

Firm Size, Productivity, Wages and Capital Distribution in China's Industry

XINGMIN YIN¹

1. Introduction

Over the last thirteen years a considerable economic literature has been produced in English dealing with industrial efficiency in China.² However, previous works have not yet investigated the relationship between firm size³ and productivity in China's industry. As Jefferson, Rawski and Zheng explained: "We find positive scale effects in both state and collective industry, although our analysis cannot evaluate the efficiency consequences of the changing size distribution of industrial firms."⁴ This paper tries to fill this gap on the relationship between firm size and productivity.

Productivity is one of the main indicators of economic efficiency in market economy. Efficiency here refers to the industrial organisation of market performance and is defined in terms of what can be called "allocative efficiency" and "technical efficiency". Allocative efficiency

1 The author is indebted to Mr. David Wall for his comments on an earlier draft. Helpful discussion with Dr. Peter Nolan and Dr. Peter Holmes is also acknowledged. All errors and omissions are the author's.

2 The main works may be listed as follows: the World Bank (1985) on the long stagnation of productivity in China's state industry; Christine Wong (1986) on the failure of China's state industry in the first few years of economic reform; Tidrick and Chen (1987) on Chinese enterprises in the transition regime for the years 1978-82; Chen et al. (1988) on the growth of multifactor productivity (capital and labour) in state industry; Jefferson (1989) on the increasing returns to scale in both state and collective industry; Dollar (1990) on the rapid growth of total factor productivity of 20 state-owned enterprises surveyed by the World Bank; Jefferson and Xu (1991) on the economic behaviour and factor efficiency of 20 enterprises in Wuhan City; Jefferson, Rawski and Zheng (1992) on the growth of multifactor productivity in both state and collective industry during the reform period 1978-88; and Woo et al. (1993) on productivity in state-owned enterprises and in township and village enterprises. This list of representative works indicates that productivity is of major concern in the growing literature on China's industry.

3 The words "enterprise" and "firm" as used in this paper have the same meaning in the Chinese context.

4 Gary Jefferson, Thomas G. Rawski, and Yuxin Zheng (1992), p. 257.

and firm size have been examined in previous works. Technical efficiency will, therefore, be focused on in this paper.⁵ With respect to efficiency so defined, the following specific questions are considered: (1) What effects has the size of firms in individual industries on technical efficiency? (2) Has the size distribution of Chinese industry affected the allocation of resources among industrial enterprises over the last decade?

2. Firm Size and Labour Productivity

An important aspect of the performance of any industry is its relative technical efficiency in producing goods. The potential gains from improvements in allocative efficiency are widely thought to be small relative to those attainable by improvements in technical efficiency – that is, by lowering the costs of the bundle of resources required to produce a given output. Therefore, a major concern in relation to the efficiency of an industry is whether resources are being used so that costs are minimised. While the identification of minimum costs is difficult, an alternative approach is to measure productivity. Productivity measures the relationship between output and one or more inputs, particularly labour and capital.

Productivity growth is an important indicator of changes in economic efficiency, and a guide to technical change. Productivity growth can be calculated as either single or total factor productivity, where the former refers to output or value added per unit of a single input, normally labour, and the latter relates output or value-added to a composite index of factor inputs, normally both labour and capital. The inclusion of capital or other resources in the construction of a total productivity measure is in principle the appropriate means to take account of non-labour factor inputs. However, the problems involved in doing so are considerable.⁶ Chinese industrial investment data includes several types of expenditure that are not encompassed by the standard national accounting concept of fixed industrial investment. Urban enterprises in China's state sector, in particular large enterprises, provide a broad array of social services for their labour force, of which housing is the most costly. Chinese industrial investment and capital stock data include the cost of housing constructed by industrial enterprises. So, if the share of housing in total investment spending in-

5 David Dollar analysed the total factor productivity and allocative efficiency of 20 industrial firms between 1978 and 1982. See David Dollar (1990), pp. 89-108. The relationship between firm size and allocative efficiency in China's industry has been examined in Xingmin Yin (Macmillan, 1994).

6 See M.I. Nadiri (1972), pp. 129-154. I.B. Kravis (1976), p. 10.

creases, as has occurred in recent years, currently available statistics cannot provide an accurate guide to trends in the availability of capital stock used for industrial production. Given the problems involved in the value of capital, the majority of empirical estimates focus on labour productivity alone. Industrial labour productivity represents the ability of a worker to make industrial products within a given period of time.

As we are concerned with the relationship between productivity and firm size, we will examine the differences in labour productivity by firm size. It is an important question whether a positive correlation between enterprise size and productivity exists or not.

Due to the data⁷ available the scope of enterprises will be limited to industrial independent accounting enterprises above township level. These enterprises contributed some 80% of China's overall industrial output in 1988, and 78.2% in 1990.⁸

We examined all Chinese manufacturing industries, except forage processing and non-classified manufacturing due to their small scale. The enterprises are classified according to employment. The data for 1988 give a strong indication of productivity increasing with the size of enterprise in each of the 29 manufacturing industries investigated.⁹ The crucial aspect of Chinese industry lies in the big differentials in labour productivity between large and small-scale enterprises.

In Table 1,¹⁰ the salient feature of productivity differentials emerges in different enterprise sizes: In group A, firm size corresponds to technology intensive industries. This group exerts a decisive influence upon the productivity of China's industry in general because its industries, such as petroleum processing, pharmaceutical goods, tobacco, machinery, and transport equipment are so dependent on capital and technology. Labour productivity in large enterprises is much higher than in small ones, with the exception of two industries: apparel and paper making.

Group B comprises industries with moderate concentration, including textiles, metal products, printing, and food processing, where labour pro-

7 Two important sources are: The *Statistical Yearbook of China's Industrial Economy* (hereafter SYCIE), and *Census Data on Industry of the People's Republic of China* (hereafter CDI). These data do not include industrial enterprises below the township level, such as village enterprises.

8 *Statistical Yearbook of China* (hereafter SYC), p. 414, SYCIE, 1991, p. 133.

9 The author chose 1988 data due to data being unavailable on firm size for 1985.

10 The explanations of the columns in Table 1 are as follows: Column 1 denotes 29 manufacturing sectors based on the two-digit level of Chinese standard industrial classification (SIC); Column 2 covers firms with more than 5,000 workers; Column 3 takes productivity in firms with 1,000-5,000 workers as the base; Column 4 denotes firms with 500-1,000 workers; Column 5 refers to firms with less than 100 workers.

Table 1: Firm Size and Labour Productivity in 29 Manufacturing Industries by Employment, 1988

SIC	Industry	<5,000	1,000-5,000	500-1,000	>500
Group A: 14 industries					
20	Tobacco	129	100	60	25
24	Apparel	169	100	97	67
28	Paper making	101	100	96	73
33	Power generation	101	100	96	73
34	Petroleum processing	110	100	35	28
35	Coke & coal goods	123	100	73	85
36	Chemical industry	136	100	82	83
38	Pharmaceutical goods	119	100	107	81
40	Chemical fibre	174	100	158	109
41	Rubber	198	100	60	42
45	Building materials	101	100	85	63
53	Machinery	103	100	90	78
56	Transportation equipment	115	100	85	68
63	Instruments and meters	135	100	127	100
Group B: 8 industries					
22	Textiles	96	100	89	88
29	Printing		100	83	52
48	Ferrous metal smelting	99	100	78	78
49	Non-ferrous metal smelting	60	100	76	88
51	Metal products	40	100	90	76
58	Electric equipment	88	100	90	54
61	Electronics	76	100	61	47
17	Food processing	76	100	100	97
Group C: 7 industries					
19	Beverages	5	100	105	78
25	Leather and fur goods	10	100	116	90
26	Timber processing	34	100	140	127
27	Furniture	8	100	121	98
30	Cultural goods	7	100	105	72
31	Arts and craft	15	100	153	109
43	Plastics		100	109	81

ductivity of enterprises with 1,000 workers is higher than both larger and smaller enterprises. It should be pointed out that some industries, including the processing of ferrous and non-ferrous metals, the electric and electronic industries, usually belong to the highly concentrated industries, yet these industries appear to have a low concentration ratio in China. For instance, the 4 firm-concentration ratio in the ferrous metal smelting industry was only 22%, and the 4 firm-concentration ratio¹¹ in the nonferrous metal smelting industry only 13% in the 1985-1990 period.

A case study also revealed that large firms in the iron and steel industry have a much higher labour productivity than their small counterparts.¹²

Groups A and B have, in most cases, been leading industries in the last decade. Their labour productivity is relatively high because of their technological structure (mainly due to being economies of scale).

Group C comprises industries of low concentration. Labour productivity appears generally higher than in those industries where economies of scale are either absent or not significant, such as furniture, arts and crafts, leather and fur products, cultural and educational products, and timber processing. The highest productivity is to be found in firms with 500-1,000 employees.

The importance of firm size has increased over time, while economies of scale have remained prominent. If the increasing return to scale effect is so dominant as this study suggests, then average labour productivity will further increase with any increase in levels of input usage. Thus some of the observed average productivity increase can be attributed to the increasing returns to scale inherent in the industrial production process.

The findings from these 29 industries in 1988 are representative of the tendencies toward scale efficiency in China's manufacturing industries in general. They lend support to the view that productivity increases with size in most industries¹³.

3. Firm Size, Productivity, Capital Intensity and Wages

In order to explain labour productivity further, let us concentrate on two factors: (a) differentials in productivity and in capital composition, and (b) differentials in productivity and wages by firm size.

¹¹ The 4 firm-concentration ratio measures the extent to which the four largest enterprises account for an industry's total output.

¹² Ji Xiaoming and Dong Ying (1991), pp. 54-60.

¹³ Some studies of American manufacturing support this view. See J. Johnston (1954), p. 351.

Firm classification and other definitions are as follows:

1. Group is classified into seven categories by number of employees in industrial independent accounting enterprises above township level.
2. LAP is labour productivity: G/L is gross output per person; and N/L is net output per person.
3. CAI is capital intensity (capital-labour ratio), where capital includes net fixed assets and circulating funds; K/L is yuan per person.
4. CAP is capital productivity; G/K is gross output as a percentage of capital; and N/K is value added as a percentage of capital.
5. Wage is yuan per person/year.

Table 2: Productivity, Capital Intensity and Wages by Firm Size, 1985

Group	LAP		CAI	CAP (%)		Wage
	G/L	N/L	K/L	G/K	N/K	Y/Y
<10,000	17,392	7,501	25,775	68	29	1407
5,000-10,000	18,348	6,417	16,605	111	39	1271
3,000-5,000	17,969	5,851	16,458	109	36	1218
1,000-3,000	16,979	5,379	12,238	119	38	1163
500-1,000	13,700	3,979	11,349	121	35	1085
100-500	10,242	2,962	8,353	123	36	964
>100	7,516	2,090	6,583	114	32	799
Average	13,196	4,281	12,509	106	34	1076

Notes: All figures are at current prices. The sources of this table were from CDI, Vol. 3. They included all sizes of independent accounting enterprises above township level. No attempt was made to adjust the published data in this Table.

Source: CDI, Vol. 3, pp. 1044-1051.

In enterprises with fewer than 100 persons labour productivity is 2,090 yuan and capital intensity 6,583 yuan. In enterprises with 3,000 and more persons labour productivity is between 5,851 and 7,501 yuan, and capital intensity is 2.5 to 3.9 times higher, causing a 2.8 to 3.6 fold difference in the productivity factor, compared with that of the small ones. In 1985

gross capital productivity (G/K) is higher in four groups with less than 3,000 workers than in the three groups with more than 3,000, while N/K is higher in firms with more than 1,000 workers than in firms with less than 1,000 workers. The G/K estimate is consistent with Jefferson et al. but the N/K is in conflict with theirs, although their investigation was based on the state and collective industry.¹⁴

Therefore, the realisation of high productivity in large enterprises is assumed to be due to a greater increase in capital-output ratio with the enlargement of size, except for firms with more than 10,000 workers.

We thus find a significant positive relationship between total factor productivity growth and firm size, but not in gross capital productivity (G/K). When the capital intensities are correlated with value added productivity (N/L) and gross value productivity (G/L) a clear linear correlation appears.

There are wage differentials in China's industry. In 1985 annual wages were 799 yuan per person in the smallest class and 1407 yuan in the largest, i.e. a difference of 57 percent. When average annual wages are correlated with capital intensity, we find that the same linear correlation appears. Thus, considerable differentials in productivity are a cause of wage differentials, and differentials in capital intensity are a cause of differentials in productivity.

Probably the large enterprises adopted high capital-intensive production methods, which in turn made high productivity and high-wage capacity possible. On the other hand, small enterprises are forced to adopt labour-intensive methods with a low technical level (or low capital intensity). This disadvantage is compensated by low wages, due to the pressure of an excess labour supply and potential unemployment, especially for township enterprises.

It seems that the relationship between firm size and productivity is a long-run relationship, for in the short run, firms in competitive industries may have a high productivity. This means that we should look at the empirical evidence over a longer period, considering above all capital intensity, capital productivity, and wages. If we examine the productivity (labour and capital) of firms over, say, a ten-year period, allowance will have to be made for differences in the rates of growth of the firms.

¹⁴ Gary H. Jefferson, Rawski, H. Thomas, and Yuxin Zheng (1992), pp. 245-47.

4. Changes of Productivity, Wages and Capital

The changes of these variables are important when examining the casual relationship between productivity and other factors. We will discuss them separately.

A. *Firm size and productivity*

In China, industrial labour productivity has improved since 1978. Between 1978 and 1988, the annual average increase was 2.4% in state industry and 4.6% in collective industry.¹⁵ In 1988 the product per worker per day in industry was one and a half that of 1978 (if calculated in terms of 1980 constant prices). The growth of industrial productivity has promoted industrial development and laid a foundation for the modernisation of China.¹⁶

Still, it is worth noting the productivity change by enterprise size. A partial indicator of differential returns among enterprises is the pattern of relative labour productivity, obtained by dividing a group's share in the gross value of industrial output and in employment. It is partial because it refers to the average and considers only one input (labour). It is, therefore, rather an experimental approach to the study of the overall trends in productivity change.

Table 3: Productivity by Enterprise Size, in Percent

Group	1980	1985	1990
<10,000	100	100	100
5,000-10,000	111	105	102
3,000-5,000	98	103	121
1,000-3,000	99	101	105
500-1,000	79	82	88
100-500	56	63	71
>100	41	44	61

Note: Group is classified by employment.

Sources: CDI, Vol. 3, pp. 1034-35 and 1076-77. SYCIE, 1991, pp. 361-68.

¹⁵ Gary H. Jefferson, Thomas H. Rawski, and Yuxin Zheng (1992), p. 240.

¹⁶ Zheng Zonghan (1991), pp. 18-19.

When looking at the productivity differentials given in Table 3, the problems of firm size in this period are underlined. In 1980, labour productivity per worker in the small-scale enterprises with less than 100 workers was only 41.1% of the largest enterprises, whereas in 1990 it was 60.6%. Productivity advanced more slowly in the large enterprises (particularly in enterprises with more than 5,000 workers). It is necessary to emphasise that there have been great variations within these categories but the large gap in productivity still exists. To explain this situation, we have to pay special attention to the structure of the working force.

Chinese enterprises have multifunctional tasks, their labour structure also reflects these characteristics. According to available statistical data, Chinese industrial enterprises, especially large and state-run enterprises, have a complicated structure. Service personnel include food service workers, elementary and secondary teachers, health workers, and many other employees not directly related to the production process.¹⁷ The 1985 census data show, for instance, that 70,342 state firms reported 15% of their workers in the "service" and "other" categories, which appear to consist mainly of personnel with non-industrial duties, while a small group of large collective firms classified only 11.4% of their workers as belonging to these two categories.¹⁸

Furthermore, the enterprises' responsibility for the welfare of their workers leads them to establish "collective" subsidiaries. These are permitted as a means of creating employment for spouses and children, who have no relation to the enterprise's main production activity. Consequently, "overstaffing in state enterprises brings down their labour productivity".¹⁹ Welfare facilities only account for a small proportion of output in township enterprises.²⁰

The labour market has significantly affected labour distribution in China. It has often been recognised that there are two broad divisions in the labour market: the market for urban enterprises and the market for small rural enterprises.

Traditionally, labour was allocated to firms by the Labour Bureau. Socially inspired allocations led to the absorption of surplus labour, burdening firms with overstaffing, high labour costs and low productivity. Compared with the state enterprises the small township enterprises have more flexibility to adjust their labour force. The belief that the Chinese worker is the subject of paternalistic care, that he is typically a life-long employee

¹⁷ *SYC* (1987), p. 229.

¹⁸ *CDI*, vol. 1, 1987, pp. 254-255.

¹⁹ Dai Yuanchen and Li Hanming (1992), p. 144.

²⁰ Zhou Qiren and Hu Zhuangjun (1989), pp. 108-144.

of the same firm, and that he benefits from a company-created miniature welfare-state, is to a large extent true of those workers in large and state-run enterprises who are classified as permanent employees. This proportion, however, varies with the ownership status and size. The larger the enterprises, the higher the number of permanent workers in these enterprises will be. In 1984, permanent labour comprised some 96.5 per cent of the staff in China's state-run industry²¹.

Employment conditions in the small township enterprises are quite different from those in the state-owned enterprises. As shown in other studies, township industrial enterprises do not provide peasants with permanent jobs when operational trouble is approaching.²²

It might be predicted that a large increase in labour productivity in the large enterprises would occur if permanent labour could be reduced.

B. Firm size and wages

A great deal of research has been done on small enterprises in China.²³ My concern here is with small enterprise as a market phenomenon, its relation to market structure, and the extent to which it presents a problem of market performance.

As mentioned earlier, small enterprises are sustained by the low cost of the labour they employ, wages being much lower than those in the largest enterprises. If there is a discrepancy between the large and the small industry sectors, changes in relative wages should be negatively correlated with changes in labour forces. Our finding is that there was a significant correlation for the years 1980-1985: relatively low wages helped small enterprises to hold their share in the industry's output.

Wage discrepancies between large and small enterprises were calculated for a two-year period. It can be seen from Table 4 that, taking wages in enterprises of more than 10,000 workers as the base, wages in the smallest enterprises (less than 100 workers) increased more slowly than wages in the larger ones. Thus, the wage record in the smallest enterprises was a widening differential from 60% to 56%, which represents a downward shift of small-scale enterprises, almost the same as with other groups.

²¹ Luo Shouchu (1987), p. 119.

²² Zhou Qiren and Hu Zhuangjun (1989), p. 131.

²³ See William A. Byrd and Lin Qingsong, 1990.

Table 4: Wage Changes of Enterprises by Employment, 1980 and 1985

Groups	Wage Y/P		Proportion		PC	WGR 1980-80
	1980	1985	1980	1985		
<10,000	990	1407	100	100		42.1
5,000-10,000	923	1271	92	89	-3	37.7
3,000-5,000	883	1218	88	85	-3	37.9
1,000-3,000	834	1163	83	82	-1	39.5
500-1,000	776	1085	77	76	-1	39.8
100-500	687	964	70	69	-1	40.3
>100	598	799	60	56	-4	33.6
Average	779	1076				38.1

Notes: PC, percentage change; WGR, wage growth rate.

Source: CDI, Vol. 3, pp. 1045 and 1077.

Table 4 shows the wage proportion among enterprises by size. This changed in the years 1980-85. Labour costs, on average, increased 38.1%; the growth rate in the largest enterprises increased by 42.1%. The smallest enterprises enjoyed a remarkable labour cost advantage, increasing by 33.6%.²⁴

In rural areas, wages in township and village enterprises (hereafter TVEs) have generally been below the levels in urban areas. Between 1986 and 1988, the average wage bill per worker in TVEs increased by 36.6 percent, compared to 30.1 percent for state industrial firms.²⁵ Other evidence shows that the township enterprises (most of these are small ones) reduce the wage level of their workers and staff in the event of depression in order to tide over these periods. In the first half of 1986 the per capita monthly income of workers (in 200 sample enterprises) decreased by 1%, that of directors by 19.6%, of salesmen by 13% and technicians by 6.8%.²⁶ It is difficult for state-owned enterprises to reduce wages in the way township enterprises do. Workers in township industrial enterprises mostly accept this situation because only few opportunities of employment are available to them in rural areas.

²⁴ As for the labour cost of small enterprises, other studies confirmed our estimate. See Ody, Anthony J. (1992), pp. 17-18.

²⁵ Ody, Anthony J. (1992), pp. 13-14.

²⁶ Zhou Qiren and Hu Zhuangjun (1989), pp. 130-131.

Distortions in the factor market go beyond the above considerations. Also important is the question of how effectively small enterprises are adapting to shifts in cost conditions. There are always gaps between best and worst practice, but the correlation with scale seems to be surprisingly high in China. The enhancement of productivity differentials was regarded as important in order to improve performance in small enterprises. On the other hand, rising labour costs may induce an increase in investment, in order to substitute capital for labour, instead of widening the wage gaps.

C. Capital concentration

One issue has remained untouched in the above analysis. The rapid growth of small industrial enterprises has had a great influence on the distribution of national capital. Narrowing the gap in labour productivity means narrowing the gap between the levels of industrial development of large and small enterprises. Narrowing the productivity gap may merely reflect increasing capital intensity, which may or may not be rational response to changing factor prices. Since capital concentration is a phenomenon common to all industrialising economies, what has been the pattern of capital concentration in China over the last decade?

Levels and changes in labour productivity reflect both these adjustments. The data on productivity differentials suggest that a problem remains for small enterprises. The ratio of value added per person in large industrial enterprise to that of all industrial enterprises was 1.91 in 1980, and still 1.77 in 1990.²⁷ This productivity differential reflects some combination of lower capital-intensity and lower wages in small enterprises. From 1980 to 1990 the productivity gap between the smallest enterprises and the largest was narrowed, from 41 per cent to 60 per cent.

Capital concentration in China presents two peculiarities: the low capital concentration in large enterprises in a capital-short economy; and the downward movement of capital concentration in the last decade. The changes in capital concentration correspond with the decreasing concentration in China's industry over the same decade.²⁸

First, the capital concentration ratio in large enterprises was obviously low. Firms with more than 3,000 persons accounted for only 43.6 per cent of overall capital in 1980 and 37.1 per cent in 1990, while firms with less than 1,000 persons accounted for 37.5 per cent in 1980 and 40.7 per cent in 1990, an increase of 3.2 percentage points.

²⁷ SYCIE (1991), pp. 160-162.

²⁸ Xingmin Yin (1993), pp. 4-10.

Table 5: Distribution of Capital by Size of Firms, 1980-1990

Group	Capital distribution			Share change
	1980	1985	1990	
<10,000	27.6	25.2	22.3	-5.3
5,000-10,000	9.2	7.5	7.7	-1.5
3,000-5,000	6.8	6.3	7.1	+0.3
1,000-3,000	18.9	18.7	22.2	+3.3
500-1,000	12.5	13.2	13.5	+1.0
100-500	19.8	22.2	20.4	+0.6
>100	5.2	6.9	6.8	+1.6
Total	100.0	100.0	100.0	

Notes: 1980 and 1985 figures are whole capital in current prices. 1990 figures are based on original fixed assets in current prices due to unavailable data.

Sources: *CDI*, Vol. 3, pp. 1020 and 1115. *SYCIE*, 1991, pp. 361-93.

Second, capital concentration has fallen. (1) The capital share of large enterprises with 10,000 persons declined from 27.6 per cent in 1980 to 25.2 per cent in 1985, and further to 22.3 per cent in 1990. Its share loss was 5.3 percentage points in the ten years.²⁹ (2) Numerous small enterprises with less than 100 persons increased their capital share from 5.2 per cent in 1980 to 6.8 per cent in 1990.

Usually, in an economy short of capital, the greater the concentration of capital, the wider the differentials in capital intensity, and *vice versa*. The analysis above shows that smaller enterprises have increased their capital share in the 1980-1990 period. It seems that the growing capital intensity of small firms reduced the productivity gap between large and small firms. Therefore the capital growth and labour-cost advantage of small enterprises in the 1980s were not only sufficient to prevent losses in their share of economic activity, but also to increase their market power. The evidence shows that the great differences in labour productivity between the largest and the smallest firms in the years 1980-1990 were narrowed by increasing capital intensity; the largest firms decreased by 5.3 percentage points of industrial capital distribution, while the smallest firms increased by 1.6 percentage points. The gap between the two categories of firms narrowed by 19.2 percentage points as regards labour productivity.

²⁹ *CDI*, Vol. 3, p. 1076; *SYCIE* (1991), p. 361.

The small enterprises in China's industry have improved their economic efficiency and productivity, but the gap between large enterprises and small ones remains quite considerable. If small enterprises continue to expand their share of capital, technical efficiency at the national level will be reduced. Obviously, a great proportion of China's enterprises are small and these small enterprises absorb a relatively high proportion of industrial labour and capital. Workers in small enterprises contribute a much smaller amount to the gross national product, and also earn much lower wages. While the upgrading of plant and equipment is an important way of increasing overall productivity in the economy, there are problems associated with this. Many small plants increased their capital while continuous mass production techniques were not implemented on a larger scale.

5. Conclusions

In the preceding sections we have examined the relationship between technical efficiency and firm size in Chinese industry over the period 1980-1990. We can now summarise our answer to the questions posed at the beginning of the paper.

From our present state of knowledge we cannot fully explain the evolution of firm size and labour productivity over the past decade, or accurately predict its future course. Identification of the various forces at work, however, provides us with a better understanding of the complex phenomena of structural change observed in the past, and a better basis for appraising alternative possibilities of future development. Moreover, this analysis of the relevant forces enables us to draw the following three conclusions:

1. Productivity and firm size are positively related. The large firms' productivity increased with size, although only up to a certain point. We discovered the following relationship between firm size and technical efficiency: higher productivity emerges when firms are large, and it also does so when firms are both large and capital-intensive.
2. Small enterprises increased their productivity more rapidly than large enterprises, but the productivity gap between large and small firms still remains big.
3. Increased capital intensity of small enterprises is an important factor for their competitiveness and productivity growth (and these small enterprises have helped to stimulate market competition), but the capital growth of small enterprises has also resulted in a proliferation

of low-productivity small-scale plants, as many small enterprises were established in the last decade.

Broadly speaking, the findings of this paper tend to support the hypothesis of a positive relationship between firm size and productivity. The results presented are, however, tentative, because other factors such as firm entry, product differentials, or subsidised input in state-run industry have not been examined due to unavailable data and controversial measures of capital deflation,³⁰ which must stand as a challenge to future research.

Literature

- Byrd, W.A. and Lin Qingsong (1990), *China's Rural Industry: Structure, Development, and Reform*, Oxford: Oxford University Press.
- Chen, Kuan / Jefferson, Gary H. / Rawski, Thomas G. / Wang Hongchang / Zheng Yuxin, "New Estimates of Fixed Investment and Capital Stock for Chinese State Industry", *China Quarterly*, 114 (1988), 243-66.
- Dai Yuanchen and Li Hanning (1992), "Labour Mobility and Wages Distribution under the Dual Track Infrastructure", *Social Sciences in China*, No. 3, pp. 141-152.
- Dollar, David, "Economic Reform and Allocative Efficiency in China's State-owned Industry", *Economic Development and Cultural Change*, 39, No. 1 (October 1990), pp. 89-108.
- Field, Robert M., "China's Industrial Performance since 1978", *China Quarterly*, 131 (September 1992), pp. 577-607.
- Jefferson, Gary H., "Potential Sources of Productivity Growth within Chinese Industry", *World Development*, 17, No. 1 (1989), pp. 45-57.
- Jefferson Gary H., "China's Iron and Steel Industry: Sources of Enterprise Efficiency and the Impact of Reform", *Journal of Development Economics*, 33 (1990), pp. 329-55.
- Jefferson, Gary H. and Xu Wenyi, "The Impact of Reform on Socialist Enterprises in Transition: Structure, Conduct, and Performance in Chinese Industry", *Journal of Comparative Economics*, 15, No. 1 (March 1991), pp. 45-64.
- Jefferson Gary H. / Rawski, Thomas G. and Zheng Yuxin, "Growth, Efficiency, and Convergence in China's State and Collective Industry", *Economic Development and Cultural Change*, 40, No. 2 (January 1992), pp. 239-268.
- Johnston, J. (1954), "Labour Productivity and the Size of Establishment", *Bulletin of Oxford University Institute of Statistics*, November-December.

³⁰ See Wing Tyhe Woo et al., 1993.

- Ji Xiaoming and Dong Ying, "On the Industrial Organisation and Industrial Policies under Dual-Track System", *China's Industrial Economics Research*, 34 (1991), pp. 54-60.
- Kravis, I.B. (1976), "A Survey of International Comparisons of Productivity", *Economic Journal*, 86, pp. 1-44.
- Luo Shouchu, "Labour Productivity and Reform of the Labour System", *Social Sciences in China*, Vol. 8, No. 3 (1987), pp. 119-132.
- Nadiri, M.L. (1972), "International Studies of Factor Inputs and Total Factor Productivity: A Brief Survey", *Review of Income and Wealth*, Vol. 18, pp. 129-154.
- Ody, Anthony J., "Rural Enterprise Development in China 1986-1990", *World Bank Discussion Papers*, 162, World Bank, 1992, pp. 17-18.
- State Statistical Bureau of China (SSB), *Census Data on Industry of PRC in 1985* (CDI), Vol. 3, All Industrial Independent Accounting Enterprises, State Statistical Press, 1988, Beijing.
- SSB, *Statistical Yearbook of China*, 1980-1993, various issues.
- SSB, *Statistical Yearbook of China's Industrial Economy* (SYCIE), State Statistical Press, 1991, Beijing.
- Tidrick, Gene, "Productivity Growth and Technological Change in Chinese Industry", *World Bank Staff Working Paper* 761, Washington, D.C., 1986.
- Tidrick, Gene and Chen Jiyuan, eds., *China's Industrial Reform*, Oxford: Oxford University Press, 1987.
- Wong, Christine P.W., "The Economics of Shortage and Problems of Reform in Chinese Industry", *Journal of Comparative Economics*, 10 (1986), pp. 363-87.
- Woo, Wing Tyhe et al., "How Successful has Chinese Enterprise Reform been? Pitfalls in Opposite Biases and Focus", *Conference Paper on the Transition of the Centrally-Planned Economies in Pacific Asia* in San Francisco, May 7-8, 1993, revision in December 1993.
- World Bank, *China: Long-Term Development: Issues and Options*, Baltimore: Johns Hopkins University Press, 1985.
- Wu Yanrui, "Efficiency Analysis of Chinese Enterprises: a Case Study", in Bing Zhao et al. (eds.), *China: Trade and Reform*, Canberra: The Australian National University, 1991, pp. 154-64.
- Yin Xingmin, "Industrial Concentration in Mainland China: Changes and Problems", *Issues & Studies*, Vol. 29, No. 11 (1993), pp. 1-25.
- Yin Xingmin, "Concentration and Performance in China's Industry", in Tian Jun (ed.), *Chinese Economy: Gradual Reform and Rapid Growth*, London: McMillan, 1994.
- Zheng Zonghan, "An Analysis of Industrial Labour Productivity in China", *Social Sciences in China*, No. 3 (1991), pp. 17-37.
- Zhou Qiren and Hu Zhuangjun, "Asset Formation and Operation Features of Industrial Enterprises in Chinese Townships, and their Macro-Effects", *Social Sciences in China*, No. 2 (1989), pp. 108-144.