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HAS A PRIVATE SECTOR EMERGED IN CHINA'S INDUSTRY? EVIDENCE FROM A QUARTER OF A MILLION CHINESE FIRMS

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ABSTRACT

This paper assesses the progress of China's transition toward a market economy by examining the structure of ownership, productivity, and profitability, as well as the concentration of production across firms, industries and regions. It does this by analyzing a database of firm microdata of the quarter of a million industrial companies in operation during the 1998–2003 period. Results show that the private sector now accounts for more than half of industrial output, compared with barely more than a quarter in 1998, and operates much more efficiently than the public sector. Higher productivity has fed through to profitability, motivating greater regional specialization of production. These changes are consistent with what would be expected in a market-based economy, and suggests that reforms are making rapid progress.

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"I watched a snail crawl along the edge of a straight razor…crawling and surviving"
– Francis Ford Coppola

1. Introduction

China's transition from a planned towards a market economy over the past 25 years is in many ways remarkable. Highly unorthodox economic reforms were pursued in a decentralized manner, in keeping with political concerns, but often at the risk of creating new self-propagating distortions. Moreover, many reforms were piecemeal and tentative at first and only accelerated gradually. The uneven path of these reforms led to well-founded concerns that the progression to a market economy could be derailed.[2]

This paper analyzes a new set of data that covers the most recent five years of reforms through 2003. The dataset covers just over a quarter of a million unique firms that report their principal financial and economic results to the government on an annual basis. As a result of firm exit and entry, the number of operating firms in any given year is considerably less, amounting to between 160,000 and 200,000 firms. The information covers all industrial companies with annual sales of over five million yuan, and so represents a detailed insight into the development of the Chinese economy.

Private ownership was not an early feature of the reform process. Instead, local government owned enterprises were the early driver of reforms in the industrial sector through the 1980s and early 1990s. These enterprises were marked by their ambiguous property rights which made up for a weak regulatory environment and offered investors some protection from expropriation.[3] Overt private ownership on a significant scale has only emerged in the past decade (OECD, 2005).

In the absence of private ownership, downstream prices were liberalized (Table 1), under a dual-track system which allowed production over a set quota to be sold at market prices. While strengthening incentives, this partial deregulation of downstream prices with upstream prices set at relatively low levels left open large rents. While this approach built support for reform, its partial nature propagated distortions, in an incomplete regulatory environment with few rules governing competition behavior.

2. Murphy, Shleifer, and Vishny (1992) illustrate the risks of getting the reform sequencing wrong, such as by introducing privatization before adequately liberalizing prices, while Lau, Qian, and Roland (2001) show that the Chinese reforms followed an apparently incentive-compatible path that sustained reform momentum even while creating (and then destroying) rent-seeking opportunities along the way. And see Maddison (1998) for a long view.

3. The mechanics of these unorthodox reforms are laid out by Li (1996) and Che and Qian (1998). Empirical support can be found in Dougherty and McGuckin (2002).

[Table 1: Share of transactions conducted at market prices]

Concern about these and related distortions gathered pitch as appraisals of the reforms of the late 1980s and early 1990s revealed disturbing trends in the structure of production, prices, productivity, and trade. In a highly influential study, Alwyn Young (2000) found that the shares of different industries across provinces were converging rather than diverging (through 1997), as would be expected if comparative advantage were playing a strong role in determining the structure of production. He also observed that prices for industrial and retail goods were diverging rather than converging and marginal productivity was not converging across sectors, as would be expected if market forces were at work. With respect to trade, Sandra Poncet (2003, 2005) found that inter-provincial barriers were having a marginally increasing negative impact on regional trade flows in the 1992 to 1997 period, whether looked at in aggregate or at the industry level.[4]

Even if one accepts the implications of Young and Poncet's studies for the period to 1997, further analysis using a variety of methods suggest that they may have reversed as time has passed. In terms of output shares of detailed industries, Bai *et al.* (2004) find that measures of regional specialization appear to have bottomed-out in the early 1990s and improved in the period to 1998. In terms of prices, Fan and Wei (2003) and Xu and Voon (2003) examine the stationarity and co-movement of up- and downstream prices and find relatively strong evidence of convergence (or domestic integration) through 2000.[5] And in terms of marginal productivities, Zhang and Tan (2004) obtain evidence that these may have converged in the period through 2001. While a new input-output table is not available yet to update Poncet's analysis, direct survey evidence by the Development Research Center (Li *et al*., 2003) suggest that inter-provincial barriers have dropped dramatically in recent years.

We proceed first by assessing the rise of the private sector, second by examining its productivity relative to the publicly-controlled sector, third by decomposing the turnaround in profitability into subcomponents, and finally by measuring the extent of reallocation of production and consequential increase in specialization that the ownership transformation has stimulated. This empirical analysis suggests that the rise of private business has gone a long way toward turning China (starting with her industrial sector) into a market economy. In short, the reversal of the formerly distortion-laden path

4. Carsten Holz (2006) has recently directly contested Young's main findings and their interpretation – particularly the extent to which they imply rising trade barriers in the mid-1990s. Naughton (2003) also found less evidence of barriers between Chinese provinces than Poncet in the pre-1992 period.

5. Byström *et al*. (2005) also find that interregional integration has increased significantly, judged by co-movement of output shares in the decade to 2001. Viewed in a similar light, Zax and Yin (2005) find that industrial factor prices had essentially reached a plateau in terms of convergence by the 1999–2002 period.

appears to be decisive and is being led by widespread – and healthy (i.e. in terms of profits) – privatization of the economy, which is in turn leading to improved allocation of production and employment.

2. Data and measurement

Uniquely comprehensive microdata

The empirical work carried out in this paper utilizes the industrial firm database of the Chinese National Bureau of Statistics (NBS). These data cover the 1998 to 2003 period and include all industrial enterprises with annual sales in current yuan of five million or higher.[6] Ten percent of firms are excluded in each year from the analysis since they have implausible or zero values for gross output, intermediate inputs, employment or fixed assets, based on criteria adapted from Geng (2004). In 1998, this leaves 140,000 firms with valid data, with the number rising to 180,000 by 2003. As a result of exit and entry to the database, about 80% of the firms in a given year have a valid observation in the previous year. In order to utilize the maximum number of firm observations, the (unbalanced) panel consisting of all firms with valid data is used in the analysis that follows.

Financial variables adjusted to be comparable as possible

For each firm, detailed balance sheet data are available (summary shown in Table 2), in addition to basic information on its ownership structure, industry, location, and employment. This high level of detail allows for several types of adjustments to be made to value added, intermediate inputs, profit, and capital concepts to correspond more closely with international practice. For instance, Chinese statistical practice includes VAT in value added and interest in intermediate inputs; we exclude them. In computing rates of returns on assets, the preferred profit concept is a national accounts one where bank debt and equity are treated neutrally. Thus, we add interest paid to profits prior to tax and investment income (essentially net surplus). And in measuring capital, we take the book value of net fixed assets plus inventories as an estimate. One drawback to the database is that assets are valued at historic cost and are not revalued. However, over the period 1998 to 2003, the increase in the price index of fixed asset investment was less than 1% per year, limiting the potential bias from this source.

[Table 2: Profile of industrial microdata]

6. In principle these data also cover state-owned enterprises even if they do not meet the threshold, but this small number of firms were excluded from the analysis. Among all industrial firms below the threshold, we estimate that the share of output by the private sector exceeds 90% (OECD, 2005).

Since the data are firm observations, we are able to reclassify firms and their data items based on firm-level ownership structure. This allows us to re-appraise previous estimates of the extent of private ownership in China. Moreover, in the final section where we compute concentration indices, firm-level heterogeneity is taken into account in the computation of the Hoover-Glaeser specialization index and Herfindahl-Hirschman (HHI) concentration ratios can be computed, including on the same basis as the U.S. Census Bureau.

3. Ownership

Definition of private control

According to contemporary theories of the firm, ownership should be defined in terms of what shareholder controls the "residual rights" of the firm, in the sense of who dictates unforeseen contingencies (Hart, 1995). This is the definition that we seek to apply. Since detailed data on the shareholding structure of each firm is available, the type of controlling shareholder can be identified. This approach contrasts with the official firm registration categories that are commonly used in analysis of China's business sector.

Rather than using the official firm registration status that is commonly shown in Chinese statistical publications to look at ownership, we separate firms by type of controlling shareholder. By examining shareholding structure, firms can be separated by whether it is the state (directly or indirectly), a collective (local government), or a private entity (individuals, domestic legal persons, or foreign companies) that controls the firm. This classification allows us to look at the type of actual owner, since the official registered enterprise structure often does not reflect the type of owner that controls the firm because companies rarely change their registration status, even when their controlling shareholder changes. The use of shareholder information is especially important for limited liability and shareholding companies (dominated by legal person shareholders), whose ownership is heavily mixed between state and private control.

In the NBS microdata, firms directly report whether they are state held: that is, they are controlled directly or indirectly by the state. In order to distinguish between direct and indirect control, firms where the *state* owns more than 50% of the share capital[7] are classified as directly state controlled, with the remainder of state held firms treated as indirectly controlled. Amongst the non-state held firms, collective controlled firms are identified if they report *collective* capital share greater than 50%. The remainder of the

7. There are drawbacks to such a classification. Share ownership is only one of the criteria that the proposed revision of the System of National Accounts (SNA) suggests as relevant. In particular, the SNA suggests looking at groups that control the board of directors. It may be possible to exert control through the board with less than 50% of the share capital.

non-state firms are subdivided among various types of private ownership depending on whether they are controlled (share capital greater than 50%) by a company (a legal person), individuals, non-mainland agents, or other shareholders. This classification by controlling shareholder – which is exhaustive – allows us to look at the *type* of actual owner, since the official registration status often does not reflect the *de facto* owner. The use of controlling shareholder also overcomes the difficulties in interpreting the bewildering array of different ownership registration categories, many of which are not meaningfully distinct. See OECD (2000) and ADB (2003) for a detailed list of the legal basis for each enterprise type.

Results

The result of this exercise is to show a rapid shift toward private ownership in China amongst firms with more than five million yuan in annual sales (Table 3). Classification by controlling shareholder shows that the private sector has grown from 27.9% of industrial value added in 1998 to 52.3% in 2003. Individually-controlled firms' share has grown most rapidly, representing almost half of this increase, with the remainder of the gain split equally between companies (controlled by legal persons) and non-mainland shareholders. Part of this increase may be attributed to the progressively larger share of all firms that have had to report to statistical authorities over the years, since most of the firms that have crossed over the reporting firm size threshold appear to be private.[8]

At the same time as the private sector has grown, the state and collective controlled sectors have fallen. The share of value added directly controlled by the state fell from 38.9% to 22.9% over the five years 1998–2003. While several percentage points of this drop may represent a shift toward *indirect* state control, the remainder occurred through the closure, restructuring, and privatization of enterprises. The collective controlled share has also fallen rapidly, as many of these firms have also exited or changed ownership.

[Table 3: Mapping of registration status to controlling shareholder]

Defining ownership based on control can differ significantly from the registered ownership categories that are usually relied upon. For instance, more than half of limited liability companies' value added was controlled by private shareholders in 2003, as was a quarter of shareholding companies and joint ownership enterprises' value added. Many such corporations were formerly state controlled and since have

8. Nevertheless, a generalization of these results to the whole commercial business sector and to aggregate GDP confirms a rapid shift toward private ownership, with it overtaking public ownership during the past five years (OECD, 2005).

been privatized. In many studies, such companies are assumed to either lie completely in the public or the private sectors (see IFC, 2000; ADB, 2003; Song *et al.*, 2005).

Even within registered ownership categories that should be more homogenous, there is a range of controlling interests. For example, although all structures classified as state-owned enterprises and solely state-funded corporations are controlled by the state in some way, over 20% were *indirectly* controlled by other state-controlled companies. And while firms officially registered as private and solely-foreign funded were overwhelming controlled by private shareholders (over 97%), almost a third of firms registered as non-mainland joint ventures, on the basis of value added, are actually controlled by the state.

The structure of the private sector has become increasingly diversified across industries as well.[9] In the industrial sector, the state remains dominant only in mining and utilities. In 1998, the private sector produced the larger share of value added in only 5 out of 23 "non-core" manufacturing industries.[10] By 2003, this was true for all 23 of these industries. Moreover, in half of them, private firms produced more than three-quarters of output. Overall in these 23 industries, the private sector employs two-thirds of the labour-force, produces two-thirds of these industries' value added and accounts for over 90% of exports. Over a quarter of all industrial output is now produced by private foreign-owned companies, notably in the telecom equipment industry. Domestic private firms have expanded the most in textiles and steel.

The growth of the private sector has not been even across the country. An overwhelming share of private industrial output is produced in the eastern coastal region (Zhejiang, Guangdong, and Jiangsu provinces), that has been at the forefront of all types of reforms. In this region the share of industrial value added from the private sector is 63% against only 32% in other regions. These other regions are about five years behind in the development of the private sector. However, the central, western, and north-eastern regions' private sectors have been growing faster than the coastal areas' over the five years to 2003, suggesting that catch-up is underway.

To date, the emergence of the private sector has been concentrated amongst small and medium enterprises, with private entities controlling 81% of the firms in the dataset with under 1 000 employees, compared with only 36% of firms with over 1 000 employees. There is evidence that an increase in the average size of a private sector company could enhance productivity, but private firms face obstacles to increase scale. This situation is symptomatic of the overall insufficient level of concentration of some industries.

9. Refer to Annex Tables 2.A2.3 and 2.A2.4 in OECD (2005).

10. The excluded manufacturing industries are petroleum, smelting, tobacco, and transport equipment. These industries are a subset of the "core" sectors where the state continues to dominate (*ibid*).

4. Productivity

Production function estimates

In order to determine the extent to which the ownership transformation has resulted in improvements in productivity, production functions are estimated at the firm level using the microdata. Several specifications are used to ensure that the results are robust. Cobb-Douglas production functions are specified in both value added and gross output forms, to ensure robustness, since each form can yield different results (Bartelsman and Doms, 2000). Wage-augmented variants are used in the preferred specification due to concerns about the quality of the measure of employment (total headcount), and the presence of large wage gaps across different types of firms. These gaps suggest that private firms either hire much more qualified workers or they utilize higher wages to deter shirking and improve incentives using efficiency wages (see Akerlof and Yellen, 1986). The value added form is thus specified as:

$$VA = A \cdot L^{\alpha_1} \cdot K^{\alpha_2} \cdot W^{\beta} \cdot e^{D \cdot \gamma_1} \cdot e^{O \cdot \gamma_2} \cdot e^{\varepsilon} \tag{1}$$

Where *VA* is value added (pre-tax, deflated using the implicit gross output deflator), *L* is labor input (in full time equivalents), *K* is capital stock (based on book value of net fixed assets), *W* is relative wage (mean-differenced), and matrix *D* is a set of control dummies for scale, time, region, and industry; ε is the (exponential) error term. The matrix *O* of dummy variables represents the various forms of ownership described in the previous section, and corresponds directly to the types of controlling shareholder shown across the columns of Table 3. No dummy has been introduced for the group of enterprises directly controlled by the state. The equation is transformed into log-linear form:

$$\ln(VA) = a + \alpha_1 \ln(L) + \alpha_2 \ln(K) + \beta \ln(W) + D \cdot \gamma_1 + O \cdot \gamma_2 + \varepsilon \tag{2}$$

This equation is then estimated for the entire dataset with controls for two-digit industries and regions, using ordinary least squares (OLS), with White heteroskedasticity-consistent standard errors. It was also estimated in log differences (growth rates) and using a two-stage least squares (2SLS) estimator with lagged values of the independent variables as instruments. Coefficients on *O* can be directly interpreted as differences in productivity for each ownership type, relative to directly state controlled firms, that interests us. The gross output form is estimated analogously:

$$GO = A \cdot L^{\alpha_1} \cdot K^{\alpha_2} \cdot M^{\alpha_3} \cdot W^{\beta} \cdot e^{D \cdot \gamma_1} \cdot e^{O \cdot \gamma_2} \cdot e^{\varepsilon} \tag{3}$$

The gross output equation is then transformed into log-linear form, with the terms analogous to equation (2) above. The additional input *M* is intermediate inputs (deflated using the materials of production deflator).

In order to ensure the robustness of the results, the gross output equation was estimated in both levels and growth rates separately within each two-digit industry using four-digit industry controls, using both OLS and random-effects panel estimators (which were not used on the overall dataset due to computational limitations).[11] The results, which allowed the production function coefficients to vary by sector, yielded differences in the ownership categories that were highly consistent with those shown in the overall OLS results, and indeed, even the capital coefficients were significant throughout, suggesting the results were unlikely to be affected by potential simultaneity problems (see Griliches and Mariesse, 1995).

In the estimations that follow, the exponential of the coefficients on the dummy variables can be directly interpreted as percent differences in the constant term, total factor productivity. Thus, differences in productivity (in levels or growth rates) between directly state controlled companies and various forms of non-state control are simply the exponential of the estimated coefficients.

The literature on firm ownership argues that firms controlled by private shareholders should have stronger profit incentives and higher productivity than those owned by government. Firms owned by governments typically suffer from weak or distorted incentives, best illustrated by the existence of soft-budget constraints, where expectations of bailouts by the state creates moral hazard problems, thus leading to chronic underperformance. Studies of the Chinese economy have found that collectives often out-perform state-owned enterprises as a result of harder budget constraints, but fewer studies have been carried out for the private sector (e.g., Jefferson and Su, 2005). Partial privatization, with the state retaining a controlling interest, has been shown to have some positive benefits, but the evidence here is more mixed (OECD, 2005). Further complications in assessing the role of private ownership arise as a result of possible selection biases in the privatization process, which can affect observed performance differences. However, meta-studies have shown that once these biases are controlled for, private owners systematically outperform state owners (Megginson and Netter, 2001), although significant lags can sometimes be observed (Brown *et al*., 2006).

11. A fixed effects panel estimator could not be used due to the inability to adequately match firm observations across the entire 1998 to 2003 period. The NBS does not assign permanent firm identifiers, and even a change of name or basic ownership structure would typically cause the firm identifier to change. As a result, a balanced panel would contain only 15% of the 307,117 firm observations with unique identifiers. However, in adjacent years, about 80% of firms could be matched. Therefore, we chose to focus on the difference, or growth rate, equation as a means of considering firm-level effects, since fewer name and structure changes occur in any pair of adjacent years, compared with the whole sample period.

Selection biases could be a problem in the case of an enterprise that started under one form of control and later shifted to another, selectively. Each of our enterprise-year observations has controlling ownership detail, but we cannot accurately match firms before and after conversion. Nevertheless, we would only expect selection biases to be an issue for firms which underwent some type of conversion – principally from direct state to indirect state or private legal person controlled firms. It is possible that the best, or worst, performing firms were privatized first. However, since we find below that the estimated coefficients for various types of private firms are all very similar, and robust to the various specifications, selection bias does not appear to be a serious problem. In particular, the results of the 2SLS level and OLS difference equation estimates show strong differences between private and state ownership, suggesting that selection biases are not affecting the results.

Results

The overall means of the data suggest that the movement of resources to the private sector has improved economic performance, as the sector is more efficient than the state-controlled sector. While labour productivity in the private sector, outside the resource-based sector, is nearly the same as in the state sector, which uses almost twice as much capital per worker. Put another way, capital intensity in the private sector is one-third that of the public sector as a whole but labour productivity is just 15% less. Efficiency may not be the sole factor influencing productivity; other factors than capital intensity such as the choice of location or industry, types of inputs or production processes, scale of production, or even the age of a firm might influence overall productivity, and a full analysis needs to take their impact into consideration.

Private firms are more productive

Regression estimates with controls for these factors confirm the superior performance of the private sector. Equation 2 is estimated using OLS, yielding estimates of total factor productivity (TFP) for firms controlled by different types of shareholders. The result confirms that overall productivity is markedly higher in private sector companies, whether they are owned by non-mainland shareholders, other private sector companies or individuals. As shown in Figure 1, on the basis of a value-added measure of output, TFP in private sector companies, after taking into account the impact of firm size, location, and industry, is double that in directly state-controlled firms (90% to 123% higher). Reforms that have changed the nature of state control over enterprises, by allowing control to be exercised indirectly – through other companies – have boosted productivity. These indirectly state controlled firms are about 50% more productive. While it is possible that selection biases may affect estimates for firms that have converted from state to private

ownership forms, the uniformly large differences in performance for all types of private enterprises, including those that have not converted from other forms suggests that this is not a problem.[12]

[Figure 1: Productivity differences]

The estimated equation appears to be quite robust, with a 56% adjusted R-squared, and highly significant coefficients on all terms, including capital (Table 4). In order to ensure that the estimates are not biased by problems of simultaneity, a two-stage least squares (2SLS) estimator was also used, with first lags used as the instruments. The result is strikingly similar to the OLS result, with the coefficients on the various forms of ownership nearly the same except that the effect of scale appears to be more significant: the total factor productivity of firms with over 1 000 employees is notably higher than that of smaller firms.

[Table 4: Firm-based value added production functions regression estimates]

The same equation estimated in growth rates (log-differences) shows that productivity is not only higher in private controlled firms, but it is increasing at about 5% per year more rapidly, whether the firm is controlled by non-state companies (legal persons), non-mainland owners, or individuals. Such rapid growth of productivity implies that the productivity gap increased during the estimation period. These results strongly support the idea that the productivity advantages of private ownership are not due to (one-time) selection biases since there is substantial ongoing growth of productivity in the three principal types of private controlled firms.[13] However, the results for indirectly state controlled firms suggest some caution, despite the apparent productivity level advantages, given the large standard error on productivity growth for legal person controlled state firms in the difference equation. Similarly, productivity growth for collective controlled firms also appears to be rather meagre, despite their high productivity levels compared to private firms.

Alternative production function

The gross output form of the production function is also estimated using OLS and 2SLS, yielding results that generally support those found using the value added specification (Table 5). Privately

12. This result is consistent with those of Jefferson and Song (2005) and Song *et al.* (2005), who find that privatization yields considerable productivity benefits for shareholding firms in China, even when compared with a control group of firms that did not undergo conversion.

13. The weak productivity growth estimate for the small number of private firms with other "other" controlling owners is harder to interpret, since we do not have detailed information on their controlling shareholder. The result likely reflects the weaknesses in private firms with overly diversified ownership, such as when there is no single controlling shareholder.

controlled firms have significantly higher productivity than those controlled directly by the state, and their rate of productivity growth is higher.

Results using the gross output specification are not directly comparable with those using the value added specification due to the intermediate content and its close association with gross output. Consequently each of these equations has a much higher adjusted R-squared. Despite the difference in output concepts, the gross output coefficients are roughly comparable with those for value added when divided by one minus the coefficient on intermediate inputs. The result suggests that perhaps as much as 20% of the productivity differential observed using the value added specification may be due to differences in the utilization of intermediate inputs. Nevertheless, this still leave more than 80% of the productivity differential remaining.

[Table 5: Firm-based gross output production functions regression estimates]

A further sensitivity test is employed by estimating the full gross output production function separately for each of the 34 individual two-digit industry categories with sufficient observations, using four-digit, rather than two-digit, industry controls, and otherwise the same input and dummy variables. While there were some differences across industries, in 32 of 34 industries, privately controlled companies performed significantly better than those controlled by the state. Moreover, the average (weighted) coefficient on private ownership was slightly higher than what was estimated using OLS for the industrial sector as a whole. Similar results were also found in estimates using a random effects panel estimator at the industry level.

The wage term

The wage term in the production function is included to address concerns about the quality of the labor input measure and the possibility that firms use efficiency wages as a means to improve incentives. Its inclusion has only a minor effect on the estimated productivity advantage attributed to private ownership. In the gross output specification, if the wage term is dropped, the productivity advantage on private control is marginally lower, but in the value added specification, the productivity advantage associated with private control is slightly higher. However, the effects of removing the wage term on the overall equation are more substantial. In particular, without the wage term, the coefficient on labor input declines by a large amount, while it increases on net fixed assets. Moreover, the adjusted R-squared drops appreciably under the value added specification. Given the stronger explanatory power of the equations that include the wage term, and previously observed wage efficiency behavior in non-state-owned

enterprises in China (see Fleisher and Wang, 2001), our preferred specifications shown above include the wage term.

5. Profits

Over time there is evidence of across-the-board gains in productivity, as industries became more competitive and under-performing companies exited or were restructured. Not all of the increase in productivity seen in the industrial sector has resulted in lower prices. There was a substantial increase in the profitability of Chinese industrial enterprises during the period 1998 to 2003, amounting to over four percentage points of GDP. Gains in productivity have occurred even in the segment of the publicly controlled sector that is directly controlled by the state, with gains in firm productivity corresponding quite closely in time to improvements in the rate of return on assets, suggesting a strong pass-through of efficiency gains to profitability. While we do not have enough time series observations to analyze the relationship between profitability and productivity in a regression framework, we are able to use the microdata to decompose the contributions of various factors to the increase in profitability, as well as to examine the distribution of profits across the spectrum of state and private controlled firms.

Decomposition of profits

Rates of return on assets and equity are computed for each of the ownership classes that we identify. These rates of return are then decomposed into subcomponents to better understand how they have changed over the 1998 to 2003 period. The rate of return on assets (ROA) is computed as:

$$ROA = \left(\frac{GOS}{VA} \frac{VA}{Cap} \right) - \frac{Dep}{Cap} \tag{4}$$

Where *GOS* is the gross operating surplus, or profits before deduction of interest, tax, and depreciation; *VA* is value added on a national accounts basis (including interest), *Cap* is the value of net fixed capital at book value plus the value of inventories, *Dep* is accounting-based depreciation. The changes over the 1998 to 2003 period are decomposed into:

$$\Delta ROA = \Delta \textit{ Gross operating margin} - \Delta \textit{ Capital output ratio} - \Delta \textit{ Depreciation rate} \tag{5}$$

The change in the gross operating margin comes from the partial derivative of the *GOS/VA* ratio; the second term, the change in the capital-output ratio comes from the partial derivative of the *VA/Cap* ratio; and the third term, the change in the depreciation rate, comes from differences in the *Dep/Cap* ratios. The

contribution of each ratio over the elapsed period is calculated for each class of ownership.[14] Financial data come from the balance sheets of companies that meet the quality criteria.

Results

A first look at the profit data suggests that gains in productivity have fed through to profits, in both the private and public sectors. In the face of increasing liberalisation and market competition, private companies have been able to maintain earnings before interest, depreciation and tax at a fairly constant share of their value added (Table 6). Growing TFP has allowed declining capital output ratios and a fall in depreciation charges even though the speed with which assets were written off increased. As a result, the net operating surplus of private industrial companies increased as a share of value added, bringing an even more marked increase in rates of return on physical capital.

[Table 6: Financial operating indicators]

Financial indicators for state controlled industrial companies show that they have made significant improvements in performance from their relatively low level at the end of the 1990s (see OECD, 2000). The improvements shadow those made in the private sector, but at a dampened pace. Earnings before interest, depreciation and taxation have increased as a share of value added. The modest improvements in total factor productivity have allowed depreciation charges to fall, in spite of a rise in the rate at which assets are written off. As a result, net operating surplus has risen markedly, bringing about a near-doubling in the rate of return to physical assets.

Decomposition shows shifts in capital driving changes

The decomposition of the rates of return on physical assets shows that a large part of the increase in profitability has come about through changes in the capital-output ratio that reflect improvements in the allocation and use of capital (Table 7). In part this is because of the gains in productivity, but more broadly this may reflect an increasingly market-based allocation of capital by state, collective, and especially private controlled companies. This change was likely motivated by an easing of pricing pressures from the exit of debt-ridden companies with low or negative rates of return that effectively held down margins. Indeed margins have improved in the period 1998 to 2003. This improved allocation of capital is also

14. The exact formula used is: $\Delta ROA = \left(\Delta \frac{GOS}{VA} \frac{\overline{VA}}{\overline{Cap}} + \Delta \frac{VA}{Cap} \frac{\overline{GOS}}{\overline{VA}} \right) - \Delta \frac{Dep}{Cap}$

reflected by the increase in regional concentration indices and specialisation without large increases in industry concentration levels, as described in the next section.

[Table 7: Decomposition of rates of return on assets]

Differential rates of return on assets for firms with different types of state control suggest that ownership restructuring has had an important role in improving state controlled firm performance. Return on assets for firms with state legal person controlling shareholders (*i.e.* indirectly state controlled firms) have fluctuated, but in the last two years were nearly 50% higher than those with direct state control. There are a small number of firms (one percent of all firms) where the state controls the company through a large minority stake. These companies performed even better, so far as to exceed the returns on assets for private enterprises in 2003.

Changes are not even across the distribution

There has also been a slight reduction in the proportion of private companies making losses, from one in six to one in seven.[15] At the other end of the earnings distribution, almost a quarter of private companies earned a rate of return of over 25% in 2003 and almost 30% of companies had no net debt. Most impressively, private companies controlled by domestic individuals and companies have even better ratios than those controlled by non-mainland agents.

Improvements in the rate of return have not been even across all state controlled companies, even though they have been fairly widespread across industries.[16] The biggest improvements have come from the upper end of the distribution, where the top 20% of state controlled firms contribute over 80% of the net overall increase in returns, with the remaining improvements spread across the low end of the distribution (Figure 2). However, changes in the middle of the distribution have been quite modest, with the rate of return for the median firm remaining in the 1% to 2% range, and the proportion of loss-making firms declining from 42% in 1998 to 35% in 2003. Overall, two-thirds of state held firms in the industrial sector earn less than a 5% rate of return on assets prior to payment of interest.

[Figure 2: Distribution of rates of return on assets]

15. This proportion compares favourably with that of loss-makers among listed companies in OECD countries (one in five, or about 20% in 2002). In contrast, one in three state controlled companies in China made losses in any given year.

16. While state controlled companies in the core industries had the largest increase in profits and are about 50% more profitable, overall state ROA increased significantly from 1998 to 2003 in all but the most competitive industries (garments, electronics and telecom equipment).

The poor financial condition of the lower tail of firms illustrates the remaining depth of problems. Nearly 15% of state controlled industrial companies trade with negative equity funds. The long tail of the distribution of performance means that a significant group of state firms are insolvent despite improvements in the aggregate state sector indicators. For many, returns on assets are also negative suggesting that even conversion of debt to equity would not save them. Restructuring appears to be a partial solution, but many will need to go through the insolvency process that is being strengthened.

6. Restructuring

Computation of concentration indices

In order to assess the degree to which enterprise restructuring is facilitating improved specialization and comparative advantage, several indices of concentration are computed. The first is the Balassa-Hoover Index, which measures the extent to which an industry is specialized by region, with higher vales of the index reflecting greater specialization in an industry (Hoover, 1936). It is based on the location quotient L with respect to output, neatly described by Bai *et al.* (2004) at time *t*:

$$L_{ij} = \frac{Y_{ij} / Y_i}{Y_j / Y} \tag{6}$$

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 specialization) in an industry i and cumulated. A Gini index is then computed of the resulting area between this curve and the 45 degree axis, resulting in a value for the Balassa-Hoover index for each industry. This value is by definition between 0 and 1, with a higher value representing greater specialization 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.

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

$$\gamma_i \equiv \frac{G_{it}/(1-\sum_j s_{jt}^{\,2}) - H_{it}}{1-H_{it}} \tag{7}$$

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:[17]

$$G_{it} \equiv \sum_j (s_{ijt} - s_{jt})^2 \tag{8}$$

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

$$H_{it} \equiv \sum_k e_{kt}^{\,2} / (\sum_k e_{kt})^2 \tag{9}$$

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.

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

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

The index is defined as the sum of the squared market shares s_i of each firm i in an industry. Industries for which the HHI index is greater than 1 800 are considered by the U.S. Department of Justice to be highly concentrated, while those over 1 000 are considered to be moderately concentrated (USDOJ-SEC, 1994). An alternative version of the index is also computed using the U.S. Census Bureau approach, which only considers the largest 50 firms (N≤50).

Results

The results of the productivity analysis section show that the ongoing privatization of the economy is driving a dramatic transformation of its productive potential and profitability. However, they do not give

17. Following Dumais, Ellison and Glaeser (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.

an indication of the aggregate implications that restructuring has had on the allocation of production across industries and regions. Previous analysis of regional specialization suggests that in the period from the late 1980s to 1997, specialization followed a J-shaped path, with relatively rapid improvements in the mid-1990s (Bai *et al.*, 2004). We extend these results – which suggest that this process has continued – using computations from the National Bureau of Statistics industrial microdata from 1998 to 2003.

Growing regional concentration of production

The Balassa-Hoover Index is been calculated across 38 industries and 30 provincial-level regions using the data on the 160 000 to 180 000 firms that appear annually in the micro-database. We compute this index for both gross output as well as for employment. This index shows a sustained and continuing increase in regional specialisation across industries over the five-year period (Figure 3). The trend of this increase is widespread across two-digit industries, with 31 of 37 industries showing gains in the index. When weighted for the size of output or employment in each industry, the index actually shows even sharper gains over the period, especially when using employment. While the level of the index does not correspond exactly with that of Bai *et al.* (2004) given differences in data coverage, the trend is even stronger, and it is monotonically increasing each year subsequent to the last year of their results in 1998.

[Figure 3: Indexes show increasing regional specialization of industry]

In order to ensure robustness of these results, we also compute the Ellison-Glaeser index, which measures regional concentration using industry employment while incorporating an adjustment for intra-firm heterogeneity. This index has several subcomponents (Table 8), the first being *G*, which is a raw measure of regional concentration without adjustment. The raw index *G*, shows a relatively stable level until 2002, when it increases sharply. The adjustment factor *H*, meanwhile, shows a steady increasing trend. An approximation of the actual index can be seen in $G - H$. This index shows a very slight drop in regional concentration between 1998–1999, followed by a strong upswing, especially between 1999–2000 and 2002–2003.

The robust Ellison-Glaeser index (weighted based on employment) suggests that the raw index is on target: there has been a strong upswing in regional concentration, especially in the most recent period. Moreover, the index weighted base on the number of firms in each industry shows a monotonic increase in regional concentration over the entire five year period. These results are consistent with the literature discussed in the first section that pointed to an increase in geographical specialisation during the late 1990s, and suggests that remaining barriers across provincial borders are not severe enough to prevent the emergence of regional specialization.

[Table 8: Regional concentration indexes]

Improvements in regional specialization suggest that policy efforts to reverse the trend of increasing barriers appear to have been useful. The Law on Unfair Competition in 1993 and the reform of the fiscal system in 1994 considerably improved behaviour of local governments. These efforts have been reinforced more recently by authorities' moves to strengthen the environment for private sector development and to improve market integration based on China's commitments under the WTO. Numerous laws and regulations that were deemed inconsistent with free trade have been amended or abolished, and directives such as the "State Council Stipulation to Forbid Regional Blockades in Market Activities" (2001) were promulgated. Nevertheless, regional integration is still incomplete, but the remaining barriers reflect more a local bias in the legal system and barriers in the labour market, rather than price and quantity barriers (OECD, 2005). Of course, even in the absence of government-imposed barriers to commerce within China, some products and many services will continue to be produced in many regional and even local markets due to transportation costs and other idiosyncratic factors.

Measures of industry concentration have stayed steady

The upsurge in regional concentration has not resulted in an increase in concentration *within* industries. Thus we compute the HHI index which yields a summary measure of concentration within individual four-digit industries, and compare these measures with the United States, using the U.S. Department of Justice guidelines. The results, shown in Table 9, suggest that over the 1998–2002 period,[18] one quarter of industries in mining, manufacturing, and utilities were moderately or highly concentrated, with this ratio remaining quite stable over the period. Such a stable ratio suggests that there was not a large increase in market power during a period when regional concentration increased substantially.

[Table 9: Extent of industry concentration]

A comparison with the United States demonstrates the moderate extent of industry concentration in China, since the share of moderately and highly concentrated industries is nearly the same in a 1997–1998 comparison; however, China has a larger share of highly concentrated industries. This suggests that although there is not tremendous reason for concern, the potential for anti-competitive behavior may exist in some industries. This emphasizes the importance of the Anti-Monopoly Law recently adopted that goes beyond earlier laws that addressed unfair trade practices rather than anti-competitive practices.

18. A reclassification of Chinese industry classification codes in 2003 meant that data for this year could not be compared when using this measure with data for the previous period.

There has been a long delay in introducing a competition law, in part due to misplaced sentiment that low levels of concentration preclude anti-competitive practices and concerns that a competition law could complicate mergers (OECD, 2002; Winslow *et al.*, 2005). Previous measures of concentration (including those used in the current draft of the Anti-Monopoly Law) have focused on the market share of the four or eight largest companies. The Herfindahl-Hirschman Index (HHI) is a preferred measure, since it is little-affected by second-tier mergers that do not result in a single dominant firm (USDOJ-SEC, 1992).[19] However, judging anti-competitive practices requires a more careful assessment than any single measure could reveal, as such practices can cause serious economic harm even when concentration is not high.

Rise in concentration appears to be healthy

In many markets in China, concentration-increasing mergers could well produce important efficiencies without creating a competition problem. The fourth section has indeed shown that productivity tends to increase with size. Many Chinese firms are undersized by many measures as a result of past laws and policies (OECD, 2002), and the lack of a mid-tier market segment is a particularly serious weakness. Although China has fifteen *Fortune 500* companies (in 2005), most other companies are small and are unlikely to have market power. Consequently, substantial gains could be obtained through efficiency-enhancing mergers that permit the realisation of scale economies, which to a certain degree are already happening.

It is difficult to give an overall picture of the dynamics of the reallocations between the public and private sectors that have taken place, since we cannot precisely identify exits and entrants to the firm database. However, employment data from the database are a good proxy. Employment in state controlled industrial companies fell by almost 40% from 1998 to 2003, as their payrolls fell by 16 million workers. Since three-quarters of state companies have fewer than 500 employees, most of the companies that exited or merged were comparably small in scale. However, since over 80% of state workers (and assets) are in firms with more than 500 employees, laid off employees typically belonged to larger companies. Yet the size distribution of state controlled firms in terms of employment after this massive shaking-up has remained virtually unchanged, suggesting that state divestment was across-the-board.[20] Much of this downsizing was offset by very rapid scaling up of the private sector. Virtually all of the net employment

19. According to U.S. Horizontal Merger Guidelines' criteria, mergers that increase a concentrated industry's HHI index by more than 100 points are subject to review. About 1 in 10 Chinese industries had such an event in each year, 1998 to 2002.

20. These results occurred in spite of the official policy summarised in the slogan "hold onto the large, release the small" (*zhuada fangxiao*). Initially, the policy applied only to firms officially classified as 'small' but in 1999, it encompassed 'medium' scale firms as well.

gains that have occurred in the past five years have been in the private sector. Individually-controlled companies, the most dynamic type of private firm, are three-quarters new entrants (according to surveys of these firms), and have been growing exponentially over the past five years.[21]

7. Conclusion

There is considerable evidence that the domestic product markets have become less subject to local regulatory control (OECD, 2005). During the initial period of economic reform, there were considerable incentives for provincial and local level governments to protect local industries. Profit rates of local state enterprises were high, as were employment and tax yields. Regulations in force for the sharing of tax revenues meant that provinces were able to retain all marginal tax revenues above contracted limits while the dual-track pricing system gave rise to significant locally-retained rents. Overall, "provincial, county and even city governments found it expedient to erect barriers to trade so as to maintain high local final industrial goods prices" (Young, 2000).

Yet more recent evidence indicates that such trends have likely reversed and barriers are now falling. This study finds complementary evidence using a uniquely comprehensive dataset that allows the computation of several measures that reflect falling barriers. The rapid emergence of a substantial private sector in China controlled by non-public entities facing market forces has transformed the productive landscape and driven up profits in the five years to 2003. These profits are the result of the superior efficiency in the private sector, and have created a highly dynamic segment of the economy that is founding new businesses and expanding them geographically through retained earnings and acquisitions, creating improved regional concentration of production, filling the void left from the downsizing of the state and collective sectors. Ongoing improvements in the allocation of production appear to be in progress as the economy moves even further toward private ownership of production. Evidence of increasing regional specialization within industries across Chinese provinces appears to be robust in the most recent five-year period, whether measured using the Balassa-Hoover Index or the Ellison-Glaeser Index. Use of either index would seem preferable to examining simple sectoral shares of production, such as in Young. [22]

21. Information on the market entry for these private firms run by individuals relies on a representative survey of privately registered firms from the Chinese University of Hong Kong's University Service Centre, as described in Box 2.1 of OECD (2005).

22. The closeness of the link between the rise of the private sector and the improving allocation of production is illustrated by the following equation, which relates the size and increase in the share of the private sector to a rise in the Balassa-Hoover Index (the *p*-values of estimated coefficients are shown in parenthesis):

Returning to the theme that this paper opened on, the breakaway of China's economy from the formerly distortion-laden path appears to be decisive, and is being led by the development of a healthy private sector. Whether the path "to salvation" (presumably economic reform) cited by Young was indeed razor-thin or not is now a moot point; regardless, the ostensibly "snail" pace of reform has carried China's economy far along that path, with the economy not just surviving, but prospering. Yet there is still considerable scope for this transformation to continue. What is important is the direction of reforms. While prices deviate across provinces in China, already the gaps and rates of convergence are not much more than what is found in the United States or Canada (Fan and Wei, 2003; Holz, 2006). Moreover, as in the United States and Canada, some products and many services will continue to operate in regional and even local markets due to transportation costs and geographical factors. Reduction of government-imposed barriers is not only implied by the empirical evidence in this paper, but also confirmed by surveys of businesses who suggest that price and quantity controls are of little importance in restricting inter-provincial trade. Perhaps most important is the scope that remains for provincial governments outside the coastal region to speed the reform process in their own areas.

Nevertheless, significant distortions still exist, especially in capital markets (Zhang and Tan, 2004; Boyreau-Debray and Wei, 2005). Reforms of the financial sector have lagged those in the real economy, and substantial distortions can still be observed. However, these distortions can often be traced to the very high share of state ownership in this part of the economy. If financial reforms do follow in the footsteps of those in the industrial sector, capital markets will surely become less distorted as well, supporting the already resilient industrial sector.

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$$\Delta bh\_index = \underset{(0.008)}{0.126}\,\Delta private\_share + \underset{(0.014)}{0.606}\,private\_share_{1998} - \underset{(0.187)}{0.130}$$

This equation has an adjusted R-squared of 0.197 on 35 observations (across two-digit industries).

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Table 1. Share of transactions conducted at market prices
Per cent of transaction volume

	1978	1985	1991	1995	1999	2003
Producer goods						
Market prices	0	13	46	78	86	87.3
State guided	0	23	18	6	4	2.7
State fixed	100	64	36	16	10	10.0
Retail sales						
Market prices	3	34	69	89	95	96.1
State guided	0	19	10	2	1	1.3
State fixed	97	47	21	9	4	2.6
Farm commodities						
Market prices	6	40	58	79	83	96.5
State guided	2	23	20	4	7	1.6
State fixed	93	37	22	17	9	1.9

Source: China National Development and Reform Commission and Price Yearbooks.

Table 2. Profile of industrial microdata (all firms meeting criteria)[1]

	1998	1999	2000	2001	2002	2003
Basic data			**Units**			
Number of firms	144,112	140,559	141,956	150,948	160,969	180,146
			Millions of persons			
Employment	59.2	55.5	53.0	51.7	52.6	55.5
			Billion yuan			
Value added (including VAT)	1,842.8	2,046.9	2,413.4	2,693.1	3,154.3	4,069.2
Value added tax payable	270.4	298.6	352.0	384.8	431.6	535.4
Sales tax and extra charges	121.2	128.3	140.4	151.9	172.3	202.4
Gross output comparable (1990) prices	4,946.1	5 242.9	6,170.0	6,861.9	7,978.5	10,345.4
Gross output current prices	6,518.5	6 991.1	8,231.4	9,170.2	10,701.2	13,879.1
Intermediate input	5,556.7	6,260.0	7,300.7	8,365.4	9,965.6	12,591.8
Exports	1,049.4	1,124.5	1,413.8	1,587.5	1,964.6	2,647.0
Income statement			**Billion yuan**			
Sales Revenue	6,168.0	6,713.5	8,090.4	9,008.7	10,577.5	13,966.8
Cost of sales	5,072.5	5,499.1	6,589.2	7,405.6	8,692.7	11,557.6
Sales charge	219.4	248.1	288.7	338.3	394.2	484.4
Sales tax and extra charge	121.2	128.3	140.4	151.9	172.3	202.4
Sales profit	754.9	838.1	1,072.2	1,112.9	1,318.2	1,722.4
Other business profits	41.3	36.3	45.0	47.9	52.3	69.8
Administrative fees and charges	466.6	487.0	541.9	572.6	640.9	780.1
Memo: R&D	..	..	..	26.2	34.9	43.8
Financial charges	232.5	210.3	188.9	181.6	192.7	206.9
Memo: Interest outlay	214.4	194.5	177.8	168.2	172.8	181.7
Operating profit	97.1	177.1	386.4	406.6	536.9	805.1
Subsidies	27.6	27.5	32.5	35.1	38.3	46.5
Investment income and adjustments	-16.7	-19.2	-8.4	-21.2	4.5	30.1
Profit[2]	141.4	223.8	427.3	462.9	570.7	821.5
Tax on profits	51.1	60.6	74.9	87.0	108.6	141.3
Dividends	56.2	63.0	87.6	96.2	114.3	..
Retained earnings	34.0	100.1	264.9	279.7	347.8	..
Balance sheet			**Billion yuan**			
Assets	7,367.9	7,843.4	8,291.3	8,902.0	9,569.9	10,947.8
Net fixed assets	4,117.4	4,516.4	4,909.8	5,231.7	5,657.0	6,406.4
Inventories	1,470.9	1,470.3	1,557.0	1,642.8	1,743.2	2,040.4
Deferred and intangible assets	1,779.6	1,856.7	1,824.6	2,027.4	2,169.7	2,501.0
Liabilities	7,367.9	7,843.4	8,291.3	8,902.0	9,569.9	10,947.8
Long term liabilities	1,951.3	2,005.5	2,065.8	2,053.4	2,119.1	2,319.3
Net short term liabilities	1,612.2	1,547.4	1,472.9	1,506.3	1,585.1	1,787.9
Equity	3,768.9	4,241.5	4,694.3	5,280.7	5,816.3	6,755.8
Performance indicators	**Profit plus interest[3] as a per cent of fixed assets plus inventories**					
Rate of return on physical assets	6.1	6.7	9.2	8.9	10.1	12.2
			Profits as a per cent of equity			
Rate of return on equity	3.8	5.3	9.1	8.8	9.8	12.2
			Billion yuan			
Profit plus interest[3]	339.1	399.1	596.7	609.8	748.0	1,033.3
Net fixed assets plus inventories	5,588.3	5,986.7	6,466.8	6,874.5	7,400.2	8,446.8
			Per cent of net fixed assets			
Depreciation rate	..	8.1	8.1	8.5	8.7	9.3

1. Missing observations and those with inconsistent data are not included.
2. Referred to as "Total Profits" in most Chinese publications.
3. Excludes investment income.

Source: China National Bureau of Statistics with joint NBS-OECD analysis.

Table 3. Mapping of official registration status to type of controlling shareholder
By percent of firms' value added, 2003

	Type of controlling shareholder (Row percent)										***Column percent***	
	State controlled			**Collective controlled**	**Private controlled**				***Private Subtotal***	***Total***		
	Direct	**Indirect**										
	State >50%	**LP >50%**	**Other**	**Collective >50%**	**LP >50%**	**Indiv-idual >50%**	**Non-main-land >50%**	**Other**			**(2003)**	***Memo*: 1998**
Official registration status[1]												
State-owned Enterprise	73.6	18.4	8.0	0.0	0.0	0.0	0.0	0.0	0.0	100	13.8	37.3
Collective-owned Enterprise	0.1	0.2	1.1	61.6	18.1	14.2	1.0	3.6	36.9	100	6.3	18.3
Joint Ownership Enterprise	45.9	11.6	4.3	12.7	14.1	7.1	0.1	4.2	25.5	100	0.7	1.1
Solely State-funded Corp.	80.3	15.1	4.6	0.0	0.0	0.0	0.0	0.0	0.0	100	5.0	3.9
Other Limited Liability Corp.	19.7	14.2	5.5	6.2	25.2	24.9	0.6	3.7	54.4	100	14.1	3.6
Shareholding Corporation	26.4	27.4	19.9	2.0	10.6	10.1	0.6	2.9	24.3	100	15.0	7.1
Cooperative Enterprise	1.2	1.0	1.8	15.6	22.6	50.6	3.8	3.3	80.3	100	2.2	3.1
Private Firm	0.0	0.1	0.1	2.7	25.1	69.1	1.1	1.7	97.1	100	13.3	2.7
Other Domestic Firm	1.6	2.0	0.0	12.7	37.0	37.5	3.3	5.9	83.7	100	0.1	0.1
Non-mainland J.V.[2]	9.1	10.2	10.4	3.0	16.0	4.8	41.5	4.9	67.3	100	17.6	16.8
Solely Non-mainland Firm[2]	0.0	0.0	0.7	0.1	1.6	0.5	95.6	1.4	99.2	100	12.0	5.9
Overall (2003)	**22.9**	**11.3**	**7.2**	**6.4**	**13.3**	**17.2**	**19.2**	**2.6**	**52.3**	**100**	**100**	
***memo*: Overall -- 1998**	**38.9**	**10.3**	**5.6**	**17.3**	**7.4**	**5.8**	**12.6**	**2.1**	**27.9**	**100**		**100**

1. Official registration status is based on the legal form used when the company was set up. See OECD (2000) and ADB (2003) for a more detailed list of the legal basis for each enterprise type.
2. Non-mainland (joint ventures and solely-funded firms) is an aggregation covering investors from, Hong Kong, China; Macao, China; Chinese Taipei and all other economies.

Source: China National Bureau of Statistics industrial microdata with joint NBS-OECD analysis

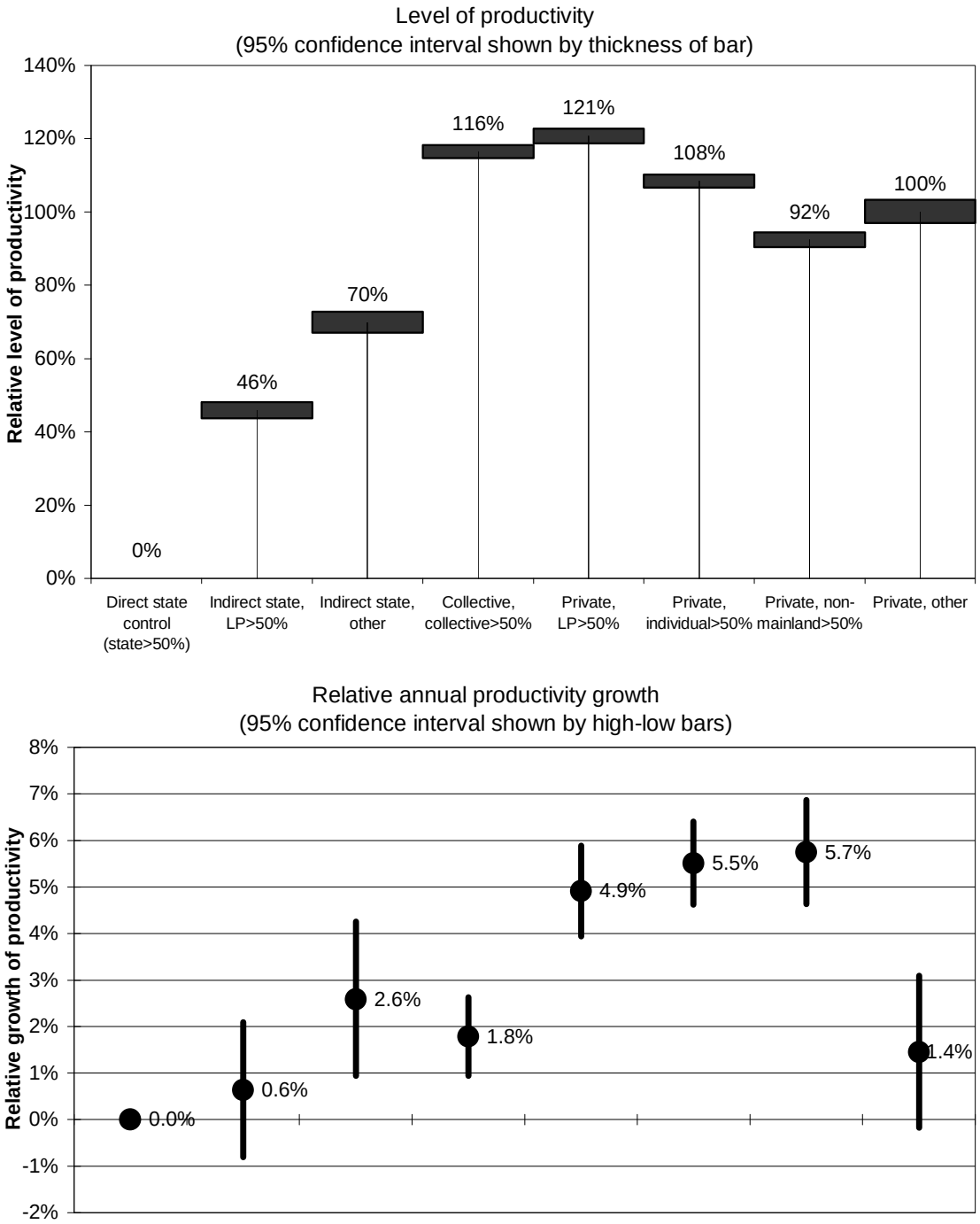
Table 4. Firm-based value added production function regression estimates
Differences from comparison group are calculated as exp(coefficient) minus one

	Levels[2]		Levels (IV)		Growth rates[2]	
	Coeff.	Robust t-stat.	Coeff.	Robust t-stat.	Coefff.	Robust t-stat.
Regression of log(real value added)[3] on:						
log(net fixed assets)	0.229	212.2	0.252	149.6	0.065	27.3
log(employees)	0.632	212.6	0.454	74.4	0.423	103.1
log(average wage rel. to mean)	0.457	201.9	0.676	127.5	0.204	76.5
Type of controlling shareholder - relative to direct state control (state>50%)						
Indirect state, LP>50%	0.378	49.2	0.307	34.0	0.006	0.9
Indirect state, other	0.530	62.6	0.511	50.1	0.026	3.1
Collective, collective>50%	0.772	185.0	0.764	146.1	0.018	4.2
Private, LP>50%	0.792	172.4	0.776	135.1	0.048	10.1
Private, individual>50%	0.734	171.1	0.737	138.4	0.054	12.4
Private, non-mainland>50%	0.654	124.0	0.585	88.3	0.056	10.4
Private, other	0.694	86.9	0.650	66.2	0.014	1.8
Scale - relative to under 51 employees						
51-100 employees	-0.157	-36.7	0.009	1.4	0.015	3.6
101-500 employees	-0.216	-36.1	0.116	9.9	0.028	7.4
501-1000 employees	-0.125	-13.0	0.378	20.5	0.039	7.7
over 1000 employees	0.151	12.0	0.799	32.9	0.060	10.8
Time - relative to 1998/1999						
year 1999	0.045	10.9				
year 2000	0.146	35.7	0.116	23.8	0.015	3.7
year 2001	0.242	60.3	0.224	48.2	0.012	3.1
year 2002	0.323	80.5	0.306	66.9	0.030	7.8
year 2003	0.405	103.1	0.373	82.5	0.049	12.9
Dummies for provincial regions	significant		significant		significant	
Dummies for 2-digit industries	significant		not significant		not significant	
Dummies for age of firm	significant		significant		significant	
Constant term	significant		significant		significant	
Number of observations (pooled)	852,354		544,871		526,550	
F-statistic (d.f. = 98/97)	10,085		6,759		196.48	
Adjusted R-squared	56.6%		57.6%		6.0%	
Root means squared error (MSE)	1.004		1.008		0.822	

1. Regressions estimated on unbalanced panel of all industrial firms with sales of 5 million yuan or higher
2. Estimates use ordinary least squares estimator with White heteroskedasticity-consistent standard errors
3. Value added deflated with gross output constant price deflator

Source: China National Bureau of Statistics (NBS) microdata with joint NBS-OECD analysis

Figure 1. **Differences in total factor productivity by firm ownership**
Relative to directly state controlled (state>50%), in units of value added



1. See Table 4 for full regression parameters

Source : National Bureau of Statistics industrial microdata and joint NBS-OECD analysis

Table 5. Firm-based gross output production function regression estimates
Differences from comparison group are calculated as exp(coefficient) minus one

	Levels		Levels (IV)		Growth rates	
	Coeff.	Robust t-stat.	Coeff.	Robust t-stat.	Coeff.	Robust t-stat.
Regression of log(real gross output) on:						
log(net fixed assets)	0.048	93.3	0.042	57.8	0.024	23.0
log(employees)	0.086	64.2	0.032	12.9	0.148	76.2
log(real intermediates)	0.848	862.4	0.910	820.2	0.635	265.6
log(average wage rel. to mean)	0.055	59.0	0.045	20.1	0.067	56.9
Type of controlling shareholder - Relative to direct state control (state>50%)						
Indirect state, LP>50%	0.089	25.5	0.059	14.4	0.001	0.4
Indirect state, other	0.121	29.8	0.089	18.1	0.010	2.8
Collective, collective>50%	0.128	68.0	0.077	34.0	0.007	4.0
Private, LP>50%	0.136	67.2	0.084	34.5	0.015	7.5
Private, individual>50%	0.121	63.9	0.074	32.7	0.019	10.6
Private, non-mainland>50%	0.087	38.6	0.035	12.7	0.018	8.1
Private, other	0.129	39.1	0.084	21.5	0.010	2.8
Scale - Relative to under 51 employees						
51-100 employees	-0.025	-14.8	-0.005	-1.9	0.009	5.1
101-500 employees	-0.030	-12.2	0.006	1.3	0.013	8.5
501-1000 employees	-0.011	-2.7	0.026	3.6	0.020	9.8
over 1000 employees	0.037	7.1	0.065	6.8	0.028	12.6
Time - Relative to 1998 / 1999						
year 1999	0.004	2.1				
year 2000	0.056	32.0	0.001	0.6	0.045	27.3
year 2001	0.057	33.6	0.049	25.6	0.004	2.5
year 2002	0.052	30.9	0.042	21.6	0.010	6.2
year 2003	0.091	54.8	0.072	38.9	0.045	28.3
Dummies for provincial regions	significant		significant		significant	
Dummies for 2-digit industries	significant		significant		significant	
Dummies for age of firm	significant		significant		significant	
Constant term	significant		significant		significant	
Number of observations (pooled)	*879,720*		*559,293*		*553,620*	
F-statistic (d.f. = 99 / 98)	*62,286*		*45,574*		*1,609.83*	
Adjusted R-squared	*91.7%*		*92.4%*		*60.0%*	
Root means squared error (MSE)	*0.417*		*0.408*		*0.345*	

1. Regressions estimated on unbalanced panel of all industrial firms with sales of 5 million yuan or higher
2. Estimates use ordinary least squares estimator with White heteroskedasticity-consistent standard errors
3. Value added deflated with gross output constant price deflator
Source: China National Bureau of Statistics (NBS) microdata with joint NBS-OECD analysis

Table 6. Financial operating indicators

	1999	2000	2001	2002	2003
State-controlled	Per cent of industrial value added				
Earnings before interest, depreciation and taxation	51.4	59.2	56.2	56.8	59.4
Depreciation	28.1	26.3	27.6	26.6	24.8
Interest	15.3	11.8	10.3	9.5	7.6
Profit	7.9	21.1	18.4	20.6	27.0
Profit plus interest[1]	23.2	32.9	28.6	30.2	34.6
Capital output ratio	3.8	3.5	3.5	3.3	2.9
Inventory output ratio	1.0	0.9	0.8	0.8	0.7
Intangible and deferred assets ratio	1.7	1.3	1.4	1.3	1.1
Total capital	6.4	5.7	5.7	5.3	4.7
Privately-controlled					
Earnings before interest, depreciation and taxation	37.3	39.4	37.9	38.3	37.6
Depreciation	15.2	13.5	13.1	12.5	11.6
Interest	7.9	6.3	5.2	4.4	3.8
Profit	14.2	19.5	19.6	21.5	22.2
Profit plus interest	22.2	25.9	24.8	25.8	26.0
Capital output ratio	1.8	1.6	1.5	1.4	1.2
Inventory output ratio	0.8	0.7	0.7	0.6	0.6
Intangible and deferred assets ratio	0.6	0.6	0.6	0.6	0.6
Total capital	3.2	2.9	2.7	2.6	2.4

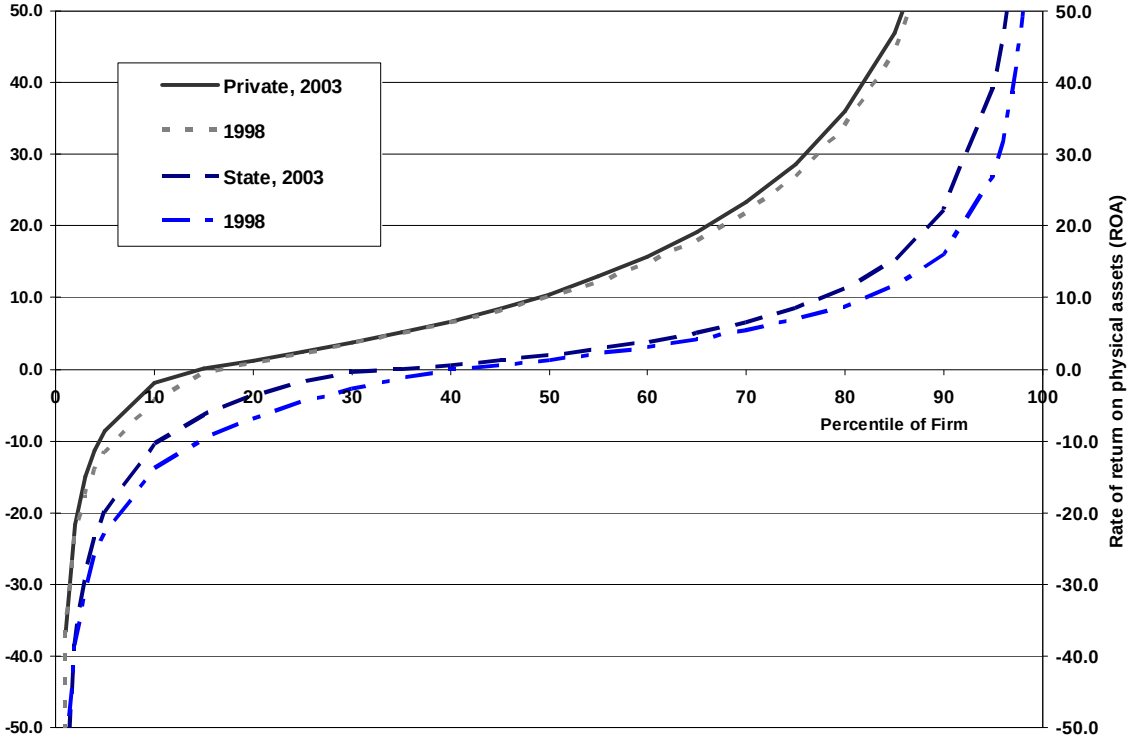
1. Net surplus, excluding investment income.
Source: China National Bureau of Statistics industrial microdata and OECD calculations.

Table 7. Decomposition of rates of return on capital

	1998	Rate change due to increase in			2003
Rate of return on physical assets[1]	**Rate of return on physical capital**	**Profit margin**	**Capital-output ratio**	**Depreciation rate**	**Rate of return on physical capital**
All enterprises	6.1	+2.1	+5.3	-1.3	12.2
State-controlled companies	4.8	+3.6	+3.3	-1.6	10.2
Controlled directly by the state	3.9	+2.9	+2.8	-1.4	8.2
Controlled by state held companies	7.4	+5.8	-0.9	-0.6	11.7
Other forms of state control	8.5	+3.4	+6.0	-2.3	15.6
Collectively controlled	11.1	+0.2	+5.5	-0.4	16.3
Private companies	7.8	+1.2	+6.7	-0.7	15.0
Non-mainland controlled	4.7	+2.9	+8.3	-1.3	14.5
Controlled by individuals	12.0	+0.4	+4.6	-1.0	16.0
Controlled by non-state companies	8.6	+2.8	+2.1	-0.5	13.0

1. Rate of return on physical capital calculated as operating surplus divided by fixed assets and inventories.
Source: China National Bureau of Statistics industrial microdata and OECD analysis.

Figure 2. Distribution of rates of return
Private and state controlled firms



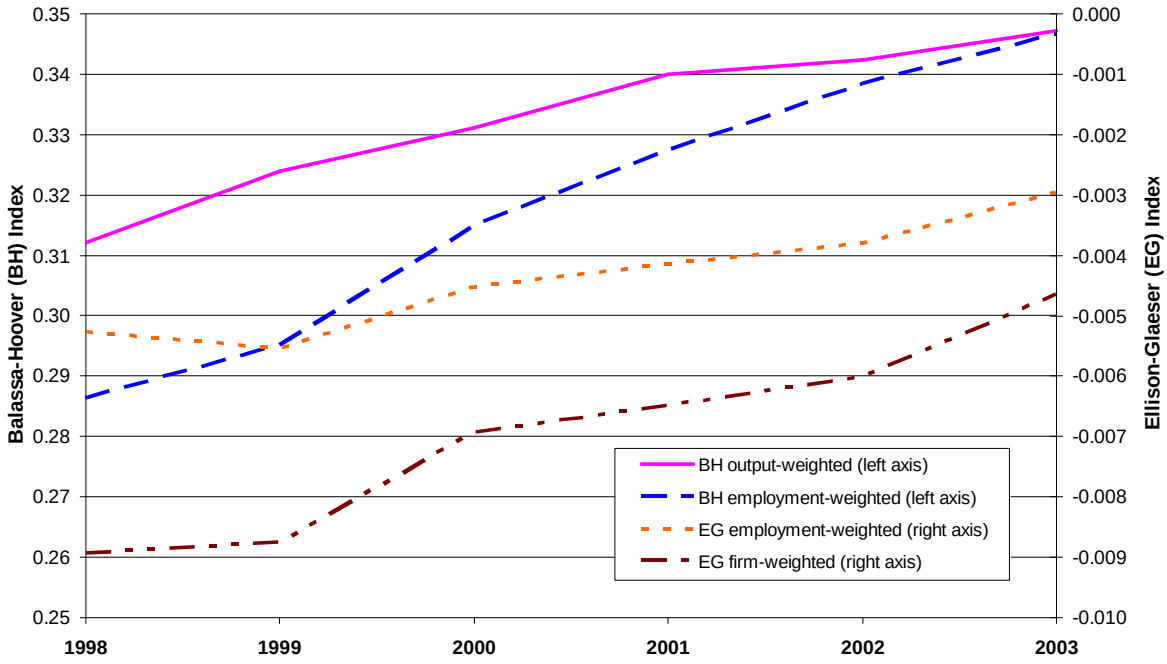
Source: China National Bureau of Statistics and OECD estimates

Table 8. Regional concentration indexes

		1998	1999	2000	2001	2002	2003
Balassa-Hoover Index							
Gross output-based							
	Simple average	0.318	0.328	0.337	0.342	0.348	0.347
	Output weights	0.312	0.324	0.331	0.340	0.342	0.347
Employment-based							
	Simple average	0.314	0.319	0.328	0.337	0.353	0.358
	Employment weights	0.286	0.295	0.315	0.327	0.338	0.347
Ellison-Glaeser Index							
Employment-based							
	Simple average	-0.2174	-0.1862	-0.0503	-0.0570	-0.0479	-0.0356
	Firm weights	-0.0089	-0.0088	-0.0069	-0.0065	-0.0060	-0.0046
	Employment weights	-0.0053	-0.0056	-0.0045	-0.0041	-0.0038	-0.0030
Memo:	Mean *G*	0.00117	0.00106	0.00109	0.00103	0.00119	0.00135
	Mean *H*	0.00747	0.00743	0.00746	0.00708	0.00689	0.00583
	G – H	-0.00630	-0.00637	-0.00637	-0.00605	-0.00570	-0.00448

Source: China National Bureau of Statistics industrial microdata and OECD analysis.

Figure 3. Indexes show increasing regional specialization of industry



Note: The 'BH' index refers to the Balassa-Hoover index; the 'EG' index refers to the Ellison-Glaeser index.

Source: China National Bureau of Statistics industrial microdata and joint NBS-OECD analysis.

Table 9. Extent of industry concentration

Number of industrial sectors in selected ranges of the Herfindahl-Hirschman concentration index[1], grouped by the U.S. Department of Justice merger thresholds

China	Mining, manufacturing, and utilities					
	1998		2000		2002	
	Number of industries	Per cent	Number of industries	Per cent	Number of industries	Per cent
Highly concentrated (over 1,800 points)	82	14%	91	16%	83	14%
Moderately concentrated (1,000-1,800 points)	72	12%	72	12%	79	13%
Not concentrated (under 1,000 points)	428	74%	423	72%	425	72%
Total number of industries	582	100%	586	100%	587	100%

China compared to the United States	Manufacturing only[2]					
	U.S. in 1997		U.S. in 2002		China in 2002	
	Number of industries	Per cent	Number of industries	Per cent	Number of industries	Per cent
Highly concentrated	37	8%	46	10%	63	12%
Moderately concentrated	89	19%	88	19%	83	16%
Not concentrated	332	72%	319	70%	380	72%
Total number of industries	458	100%	453	100%	526	100%

1. The Herfindahl-Hirschman Index is defined as sum of squared market shares, out of 10 000; Industrial sectors used correspond to 4-digit ISIC industries for China, 6-digit NAICS for the United States.
2. Calculated for 50 largest firms in manufacturing sectors, corresponding to U.S. Census Bureau method.

Source: U.S. Census Bureau; China National Bureau of Statistics industrial microdata and joint NBS-OECD Analysis.