ARE CHINESE MARKETS FOR MANUFACTURED PRODUCTS MORE COMPETITIVE THAN IN THE US?:
A COMPARISON OF CHINA –US INDUSTRIAL CONCENTRATION RATIOS

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ABSTRACT

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available estimates for the same years and industrial classification for the US. These comparisons clearly
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are considerably more competitive than in the US.

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1. Introduction

In this paper we present estimates of 4 and 8 firm concentration ratios by industry and in weighted aggregate form for the manufacturing sector for Chinese enterprises for 2002 and 2007. These are then compared to available estimates for the same years and industrial classification for the US. These comparisons clearly point in the direction of China having sharply lower concentration ratios, in the order of one half of the US for 4 firm ratios. One possible implication is that markets for Chinese manufactured products are considerably more competitive than in the US.

For our central comparisons we use data from the Chinese National Bureau of Statistics (NBS) and the US Census Bureau (CB). Our calculations for China are made for the same individual industrial categories and years used in the US CB data, and so we can draw country comparisons between concentration ratios organized on the same industrial classification. These groupings differ a little from these used in other US studies (Pryor, 2001; 2002), but also allow weighted average concentration ratios for both countries to be calculated using value-added by industry as weights.

For 4-firm concentration ratios, the weighted average ratio for Chinese manufacturing enterprises in 2002 is in the range of 0.2, and around 0.15 in 2007, approximately half of what is reported in CB data for the US. China-US ratio comparisons are a little larger than one half for 8-firm concentration ratios. The ratio estimates reported here also suggest that in China industrial concentration is declining significantly over the period 2002 to 2007, while estimates for the US point in the direction of slightly increasing ratios over time. This all points in the direction of relative competitiveness in manufactures between the US and China diverging rather than converging. We also report on supplementary calculations of concentration ratios from other sources, which while not so directly comparable, also clearly point in the same general directions.

Several qualifications are in order in interpreting these calculations. First, the data we use only relate to the manufacturing sector in China and the US and thus exclude critical service sectors such as banking, telecoms and transportation where there is extensive presence of large state-owned monopoly enterprises in China. The relative concentration estimates for the whole economy could be much closer were non-manufacturing sectors able to be included. In addition,

it is not possible from available data to separate out individual categories of enterprises, which could also affect the calculations. For instance, foreign enterprises producing exclusively for export are included in these estimates for China, and thus concentration ratios include both foreign and domestic economic activity. Finally, the Chinese economy is widely thought to be considerably more regionally fragmented than the more regionally integrated US economy. Thus, in any individual regional economy there could be less competition in the Chinese economy than in the US economy, even though the aggregate economy wide concentration ratios suggest the opposite.

2. Data and Methods of Calculation

2.1 Chinese Data

We use Chinese data from 3 separate sources to calculate individual concentration ratios for manufacturing industries, which we then aggregate using industry value-added weights. Since we use US concentration ratio estimates from United States Census Bureau data for comparative purposes, we restrict Chinese data to the same years as available in US data, and also place Chinese data onto the same industrial classification as US CB data.

To do this we use concordances between the North American Industry Classification System (NAICS), the National Industry Classification for China (GB)[1] and the International Standard Industry Classification (ISIC). We report Chinese industrial concentration ratios for the same ISIC classification as in the US CB data.

Data Sources

The first Chinese source is China Industrial Enterprises data from the National Bureau of Statistics of China for 2002 and 2007. It covers all state-owned enterprises, and those non-state-owned enterprises with annual sales of five million RMB (Chinese currency) or more. The data contain firm identification information, and their operation and performance information, including both sales and value-added.

Data Arrangement

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[1] The National Industry Classification for China is issued by the National Bureau of Statistics, which is abbreviated as GB/T4754-2002. Here we use GB to represent this abbreviation.

To improve the accuracy of the data, we have deleted some observations based on the following criteria: (1) We delete observations where key indicators are missing (number of employees, total assets or net fixed assets, etc.) ; (2) Following Jefferson et al. (2008), we delete observations where the numbers of employees are less than 8 because they are likely individually owned stores without a reliable accounting system; (3) Following Bai et al. (2009), we also delete observations with a ratio of profit either below a 0.1% level or above a 99.9% level; (4) If total assets are less than current assets and the net value of fixed assets we drop the observations. And if accumulated depreciation is less than the current depreciation, we also drop the observations; (5) We delete observations that for which paid-up capital is less than or equal to 0 and delete observations with sales below 500 million RMB.

The Calculation of Concentration ratios

Using the modified Chinese data, we calculate the concentration ratios of 3-digit GB industries and then transfer these concentration ratios to corresponding ISIC categories. We use the following three-step procedure to calculate weighted average aggregate concentration ratios for the whole manufacturing sector:

(1) Calculate the concentration ratios of 3-digit GB industries

We first calculate each enterprise's share of total manufacturing industry value-added in each industry in each year, S_{it}^{j}, ie

$$S_{it}^{j} = VA_{it}/X_{jt}, \ i=1, \cdots, m; \ j=1, \cdots, r; \ t=2002,2007 \tag{1}$$

where VA_{it} is the value-added of enterprise i in year t and X_{jt} is industry j's value-added in year t. m and r are separately the number of enterprises in industry j and the number of industries.

We can then calculate n-firm concentration ratios for industry j as

$$CR_{nj} = \sum_{j} max_{n} \ S_{it}^{j} \tag{2}$$

In our later tables we concentrate on 4 and 8 firm concentration ratios.

(2) Transfer the concentration ratios of 3-digit GB categories to corresponding ISIC categories

The Chinese NBS publish a 'National Industry Classification Comment' which contains a correspondence table between GB (2002) and ISIC (Rev.3). The correspondence of the codes between GB and ISIC is not one to one, rather one GB code corresponds to several ISIC codes and one ISIC code corresponds to several GB codes. In order to make them match, we assume that the number of ISIC codes corresponding GB code j is Q. We denote the value-added of industry j with GB code j as X_j and the n-firm concentration ratios as CR_{nj}. If we split industry j into Q-unit same size sub-industries, then the value-added and concentration ratio of each sub-industry separately are X_j/Q and CR_{nj}.

With these adjustments, each ISIC industry corresponds to a group including several sub-industries on a GB classification. Meanwhile, one sub-industry for GB corresponds to one industry for ISIC. We can then calculate the weighted average concentration ratio using the value-added of each sub-industry for each group as the corresponding concentration ratio using 3-digit ISIC codes.

(3) Calculate the weighted average concentration ratios across 2-digit ISIC codes for the whole manufacturing industry for 4 and 8 firm concentration ratios using value-added as weights.

Using a weighted average method, we calculate the concentration ratios for 2-digit ISIC codes and then for the whole of the manufacturing industry. For each year we weight industries by their value-added for the corresponding year. These results are reported in Table 1 along with comparable US estimates.

2.2 US Data

For the US we use manufacturing industry concentration ratios from the Economic Census conducted by the US Census Bureau from which they calculate weighted concentration ratios[1]. We adjust their data to correspond to the same ISIC codes as the Chinese data. The original data are published as concentration ratios for 3-digit to 6-digit NAICS code for 2002 and 2007. We use concentration ratios for 5-digit NAICS codes to calculate US concentration ratios comparable to those for China. The United Nations Statistics Division issues a correspondence

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[1] http://www.census.gov/econ/concentration.html

Table 1 Manufacturing Concentration Ratio (ISIC Classification) Comparisons between US and China in 2002 and 2007 (%)

ISIC code	Industry	US				China				Ratio Comparison (US/China)			
		2002 4-firm	2002 8-firm	2007 4-firm	2007 8-firm	2002 4-firm	2002 8-firm	2007 4-firm	2007 8-firm	2002 4-firm	2002 8-firm	2007 4-firm	2007 8-firm
	Total manufacturing	**36.5**	**47.6**	**36.8**	**48.9**	**20.8**	**30.5**	**15.5**	**22.5**	**1.75**	**1.56**	**2.37**	**2.17**
15	Food products and beverages	43.2	57.5	43.7	57.3	18.5	27.1	14	20.2	2.34	2.12	3.12	2.84
16	Tobacco products	89.5	95.8	92.5	97.1	30.3	44.8	34.6	53.4	2.95	2.14	2.67	1.82
17	Textiles	27.3	36.6	30	39.5	9.5	13.6	11.1	14	2.87	2.69	2.70	2.82
18	Wearing apparel; dressing and dyeing of fur	24	30.9	18.2	27.2	7.7	11.6	5.1	7.9	3.12	2.66	3.57	3.44
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	14.9	22.1	15.9	23.3	21.5	27.8	10.8	14.6	0.69	0.79	1.47	1.60
20	Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	18.9	26.5	19.2	26.1	14.7	22.3	8.5	12.5	1.29	1.19	2.26	2.09
21	Paper and paper products	35.2	47.7	35.2	49	14.4	21.5	14.3	20.6	2.44	2.22	2.46	2.38
22	Publishing, printing and reproduction of recorded media	13.4	19.5	15.5	21.3	11	17.2	7.2	11.4	1.22	1.13	2.15	1.87
23	Coke, refined petroleum products and nuclear fuel	37.3	54.2	39.5	65.1	35.3	57.2	24.6	36.4	1.06	0.95	1.61	1.79
24	Chemicals and chemical products	39.8	52.9	43.2	57.1	15.7	22.7	14.1	19.9	2.54	2.33	3.06	2.87
25	Rubber and plastics products	30.2	40.1	30	39.7	18.1	28.3	13.7	20.5	1.67	1.42	2.19	1.94
26	Other non-metallic mineral products	34	46.6	34.6	46.8	9.4	13.8	6.2	9.4	3.62	3.38	5.58	4.98
27	Basic metals	28.4	40.1	36.9	49.1	31.9	46	19.1	28.2	0.89	0.87	1.93	1.74
28	Fabricated metal products, except machinery and equipment	14	20.1	14.7	20.5	14.2	21.5	10.8	15.6	0.99	0.93	1.36	1.31
29	Machinery and equipment n.e.c.	36.3	48	36.4	47.4	15.3	22.7	16.3	23	2.37	2.11	2.23	2.06
30	Office, accounting and computing machinery	46.8	61.1	56.6	64.5	12.8	20.5	18.5	28	3.66	2.98	3.06	2.30
31	Electrical machinery and apparatus n.e.c.	32.8	42.1	27.9	38	37.9	55.5	10.5	15.4	0.87	0.76	2.66	2.47
32	Radio, television and communication equipment and apparatus	45.8	54.7	45.1	55.6	22	32.1	19.5	27.8	2.08	1.70	2.31	2.00
33	Medical, precision and optical instruments, watches and clocks	23.4	32.6	21.6	32.7	31.7	44.9	23.7	33.2	0.74	0.73	0.91	0.98
34	Motor vehicles, trailers and semi-trailers	63.8	74.2	57.5	68.3	26.2	37.5	15.3	23.5	2.44	1.98	3.76	2.91
35	Other transport equipment	39.7	51	39.7	50.5	26.8	41.5	19.9	29.9	1.48	1.23	1.99	1.69
36	Furniture; manufacturing n.e.c.	23.6	31.3	24.4	32.7	18.6	26.8	9.7	14.5	1.27	1.17	2.52	2.26

We use value-added as weights. The numbers before 15 in the industrial classification are for ISIC codes for non-manufacturing industries.

table between ISIC (Rev.3) and NAICS (2002)[1]. We first use this correspondence to transfer concentration ratios for 5-digit NAICS categories to corresponding ISIC categories.

Using this correspondence, we find that each 3-digit ISIC code corresponds to a group including several 5-digit NAICS codes. We calculate the weighted average concentration ratio for each group as the corresponding concentration ratio using 3-digit ISIC codes. Following the calculation of Chinese ratios, we also calculate the concentration ratios for 2-digit ISIC codes and the whole manufacturing industry for the US as a weighted average where industry value-added are weights. These results are also reported in Table 1 to compare with Chinese results.

3. The Central US-Chinese Industrial Concentration Comparisons

Table 1 reports our central estimates of market concentration ratios for the Chinese and US manufacturing sectors for 2002 and 2007 for both 4 and 8 firm ISIC categories. These estimates show considerably lower concentration ratios in China for both years, and also for both 4 and 8 firm calculations. Ratios of comparable US to China concentration ratios increase from 1.75 to 2.37 between 2002 and 2007 for 4-firm ISIC categories aggregated by value-added. For 8-firm ISIC categories, aggregated ratios increases in relative terms from 1.56 to 2.17 between 2002 and 2007. For the large majority of industries the concentration ratios for China substantially exceed those for the US, with the maximum divergence being for the 4-firm ISIC comparison for 2002 for office, accounting, and computing machinery. From these estimates, an inference would seem to be that Chinese markets for manufacturing goods are significantly more competitive than US markets, and the difference in domestic competitive concentration is increasing rather than decreasing.

4. Supportive Supplementary Calculations and Estimates

We also report some supplementary Chinese calculations of concentration ratios and, for the US, secondary estimates of concentration ratios that together provide the same general picture that we suggest for our main China-US comparison above. These are not on a strictly comparable industrial classification basis and the years differ slightly from one another. We use Chinese data from 2 separate sources to calculate individual industrial concentration ratios for sales for 24

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[1] http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=28&Lg=1&Co=&T=0&p=5

Chinese industries, which we then aggregate using industry sales as weights. We make no original calculation of US concentration ratios for comparative purposes, but instead rely on secondary sources (Pryor, 2001) for supplementary US concentration ratio estimates.

The main Chinese source for these supplementary calculations is data compiled by an industrial trade association in China, *China Enterprise Confederation/China Enterprise Directors Association.* This is a non-state organization to which enterprises in China are members. Every year it conducts a survey among its membership. In the survey it asks for data on a range of items, including name of enterprise, sales income, profit and assets. It then tabulates this information which is then published in an annual publication for the top 500 Chinese companies. It unfortunately does this with gaps so that only an incomplete picture of industrial activity can be obtained in certain years. We have been able to purchase missing data for individual years over the period 2000-2010, but the only item for which a complete series for all years is available for all 500 top firms is "sales income". "Sales income" equates with revenue from sales by the enterprise during the year and differs from the value-added used in our central comparison.

The industrial classification on which this data is available is for the 24 manufacturing industries listed in Table 2, which is also available on the same classification of individual industries for total sales reported in the Chinese Statistical Yearbook, our second supplementary data source. We allocate sales income data for individual enterprise to the 24 manufacturing industry category using judgment, given that some of the enterprises are multi-product enterprises.

Having identified sales income by enterprise for the top 500 Chinese firms, we then use data by industry from the China Statistical Yearbook on total sales for the whole industry on the same 24 industry classification[1].

Having allocated enterprise shares of sales to the 24 manufacturing industry groups using a best judgment procedure where multi-product enterprises are involved, we then calculate concentration ratios for each industry for the same 4 and 8 firm cases as above.

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[1] The National Bureau of Statistics of China publishes aggregate data by industry in the China Statistical Yearbook each year. They also can be checked through their website. The website address is http://data.stats.gov.cn/workspace/index;jsessionid=6C2DA141E9DD01B448E0C9E7AE5EC8B7?m=hgnd.

Table 2 Supplementary Estimates of Market Concentration Ratio for Chinese Manufacturing Industries (%)

GB Code	Industry	CR_n	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Total manufacturing	**4**	**23.4**	**22**	**22.9**	**18.1**	**19.4**	**19.5**	**18.6**	**16.3**	**16.9**	**16.8**
		8	**30.5**	**27**	**28.7**	**28.2**	**24.4**	**25**	**23.4**	**22.2**	**23.6**	**22.5**
13	Processing of Food from Agricultural Products	4	5.2	4.6	4.4	16.0	14.7	13.9	13.4	12.7	9.4	8.5
		8				18.6	17.6	16.6	17.1	16.0	12.5	11.8
14	Foods	4	14.3	13.8	13.6	9.9	10.9	17.1	16.0	13.7	11.9	14.8
		8	21.9	21.3			18.2	23.8	22.4			
15	Beverages	4	12.1	14.9	15.5	15.2	14.2	13.7	13.7	13.4	13.4	13.0
		8	17.8	20.8								
16	Tobacco	4	36.2	32.0	28.2	29.6	36.1	39.4	39.4	43.7	43.0	44.4
		8	47.2	41.4	39.8	44.3	54.1	57.8	59.2	63.4	63.8	68.5
17	Textile	4	6.1	4.1	6.4	7.0	6.2	6.3	6.4	6.1	5.7	6.3
		8	8.4	6.0	8.4		9.5		9.5		8.2	8.8
18	Textile Wearing Apparel, Footware and Caps	4	5.1		6.9	8.0	8.6	8.2	7.6	7.4	7.2	7.6
22	Paper and Paper Products	4							6.1	7.3	5.9	6.9
25	Processing of Petroleum, Coking, Processing of Nuclear Fuel	4	73.7	77.1	73.3		68.3	70.3	67.8	64.0	65.3	67.3
		8									67.7	
26	Raw Chemical Materials and Chemical Products	4	4.6	5.0	4.5	4.6	4.2	3.8	6.5	6.0	5.0	4.9
		8	6.3	7.0	6.5	6.5	6.1	5.8	8.7	8.3	7.1	6.9
27	Medicines	4	21.9	29.5	30.5	28.4	18.1	18.4	12.8	11.9	14.1	16.0
		8	34.9	42.3	42.1	38.8	27.3	26.7				
28	Chemical Fibers	4	13.6	15.2	16.4	18.0	16.4	17.0	17.2	18.5	23.0	24.6
29	Rubber and Plastics	4	3.2	3.8	3.8	4.1	4.2	4.7	4.6	4.4	4.5	4.2
		8			6.4							
31	Non-metallic Mineral	4	2.8		2.6	5.1	5.5	5.0	5.5	5.6	5.5	6.3
		8									7.2	
32	Mining, Smelting and Pressing of Ferrous Metals	4	22.8	20.3	23.2	21.5	18.0	15.7	14.7	13.5	13.3	14.1
		8	31.0	28.7	32.0	29.0	25.9	23.8	23.3	22.2	23.1	24.5
33	Smelting and Pressing of Non-ferrous Metals	4	8.5	13.7	14.5	15.1	13.2	14.1	12.5	12.2	12.2	13.2
		8	14.1	18.8	18.7	19.8	18.5	20.4	16.9	16.3	17.6	19.5
34	Metal Products	4	22.1	25.4	26.8	27.4	26.5	26.5	25.0	20.4	23.5	26.6
35	General Purpose Machinery	4			3.1	3.0	5.2			4.5		2.5
		8			4.9							
36	Special Purpose Machinery	4	13.5	14.3	13.0	13.1	7.9	11.0	7.7	6.4	10.6	12.0
		8	19.3	20.3	18.0	18.1	12.2	16.1	11.8	9.2	14.8	16.0
37	Transport Equipment	4	25.3	33.6	30.5	26.9	25.9	24.0	22.8	18.3	20.0	21.1
		8	36.3	45.9	40.5	38.3	36.9	35.7	33.9	28.5	30.2	30.6
39	Electrical Machinery and Equipment	4	22.6	29.9	23.5	22.4	19.0	13.5	12.0	10.2	9.5	8.6
		8	30.6	39.9	31.9	28.8	24.8	20.8	17.0	14.5	14.0	12.9
40	Communication Equipment, Computers and Other Electronic Equipment	4	16.5	15.1	9.3	8.6	10.2	10.2	12.6	8.8	9.0	10.0
		8	23.8	22.1	13.7	13.1	14.4	15.4	18.0	12.4	12.7	13.3
44	Production and Supply of Electric Power and Heat Power	4	69.4	30.4	76.7	55.2	48.7	48.6	49.2	48.7	49.2	49.8
		8	73.4	34.3	84.1	64.2	56.0	55.2	56.5	57.4	58.8	59.9

We use industrial sales as weights to calculate the total manufacturing. The numbers before 13 in the industrial classification are for GB codes for non-manufacturing industries.

Where substantial concentration ratios occur (such as in petroleum processing in 2004) and there is not a minimum of either the 4 or 8 enterprises required for the concentration ratios in the corresponding industrial classification, then the industry values are not defined. This explains the blanks in Table 2 (such as CR_4 under foods, 2004).

By way of comparison, Table 3 reports Pryor's (2002) estimates of US concentration ratios for 1992 and 1997 using value-added as weights to aggregate concentration ratios. These stand in similar relation to the supplementary Chinese concentration ratios in Table 2 as in our main estimates in Table 1. Estimates for China are approximately one half of those for the US and the difference between the US and Chinese ratios increases over time.

Table 3 Pryor's (2002) Estimates of US Manufacturing Concentration Ratios (SIC Classification) in 1992 and 1997

SIC Code	Industry	1992 4-firm	1997 8-firm	1992 4-firm	1997 8-firm
	Total manufacturing	**39.4**	**51.5**	**42.0**	**53.7**
20	Food and kindred products	48.1	61.1	42.6	52.0
21	Tobacco manufacturing	83.7	90.0	89.0	90.4
22	Textile mill products	36.0	50.4	37.3	52.8
23	Apparel and other textile products	29.4	39.6	25.7	35.6
24	Lumber and wood products	21.7	30.1	22.1	30.0
25	Furniture and fixtures	28.0	38.3	28.5	39.8
26	Paper and allied products	37.0	53.9	39.5	56.5
27	Printing and publishing	21.9	31.1	21.8	32.6
28	Chemicals and allied products	38.4	53.0	39.3	53.2
29	Petroleum and coal products	30.7	48.7	29.6	48.1
30	Rubber and misc. plastic products	21.5	30.1	20.8	29.4
31	Leather and leather products	44.1	60.5	48.6	64.2
32	Stone, glass, clay products	37.9	49.8	37.2	49.0
33	Primary metal industries	36.5	53.1	35.9	52.1
34	Fabricated metal products	25.4	33.6	26.2	36.4
35	Machinery except electrical	32.3	43.2	32.8	46.2
36	Electric, electronic equipment	42.7	56.1	49.1	60.3
37	Transportation equipment	67.0	78.4	72.7	83.3
38	Instruments, related products	37.3	50.6	53.7	63.9
39	Miscellaneous manufacturing	26.4	36.2	34.4	42.0

Data source: Pryor, F.L. (2002) 'New Trends in U.S. Industrial Concentration, 1992-1997', Review of Industrial Organization, 20, 183-185. The numbers before 20 in the industrial classification are for SIC codes for non-manufacturing industries.

5. Concluding Remarks

In China's WTO accession terms, China agreed to being classified as a non-market economy, thus affecting China's situation with respect to anti-dumping duties in OECD export markets. The basis for the non-market claim was the preponderance of state-owned enterprises in China's manufacturing sector at the time and the belief that they dominated Chinese domestic markets which were viewed as highly concentrated. The calculations we report of relative concentration ratios between China and US point in the opposite direction of China having a more competitive manufacturing sector than the US and hence, if anything, China now having more claim that they have evolved from that non-market economy status of a decade ago. Our calculations challenge this still wildly held perception, but this claim is subject to the qualifications set out in the introduction.

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