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What is Holding Back Productivity Growth in India? Recent Microevidence

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Introduction

The slow take-off of India's manufacturing sector compared with many of its Asian neighbours is the source of a considerable amount of consternation and mystery. Manufacturing's share of value added has barely risen over the past three decades, and India's goods exports have remained below 1% of corresponding world trade. At the same time, services trade has expanded rapidly and the decline in the share of agriculture in the economy has found its counterpart in services rather than manufacturing (OECD, 2007).

In apparent contradiction, the literature on economic development has long argued that production shifts first from agriculture into manufacturing and – only at a later stage of development – from manufacturing into services. This so-called Three-Sector (or Fisher-Clark-Kuznets) Hypothesis appears consistent with much cross-country evidence, and has been associated with demand shifts and productivity differentials: the resource shift out of low-productivity agriculture into higher-productivity manufacturing boosts overall productivity in converging economies.[1]

Two recent studies have attempted to answer the question of whether India can bypass a manufacturing stage. Kochhar *et al.* (2006) look across India's states and at industry-level evidence, and argue that the distortions in skill-intensity and scale that have emerged are persistent and may allow it to bypass the more traditional development path that other countries have followed. OECD (2007) takes a more sceptical view, noting that few countries have not relied heavily on manufacturing at some stage for their development.

This paper elaborates on the latter view by examining the production structure and productivity of Indian firms using plant and firm microdata, and identifies a set of distortions that exist in India's economy at several different levels that are depressing productivity. These distortions include large fissures in performance and the concentration of production across institutional sectors, industries, size classes and business units. While some evidence has been accumulated on each of these points previously, earlier evidence was based primarily on much more aggregated and/or less timely data.[2]

Resource shifts and prices

Resource shifts across sectors

Earlier evidence on the effect of resource shifts on productivity has supported a view that structural change across sectors has contributed positively to growth. Bosworth and Collins (2008) find that between 1993 and 2004 the reallocation of workers from agriculture to industry and services contributed 1.2 percentage points to annual productivity growth in both India and China. A first look at the sectoral distribution of employment and productivity confirms that India has indeed been able to increase its overall productivity through this type of labour reallocation. In particular, a comparison of the productivity level of the economy with current and fixed weights suggests that the shift of employment from agriculture to manufacturing and services has boosted labour productivity growth by 0.9% per year, accounting for about one-quarter of overall labour productivity growth between 1978 and 2003 (Table 1, top panel).[3]

Table 1. **Labour productivity and employment shares by industry and institutional sector**

	Level of productivity		Share of employment		Change in productivity	Change in employment share
	Net product per person, 1999/2000 prices, rupees		Per cent of total employment		Per cent per year	
	1993	2003	1993	2003	1993 to 2003	
By industry						
Primary	15 015	17 749	64.3	58.0	1.7	–1.0
Secondary	33 039	40 036	14.9	18.1	1.9	2.0
Tertiary	71 171	113 771	20.8	23.9	4.8	1.4
Whole economy	29 399	44 706	100.0	100.0	4.3	0.0
Whole economy with 1993 industry employment weights	*29 399*	*41 070*			*3.4*	
Productivity growth due to change in employment composition by industry					**0.9**	
By institutional sector						
Informal	20 721	27 958	92.6	94.0	3.0	0.1
Agriculture	14 745	17 431	63.9	57.7	1.7	–1.0
Other	33 989	44 674	28.8	36.3	2.8	2.4
Formal	139 663	308 099	7.4	6.0	8.2	–2.1
Private companies	174 220	431 699	2.1	1.9	9.5	–1.3
Public enterprises	148 215	319 883	2.7	2.0	8.0	–2.8
Public services	101 756	186 891	2.5	2.1	6.3	–1.9
Whole economy	29 475	44 706	100.0	100.0	4.3	0.0
Whole economy with 1993 institutional employment weights	*29 475*	*46 525*			*4.7*	
Productivity growth due to change in employment composition by institutional sector					**–0.4**	

Source: National Account Statistics, National Sample Survey.

However, there are grounds for being sceptical about the extent to which labour reallocation has boosted productivity growth in India. Using an alternative "institutional" breakdown, the economy can be separated into agriculture, as well as the informal and the formal parts of the non-agricultural economy. This is done using the National Sample Survey combined with National Accounts data. Huge productivity differences emerge: productivity in the formal sector is 18 times higher than in agriculture, rising to a 25-fold difference in the formal private company sector. An analysis of the increase in productivity based on changes in the shares of labour employed in different parts of the economy should take into account not only flows by industry, but also the shares of the different institutional sectors within each industry.

This alternative way of looking at the changing shares of labour alters the conclusion about the impact of the movement of labour in India. Most labour has moved from agriculture to the *informal* non-agricultural sector and this has boosted productivity. However, at the same time, labour has moved out of the highest-productivity sector – the formal sector. The proportionate fall in formal employment was greatest in the public sector and, even in the most productive formal private sector, the share of employment has fallen slightly (Table 1, bottom panel). As a result, the overall impact of changes in employment shares has been to *reduce* the growth of labour productivity.

One reason for the poor employment performance of the formal sector, notably private companies, may be restrictive labour legislation that has resulted in growing capital intensity (see Dougherty, 2008). Less restrictive labour legislation might have led to increased employment and greater reallocative gains, notwithstanding the damping effect from lower capital intensity.

Unit labour cost levels

The simple decomposition just described raises the question of whether the large differences in productivity between the formal and informal sectors may shed some light on the slow growth of India's goods exports. Since virtually all of India's goods exports come from the formal sector, an examination of labour price competitiveness in this sector is sufficient. The appropriate means of comparison of such costs is to use purchasing power parity-adjusted unit labour cost levels (see Annex A1, equation [1]). These purchasing price parities are estimated using a detailed item-by-item comparison of manufacturing census unit values between India and Germany for almost 1 000 products within 43 three-digit industrial branches for the fiscal year 2002/03 carried out as background to this study, and are described in Erumban (2007).

The result of these comparisons suggests that the gap in effective unit labour cost (ULC) levels between India and developed OECD countries is large. In the most recent period, India's ULC was only 16% of the level in Germany: an 84% gap (Figure 1, Panel C). This labour cost gap is much larger than in the first half of the 1980s, when it was 50%. The main reason for India's improved cost competitiveness was the depreciation of the Indian Rupee in the second half of the 1980s, which reduced India's wage costs by more than half in foreign currency terms (Panel A), while at the same time relative productivity per hour increased by 29% (Panel B), or by 71% per employee. There are also large differences in ULCs across industries, ranging from 7% of the German level for the communications equipment sector to about 44% for the pulp and paper sector.

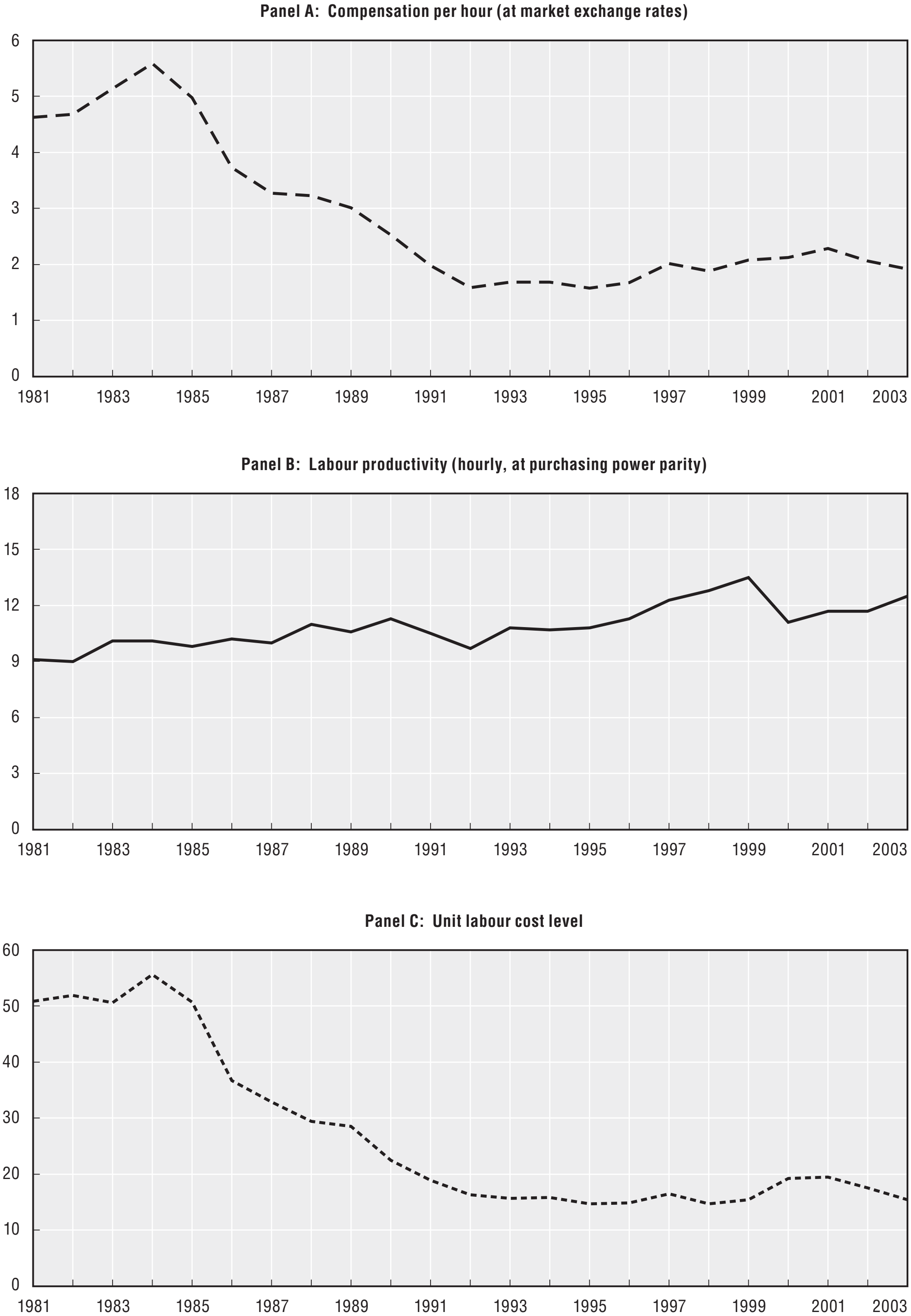
Even among emerging markets, India's ULCs are among the lowest – much lower than Mexico, Turkey or Poland – although Indian ULCs are very similar to those estimated for China (Figure 2). Much of the difference with emerging OECD countries stems from lower levels of compensation per employee rather than higher labour productivity levels (which also remain *relatively* low).

Despite cost advantages that emerged by the early 1990s, India's manufacturing output and exports have grown relatively slowly until this decade. Weak overall productivity growth was seen as the cause of this outcome (Nagaraj, 2004), and indeed the fall in ULCs has been mostly driven by a fall in the real exchange rate. Until the most recent period export performance in manufacturing lagged behind that of East Asian countries, where goods exports have been an important driver of growth (Table 2). Since the beginning of this decade, though, manufactured exports from India have grown faster than those of most East Asian countries except China. As a result, the gap between the growth of manufacturing and service output has narrowed, with manufacturing even outpacing services in 2007.

However, as a result of its relatively small share in non-agricultural output, manufacturing's absolute contribution to overall output growth has been less than a third of that for commercial services in the eight years to 2007, with its annual growth rate being 2 percentage points lower. Moreover, some service sectors have performed

Figure 1. **Relative employee compensation, productivity and unit labour costs**

Per cent of Germany

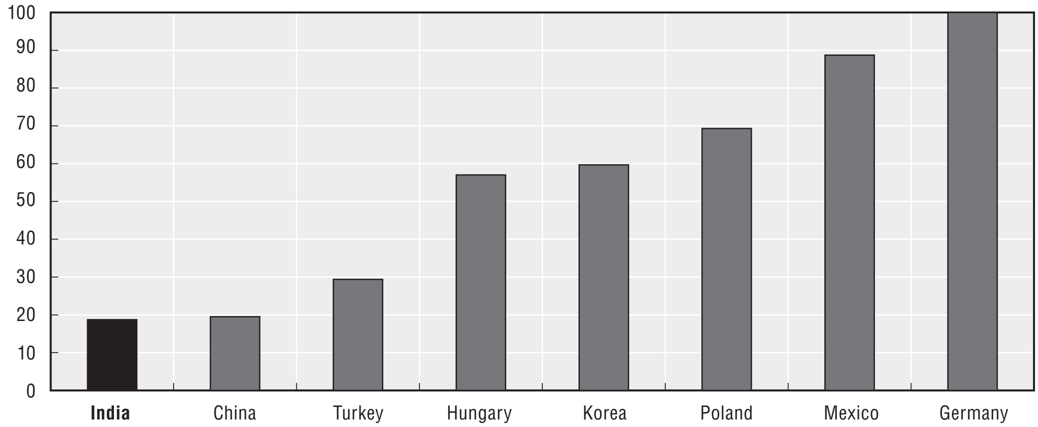


Note: Figures are for manufacturing only, excluding the petroleum industry.

Source: Erumban (2007).

Figure 2. **Relative unit labour cost levels across countries**

2002, per cent of Germany



Source: OECD Productivity Database, van Ark *et al.* (2006), Erumban (2007).

Table 2. **Growth in the value of merchandise exports**

Per cent per year, values measured in US dollars

	1980-85	1985-90	1990-95	1995-2000	2000-05	1980-2005
China	8.6	17.8	19.1	10.9	25.0	16.1
Turkey	22.3	10.2	10.8	5.1	21.5	13.8
Thailand	1.8	26.5	19.6	4.1	9.8	12.0
Korea	11.6	16.5	14.0	6.6	10.5	11.8
Hong Kong, China	8.2	22.3	16.1	3.1	7.6	11.3
Mexico	8.2	8.8	14.3	15.9	5.1	10.4
India	**1.3**	**14.5**	**11.3**	**6.7**	**17.5**	**10.1**
Malaysia	3.6	13.8	20.2	5.9	7.5	10.0
Chinese Taipei	9.2	16.9	10.9	6.0	5.5	9.6
Philippines	–4.3	12.0	16.6	17.8	0.7	8.2
Pakistan	0.9	15.4	7.4	2.4	12.0	7.5
Brazil	5.0	4.1	8.2	3.4	16.5	7.3
Japan	6.3	10.2	9.0	1.6	4.4	6.3
Indonesia	–3.2	6.7	12.1	7.6	5.7	5.6

Source: World Trade Organisation Trade database.

exceedingly well, with communications, for instance, contributing seven times its share of GDP towards growth during this period. The rapid growth of services does raise the question of whether India could follow a development path that essentially bypasses manufacturing, as it has led to an acceleration of overall growth. However, it would seem unnecessary and suboptimal for India to pursue such a unique path of development given its potential strengths and comparative advantages, and the need for more broad-based development to provide enough employment opportunities for its growing labour force. India's revealed comparative advantage (RCA) is, in fact, in many of the same (disaggregated) labour and resource-intensive manufacturing sectors as China's, suggesting that it could better exploit its competitive export strengths by further expanding its manufacturing sector (Batra and Khan, 2005).[4]

A number of unusual characteristics of India's pattern of development appear to be symptomatic of deeper structural distortions in the economy, potentially explaining why India's manufacturing is lagging behind. These features include relatively high capital intensity in the organised sector – despite low labour costs – and an extraordinarily large share of overall manufacturing employment in micro-enterprises, most of which are in the informal sector.

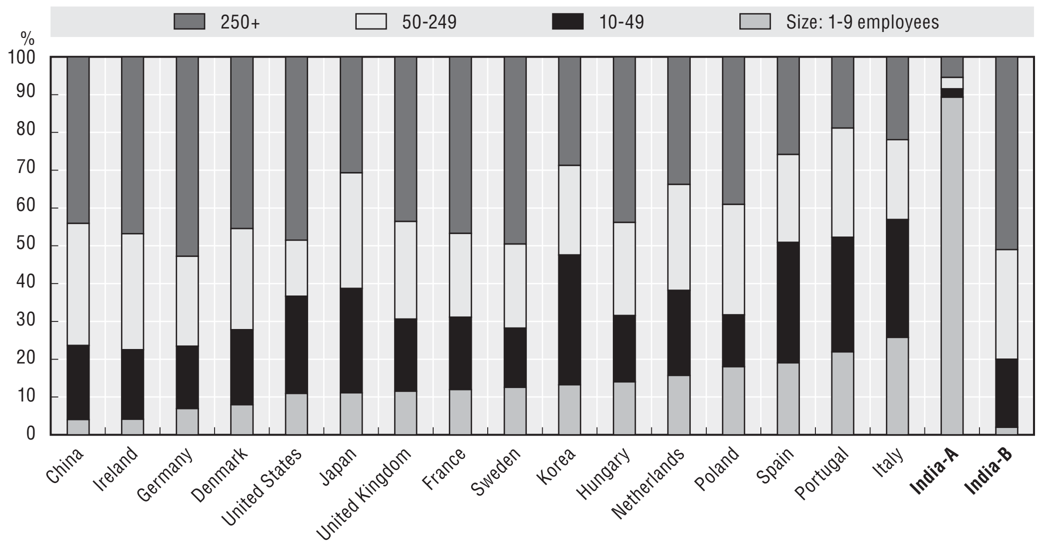
Scale, capital intensity and productivity

Extremely small scale

Perhaps the most dominant characteristic of India's manufacturing sector is the extraordinarily small scale of establishments relative to any OECD or major emerging country when measured in terms of employment and output (Figure 3). About 87% of manufacturing employment is in micro-enterprises of less than 10 employees, a smallness of scale that is unmatched, with the closest comparator being Korea, where less than half of employment is in micro-enterprises. While there is a fairly high share of very large companies – making for a bimodal distribution – there are few enterprises of intermediate size.

Figure 3. **International comparison of the distribution of firm size in manufacturing**

2005 or nearby year



Notes: For China (2004), India (2005) and the United States (2002) includes service sectors. India-B is for organised manufacturing only, from the Annual Survey of Industries.

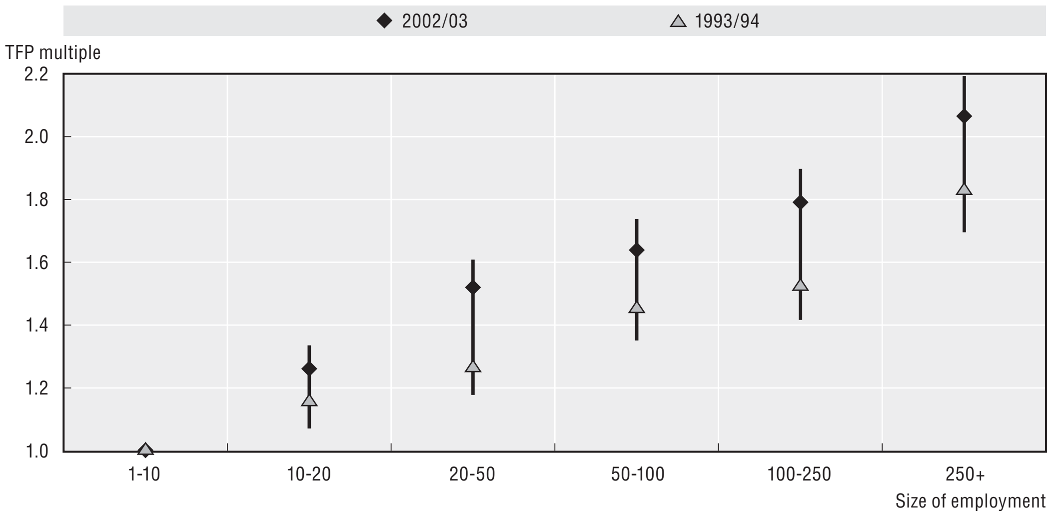
Source: *OECD Structural Business Statistics* and *Economic Survey of India* (2007).

The small scale of Indian industry arose in part by design: the pre-reform licensing system meant that only one major company was allowed to operate in many industries, while other industries were reserved (as "small-scale industries"). While these market entry restrictions have been largely dismantled, their legacy continues to reduce competition, scale and productivity in many sectors. In addition, other regulations persist, notably those related to labour and administrative approvals, which also constrain firms' growth (see Conway and Herd, 2008).

Given the relatively small size of many manufacturing firms, India is reaping far smaller gains from scale economies than many other countries. Larger establishments often use newer technologies[5] and thus achieve higher productivity, while smaller establishments are much less productive. Accordingly, although small firms' share in manufacturing employment is almost 90%, they produce only about a third of manufacturing output. An estimate of scale effects for plants, based on individual establishments in the Annual Survey of Industries, shows them to be very large and persistent. Even after controlling for technology, industry, region and firms' age, total factor productivity (TFP) is about twice as high in firms with more than 250 employees than in those with only up to 10 employees (Figure 4).

Figure 4. **Gains in productivity from larger plant size in India**

Total factor productivity (TFP) in a given plant size relative to a plant with 1 to 10 employees



Note: The drop lines in the figure represent 95% confidence intervals.

Source: OECD estimates based on production functions estimated from Annual Survey of Industries unit level data.

The extent of potential gains from larger size is perhaps not surprising considering that anecdotal information from interviews of Indian businesses and industry experts reveal excessive fragmentation of business operations into small subcontracting units to avoid regulations that further exacerbate the problem by creating further inefficiencies (Mukerji, 2006). Moreover, aggregate labour productivity data on the unorganised (micro-enterprise) sector suggest that past investment restrictions on this sector have created *diseconomies* of scale in the smallest size classes (SSI Census, 2004), and firm size peaks can be observed in microdata at sizes thresholds where key labour legislation starts to become binding (Dougherty, 2008).

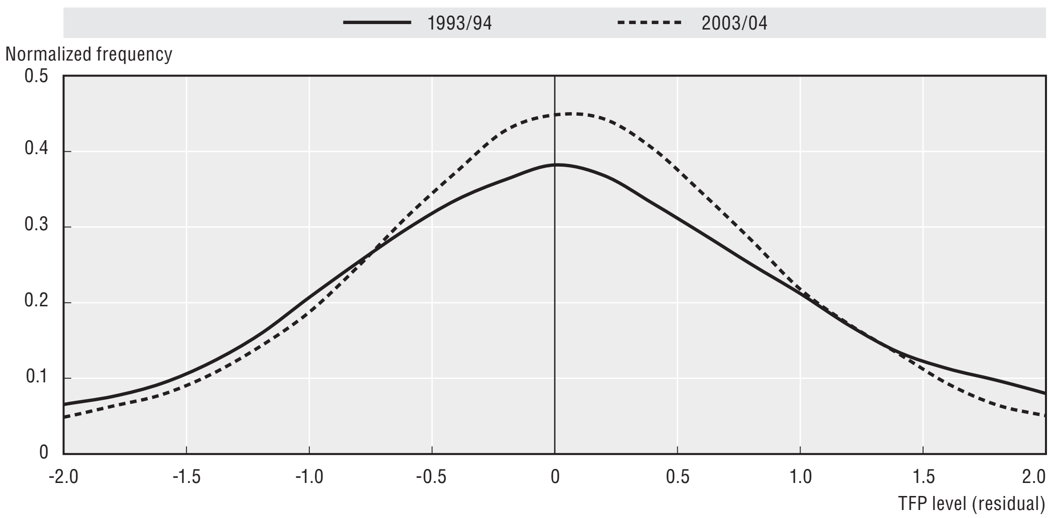
High capital intensity and productivity

While firms in India have remained small, a large share of India's manufacturing has been in sectors that usually require a larger scale of production. Moreover, production has tended to be particularly capital-intensive, with the labour share in value added at about a quarter and falling, compared with a share of nearly two-thirds in many OECD countries. Such a pattern of production appears out of line with revealed comparative advantage (RCA) estimates that show less comparative advantage in skill-based industries relative to China. The relatively high capital intensity of manufacturing also appears out of line with relative prices, given that the cost of capital has been very high relative to labour costs throughout most of the economy as, until recently, prices of investment goods were driven up by import tariffs.[6]

Labour productivity in manufacturing has doubled over the course of the past two decades. A number of studies suggest that most of this increase was due to capital deepening rather than TFP growth. While there were clear improvements in TFP growth during the 1980s, there is very little evidence of acceleration after 1991 (Kaur, 2006).[7]

It is somewhat puzzling if the trade liberalisation and deregulation that took place did not raise TFP growth during the 1990s, either for the total economy or for the manufacturing sector. However, these reforms could have still increased competition. In order to examine this hypothesis, a value added production function (see Annex A1, equation [2]) was estimated on cross-sections of all plants in the organised sector, using Annual Survey of Industries data.[8] The results of this estimation suggest that the distribution of TFP levels across industrial firms became narrower (Figure 5), which is generally taken as a sign of increased competition (Bartlesman and Doms, 2000). Nonetheless, in many industries the market structure remained concentrated so that there was not enough competitive pressure to raise TFP.

Figure 5. **Distribution of TFP levels across industrial plants**



Source: OECD estimates using plant level data from the *Annual Survey of Industries*.

The situation may have changed during the 2000s. For the industrial sector as a whole it was found that TFP may have increased from 2002 (Virmani, 2006). Our own estimates on the basis of production functions using firm-level listed company data suggest an increase in annual TFP growth in the manufacturing sector from less than ½ per cent per year during the 1990s to around 2½ per cent per year during 2000-05.[9] This could imply that the opening of the economy and higher competition is finally bearing fruit also in terms of higher TFP growth. However, the aggregate estimates of OECD (2007) suggest less acceleration in TFP, implying that such gains may have been limited primarily to the largest corporations.

There is evidence that economic reforms did have a positive effect on the productivity of some firms and industries. However, as many of the firms that coped less well with increased competition and suffered relative productivity losses remained in the market, the effect of reform on overall productivity was muted. Sivadasan (2003, 2006), using plant-level data through the mid-1990s, found an improved productivity performance in industries that liberalised (through de-licensing) in comparison to those that did not. Industries that were affected by FDI liberalisation had an 18% to 23% increase in productivity, and industries that faced tariff liberalisation experienced productivity gains of around one-third. His studies also suggest that twice as much of the change occurred within as across plants.

A strong positive impact of trade liberalisation on TFP was also found by Topalova (2004), using a firm-level panel dataset from 1989 to 2001. She found that a 10% decrease in tariffs resulted in a ½ per cent increase in TFP. Again, the gains accrue within existing firms rather than as result of the demise of unproductive firms, as exit rates are extremely low. Bhaumik *et al.* (2006) looked at the change in the dispersion of productivity across industries and plants (before and after the 1991 reforms) and showed that it was associated with a substantial increase in new entry, as pro-competitive reforms influenced firm location decisions.[10] In particular, liberalisation of entry barriers and the consequent increase in net firm entry rates had a strong positive impact on productivity, even as labour policies appear to have restrained it due to the lack of reallocation and limited exit of firms with obsolete technology. These studies all suggest that reforms led to a divergence in performance *across firms* in different industrial sectors and that overall productivity would have increased more had a greater number of the less productive firms exited the market.

Resource reallocation

Exits and labour migration

The reallocation of resources to more productive uses that would be expected to occur in an increasingly open economy has only taken place slowly. This appears to be a consequence of too few exits of firms, low labour migration across states and ongoing high concentration of production in some industries.

Most studies find a limited impact of firm exits on productivity. Consistent with this observation, the exit/hazard rates for large industrial firms are very low, at 3% per year for quoted corporations (from Prowess firm data) – many times smaller than in nearly all OECD economies and most other developing countries. This low exit rate reflects the great difficulty of closing a business in India where there is no bankruptcy code, and prior permission of the government is required before laying off workers.

Labour is highly immobile across states in India as a whole, as well, impeding reallocation of human resources. Almost half of the migrants across states are women moving for marriage while less than 10% move to find new employment. The bulk of internal migration in India is short-distance, with 60% of the stock of migrants changing their residence within the district of enumeration, over 20% outside the district but within the state of enumeration and only 13% moving across state boundaries. Moreover, of those who moved outside their original district, net rural to urban migration represented less than a quarter of lifetime migration – only 26 million persons (Lusome and Bhagat, 2006).

Evidence from the 61st National Sample Survey suggests that migration rates have only mildly increased over the past decade. One oft-mentioned reason for the low internal migration is the multitude of languages and dialects spoken in the country.[11] However, a comparison of migration rates across the then 15 members of the European Union with that across Indian states over a recent 10-year period suggests that there was twice as much migration within Europe as within India, and that it was heavily oriented towards employment.[12] Limited migration in India may lead to adverse impacts of trade liberalisation for states with heavily-protected labour markets. And indeed, there is evidence that states with the most restrictive labour regulations experienced even less labour mobility, impeding poverty reduction (Topalova, 2004).

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Regional concentration indexes

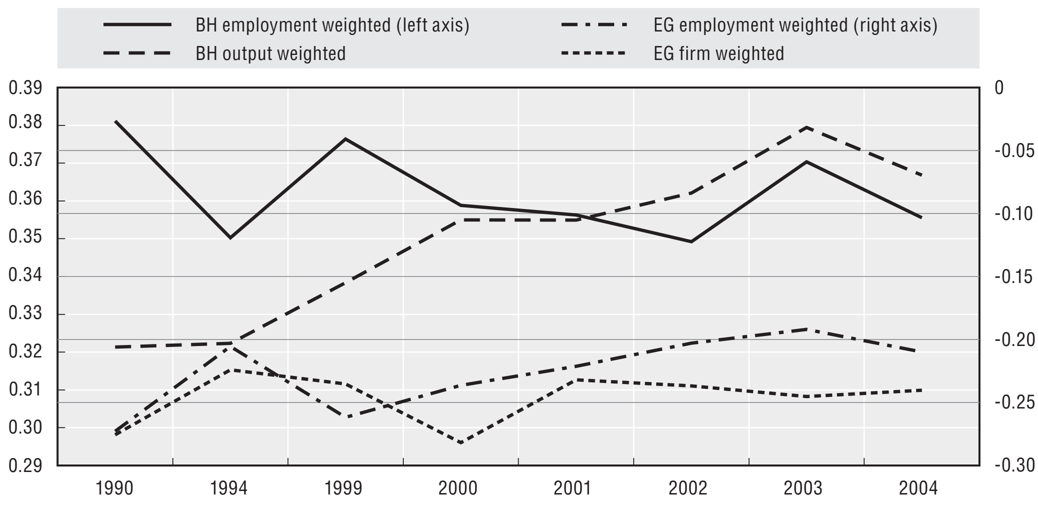
One way to assess the extent of reallocation across sectors and regions in India is to use regional concentration indexes. There are two leading measures of regional concentration available in the literature, the Balassa-Hoover and Ellison-Glaeser indexes (see Annex A1, equations [5]-[8]). The Balassa-Hoover Index measures the extent to which an industry is specialised by region, with higher values of the index reflecting greater specialisation.

The Ellison-Glaeser Index is an alternative regional concentration index that controls for the size distribution of firms. It is also computed, taking advantage of the firm-level data available in this study. This index yields a measure of regional concentration by industry that includes an adjustment for intra-firm heterogeneity (Ellison and Glaeser, 1997). Its components are computed at the three-digit industry level among the 28 states and the largest provincial-level region (Delhi). They are then weighted up to the aggregate level using both firm and employment weights.

Taking advantage of Annual Survey of Industries microdata, regional concentration indexes were computed across states and industries for 1990, 1994, and 1999-2004 (Figure 6). Even over this extended period, the indexes show almost no change in regional specialisation using employment (or firm) weights. The only exception is when output weights are used with the Balassa-Hoover Index. Then a gradual increase in regional specialisation is found. This divergence between the various indexes likely reflects the low extent of migration across regions, which has resulted in limited reallocation of production, coming from shifts in the distribution of capital rather than labour.

Figure 6. **Measures of regional specialisation**

Using the Balassa-Hoover (BH) and Ellison-Glaeser (EG) indices



Source: OECD computation from plant level data from the *Annual Survey of Industries*.

Despite little evidence of changes in regional specialisation that might be expected if barriers to inter-state factor movement were being reduced, there is evidence of growing integration of markets based on changes in retail commodity prices, potentially facilitated by better telecommunications. For 24 basic commodities, price dispersion across states (as measured by the coefficient of variation) fell from 15% to 9% between 1994 and 2004, and a simple average of the price differentials for these commodities fell from 60% to 22% (Virmani and Mittal, 2006). A broader set of non-food manufactured goods commodities suggests an even lower differential (12%) when prices are expenditure-weighted. In China, the mean absolute price differentials across provinces was only around 7% for manufactured products although such comparisons are inexact since they are based on wholesale rather than retail prices (see Dougherty *et al.*, 2007b). For agricultural products, whether in their primary or processed state, differentials across states are larger and exhibit a greater degree of variability than for non-food manufactured products.

Industrial concentration

The above indicators suggest that stable regional concentration has been accompanied by a stable, yet high, degree of market concentration in many Indian industries. In particular, indexes of market concentration have high values based on standard criteria and have not fallen much over time, with about as many industries' concentration ratios rising as falling during the 1990s (Ramaswamy, 2006). Moreover, in those industries where market concentration has risen, one or two large firms typically dominate the market (a number of which are public-sector undertakings).

The Herfindahl-Hirschman Index (HHI) is computed in order to assess the degree of market concentration in an industry (see Annex A1, equation [9]). Industries for which the HHI index exceeds 1 800 are considered by the US Department of Justice to be highly concentrated, while those where it ranges between 1 000 and 1 800 are considered to be moderately concentrated (US DOJ-FTC, 1992).

The extent to which the output of industries is concentrated in a few firms is indeed remarkable compared with other major economies. Applying the 1 800 HHI threshold to census data at similarly detailed levels of industry classification shows that India's share of highly concentrated industries is more than three times higher than that of the United States or China, and twice as high as that for Germany (Table 3, top panel). While in principle this could reflect the small size of the Indian market relative to optimal plant size, it does suggest that there is scope for anti-competitive behaviour in many manufacturing industries.

The studies cited above showed that tariff reduction helped to raise productivity but that the impacts varied across industries. The extent of competition in a given industry appears to be one factor affecting the magnitude of productivity gains, as there is evidence that trade liberalisation has only improved firm and plant-level productivity in unconcentrated industries. Analysis of the impact of industry-specific tariffs on firm-level (corporate) productivity shows that liberalisation had a strong positive effect (through 2001), but only in private sector companies and for those in unconcentrated industries (Topalova, 2004). This may in part be due to the fact that regulations that raise entry barriers for foreign firms are more likely to be found in industries that are highly concentrated, diminishing the benefits of this potential foreign competition for consumers (Chari and Gupta, 2008).

State ownership

Industries dominated by public-sector firms appear not to have seen the same gains in efficiency as a result of foreign competition. The profitability of public manufacturing firms have risen this decade, but the share of their operating surplus in net value-added remains below that of private sector companies and the rate of return on capital is even lower as public-sector firms tend to be more capital-intensive. Efficiency may also be adversely affected in a limited number of industries due to very high concentration and the presence of dominant public-sector firms. There are eight industries where the public sector

Table 3. **International comparison of industry concentration in 2002**

The concentration groupings are based Herfindahl index scores, using the US Department of Justice criteria

	India		United States		Germany (2001)		China	
	5-digit NIC sector		6-digit NAICS sectors		4-digit NACE sectors		4-digit SIC sector	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Highly concentrated	144	36.6	46	10.2	38	17.8	63	12.0
Concentrated	105	26.7	88	19.4	37	17.4	83	15.8
Unconcentrated	144	36.6	319	70.4	138	64.8	380	72.2
Total	393	100	453	100	213	100	526	100
	India: Industries classified by share of public sector in output							
	Under 5%		More than 5% but less than 25%		More than 25% but less than 50%		Greater than 50%	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Highly concentrated	118	38.1	13	24.1	5	35.7	8	53.3
Concentrated	84	27.1	12	22.2	7	50.0	2	13.3
Unconcentrated	108	34.8	29	53.7	2	14.3	5	33.3
Total	310	100	54	100	14	100	15	100

Source: OECD tabulation of Annual Survey of Industries plant-level data for India; US Census Bureau data for the United States; Deutscher Bundestag data for Germany; OECD (2005), *Economic Survey of China*, OECD, Paris.

accounts for more than half of output and which are highly concentrated (Table 3, bottom panel).[13] Moreover, in three of these industries there is only one public-sector company and each has a market share averaging 90%. This high degree of monopoly power complicates the process of privatisation in these cases, especially given the lack of a competition framework until recently. In general, though, public-sector companies in manufacturing are not in concentrated sectors.

More fundamentally, the state or publicly-controlled commercial sector in India remains relatively large, at one-seventh of total GDP and one-fifth of non-farm business sector output, even after the substantial decline seen in the 1990s. Most of this decline was in manufacturing and, by 2004, the share of the public sector in manufacturing output was similar to its share in the aggregate non-farm business sector. Non-manufacturing network industries have much higher shares of public ownership.[14] An exhaustive survey of the international literature by Megginson and Netter (2001) concludes that even after controlling for this type of bias, private ownership is more efficient than public ownership under most circumstances. This appears to be the case as well in India, where profitability of public enterprises is low relative to the private sector (see Conway and Herd, 2008).

India-specific studies, such as Gupta (2005), find that even partial privatisation has substantial benefits for investment, productivity, profits and employment. Our own estimates of the productivity performance of private and public firms suggest that there is a clear advantage for private ownership in India. These estimates used a production function framework (see Annex A1, equation [3]), on the unbalanced panel of corporate firms in the Prowess dataset over the 1990-2006 period, including all firm observations regardless of when the firms began or ended operations. Without controlling for state and industry-specific factors, productivity in public firms is 10% lower than in private firms. When controlling for this heterogeneity, private firms are on average 32% more productive than public ones, in units of value added, or about 10% more productive in gross output terms (see Table A2.2).

Conclusions and scope for further research

This paper has added to the existing evidence on the productivity of Indian firms, helping to explain why India's manufacturing sector has not performed as well as some other large emerging economies. A series of structural distortions were documented, all of which should depress the performance of manufacturing, and thus of the economy as a whole. These distortions exist at multiple levels, and reflect long-standing problems with the reallocation of labour across sectors, excessively small scale of firms, low firm turnover, poor market integration, high concentration and persistent state ownership. Combined, these phenomena represent severe restraints on the level and growth of productivity in manufacturing, suggesting that much remains to be done to improve the strength and sustainability of India's development path.

In trying to understand why India's manufacturing sector has not been more dynamic, perhaps the most persuasive explanation is that anti-competitive regulations have deterred firms' expansion and the entry of new firms. A number of national and international business surveys suggest that weaknesses in India's business environment have inhibited or distorted investment, thus reducing growth and employment creation. Surveys by business associations of manufacturing firms, asking them to state the most important barriers to investment and expansion, typically feature labour regulation and restrictive exit policies at the top of the list (FICCI, 2004; CII, 2006). Evidence collected in the 2007 *Economic Survey of China* also supports the view that these problems remain dominant, among others, and indicates that considerable costs are incurred by business and labour as a result of either following or avoiding the regulations.[15, 16]

Given the importance of framework conditions for economic performance in India as a whole and in the individual states, more information is needed based not only on perceptions but on the actual regulatory settings in the various areas. With this goal in mind, the OECD's comprehensive product market regulation (PMR) indicator, which measures the extent of business regulations across countries, was constructed for India as a whole and for 21 Indian states (OECD, 2007). The main results of this work are described in Conway and Herd (2008), with a similar exercise for labour regulations described in Dougherty (2008), using the OECD's employment protection legislation (EPL) index and a state-level analogue. The PMR indicator is inversely correlated with state-level labour productivity, while the EPL indicator is inversely correlated with the extent of job turnover, suggesting that both types of regulations affect economic performance. A key area for future exploration is to exploit this regulatory data in econometric analysis, and at the same time to address possible concerns about endogeneity, given the potential for reverse causality, since the level of development in a state may also influence its regulatory environment.[17] Measurement of changes in the regulatory environment over time may also allow for a fuller account of such effects, as regulatory reforms proceed at a varying pace across Indian states.

Notes

1. However, the Three-Sector Hypothesis has been questioned as well. One problem is its reliance on local currency prices when making comparisons, which can be misleading. When international prices are used so that adjustments are made for the fact that services prices tend to rise over time as economies become more integrated with global markets – often called the Balassa-Samuelson effect – it would appear that, rather than rising proportional to income, the real share of services in output remains nearly constant (Heston and Summers, 1992; Hsieh and Klenow, 2007a).

2. This paper principally relies upon three datasets, with data through 2004/05: *i)* the Annual Survey of Industries, a plant-level census of the organised sector; *ii)* the Prowess database, a firm-level database of all listed companies in India; as well as *iii)* the National Sample Survey, a stratified household survey.
3. A more detailed analysis, using census rather than National Sample Survey data, removing housing services from output and disaggregating the data to a greater extent, found a slightly higher contribution to productivity growth from the sectoral shift in employment (De Vries and Timmer, 2007), and suggests that prior to reforms in the mid-1980s, there was little gain in productivity due to sectoral reallocation.
4. Since actual comparative advantage is difficult to measure, RCA (or the Balassa Index) is often used instead. It is defined as a country's share of world exports of a good divided by its share of total world exports.
5. Technology use across firms is discussed in Banerjee and Duflo (2005) and Hsieh and Klenow (2007b).
6. For instance, the price of machinery capital fell from substantially above world levels in the early 1980s, by about 1% per year during the 1980s with the initial liberalisation of capital goods imports, by 2% per year in the 1990s as high tariffs and quantitative restrictions were dismantled, and by 3% per year as trade opened further during the first part of this decade (Virmani, 2006). As a consequence, machinery investment rates rose in step with the decline in its price, although this uptake in investment could well have been much more rapid.
7. A few studies have shown a slight increase during the 1990s as compared with the 1980s, but their methodological assumptions have been widely questioned for (see Goldar, 2004).
8. Since the ASI data cannot be longitudinally linked at the plant level (plant identifiers are not released with the microdata), only the distribution of TFP within a given year can be examined here.
9. See equation [3] in Annex A1. This result relies upon gross output production function estimates on corporate firm microdata from the Prowess database, 1990-2005.
10. Such effects may be aggravated by the phenomenon that Burgess and Venables (2004) observe in a comparison of Indian and UK firms, where firms that were closer to the technological frontier may have benefited more from trade liberalisation than those that were further from it, feeding a divergence in productivity that may have resulted in aggregate TFP stagnating.
11. In India there are 24 major languages spoken by a million or more persons. Although Hindi is spoken by half of the population, they are concentrated in less than half of the (mainly northern) states. Official estimates suggest that between 150 and 250 million people speak English out of a population of 1.1 billion.
12. This comparison is based on analysis of OECD Labour Force Survey data for the 1995-2005 period and estimates from CSO (2001) between the 1991 and 2001 population censuses.
13. These eight industries are shipbuilding, milling machinery, electric motors, gas turbines, basic fertiliser chemicals, paraffin wax, stainless steel and miscellaneous electronic components.
14. Public enterprises produce over 90% of output in utilities, and well over half in mining, banking and communications (OECD, 2007).
15. Other problems include poor transport infrastructure and taxation of trade. These are discussed in OECD (2007) as a barrier to further market integration, and further highlighted in Gupta *et al.* (2008).
16. More perception-based evidence comes from investment climate surveys undertaken under the aegis of the World Bank (2004) across 12 Indian states, which find considerable differences in investors' perceptions of the business environment. Measures of these perceptions have been used in related work to examine the linkages between the perceptions and actual investment flows across states (Veeramani and Goldar, 2005) and at the level of plants or establishments (Lall and Mengistae, 2005). Yet perceptions by business of the importance of the regulatory environment and the stringency of labour laws may or not play out in practice.
17. An example of one possible approach to address this type of issue is found in Menon and Sanyal (2007).

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ANNEX A1

Detailed Equations

The data

This paper principally relies upon three datasets, running through 2004/05: *i)* the Annual Survey of Industries (ASI), a census of all registered manufacturing plants in India with more than 100 workers and a random one-third sample of remaining registered plants with more than 10 workers (or 20 if no electrical equipment is used), with sampling weights reflecting the population of registered plants; *ii)* the National Sample Survey (NSS), a stratified household survey, with information on economy-wide employment based on thin annual samples (since 1989) and five-yearly "deep" surveys; *iii)* the Prowess database, a firm-level panel of all listed companies' financial statements starting in 1990.

The equations

Unit labour cost levels

Unit labour cost (ULC) is defined as the cost of labour required to produce one unit of output in a particular industry, sector or the aggregate economy. ULC indices can be directly compared between countries. The paper uses a comparison of relative *levels* of unit labour cost, which allows comparisons of cost competitiveness in absolute terms, not just relative shifts. The unit labour cost measure is a ratio constructed from a numerator reflecting the major cost category in the production process (which is labour compensation) and a denominator reflecting the output from the production process (GDP or value added). Countries with a low level of ULC relative to other countries may be regarded as competitive. The ULC is defined in levels as follows:

$$ULC^{ab} = \frac{(LC^{a}/ER^{ab})/LC^{b}}{(LP^{a}/PPP^{ab})/LP^{b}} \qquad [1]$$

where *ULC* stands for unit labour cost, *LC* for average labour compensation, *LP* for average labour productivity, *Y* for value added, ER^{ab} for the official nominal exchange rate between countries *A* and *B* and PPP^{ab} for the purchasing power parity for output in country *A* relative to country *B*. We use the unit value ratio to approximate the *PPP*.

A specific characteristic of unit labour cost (level) measures is that the numerator, which reflects the labour cost component of the equation, is typically expressed in nominal terms, whereas the denominator, which is output or productivity, is measured in real or volume terms. This implies that, when comparing unit labour cost levels across countries, the level of wages or labour compensation is converted at the official exchange rate: it represents the cost element of the arbitrage across countries. In contrast, output or productivity relates to a volume measure as it resembles a quantity unit of output. Hence for level comparisons, output needs to be converted to a common currency using purchasing power parity instead of the exchange rate, so that comparative output levels are adjusted for differences in relative prices across countries. These purchasing price parities are estimated using an item-by-item comparison of manufacturing census unit values between India and Germany within three-digit industrial branches, as described in Erumban (2007). An interspatial Fisher-type price index is used for weighting, based on the expenditure weights of each product in output; see Dougherty *et al.* (2007b) for more details on the computation of specific PPPs from unit values.

Production function estimates

In order to estimate total factor productivity, production functions were estimated using the ASI and Prowess microdata. TFP is calculated as the residual in a log-linear formulation of the production function, estimated with appropriate controls. Differences between groups are estimated using dummy variables for different types of plants or firms. The value added production function was estimated on cross-sections of all plants in the organised sector with the ASI data, using a Cobb Douglas formulation for simplicity:

$$\ln(VA/L) = \alpha + \beta \ln(K/L) + D \cdot \delta + \varepsilon \qquad [2]$$

where *VA* is value added, *L* is labour input (in full-time equivalents), *K* the capital stock (based on the book value of net fixed assets), matrix *D* a set of fixed effects for scale, time, region, and industry and ε the (exponential) error term. For the firm-level estimates using the Prowess database, data on actual employment was missing for most firms, so the wage bill was used as the measure of labour input:

$$\ln(VA_t) = \alpha + \beta_K \ln(K_t) + \beta_W \ln(W_t) + O \cdot \gamma + D \cdot \delta + \varepsilon \qquad [3]$$

where *VA* is value added, *K* the book value of fixed assets,[1] *W* is the total wage bill, matrix *O* is a dummy for ownership, matrix *D* a set of fixed effects for time, state, and industry and ε the error term. The equation is estimated using OLS on the 1990-2005 panel of firm data, regardless of when a firm entered. To control for possible endogeneity of wages, a two-stage estimator is also employed (yielding essentially the same results). In addition, a log-linear gross-output based production function was also used to confirm the results of the value added function, with energy (*E*) and intermediate materials (*M*) as additional inputs:

$$\ln(GO_t) = \alpha + \beta_W \ln(W_t) + \beta_K \ln(K_t) + \beta_M \ln(M_t) + \beta_E \ln(E_t) + O \cdot \gamma + D \cdot \delta + \varepsilon \qquad [4]$$

All data were measured in real terms. Gross output is deflated using two-digit industry-specific wholesale price indexes (WPIs), investment using the WPIs for fixed investment, the wage bill using the CPI for industrial workers, material inputs using a weighted combination of industry deflators based on the relevant input structure from the 1999 Input-Output table, and energy using the relevant sectoral WPI.

Regional and market concentration indexes

Two measures of regional concentration were computed: the Balassa-Hoover and Ellison-Glaeser Indexes (also see Dougherty and Herd, 2005). The first, the Balassa-Hoover Index, measures the extent to which an industry is specialised by region, with higher values of the index reflecting greater specialisation in an industry (Hoover, 1936). It is based on the location quotient L with respect to output, described by Bai *et al.* (2004), at time *t*:

$$L_{ij} = \frac{Y_{ij}/Y_i}{Y_j/Y} \qquad [5]$$

where Y_{ij} is output of industry *i* in region *j*, Y_j is total output in region *j*, Y_i is total output in industry *i*, and *Y* is total industrial output. If L_{ij} is greater than 1, then region *j* has a higher percentage of industry *i* than of total industrial output. The regions *j* are arranged in order of increasing location quotients (degree of specialisation) in an industry *i* and cumulated.

The Balassa-Hoover index for each industry is given by the Gini index of the resulting area between this curve and the 45 degree axis. This value is by definition between 0 and 1, with a higher value representing greater specialisation by region. In order to yield an overall index, the index for each industry is then aggregated weighting by the industry's share in total output. This index is also computed using employment data in place of output data (defining Y as employment rather than output). These computations are done at the two-digit industry level among provincial-level regions, for each year in the dataset.

The Ellison-Glaeser Index is an alternative regional concentration index that controls for the size distribution of firms. It is also computed, taking advantage of the firm-level data available in this study. This index yields a measure of regional concentration by industry that includes an adjustment for intra-firm heterogeneity (Ellison and Glaeser, 1997). It is defined at time *t* as:

$$\gamma_i \equiv \frac{G_{it} / (1 - \sum_j s_{jt}^{\,2}) - H_{it}}{1 - H_{it}} \qquad [6]$$

where the term G_{it} is the sum of squared deviations of the industry *i*'s employment shares s_{ijt} from a measure, s_{jt} of region *j*'s share of aggregate employment:[2]

$$G_{it} \equiv \sum_j (s_{ijt} - s_{jt})^2 \qquad [7]$$

and the term H_{it} is a Herfindahl-style measure of the firm-level concentration of employment in an industry:

$$H_{it} \equiv \sum_k e_{kt}^{\,2} / (\sum_k e_{kt})^2 \qquad [8]$$

where e_{kt} is the level of employment in the *kth* firm in industry *i* at time *t*. These measures are computed at the three-digit industry level among provincial-level regions. They are then weighted up to the aggregate level using both firm and employment weights.

The Herfindahl-Hirschman Index (HHI) is also computed, in order to assess the degree of market concentration in an industry:

$$HHI = \sum_{i=1}^{N} (100 \cdot s_i)^2 \qquad [9]$$

The index is defined as the sum of the squared market shares s_i of each firm *i* in an industry.

Notes

1. For a balanced sub-sample, a capital stock measure was built up using the perpetual inventory method. The equations were re-run, with the results yielding nearly the same coefficients on ownership, and a slightly higher elasticity on the capital stock, compared with using book value of fixed assets.
2. Following Dumais *et al.* (2002), we define s_{jt} as the unweighted arithmetic mean of the s_{ijt} terms across the industries in the sample, $s_{jt} = (1/I)\sum_I s_{ijt}$ where *I* is the total number of industries.

ANNEX A2

Econometric Results

Table A2.1. **Regressions on ASI plant data**

OLS estimates on manufacturing plants, used in Figures 5 and 6

Dependent variable: value added per worker (log)	1993/94	2002/03
Capital per worker (log)	0.337***	0.442***
	(0.000)	(0.006)
Relative to plants with 1-10 employees:		
10-20 employees	0.144***	0.231**
	(0.000)	(0.030)
20-50 employees	0.234***	0.418**
	(0.000)	(0.029)
50-100 employees	0.373***	0.493**
	(0.000)	(0.030)
100-250 employees	0.420***	0.582**
	(0.000)	(0.030)
250+ employees	0.603***	0.724**
	(0.000)	(0.031)
Fixed effects:		
States	Yes	Yes
Industries	Yes	Yes
Observations	29 903	24 864
R-squared	0.983	0.991

Notes: The exponential of the coefficient on the scale dummies can be interpreted in per cent. See equation [2]. Standard errors are shown in parentheses. * denotes significance at the 10% level; ** at the 5% level; *** at the 1% level.

Table A2.2. **Regressions on Prowess data**

Estimates for corporate firms

	Dependent variable: value added (log)		Gross output (log)	
	OLS	2SLS	OLS	2SLS
Gross fixed assets (log)	0.334***	0.351***	0.049***	0.071***
	(0.003)	(0.004)	(0.002)	(0.003)
Wages (log)	0.629***	0.608***	0.211***	0.201***
	(0.003)	(0.004)	(0.002)	(0.003)
Materials (log)			0.638***	0.634***
			(0.002)	(0.002)
Energy (log)			0.093***	0.082***
			(0.002)	(0.003)
Private ownership	***0.279*** ***	***0.263*** ***	***0.105*** ***	***0.098*** ***
	(0.019)	*(0.020)*	*(0.011)*	*(0.011)*
Fixed effects:				
Years	Yes	Yes	Yes	Yes
States	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Observations	49 855	42 812	45 194	38 269
Adjusted R-squared	0.833	0.836	0.938	0.942

Notes: The exponential of the coefficient on the private ownership dummy can be interpreted in per cent. See equations [3] and [4]. Results using the value added and gross output specifications are in their respective units (average ratio is ¼). OLS and 2SLS estimates carried out on the unbalanced panel of all active firms. The 2SLS estimates use lagged values of independent variables as instruments. Standard errors are shown in parentheses. * denotes significance at the 10% level; ** at the 5% level; *** at the 1% level.