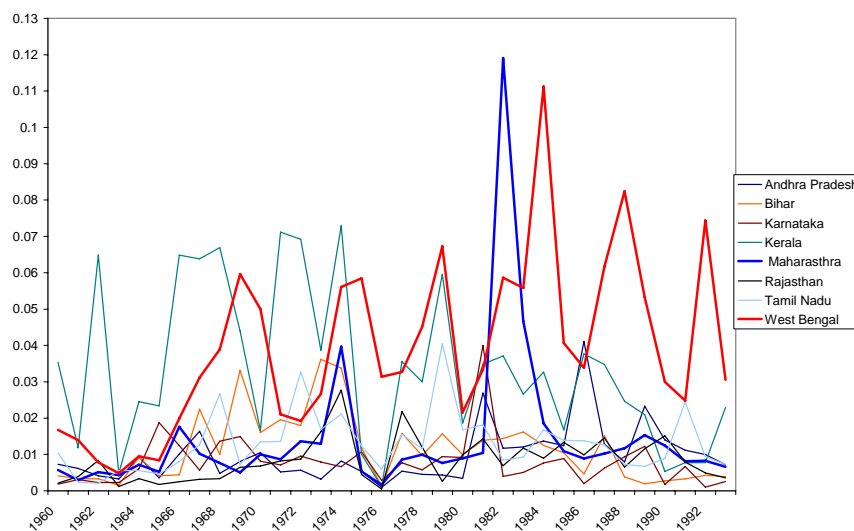


In 1960, relative real wages were almost the same as the relative VMPL in manufacturing. This is exactly what optimality in a frictionless environment would predict. From 1965 onwards, however, the relative VMPL in West Bengal declined from 80 percent of Maharashtra to 40 percent by 1995, while relative real wages rose from 80 percent to almost 165 percent of Maharashtra by 1992 (the last year for which we have the manufacturing wage data)! The emergence of higher real wages at the same time that labor productivity was declining in the state suggests that there may have been an increase in the political strength of labor in West Bengal during this period.

One indicator of labor's strength is the incidence of industrial action (strikes and lockouts), which reflects a breakdown of working relations between labor and owners of capital. In Figure 12, we plot the ratio of man-days lost to man-days worked in West Bengal and Maharashtra between

1960 and 1995, as well in several states that experienced a significant amount of industrial action. The figure shows that since 1967 the man-days lost ratio in West Bengal was always higher than in Maharashtra, with the exception of one year, 1982. During this period the mean for the man-days lost ratio in West Bengal was almost three times that in Maharashtra. With the exception of Kerala in the first half of the period, no other state experienced the level of industrial action of West Bengal.¹⁵

Figure 12: Man-days lost due to industrial action



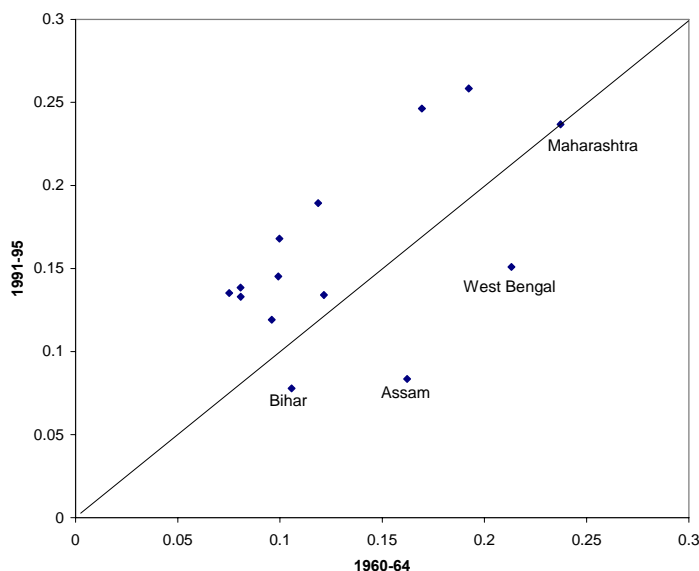
We interpret movements in these variables as indicators of growing labor power and a possible worsening of the business environment in West Bengal. Because organized business was mostly concentrated in manufacturing, any negative effects of a worsening business climate in the state

¹⁵ Another sign of increasing labor power in West Bengal during this period is the rapid expansion in the number of registered trade unions in West Bengal. It increased by a factor of 2.5, from 2057 in 1957 to 4808 in 1970. During the same period, the number of registered trade unions in Maharashtra increased from 1586 to only 2560. Unfortunately, our data on trade unions in West Bengal does not extend beyond 1970. The numbers on trade unions take on additional meaning once it is noted that after 1965 a significant fraction of manufacturing output in West Bengal shifted into the un-registered sector which was theoretically free of trade unions.

would likely be felt most by the manufacturing sector.

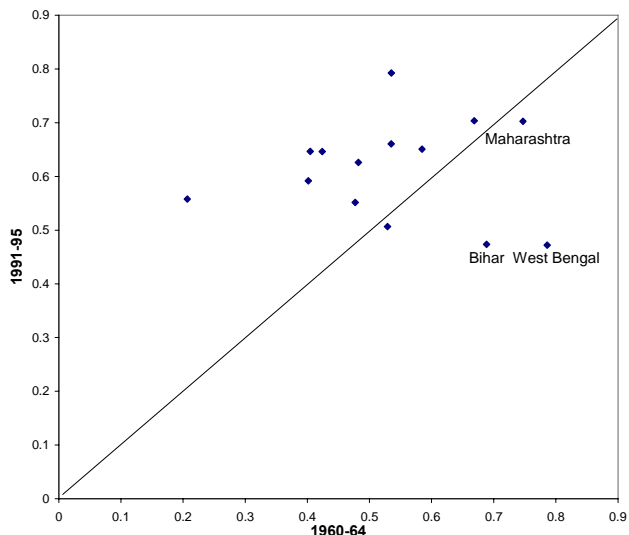
So how did manufacturing react? Figure 13 shows that the manufacturing share of total NDP in West Bengal declined between the early 1960s and the early 1990s. Moreover, West Bengal (along with Bihar and Assam) was clearly an outlier in this, because the manufacturing share of output expanded in the other states.

Figure 13: Manufacturing share of total NDP



Because the effect of stronger labor unions is probably felt more intensively in organized (registered) industry, in which, for example, workers are allowed to organize, one would expect to see a shift in the composition of manufacturing output from organized industry to small-scale, unorganized production if the labor environment had indeed worsened significantly during this period. To investigate this, we examine the behavior of the share of registered manufacturing in total manufacturing output in each state. Figure 14 shows that registered manufacturing's share of total manufacturing output was slightly higher in West Bengal than in Maharashtra, 79 percent versus 75 percent during the five year period 1960-64. However, by 1991-95, in West Bengal this share had declined to just 47 percent, while in Maharashtra it declined slightly to 70 percent. Moreover,

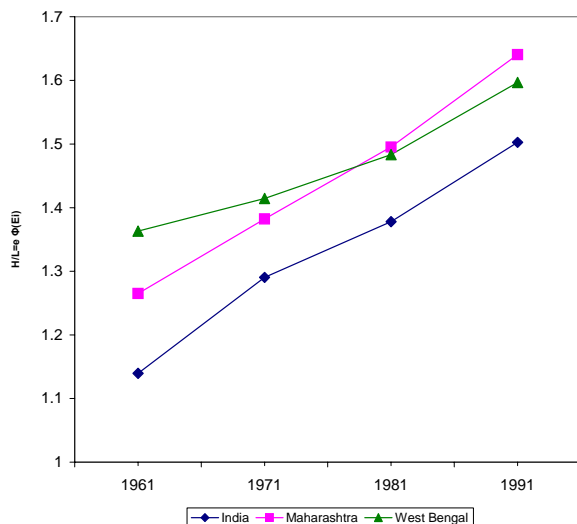
Figure 14: Registered manufacturing share of total manufacturing output



except for Bihar, the other states of India were more like Maharashtra than West Bengal. Again, West Bengal is an outlier.

The preceding discussion suggests that focusing on the manufacturing sector as in Besley and Burgess [9] (in their study of Indian states) would probably reveal most of the key reasons for West Bengal’s poor performance. However, our wedge diagnostic exercise suggests a key caveat to the Besley-Burgess account. In [9], the empirical framework is motivated by a bargaining model of firms and workers; in particular, contracts are incomplete in the sense that there is a hold-up problem. An increase in bargaining power raises the effective cost of capital. This, in turn, leads to a decline in output in registered manufacturing, as well as a shift in the composition of manufacturing output from registered to unregistered. This is consistent with the evidence we presented above. However, an increase in the cost of capital should show up as a larger wedge in the intertemporal Euler equation. Because we do not find evidence of increased Euler wedges, we conclude that this particular type of labor market inefficiency is unlikely to be a key driving force in West Bengal’s decline. Rather, to the extent union and bargaining power matter, it must be through some other

Figure 15: Human capital: India, Maharashtra, and West Bengal



channel than raising the effective cost of capital.

4.2 Infrastructure

One proximate source of West Bengal’s productivity decline in services and manufacturing might be infrastructure. Here, we present evidence on social infrastructure (human capital) and physical infrastructure (roads and electricity). We construct a state-wide measure of human capital following the method of [18]. Details on the data sources are provided in the data appendix. Figure 15 illustrates human capital for West Bengal, Maharashtra, and India. It shows that Maharashtra’s human capital surpassed West Bengal’s during the 1970s. In 1961, human capital in West Bengal was 8 percent higher than in Maharashtra, but by 1991, it was 3 percent lower than in Maharashtra.¹⁶

[8] have data on two measures of physical infrastructure stocks. Between 1960 and 1987, West

¹⁶In a previous version of this paper, we conducted a Hall-Jones levels accounting exercise to ascertain the sources of the growth differential between West Bengal and Maharashtra from 1961 to 1991. We found that differences in human capital growth accounted for 23 percent of the overall growth differential.

Bengal's surfaced state roads increased from about 6,000 km to 17,000 km. During that period, Maharashtra's surfaced state roads more than quintupled from 39,000 km to 212,000 km. Similarly, in 1960, total installed generating capacity was virtually identical in Maharashtra and West Bengal, 700 megawatt versus 680 megawatts. However, by 1989, Maharashtra's capacity had increased to 8200 megawatts, while West Bengal's rose only to 2600 megawatts. In addition, according to a firm-level survey of manufacturing firms conducted jointly by the World Bank and the CII in 2000 (see [14] and [27]), in West Bengal, 97.2 percent of the firms had their own generators, while in Maharashtra it was only 44.4 percent of firms. Hence, West Bengal was hampered by low capacity and by low delivery of that capacity.

5 Conclusion

Our wedge diagnostics yielded two broad sources of decline in West Bengal relative to Maharashtra between 1960 and 1995. First, productivity in both the manufacturing and services sectors suffered steep declines. Second, both capital and labor were misallocated between the services and manufacturing sectors (and between agriculture and manufacturing), especially after 1980. Thus, there was an *intratemporal* misallocation of capital and labor. Our diagnostics also pointed to several forces that were not sources of West Bengal's relative decline. The agriculture sector actually gained in productivity (relative to Maharashtra). Labor does not appear to be misallocated between the agriculture and services sectors. In addition, there is little evidence of an *intertemporal* misallocation of capital.

Our results help narrow the set of explanations for West Bengal's poor performance. For example, explanations based on productivity alone will not be enough. Moreover, our differing results across sectors indicate that a single sector model will also not be enough. Explanations based on credit constraints, which have been identified as a source of low investment in India, can only matter to the extent that they show up as low productivity or as misallocation of capital between services or agriculture and manufacturing. Consequently, what is needed is a multi-sector

model with multiple "shocks" in which the transmission channels are productivity and intratemporal misallocation of factors.

We suggest a few of the possible shocks. We presented evidence that the decline in manufacturing in West Bengal could be tied to the rise in labor power in that state. We also present evidence that public investments in social and physical infrastructure in West Bengal declined substantially. One set of distortions that we have not examined would be those associated with the mobility of goods and factors between states. This is an important avenue for future research.

References

- [1] Abler, David G., George S. Tolley, and G.K. Kripalani, 1994, *Technical Change and Income Distribution in Indian Agriculture*. Boulder, CA. Westview Press.
- [2] Ahluwalia, Montek S., 2001, "State Level Performance Under Economic Reforms in India." Stanford University Center for Research on Economic Development and Policy reform, Working Paper 96.
- [3] Bandyopadhyay, Sanghamitra, 2003, "Convergence Club Empirics: Some Dynamics and Explanations of Unequal Growth Across Indian States." WIDER Discussion Paper 2003/77.
- [4] Banerjee, Abhijit, and Kaivan Munshi, 2004, "How Efficiently is Capital Allocated? Evidence from the Knitted Garment Industry in Tirupur." *Review of Economic Studies* 71, 19-42.
- [5] Banerjee, Abhijit, and Esther Duflo, 2004, "Growth Theory through the Lens of Development Economics." manuscript, MIT, forthcoming, *Handbook of Economic Growth*.
- [6] Barro, Robert J. and Xavier Sala-i-Martin, 1992, "Convergence," *Journal of Political Economy* 100 (2), 223-251.
- [7] Barro, Robert J. and Xavier Sala-i-Martin, 1995, *Economic Growth*. New York, McGraw-Hill.
- [8] Besley, Timothy, and Robin Burgess, 2004, "Can Labor Regulation Hinder Economic Performance? Evidence from India," *Quarterly Journal of Economics* 119 (1), 91-134.
- [9] Besley, Timothy, and Robin Burgess, 2002, "Can Labor Regulation Hinder Economic Perfor-

- mance? Evidence from India," CEPR Discussion Paper, No. 3260.
- [10] Census of India, 1961, 1971, 1981, 1991, Central Statistical Office, India.
- [11] Chari, V. V., Patrick J. Kehoe, and Ellen McGrattan, 2004, "Business Cycle Accounting," NBER Working Paper 10351.
- [12] Cole, Harold L., and Lee Ohanian, 2002, "The U.S. and U.K. Great Depressions through the Lens of Neoclassical Growth Theory," *American Economic Review* 92 (2), 28-32.
- [13] Cole, Harold L., and Lee Ohanian, 2004, "New Deal Policies and the Persistence of the Great Depression: A General Equilibrium Analysis," *Journal of Political Economy* 112 (4), 779-816.
- [14] Dollar, David *et al*, 2002, "Competitiveness of Indian Manufacturing: Results from a Firm-Level Survey", World Bank WP# 31797.
- [15] Duraismay, P., 2002, "Changes in Returns to Education in India, 1983-94: by Gender, Age-Cohort and Location," *Economics of Education Review* 21, 609-22.
- [16] Economic and Political Weekly Research Foundation, CD-ROM on "Domestic Product of States of India, 1960-61 to 2000-01" and on "National Account Statistics of India, 1950-51 to 2000-01."
- [17] Gollin, Douglas, 2002, "Getting Income Shares Right," *Journal of Political Economy* 110 (2), 458-74.
- [18] Hall, Robert, and Charles Jones, 1999, "Why Do Some Countries Produce So Much More Output per Worker than Others?," *Quarterly Journal of Economics*, 114, 83-116.
- [19] Ingram, Beth F., Narayana Kocherlakota, and N. Eugene Savin, 1994, "Explaining Business Cycles: A Multiple Shock Approach." *Journal of Monetary Economics* 34, 415-428.
- [20] Kehoe, Timothy, and Kim Ruhl, 2003, "Recent Great Depressions: Aggregate Growth in New Zealand and Switzerland," manuscript, University of Minnesota and Federal Reserve Bank of Minneapolis.
- [21] Kochhar, Kalpana, Utsav Kumar, Raghuram Rajan, Arvind Subramanian, and Ioannis Tokat-

- lidis, 2006, "India's Pattern of Development: What Happened, What Follows," International Monetary Fund WP/06/22.
- [22] Mulligan, Casey B., 2005, "Public Policies as Specification Errors," *Review of Economic Dynamics* 8, 902-926.
- [23] Ozler, Berk, Gaurav Datt and Martin Ravallion, 1996, "A Database on Poverty and Growth in India." World Bank.
- [24] Psacharopoulos, George, 1994, "Returns to Investment in Education: A Global Update." *World Development* 22, 1325-43.
- [25] Purfield, Catriona, 2006, "Mind the Gap – Is Economic Growth in India Leaving Some States Behind?" International Monetary Fund WP/06/113.
- [26] Veeramani, C., and Bishwanath Goldar, 2004, "Investment Climate and Total Factor Productivity in Manufacturing: Analysis of Indian States" ICRIER WP #127.
- [27] World Bank, 2002, "Improving the Investment Climate in India", Manuscript.

A Data Appendix

Our data come from many sources. The primary sources are the Census of India for 1961, 1971, 1981, and 1991, and three CD-ROMs from the Economic and Political Weekly (EPW) Research Foundation database ("Domestic Product of States of India, 1960-61 to 2000-01", "National Account Statistics of India, 1950-51 to 2000-01", and "Annual Survey of Industries, 1973-74 to 1997-98"). Data on population, employment, and schooling are drawn from the Census. Data on net state domestic product (NDP), sector-level NDP, and all-India capital, draw from EPW. Most of this data is available in current prices and constant prices.

The Annual Survey of Industries (ASI) provides data on registered manufacturing output, employment, capital, earnings, and labor activity. The ASI manufacturing data is supplemented by manufacturing data from Besley and Burgess (2004). This data is from the ASI, as well, but it extends further back, to 1960. (We thank Robin Burgess for sending us this data.)

We also use the World Bank data base created by Ozler, Datt, and Ravallion (1996), primarily for measures of price indices that control for inter-state price differentials. The World Bank data set also provides data on consumption.

We now describe the data sources and variable construction (further details are available from the authors on request):

A.1 Two Facts Section

The real per capita NDP numbers underlying Figures 1 and 2 were constructed in three main steps. First, several constant-price NDP series from the Domestic Product of the States of India CD-ROM (DPSI) were spliced together. For the time period 1960-61 through 1993-94 (hereafter, "1960" means "1960-61"), there are four constant-price NDP series, each based on prices for a particular year (1960, 1970, 1980, and 1993) and each covering a subset of the overall period. The splicing procedure involves two parts. First, for years in which more than one constant-price NDP series exist, the more recent NDP series are used. Second, to convert the 1980 series into 1993 prices, a conversion factor is needed. This conversion factor is obtained by finding the first year that two series has in common, e.g., 1993, and then dividing NDP in 1993 measured in 1993 prices by NDP in 1993 measured in 1980 prices. This ratio is then used to convert all other years for which the 1980 constant-price series is the relevant series. A similar exercise is done for the other constant-price series. At the end, we have a single, real NDP series for each state measured in 1993 prices. Second, these series are divided by population. The population data is obtained from the Census. We linearly interpolate to obtain estimates of population for the non-Census years. Third, we multiply by an adjustment factor that facilitates cross-state comparisons. In particular, we use two consumer price indices (CPI) drawn from the World Bank data base. One CPI is for agricultural laborers and the other is for industrial workers. Both indices adjust for inter-state cost of living differences.¹⁷ We take a simple average of these two indices' values for 1993, and we then multiply this average by the constant-price NDP series. This renders the series comparable across states. In Figure 1, the "final" NDP per capita value is divided by the corresponding value for Maharashtra. In Figure 2, we add all states other than Maharashtra and West Bengal together to form the rest of India aggregate. The states include Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Punjab, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan,

¹⁷See the documentation associated with Ozler, Datt, and Ravallion (1996) for more details on how these CPI indices were constructed.

Tamil Nadu, and Uttar Pradesh.

The sectoral output shares presented in figure 3 are created from agriculture, total manufacturing, services, and overall DPSI NDP current price (nominal) data spliced in a similar manner to the constant price (real) series discussed above. The sum of the sectoral shares is less than one, as overall NDP includes forestry and fishing, mining, construction, and electricity. The Rest of India aggregate is composed of the same states as in figure 2, except for Orissa, which lacks sectoral level data). These data all draw from the Domestic Product of States of India CD-ROM.

A.2 Model-Based Diagnostics Section

In our model diagnostics section, there are six key sets of variables: real state NDP per capita (total and at the sector level), sector-level labor, real personal consumption, sectoral and overall price deflators derived from real and nominal NDP series, manufacturing capital stock, and the agriculture and services capital stocks.

The real state NDP variables are from the EPW, and are constructed in the same manner as the data underlying figures 1 and 2, except we do not control for inter-state price differentials. It is important to note that the real NDP variables are used for two purposes, first, to represent output in the wedge calculations in the figures, and second, along with the nominal NDP series, to back out the price deflators from which the relative price series are derived. For agriculture, services, and total NDP, the real DPSI NDP series are used for both these purposes. However, for manufacturing, the DPSI registered manufacturing real and nominal series are used to back out the manufacturing price deflator series, but the ASI registered manufacturing output series 'net value added' is the actual manufacturing output series used in the wedge calculations. The ASI output series is given in nominal terms; it was converted to real terms using the registered manufacturing price deflator created from the DPSI real and nominal registered manufacturing output series.

We used the ASI data as the single source for all of the key manufacturing variables used to construct the wedges: capital, labor, and output. As there is no comparable survey for the agriculture or services sectors, our labor data for these two sectors draws from the Census, and our output data is from the DPSI NDP series. No data for capital exists at the state level for these two sectors.

We define agricultural labor as the sum of the Census categories "cultivators" and "agricultural laborers". Services labor is defined as the sum of the categories "trade and commerce" workers, "transport, storage, and communications" workers, and "other services" workers. These data are linearly interpolated for the non-Census years. The ASI labor data used is "registered manufacturing employees". This series is drawn from Besley and Burgess (2004) for the years 1960-73, and the ASI CD-ROM for the years 1974 onwards. (According to the Registered Manufacturing Act of 1958, manufacturing firms were required to "register" if they used electrical power and had at least 10 workers, or if they used no power but had at least 20 workers.)

Measuring employment in each Census year is complicated by the fact that during the period we study, there were two major conceptual and definitional changes on the measurement of workers, one at the 1971 Census and one at the 1981 Census. In the 1971 Census, the underlying concept that differentiated a worker from a non-worker was changed from "labour time disposition" to "gainful occupation". In particular, the reference period for agricultural work was changed from the "greater part of the working season" to the entire year. This led to a decline in the all-India reported number of workers between 1961 and 1971 by almost 5 percent, a period in which India's population aged 15 and over increased by 23 percent! This decline was more than accounted for by

a reported decline in female rural workers, which fell by 50 percent.

The second major conceptual change occurred in 1981, in which workers were now categorized as main and marginal according to whether they worked for the major part of the year or not. The idea behind this was to come up with a concept similar to the 1971 Census but also to provide comparability with earlier Censuses. Thus the main workers concept in 1981 is comparable to the workers concept in 1971, and the main-plus-marginal workers concept in 1981 is broadly comparable to the workers concept in 1961.¹⁸

Real personal consumption is constructed as follows. Nominal per capita consumption expenditure is from the World Bank data base variable "overall mean per capital monthly expenditures by state". There are separate variables for rural and urban areas. An (all-India) population weighted average of these two variables is used to create the final monthly nominal per capita expenditure series. These series are multiplied by 12 to yield an annual series. Each series is then deflated by the implicit NDP deflator derived from dividing the current price NDP series by the constant price NDP series.

The manufacturing capital stock data is from the ASI and Besley and Burgess (2004). We use the "fixed capital stock" variable, which also is for registered firms only. This is deflated by the overall state NDP implicit price deflator, i.e., the same deflator used to deflate the consumption variable.

Unlike with the manufacturing capital stock, there is no official state-level series for agricultural and services capital stocks. We impute each state's agriculture capital stock by assuming that the state's share of India's nominal agricultural capital stock equals the state's nominal share of India's agricultural output. To construct each state's services capital stock we apply the same exercise for the following services sectors: transport, storage and communication; trade, hotels, and restaurants; banking, insurance, and real estate; community, social, and personal services; other services, and then aggregate across these sectors. We then deflated each capital stock by the overall state NDP implicit price deflator.

¹⁸There remains the issue of comparing 1961 and 1971. We adopt three approaches. The first is to use the originally reported Census numbers for 1961 and 1971, as well as "main" workers in 1981 and 1991. This is our benchmark. The second is to employ official adjustments made in 1971 to the 1971 Census and the 1961 Census to make them more compatible. In particular, a new sample was conducted late in 1971 in which participants were asked the questions from the 1961 census. The resulting outcome led to an adjusted 1971 census. In addition, the change in participation rates between 1961 and the adjusted 1971 census is used to create an adjusted 1961 census that are the values that ensure that the change in participation between adjusted 1961 and 1971 is the same as between 1961 and adjusted 1971. These adjustments provide two alternatives, then. One alternative uses the original 1961 numbers, the adjusted 1971 numbers, and the appropriate categories for 1981 and 1991 (main plus marginal workers). The second alternative uses the adjusted 1961 numbers, the original 1971 numbers, and the appropriate categories for 1981 and 1991 (main workers). The third approach is to employ adjustments along the lines of Abler, Tolley, and Kripalani (1994), who use data from the National Sample Survey (NSS) to impute a workforce for 1971. This adjustment essentially ties the number of workers more closely to the growth of the working age population.

Given that our primary goal is to compare West Bengal to Maharashtra, if the changing Census definitions over time do not affect West Bengal and Maharashtra differently, then the relative comparisons are unaffected. However, female participation rates in Maharashtra historically have been much higher than in West Bengal (in 1961 it was 38 percent compared to 8 percent). Thus, the underreporting of women had a larger effect on Maharashtra than on West Bengal. Consequently, for robustness, we employ all three approaches - the benchmark approach, as well as the three adjustments in the other two approaches.

A.3 Linking the Wedges to Additional Data Section

The sectoral NDP, labor and price deflator series described in the model-based diagnostics section are used to construct the relative (WB to Mah) sectoral value marginal product of labor series in figure 11. In figure 11, we derive the relative wage series from the nominal variable “earnings” for West Bengal and Maharashtra, drawn from the Besley and Burgess ASI data set. This variable is defined as the “per capital annual earnings of employees in manufacturing industries (rps.)”. To convert to real terms, the nominal series is deflated by the overall price index that we backed out from the total NDP data.

For Figure 12, data for days lost to strikes and lock-outs and for days worked are also drawn from Besley and Burgess and the ASI CD-ROM. We use the variables for total "man-days lost to industrial action" from Besley and Burgess. For total days worked, we use the interpolated man-days of employees series from Besley and Burgess (1960-73) and the total man-days worked series from ASI CD-ROM (1974 onwards).

Figures 13 and 14 are based on the DPSI registered and total manufacturing NDP and the DPSI total overall NDP series. For Figure 13, we used the same total manufacturing sectoral shares as in Figure 3, except that the averages of the first and last five years of the series for West Bengal are contrasted. For Figure 14, we calculate the registered manufacturing share of total manufacturing using the same total manufacturing series (as in Figure 13) in the denominator and the registered manufacturing series in the numerator.

Human capital and employment are drawn from the India Census. We focus on the four census years 1961, 1971, 1981, and 1991. For human capital, we use the Census tables that classify workers by type and by level of education and that classify workers by industrial category and by level of education. This data divides the work force into several schooling categories. We convert these categories into years of schooling as follows. "Literate without any formal schooling/below primary": 2 years; "Primary": 5 years; "Middle": 8 years; "Matriculation/secondary": 10 years; "Higher secondary / intermediate / pre-university or non-technical/technical diploma or certificate not equal to degree": 12 years; "University degree or post-graduate degree other than technical degree/Technical degree of diploma equal to degree or post-graduate degree (includes engineering, medicine, and teaching): 16 years.¹⁹ From this data, the share of the worker population which has completed each level of education can be calculated for each census year. This vector of education weights is multiplied by $\phi(E)$ to obtain a measure of the log of human capital per unit labor.

Our functional form for $\phi(E)$ is piecewise linear and draws from Psacharopoulos (1994). for the first four years of education the rate of return is 13.2 percent, for the next four years the rate of return is 10.1 percent, and any year of schooling after that has a rate of return of 6.8 percent.

¹⁹Our calculations yield an average years of schooling for West Bengal and for Maharashtra in 1981 (1991) that are about a half-year below (a half year above) the India years of schooling number, based on 1985, from the Barro-Lee data set.