The Contribution of Restructuring and Reallocation to China's Productivity and Growth

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Abstract

China has exhibited very rapid measured aggregate productivity growth. At the same time, the structure of its markets and the structure of businesses have been changing at an equally rapid rate. In this paper, we measure the extent of restructuring and the reallocation of resources (including the reallocation of jobs) and then quantify the contribution of the reallocation and restructuring to the aggregate productivity growth of China's industrial structure. Our gross job flow analysis illustrates that reallocation and restructuring took many forms including shedding of jobs by government controlled enterprises and the increasing share of employment for FDI joint ventures. However, the analysis shows that it is not just shifts between firm types that are important but also reallocation and restructuring within firm types. For example, we find a high pace of job reallocation within SOEs and FDI joint ventures over and above what is needed to accommodate the net changes for these firm types (as high as 28 and 22 percent, respectively). We find evidence that the restructuring and reallocation contributed significantly to the high productivity growth. For example, our analysis shows that more than half of the labor productivity growth in 2001 is due to reallocation and restructuring. In that year, the industrial sector exhibited a labor productivity growth rate of around 22 percent which in the absence of reallocation and restructuring would have been around 10 percent.

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I. Introduction

China's transition to a market economy has been ongoing for almost three decades. As part of this process, China has undergone massive restructuring of its industrial enterprises and granted market access to foreign and private domestic firms. Much existing research has been devoted to assessing the progress of China's reforms. However, data limitations have implied that relatively little systematic research has been done to reveal the details of the dynamics of China's reallocation and restructuring at the firm level and in turn the contribution of this reallocation and restructuring to industry and aggregate productivity growth. This study provides an in-depth analysis of the pace and nature of the reallocation dynamics at the firm level and the associated contribution to productivity using firm level data for China's large and medium industrial enterprises during 1995-2003.

Recent research for advanced economies as well as emerging and transition economies have emphasized the importance of static and dynamic allocative efficiency for productivity levels and growth rates within and across countries. By static allocative efficiency we mean that more productive firms have higher market shares and are more likely to survive. By dynamic allocative efficiency we mean that resources are moving towards more productive firms and away from less productive firms. For healthy, market economies, the evidence on static allocative efficiency suggests that in the U.S., for example, the level of productivity is 50 percent higher than it would be if market shares were allocated randomly as opposed to having more productive firms have higher market shares (see, e.g., Bartelsman, Haltiwanger and Scarpetta, 2006). The evidence for dynamic allocative efficiency is that a large fraction of aggregate productivity growth is accounted for by the reallocation of outputs and inputs from less productive to more productive firms (see, e.g., Foster, Haltiwanger and Krizan 2001, 2006 and Bartelsman and Doms 2001). An accompanying and presumably important underlying factor is that the pace of output and input reallocation is high in healthy, market economies reflecting both reallocation and restructuring among continuing firms and a high pace of entry and exit.

For emerging and transition economies, the working hypothesis is that distortions to the allocative process from a variety of factors impinge on both static and dynamic allocative efficiency. The implication is that the low productivity levels and growth rates will be

observed in those economies with high distortions to allocative efficiency and in turn productivity growth will be exhibited especially for those economies reducing such distortions to allocative efficiency. The evidence is accumulating in support of this working hypothesis in that in a number of countries, market reforms have led to substantial improvements in productivity via improvements in allocative efficiency (see, for example, Eslava et. al. (2004, 2006), Bartelsman, Haltiwanger and Scarpetta (2006) and Hsieh and Klenow (2006)).

This paper explores the working hypothesis that improvements to allocative efficiency have been important for China. Given China's moves to a market economy and its apparent rapid productivity growth, a natural question is the contribution of reallocation and restructuring to productivity growth in China. There have been numerous studies documenting the nature of the China's reforms and a related research evaluating their impact using aggregate, industry and provincial data.[1] For example, Zheng and Hu (2001) adopted a frontier technology estimation to study changes in the distribution of productivity in China. Using provincial level data they found that improvements in technological progress dominated improvements in efficiency. Since they did not have firm level data but only exploited variation at the provincial level, they may have been missing much of the contribution of improvements from efficiency. In one of the few existing studies using firm level data, Zhang, Zhang, and Zhao (2004) found significant differences in efficiency across ownership types. In this respect, our results are consistent with these findings. However, their methodology does not provide insights into whether the reallocation process is shifting resources away from less productive to more productive businesses Our contribution is to use firm level data on productivity and reallocation over an extended period of time to document the contribution of reallocation and restructuring to aggregate (industry-level) productivity growth. This report is based on a new database developed in cooperation with the National Bureau of Statistics of China (NBS). The database follows large and medium sized industrial firms, roughly 22,500 firms per year, from 1995-2003. We adopt the

[1] A Conference Report documented that China's massive restructuring, which has been crucial to its rapid growth and its emergence as an international competitor with expanding exports to developed countries, was also generating fewer manufacturing jobs (McGuckin and Spiegelman TCB R-1352-04-RR). The report also identified the large drop in shares of employment and output being produced in State Owned Enterprises (SOEs) and concomitantly, the increased employment and output attributable to the private sector.

methodology developed in Davis, Haltiwanger and Schuh (1996) for the U.S to measure employment reallocation using firm level data. Gross job creation is calculated as the sum of employment gains from expanding and entering firms, and gross job destruction is measured as employment losses from contracting and exiting firms. These measures are summary statistics of the changes in allocation of employment opportunities across firms and we measure these statistics across time and across different types of firms.

The time series of gross job flow statistics exhibits wide-ranging restructuring of enterprises. Our gross job flow analysis illustrates that government controlled enterprises and federally administered firms were at the center of restructuring. However, a key aspect of our findings is that most of the reallocation is within firm types (measured either by industry, ownership type or industry) rather than between firm types. For example, our upper bound estimate is that on average large and medium State-Owned Enterprises (SOEs) contracted at a 9.8 percent annual rate while FDI joint ventures expanded at a 9.4 percent annual rate.[2] These large net changes are still dwarfed by the gross job flows underlying these net changes. The net decline of 9.8 percent for SOEs is accomplished by an 11.1 gross job creation rate and a 20.9 gross job destruction rate. The net increase of 9.4 percent for FDI joint ventures is accomplished by a gross job creation rate of 24.2 percent and a gross job destruction rate of 14.8 percent (again using our upper bound estimates as described below). In order to link the gross job flows with China's business performance, we measure labor productivity at the firm level using as a measure real gross output per worker. Following the recent literature, we explore the role of allocative efficiency in accounting for the productivity growth. Labor productivity growth of firms in the industrial sector of China (focusing on the large and medium firms in our firm level dataset) grew at an astounding annual rate of 20.4 percent, which is not too far from the official NBS publication, their labor productivity growth rate for the large and medium industrial firms is 19.7 percent during 1995-2003.[3]

[2] As we describe in detail below, given data limitations we compute upper bound and lower bound measures of job creation and job destruction. The upper bound measures are better summary measures of restructuring but are less comparable to job flow measures that have been computed for other countries. Our lower bound estimates are conservative estimates relative to measures that have been computed for other countries but still useful to compare to other countries (e.g., the U.S.) since if lower bound estimates are larger than that computed for other countries we can confidently say that China has higher job flows.

[3] The labor productivity growth of the industrial sector is substantially higher than the labor productivity growth of the entire economy. For the latter, the official NBS statistics show a labor productivity growth of 13.3

We find important differences in the productivity patterns across different types of firms. For example, we find that private firms outperformed government controlled firms, but government controlled firms pushed up their labor productivity growth by shedding redundant employment and reorganizing into joint stock enterprises. Shifts of governmental regulation to more local areas have also created a productivity stimulus for federally administered firms to catch up with firms at the local government level. However, the novel aspect of our analysis is that with our firm level data we can measure and analyze the contribution of restructuring and reallocation within and between different types of firms. For example, we can measure and analyze how much the reallocation of jobs across firms that are FDI joint ventures played in the productivity growth of FDI joint ventures and in turn the aggregate industrial sector. In quantifying the contribution of restructuring and reallocation, we can distinguish between the effects from the reallocation of jobs among continuing large and medium firms and firms that enter and exit.

Our major finding is that restructuring and reallocation accounted for a large share of the high productivity growth in the industrial sector. When we classify firms by ownership type (e.g., state owned, joint stock, FDI joint ventures, etc.), we find that on average restructuring and reallocation between and within firms classified in this manner accounted for 41 percent of annual productivity growth. In some years, the contribution is substantially higher. We find that the contribution starts rising in 1999 and peaks in 2001. In 2001, the aggregate industrial sector exhibited productivity growth of around 22 percent. Our analysis finds that 12% of the 22% (more than half) is due to restructuring and reallocation.

These findings provide striking evidence that restructuring and reallocation played a major role in the productivity growth observed in the industrial sector. However, given the measurement challenges in using firm level data, it is appropriate to be cautious about our findings on a number of dimensions. First, our measures of productivity are crude based on measures of real gross output per worker. Second, it is critical to emphasize that our firm level data provides only proxies for entry and exit. Specifically, our measure of entry in a

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percent for the entire economy over this period. A recent study reveals 7.3 percent labor productivity growth rate over 1995-2004 by adopting downwardly adjusted GDP growth rates from the economic historian, Angus Maddison (see, Van Ark, Guillermineau, and McGuckin, 2006). The discrepancy between our 20.4 percent growth rate and a similar rate from NBS may reflect a variety of factors including our use of real gross output per worker as the measure of labor productivity. Note as well that the labor productivity growth using gross output per worker but including all SOEs and non-SOEs above designated size (annual sales greater than 5 million yuan) is 17.6 percent.

given year is the set of firms that became large and medium firms in that year. It is unlikely this is the first year of the existence of the firm but rather the first year they transited from small to large and medium status. Similarly, our measure of exit is the set of firms that exited the large and medium status in that year. It may be that the firm actually exited (shutdown) but it could be that the firm became smaller. Such transitions from small to medium and large status and vice versa are important transitions in their own right and we find an important part of the story. Put differently, firms growing rapidly enough to become a large and medium firm and firms contracting sufficiently to become a small firm are important phenomena and our analysis tracks firms that make such transitions. However, we are not able to study the dynamics of small firms in China at the micro level and this is an important area for future research. Note that in spite of this limitation we argue below that our findings shed considerable light on the overall industrial sector since we find that the labor productivity growth of large and medium firms overall is slightly higher than that for small firms.

Third, it is always useful to be cautious with longitudinal firm level data about the quality of longitudinal linkages. In all countries, creating and maintaining linkages of firms over time is difficult and subject to measurement error. Shifts in ownership types, changes in a firm's industry classifications because of a change in products produced, shifts in headquarters locations, or regulatory and registration procedures that are controlled and undertaken by other agencies, not to mention mergers, divestitures, and other forms of reorganization make it difficult to link firms across time. Given the striking nature of our findings, further analysis of restructuring and reallocation is called for in China including more up to date statistics and analysis of the quality of the firm level data infrastructure in China.

The roadmap of the paper is as follows. In section II, we describe the data and some basic facts. One of the main points that emerges quickly is that although our sample of firm level data is restricted to large and medium firms, large and medium firms account for a very large share of activity and exhibit very rapid productivity growth. We then turn our attention to restructuring and reallocation. We define the measurement methodology for job reallocation in section III and present basic facts about the job flows in section IV and V. This analysis provides a rich characterization of the pace and nature of reallocation in China

and as such the backdrop for the main analysis which is the contribution of this reallocation to productivity growth. Sections VI and VII present the main analysis of the contribution of reallocation to productivity growth. In section VI section, we develop the methodology for quantifying the contribution of reallocation on step-by-step basis. Using this methodology and the results from section VI, in section VII we conduct counterfactual analysis of the following sort. We ask empirically what productivity growth in China would have been in a particular sector and year if there had been no restructuring (no entry or exit, no changing of market shares, no changes in composition). It is on the basis of this counterfactual analysis that our strong findings on the contribution of reallocation emerge.

II. Data Description and some Basic Facts

China's industrial enterprise statistics are collected and maintained by NBS. They are derived from the 1995 Chinese Industrial Census and Annual Report of Industrial Statistics for 1996-2003.[4] The database is at the individual firm level for 39 industries covering the mining, manufacturing and utility sectors. After 1998, the scope of the firm level data has changed to focus on the size of firms with probability sampling introduced more recently. These firms include all state-owned industrial enterprises and non-state industrial enterprises with annual sales over five million Yuan.

Our study sample is a subset of the industrial data set described above, which covers China's large and medium size firms of the industrial sector for the year 1995-2003. A large firm has over 2000 employees and more than 300 million yuan annual sales and possesses above 400 million yuan total assets. A medium firm has thresholds of employment at 300, annual sales at 30 million yuan and total assets at 40 million yuan. On average, the database contains about 22.5 thousands of firms each year.

For each of the large and medium firms, we measure gross output and employment. The measure of labor productivity we use is real gross output per worker. This simple measure of labor productivity has the advantage that the components are more likely to be measured accurately. Appropriate caution is required in making comparisons across industries given that value added per worker and gross output per worker while likely highly

[4] A new complete census was undertaken in 2005 and we hope to use these data in the future.

correlated may exhibit different patterns. It will become clear in what follows that for many empirical exercises, we explore variation across firms within industries and hold the industry composition constant to avoid these concerns.

The large and medium firms differ from small firms in some important ways.[5] First, in terms of firm size, the average number of employees per large and medium firm is seven times greater than smaller firms. Second, in terms of production scale, the average gross output is nine times larger than small firms. Thus, the sector-wide employment share of smaller firms is larger than their output share. Additionally, the large and medium firms exhibit 15.4 percent higher labor productivity than small ones.

This sample is not designed to be statistically representative of the entire industrial sector but rather for large and medium firms —it accounts for 13 percent of China's industrial firms but for large shares of both output (57 percent) and employment (32 percent). In terms of growth and changes, large and medium firms' performance demonstrates deeper restructuring than the rest of the sector. The large and medium firms show a 28.9 percent net job loss between 1995 and 2002, much higher loss than that of all SOEs and non-SOEs above designated size—17.5 percent. Nonetheless, the broader sector sees slightly slower output growth (17.5 percent annually vs. 18.8 percent in the large and medium) between 1998 and 2003. These suggest that large and medium firms show a faster pace of the restructuring than the broader industrial sector.

Basic comparisons of the output and employment patterns for large, medium and small firms are provided in Figure 1 and Figure 2. Table 1 briefly summarizes the sample statistics. Consistent with the first TCB report on China's employment, China's industrial jobs fell dramatically from year 1998 on (McGuckin and Spiegelman, 2004). While the annual employment losses were not too much different for the first three years of our study period than the last five years (3.8 percent for the years 1995-1998 vs. 4 percent for the years 1998-2003), the gross output increased more in the later period (18.9 percent in 1998-2003 vs. 10.5 percent in 1995-1998). Therefore, the labor productivity growth accelerated from

[5] The major advantage of using a large and medium firm sample is that data quality is much better for larger firms. For example, firm level statistics for small industrial enterprises were not collected for the year 1996 and 1997. Moreover, the larger firms are monitored more closely and the editing routines are more extensive. A related advantage is that the linkages of firms over time are better in large and medium firms than in small firms.

14.9 percent before 1998 to 23.9 percent after 1998. In fact, including the slow growth period 1995-1998, it was 20.4 percent over the whole sample period.

In Figure 3, output, employment and labor productivity growth for large and medium firms combined is compared to that of small firms. Figure 3 shows that labor productivity growth for small firms exhibits similar patterns to that for large and medium firms. Labor productivity growth for small firms over the entire period is slightly smaller than for large and medium firms reflecting similar output growth trajectories but falling employment for large and medium firms and a slight increase in employment for small firms. The good news from this comparison is that the patterns of labor productivity are sufficiently similar that our analysis of the underlying firm dynamics is shedding light on a group of firms that on at least this basis are approximately representative of the entire sector.

III. The Gross Job Flows Definitions and Its Compositions

3.1. The Gross Job Flow Definitions

The first major step in our analysis is to measure and analyze the pace and nature of reallocation across firms in China. For this purpose, we use the gross job flow concepts developed by Davis, Haltiwanger and Schuh (1996). Gross job flow calculations look at firms between time t-1 and time t. In theory, the time span between time t-1 and t could be almost any: one month, one quarter, one year, or even one decade. Since NBS data are annual statistics, the frequency in our study is annual or a multiple of years.

We use year t or year u to denote years, where t<u. So t is the beginning and u is the ending point of the interval over which time is measured. Assume there are a total of N+M firms in year t and u.[6] Among them, N firms are entrants, expanded firms or firms that have the same number of employment, M firms are exiting or contracting firms. In other words, $E_{i,u}-E_{i,t} >= 0$ for N firms, and $E_{i,u}-E_{i,t} < 0$ for M firms, where E stands for employment, and i refers to each individual firm.

[6] Note that if a firm exists between year t and u, but does not exist in either year t or u, this firm is not considered in the N+M sample when calculating gross job flows between year t and u.

Definition 1 (Gross) job creation at year u equals employment gains summed over all firms that expand or start up (enter) between year t and u.

$$JC = \sum_{i=1}^{N} (E_{i,u} - E_{i,t}), \quad \text{for } E_{i,u} > E_{i,t}.$$

Definition 2 (Gross) job destruction at year u equals employment gains summed over all firms that contract or shut down (exit) between year t and u.

$$JD = \sum_{j=N+1}^{N+M} (E_{j,t} - E_{j,u}), \quad \text{for } E_{j,u} < E_{j,t}.$$

Definition 3 The net employment change at year u is the difference between employment at year t and employment at year u.

$$\Delta E = JC - JD = \sum_{k=1}^{N+M} (E_{k,u} - E_{k,t})$$

Definition 4 (Gross) job reallocation at year u is the sum of all firm-level employment gains and losses that occur between year t and year u.

$$JR = JC + JD = \sum_{k=1}^{N+M} | E_{k,u} - E_{k,t} |$$

Definition 5 Excess job reallocation[7] at year u equals the difference between (gross) job reallocation and the absolute value of net employment change.

$$JR_{ex} = JR - | \Delta E | = (JC + JD) - | JC - JD | = 2 \times Min(JC, JD)$$

All of the job flows are converted to rates by dividing by employment for the classification of firms for which the flows are computed.

[7] Note that excess is not used here to mean inefficient reallocation but rather reallocation in excess of what is needed to accommodate the net changes of sectors.

3.2. Enter, Exit, and Continuing Firms

Job creation consists of job creation by entrants (CE), and expanding continuing firms. Furthermore, expanding continuing firms can be distinguished by whether they remain in the same sector (CC), or are reclassified in a different sector (GC). Similarly, job destruction is comprised of job loss from exits (DE), contracting continuers that remain in the same sector (DC), and reclassified contracting continuers (LC). We know the number of employees in year t and year u. The following basic equation links the employees or jobs at year u to the jobs at year t.

Employees (t) + CC + CE + GC – DC – DE – LC= Employees (u)

This identity also holds for *each aggregate sector* (ownership, industry, or jurisdiction), as well as for the entire sample. The Appendix provides a more detailed explanation. We convert the numerical flows to rates by dividing through by employment for the relevant sector and year.

One technical difficulty in calculating gross job flow for China's large and medium industrial firms is that the job flow measures have limitations given that observed entry is really entry into the large/medium sector and not de novo entry, and exit is really exit from the large/medium sector and not firm shutdown. As discussed in the introduction, such transitions from small to large/medium and vice versa are important transitions in their own right and it is useful to identify the contribution of such transitions. As summary measures of restructuring for large and medium firms, including the expansions from small and contractions to small is essential. However, for purposes of measuring job flows relative to methods used in other countries, incorporating such transitions yields an upper bound on the magnitudes of job creation and destruction. We can generate lower bounds of job creation and destruction for large and medium firms in China to address the limitation.

In order to obtain the lower bound job creation and destruction rates, we first compute job creation and destruction rates for continuers. We then consider how to treat the entrants and the exits. The upper bound treats all of the measured entry or exit as true entry or exit. For the lower bound, we take a much more conservative approach. We combine two alternative lower bounds approaches. First, we compute job creation and destruction rates

for these firms assuming they had the same rates as for continuers. Second, we use the information we know about the thresholds for large and medium firms. That is, we know that a firm drops below the threshold (and thus exits) if employment drops below 300 employees and a firm becomes part of the sample (and thus enters) if employment rises above 300. Since we know the employment of the firms that enter and exit we can take the difference between the employment and the threshold to compute bounds on creation for entering firms and destruction for exiting firms. Both of these approaches yield alternative lower bounds and since both are lower bounds we take the higher of the two measures (that is the bound is binding).

In considering the lower bound it is useful to also note that small firms in most economies (see, Davis and Haltiwanger (1999)) are more volatile and even for continuing firms the rates of job flows for small firms are likely larger than for medium and large firms. Thus, the lower bound measures are likely to understate the rates of job flows for the entire industrial sector not only because they are lower bounds but they exclude small firms.

Overall, then, the lower bound measures yield estimates that understate gross flows while the upper bound yield estimates that overstate gross flows. In terms of international comparability, the lower bound estimates are more appropriate since they capture job flows that conceptually are also measured in other countries. Moreover, a finding that China has higher rates than in another country (e.g., the U.S.) using the lower bound estimates enables us to be able to say that China has rates that are higher than the other country.

IV. Job Creation and Job Destruction in China

4.1 Basic Facts of Job Creation and Job Destruction

We first look at the gross job flows for the whole industrial sector in China. The upper bound statistics are reported in Table 2 while the lower bound statistics are reported in Table 3. Both the upper bound and the lower bound measures are of interest. The upper bound measures are as noted better overall measures of the degree of restructuring amongst large and medium firms. The lower bound estimates alternatively are measures that are

likely to be more comparable to gross job flow statistics that have been computed for other countries – especially if the comparison is made to rates for large and medium size firms.

The first key aspect of the job flows is that the gross flows are large relative to the net flows. Even for the conservative measure, the lower bound employment on average decreased 5.2 every year which is accomplished by an average annual job creation of 10.9 percent and job destruction of 16.1 percent.

A related way to evaluate the high absolute pace of job flows in Table 2 andTable 3 is to focus on the summary measures of job reallocation and excess job reallocation. Taken at face value the measures in Table 3 suggest that on average 26.9 percent of employment opportunities were reallocated every year over this period. Some of this reallocation as noted reflects net contraction. Using excess job reallocation as an alternative summary measure that abstracts from net changes, excess reallocation has an average that is also very large – 21.7 percent. Thus, using either job reallocation or excess job reallocation as a summary measure, the pace of reallocation in China is very high.

Turning to time series variation, Table 3 shows some tendency for job creation and job destruction to rise and fall together. For example, both job creation and destruction are especially high in 1998. The correlation coefficient of the time series variation in the job creation rate and job destruction rate is 0.37. Thus, changes involve shifting or reorganizing as well as greater declines. Job destruction exceeds job creation in almost years. Consequently, total employment keeps declining through the whole study period except the last year. The aggregate job flow statistics suggest that the structural adjustments in China's industrial sector resulted in continuous employment loss from 1998 to 2002.[8]

The difference between the lower bound and the upper bound can be illustrated by examining the contribution of measured "entry" and "exit" vs. continuing job reallocation as illustrated in Figure 4. It is clear that there is a large contribution of measured entry and exit and this accounts for the large difference between the upper and lower bound statistics. While the measured entry and exit should likely not be interpreted as true entry and exit, these measured statistics are indicators of restructuring since they reflect large and medium

[8] China's Large and Medium firms' employment increased mildly in year 2003. Refer to the Table 2 for upper bound job flow statistics. There is an obvious turning point for the performance of labor market. In 1998, job destruction increased dramatically (from 12.3 percent in 1997 to 21.5 percent in 1998). One reason could be the change of statistic system which takes place in 1998. The dramatic change of job flows could also suggests that the restructuring and privatization process accelerated after 1998 and carried on its momentum afterwards.

firms that have contracted sufficiently to fall below the threshold to be a medium firm and firms that have expanded sufficiently to rise above the threshold to be a medium firm.

With some assumptions and adjustments, the lower bound job flows are more appropriate in terms of comparisons with job flow statistics from other countries. In the next section, we make such adjustments and compare the magnitudes with those in the U.S.

4.2 Magnitude – Comparisons with the U.S.

In this section, we compare our job flow calculations for China (1995-2003) with that of the US in the period of 1995-2002. This comparison is for suggestive purposes only since there are many differences in the methodology and underlying micro data between the measures for China and the U.S. As noted the statistics for China use the firm as the unit of observation and restrict attention to the large and medium firms. For the U.S. the unit of observation is the establishment and the underlying data are nationally representative of the U.S. manufacturing sector with entry and exit in the U.S. statistics representing true entry and exit. For reasons discussed above, we use the lower bound estimates in comparing magnitudes with the U.S.

Figure 5 gives the comparison of the gross job flows statistics for China (1995-2003) and the U.S (1995-2002).[9] The lower bound average yearly job creation and job destruction rate for China is 10.9 percent and 16.1 percent, respectively. Using the rates in the U.S. for all establishments, the U.S. manufacturing sector exhibits job creation and destruction both around 10 percent. However, since we are focusing on large and medium firms for China, it is useful to compare to similarly sized businesses for the U.S. Using an employment size cutoff of 250 (for China the cutoff is 300 workers) in the U.S., we observe job creation and destruction rates of 8 and 7 percent respectively. Taken together, these statistics suggest that China has higher job flows than the U.S.

[9] This comparison is for suggestive purposes only since there are many differences in the methodology and underlying micro data between the measures for China and the U.S. As noted the statistics for China use the firm as the unit of observation and restrict attention to the large and medium firms. For the U.S. the unit of observation is the establishment and the underlying data are nationally representative of the U.S. manufacturing sector with entry and exit in the U.S. statistics representing true entry and exit. Given these differences, a variety of comparisons are made in Figure 1.

Given the widespread restructuring in China, it might be anticipated that China would exhibit much higher flows than in the United States. However, given the remaining restrictions in markets in China, having achieved rates higher than the United States suggests China is indeed exhibiting a high pace of reallocation. After all, a pace of job reallocation of 26.9 percent on an absolute basis is huge. These statistics suggest that among large- and medium-firms 26.9 percent of the employment opportunities have been reallocated annually over this time period in China.

The fourth set of bars in Figure 5 shows the net changes in employment, obtained by subtracting job destruction from job creation. Both China's industrial sector and the U.S. manufacturing sector lost jobs over this period. In terms of percentage rates, China's average annual job loss is 5.2 percent, which is a larger magnitude of job loss than that of the United States for any of the alternatives considered. Considering its larger labor market, China's annual job loss in terms of absolute numbers is even more pronounced than that of the United States. In order to better understand the percentage numbers, and given the different time span, we interpret them on an annual average basis. For the United States, its manufacturing sector lost 263 thousand manufacturing jobs (out of 18 million workers) each year between 1995-02; while for China's large and medium firms in the industrial sector, 1.3 million jobs out of 30.8 million workers were lost each year during the period of 1995-2003 — an employee loss of almost five times the United States.

The last set of bars in Figure 5 report a summary measure of overall churning of jobs over and above that required to accommodate the net changes in the sector. Since the net employment growth of the industrial sector is shrinking, some of the total job reallocation statistic reflects this sectoral shrinking. The measure of excess job reallocation subtracts the absolute value of net employment growth from the total job reallocation to obtain this summary measure of churning. Interestingly, even abstracting from the differences in net employment growth rates for manufacturing between China and the U.S., China's excess reallocation rate exceeds that of the U.S.

V. Empirical Analysis --Variations by Sectors

5.1 .1 Job Flows by Ownership Type

The data are classified into eight ownership classes by the National Bureau of Statistics.[10] The upper and lower bound Average annual job flow calculations by ownership type are summarized in Table 4 and Table 5.[11] The ownership types fall into two groups: State-Owned Enterprises (SOEs) and collective enterprises in one group which are referred to as "government firms" and the rest referred to as "private firms". The net employment growth rates are negative for the government firms and positive for the private firms. This is not surprising in light of the privatization and downsizing of government firms reflected in the earlier work on this issue.

Although the differences in net growth rates are large, the reallocation within ownership types is even larger. The SOEs are contracting at a rate of 9.5 percent but this is accomplished by a gross job creation rate of 9.1 percent and a gross job destruction rate of 18.6 percent implying a job reallocation rate of 27.7 percent. The FDI joint ventures are expanding at a 5.4 percent rate but this reflects gross job creation of 13.5 percent, gross job destruction of 8.2 percent and an implied job reallocation rate of 21.7 percent. These excess job reallocation rates indicate that there is substantial churning within ownership types that is missed when looking at data aggregated to the group level.

In considering the variation in gross job flows across ownership types, there is slightly more variation in job creation rates than job destruction rates. Job creation rates are small for government firms (job creation for SOE and collectives are 9.1 percent and 11.6 percent respectively) versus 13 percent for domestic private firms. Other private firms also show higher job creation rates, ranging from 13.5 percent to 25.6 percent.

Joint stock firms are of particular interest, because most of them were formed by reorganizing former SOEs. This type of firm shows relatively high job destruction rates (16.1 percent), following right after SOEs. Since most of these joint stock enterprises were

[10] These ownership classes are described in some detail in previous TCB report (McGuckin and Spiegelman, 2004). SOE joint ventures are categorized into SOEs; and collective joint ventures are grouped into collective firms. Since the residual joint venture firms had negligible impact -- less than one percent of total employment, or total gross output—Table 4 and Table 5 do not list them. The last catch-all category "others" is also ignored in what follows since it is very small and mixed.

[11] The difference between the lower bound estimates of job flows in Table 5 and the upper bound estimates is quite large for some of these groups. For example, for private domestic firms the upper bound estimates yield a job creation rate of 53.1 percent and a job destruction rate of 17.1 percent. Thus, we are potentially understating the pace of restructuring and reallocation in Table 5 especially for some groups. However, the lower bound job flows are large even using conservative estimates reflecting the high pace of restructuring and reallocation

reclassified from SOEs, a substantial portion may still reflect the relatively poor performance of their predecessors and be in the midst of shedding jobs, restructuring or even exiting completely from operations. Joint stock firms also have a high level of job creation — 23.4 percent. Thus, unlike SOEs or collectives, the net employment growth for joint stock firms is positive. This partly reflects the success of restructuring and the capturing of resources/workers from other inefficient firms.

5.1.2 Government Controlled Enterprises Declining in Importance

The extensive restructuring of SOEs and collectives has been accomplished through downsizing and job losses and as a result the share of these firms' employment and output has dropped considerably.

Figure 6 and Figure 7 give the percentage of workers and gross output (in constant prices) associated with each ownership type. The SOEs and collectives have lost their dominant place in the industrial sector. In 1995, 81.9 percent of workers in the industrial sector were employed by an SOE, plus another 8.5 percent worked for a collective firm. Thus government controlled over 90 percent of industrial employment. These firms also contributed 75.7 percent of total industrial output.[12] SOEs' shares continuously dropped from 1995 to 2003: employment share fell 38.6 percentage points to 43.3 percent; gross output share decreased 52.3 percentages to 23.4 percent. So did the shares for collective enterprises. Altogether, SOEs and collective firms lost 20.2 million workers; their output contribution to industrial sector dropped 48 percentage points in the 9 years to 28.2 percent in 2003.

In contrast, the employment share of joint stock enterprises' increased nearly six fold (from 5.1 percent in 1995 to 29.5 percent in 2003), which corresponds to 6 million new jobs. Gross output increased 20.1 percentage points, a 35.4 percent annual growth rate, much higher than the annual growth rate for the entire industrial sector (15.7 percent). As discussed above, the rapid growth of joint stock enterprises is a reflection of the SOEs'

[12] Although the government controlled firms were the largest both in terms of employment and gross output, the employment share exceeds gross output's share by 14.7 percentage—a clear indication of lower productivity than other types of firms in year 1995.

restructuring process. The consistent pattern of opposite evolution for these two types of firms reflects that the privatization process has been undertaken as part of China's enterprises reform. Additionally, the continuous growth of joint stock enterprises is a positive indicator of the effects of the reform.

In the earlier years of the study period, large and medium sized domestic private firms were virtually non-existent. Even as late as 1999 both employment and gross output of these enterprises was still less than one percent. By 2003, they accounted for 4.9 percent of employment and 4.1 percent of gross output. This reflected astounding average annual growth rates for employment and gross output, respectively—135.3 percent and 163.2 percent—the highest among all types of firms. The fast growth of this group is partially due to its low starting base; nonetheless it reflects the prosperous development of private enterprises induced by a more market-driven economy.

Firms with foreign ownership (including HK/TW/MA invested, foreign invested, and pure foreign invested firms) also grew. More than 3.1 million new jobs were created by them during 1995-2003 and their share of output more than doubled from only 15.2 percent in 1995 to 39.4 percent in 2003.

5.2 Variations across Jurisdiction

We follow the definition of jurisdiction for China outlined in McGuckin and Dougherty (2002), which group China's enterprises into federal and local enterprises. Figure 8 demonstrates how Chinese jurisdictions are defined. On average during the period of 1995-2003, about three fifths of large and medium firms administered by federal governments (hereafter federal firms), while less than two fifths are constituted by firms administered by local governments (hereafter local firms). However, the number of federal firms kept falling especially after 1997. Consequently, their dominant role declined from 64.2 percent in 1995 to 47.8 percent in 2003, less than half of the large and medium firms. Figure 9 details the declining trend of federal firms.

The size of China's industrial firms shrank from 1995-2002, but picked up slightly in the year 2003. This pattern is especially true for federal firms than for local firms (Figure 10). The average size of federal firms shrank nearly one quarter from 2080 to 1555 workers.

Therefore, the weakening impact of federally administered firms on the entire industrial sector is further emphasized by the decreasing total number of workers employed by these firms. In fact, federal firms lost a total of 11.8 million workers over the nine years during the study period; its employment share dropped from 80.6 percent in year 1995 to 60.8 percent in year 2003. For local firms, although their size slightly contracted (from 879 workers per firm in year 1995 to 816 workers in year 2003), the new jobs created by entering local firms more than compensated the job losses from shrinking firms. Therefore, the net employment effect for local firms was positive.

To determine the sources of job losses or job gains for firms at different jurisdiction, we conducted the job flow analysis by jurisdiction.

Table 6 and Table 7 present the upper bound and lower bound job flows by jurisdiction. Similar to previous tables, they give the simple average of each job flows statistics over the study period (1995-2003). Again, we find a high pace of excess job reallocation reflecting substantial within jurisdiction restructuring.[13]

Federal firms exhibit high level of job flows suggesting higher job fluidity among federal firms, most probably due to the privatization process among China's SOEs. Since most SOEs are administered by federal governments, especially in the early years (only one fourth of SOEs were local firms in 1995), the substantial downsizing of SOEs and lack of entrants led to job losses for the federal group. Comparatively, employment for local SOEs has been fairly stable over the study period (Figure 11). The results are consistent with McGuckin and Dougherty's federalism argument (2002) where industries exhibit shifts from governmental administration and regulation to more local areas.

Although job flows for local firms is lower than federal firms, local firms experienced net employment gains. As discussed above, entrants contribute the most to new jobs in local firms. In fact, among all jobs created by firms administered by governments below the federal levels, about two thirds of them were created by entrants, or more precisely, entrants and continuing firms growing fast enough from small to medium or large size. Since local

[13] An immediate observation from Table 6 and Table 7 is that the gap between upper bound and lower bound job flows are much wider for local firms than for federal firms. This is due to the cluster of local firms around the large and medium firms' threshold (Recall Figure 10 that the average size of federal firms are more than double that of local firms).

SOEs and collective firms both experience job losses, it is clear that many of the new jobs created in the local firms were from these with more private ownership shares.

In this sense, privatization of China's industrial enterprises has been fairly successful as part of China's enterprises reform. We will discuss more of these implications when analyzing the productivity gains associated with this greater flexibility.

5.3 Variations across Industries

Gross job flows are also calculated for each industry. Table 8 shows the average upper bound and lower bound of job creation and job destruction by industry. As described in McGuckin and Spiegelman (2004), the Textile industry underwent deep restructuring reflected in its high job destruction to job creation ratio. Other industries share similar experiences include production associated of natural resources and machinery. These industries are mostly SOEs and heavily government controlled. Industries expanded from mid-1990s include food, apparel, footwear, furniture, communication equipment, which reflected in the higher job creation relative to job destruction.

Table 8 shows the upper bound and lower bound statistics by industry. Figure 12 shows the job flow analysis across industries for the US (1995-1998) and China (1995-2003) using the lower bound estimates.[14] For each industry shown in Figure 12, the upper bar represents US and the lower bar represents China. For each bar, the left box refers to job creation and the right one refers to job destruction. Each bar indicates the job reallocation rate as percent of employment.

While there is substantial diversity in job creation and destruction rates across industries, reallocation is very high in almost all industries for China. This implies the patterns at the total manufacturing level are not simply the result of major restructuring in just a few large industries. Similar to the comparison of aggregate job flow statistics, the magnitude of China's job flows are typically higher than that of the US across all industries

[14] The US job flows calculation is done by SIC code two-digit industry. It may not match the China's industrial classification exactly. However, as shown in McGuckin and Spiegelman (2004), many industries of the two countries have roughly the same coverage. The estimates for China are based upon the lower bound estimates for China adjusted for likely contribution of entry and exit. The adjustment factors here at the industry level.

except lower bound job flows of apparel (Figure 12), which shows that the impact of restructuring on industries was more diverse and of a much larger scale in China.

Closer inspection reveals more differences in the restructuring effects on labor markets in the two countries. For the U.S. during the time period reported (1995-1998), the majority of U.S. manufacturing sector are gaining jobs during 1995-1998, except textile, apparel, petroleum, leather, and instrument. However, this was a period of robust U.S. economic growth and for longer time periods (in particular 1973-98) we have found in unreported statistics that almost all industries experienced job losses, except printing (barely gaining 0.1 percent employment) and rubber (merely gaining 0.8 percent). While for China's industrial sectors, although the majority of industries experienced job losses, a few industries such as apparel, leather, furniture, communication equipment still stood to gain. As discussed in McGuckin and Spiegelman (2004), this is due to the offshoring effect—many developed countries like the U.S. outsourced low paid jobs to developing countries like China.

However, we also noticed that although these industries are at the heart of the offshoring trend, some of the net job gains did not come from low job destruction. In fact, the job destruction rates for furniture and communication were, like most of the other industries, also high compared to that of the U.S. High job destruction rates together with high job creation rates generate high excess job reallocation rates. This fact is consistent with our earlier observations that, during the restructuring period, there were more job shuffling activities for almost every industry in China, even though net employment in some industries rose.

One feature of job flows at the industry level for both China and the U.S. (and has been documented elsewhere – see, Baldwin, Dunne and Haltiwanger (1998) and Davis and Haltiwanger (1999)) is that industries with high job creation also tend to have high job destruction. This makes sense as the sum of job creation and destruction (job reallocation) is a summary measure of firm volatility in a sector. Moreover, industries are subject to different intensities of idiosyncratic profitability shocks (from either technology, taste or demand shocks) and also have industry specific components to adjustment costs including the costs of entry and exit. Part of the latter reflects the minimum efficient scale of production that varies across industries. For example, automobile assembly plants are

inherently larger and more capital intensive than bakeries with associated differences in the entry and exit patterns.

To the extent that the adjustment costs and intensity of idiosyncratic shocks is similar across countries, we would anticipate that industries with a pace of reallocation and volatility in one country would also have high volatility in another country. Along these lines, Baldwin, Dunne and Haltiwanger (1998) found that the industry patterns of job reallocation are highly correlated between the U.S. and Canada. We find that the China and US gross job flows observed among advanced economies for example between the U.S. and Canada. Both the pearson and the spearman correlation coefficients of matched industries between China and US job reallocation are 0.4 (in contrast, for the U.S. and Canada the analogous correlations are above 0.8). Even though the China – U.S. job reallocation correlation is not that high, it is still positive and suggests that common factors are playing a role (as one would expect) in the pace of reallocation across industries in China and the U.S. Interestingly, the correlation of net employment growth of industries between China and the U.S. is negative. This latter pattern is not surprising since this may in part reflect shifting patterns of production between China and the U.S. which would inherently create a negative correlation (e.g., the shifting of textile production from the U.S. to China

VI. Reallocation and Productivity

As discussed in the introduction, healthy market economies are constantly restructuring and reinventing themselves in response to changing economic conditions and the process of growth is noisy and complex. Firms are trying new products, new processes, new locations and new ways of doing business. Firms that find the best practices grow while those that learn they are less profitable than their counterparts contract and exit. In emerging and transition economies, there are likely distortions to these market incentives. However, in many such economies (like China) economic reforms are rapidly changing the market incentives. In such economies, the potential return from improvements in allocative efficiency is large.

To explore this working hypothesis, we relate the measured restructuring and reallocation to firm performance. The contribution of restructuring and reallocation are quantified through a series of decompositions and counterfactuals. We start by quantifying

the differences in productivity across different firm types (e.g., ownership type) and across continuing, entering and exiting firms. It will be this variation that we exploit in our decompositions and counterfactuals.

Table 9 shows the different productivity levels and growth rates for entrants, exits, and continuing firms based on the entire large and medium sized samples. We further decompose continuing firms according to whether they remain in the same ownership type or not. We also differentiate between reclassified expanding and contracting firms. Consistent with the TCB report on China's jobs and productivity (2004) which contained data through 2002, the extended data set shows China's industrial sector productivity growing at an astounding rate of 20.4 percent annually from 1995 to 2003.

Firms in all classes experienced productivity growth, even exiting firms. Figure 13 shows that the average firm exiting in 2002 had far higher productivity level than an exiting firm in, say 1998. While exiting firms showed far lower productivity levels than either continuing or entering firms in any year, the standards were advancing and the performance required to remain competitive has been progressing rapidly in China.
For example, the average productivity levels for entrants and reclassified expanding continuers were 177 and 165 thousand Yuan per worker per year, higher than the average industrial level (153 thousand Yuan per worker). The exits were at the bottom of the productivity rankings, at just 109 thousand Yuan per worker (Table 9). China's industrial productivity grew at a rapid pace because low productivity firms were not able to sustain intense competition and exit while higher productivity firms entered, grew, and survived.

The growth rate of productivity in China's industrial sector was relatively flat in the early years of the sample period, 1995-1998, but it accelerated after 1999. In studies by McGuckin and Stiroh (TCB 2002 and RES 1999) and Foster, Haltiwanger and Krizan (2001) on the productivity performance of U.S. manufacturing plants, new plants tend to have lower productivity level than the average manufacturing sector plant (although new plants have higher productivity than exiting plants). However, those cohorts of new plants that survived increased to industry averages and above in later years. This is consistent with both selection

and the learning by doing argument as new firms get experience operating in the industry and scale economies as they survive and grow (and the low productivity entrants exit).[15]

In China, we observe that entrants come in higher than incumbents which might be surprising at first glance. However, recall that entrants here means entry into large and medium status. Thus, some entry is really small firms that have grown sufficiently to become a large and medium firm which is already a sign of positive business performance. As such, it is not surprising that the small firms that transit have high productivity relative to incumbent large and medium firms.

Figure 14 provides another look at this issue of entrants and exits as well as reclassified firms moving from one ownership class to another. The top line on the graph gives the productivity ratio of entrants to exits, while the lower line shows the productivity ratio of reclassified expanding firms to reclassified shrinking firms. On average, entering firms were 63.6 percent more productive than firms exiting China's industrial sector; the expanding reclassified firms were 12.1 percent more productive than shrinking reclassified firms. Recall that the majority of job creations and job destructions came from firms entering to and exiting from large and medium firms. This implies, as expected, that those firms had a larger impact than the reclassified continuers on the evolution of industrial productivity.

6.1. Productivity and Ownership Type

This section provides a simple comparison of productivity levels and growth rates by ownership type. In Figure 15 and Figure 16, domestic firms are listed towards the left axis, while firms with foreign ownership are listed towards the right, with pure foreign enterprises listed at the right end. Furthermore, firms are listed in order of increasing government involvement, with firms having the most government involvement listed on the left and private firms on the right.

There is substantial variation in the levels and growth rates of productivity across firms of different ownership types (Figure 15). While all types of firms increased

[15] Foster, Haltiwanger and Syverson (2006) show that one of the reasons that new plants may have lower measured productivity than incumbents is that the standard measures of productivity at the plant level are based on a measure of real revenue per unit of input (which is true here). They find that new plants charge lower output prices than incumbents and that in terms of physical efficiency new plants are more productive than incumbents. It would be of interest to explore the role of between plant price variation in China.

productivity during the period 1995-2003 (Figure 15 and Figure 16), domestic enterprises showed lower productivity levels than firms with foreign ownership. In 1995 the most productive firms were pure foreign-owned while the least productive were SOEs. By 2003, the most productive firms were Foreign Direct Investment (FDI) joint ventures and the least productive continued to be SOEs. However, while SOEs lagged behind they showed more rapid growth rates than a number of firm types (including pure foreign-owned ventures and domestic private firms) especially in the second half of the sample period (see Figure 16). The most rapid growth over the 1998-03 period is for FDI joint ventures, which averaged more than 21 percent per year.

There are also considerable differences in the paths towards improved labor productivity. The restructuring of SOEs generates enormous productivity gains to both SOEs and joint stock enterprises. SOEs (see Figure 22) accomplished their rapid growth in labor productivity over the 1995-03 period by downsizing and shedding workers. Joint stock companies (see Figure 23) achieved the similar rapid growth over the 1995-03 period (especially rapid from 1998-03 with a growth rate of 18 percent per year on average) along with expanding employment.

The productivity performance of the FDI joint ventures has been exceptional. Although their productivity levels were only about 61.8 percent of pure foreignowned firms in 1995, they grew at an annual rate of 18.1 percent during 1995-2003, reaching 1,083 Yuan per worker per year in 2003—83.6 percent more productive than pure foreign-owned firms. These patterns are consistent with pure foreign-owned firms starting close to the global frontier and FDI joint ventures starting behind the global frontier but catching up rapidly.

6.2. Productivity and Jurisdiction

In China, the so-called "soft budget" (e.g., state supported firms not able to cover their costs with revenues stay in business and pay for expenses out of state funds) leads to low efficiency especially in federally administered firms. The federal vs. local administration of a firm matters here since the majority of SOEs are federally administered.[16]

[16] Since pure foreign enterprises are a special group which follows different regulations, we will study this group separately.

On average, local firms are 26 percent more productive than federal firms during the period 1995-2003. In Figure 17, each left bar (federal) is always lower than the right one (local). However, the productivity gap between federal firms and local firms has been closing up over time. In 2003, the federal firms' productivity performance was almost the same as that of local firms.

The catching up of federal firms already indicates that their productivity grew at a faster pace than the local firms. Figure 18 gives the evidence by illustrating the annual productivity growth rates by jurisdictions. Except for 1996 and 2001, federal administered firms always had productivity growth rates higher than their local counterparts. In fact, the productivity of federal administered firms grew 3 percentage points faster than local firms on an annual average basis during the study period (20.5 percent vs. 17.1 percent).

Most of the fast growth was driven by federalization and privatization process. Many SOEs improved efficiency by shedding off redundant employees, especially non-production workers. Many more SOEs converted to joint stock firms and took in private shares. Since the majority of SOEs are administered at the federal level, the restructuring of SOEs led to productivity gains over the reform period.

The pure foreign enterprises started from a high level in terms of productivity performance (see Figure 17). Therefore, they were growing at a relatively low annual growth rate of 3.1 percent. However, when breaking this group by jurisdictions, federally administered pure foreign firms grew at 14.7 percent, while locally administered pure foreign firms even had a -0.8 percent productivity growth rate.[17]

Putting the pieces together, the pattern of results suggests a changing competitive landscape and, in turn that competition for market share may be generated from unexpected

[17] In order to further investigate the sources of the different productivity growth, we study the evolution of pure foreign firms by jurisdictions. It turns out that the total number of pure foreign firms slowly increased but stayed fairly flat until year 2000 at both federal level and local level (Figure 20). However, from year 2001 onward the difference has been dramatic. While for locally administered pure foreign firms, the total numbers shoot up every year after 2001, the total numbers of federally administered pure foreign firms dropped and stayed small. In year 2003, the number of locally administered pure foreign firms was ten times the number of federally administered pure foreign firms. This indicates that most of the new pure foreign firms, at least for the years 2000-2003, entered at the local level. While many of the federally administered firms probably were continuers.
Therefore, we deduce that the productivity growth for locally administered pure foreign firms was probably dragged down by lower productivity levels for entrants. Meanwhile, a small notable portion of continuers administered at the federal level increased their productivity over time. Although this is not the case for China's large and medium industrial firms at the aggregate level as discussed earlier, it is consistent with other literatures on the learning by doing argument.

quarters. For example, while SOEs are still lagging behind in absolute productivity terms, their sheer size and impressive productivity growth rates imply that they are becoming forces to be reckoned with. In contrast, pure foreign firms, which had a massive initial productivity advantage over all other types of firms, exhibited only modest productivity growth during the study period. Interestingly, joint ventures started with a lower productivity level than pure foreign firms but have surpassed pure foreign firms with rapid growth of their own. It is as though these firms have taken the best from their foreign partners but also have developed the organizational capital that permits them to thrive in China.

VII. Quantifying and Decompose Productivity Growth

In this section we use standard shift-share decompositions – e.g., how much of the total change is due to changes in shares vs. changes within each group? – to quantify the contribution of the reallocation and restructuring to the aggregate productivity growth of China's industrial structure. On one hand, productivity grows rapidly due to shifting of labor away from less productive enterprises towards more productive enterprises. On the other hand, enterprises adopting advanced technologies, shedding off redundant employment also promote productivity growth within themselves. We refer to the former as the between effect and to the latter as the within effect. In this study, by computing the between effect and within effect of China's productivity growth, we attempt to quantify the contribution of the reallocation and restructuring to the aggregate productivity growth of China's industrial structure. In particular, we seek to understand a series of questions. Has the rapid productivity growth been shared by all types of firms? What is the role of restructuring across ownership types, jurisdictions, size classes in contributing to aggregate employment, output and productivity growth?

We calculate the contribution of restructuring and reallocation in steps. The first step is to focus on changing shares of activity across types of firms – for example, the shift in activity away from SOEs to private firms. The second step is to examine reallocation of activity amongst firms of the same type. For example, the potential gains in productivity in shifting resources from less productive to more productive SOEs. The final step combines the between and within firm type restructuring for our bottom line contribution.

7.1 Contribution of Between and Within Group Restructuring

In order to answer the above questions, we start with a decomposition of productivity growth into the sum of within effect and between effect across firm types:

$$\Delta P_t = \sum_i \Delta P_{it}\theta_i + \sum_i \Delta\theta_{it}P_i \,, \qquad (1)$$

where P is labor productivity in logs, θ is the employment share of group i (denominator is total economy employment), t is time, "i" is type of firm. In this study, we consider four different "i" groups. They are firm size, ownership type, jurisdiction, and industry. A variable without a t subscript but an i subscript is the time average of this variable for type i firms.

The results of implementing equation (1) are shown in Table 10. It is clear that the within effects dominate between effects in all cases. The between effects are most pronounced when decomposing productivity growth by ownership types. About one quarter of aggregate productivity growth in the industrial sector in China is accounted for by the shift in ownership structure. The remainder of the growth is due to within group restructuring. The finding that resources reallocate to more efficient group of firms is stronger across ownership types than across different, or sizes, or industries. In other words, restructuring and reallocation are across ownership types and among firms of all jurisdictions, industries, and firm sizes.

We also extend this to consider decompositions within each industry, using the ownership type and jurisdiction. This yields a large number of industry decompositions. Note in this case all shares are based on shares of group i for a particular industry. It is useful to compute and then take average across the industry decompositions using average gross output shares (time invariant as weights). The reason for doing the latter is that in computing decompositions separately by industry and then aggregating, we are decomposing the within industry variation and keeping between industry shares constant. The original decomposition above by ownership type only in part reflects changes in composition across industries.

The results of decomposing productivity growth within each industry by ownership type and jurisdiction and then taking weighted averages of the industry level results are shown in Table 11. The patterns of within effect and between effects exploiting only within industry variation are similar as those that also exploit between industry variation. The finding that the results in Table 10 and Table 11 are similar reduces concerns about the use of gross output per worker as our measure of productivity for firms. Gross output per worker and value added per worker at the industry level need not be highly correlated so there could be spurious composition effects from shifting resources from a low gross output per worker industry to a high gross output per worker industry even if there is not much difference in value added per worker. Table 11 shows that our findings hold when we focus on within industry restructuring only and thus mitigates this concern. In what follows for most of the exercises we are constrained to using measures of gross output per worker by firm type and do not have available breakdowns by firm type and industry (e.g., for entrants, exits, and continuers). We believe our findings in Table 10 and Table 11 alleviate concerns that such results are being driven by measurement issues associated with using gross output per worker. Moreover, the findings in Table 10 and Table 11 suggest that much of our findings on ownership type and jurisdiction are being driven by restructuring and reallocation within industries.

To further illustrate the role of restructuring across ownership types, we map the employment share and labor productivity by ownership type and the corresponding decomposition of labor productivity growth over the period of 1995-2003 in Figure 21 to Figure 25. Figure 21 gives the average share and labor productivity by ownership type. SOEs have the highest employment share but the poorest performance. By reallocating labor resources to more efficient firms in other ownership types, the employment share for SOEs continuously decreases over the study period (Figure 22). Other types of firms showing decreasing employment shares include collective firms and domestic joint ventures . They are all government controlled enterprises. On the contrary, more efficient firms in other private firms are gaining employment shares over the same period (Figure 23 shows joint stock firms for an example).

Figure 24 and Figure 25 show the patterns for SOEs and Joint Stocks for a specific industry – computer equipment. The decline in employment share for SOEs and the rise in employment share for joint stock firms is quite dramatic in this industry with associated accompanying increases in productivity for both types of firms. These patterns show that much of what we are capturing is a within industry phenomenon rather than a between industry phenomenon and thus highlights the importance of measuring and analyzing restructuring and reallocation within industries.

Similarly, Figure 26 and Figure 27 illustrate the evolution of employment share and labor productivity for federal and local firms and the corresponding decomposition of labor productivity growth over the period of 1995-2003. With shifts of governmental regulation to more local areas, employment share of federal firms declines while that of local firms picks up over time. However, these trends are not as obvious as that for ownership types.

7.2 Contribution of Reallocation Within Groups including Entry/Exit

The above decompositions are standard shift-share decompositions – how much of the total change is due to changes in shares vs. changes within each group. However, this is only the first step since the decompositions in (1) do not take into account the reallocation within each firm type. Recall that our findings on gross job flows is that there is substantial job creation and destruction within each firm type so there is important reallocation within firm type. To quantify the contribution of this restructuring and reallocation within groups, consider the following decomposition for any group i:

$$\Delta P_{it} = s_{ci}\Delta P_{cit} + (P_{ci} - P_i)\Delta s_{cit} + s_{Nit}(P_{Nit} - P_i) - s_{Xit-1}(P_{Xit-1} - P_i), \qquad (2)$$

where c is continuers, N is entrants and X is exits and in this case s reflects shares of employment for continuing firms, entering and exiting firms respectively. For example, the numerator for the share for s_{cit} is the employment of businesses in group i in period t for businesses that continued between time period t-1 and t. The denominator is total employment for group i in period t. As before a variable without a time subscript reflects the time average of the variable for the group in question.

Note that s shares are within group shares which distinguish from the Θ are between group shares. To be precise, consider the following examples where we considering shares of employment:

$$\theta_{it} = EMP_{it} / EMP_{t,},$$

$$s_{cit} = EMP_{cit} / EMP_{it} .$$

We have applied equation (2) to the following groups: 1) total economy, 2) ownership type, 3) jurisdiction, 4) industry. When we apply this methodology at the total economy level we are neglecting the contribution of between group shifts in resources (e.g., between SOEs and FDI Joint Ventures) so this neglects the between group effects emphasized in the prior section. Still, Figure 28 confirms that the sources of labor productivity growth come from both reallocation of resources and improvement of existing firms. On average, 70 percent of aggregate productivity in the industrial sector in China is accounted for by shedding of redundant employment and improving performance of continuing firms, while the rest aggregate productivity growth comes from releasing production resources from inefficient firms to more efficient firms, which is reflected by exiting firms' lower than average productivity and entering firms' higher than average productivity.

Figure 29 and Figure 30 show the application of equation (2) to SOEs and joint stock firms. A common feature of those two ownership types is that the within effect accounts for about 80 percent, which is higher than the industrial average. Entering and exiting firms contribute less 20 percent. The between effect of continuers is almost negligible. This is consistent with the view that the gains in productivity for SOEs from reforms is likely due to of the massive layoffs at SOEs (Assar Lindbeck, 2006). Our study reveals that more than 80 percent of productivity growth of SOEs is attributable to substantial job elimination. This process of government furloughing millions of factory workers continued through all the years of our study sample, which indicates SOEs' reforms started in mid-1990s and carried on its forceful momentum for almost a decade, only has slight slow down in year 2003.

This process of shedding of redundant workers is more pronounced for federal firms than for local firms. We find in unreported results that when decomposing productivity growth by jurisdiction, the within effect takes 73 percent of productivity growth for federal firms on average, versus 64 for that of local firms. Higher within effect of federal firms than

local firms reflects that the more governmental involvement a firm has, the deeper restructuring it has undergone.

This is also confirmed by decomposing productivity growth by industry.[18] For example, mining and washing of coal is heavily governmental controlled due to protection of national natural resources. The average within effect takes up to 91 percent, which is reflected in by almost coincided total productivity growth and the within effect of this industry. The pattern is similar for other mining and processing industries. Although within effect is still important, entering and exiting firms contribute to performance improvement significantly for industries with more private assets such as textile, recording media, rubber.

7.3 Quantifying the Overall Contribution of Restructuring and Reallocation

We are now finally ready to put all the pieces together. In the previous sections, we have shown that between group and within group reallocation and restructuring have both contributed to productivity growth. Our objective is to quantify the overall contribution of reallocation and restructuring to productivity growth. To accomplish we must combine the results from the decompositions in equations (1) and (2). To combine the effects, we construct a series of counterfactuals. The counterfactual we consider is what would have happened to productivity growth if all continuing firms had their actual productivity growth but there was no entry and exit and no changes in market shares across continuing firms. If there is no restructuring (i.e., no changes in any shares and no entry/exit), the second term is zero in equation (1), and so aggregate change in productivity is merely due to within group productivity shifts for continuers. Moreover, this counterfactual further decomposes the first term in equation (1) with only the first term in (2) permitted to be nonzero. This counterfactual can be expressed as:

$$\Delta\hat{P}_t = \sum_i \Delta\hat{P}_{it}\theta_i = \sum_i s_{ci}\Delta P_{cit}\theta_i \qquad (3)$$

Figure 31 compares log productivity growth with conjectured log productivity growth without restructuring where groups are defined by ownership. We have also in unreported results examined the contribution for groups defined by jurisdiction and industry. On

[18] Tables and Figures by Industry available upon request.

average, restructuring contribute 41 percent, 32 percent, and 33 percent to the aggregate productivity growth for ownership type, jurisdiction, and industry respectively. In Figure 31 (and in the unreported results for jurisdiction and industry), the restructuring accelerated from 1996 to 2001 and kept steady in the recent years. The contribution in the second half of our sample is very large especially when we conduct the counterfactual by ownership type. In 2001, the actual labor productivity growth is 22% and 12% (more than half) is due to restructuring and reallocation in Figure 31.

The counterfactual from (3) combines the contribution of shifting of resources between observable types of firms (e.g., from SOES to Joint Stock) as well as the shift of resources across firms of the same type. To focus on the overall contribution of the latter, we also consider the following counterfactual given by:

$$\Delta \tilde{P}_t = \sum_i \Delta \hat{P}_{it} \theta_i + \sum_i \Delta \theta_{it} P_i = \sum_i s_{ci} \Delta P_{cit} \theta_i + \sum_i \Delta \theta_{it} P_i$$

The results for this counterfactual show that there is an important role for both between firm type restructuring and within firm type restructuring. For example, in 2001 restructuring between and within ownership types accounts more than half of the productivity growth. We find using this latter decomposition that about two thirds of the latter is due to shifting of resources between ownership types and the remainder is due to shifting of resources within ownership types. Recall that the pace of reallocation within ownership types is large (Table 4 and Table 5). This latter finding suggests this within type reallocation is productivity enhancing.

VIII. Concluding Comments

We quantify the contribution of restructuring and reallocation to China's productivity growth. While much has been done studying China's economic reforms and its impact on aggregate or industrial level performance, to understand the impact of economic reforms intended to improve allocative efficiency, the firm level link between reallocation and productivity growth must be analyzed. We conduct this analysis with a unique longitudinal firm-level database for large and medium firms over the 1995 to 2003 period. This rich data

permits us to quantify the pace and nature of reallocation and to quantify the contribution of reallocation and restructuring to productivity growth.

We find a high pace of job creation and job destruction rates for China that is at least as high as that in the U.S. The excess job reallocation at the level of the industrial sector overall is estimated to be as high as 31.8 percent and within many firm types it is even higher. This high pace of excess reallocation particularly within firm types (e.g., within SOEs or within FDI joint ventures) indicates a high pace of restructuring within the industrial sector. While there are measurement concerns and difficulties in comparing such statistics across countries, it is clear that this period of time has been one of rapid restructuring and reallocation. Moreover, job destruction dominates job creation during this period, which leads to net employment loss annually especially after 1998, with the exception of 2003. Thus, part of the story of the restructuring is labor shedding by large and medium firms.

China's labor productivity performance over this period for the large and medium firms in the industrial sector is impressive with an average annual rate of 20.4 percent. We find that a substantial fraction of this productivity growth is associated with restructuring and reallocation across firms. When we consider restructuring and reallocation between and within firms classified by ownership type (e.g., state owned enterprises, joint stock, privately held, foreign direct investment ventures, etc.), we find that restructuring and reallocation contributed 41 percent on average to the labor productivity growth. We find that the contribution of this reallocation and restructuring accelerated after 1998 reaching a peak in 2001. In that year, we find reallocation and restructuring accounted for 55 percent of the labor productivity growth.

In short, the economic reforms that China has made over the 1995 to 2003 have yielded high labor productivity growth that is driven substantially by improved allocative efficiency. Beyond measurement concerns of which there are many, many open questions remain including whether these improvements in allocative efficiency have persisted in the last few years and whether they will continue in the future. In addition, given the important role of restructuring and reallocation that has accompanied the economic reforms, it is of clear interest to investigate which reforms played a positive role in the productivity enhancing reallocation and which remaining distortions have slowed down the contribution of restructuring and reallocation to productivity growth.

It is also clearly of interest to explore the potential for future productivity gains from improving allocative efficiency. A recent paper exploring closely related issues using a more structural modeling approach and numerical calibration (i.e., Hsieh and Klenow (2006)) offers an estimate of the potential for future restructuring in China suggesting that improvements in allocative efficiency to U.S. levels would yield a 40 to 50 percent gain in productivity. In order to be able to refine such estimates as well as to explore the market and policy reforms required to achieve such gains, there is a continued need to develop the firm level data infrastructure in China. We view the current paper as helping motivate such work but also to highlight the measurement challenges for such analysis.

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Appendix: Empirical Application—Calculating Gross Job Flows

1. Observed Sample

To date, we have not dealt with a universe of all firms, but instead a sample of roughly 22,500 firms each year. The sample was defined as follows:

Any firm that is large or medium in one of the 9 years studied was included in the sample. However, when a firm is not large or medium, it was considered to *not exist* in that year.

This sample was used for several reasons. First, sample of large and medium firms was the most likely to contain firms for which year–to-year linkages could be found, it conformed to the sample in the original project with the 1995 data and work had already been undertaken by NBS. As stated previously, a larger, more complete set of firms that also contains small industrial firms would be ideal. However, data quality and inconsistency issues associated with small firms would obstruct accurate calculation of gross job flows.

For a job flows calculation between year t and year u the following table shows how firms should be classified:

	Status in year t	**Status in year u**
Continuer	Large or Medium	Large or Medium
Entrant	Small or Does not exist	Large or Medium
Exit	Large or Medium	Small or Does not exist
Not Included	Small or Does not exist	Small or Does not exist

2. Calculating Job Flows by Sectors

How does job creation and job destruction vary among ownership, industry and jurisdiction? Here we follow the concept of "sectors" by Davis *et. al*: sectors are groups of firms defined by observable characteristics. In the context of our study, it refers to ownership, jurisdiction, and industry. We elaborate on the job flow calculation method for ownership types. The scheme can also be applied to industry and jurisdiction.

The following table defines how ownerships should be categorized (X is a variable representing a specific ownership type. There are 9 such ownership types or classifications.):

Type	**Status in year t**	**Status in year u**	**Ownership Classification**
Continuer	Ownership = X	Ownership = X	X
Continuer	Ownership = unknown	Ownership = X	X
Continuer	Ownership = X	Ownership = unknown	X
Continuer	Ownership = unknown	Ownership = unknown	Unknown
Continuer	Ownership = X	Ownership = Y	XY
Entrant		Ownership = X	X
Entrant		Ownership = unknown	unknown
Exit	Ownership = X		X
Exit	Ownership = unknown		Unknown

In all these cases when the variable of a continuer changes from year t to year u, it is labeled as a hybrid value XY which corresponds to reclassified firms. There are some special issues associated with these reclassified firms when calculating job flows by groups; it is further discussed below.

3. Calculating the job flows

The calculation of job flows is then done for each ownership, jurisdiction, and industry. Job flows represent a change in the number of jobs from year t to year u. The flows are based on the number of workers in year t and in year u. The following table summarizes the six types of flows:

Flow Type	Firm Type	Criteria (year t and u)	Calculation of flow
CC = Creation from continuer	Continuer	workers(u) > workers(t)	Workers(u) – workers(t)
DC = Destruction from continuer	Continuer	Workers(u) < workers(t)	Workers(t) – workers(u)
CE = Creation from entry	Entrant	All entrants will be CE	Workers(u)
DE = Destruction from exit	Exit	All exits	Workers(t)
LC = Loss from reclassification of a firm to a new category	Continuer	The firm is in group X in year t, but not in year u.	Workers(t) – workers(u)
GC = Gain from reclassification of a firm to a new category	Continuer	The firm is in group X in year u, but not in year t.	Workers(u) – workers(t)

The last two rows deal with firms changing classifications. We typically consider classification of firms based on their status in "t" – not in t-1. Therefore any firm in some group, e.g., joint stock in t should have their t-1 employment classified in same group for the purposes of looking at t-1 to t growth rates. The good news about this approach is that employment for any pair of years t-1 and t will have shares in year t consistent with aggregates – but not in t-1.

4. Building the link between annual data and flows

For any given group (ownership, industry, or jurisdiction), we know the number of workers in year t and year u. The following basic equation should always hold true:

Workers (t) + CC + CE + GC – DC – DE – LC= Workers (u)

This identity should sum over each group, so it will hold in each aggregate case and for all firms in the sample.[19]

[19] However, notice that GC=LC=0 when calculating job flows for the whole sample, because then there would be no reclassifications.

Figure 1: China's Industrial Gross Output (1990 Price), 1995-2003

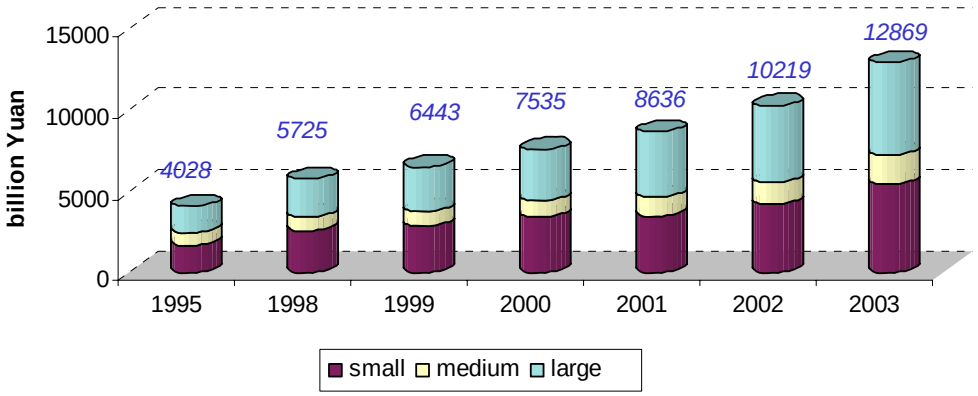


Figure 2**:** China's Industrial Employment, 1995-2003

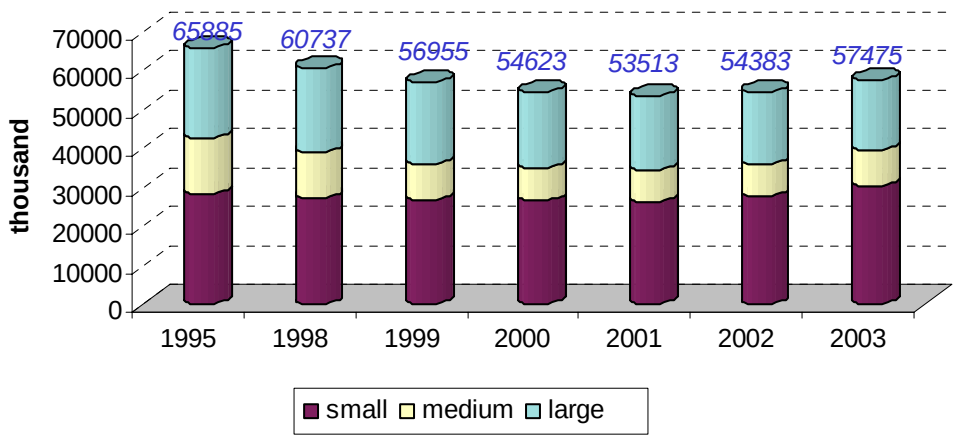


Figure 3: China's Productivity, Employment and Gross Output Levels for Industrial firms, 1995-2003 (L+M=Large + Medium, S=Small)

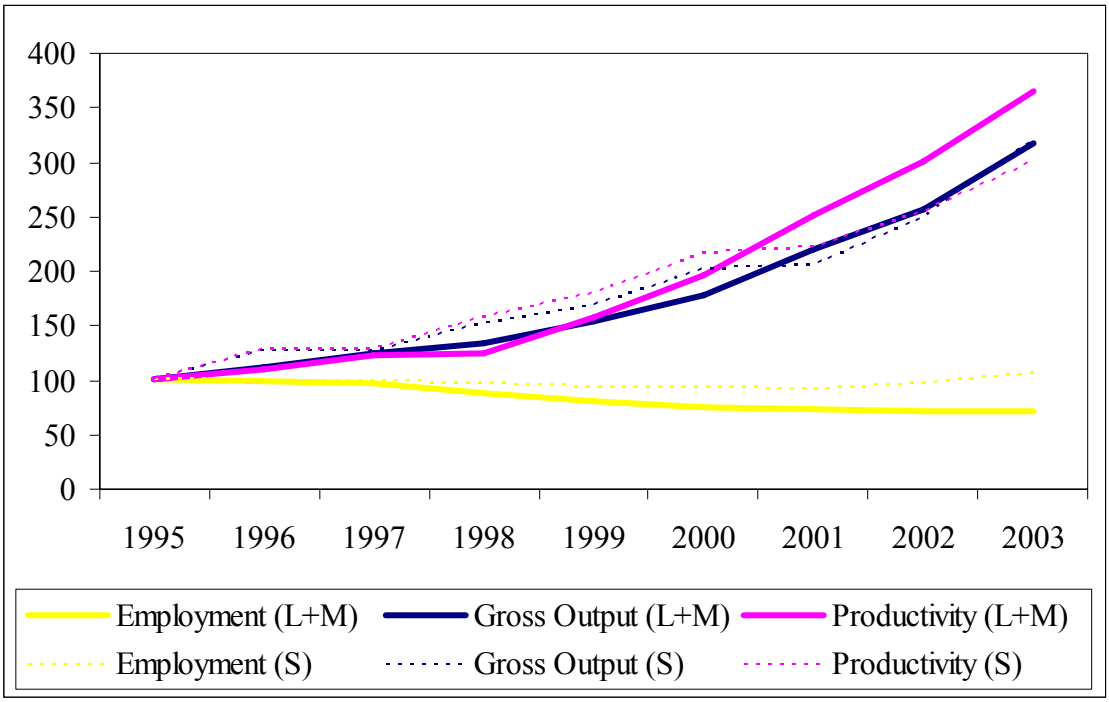


Figure 4: Decomposition of Job Creation and Job Destruction for China's Large and Medium Industrial Firms, 1995-2003

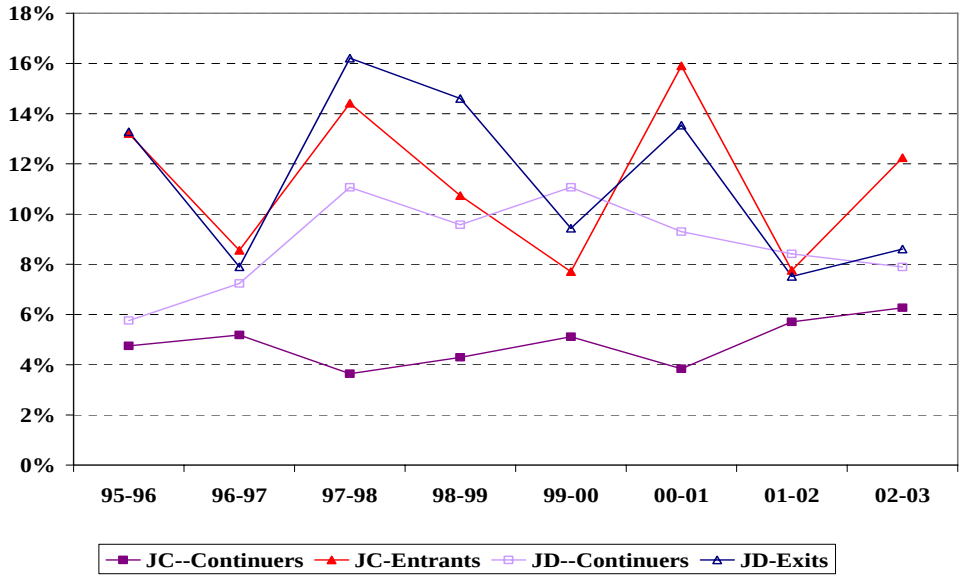


Figure 5**:** Gross Job Flows of China (Lower Bound) vs. US

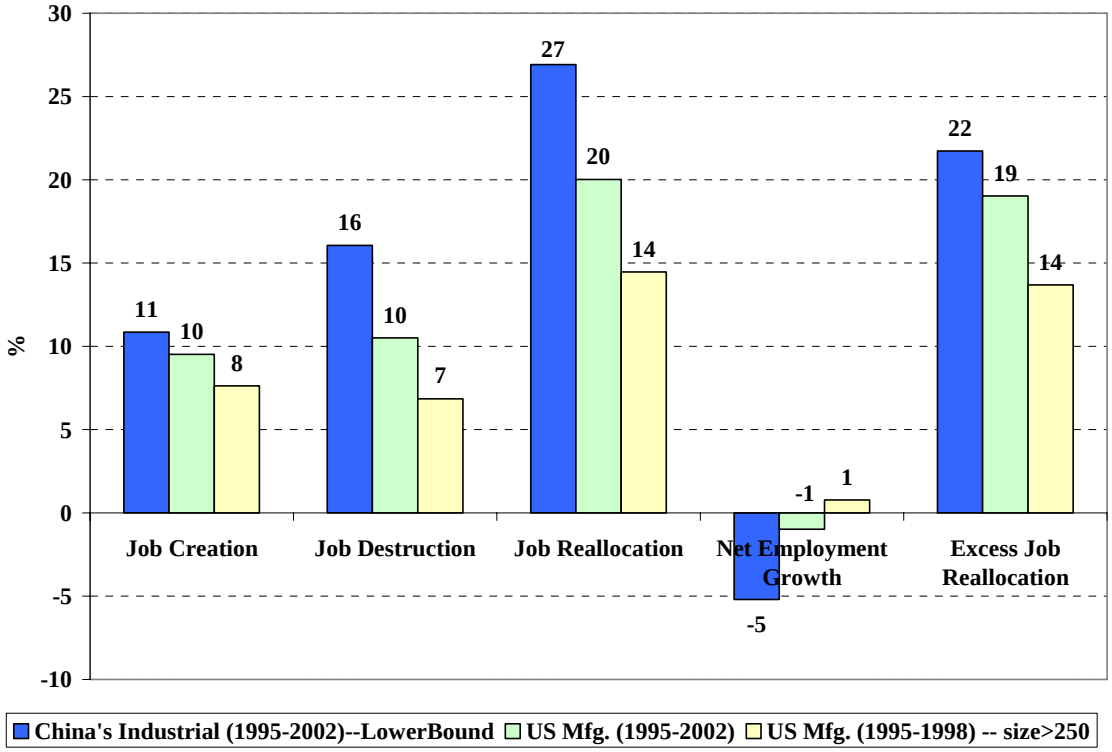


Figure 6: Employment Percentage by Ownership

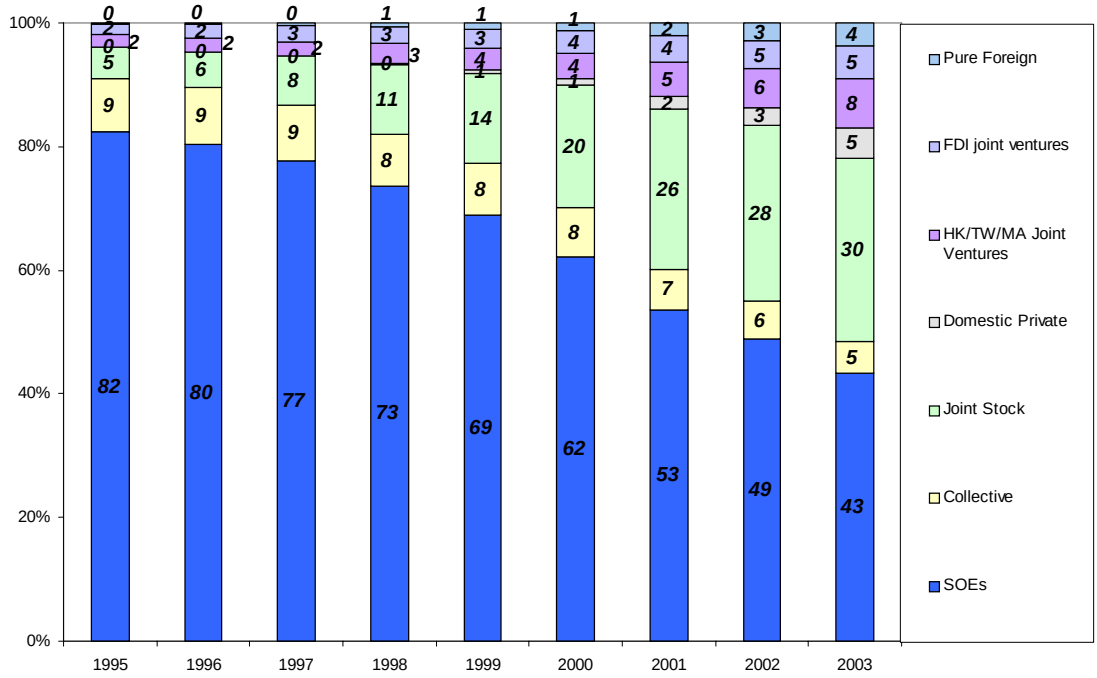


Figure 7: Gross Output (1990 Price) Percentage by Ownership

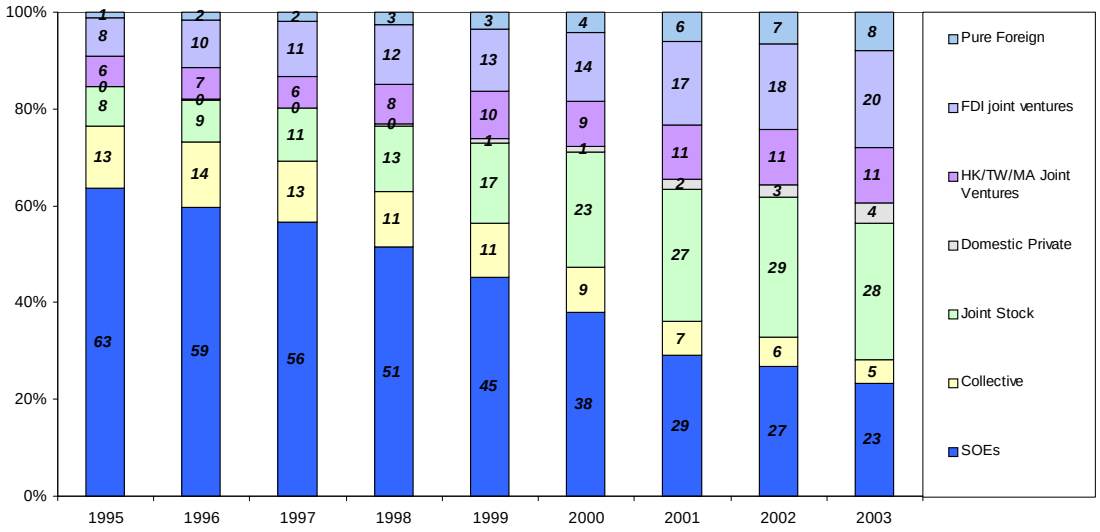


Figure 8: China's Jurisdiction Pyramid

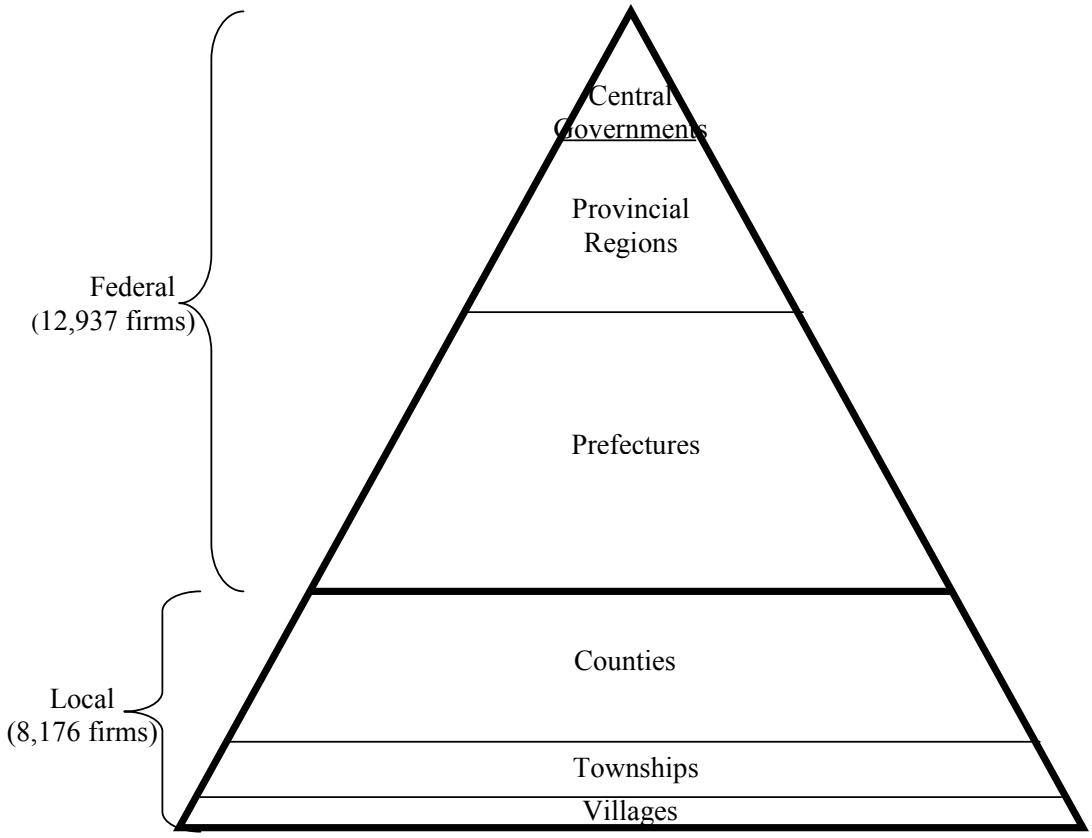


Figure 9: Federal Administered Firms Decreased over 1995-2003

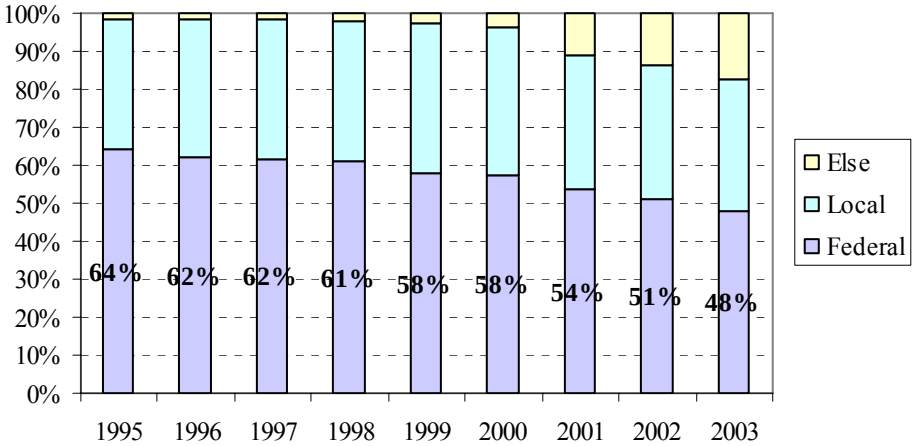


Figure 10: Average Size of Firms by Jurisdiction, 1995-2003

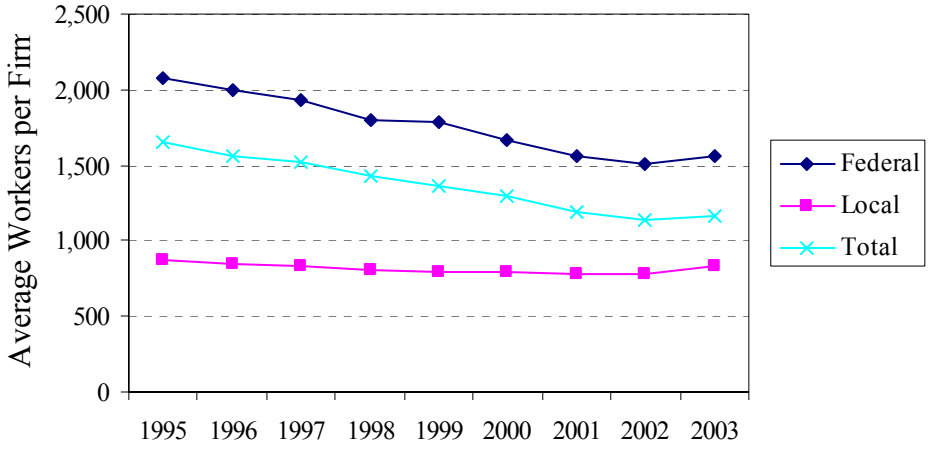


Figure 11: Job Losses for SOEs are More Pronounced for Federal than for Local

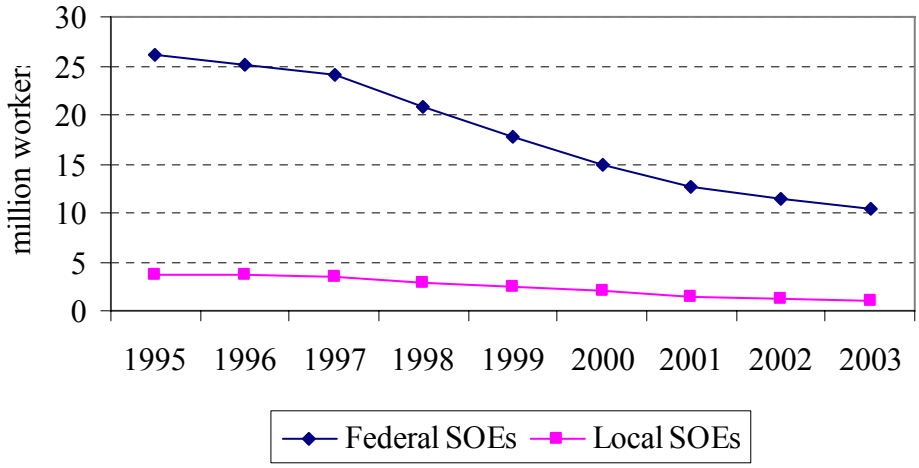


Figure 12**:** Job Flows for China (1995-2003) and US (1995-1998), (% of Employment)

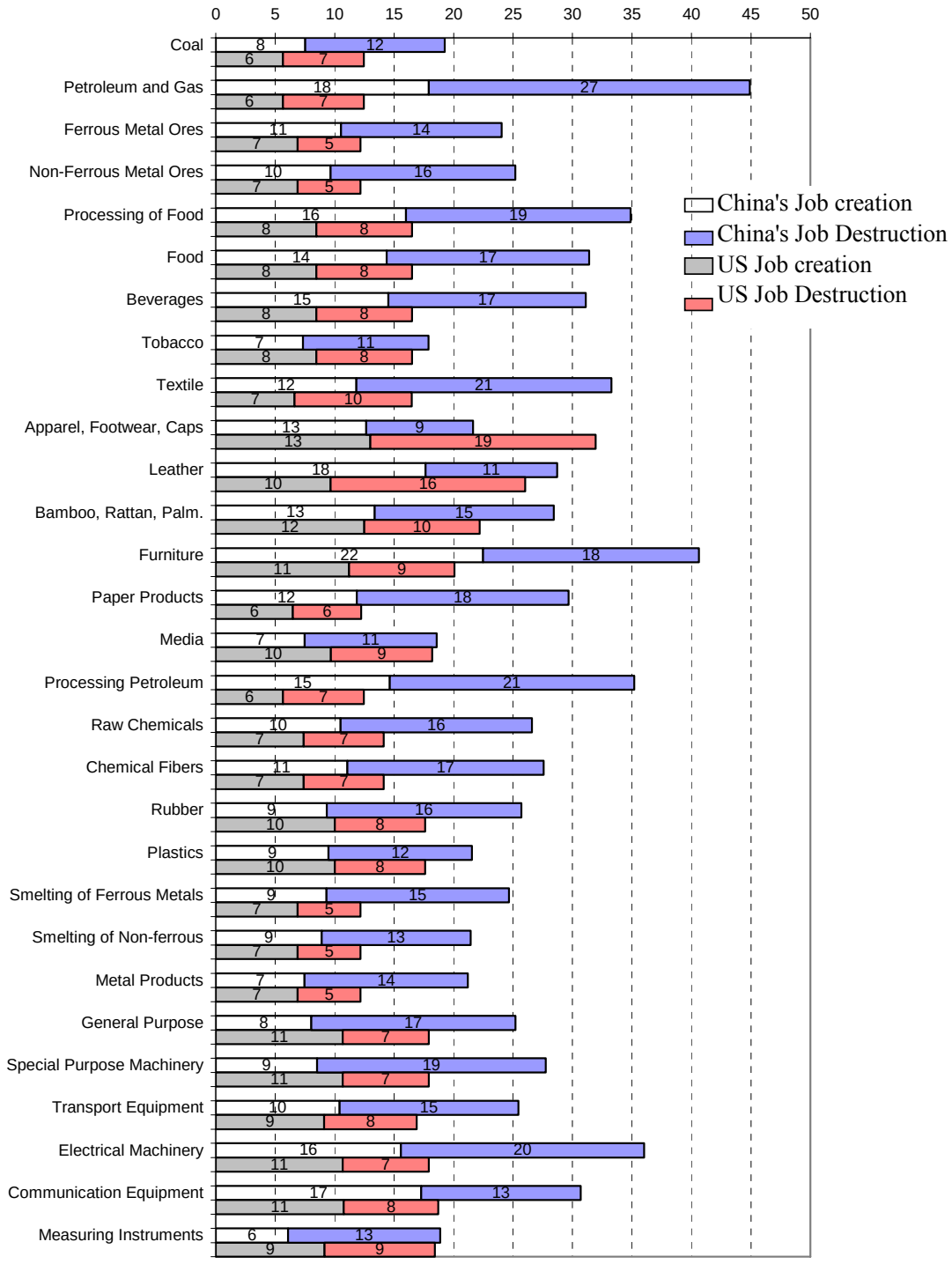


Figure 13: Productivity Levels for Entrants, Exits, and Continuers, China's Large and Medium Industrial Firm, 1995-2003

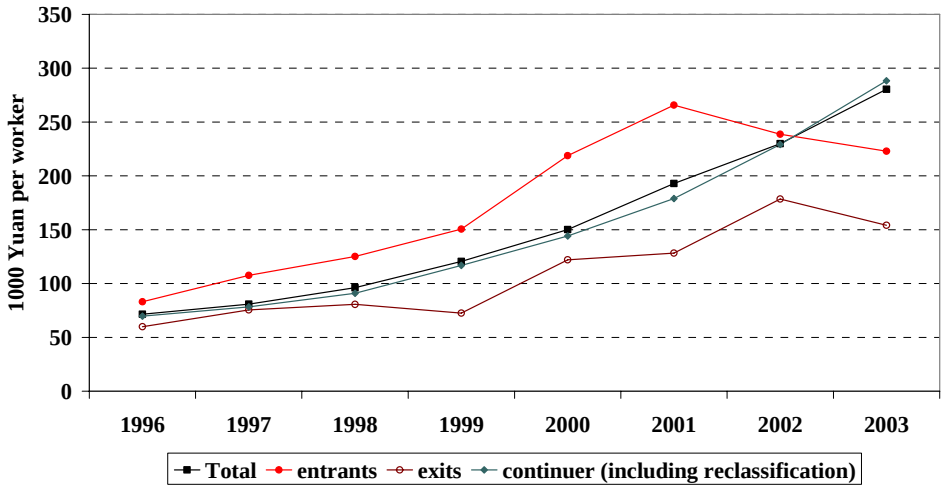


Figure 14: Productivity Comparison: Entrants vs. Exits, Reclassified Expanding vs. Reclassified Contracting firms (1995-2003)

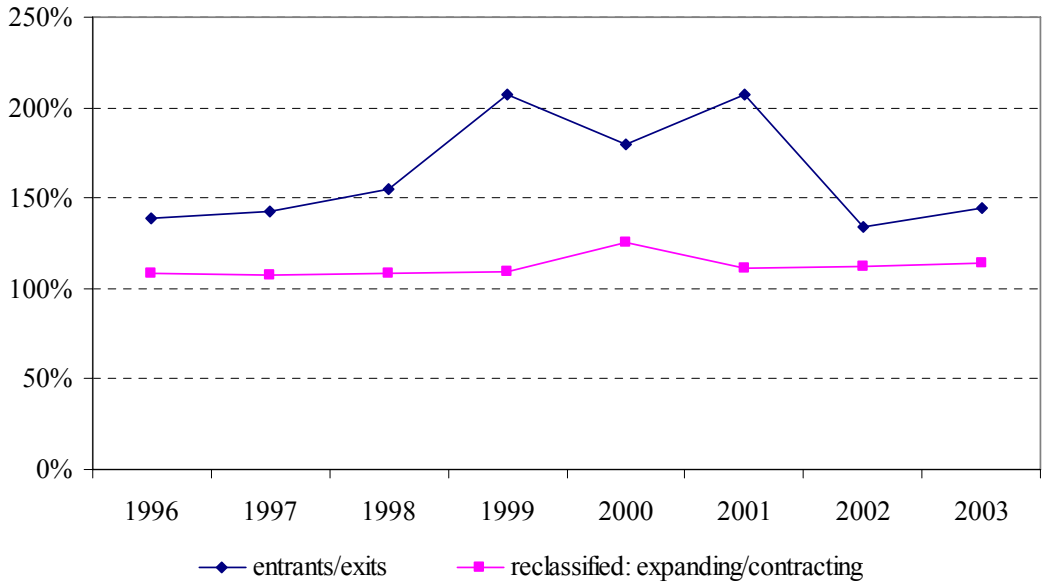


Figure 15: Comparison of Productivity Levels by Ownership Type

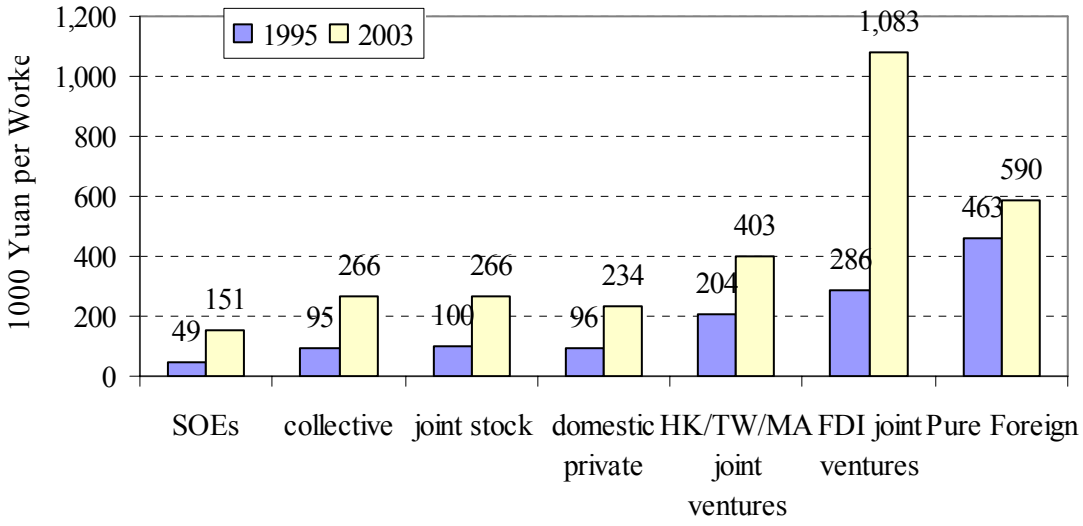


Figure 16: Comparison of Productivity Growth by Ownership Type

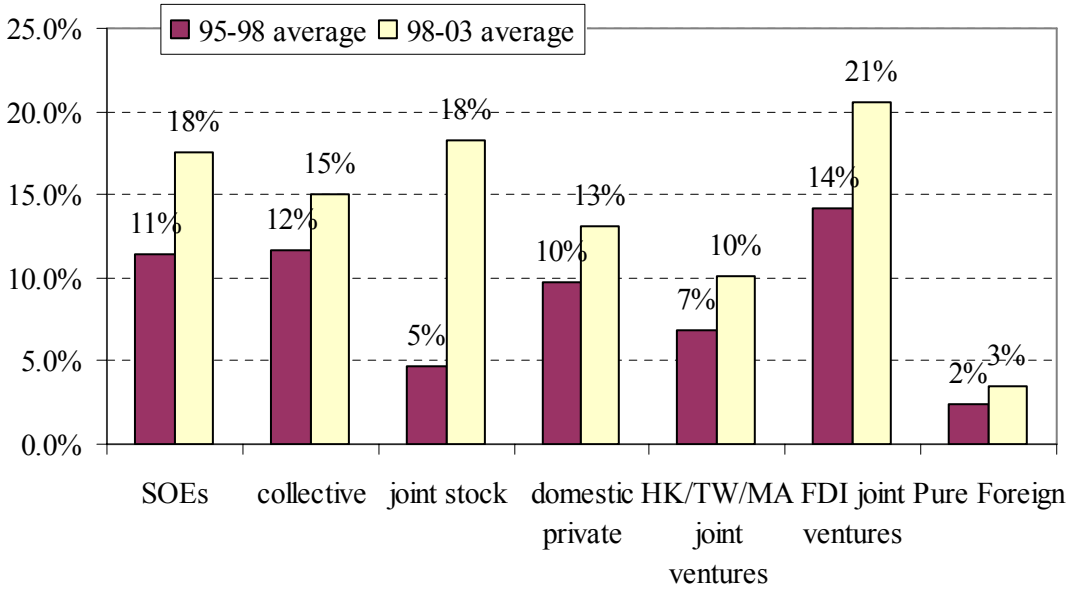


Figure 17: Productivity Levels by Jurisdiction (Excluding Pure Foreign) for China's Large and Medium Industrial Firms, 1995-2003

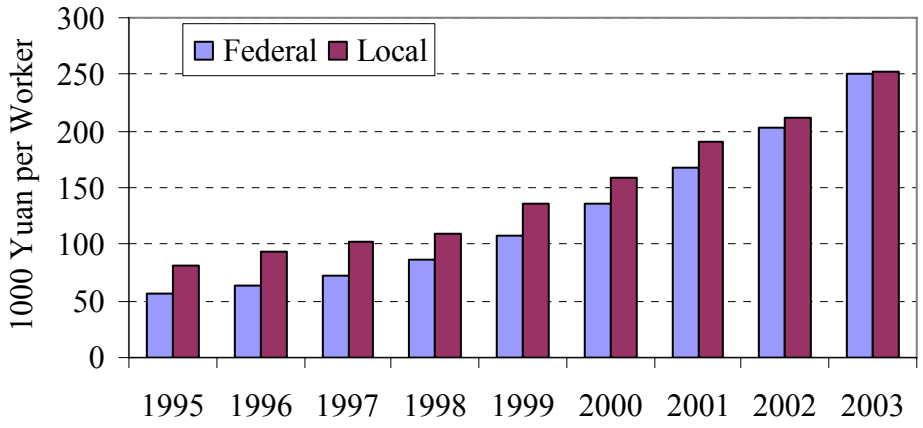


Figure 18: Productivity Growth by Jurisdiction (Excluding Pure Foreign) for China's Large and Medium Industrial Firms, 1995-2003

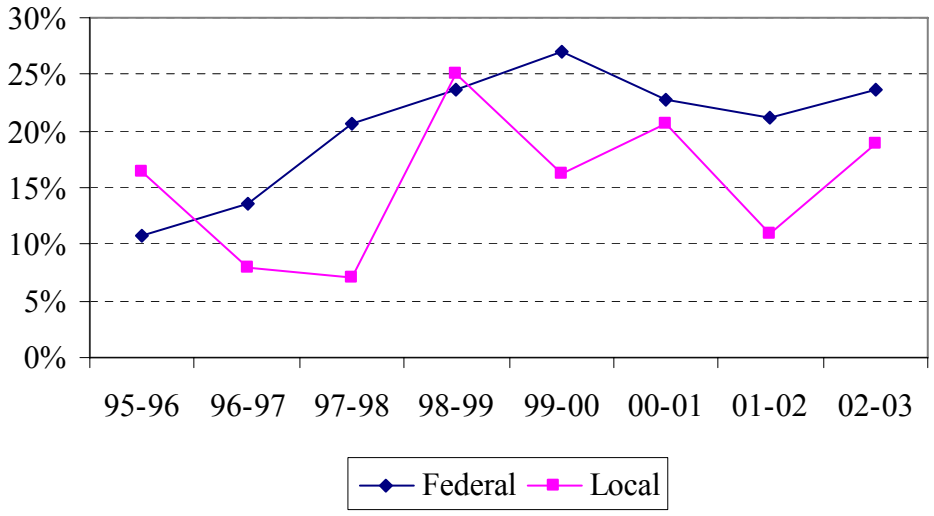


Figure 19: Productivity Levels for China's Large and Medium Pure Foreign Enterprises by Jurisdiction, 1995-2003

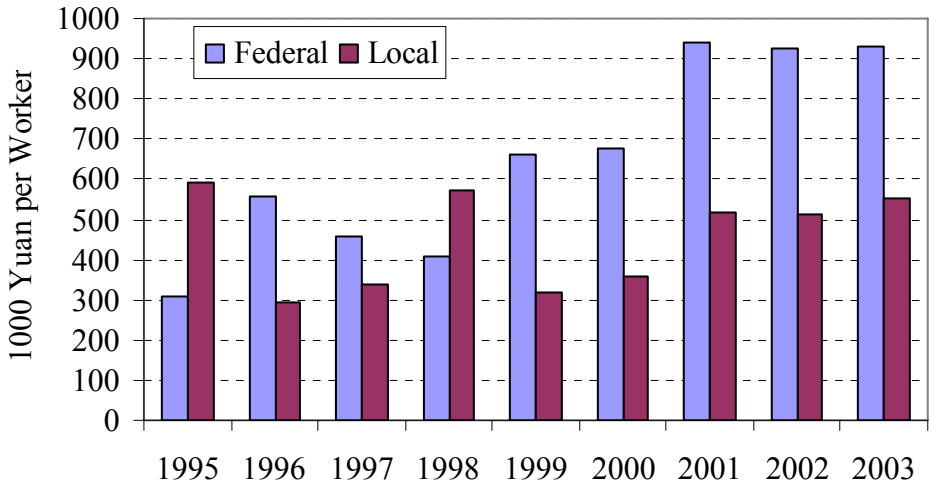


Figure 20: Number of China's Large and Medium Pure Foreign Enterprises by Jurisdiction, 1995-2003

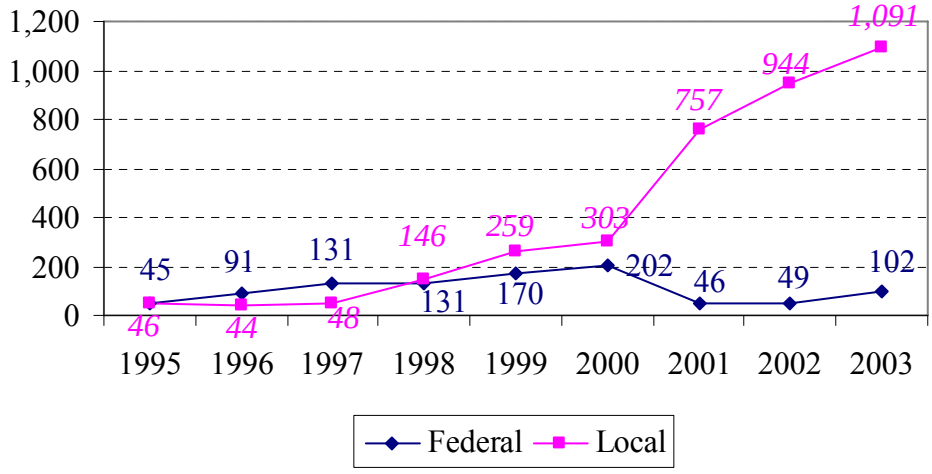


Figure 21: Employment Share and Labor Productivity
by Ownership Type, 1995-2003 Average

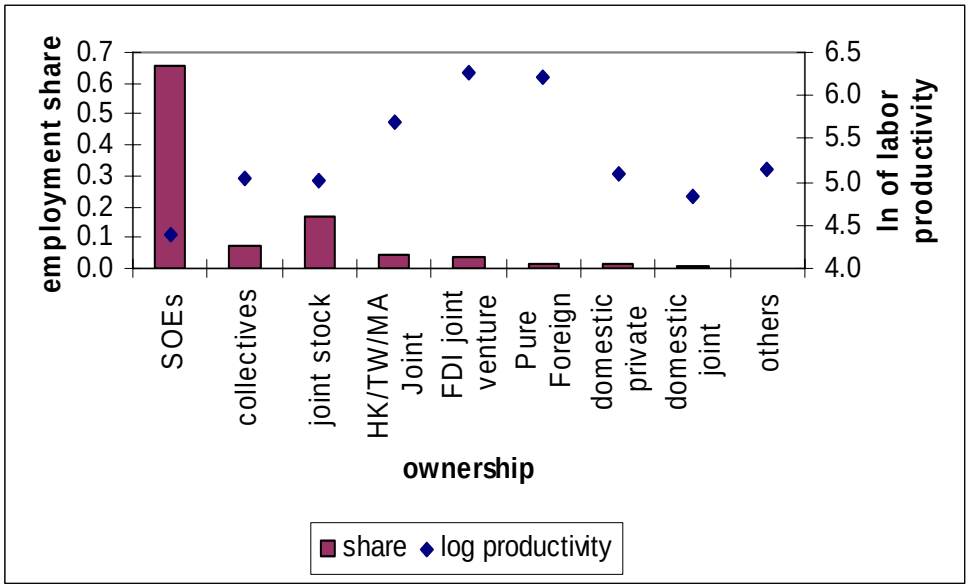


Figure 22**:** Employment Share and Labor Productivity for SOEs, 1995-2003

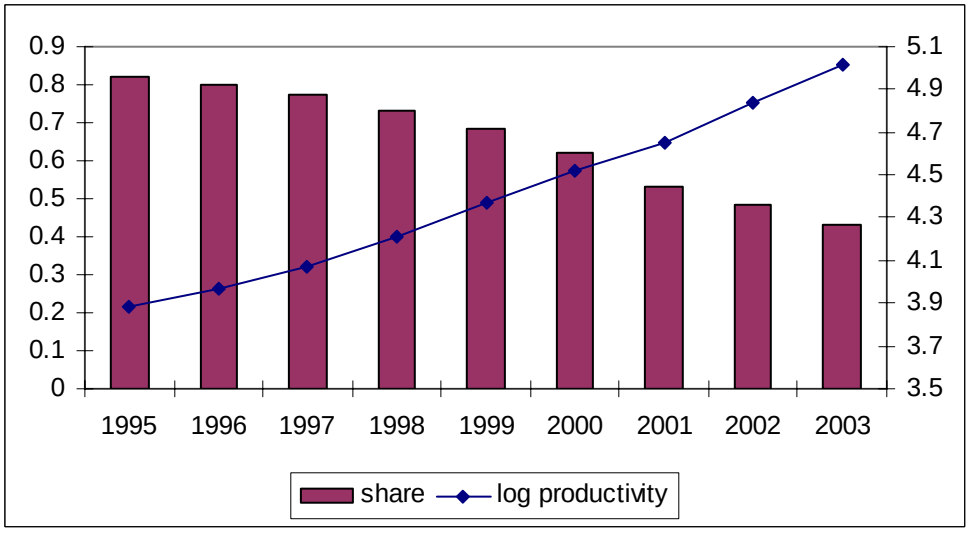


Figure 23**:** Employment Share and Labor Productivity for Joint Stocks, 1995-2003

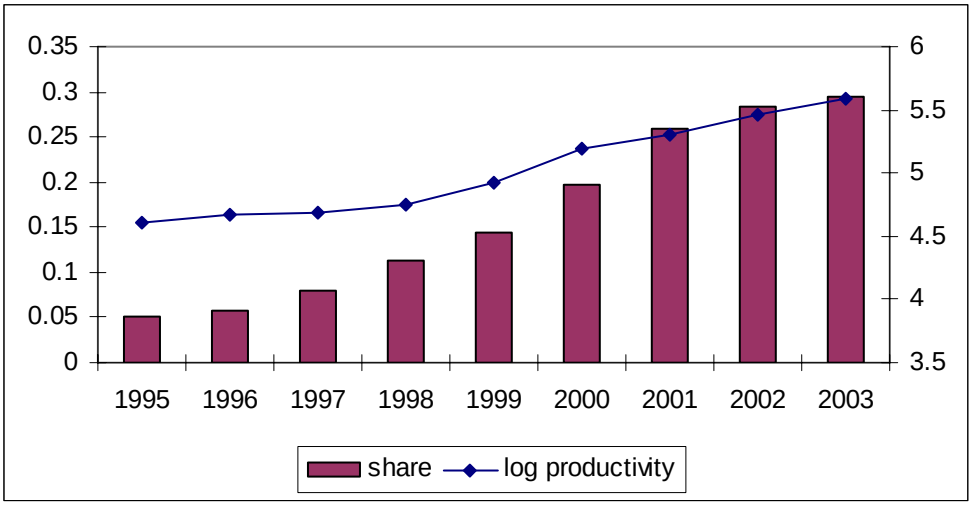


Figure 24: Employment Share and Labor Productivity for SOES (Computer Industry)

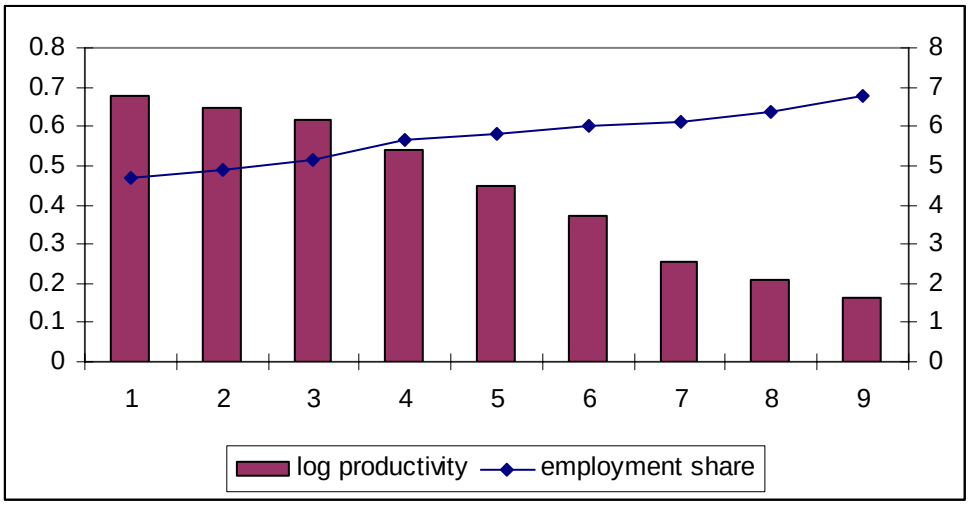


Figure 25: Employment Share and Labor Productivity for Joint Stocks (Computer Industry)

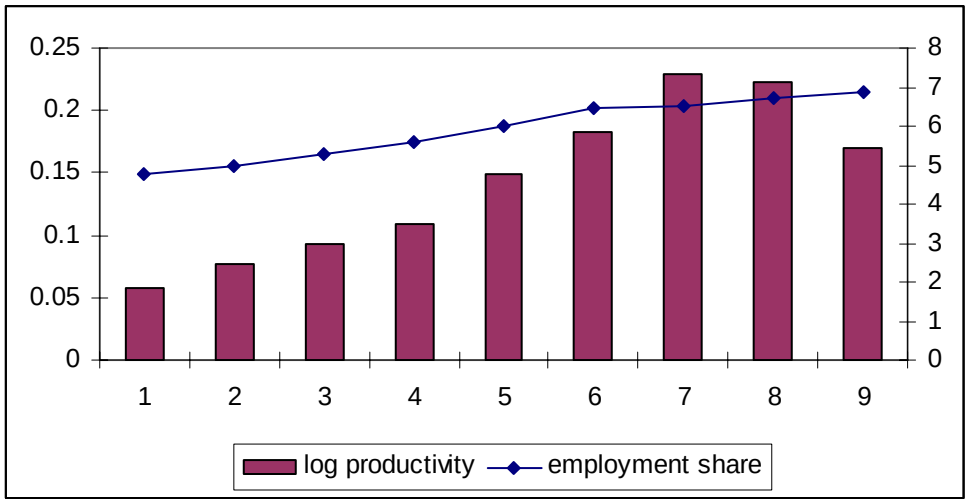


Figure 26: Employment Share and Labor Productivity for Federal Administered Firms

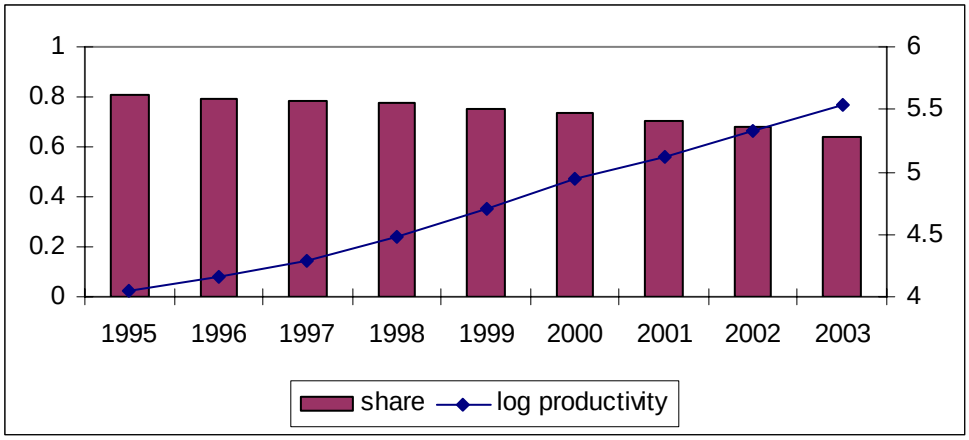


Figure 27: Employment Share and Labor Productivity for Local Administered Firms

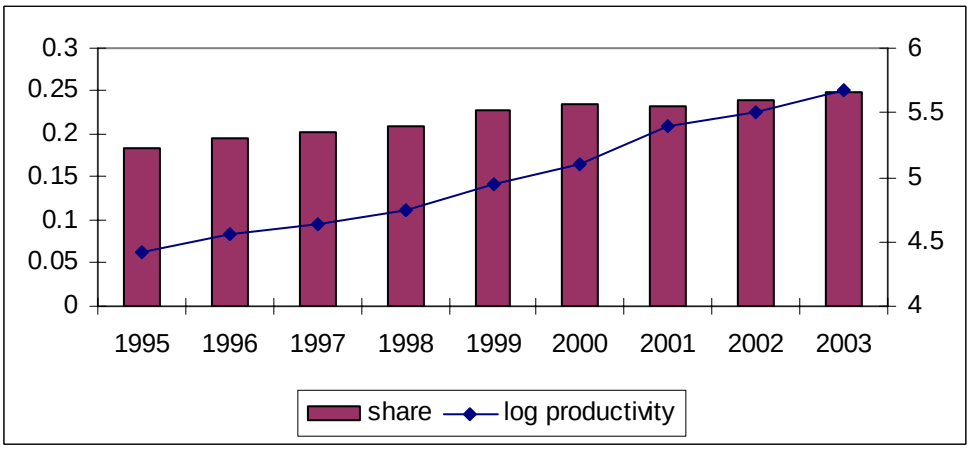
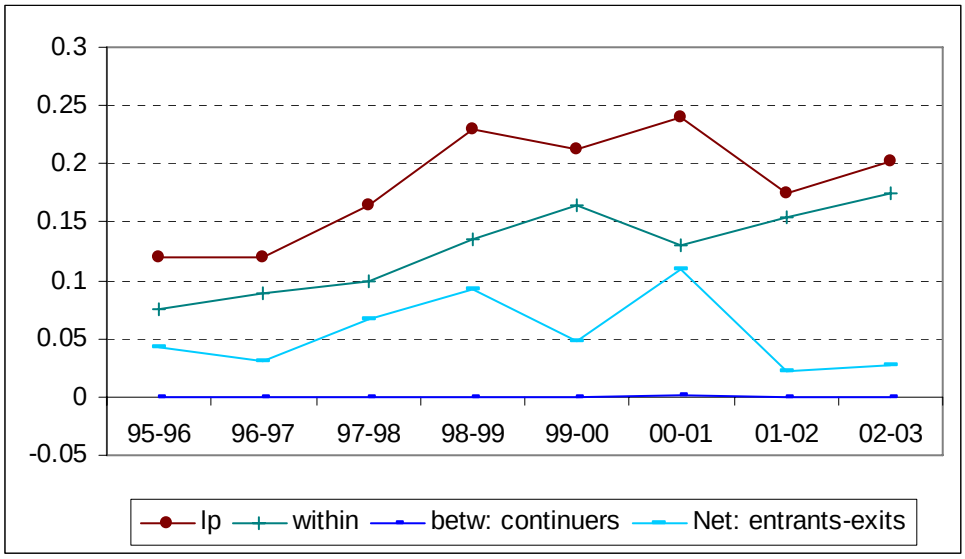


Figure 28**:** Labor Productivity Decomposition -- Total Economy

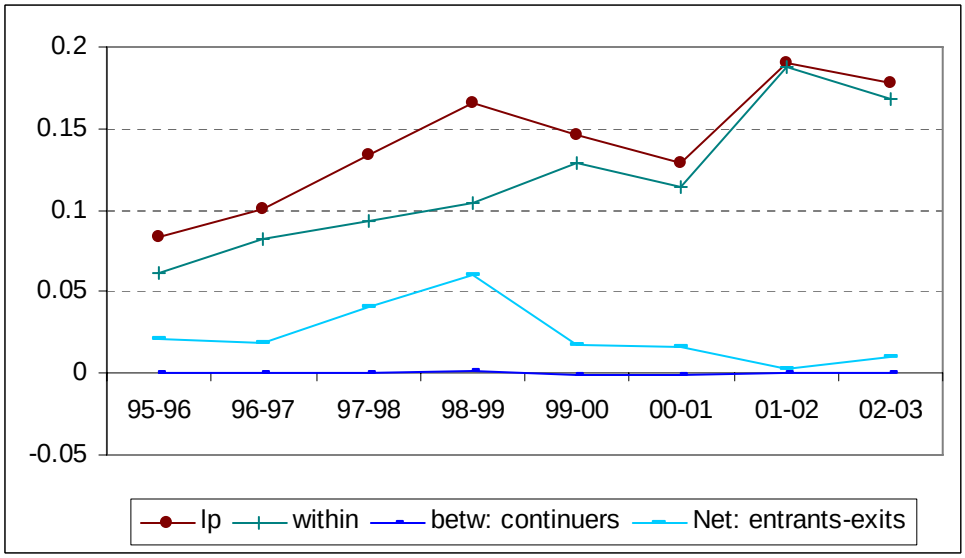


lp—log labor productivity growth, within—within effect,

betw: continuers—between effect of continuers,

net: entrants-exits—net effect of entrants minus exits.

Figure 29**:** Labor Productivity Decomposition -- SOEs

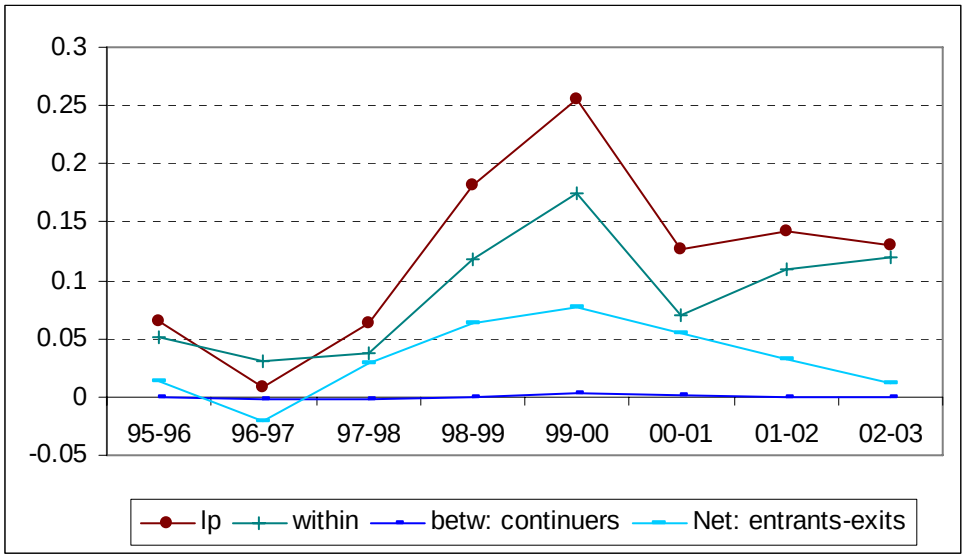


lp—log labor productivity growth, within—within effect,

betw: continuers—between effect of continuers,

net: entrants-exits—net effect of entrants minus exits.

Figure 30**:** Labor Productivity Decomposition – Joint Stock



lp—log labor productivity growth, within—within effect,

betw: continuers—between effect of continuers,

net: entrants-exits—net effect of entrants minus exits.

Figure 31: The Overall Contribution of Restructuring to Aggregate Productivity Growth -- Ownership

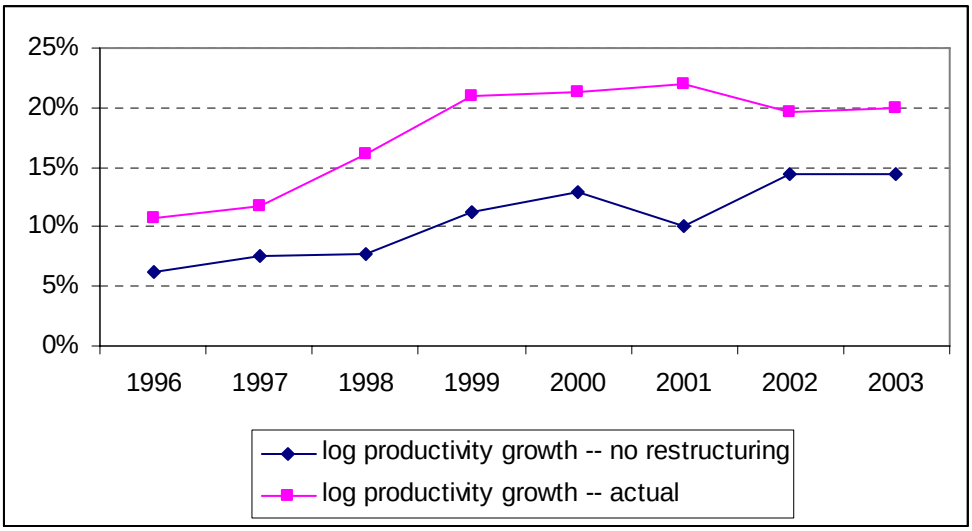


Table 1: China's Large and Medium Firms' Employment, Gross Output, & Productivity

Year	Sample Size	Employment (1000 persons)	Gross Output (1990 Price, 1b RMB)	Gross Output (Current Price, 1b RMB)	Productivity (1000 RMB/wk)	Productivity Growth Rate
1995	22,081	36,562	2,316	3,030	63	
1996	23,089	36,169	2,585	3,366	71	13%
1997	23,521	35,666	2,884	3,643	81	13%
1998	22,857	32,518	3,124	3,695	96	19%
1999	21,695	29,673	3,576	4,082	121	25%
2000	21,196	27,479	4,126	4,838	150	25%
2001	22,454	26,641	5,138	5,668	193	28%
2002	22,801	25,989	5,973	6,459	230	19%
2003	22,766	26,518	7,433	8,262	280	22%
Average	22,496	30,802	4,128	4,783	143	20.6%
Annual Growth (1995-1998)	1.2%	-3.8%	10.5%	6.8%	14.9%	
Annual Growth (1998-2003)	-0.1%	-4.0%	18.9%	17.5%	23.9%	
Annual Growth (1995-2003)	0.4%	-3.9%	15.7%	13.4%	20.4%	

Table 2: Gross Job Flows in China's Industrial Sector (Upper Bound), 1995-2003

(%)

Year	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
1996	18.0	19.0	37.0	-1.1	35.9
1997	13.7	15.1	28.9	-1.4	27.5
1998	18.0	27.3	45.3	-9.2	36.1
1999	15.0	24.2	39.2	-9.1	30.1
2000	12.8	20.5	33.3	-7.7	25.6
2001	19.7	22.8	42.6	-3.1	39.5
2002	13.5	15.9	29.4	-2.5	26.9
2003	18.5	16.5	35.0	2.0	33.0
Average	**16.2**	**20.2**	**36.3**	**-4.0**	**31.8**
std	**2.693**	**4.341**	**5.895**	**4.176**	**5.062**
Maximum	**19.7**	**27.3**	**45.3**	**2.0**	**39.5**
Minimum	**12.8**	**15.1**	**28.9**	**-9.2**	**25.6**

Table 3: Gross Job Flows in China's Industrial Sector (Lower Bound), 1995-2003

(%)

Year	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
1996	11.8	14.3	26.1	-2.5	23.6
1997	9.8	12.3	22.1	-2.6	19.5
1998	11.3	21.5	32.8	-10.1	22.7
1999	11.4	20.7	32.0	-9.3	22.7
2000	8.7	17.0	25.7	-8.4	17.4
2001	14.3	17.8	32.1	-3.6	28.6
2002	8.4	12.5	21.0	-4.1	16.9
2003	11.2	12.3	23.5	-1.1	22.4
Average	**10.9**	**16.1**	**26.9**	**-5.2**	**21.7**
std	**1.9**	**3.8**	**4.8**	**3.5**	**3.8**
Maximum	**14.3**	**21.5**	**32.8**	**-1.1**	**28.6**
Minimum	**8.4**	**12.3**	**21.0**	**-10.1**	**16.9**

Table 4: China's Industrial Job Flows by Ownership Type (Upper Bound), 1995-2003

(%)

Ownership	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
SOEs	11.1	20.9	32.1	-9.8	22.3
Collective	20.4	25.7	46.0	-5.3	39.1
Joint Stock	26.8	18.6	45.4	8.1	37.2
Domestic Private	53.4	18.1	71.5	35.3	36.2
HK/TW/MA Joint Ventures	29.0	16.5	45.4	12.5	32.9
FDI Joint Ventures	24.2	14.8	39.0	9.4	29.6
Pure Foreign	41.0	7.4	48.5	33.6	14.9

Table 5: China's Industrial Job Flows by Ownership Type (Lower Bound), 1995-2003

(%)

Ownership	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
SOEs	9.1	18.6	27.7	-9.5	18.2
Collective	11.6	15.2	26.8	-3.6	23.2
Joint Stock	23.4	16.1	39.5	7.2	32.3
Domestic Private	13.0	6.4	19.4	6.6	12.9
HK/TW/MA Joint Ventures	14.5	8.3	22.8	6.2	16.6
FDI Joint Ventures	13.5	8.2	21.7	5.4	16.4
Pure Foreign	25.6	4.3	30.0	21.3	8.7

Table 6: China's Industrial Job Flows by Jurisdiction (Upper Bound), 1995-2003

(%)

Jurisdiction	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
Federal	13.1	19.8	32.9	-6.7	26.3
Central	12.6	18.2	30.8	-5.5	25.3
Provincial and Prefectural	13.5	20.6	34.1	-7.1	27.0
Local	25.0	21.8	46.8	3.2	43.5

Table 7: China's Industrial Job Flows by Jurisdiction (Lower Bound), 1995-2003

(%)

Jurisdiction	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Job Reallocation
Federal	12.2	18.9	31.0	-6.7	24.3
Central	11.5	17.0	28.5	-5.5	22.9
Provincial and Prefectural	12.6	19.7	32.3	-7.1	25.2
Local	9.9	9.5	19.4	0.5	18.9

Table 8: China's Industrial Job Flows by Industry, 1995-2003 (%)

Industry	Upper Bound		Lower Bound		Job Creation / Job Destruction Rank
	Job Creation	Job Destruction	Job Creation	Job Destruction	
Water	8.5	7.7	6.0	6.5	8
Gas	15.5	17.0	11.6	14.6	14
Electric and Heat Power	22.2	19.1	15.5	14.7	7
Measuring Instruments	16.7	22.3	6.1	12.8	35
Communication Equipment	22.8	18.3	17.3	13.4	5
Electrical Machinery	18.8	21.1	15.6	20.5	17
Transport Equipment	14.3	17.9	10.4	15.0	21
Special Purpose Machinery	14.4	23.2	8.5	19.2	37
General Purpose Machinery	13.6	20.6	8.0	17.2	36
Metal Products	19.1	23.5	7.4	13.7	34
Smelting of Non-ferrous Metals	12.6	14.9	8.9	12.5	19
Smelting of Ferrous Metals	11.6	17.1	9.3	15.3	29
Non-metallic Mineral Products	17.6	23.5	9.4	16.5	32
Plastics	22.8	21.5	9.5	12.1	15
Rubber	14.2	20.8	9.3	16.3	31
Chemical Fibers	14.6	20.7	11.1	16.5	23
Medicines	21.1	20.7	13.9	15.6	9
Raw Chemicals	15.9	21.1	10.5	16.1	26
Processing Petroleum	17.7	22.1	14.6	20.6	18
Culture, Education, and Sports	28.0	16.7	15.9	9.6	2
Media	14.3	16.5	7.5	11.1	22
Paper Products	19.0	23.9	11.9	17.8	24
Furniture	37.8	27.7	22.5	18.2	6
Bamboo, Rattan, Palm. And Straw	23.8	23.6	13.4	15.1	10
Leather	26.7	19.2	17.6	11.1	3
Apparel, Footwear, Caps	25.3	19.7	12.7	9.0	4
Textile	17.2	26.1	11.8	21.5	33
Tobacco	10.5	15.4	7.3	10.6	20
Beverages	20.2	22.7	14.5	16.6	11
Food	24.0	24.5	14.4	17.0	13
Processing of Food	24.4	26.9	16.0	18.9	12
other Ores	10.6	14.9	10.6	2.8	1
Nonmetal Ores	14.1	20.6	10.6	17.9	30
Non-Ferrous Metal Ores	13.3	21.1	9.7	15.5	28
Ferrous Metal Ores	14.5	15.3	10.5	13.5	16
Petroleum and Gas	18.2	27.2	17.9	27.0	25
Coal	8.3	12.3	7.5	11.7	27
TOTAL	16.2	20.2	10.9	16.1	

Table 9: Productivity Decomposition for China's Large and Medium Industrial Firms, 1995-2003

	Simple Average 1000 Yuan per worker	Annual Growth Rates %
Industrial Total	153	20.4
Continuers (including reclassification)	149	22.5
Reclassified expanding continuers	165	14.6
Reclassified contracting continuers	146	13.8
Entrants	177	15.2
Exits	109	14.5

Table 10: Decomposing Labor Productivity Growth By Firm Type

decomposing by:		ownership type			jurisdiction			size			industry		
starting year	ending year	within effect	between effect	log productivity growth	within effect	between effect	log productivity growth	within effect	between effect	log productivity growth	within effect	between effect	log productivity growth
1995	1996	8.3%	2.4%	10.7%	11.7%	0.4%	12.1%	17.4%	0.1%	17.6%	11.1%	1.3%	12.4%
1996	1997	9.4%	2.4%	11.7%	12.1%	0.3%	12.4%	6.7%	0.2%	6.9%	9.9%	-0.1%	9.7%
1997	1998	12.7%	3.4%	16.1%	16.7%	0.6%	17.4%	18.3%	0.3%	18.6%	11.7%	1.3%	13.0%
1998	1999	17.1%	3.9%	21.0%	21.9%	0.8%	22.7%	17.8%	0.5%	18.3%	20.4%	0.5%	20.9%
1999	2000	16.0%	5.4%	21.3%	21.8%	0.8%	22.5%	19.7%	-0.1%	19.6%	19.7%	0.4%	20.1%
2000	2001	13.7%	8.3%	22.0%	20.8%	2.9%	23.7%	14.1%	-0.1%	14.0%	19.5%	2.3%	21.8%
2001	2002	15.0%	4.6%	19.6%	16.4%	1.7%	18.1%	15.5%	-0.7%	14.8%	16.2%	0.6%	16.9%
2002	2003	14.6%	5.5%	20.0%	18.9%	1.7%	20.7%	18.5%	-1.4%	17.1%	17.2%	1.3%	18.5%
average		13.3%	4.5%	17.8%	17.5%	1.2%	18.7%	16.0%	-0.2%	15.9%	15.7%	0.9%	16.7%

Table 11: Decomposing Labor Productivity Growth By Firm Type (Within Industry Variation)

decomposing by:		ownership type			jurisdiction		
starting year	ending year	within effect	between effect	log productivity growth	within effect	between effect	log productivity growth
1995	1996	7.9%	1.7%	9.6%	10.6%	0.2%	10.8%
1996	1997	9.6%	2.1%	11.7%	11.5%	0.5%	12.0%
1997	1998	13.0%	3.6%	16.6%	16.0%	0.5%	16.5%
	1999	17.4%	3.3%	20.7%	20.6%	0.9%	21.5%
1999	2000	15.5%	4.8%	20.2%	20.2%	-0.1%	20.1%
2000	2001	13.1%	7.3%	20.4%	20.4%	1.3%	21.7%
2001	2002	14.0%	3.8%	17.8%	15.2%	0.8%	16.0%
2002	2003	14.1%	3.1%	17.3%	17.1%	0.7%	17.8%
average		13.1%	3.7%	16.8%	16.4%	0.6%	17.1%