

A Benchmark Comparison in Manufacturing between China and Germany by ICOP Approach

Ren Ruoen

Professor
School of Economics and Management
Beijing University of Aeronautics and Astronautics
Director – Center for Competitiveness and Risk Analysis (CCRA)
Beijing 100083, China
Tel: 8610-82315433 or 82316905
Fax:8610-82316100
E-mail: ruoen@seec.com.cn or ruoen8324@sina.com

Bai Manying

Associate professor
School of Economics and Management
Beijing University of Aeronautics and Astronautics
Research fellow – Center for Competitiveness and Risk Analysis

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ABSTRACT

The present study on China-Germany productivity comparisons for the year 1995 is the first attempt to compare the China's economic performance with one of European countries by following the purchasing power parity conversion method. The method used in estimating PPPs, which were then applied to convert value added and hence productivity, is the ICOP approach developed by the Groningen University in the ICOP project. Chinese manufacturing GDP converting into Germany currency by PPPs provides labor productivity in 1995 of 6.94 percent of the Germany level if the Chinese data coverage was limited on the enterprises at township and above; and 5.18 percent of the Germany level if the Chinese data coverage was expanded to the enterprise at village level. This is quite similar to the figure derived in the 1985 benchmark comparison between China and the US (Szirmai and Ren, 2000) and higher than the figures derived in the preliminary 1995 benchmark comparison between China and the US (Bai and Ren, 2000). It has been found that the relative productivity performance at branch level varied considerably, from 22.17 percent of the Germany level in leather products and footwear to 3.59 per cent in paper products based on the narrow coverage data while from 19.71 percent of the Germany level in wearing apparel to 3.28 per cent in paper products based on the wider coverage data.

1. Introduction

Since 1993 a project was initiated for comparing sectoral performance in manufacturing between China and US using methodology of International Comparison of Output and Productivity (ICOP), developed at the University of Groningen. The ICOP approach requires deriving the production-side PPPs and applying the PPPs to convert the added value from local currency into a common valuation. Based on the PPPs derived we compared the labor productivity in manufacturing between China and US for 1985 and built the time series of comparative labor productivity from 1980 to 1992. This study was published in a preliminary version as a University of Groningen research memorandum 581 (GD-20) (Szirmai and Ren, 1995). The revised version appeared as a chapter in *The Chinese Economy* edited by M. Fouquin and F. Lemoine. The final version was published in *China Economic Review* (Szirmai and Ren, 2000). The findings were also incorporated in a book for the OECD Development Centre (Ren, 1997).

The comparisons by ICOP approach have been regarded as useful for measurement of competitiveness of a country at industry level. The PPPs derived from production-side are also useful for the TFP comparisons cross countries such like the KLEMS project.

The 1995 Industrial Census of China provided a new opportunity to carry out a new benchmark study on the comparison between China and the other countries in manufacturing. We have completed another benchmark study on PPP estimates and labor productivity comparison in manufacturing between China and US for 1995 by ICOP approach (Bai and Ren, 2000).

The current paper will report the findings derived from the new 1995 benchmark study in manufacturing between China and Germany by ICOP approach. The purpose of the research is to compare the manufacturing industries performance of China with that of a European country representing the core of the European Union, Germany. It applies the ICOP methodology recently refined at the University of Groningen (Timmer, et al., 2001) to carry out

the new comparison. The results of the China/Germany comparison combining with the further studies will allow conclusions to be drawn concerning:

- the levels of output and labour productivity in the different manufacturing industries of the two countries and their trends;
- the disparity of productivity levels between different categories of Chinese firms, characterised by their sizes (small and medium sized and large sized firms) or ownership regime (State-owned units, collective and private enterprises, foreign firm affiliates);
- the pattern of relative prices and, after taking into account the Balassa effect, the under/over valuation of the exchange rate, and its evolution in the recent years;
- the pattern of China's international competitiveness (relative productivity/relative unit labour costs), which can be compared with the international competitiveness revealed in its trade with Europe.

The findings of this bilateral comparison will be discussed in the light of other similar studies. First, the relative levels of productivity in China *vis à vis* Germany will be compared with the results found in the USA/China comparison. Bilateral comparisons between countries having different levels of economic development and different economic systems raise a lot of methodological problems, and comparing the results of bilateral comparisons may be useful in qualifying conclusions which can be drawn about the efficiency of productive activity in China. The European and Chinese productivity levels are also to be interpreted in relation to the results found for other developing countries. Available data also allow the Chinese production and productivity levels to be compared directly with that of a developing country in the European periphery.

In section 2 we present a brief discussion of the method used in this study. Section 3 deals with the data issues on the comparison. Section 4 reports the benchmark comparison for 1995. The PPPs derived from the benchmark study were used to calculate relative price levels and labor productivity comparisons. The discussion about the implication of the comparison was given in the concluding remarks.

2. Methodology for the 1995 Benchmark Comparison

The ICOP methodology for the benchmark comparisons has been discussed in detail in many papers (see Maddison, A. and B. van Ark, 1988; Van Ark, 1993a, 1993b; Ark, B. van, and D. Pilat, 1993; Maddison, 1998; Ren, 1997; Szirmai and Ren, 2000). Timmer, et al., (2001) has refined the basic approach used in the recent comparisons. Only a brief outline of the revised methods presented in Timmer et al. paper (2001) was provided in this paper.

The basic data used in this comparison are the Germany and China 1995 Industrial and Manufacturing Census. These data provide information on product quantities and gross output values, in some cases, prices (The prices or average prices were given for around 800 items or the group of products in Chinese census). These data can be used to derive unit values for products.

2.1 Unit Value

A major task in the ICOP approach to manufacturing is to derive industry-specific conversion factors on the basis of relative product prices. As a first step, unit values (uv) are derived by dividing ex-factory output values (o) by produced quantities (q) for each product *i* in each country

$$0_{uv_i} = \frac{o_i}{q_i} \quad (1)$$

In a bilateral comparison, broadly defined products with similar characteristics are matched,

for each matched product; the ratio of the unit values in both countries is taken. This unit value ratio (UVR) is given by

$$UVR_i^{xu} = \frac{uv_i^x}{uv_i^u} \quad (2)$$

with x the countries being compared, and u being the base country.

Product UVRs are used to derive an aggregate UVR for manufacturing branches and total manufacturing in a stepwise weighting procedure. There are four levels which are being distinguished: products, industries, branches and total manufacturing. These levels correspond with the levels distinguished in the International Standard Industrial Classification (ISIC rev 3). ICOP industries consist four-digit ISIC industries, and ICOP branches consist of two-digit divisions. The total manufacturing output is the sum of branch output, which is the sum of industries' output value. The output value of an industry is the sum of the value of output of its products.

Two UVRs are derived at each level. A Laspeyres UVR is calculated by using base country weights and a Paasche by using weights for the other country. The Laspeyres and Paasche indices are combined into a Fisher index when a single currency conversion factor is required. It is defined as the geometric average of the Laspeyres and the Paasche.

2.2 Aggregation Step One Industry Level UVRs

The industry UVR (UVR_j) is given by the mean of the UVRs of the sampled products. Product UVRs are weighted by their output value, as more important products should have a bigger weight in the industry UVR:

$$UVR_j = \sum_{i=1}^{I_j} w_{ij} UVR_{ij} \quad (3)$$

with $i=1, \dots, I_j$ the matched products in industry j; $w_{ij} = o_{ij} / o_j^M$ the output share of the i^{th} commodity in industry j in total matched output; and $o_j^M = \sum_{i=1}^{I_j} o_{ij}$ the total matched value of output in industry j. In bilateral comparisons the weights of the base country (u) or the other country (x) can be used. The use of base country value weights leads to the Laspeyres index. Substituting base country weights in (3) gives:

$$UVR_j^{xu(u)} = \sum_{i=1}^{I_j} w_{ij}^{u(u)} UVR_{ij} \quad (4)$$

with $w_{ij}^{u(u)} = o_{ij}^{u(u)} / o_j^{M u(u)}$; $o_j^{M u(u)} = \sum_{i=1}^{I_j} o_{ij}^{u(u)}$; and $o_{ij}^{u(u)} = uv_{ij}^u q_{ij}^u$, the output value of matched product i in country u at own prices. Using (1), (4) can be rewritten as

$$UVR_j^{xu(u)} = \frac{\sum_{i=1}^{I_j} uv_{ij}^x q_{ij}^u}{\sum_{i=1}^{I_j} uv_{ij}^u q_{ij}^u} \quad (5)$$

with $UVR_j^{xu(u)}$ indicating the Laspeyres index which is the unit value ratio between country u and x weighted at base-country quantities indicated by the u between brackets. For the Paasche index, weights of the other country quantities valued at base country prices are used in formula (3). This gives

$$UVR_j^{xu(x)} = \sum_{i=1}^{I_j} w_{ij}^{u(x)} UVR_{ij} \quad (6)$$

with $w_{ij}^{u(x)} = o_{ij}^{u(x)} / o_j^{M u(x)}$; $o_j^{M u(x)} = \sum_{i=1}^{I_j} o_{ij}^{u(x)}$; and $o_{ij}^{u(x)} = uv_{ij}^u q_{ij}^x$, the output value of matched product i in country x at u prices.. Using (1), (6) can be rewritten as

$$UVR_j^{xu(x)} = \frac{\sum_{i=1}^{I_j} uv_{ij}^x q_{ij}^x}{\sum_{i=1}^{I_j} uv_{ij}^u q_{ij}^x} \quad (7)$$

with $UVR_j^{xu(x)}$ indicating the Paasche index which is the unit value ratio between country u and x weighted at the quantities of the other country (x).

2.3 Aggregation Step Two Branch Level UVRs

Branch UVRs (UVR_k) are calculated as a weighted average of industry UVRs. Use of weights from the base country and the industry UVRs at base country weights, gives the Laspeyres index for branch k .

$$UVR_k^{xu(u)} = \sum_{j=1}^{J_k} w_{jk}^{u(u)} UVR_{jk}^{xu(u)} \quad (8)$$

with $j=1, \dots, J_k$ the number of industries in branch k in which a product match has been made and $w_{jk}^{u(u)}$ the industry weight. UVRs of industries with bigger output should have a higher weight to reflect the structure of the economy.

To arrive at the Paasche index, the output weights of country x valued at base prices is substituted. This gives

$$UVR_k^{xu(x)} = \sum_{j=1}^{J_k} w_{jk}^{u(x)} UVR_{jk}^{xu(x)} \quad (9)$$

2.4 Aggregation Step Three Total Manufacturing UVRs

The total manufacturing UVR is a weighted average of the branch UVRs. Use of weights from the base country and the branch UVRs at base country weights, gives the Laspeyres index for total manufacturing ($UVR^{xu(u)}$)

$$UVR^{xu(u)} = \sum_{k=1}^K w_k^{u(u)} UVR_k^{xu(u)} \quad (10)$$

with $k=1, \dots, K$ the number of branches and $w_k^{u(u)}$ the branch weight. For branch weights the total branch output is used.

To arrive at the Paasche index, the output weights of country x valued at base prices is substituted. This gives

$$UVR^{xu(x)} = \sum_{k=1}^K w_k^{u(x)} UVR_k^{xu(x)} \quad (11)$$

Originally ICOP was based on ISIC rev 2, some aggregated branches (3 digits) were taken such as basic and fabricated metals (which are separate branches in ISIC rev 2). Since then the industrial classifications have changed across the world. ISIC has been revised in 1990 to rev 3. ICOP at the moment distinguishes 14 to 16 (depending on whether food is taken together with beverages and tobacco) branches in the manufacturing (Our previous comparison has been following this classification). In the current comparison we adopted the proposed new ICOP branches including 17 branches as suggested in Timmer et al (2001).

3. Data Sources

3.1. Overview of Chinese 1995 Industrial Census

The basic data for the comparison is the *1995 Industrial Census* of China. This Industrial Census includes quantity data for around 2000 products and ex-factory average prices data for about more 800 products. It also provides the value added data. The basic data for the Germany was *Produzierendes Gewerbe. Fachserie 4. Reihe 4.3. Kostenstruktur des Unternehmen im Verarbeitenden Gewerbe sowie im Bergbau und der Gewinnung von Steinen und Erden, 1995*" (Statistisches Bundesamt), which provides the data about the output and employments for the sample industries and branches of manufacturing, and "Produktion im produzierenden Gewerbe des In- und Auslands, 1995" (Statistisches Bundesamt), which provides the data on the value, quantities and unit value for around 7000 products. The following discussion focuses on the Chinese data.

In a recent paper (Szirmai, Bai, and Ren, 2001), the authors provided a detailed analysis of concepts, coverage and consistency of different time series of employment and output in manufacturing mainly by using the wealth of information contained in the 1995 industrial census. Some findings derived from that paper were incorporated in the current comparison. On the basis of the findings derived from that paper, we will present adjusted data on the output and employments for China to implement the bilateral comparison between China and Germany, the knowledge about the data issues for China side has been improved compared to the previous comparisons between China and the US.

Similar to the previous Industrial Census (1985), in the new census the production is classified by firms and the detailed information on a larger set of variables broken down by sector of manufacturing is primarily collected only from 'enterprises with independent accounting systems (IAS) at township level and above'. These include the great majority of state-owned enterprises, urban collectives, joint ventures and large foreign owned enterprises. The most detailed information is collected about the state-owned sector, of which the importance in the industrial economy is declining. For the enterprises such as sole proprietorships, private enterprises, village collectives, rural cooperatives, etc, information is scarce and incomplete and sectoral breakdown is not available. The problems of coverage are getting worse over time, as China moves towards a market economy and the ownership structure is changing.

In 1978, independent accounting enterprises at township level and above accounted for most of output and employment in the industrial sector, but every year this becomes less and less true. In 1985, detailed information was available for a subset of enterprises accounting for 87 percent of total gross output in industry. By 1995, this percentage had declined to 67 per cent. Since then it has declined further. In terms of employment, the coverage declined from 68 per cent in 1985 to 58 percent in 1995 (Industrial Census, 1985, 1995).

The coverage of employment in time series is even more limited than in the industrial census. If one wants to study trends in branches of industry or manufacturing, the overwhelming bulk of employment is left out of consideration. For instance, in the published 1993-99 time series on employment, sectoral detail is only provided for 52.1 million of the total of 147.4 million persons engaged in industry in the year 1995. For output, coverage is slightly higher as the covered enterprises tend to have higher productivity per worker than the non-covered enterprises. But these differences in coverage affect all productivity estimates.

For independent accounting enterprises at township level and above, information is provided on a wide range of variables including gross output (new concept) gross output (old concept),

gross value added, employment, sales tax, value added tax, total tax and a several variables referring to financial dimensions (profit, wages, interest and so forth). This detailed information is not available for the enterprises below this administrative level.

As Szirmai, Bai, and Ren, (2001) demonstrated in their paper, the independent accounting enterprises at township level and above have the same coverage as the time series for industrial output. Therefore it is important to know what the coverage exactly includes and excludes. It includes most but not all of the state enterprises (excluded are the affiliates). It includes all county and township collectives with independent accounting systems, including a large unspecified residual category. It excludes all other collectives such as village collectives or rural collectives below township level. Of the joint ventures, foreign owned enterprises, incorporated (share holding) enterprises and other enterprises; it includes all the enterprises except affiliates without independent accounting systems.

Since 1993 a new concept of gross output has been introduced. Compared to the old concept, it includes a few new items: value of output produced with non-purchased intermediate inputs, revenue from processing of intermediate inputs for others and the value of semi-finished goods and goods in process. These make the new concept somewhat higher than the old one. The most important difference however is that value added taxes – introduced in 1994 – are excluded from the old concept. This makes the new concept lower than the old one. Since the Chinese statistical practice has been following the SNA guideline, the value added excludes the intermediate input no matter which comes from the manufacturing industries or the services industries. The annex activities were excluded from the output produced by the major production and reallocated to the relevant industry.

The concept of value added in census (and the time series) includes sales and other taxes and excludes value added taxes. By deducting sales taxes from the published figures we can get value added at factor cost, by adding the value added taxes, we can get value added at market prices. These concepts can be used for comparison of the census with other sources and for international comparisons.

In the census one can distinguish three concepts of employment. The first is often referred to in Chinese statistical practice as the *Social Labour Force*. It includes all persons engaged in industry, including persons with a second job and including self employed persons, persons working in village enterprises, private enterprises and sole proprietorships. The census estimate of the social labour force in “Industry ” is 147.4 million persons.

The much more restricted concept of the labour force is the so-called *staff and worker concept* (also referred to as *formal employment*). This concept refers to workers with a formal employment status at township level and above. Since 1998, the staff and worker concept has been redefined in a more restrictive sense and renamed ‘*on-post staff and worker*’. This concept excludes people who have some kind of contractual relation with the enterprise but are no longer actually working. It is important to note that the concept of staff and workers includes part-time workers. The total number of staff and workers in the census in 1995 is 85 million, representing 58 per cent of the social labour force.

The labour forces working in the annex activities distinguished from the major production activity were included in the employment statistics. So the portion of the employment was deducted to arrive at the figure of employment consistent to the output figures.

3.2 Data on Output and Employment

In this section we present basic data on output and employment by branch of manufacturing based on the 1995 census. For a benchmark comparison of productivity with other countries, the widest possible coverage is preferable. There are three alternative procedures for constructing a basic data table 1995 for China with different coverage and various adjustment involved. In fact, we can construct two data sets based on the 1995 industrial census and 1995 input-output table.

For the one data set, we used census value added and employment figures for IAS enterprises at township level and above. In this data set we took the value added and employment figures from page 46 of census. This table does have substantially more limited coverage. We could then blow up the comparison, by comparing output per work on page 3 with that on page 46. In the data set, the data both for output and employment were taken from a single table without any adjustment; also the data set has the advantage that it is consistent in coverage with the published time series of output, the only disadvantage is the limited coverage.

For another data set, we used census gross output and employment data on enterprises at village level and above. We took the gross output and employment figures from page 3 of census (village enterprises and village and above with more than 1 million sales), and applied value added output proportions from the 1995 IO table. This has the advantage that output and employment are directly from the census. Page 3 has sufficient sectoral breakdown. The coverage of this comparison will be much better than that of 1985 China and US comparison. The data on page 3 include 85 per cent of gross output, 75.5 per cent of employment and 17.5 per cent of the number of enterprises, compared to the full coverage on page 1 of the census. The only categories excluded are the sole proprietorships, the so-called affiliated enterprises and some enterprises with less than one million sales.

Although we do not have complete coverage of output and employment, from a productivity perspective, this is not such a problem. As mentioned, at aggregate level, we can also adjust the productivity comparison by taking the non-covered part of the census into account. A problem is that page 3 does not have value added data. To get value added by sector we applied proportions by sector from the 1995 IO table. The approach can be justified by the similarity of output structure between page 3 of the census and the 1995 IO table. Szirmai, Bai, and Ren, (2001) have made a comparison between the structure of gross output in industry and manufacturing in the census (p.3) and the 1995 IO table. In spite of the differences in coverage, the structure is surprisingly similar. Also the employment concept of the census, page 3 corresponds to the concept of the social labour force. In constructing the data set, we just made the fewest assumptions compared with the other option, but the data cover a very large proportion of output, including that of village enterprises.

So we can make two productivity comparisons. In these two comparisons, the Germany data are the same, but the China data are different. For these two comparisons, we present two versions of the basic data tables for China with different coverage. The first version (table 1) provides information about enterprises with independent accounting systems at township level and above.

The table presents estimates of gross output (new concept) and value added. Some conceptual discussion is in order here. The new concept of gross output is neither at factor cost, nor at market prices, but somewhere in between. It includes sales and other taxes, but excludes value added taxes. For purposes of international comparison and comparison with other sources, the

output figures have to be adjusted to factor cost.

For enterprises at township level and above (table 1) the census provides full detail on gross output, value added, total taxes, sales and other taxes and value added taxes (and a multitude of other variables). By deducting sales taxes we arrive at factor cost concepts. The basic data on gross value of output, gross value added and employment for Germany are presented in tables 2.

Table 1 - Basic Data on Output and Employment for China, 1995

Industrial Census	Gross Value	Gross Value	Gross Value	Employment
	of Output at factor cost (mill. Yuan)	Added at factor Cost (mill. Yuan)	Added in Branch as % of Total	(persons)
1. Food and Kindred Products	626275	170735	14.18	5707900
2. Textiles Mill Products	460400	89845	7.46	8271400
3. Wearing Apparel	147015	34729	2.88	2618800
4. Leather Products and Footwear	97441	20147	1.67	1375500
5. Wood Products	40553	9508	0.79	995500
6. Paper Products, Printing Publishing	130399	29506	2.45	2777000
7. Chemicals Ailled Products	559099	141038	11.71	6076100
8. Petroleum Coal Products	202812	56133	4.66	688200
9. Rubber and Plastic Products	174753	36343	3.02	2473800
10. Non-Metallic Mineral Products	301836	89991	7.47	7623000
11. Basic Metal Products	503251	135533	11.25	4571600
12. Fabricated Metal products	165072	38394	3.19	2709100
13. Machinery and Equipment	412223	111916	9.29	7405900
14. Transport Equipment	330328	80512	6.68	3704700
15. Office, Accounting and Computing machinery	35056	9209	0.76	101100
16. Electrical Machinery and Equipment	557314	136137	11.30	5236780
17. Other Manufacturing Products	59709	14761	1.23	1174000
Total Manufacturing:	4803536	1204437	100.00	63510380

Sources: The coverage is the IAS enterprises at township level and above. The gross value of output and value added from p46-197 of census, while labor data from p.198-233 of census. The labor data refer to the average figures and service employment was excluded.

Note: The other manufacturing product branch includes 1. Furniture manufacturing, 2. Cultural goods, sporting and athletic and recreation products, 3. Instruments, meters and other measuring equipments, 4. Cultural and office equipments. The printers, typewriter and other office equipments are included in Office, Accounting and Computing Machinery branch.

Table 2 - Basic Data on Output and Employment for Germany, 1995

Industrial Census	Gross Value	Gross Value	Gross Value	Employment
	of Output at factor cost (mill. US\$)	Added at factor Cost (mill. US\$)	Added in Branch as % of Total	(persons)
1. Food and Kindred Products	250,236.86	50,905.69	7.87	563935
2. Textiles Mill Products	31,981.16	9,959.47	1.54	150334
3. Wearing apparel	22,525.72	6,123.18	0.95	102923
4. Leather products and Footwear	7,531.65	2,099.69	0.32	35383
5. Wood products	30,766.93	10,225.04	1.58	122445
6. Paper Products, Printing Publishing	121,194.77	44,720.11	6.91	539005
7. Chemicals Ailled Products	225,774.37	73,210.73	11.32	553305
8. Petroleum Coal Products	116,156.73	3,860.14	0.60	24679
9. Rubber and Plastic products	88,810.56	32,147.68	4.97	365773
10. Non-Metallic Mineral Products	74,059.28	29,008.39	4.49	284002
11. Basic Metal Products	106,157.60	31,597.91	4.89	299347
12. Fabricated metal products	115,254.29	46,192.13	7.14	546678
13. Machinery and Equipment	245,947.47	95,144.26	14.71	1039431
14. transport equipment	313,690.86	94,068.31	14.54	895895
15. Office, Accounting and Computing machinery	30,380.74	7,478.10	1.16	66620
16. Electrical Machinery and Equipment	255,053.06	91,404.82	14.13	1009334
17. Other manufacturing products	51,374.94	18,640.97	2.88	249661
Total Manufacturing:	2,086,896.97	646,786.64	100.00	6848750

Sources: *Produzierendes Gewerbe. Fachserie 4. Reihe 4.3. Kostenstruktur der U 1995*

The second version (table 3) refers to output and employment in all village collectives plus all enterprises at village level and above with annual sales of more than one million yuan. Affiliated units of enterprises outside the industrial sector are excluded. Less information is available for the wider coverage of enterprises at village level and above (table 3). Here only gross output and total taxes are given. First, we adjusted gross output figures to factor cost. For this we applied the proportion of sales and other taxes to total taxes from township level and above to the total tax figures for village level and above. This gave us an estimate of sales taxes. As total taxes for village and above are only 9 per cent higher than in township and above, this is a fairly safe assumption. A similar procedure was used to estimate value added taxes. The final step was to apply value added/gross output ratios (at factor cost) from the 1995 IO table to get estimates of gross value added at village level and above.

Table 3 provides the widest coverage for which any sectoral detail is available in the census. Though table 3 does not have complete coverage it accounts for a very substantial proportion (84.6 per cent) of total output in the census and 75.5 per cent of employment. Excluded are primarily the smallest enterprises: small private enterprises, small sole proprietorships and small collectives. One would indeed expect productivity to become higher as coverage becomes more limited and smaller enterprises are excluded. But the difference in productivity is also due in part to the fact that the average value added-output ratio for township enterprises and above (which is available in the census) is three per cent higher than the ratio from the 1995 IO table applied in table 3 (26.7% versus 23.7 percent).

The data used in the China and Germany comparison have slight differences compared to the similar coverage data displayed in the table 9 (wider coverage) and table 10 (limited coverage) in Szirmai, Bai, and Ren (2001). The differences come from the two sources; one is that there are 17 branches in China and Germany comparison following to the new classifications system while only 16 branches used in Szirmai, Bai, and Ren (2001). The other is that there are different sub-industries in the branch of other manufacturing in the China and Germany comparison. The basic data on Chinese gross value of output, gross value added and employment for the benchmark comparison 1995 with wider coverage are presented in table 3.

Table 3
Basic Data on Output and Employment for China, 1995

	Gross Value of Output at factor cost (mill. Yuan)	Gross Value Added at factor cost (mill. Yuan)	Gross Value Added in Branch as % of Total	Employment (persons)
1. Food and Kindred Products	731,816.92	147,746.10	11.02	8,060,400
2. Textiles Mill Products	555,730.46	93,184.25	6.95	10,140,000
3. Wearing apparel	223,256.52	50,404.88	3.76	4,188,700
4. Leather products and Footwear	140,776.90	18,750.25	1.40	2,365,600
5. Wood products	70,053.16	18,031.79	1.34	1,621,600
6. Paper Products, Printing Publishing	199,510.39	39,111.31	2.92	4,023,100
7. Chemicals Allied Products	634,149.27	123,228.74	9.19	7,526,800
8. Petroleum Coal Products	204,731.75	59,962.99	4.47	949,100
9. Rubber and Plastic products	250,812.39	49,696.98	3.71	3,849,900
10. Non-Metallic Mineral Products	496,560.76	140,212.23	10.45	13,847,500
11. Basic Metal Products	579,001.11	123,872.72	9.24	5,823,400
12. Fabricated metal products	271,971.29	63,702.98	4.75	4,340,000
13. Machinery and Equipment	540,770.08	111,145.12	8.29	10,247,200
14. transport equipment	369,806.08	91,532.33	6.82	4,793,200
15. Office, Accounting and Computing machinery	43,442.53	11,577.30	0.86	202,100
16. Electrical Machinery and Equipment	556,036.07	128,145.51	9.55	6,120,300
17. Other manufacturing products	274,688.02	70,919.35	5.29	6,669,490
Total Manufacturing:	6,143,113.71	1,341,224.85	100.00	94,768,400

Data Sources: data on enterprises at village level and above with more than 1 million sales eddy annex 9

Col. 1: Number of enterprises from Industrial Census, 1995 p. 3 ff.

Col. 2: Gross value of output (new concept), Industrial Census, 1995 p. 3 ff. The new concept is net of value added tax, but gross of sales and other taxes

Col. 3: GVO adjusted to factor cost by deducting estimates of sales and other taxes. These taxes are estimated using the proportions of sales and other taxes to total taxes at township level and above (census p. 46), where more detail on taxes is provided. For page 3 only total taxes are given.

Col. 4: Value added at factor cost calculated by applying gross value added/gross output ratios from the 1995 IO table, p. 82 ff. (33 x33 use matrix) where the 1995 IO table does not have sufficient detail, it is broken down using proportions from the 1997 IO table. In some cases, value added at factor cost calculated by applying gross value added/gross output ratios from the 1995 Census data, p. 46.

Col. 7: Employment (year end from Industrial Census, 1995, p. 3 ff.) , deducting service staffs.

Notes: (a) teamaking reclassified from beverages to food manufacturing, (b) Other manufacturing includes the unallocated residual for total industry. It is assumed that this residual is primarily included in manufacturing. (c) For the census total the adjustment tot factor cost and market prices was done by deducting and adding the same absolute amount of taxes as for total industry village level and above. The small individual enterprises pay income tax. We assume they do not pay much in the way of sales and vat. We used the same proportions of value added to gross output as for total industry at village level and above.

3.3 Data for Deriving Chinese Unit Value

In the ICOP methodology, as a first step, unit values are derived by dividing ex-factory output values by produced quantities for each product *i* in each country. However, because of the data limitation, this approach was not applied satisfactorily in the 1985 China and US comparison (Szirmai and Ren, 2000). In the comparison, authors have adopted the following procedure to derive unit value for Chinese products. They divided output quantities from a long list in 1985 census, which is quite similar to the long list of quantities from the 1995 Census (p. 234), into output values from the census to derive unit values. The disadvantages of the procedure should be noted that one does not know what products are included in sectoral gross output. In one sector the value of output may indeed consist exclusively of the commodity listed in the commodity list. In the other sector, there may be many other products. So the coverage of

gross output and quantities may not be the same. This will affect the reliability of the unit values. If we only use the original data from the 1995 Industrial Census of China, we may face the same unsatisfactorily unit value. For the current study and further research agenda, we need to construct a commodity list of Chinese products with their corresponding quantities, output values and unit values for purposes of international comparisons. We have the following data sources for this task:

1. *Long list of quantities from the Census, p. 234*

The table heading is translated as: output of major industrial products of industrial enterprises and subsidiary units dealing with industrial production. We know that in principle the coverage of this list is intended to be for the total economy. However, based on the examination of data from the various sources, it is possible that output of the small private enterprises and sole proprietorships is not well covered. On the other hand, the subsidiaries (non independent accounting enterprises) are explicitly included.

A problem with this list is that it is not complete. The NBS has a longer list of quantities, which has not been published because NBS has doubts about the quality of the data. This means that using the quantities as weights may involve bias. Sometimes the quantities listed seem to be very modest for a large country as China. The possible incompleteness of the quantity list is a potential source of bias in the weighting of the unit values from the matches.

2. *Average prices for large & medium enterprises by quality from the Census, p. 314*

The table heading is translated as: product quality of national large-scale and medium-scale independent accounting enterprises. Since IAS enterprises are generally limited to township and above levels, so that most probably the coverage of this data is identical to p. 46 ff of census: independent accounting enterprises at township level and above, but within that category limited to large and medium. Within that category large and medium enterprises account for 56 per cent of gross output and 62 per cent of value added. This source provides total quantity and total value, so that one can calculate unit values for 450 items. It also provides quantities and values of first, second and third quality products.

The average prices can be used directly in product matches with the Germany. The unit values can be weighted by the quantities in the list. Once the unit values by sample industry have been derived, they can be applied at township level and above. The branch unit values calculated at township level and above can also be applied to higher levels of coverage such as p. 3 of census.

3. *Average prices and sales revenues from Census, p. 382*

The table heading is translated as: sales income and sales expenditure of national large-scale and medium-scale independent accounting enterprises. This table lists some 450 average prices and sales revenues for large sale and medium scale independent accounting enterprises. The coverage of this list is identical to previous source. This table contains information about average prices, sales revenue and sales cost. We may safely assume the average prices refer to sales prices. Dividing sales revenue by average prices would result in an implicit sales quantity list, which could well be used as weights for the calculation of UVRs for township and above.

4. *Ex factory prices from a government agency website*

This is a data set of firm level ex factory prices from a government agency price website, starting 1998. We have used the price index to put the price back to the 1995 benchmark. Because at present the data on detailed price indexes are not satisfactory, this price backward

procedure is very rough.

For the current studies, we compared the value, quantities and prices information from the different sources to compile a 1995 Chinese commodity listing. This list provided a unit value list for a large number of commodities. The coverage of the unit value list is identical to the coverage of the large and medium enterprises for the township and above.

When we have the output values and average prices data, we can divide output values from the census by average prices from large and medium coverage to derive the quantities information. This procedure is definitely preferable to the procedure adopted in the 1985 China and US comparison. The rationale behind the approach is that average prices from large and medium coverage are applicable to the whole economy, which is a reasonable assumption often used in ICOP. This procedure avoids one of the important drawbacks of early procedure, namely that the coverage of the quantities and the values may not correspond.

So this unit value list can be used to derive unit value ratios at sample industry level. At the lowest level we weight unit value ratios with quantities from the commodity list. Then the sample industry unit value ratios can be weighted using gross output at township level and above figures to get branch uvr. This will immediately give a benchmark comparison for township and above (p. 46 of the census), which is consistent with the Chinese time series. We call this comparison is the comparison with limited coverage. As next step we can apply the branch PPPs to higher levels of coverage such as Census p.3: village and above. This covers 85 percent of Chinese output. This is the standard ICOP approach. Once you have derived UVRs you assume they are representative for larger aggregates. As Maddison and van Ark 1988 have showed, it is much safer to makes this assumption for prices than for output quantities or value of output.

4. Results at Branch Level

4.1 Purchasing Power Parities and Relative Price Levels

According to the revised ICOP classification system, we selected 52 sample industries for the 17 branches of manufacturing. The sample industries on the Germany side consist of one or more four digit industries. The Chinese census is still not classified by industry codes. However, it is possible to organize industries based on the similar codes used in the International Standard Industrial Classification (ISIC). In the current study totally 297 products or group of products were matched in 52 sample industries belonging to 17 branches of manufacturing. The matched value of output accounts for 32.8% of the gross value of output in China and 21.49% in Germany. Because of the tremendous efforts made in reorganizing the value, quantity, and price information provided in the 1995 Chinese census as well as the additional information from other sources, the number of matching made in the current study has grown by large scale compared to the previous benchmark study between China and US. Table 4 shows the coverage ratios at branch and sample industry levels and Table 5 shows the PPPs at branch level:

Table 4
Coverage Ratio: Gross Value of Matched as % of Total Gross Value of Output in Sample Industries: China and the Germany, 1995

	Branch and Sample Industries within the Branch	China 1995	Germany 1995	Number of Matches
1	Food and Kindred Products	33.83	20.51	18
	1. Forage and Grain Mill Products	18.65	37.67	3
	2. Edible Vegetable Oil	11.62	18.54	3
	3. Salt Industry	31.73	84.91	1
	4. Sugar & Sugar Factories	47.97	68.16	1
	5. Food Products	9.87	4.50	2
	6. Milk	22.23	6.35	1
	7. Beverages	41.32	58.34	6
	8. Tobacco	93.03	23.56	1
2	Textiles Mill Products	39.81	42.38	23
	9. Fibre Raw and Processed Industry	31.70	0.82	1
	10. Textile , Printing and Dyeing Product	41.05	40.66	19
	11. Knitting Industry	34.61	90.25	3
3	Wearing Apparel	10.12	19.58	4
	12. Wearing Apparel	11.54	21.03	4
4	Leather Products and Footwear	13.76	36.36	5
	13. Curryng Leather	33.55	61.17	2
	14. Leather Industry	12.19	33.14	3
5	Wood Products	14.86	34.72	4
	15. Wood Products	11.54	81.86	1
	16. Man Building Board Proceeding	29.82	81.93	3
6	Paper Products, Printing Publishing	43.54	11.54	6
	17. Paper Products, Printing Publishing	79.40	62.60	6
7	Chemicals Ailled Products	15.79	8.00	30
	18. Inorganic Chemicals	80.66	9.33	5
	19. Fertilizer	11.34	44.19	3
	20. Pesticides	2.02	59.92	2
	21. Organic Chemicals	27.12	5.47	11
	22. Chemical Fibres	23.63	36.55	1
	23. Special Purpose Chemical Products	5.67	4.39	3
	24. Daily Chemical Products	27.03	26.63	5
8	Petroleum Coal Products	63.42	13.80	13
	25. Petroleum Refineries	63.42	13.80	13
9	Rubber and Plastic Products	68.05	39.39	13
	26. Rubber Products	37.45	22.01	3
	27. Plastics	84.86	45.37	10

10	Non-Metallic Mineral Products	18.49	13.90	19
	28. Cements	16.95	16.65	2
	29. Glass and Glass Fibres products	66.87	25.82	7
	30. Concrete Products and Fibrotile	4.37	4.42	3
	31. Waterproof, Heat Preservation			
	32. and Asbestos Products	30.20	34.50	5
	33. Other Enduring Fire Materials	77.63	78.95	2
11	Basic Metal Products	71.76	36.31	24
	34. Iron and Steel	170.61	0.05	12
	35. Non-ferrous Metals	47.68	58.26	12
12	Fabricated Metal Products	6.15	17.05	6
	36. Fabricated Metal Products	6.15	17.05	6
13	Machinery and Equipment	18.35	17.17	70
	37. Industry Boiler	49.12	7.42	9
	38. Metal Proceeding Industry	21.96	40.97	26
	39. Common Machine Industry	6.61	10.92	11
	40. Machine Industry for Other Purpose	6.32	15.74	15
	41. Agriculture and Forest Machine Industry	54.80	76.52	9
14	Transport Equipment	32.71	39.17	12
	42. Railway Industry	66.30	66.36	4
	43. Road Transport Equipment	42.23	40.72	5
	44. Ships	47.46	43.65	3
15	Office, Accounting and Computing Machinery	20.91	33.68	6
	45. Office, Accounting and Computing Machinery	20.91	33.68	6
16	Electrical Machinery and Equipment	23.92	14.81	39
	46. Electrical Machinery and Equipment Industry	13.78	10.01	11
	47. Lights and Bulbs	20.28	47.95	2
	48. Electrical Household Appliances	52.06	28.20	5
	49. Electronics and Telecommunication	59.43	13.22	4
	50. Communication Equipment	35.36	39.77	2
	51. Measurement Instruments	11.77	9.94	15
17	Other Manufacturing Products	3.17	1.99	5
	52. Other Manufacturing Products	3.17	1.99	5
Total Manufacturing:		32.80	21.49	297

Sources: value: IAS enterprises at township level and above p.46 price: l and m enterprises at township level and above p.46

Table 5
Purchasing Power Parities and Price Levels by Major Manufacturing Branch
China and the Germany, 1995

Branch industry	----- PPP (Yuan/DM) -----			Relative Price Level China (Germany = 100)
	at Chinese Quantity Weights	at Germany Quantity Weights	Geometric Average	
1. Food and Kindred Products	3.66	3.59	3.62	62.17
2. Textiles Mill Products	1.89	2.47	2.16	37.04
3. Wearing Apparel	1.02	1.04	1.03	17.61
4. Leather Products and Footwear	1.19	1.04	1.11	19.11
5. Wood Products	1.92	2.12	2.01	34.55
6. Paper Products, Printing Publishing	3.29	3.87	3.57	61.24
7. Chemicals Allied Products	2.00	3.59	2.68	45.97
8. Petroleum Coal Products	7.10	6.98	7.04	120.85
9. Rubber and Plastic Products	1.80	2.92	2.29	39.37
10. Non-Metallic Mineral Products	2.91	2.47	2.68	46.05
11. Basic Metal Products	5.66	2.51	3.77	64.69
12. Fabricated Metal Products	1.65	1.57	1.61	27.60
13. Machinery and Equipment	0.87	3.03	1.63	27.93
14. Transport Equipment	1.44	3.25	2.16	37.15
15. Office, Accounting and Computing Machinery	1.61	4.39	2.66	45.67
16. Electrical Machinery and Equipment	0.89	3.33	1.72	29.52
17. Other Manufacturing Products	0.73	1.24	0.95	16.35
Total Manufacturing:	2.55	3.29	2.89	49.68
Official Exchange Rate		5.83		

Sources: IAS enterprises at township level and above, value data refer to IAS enterprises at township level and above from p.46 of census, price data refer to large and medium enterprises at township level and above.

4.2 Structural Analysis of Manufacturing Industries for Both Countries

We use the following tables to display the structural differences between China and Germany at the different coverage. Table 6 showed the structural differences in manufacturing between the two countries where the Chinese data refer to IAS enterprises at township level and above; while the table 7 showed the structural differences in manufacturing between the two countries where the Chinese data refer to enterprises at village level and above with more than 1 million sales:

Table 6
Gross Value Added, Gross Value of Output in Branch as % of Total
China and the Germany, 1995

	Gross Value of Output in Branch as % of Total		Gross Value Added in Branch as % of Total		Gross Value Added in Branch as % of Gross Value of Output	
	China	Germany	China	Germany	China	Germany
	1. Food and Kindred Products	13.04	11.99	14.18	7.87	27.26
2. Textiles Mill Products	9.58	1.53	7.46	1.54	19.51	31.14
3. Wearing Apparel	3.06	1.08	2.88	0.95	23.62	27.18
4. Leather Products & Footwear	2.03	0.36	1.67	0.32	20.68	27.88
5. Wood Products	0.84	1.47	0.79	1.58	23.45	33.23
6. Paper Products, Printing Publishing	2.71	5.81	2.45	6.91	22.63	36.90
7. Chemicals Ailled Products	11.64	10.82	11.71	11.32	25.23	32.43
8. Petroleum Coal Products	4.22	5.57	4.66	0.60	27.68	3.32
9. Rubber and Plastic Products	3.64	4.26	3.02	4.97	20.80	36.20
10. Non-Metallic Mineral Products	6.28	3.55	7.47	4.49	29.81	39.17
11. Basic Metal Products	10.48	5.09	11.25	4.89	26.93	29.77
12. Fabricated Metal Products	3.44	5.52	3.19	7.14	23.26	40.08
13. Machinery and Equipment	8.58	11.79	9.29	14.71	27.15	38.68
14. Transport Equipment	6.88	15.03	6.68	14.54	24.37	29.99
15. Office, Accounting and Computing machinery	0.73	1.46	0.76	1.16	26.27	24.61
16. Electrical Machinery and Equipment	11.60	12.22	11.30	14.13	24.43	35.84
17. Other Manufacturing Products	1.24	2.46	1.23	2.88	24.72	36.28
Total Manufacturing:	100.00	100.00	100.00	100.00	25.07	30.99

Sources: Chinese data on IAS enterprises at township level and above

Table 7
Gross Value Added, Gross Value of Output in Branch as % of Total
China and the Germany, 1995

	Gross Value of Output in Branch as % of Total		Gross Value Added in Branch as % of Total		Gross Value Added in Branch as % of Gross Value of Output	
	China	Germany	China	Germany	China	Germany
	1. Food and Kindred Products	11.91	11.99	11.02	7.87	20.19
2. Textiles Mill Products	9.05	1.53	6.95	1.54	16.77	31.14
3. Wearing apparel	3.63	1.08	3.76	0.95	22.58	27.18
4. Leather products and Footwear	2.29	0.36	1.40	0.32	13.32	27.88
5. Wood products	1.14	1.47	1.34	1.58	25.74	33.23
6. Paper Products, Printing Publishing	3.25	5.81	2.92	6.91	19.60	36.90
7. Chemicals Ailled Products	10.32	10.82	9.19	11.32	19.43	32.43
8. Petroleum Coal Products	3.33	5.57	4.47	0.60	29.29	3.32
9. Rubber and Plastic products	4.08	4.26	3.71	4.97	19.81	36.20
10. Non-Metallic Mineral Products	8.08	3.55	10.45	4.49	28.24	39.17
11. Basic Metal Products	9.43	5.09	9.24	4.89	21.39	29.77
12. Fabricated metal products	4.43	5.52	4.75	7.14	23.42	40.08
13. Machinery and Equipment	8.80	11.79	8.29	14.71	20.55	38.68
14. transport equipment	6.02	15.03	6.82	14.54	24.75	29.99
15. Office, Accounting and Computing Machinery	0.71	1.46	0.86	1.16	26.65	24.61
16. Electrical Machinery and Equipment	9.05	12.22	9.55	14.13	23.05	35.84
17. Other manufacturing products	4.47	2.46	5.29	2.88	25.82	36.28
Total Manufacturing:	100.00	100.00	100.00	100.00	21.83	30.99

Data Sources: Chinese data on enterprises at village level and above with more than 1 million sales

4.3 Benchmark Comparison based on Data on Enterprises at Township Level and above

Application of the geometric average PPPs from table 5 to the gross value of output at factor cost columns of China and the Germany in tables 1 and 2 gives the result that in PPP valuation Chinese manufacturing GDP in the census, which refers to the IAS enterprises at township and above, is 79.52 per cent of that in the Germany. It is important to note that this figure is twice as high as a figure calculated using the exchange rate. In the comparison presented in this section, all data for the Chinese side limits the coverage to the IAS enterprises at township and above. So the comparisons provided the insight on the Chinese manufacturing comparative performance at the higher administrative level. Table 8 shows the gross value of output comparison by branches in the manufacturing between China and Germany and table 9 shows the per capita comparisons in terms of gross value of output in the manufacturing by the branches between the two countries. Usually, the international comparisons of productivity focus on the value added rather gross value of output, because the measurement of gross value of output involves the double counting problem. However, in the current comparison we will also present the comparisons in manufacturing between China and Germany in terms of gross value of output as the starting point of the construction of internationally comparable database, which may be useful in the other type research, like KLEMS study.

**Table 8 - Gross Value of Output by Major Manufacturing Branch
China and the Germany, 1995**

	---- at Chinese prices ----			----- at Germany prices -----			Geometric China/ Germany %
	China	Germany	China/ Germany	China	Germany	China/ Germany	
	In million Yuan		%	In million DM		%	
1. Food and Kindred Products	626275.00	898192.81	69.73	171282.56	250236.86	68.45	69.08
2. Textiles Mill Products	460400.00	78989.56	582.86	244116.60	31981.16	763.31	667.01
3. Wearing Apparel	147015.00	23337.67	629.95	144646.82	22525.72	642.14	636.01
4. Leather Products and Footwear	97441.00	7837.23	1243.31	81768.85	7531.65	1085.67	1161.82
5. Wood Products	40553.00	65102.00	62.29	21174.69	30766.93	68.82	65.48
6. Paper Products, Printing Publishing	130399.00	469461.62	27.78	39674.24	121194.77	32.74	30.15
7. Chemicals Ailled Products	559099.00	809930.19	69.03	279478.43	225774.37	123.79	92.44
8. Petroleum Coal Products	202812.00	810888.35	25.01	28553.81	116156.73	24.58	24.80
9. Rubber and Plastic products	174753.00	259197.58	67.42	96902.32	88810.56	109.11	85.77
10. Non-Metallic Mineral Products	301836.00	182944.28	164.99	103568.60	74059.28	139.85	151.90
11. Basic Metal Products	503251.00	266499.68	188.84	88904.29	106157.60	83.75	125.76
12. Fabricated Metal Products	165072.00	180728.60	91.34	100073.32	115254.29	86.83	89.05
13. Machinery and Equipment	412223.00	745009.73	55.33	471598.12	245947.47	191.75	103.00
14. Transport Equipment	330328.00	1020887.11	32.36	229473.62	313690.86	73.15	48.65
15. Office, Accounting and Computing Machinery	35056.00	133255.86	26.31	21710.93	30380.74	71.46	43.36
16. Electrical Machinery and Equipment	557314.00	849001.34	65.64	626883.12	255053.06	245.79	127.02
17. Other Manufacturing Products	59709.00	63460.38	94.09	81296.56	51374.94	158.24	122.02
Total Manufacturing:	4803536.00	6864723.98	69.97	1885656.41	2086896.97	90.36	79.52

Sources: IAS enterprises at township level and above

Table 9
Gross Value of Output per Person Employed
China and the Germany, 1995

	-- at Chinese Prices --		---- at Germany Prices ----		Geometric		
	China	Germany	China/ Germany	China	Germany	China/ Germany	
	In Yuan		%	In DM		%	
1. Food and Kindred Products	109720.74	1592724.00	6.89	30007.98	443733.51	6.76	6.83
2. Textiles Mill Products	55661.68	525427.10	10.59	29513.33	212734.01	13.87	12.12
3. Wearing Apparel	56138.31	226748.79	24.76	55234.01	218859.95	25.24	25.00
4. Leather Products and Footwear	70840.42	221497.00	31.98	59446.64	212860.72	27.93	29.89
5. Wood Products	40736.31	531683.61	7.66	21270.40	251271.41	8.47	8.05
6. Paper Products, Printing Publishing	46956.79	870978.22	5.39	14286.73	224849.06	6.35	5.85
7. Chemicals Ailled Products	92016.10	1463804.21	6.29	45996.35	408046.86	11.27	8.42
8. Petroleum Coal Products	294699.22	32857423.23	0.90	41490.58	4706703.31	0.88	0.89
9. Rubber and Plastic Products	70641.52	708629.62	9.97	39171.44	242802.39	16.13	12.68
10. Non-Metallic Mineral Products	39595.43	644165.48	6.15	13586.33	260770.27	5.21	5.66
11. Basic Metal Products	110082.03	890270.09	12.37	19447.08	354630.57	5.48	8.23
12. Fabricated Metal Products	60932.41	330594.25	18.43	36939.69	210826.65	17.52	17.97
13. Machinery and Equipment	55661.43	716747.65	7.77	63678.70	236617.41	26.91	14.46
14. Transport Equipment	89164.57	1139516.47	7.82	61941.22	350142.44	17.69	11.77
15. Office, Accounting and Computing Machinery	346745.80	2000238.13	17.34	214747.11	456030.32	47.09	28.57
16. Electrical Machinery and Equipment	106423.03	841150.05	12.65	119707.74	252694.41	47.37	24.48
17. Other Manufacturing Products	50859.45	254186.18	20.01	69247.49	205778.80	33.65	25.95
Total Manufacturing:	75633.87	1002332.39	7.55	29690.52	304712.10	9.74	8.57

Sources: IAS enterprises at township level and above

By applying PPPs derived in the current study, we can make the bilateral comparisons of value added in manufacturing between China and the Germany for 1995. The results compared were presented in Table 10:

Table 10
Gross Value Added by Major Manufacturing Branch
China and the Germany, 1995

	---- at Chinese prices ----			----- at Germany prices -----			
	China	Germany	China/ Germany	China	Germany	China/ Germany	Geometric China/ Germany
	million Yuan	(%)	million DM	(%)	(%)	%	%
1. Food and Kindred Products	170735.00	182719.39	93.44	46695.03	50905.69	91.73	92.58
2. Textiles Mill Products	89845.00	24598.68	365.24	47638.26	9959.47	478.32	417.98
3. Wearing Apparel	34729.00	6343.89	547.44	34169.57	6123.18	558.04	552.71
4. Leather Products and Footwear	20147.00	2184.88	922.11	16906.61	2099.69	805.19	861.67
5. Wood Products	9508.00	21635.91	43.95	4964.59	10225.04	48.55	46.19
6. Paper Products, Printing Publishing	29506.00	173228.41	17.03	8977.28	44720.11	20.07	18.49
7. Chemicals Ailled Products	141038.00	262632.03	53.70	70501.07	73210.73	96.30	71.91
8. Petroleum Coal Products	56133.00	26947.58	208.30	7902.94	3860.14	204.73	206.51
9. Rubber and Plastic Products	36343.00	93824.43	38.74	20152.56	32147.68	62.69	49.28
10. Non-Metallic Mineral Products	89991.00	71657.73	125.58	30878.50	29008.39	106.45	115.62
11. Basic Metal Products	135533.00	79323.89	170.86	23943.25	31597.91	75.77	113.78
12. Fabricated Metal Products	38394.00	72433.22	53.01	23276.00	46192.13	50.39	51.68
13. Machinery and Equipment	111916.00	288205.45	38.83	128035.98	95144.26	134.57	72.29
14. Transport Equipment	80512.00	306139.39	26.30	55930.41	94068.31	59.46	39.54
15. Office, Accounting and Computing Machinery	9209.00	32800.39	28.08	5703.33	7478.10	76.27	46.27
16. Electrical Machinery and Equipment	136137.00	304261.47	44.74	153130.89	91404.82	167.53	86.58
17. Other Manufacturing Products	14761.00	23026.07	64.11	20097.78	18640.97	107.82	83.14
Total Manufacturing:	1204437.00	2127566.34	56.61	472808.85	646786.64	73.10	64.33

Sources: IAS enterprises at township level and above

The comparisons between China and Germany in terms of gross value added per person are presented in table 11. This should be regarded as a major finding from the current comparison. At branch level there is quite large variation in relative productivity performance. Highest labour productivity is found in office, accounting and computing machinery (30.49% of the Germany level), leather products and footwear (22.17%), wearing apparel (21.72), other manufacturing products (17.68) and electrical machinery and equipment (16.69%). Low relative productivity is found in paper products, printing & publishing (3.59%), non-metallic mineral products (4.31%), and wood products (5.68%). For total manufacturing, if the data used are limited to the enterprises at township and above, Chinese productivity was 6.94 per cent of the Germany level.

Table 11
Gross Value Added per Person Employed
China and the Germany, 1995

	-- at Chinese Prices --			---- at Germany Prices ----			Geometric China/ Germany (%)
	China In Yuan	Germany In DM	China/ Germany (%)	China In DM	Germany In DM	China/ Germany (%)	
1. Food and Kindred Products	29912.05	324007.88	9.23	8180.77	90268.72	9.06	9.15
2. Textiles Mill Products	10862.13	163626.88	6.64	5759.40	66248.97	8.69	7.60
3. Wearing Apparel	13261.42	61637.26	21.52	13047.80	59492.83	21.93	21.72
4. Leather Products and Footwear	14647.04	61749.47	23.72	12291.25	59341.83	20.71	22.17
5. Wood Products	9550.98	176698.97	5.41	4987.03	83507.18	5.97	5.68
6. Paper Products, Printing Publishing	10625.14	321385.53	3.31	3232.73	82967.90	3.90	3.59
7. Chemicals Ailled Products	23211.93	474660.50	4.89	11603.01	132315.32	8.77	6.55
8. Petroleum Coal Products	81564.95	1091923.69	7.47	11483.49	156414.00	7.34	7.41
9. Rubber and Plastic Products	14691.16	256509.99	5.73	8146.40	87889.69	9.27	7.29
10. Non-Metallic Mineral Products	11805.19	252314.18	4.68	4050.70	102141.51	3.97	4.31
11. Basic Metal Products	29646.73	264989.78	11.19	5237.39	105556.14	4.96	7.45
12. Fabricated Metal Products	14172.23	132497.04	10.70	8591.78	84496.05	10.17	10.43
13. Machinery and Equipment	15111.74	277272.33	5.45	17288.38	91534.95	18.89	10.15
14. Transport Equipment	21732.39	341713.47	6.36	15097.15	104999.26	14.38	9.56
15. Office, Accounting and Computing Machinery	91088.03	492350.44	18.50	56412.77	112250.00	50.26	30.49
16. Electrical Machinery and Equipment	25996.32	301447.76	8.62	29241.42	90559.54	32.29	16.69
17. Other Manufacturing products	12573.25	92229.36	13.63	17119.07	74665.14	22.93	17.68
Total Manufacturing:	18964.41	310650.32	6.10	7444.59	94438.64	7.88	6.94

Sources: IAS enterprises at township level and above

4.4 The Bilateral Comparison of Labor Productivity based on Data on Enterprises at Village Level and above

In the comparison presented in this section, all data for the Chinese side used in the comparisons have much wider coverage. As we have demonstrated that the data at this lower administrative level account for a very substantial proportion (84.6 per cent) of total output in the census and 75.5 per cent of employment. Excluded are primarily the smallest enterprises: small private enterprises, small sole proprietorships and small collectives. The comparison of labor productivity at this level may have much more sense because the Germany data does have a complete coverage. Table 12 shows the gross value of output comparison by branches in the manufacturing between China and Germany and table 13 shows the per capita comparisons in terms of gross value of output in the manufacturing by the branches between the two countries.

Table 12
Gross Value of Output by Major Manufacturing Branch
China and the Germany, 1995

	---- at Chinese prices ----			----- at Germany prices -----			Geometric China/ Germany (%)
	China In million Yuan	Germany	China/ Germany (%)	China In million DM	Germany	China/ Germany (%)	
1. Food and Kindred Products	731816.92	898192.81	81.48	200147.66	250236.86	79.98	80.73
2. Textiles Mill Products	555730.46	78989.56	703.55	294663.40	31981.16	921.37	805.12
3. Wearing Apparel	223256.52	23337.67	956.64	219660.21	22525.72	975.15	965.85
4. Leather Products and Footwear	140776.90	7837.23	1796.26	118134.72	7531.65	1568.51	1678.53
5. Wood Products	70053.16	65102.00	107.61	36578.15	30766.93	118.89	113.11
6. Paper Products, Printing Publishing	199510.39	469461.62	42.50	60701.57	121194.77	50.09	46.14
7. Chemicals Ailled Products	634149.27	809930.19	78.30	316994.03	225774.37	140.40	104.85
8. Petroleum Coal Products	204731.75	810888.35	25.25	28824.10	116156.73	24.81	25.03
9. Rubber and Plastic Products	250812.39	259197.58	96.76	139078.02	88810.56	156.60	123.10
10. Non-Metallic Mineral Products	496560.76	182944.28	271.43	170384.26	74059.28	230.06	249.89
11. Basic Metal Products	579001.11	266499.68	217.26	102286.30	106157.60	96.35	144.69
12. Fabricated Metal Products	271971.29	180728.60	150.49	164880.00	115254.29	143.06	146.72
13. Machinery and Equipment	540770.08	745009.73	72.59	618660.66	245947.47	251.54	135.12
14. Transport Equipment	369806.08	1020887.11	36.22	256898.42	313690.86	81.90	54.47
15. Office, Accounting and Computing Machinery	43442.53	133255.86	32.60	26904.89	30380.74	88.56	53.73
16. Electrical Machinery and Equipment	556036.07	849001.34	65.49	625445.67	255053.06	245.22	126.73
17. Other Manufacturing Products	274688.02	63460.38	432.85	374000.42	51374.94	727.98	561.34
Total Manufacturing:	6143113.71	6864723.98	89.49	2411515.55	2086896.97	115.56	101.69

Data Sources: data on enterprises at village level and above with more than 1 million sales

Table 13
Gross Value of Output per Persons Employed
China and the Germany, 1995

	---- at Chinese prices ----			----- at Germany prices -----			Geometric China/ Germany (%)
	China In Yuan	Germany	China/ Germany (%)	China In DM	Germany	China/ Germany (%)	
1. Food and Kindred Products	90791.64	1592724.00	5.70	24830.98	443733.51	5.60	5.65
2. Textiles Mill Products	54805.77	525427.10	10.43	29059.51	212734.01	13.66	11.94
3. Wearing Apparel	53299.72	226748.79	23.51	52441.14	218859.95	23.96	23.73
4. Leather Products and Footwear	59510.02	221497.00	26.87	49938.59	212860.72	23.46	25.11
5. Wood Products	43200.03	531683.61	8.13	22556.83	251271.41	8.98	8.54
6. Paper Products, Printing Publishing	49591.21	870978.22	5.69	15088.26	224849.06	6.71	6.18
7. Chemicals Ailled Products	84252.17	1463804.21	5.76	42115.38	408046.86	10.32	7.71
8. Petroleum Coal Products	215711.46	32857423.23	0.66	30369.92	4706703.31	0.65	0.65
9. Rubber and Plastic Products	65147.77	708629.62	9.19	36125.10	242802.39	14.88	11.70
10. Non-Metallic Mineral Products	35859.24	644165.48	5.57	12304.33	260770.27	4.72	5.13
11. Basic Metal Products	99426.64	890270.09	11.17	17564.71	354630.57	4.95	7.44
12. Fabricated Metal Products	62666.20	330594.25	18.96	37990.78	210826.65	18.02	18.48
13. Machinery and Equipment	52772.47	716747.65	7.36	60373.63	236617.41	25.52	13.71
14. Transport Equipment	77152.23	1139516.47	6.77	53596.43	350142.44	15.31	10.18
15. Office, Accounting and Computing machinery	214955.06	2000238.13	10.75	133126.29	456030.32	29.19	17.71
16. Electrical Machinery and Equipment	90851.11	841150.05	10.80	102192.00	252694.41	40.44	20.90
17. Other Manufacturing Products	41185.70	254186.18	16.20	56076.23	205778.80	27.25	21.01
Total Manufacturing:	64822.39	1002332.39	6.47	25446.41	304712.10	8.35	7.35

Data Sources: data on enterprises at village level and above with more than 1 million sales

Similarly, by using PPPs from table 5, we can make the bilateral comparisons of value added in manufacturing between China and the Germany for 1995. The results compared were presented in Table 14:

Table 14
Gross Value Added by Major Manufacturing Branch
China and the Germany, 1995

	---- at Chinese prices ----			----- at Germany prices -----			
	China	Germany	China/ Germany	China	Germany	China/ Germany	Geometric China/ Germany
	million Yuan	(%)	million DM	(%)	(%)	%	%
1. Food and Kindred Products	147746.10	182719.39	80.86	40407.70	50905.69	79.38	80.12
2. Textiles Mill Products	93184.25	24598.68	378.82	49408.82	9959.47	496.10	433.51
3. Wearing Apparel	50404.88	6343.89	794.54	49592.94	6123.18	809.92	802.19
4. Leather Products and Footwear	18750.25	2184.88	858.18	15734.51	2099.69	749.37	801.93
5. Wood Products	18031.79	21635.91	83.34	9415.27	10225.04	92.08	87.60
6. Paper Products, Printing Publishing	39111.31	173228.41	22.58	11899.72	44720.11	26.61	24.51
7. Chemicals Ailled Products	123228.74	262632.03	46.92	61598.71	73210.73	84.14	62.83
8. Petroleum Coal Products	59962.99	26947.58	222.52	8442.16	3860.14	218.70	220.60
9. Rubber and Plastic Products	49696.98	93824.43	52.97	27557.48	32147.68	85.72	67.38
10. Non-Metallic Mineral Products	140212.23	71657.73	195.67	48110.84	29008.39	165.85	180.14
11. Basic Metal Products	123872.72	79323.89	156.16	21883.35	31597.91	69.26	104.00
12. Fabricated Metal Products	63702.98	72433.22	87.95	38619.33	46192.13	83.61	85.75
13. Machinery and Equipment	111145.12	288205.45	38.56	127154.06	95144.26	133.64	71.79
14. Transport Equipment	91532.33	306139.39	29.90	63586.06	94068.31	67.60	44.96
15. Office, Accounting and Computing Machinery	11577.30	32800.39	35.30	7170.07	7478.10	95.88	58.17
16. Electrical Machinery and Equipment	128145.51	304261.47	42.12	144141.83	91404.82	157.70	81.50
17. Other Manufacturing Products	70919.35	23026.07	308.00	96559.97	18640.97	518.00	399.43
Total Manufacturing:	1341224.85	2127566.34	63.04	526505.73	646786.64	81.40	71.64

Sources: data on enterprises at village level and above with more than 1 million sales

An international comparison of labor productivity based on PPPs valuation in terms of value added with wider coverage was presented in Table 15. This should be regarded as another major finding from the current study. The highest labor productivity is found in leather products (25.11% of Germany level) and wearing apparel (23.73% of Germany level). The lowest productivity is found in petroleum and coal products (0.65% compared with Germany) and Non-Metallic Mineral Products (5.13%).

Table 15
Gross Value Added per Persons Employed
China and the Germany, 1995

	---- at Chinese prices ----			----- at Germany prices -----			Geometric
	China	Germany	China/ Germany	China	Germany	China/ Germany	China/ Germany
	In Yuan		(%)	In DM		(%)	(%)
1. Food and Kindred Products	18329.87	324007.88	5.66	5013.11	90268.72	5.55	5.61
2. Textiles Mill Products	9189.77	163626.88	5.62	4872.66	66248.97	7.36	6.43
3. Wearing Apparel	12033.54	61637.26	19.52	11839.70	59492.83	19.90	19.71
4. Leather Products and Footwear	7926.21	61749.47	12.84	6651.38	59341.83	11.21	11.99
5. Wood Products	11119.75	176698.97	6.29	5806.16	83507.18	6.95	6.61
6. Paper Products, Printing Publishing	9721.68	321385.53	3.02	2957.85	82967.90	3.57	3.28
7. Chemicals Ailled Products	16372.00	474660.50	3.45	8183.92	132315.32	6.19	4.62
8. Petroleum Coal Products	63178.79	1091923.69	5.79	8894.92	156414.00	5.69	5.74
9. Rubber and Plastic Products	12908.64	256509.99	5.03	7157.97	87889.69	8.14	6.40
10. Non-Metallic Mineral Products	10125.45	252314.18	4.01	3474.33	102141.51	3.40	3.69
11. Basic Metal Products	21271.55	264989.78	8.03	3757.83	105556.14	3.56	5.35
12. Fabricated Metal Products	14678.11	132497.04	11.08	8898.46	84496.05	10.53	10.80
13. Machinery and Equipment	10846.39	277272.33	3.91	12408.66	91534.95	13.56	7.28
14. Transport Equipment	19096.29	341713.47	5.59	13265.89	104999.26	12.63	8.40
15. Office, Accounting and Computing Machinery	57284.86	492350.44	11.63	35477.74	112250.00	31.61	19.18
16. Electrical Machinery and Equipment	20937.78	301447.76	6.95	23551.43	90559.54	26.01	13.44
17. Other Manufacturing Products	10633.38	92229.36	11.53	14477.84	74665.14	19.39	14.95
Total Manufacturing:	14152.66	310650.32	4.56	5555.71	94438.64	5.88	5.18

Data Sources: data on enterprises at village level and above with more than 1 million sales

5. Concluding Remarks

In this paper, we have made a new effort on estimating the PPPs, and international comparison of real output, gross value added and labor productivity in manufacturing industries between China and the Germany for the benchmark year 1995. The findings derived in current study can be compared with the estimates presented in the previous comparisons done in the same framework between China and the US both for 1985 and 1995. The comparison of labor productivity has shown that the gaps in terms of labor productivity between China and Germany are quite large, the findings found in this study are generally consistent with the findings derived in the other two benchmark comparison between China and US in manufacturing. The dynamic analysis among these benchmark comparisons would be very useful for an assessment of China's economic performance in an international and dynamic perspective.

Chinese manufacturing GDP converting into Germany currency by PPPs provides labor productivity in 1995 of 6.94 percent of the Germany level if the Chinese data coverage was limited on the enterprises at township and above; and 5.18 percent of the Germany level if the Chinese data coverage was expanded to the enterprise at village level. This is quite similar to the figure derived in the 1985 benchmark comparison between China and the US (Szirmai and Ren, 2000) and higher than the figures derived in the preliminary 1995 benchmark comparison between China and the US (Bai and Ren, 2000). It has been found that the relative productivity performance at branch level varied considerably, from 22.17 percent of the Germany level in

leather products and footwear to 3.59 per cent in paper products based on the narrow coverage data while from 19.71 percent of the Germany level in wearing apparel to 3.28 per cent in paper products based on the wider coverage data.

In Szirmai and Ren (1995, 2000), the first benchmark comparison between China and US for 1985, using the ICOP methodology was presented. One of the problems of the 1985 benchmark was that the Chinese industrial census presents a wealth of commodity quantity information, while does not provide the values information in the way that two variables can be recognized as in the consistent fashion. So the calculation of unit values had to be undertaken by an unsatisfactory way that the quantities of commodities and subsector values of output came from two tables, and they may represent different coverage. This weakened the reliability of the unit value ratios in that comparison.

Based on the 1995 new industrial census, as well as other sources of data, Szirmai, Bai, and Ren, (2001) discussed various issues on concepts, coverage and consistency in Chinese data of quantity, value, price, and employments in manufacturing. The findings derived from that paper help us to improve the estimation of unit value of Chinese commodities in the China and Germany comparison. The some 750 well defined unit values list of Chinese commodities built for the new benchmark comparison between China and US and used in the current benchmark comparison between China and Germany should be regarded as a major step forward.

Also based on the discussion provided by Szirmai, Bai, and Ren (2001) about the statistical problems involved in putting together time series of output and employment, which are consistent in concept and coverage over time and consistent with each other in terms of their coverage, we could construct the basic data for output and employments for China's manufacturing by branch in 1995. We presented the two productivity comparisons between China and Germany in manufacturing based on the basic data. With the data for China referring to the limited coverage, we made the bilateral comparison, which is consistent with time series of output and labor.

The labour productivity comparison in 1995 at village level and above, based on our industry of origin comparisons, provided a lower comparative performance of Chinese manufacturing against Germany. Although this is an estimate, which used the data depending on more adjustments and assumptions, therefore are subject to more errors, it may be closer to the reality. This is because the Germany data have a completed coverage, so the use of Chinese data with more completed coverage, generally speaking, could improve the assessment of Chinese labour productivity from an international comparative perspective.

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Chinese-English Glossary of Concepts

Ownership categories

Affiliated units

Collectives

Collective enterprises at township and above

Enterprises with independent accounting systems at township level and above

Rural collectives

Rural township collectives, non IAS

State-owned enterprises, non IAS

Township and village enterprises

Urban state-owned enterprises

Urban collective enterprises

State-owned enterprises

 Central government owned enterprises

 Provincial, district and county owned enterprises

 County owned enterprises

Collective enterprises

 County collectives

 Rural township collectives

 village collective enterprises

 urban township cooperative enterprises

 rural cooperatives

Joint ventures (between Chinese state enterprises and other Chinese enterprises)

individual enterprises/sole proprietorships

private enterprises (including limited liability companies)

incorporated enterprises (also called share holding enterprises)

joint ventures enterprises, " "

Foreign funded enterprises

 Non-Chinese foreign funded

 Joint ventures

 Collaborations

 Foreign owned

 Overseas Chinese funded

 Joint ventures

 Collaborations

 Foreign owned

Other enterprises

Employment

social labour force

staff and workers

on-post staff and workers

not-on-post staff and workers

Output, sales and taxes

Gross value added

Gross output (new concept)

Gross output (old concept)

Net industrial output (net material product)

Non-material inputs

Sales revenue

Sales and other taxes

Value added tax

Total taxes