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October 2004
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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 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 underperformed 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,

[1] This is primarily because more and better data are available. For example, compared to cross-country analysis, state-level analysis involves data collection methodoogies 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.

Our primary finding is that West Bengal's productivity growth in manufacturing and services was considerably lower than Maharashtra's. The ratio of West Bengal's manufacturing productivity to Maharashtra's manufacturing productivity, for example, declined from 0.85 to 0.36 between 1960

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

and 1995. In addition, we find that many of the wedges in the two states changed little or in the same direction. This includes the investment wedge from the intertemporal Euler equation, which was relatively stable over our sample period; the capital allocation wedges, taken together; and the labor allocation wedge between agriculture and services, in which both states became less efficient. There were two wedges that behaved quite differently across the two states, the labor allocation wedge between services and manufacturing, and the labor allocation wedge between agriculture and manufacturing. Hence, manufacturing appears to be central in understanding the differential performance of the two states.

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) [9].[3] They 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, Besley and Burgess construct an index that classifies each state as pro-labor, neutral or pro-employer. They find that pro-labor legislation reduced growth

[3]Several 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.

of manufacturing output, investment, and employment. While our results are consistent with their findings, we note that 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.

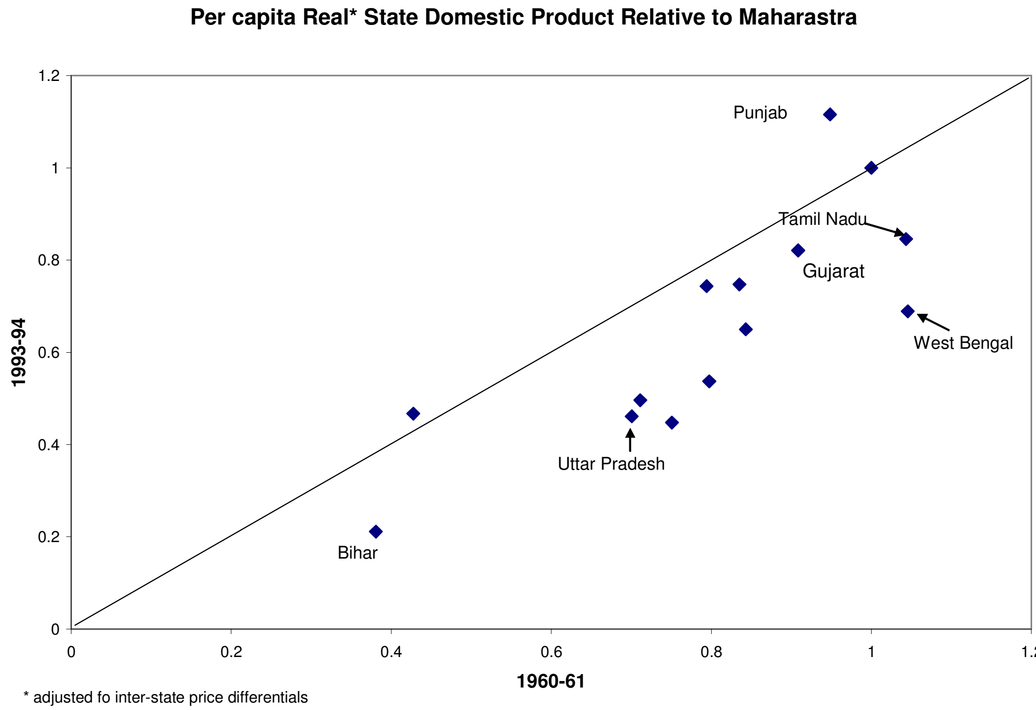
2 Two Facts

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

[4] Data from Table 27 of the OECD publication "National Accounts of Less Developed Countries" (1967) suggests

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

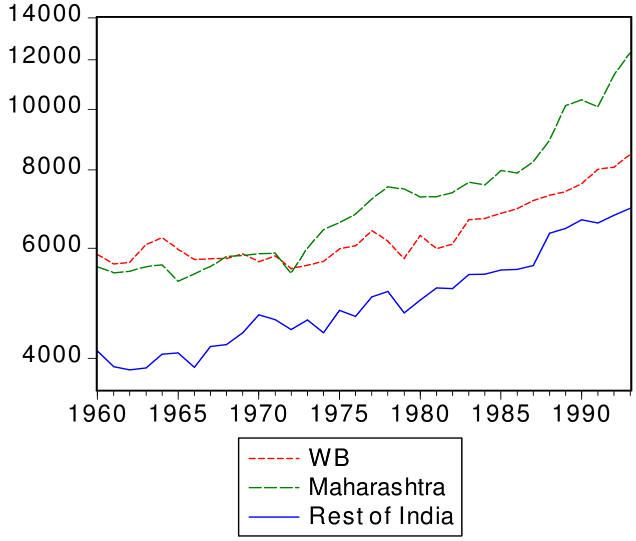


data appendix. Broadly, there were three main steps, splicing together several overlapping real NDP series, dividing these series by population, and multiplying them by a price adjustment factor to facilitate cross-state comparisons. In 1960, West Bengal was the richest state in India, with a per capita income about 5 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

that in the 1950s West Bengal was the richest state in both 1950 and 1955. Maharashtra was rich as well (data on 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



income of West Bengal has been going on for decades, and that even as West Bengal is losing 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

[5]It 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.

10.0 percent per year over the next 20 years, while the other two grew only about 7 percent per year. So, China exhibited divergence as well, although 7 percent growth is still a very good growth performance.

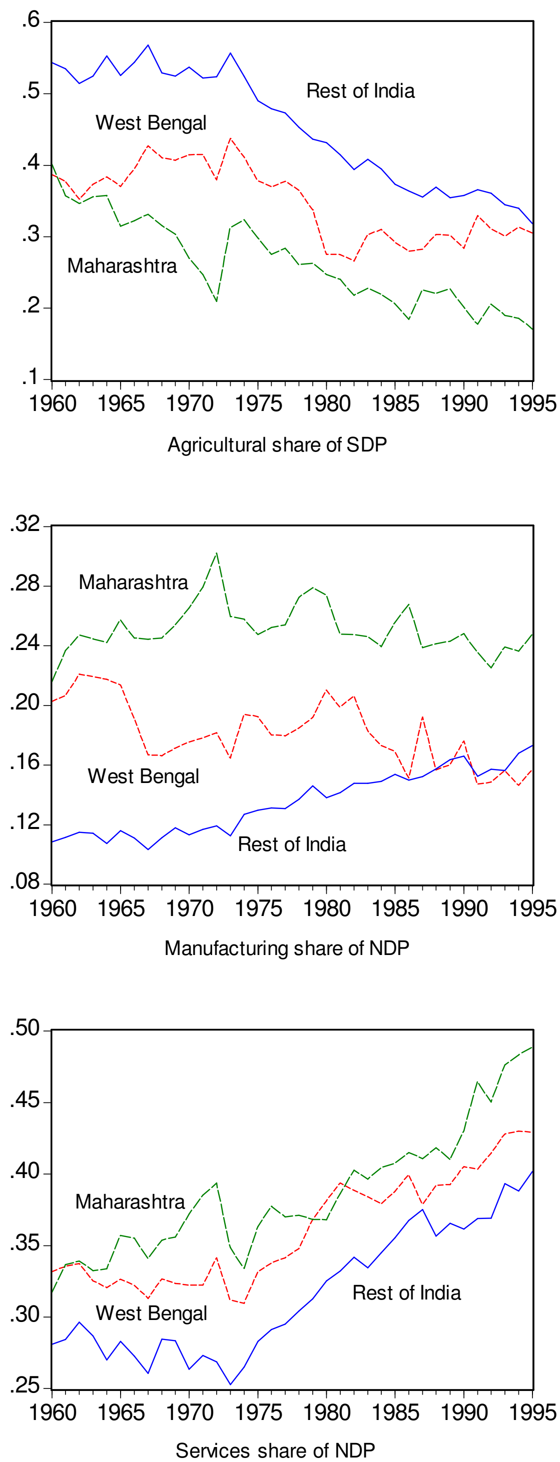
It is also not easy to find similar cases from the cross-country data. As pointed out by Kehoe and Ruhl (2003), there are a few examples like New Zealand and Switzerland that showed 40 percent declines in per capita incomes relative to the U.S. between 1960 and 2000. However, New Zealand (4 million people 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

[6] The 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



gained about 50 percent relative to West Bengal). We have also seen that the two states experienced 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:

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

[7] We 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.

[8] We 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 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:

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

where k is the capital stock per person, b is the amount of assets held per person, δ is the depreciation rate, w is the wage rate, r is the rental rate on capital, and q is the price of a one-period bond. 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:

$$y = g(\hat{y}_s, \hat{y}_m, \hat{y}_a)$$

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. We assume that the function g exhibits constant returns to scale in its three arguments. Note that our framework allows for trade in the intermediate goods. We assume balanced trade in each period. 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 the household and firm first order conditions for optimality. 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 equals 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":

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

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

$\omega^{l,i}$ 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] $\omega^{I,i}$ 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:

$$\omega_t^{k,as,i} = \frac{p_{at}}{p_{st}}\frac{\upsilon y_{at}/k_{at}}{(1-\sigma)y_{st}/k_{st}}$$

$$\omega_t^{k,sm,i} = \frac{p_{st}}{p_{mt}}\frac{(1-\sigma)y_{st}/k_{st}}{\alpha y_{mt}/k_{mt}}$$

$$\omega_t^{l,as,i} = \frac{p_{at}}{p_{st}}\frac{\mu y_{at}/l_{at}}{\sigma y_{st}/l_{st}}$$

$$\omega_t^{l,sm,i} = \frac{p_{st}}{p_{mt}}\frac{\sigma y_{st}/l_{st}}{(1-\alpha)\,y_{mt}/l_{mt}}$$

where i = 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

[9] Note 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 $\omega^{l,i}$.

[10] Because we have substituted 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.

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 $\omega_t^{l,sm,i}$.

We also calculate the sectoral productivities in labor augmenting form:

$$X_{at} \equiv x_{at}^{\mu} = \frac{y_{at}}{k_{at}^{\upsilon} l_{at}^{\mu}} \tag{1}$$

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

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

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 intermediate goods trade between states.[12] 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

[11] See, 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.

[12] However, our framework does not allow for intertemporal borrowing and lending, that is, net capital flows between states is not permitted. We could allow for it by suitably modifying the representative agent's budget constraint. This will not affect the first order conditons that we focus on (but it would create an additional set of wedges that could potentially be examined). Hence, the wedges we focus on are essentially invariant to the specification of openness in both intra-temporal and intertemporal trade.

trade regime or from some more restricted trading regime.

We parameterize the model as follows:

Parameter	Description	Value
α	Manufacturing capital share	0.3
μ	Agriculture labor share	0.45
υ	Agriculture capital share	0.25
σ	Services labor share	0.7
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). 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 υ.

3.3 Results

Figures 4-8 show the evolution of the capital allocation and labor allocation wedges, and the Euler equation wedge. The usual practice in the presentation of wedges is to normalize the value in the initial year to one.[13] There are at least two rationales for this. First, often the first year can be interpreted as consistent with an initial steady-state. Second, to the extent there exists non-time

[13] See for example Cole and Ohanian (2002) or Chari, Kehoe, and McGrattan (2007). Mulligan (2005), on the other hand, reports the actual wedges.

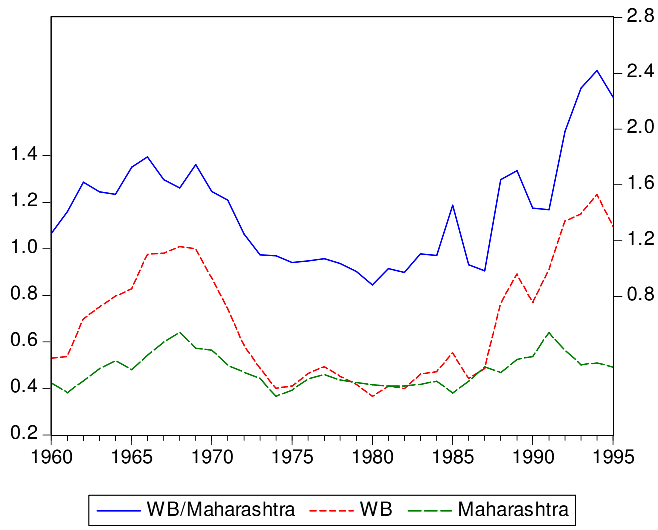
varying measurement error, normalizing the wedges eliminates that. Indeed, with one of our wedges below we provide some supportive evidence to this. To these rationales, we add a third, which is that because we are focused on changes in the per capita income between the two states, we are interested in the trends in the wedges over time (and the differences in these trends between the two states).

Nevertheless, the normalization can be potentially misleading under some circumstances (such as when there is no measurement error). Suppose the West Bengal labor allocation wedge between agriculture and services was initially less than one, and suppose the Maharashtra wedge was initially equal to the West Bengal wedge. Now suppose, over time, the West Bengal wedge increased and moved closer to one or efficiency, while the Maharashtra wedge remained constant. Clearly, West Bengal is becoming more efficient than Maharashtra. However, the normalized wedges would show that West Bengal was moving further from one, while Maharashtra was staying at one, which would suggest that West Bengal is becoming less efficient than Maharashtra. In the figures that follow, we present the un-normalized wedges in the two states; we also present the ratios of the wedges (the wedge in West Bengal relative to Maharashtra).

Figure 4 shows the wedge for optimal capital allocation between services and manufacturing. Both wedges were initially close to one-half in 1960, indicating that the value marginal product of capital (VMPK) was about twice as high in manufacturing as in services. Over time, West Bengal's wedge fluctuates a great deal, and rises sharply in the 1990s. By contrast, Maharashtra's wedge varied much less and was about 0.5 by 1995. In that year, West Bengal's wedge is considerably closer to one than its wedge in 1960, suggesting that West Bengal moved closer to efficiency than Maharashtra did. However, the mean ratio of the two wedges was only 14 percent higher than the ratio in 1960. Excluding the 1990s, it is only 5 percent higher. Consequently, this wedge does not appear to be a significant factor in West Bengal's under-performance between 1960 and 1995.

The wedge for optimal capital allocation between agriculture and services is much smoother

Figure 4: Capital allocation wedge between services and manufacturing

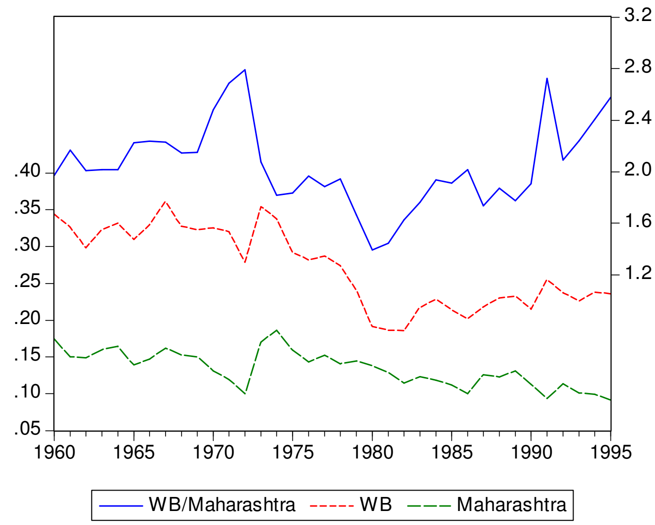


over time than between services and manufacturing. In both states, the wedge was initially around two, indicating that VMPK in agriculture was about twice as high as in services. For each state the wedge varied little around its mean value during the sample period. By 1995, West Bengal's wedge was just 1.4 percent higher than its 1960 value, and Maharashtra's wedge was just 3.1 percent higher. The average for West Bengal relative to Maharashtra over 1960-95 was 1.04.[14] Clearly, this wedge was not a margin in which major changes happened.

Note that the capital allocation wedge between agriculture and manufacturing is the product of the above two wedges. This implies that capital allocation between agriculture and manufacturing was close to efficient in 1960 for both states, but that in West Bengal the wedge began to increase over time, reaching two by 1995, while in Maharashtra, the wedge stayed fairly constant at around one. Hence, trends in the two states' capital allocation efficiency between agriculture and manufacturing are essentially the opposite as the trends between services and manufacturing. Crucially, however, the magnitudes of the mean difference in the wedges are not large. We conclude that the

[14] To save space we have not included a picture of the wedge here. It is available from the authors on request.

Figure 5: Labor allocation wedge between agriculture and services



capital allocation wedges are not a major source of the differential performance of these two states between 1960 and 1995.

We now turn to the labor allocation wedges. Figure 5 shows that the wedge for each state is initially significantly lower than one – reflecting the well-known characteristic of developing countries that the value marginal product of labor (VMPL) is low in agriculture – and that both wedges trend downward over time. This implies that for each state the gap between services' VMPL and agriculture's VMPL widened. The similar behavior of the two wedges is reflected in the fact that the average ratio of West Bengal's wedge to Maharashtra's wedge over the sample period was only 4 percent higher than the initial wedge ratio. Hence, labor misallocation between agriculture and services does not seem to be an important factor in understanding the differential performance of the two states.

Figure 6 presents the labor allocation wedge between services and manufacturing. Both states' wedges were slightly greater than 0.5 in 1960 indicating that the VMPL of manufacturing was about twice as high as for services. Subsequently, West Bengal's wedge rose, while Maharashtra's fell.

In 1995, the two wedges were 0.59 and 0.39, respectively. This suggests that West Bengal became considerably more efficient than Maharashtra over time. Indeed, the average ratio of West Bengal's wedge to Maharashtra's wedge was 28 percent higher than the initial wedge ratio. However, for manufacturing there is an alternative source of data on output and labor, the National Accounts Statistics (NAS) and the Census of India, respectively. As a robustness check, we re-run the labor allocation wedge between services and manufacturing with this data.[15] Figure 7 shows that with this data West Bengal's wedge rises over time, while Maharashtra's wedge shows little trend. However, because both wedges are initially at a value close to 1, the figure implies that West Bengal became less efficient than Maharashtra over time.

Despite the different initial values of the wedge generated by the different data sources, the two wedge computations share one feature in common. The relative wedge, that is, the ratio of West Bengal's wedge to Maharashtra's wedge, on average was about the same across these two sets. As noted above, in the first set of wedges the average wedge ratio was 28 percent higher than the initial wedge ratio. For the second set of wedges, the average wedge ratio was 32 percent higher than the initial wedge ratio. Hence, while we cannot give an efficiency interpretation, we can infer that the manufacturing labor productivity relative to services labor productivity decreased substantially over time in West Bengal compared to Maharashtra. The large magnitude of this relative wedge suggests that – regardless of which state became more efficient over time – the allocation of labor between services and manufacturing could be an important part of the differential evolution of the two states.

As discussed above, the third labor allocation wedge, between agriculture and manufacturing, is derived by multiplying the wedge between agriculture and services by the wedge between ser-

[15] This alternative data covers the entire manufacturing sector. The ASI data that is our benchmark data covers only the registered sector. We use the ASI as our benchmark for two reasons. First, both the output and employment data in the ASI are from the same source. Second, the ASI data includes capital stock numbers while the NAS data does not.

Figure 6: Labor allocation wedge between services and manufacturing (ASI)

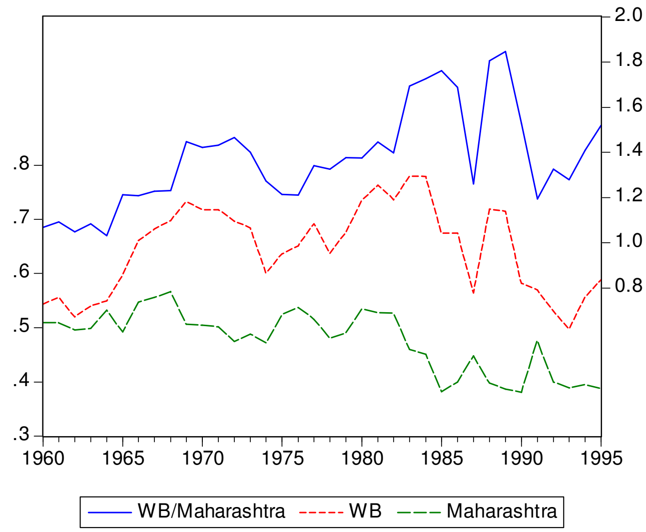
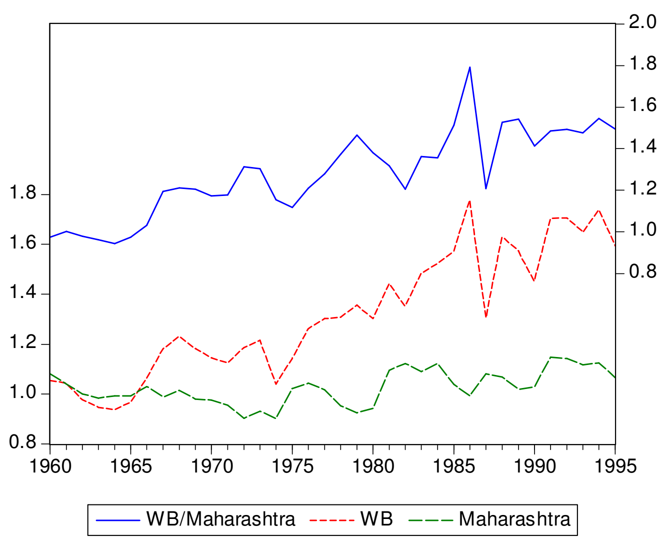


Figure 7: Labor allocation wedge between services and manufacturing (NAS and Census)



vices and manufacturing. In 1960 the wedge was 0.09 and 0.19 in Maharashtra and West Bengal, respectively, indicating that the VMPL of agriculture was considerably less than the VMPL of manufacturing in both states. In both states, also, the wedge declined sharply over time, indicating increasing misallocation of labor. However, Maharashtra's wedge declined by more than West Bengal's. Summarizing the labor allocation wedges, both of the wedges involving manufacturing revealed large movements over time, as well as large differences over time between West Bengal and Maharashtra.

Figure 8 shows the investment wedge or the wedge for optimal intertemporal allocation. In 1960, the investment wedge in West Bengal was 0.90. In Maharashtra it was 0.82. The wedge displays some volatility, but there is very little trend over time, as both wedges rise slightly by 1993 (to 0.99 in West Bengal and 0.87 in Maharashtra). In both states, then, the wedges became slightly more efficient. Over the sample period, the average ratio of West Bengal's wedge to Maharashtra's wedge was only about 6 percent lower than the initial ratio. This suggests that investment forces were not important in explaining the weak performance of West Bengal during the 1960s onwards. In light of footnote 9 above and the fact that the observed wedges in inter-sectoral labor allocations are systematically different from one, we ignore the labor-leisure wedge $\omega^{l,i}$.

Next, we turn to the evolution of the sectoral productivity in the two states. Figures 9-11 show the evolution of productivity, measured in labor augmenting form, in agriculture, manufacturing, and services. We present the state-specific productivities on the left axis; they are normalized to equal 1 in 1960. The relative sectoral productivity of West Bengal on the right axis. Agriculture in both West Bengal 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,

Figure 8: Intertemporal savings wedge

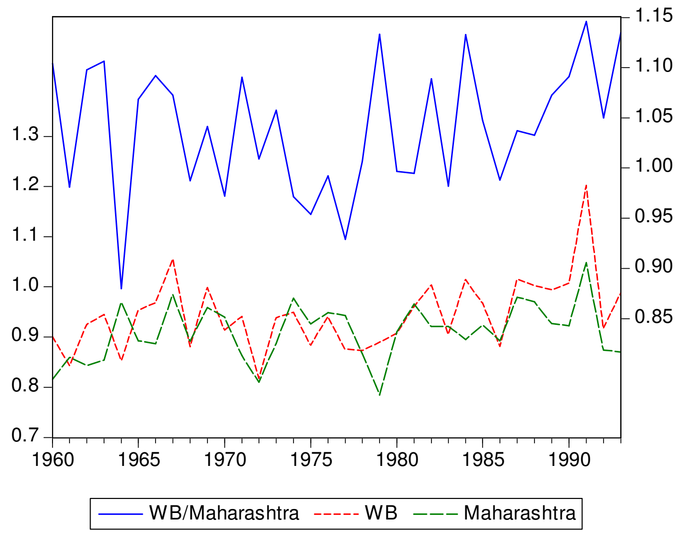


Figure 9: Agricultural productivity

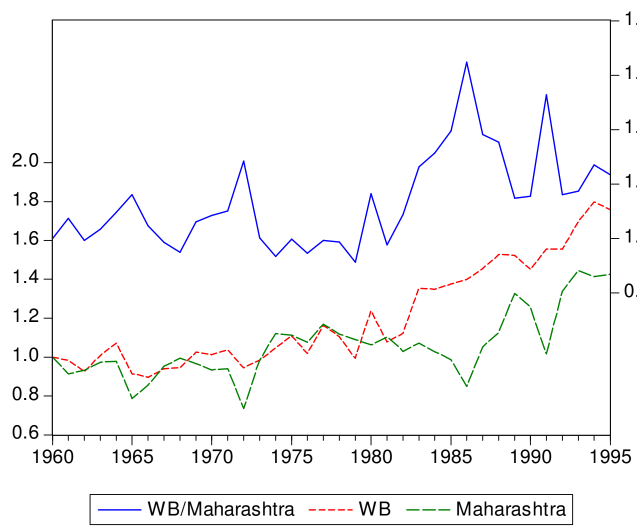
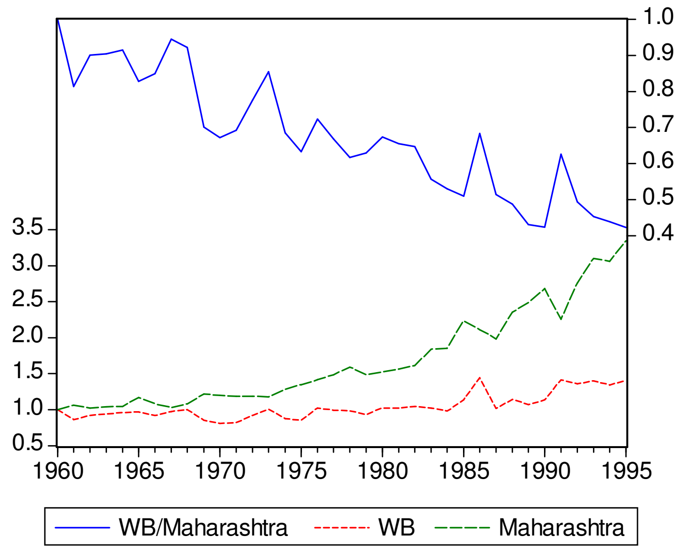


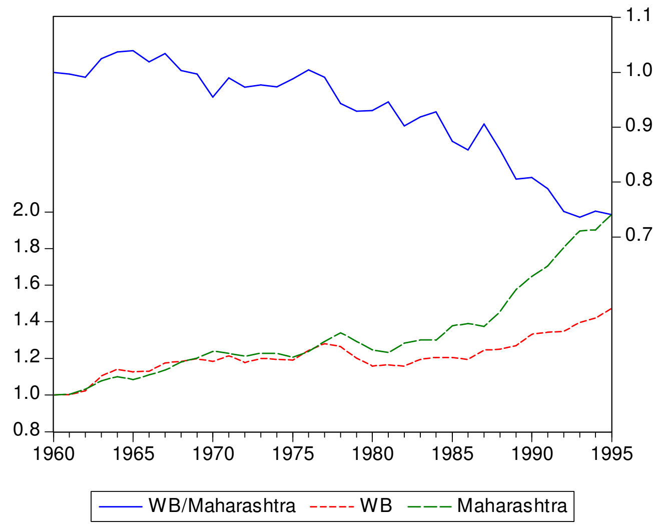
Figure 10: Manufacturing productivity



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.

We conclude our discussion of the wedges by making the following observations. For both of the labor allocation wedges involving manufacturing, a wedge gap opened up over time between the two states. Because of the real possibility of measurement error in the wedge between services and manufacturing, we cannot conclude that West Bengal's wedges diminished over time. In the case that they did, the wedge diminution would partially offset the loss from West Bengal's relatively low manufacturing productivity growth. In the case that the wedges did not diminish or even grew over time, this force would complement the low manufacturing productivity growth in accounting for West Bengal's poor performance.

Figure 11: Services productivity



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 similar to our main results with manufacturing capital. The correlation coefficients 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

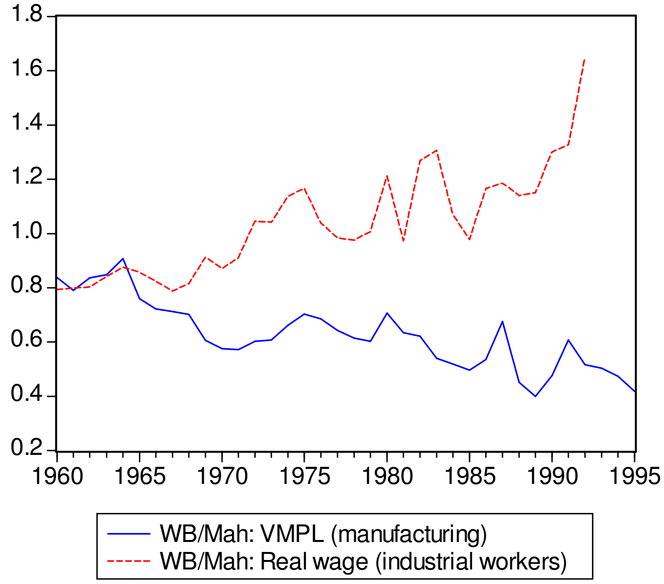
The wedge diagnostics point to the central role played by manufacturing, in particular, and, to a lesser extent, services – but along particular dimensions. Among the labor wedges, the wedges between services and manufacturing, and between agriculture and manufacturing, widened substantially. In addition, manufacturing productivity in West Bengal 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.[16]

As a first step, we compare our measured VMPL in manufacturing to manufacturing real wages. Figure 12 plots the VMPL in manufacturing in West Bengal relative to Maharashtra, as well as the corresponding relative manufacturing real wage between 1960 and 1995.

In 1960, relative real wages were almost the same as the relative VMPL in manufacturing. This is what optimality in a frictionless environment would predict. From 1965 onward, 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.

[16] Data constraints prevent us from also examining the services sector.

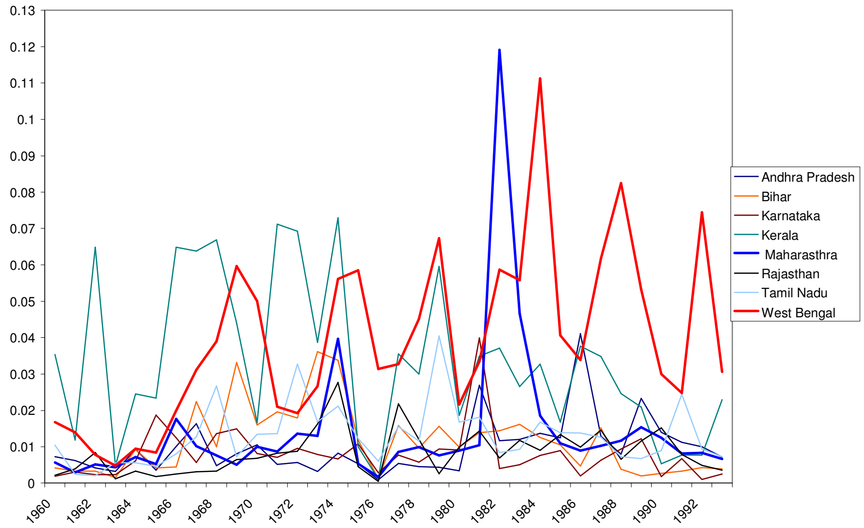
Figure 12: Wages and VMPL in Manufacturing



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 13, 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.[17]

[17] 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.

Figure 13: 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 would likely be felt most by the manufacturing sector.

So how did manufacturing react? Figure 14 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.

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 15 shows that registered manufacturing's share of total

Figure 14: Manufacturing share of total NDP

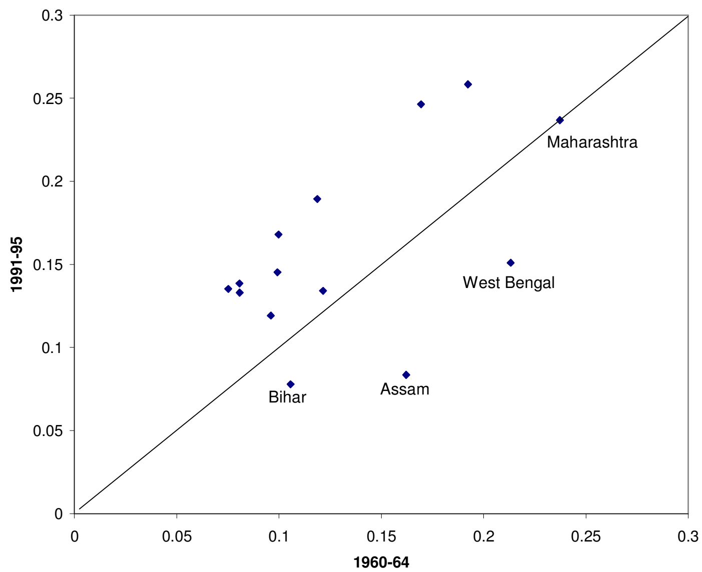
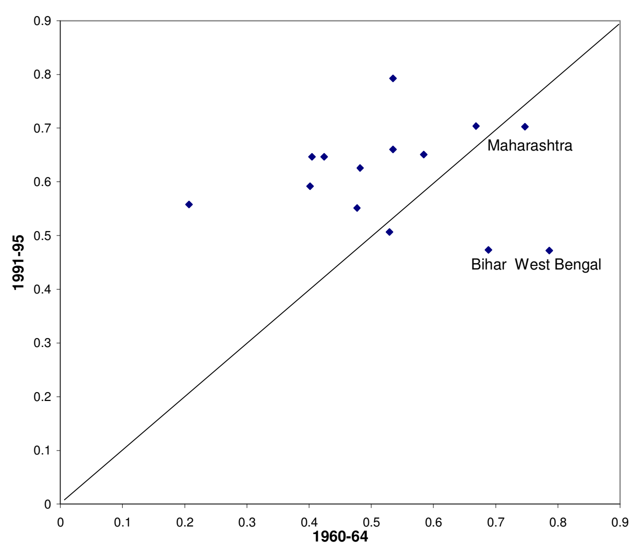


Figure 15: Registered manufacturing share of total manufacturing output



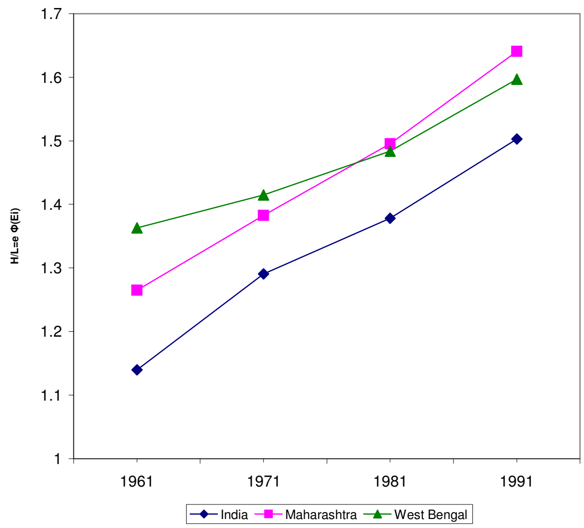
manufacturing output was slightly higher in West Bengal than in Maharashtra, 79 percent versus 75 percent during the five-year period 1960-64. However, by 1991-95, in West Bengal this share had declined to just 47 percent, while in Maharashtra it declined slightly to 70 percent. Moreover, except for 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 [10], as well as in Aghion *et al* [2], (in their studies 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. Their 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 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 [19]. Details on the data sources are provided in the data appendix. Figure 16 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

Figure 16: Human capital: India, Maharashtra, and West Bengal



Bengal was 8 percent higher than in Maharashtra, but by 1991, it was 3 percent lower than in Maharashtra.[18]

[9] have data on two measures of physical infrastructure stocks. Between 1960 and 1987, West 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 [15] and[28]), 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

[18] In 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.

and by low delivery of that capacity.

5 Conclusion

Our wedge diagnostics yielded two broad sources of change in West Bengal relative to Maharashtra between 1960 and 1995. First, productivity growth in both the manufacturing and services sectors was considerably less in West Bengal. Second, the two labor allocation wedges involving manufacturing changed substantially within and between the two states. Thus, there was an *intratemporal* misallocation of labor that increased over time. Interestingly, our analysis suggests that this increase in misallocation could have been greater in Maharashtra than in West Bengal – at least partly because manufacturing productivity grew so much more rapidly in Maharashtra. In other words, the slow productivity growth in West Bengal in manufacturing, and also services, could have helped prevent labor inefficiencies from growing more rapidly. Verification of this possibility could come from the sort of wedge accounting exercises advocated by [12].

Our diagnostics point to several other forces that were not sources of West Bengal's relative decline. The agriculture sector actually gained in productivity (relative to Maharasthra). Labor does not appear to have been increasingly misallocated between the agriculture and services sectors. In addition, there is little evidence of large *intertemporal* or *intratemporal* misallocations 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 labor.

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.

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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 these data are 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). These data are from the ASI, as well, but they extend 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 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 exists, 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 have 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 are 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.[19] 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,

[19] See 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 onward. (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 the number of female rural workers, which fell by 50 percent.

The second major conceptual changed 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.[20]

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 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.

[20] There 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 onward).

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. These data divide 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. [21] From these 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.

[21] Our 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.