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COMPARATIVE OUTPUT AND LABOUR PRODUCTIVITY IN MANUFACTURING FOR CHINA, JAPAN, KOREA AND THE UNITED STATES FOR 1935 BY A PRODUCTION PPP APPROACH[*]

Kyoji Fukao
Hitotsubashi University

Harry X. Wu[**]
The Hong Kong Polytechnic University

Tangjun Yuan
Hitotsubashi University

ABSTRACT

In this study, following the standard methodology for measuring industry-of-origin or production-side PPPs, we compared the unit values of manufacturing products in China, Japan, Korea and the US to calculate unit value ratios (UVRs) and hence derived PPP measures for individual manufacturing industries using the US as the base country. In any case the estimated production PPPs for total manufacturing are only between half and two thirds of the prevailing market exchange rates, suggesting much lower cost of production in manufacturing in these countries compared with that of the US. However, or findings show that manufacturing of "producer goods" was more costly than that in Japan. The PPP results are used to estimate total and industry-level output and labour productivity in China, Japan and Korea relative to those of the US for *circa* 1935. It shows that the size of factory manufacturing in Japan was 11.5 percent of the US level whereas in China and Korea only one percent or lower. In terms of comparative labour productivity in *circa* 1935, measured as PPP$ per hour worked with the US as the base, Japanese and Korean manufacturing on average was 23 and 21 percent of the US level, whereas Chinese manufacturing on average was only 6 percent of the US level.

Key Words: Production (industry-of-origin) purchasing power parity, unit value ratio, comparative output and labour productivity in PPPs, economic development

***JEL* References**: L60, O47, P52

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[**] Send correspondence to Harry X. Wu at afhxwu@inet.polyu.edu.hk.

1. INTRODUCTION

The Post-World War II rapid economic development of the East Asian economies cannot be well understood without a proper measure of the pre-WWII economic conditions in an internationally comparative framework. What is missing in the conditional convergence literature is a measure on real production costs at industry level especially for producer goods manufactures that play a key role in the modern economic development.

Level of a country's real per capita GDP measured by expenditure-side purchasing power parities (PPPs) is by nature a measure of a nation's welfare level relative to that of the benchmark country. While it may suggest the country's relative stage of economic development but does not *directly* measure the level of its industrialization and (industry-specific) labour productivity compared with those of the benchmark country.[1] It has been widely accepted that "industry-of-origin" or production-side PPP approach is a more appropriate, *direct* method for measuring such conditions between countries or in an internationally comparative framework (Rostas, 1948; Paige and Bombach, 1959; Maddison, 1970 and 1983).[2] This is because by comparing industry-specific prices between countries it measures the real factor costs of production at industry level taking into account the prices of tradables and (implicitly) non-tradables, an approach that can shed important light on a country's comparative advantage and international competitiveness.

The current study attempts to fill this gap in literature to measure the pre-WWII East Asia comparative output and labour productivity by constructing the production-side PPPs in manufacturing for three major East Asian economies, China, Japan and Korea, with the US as the reference country for *circa* 1935 – the best pre-war period. This is particularly important for the understanding of the pre-war economic conditions in China. Compared with Japan and Korea,[3] historical macroeconomic

[1] The expenditure PPP approach was pioneered by Gilbert and Kravis (1954) and developed by Kravis, Heston and Summers in the International Comparison Program (ICP) since the 1960s and resulted in the Penn World Tables (see Kravis, Heston and Summers, 1982; Summers and Heston, 1991).

[2] See Maddison and van Ark (2002) for a comprehensive review of the industry-of-origin PPP approach developed in the International Comparison of Output and Productivity (ICOP) program led by Maddison at University of Groningen.

[3] Among the East Asian economies, the most consistent and reliable long-term GDP series going back to the late-19th century are available only for Japan, partly thanks to the efforts of the Long-Term Economic Statistics (LTES) project under the leadership of Kazushi Ohkawa at the Institute of Economic Research of Hitotsubashi University in Japan, leading to a publication of 14 volumes for

statistics for China are sketchy. Solid economic statistics for standard national accounts are only available for the mid 1930s, thanks to the pioneering work on constructing China's GDP for the period 1931-36 by Ou (1947), Liu (1947), and Liu and Yeh (1965). We argue that by benchmarking China with the leading regional (Japan) and international (the US) economies where better and longer time series data are available, together with other social and economic information, we may find a sensible way to quantitatively position China. Of course, focusing on one benchmark (i.e. 1935) is insufficient to anchor a long historical course of China's industrialization that began in the late period of the Qing Empire, but it is an important starting point.

In addition, a production-side PPP study also plays a complementary role in checking any existing expenditure PPP study for the same countries during the same period. In particular, this study may help complement recent studies for Japan/China, Japan/US and China/US for *circa* 1935 using the expenditure PPP approach (see Fukao, Ma and Yuan, 2007, for example).[4] In theory, a country's PPP GDP estimated by expenditure and production approach respectively should be the same or at least well reconciled. A production-side PPP study on manufacturing is one important step towards that goal.

Like many production-side PPP studies, the current study concentrates on the manufacturing sector. Although there are generally more data available for manufacturing than for other industries, it is the importance of manufacturing in modern economic development rather than the data availability that has been the major motivation behind these studies. Among all industries, manufacturing plays the most important role especially at the early stage of industrialisation. It is the most dynamic sector because manufactured goods have relatively high income elasticity of demand; they are highly tradable and have greater potential to gain from specialisation and economies of scale through trade. Manufacturing growth is also one of the main sources of technological progress. Therefore, as found in many studies, the substantially rising share of manufacturing is almost a universal feature of rapid

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Japan (an abridged English version by Ohkawa and Shinohara, 1979). The Hitotsubashi group extended this line of research to two former Japanese colonies, Taiwan and Korea, with the 1988 publication of a statistical volume compiled by Mizoguchi and Umemura. The volume provides annual estimates of GDP and its various components for these two economies during the period of Japanese occupation based on the detailed economic statistics of the colonial administrations.

[4] The recent study by Fukao, Ma and Yuan (2007) for the first time constructs expenditure PPPs for Japan/China, Japan/US and China/US for circa 1935. Together with other studies (Fukao, Ma and Yuan, 2006; Yuan and Fukao, 2002), this study also extends the expenditure PPP-based international comparison to Taiwan and Korea for the same period.

structural transformation at the early stage of industrialisation (Kuznets, 1971; Chenery, Robinson and Syrquin, 1986).

This paper proceeds as follows. In Section 2 we provide a general picture of China, Japan, Korea and the US with their output and employment structures and foreign trade by major commodity groups, which serves as a useful background for the whole study. Section 3 presents the standard industry-of-origin PPP approach and discusses measurement issues concerned. In Section 4, data sources are provided and problems are discussed for individual countries. In Section 5 we report the estimated PPPs and discuss the results against the background of cost conditions in individual countries. In Section 6 we apply the estimated PPPs to cross country output and labour productivity comparisons. Finally, we conclude this study in Section 7.

2. The Chinese, Japanese, Korean and the US Economies in the mid 1930s

The selected countries in the current study are fairly representative for different stages of modern economic development. By the mid 1930s, while the US was the world's leading industrial power, just recovered from the Great Depression in 1929-33, the Japanese economy had already undergone a rapid catch up with the West in industrialisation that began during the Meiji period (1868-1912).[5] China's modern industrial development was motivated by its consecutive failures in wars with the Western powers since the First Opium War (1840), but had been slow and defence oriented. Japan's rising as the major regional military power in competing with China's military build up in 1880s and success in defeating the Qing Imperial Navy in 1894 forced China to fasten its own industrialization since the 1900s. However, the political and social chaos in the early period of the Republican China (1911 to the early 1920s) significantly delayed the course of the industrial development. By the time of the mid-1930s (our benchmark year), China had just enjoyed its first "golden period" of industrialization, but it was still well below the level of Japan (Table 1). Korean economy in our comparison serves as a different reference. Korea underwent its modern industrial development when it was held as the Japanese colony in 1910-1945.[6] However, the Korean development was typically a colonial one concentrating

[5] The Meiji Restoration (1868) was the catalyst toward industrialization in Japan that led to the rise of the island nation as a major military power by 1905, under the slogan of "Enrich the country, strengthen the military" (fukoku kyōhei). See Beasley (1995).

[6] According to Korean legal thought, *de jure* sovereignty was not transferred to the Emperor of Japan with the forced end of the Joseon dynasty, such that the Provisional Government of the Republic of Korea became the *de jure* government of the Korean people from 1919 to 1948, and the foreign

on agricultural and primary resource-based manufacturing that well complemented the resource-hungry Japanese economy. The integration of the Japanese and Korean economies through colonialism might lead to a faster growth in Korea in terms of per capita output or GDP (Table 1) but might not be a "healthy" manufacturing development (Table 2).

Income Level and Economic Structure

Both the level and the structure of GDP in Table 1 indicate different stages of economic development. The US was the largest economy in total and per capita GDP and left other countries far behind. In *circa* 1935, in terms of total GDP measured by market exchange rate, China was 12 percent of the US level, followed by Japan (8 percent) and Korea (1 percent). If measured by per capita GDP at market exchange rate, the order changed, because of the removal of the population effect, and more appropriately reflects the stage of development with \$450 for the US and \$64 for Japan, followed by \$28 for Korea and \$14 for China.

TABLE 1

BASIC NATIONAL ACCOUNTS INDICATORS FOR COUNTRIES IN COMPARISON IN 1935

	USA	China[5]	Japan	Korea
Total GDP (in mil US\$)[1]	65,400	9,522	4,445	651
Population (thousand persons)	127,250	488,531	69,254	22,899
GDP per Capita (US\$)	514	14	64	28
PPP GDP per Capita (Expenditure PPP\$)[2]	514	45	143	66
Structure of GDP: (%)[3]	100.0	100.0	100.0	100.0
Agriculture, Fishery, Forestry	11.7	62.5	18.1	49.0
Mining	2.1	0.9	30.3	2.1
Manufacturing[4]	23.4	10.1		10.2
Construction	2.3	1.7	6.3	3.3
Utilities	3.8	0.7	10.2	2.5
Transportation	6.5	5.7		6.7
Other Services	50.2	18.4	35.1	26.2

Sources: For total GDP, industrial composition of GDP and population, Chinese data are from Ou (1947, p.17，Table.4), Yeh (1965, pp…) and Luo (2000, pp…), Korea data are from Kim (2006, pp.393 and 420, Table I-2 and I-9), Japanese data are form Ohkawa, Shinohara and Umemura (1974, pp…), and the US data are from U.S. Department of Commerce Bureau of the Census (1976, Part I, p.224.).

Notes:

1) All figures measured in US\$ in this table are simply converted by the prevailing market exchange rate. In 1935, 1 US\$ was equal to 3.43 Japanese Yen and 3.01 Chinese Yuan. Korean Won = Japanese Yen. (References???)
2) Based on Fucao, Ma and Yuan for the average of 1934-36 (2007, Table …), suggesting a PPP converter as 3.21, 2.23 and 2.36 for China, Japan and Korea, or 31, 45 and 42 percent of the US price level, respectively.
3) Industry compositions of GDP are calculated in nominal terms of national currencies. Industry composition data for Japan is based on net domestic product.

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governors merely exercised *de facto* rule for the period. After the Japanese defeat in WWII, Korea came under US and Soviet control.

4) See Table 2 for the structure of manufacturing by factory production.
5) Yeh (1965, pp…) estimated China's 1935 GDP at 1933 prices. We use weighted agricultural and industrial price indices for 1933-35 to adjust the estimate to 1935 prices.

It is however more sensible to convert these per capital figures into PPPs. By applying the only available bilateral expenditure PPP estimates in Fucao, Ma and Yuan (2007) to the above figures, we can come out with per capita PPP estimates as $143 for Japan, $66 for Korea and $45 for China. It shows that while Japan had already reached to nearly one third of the US level of per capita PPP GDP, China only achieved one tenth of the US level, which was even 30 percent below the Korean level.

The GDP structure of these countries also reflects different stages of economic development. As shown in Table 1, in *circa* 1935 China had the largest share in agriculture (62.5 percent), followed by Korea (49.0), Japan (18.1) and the US (11.7). In the same period, one forth of the US GDP (25.5) was produced by the industrial sector (manufacturing and mining). By contrast, as the country that experienced the most rapid catch up with the US, 30.3 percent of Japanese GDP came from industry, compared with only 12.3 in Korea and 11.0 in China. Furthermore, China's relative inferior position in industrialization is also reflected by the development of the so-called facilitating industry such as utilities and transportation. In *circa* 1935, only 6.4 percent of the Chinese GDP was produced by facilitating industry, whereas the share was over 10 percent in both the US and Japan and about 9 percent in Korea.

Manufacturing Structure

The structure of the manufacturing sector in these countries also indicates the different level of development. In Table 2, we first present the share of factory manufacturing in total manufacturing, which indicates to what extent the economy has transformed from traditional to modern manufacturing. We then examine the structure of factory manufacturing among these countries.

As Table 2 shows, the factory share of the US manufacturing was 95.5 percent (as shown in the figures in brackets under manufacturing GVA), compared with 72.3 percent in the case of Japan. Such a difference looks plausible given the stage of their development. In fact, the definition of "factory" in the US statistics is more stringent than that in the Japanese statistics. In the US statistics, "factory" was defined as any enterprise that produced $5000 or more output (ref, xxxx, pp…) whereas in Japan it was defined as any enterprise that hired five or more workers and used machine power (ref, xxxx, pp…). China's factory share in manufacturing was only 11.4 percent. This is from Makino and Kubo (1997) who adjusted Ou's estimates (1947) based on Lieu's industrial survey on factories (1937). According to Lieu, Chinese factories were defined by *Factory Law* as enterprises that used machine power and hired 30 or more workers. However, the actual survey conducted by Lieu ended up with many factories that did not meet the *Factory Law* criteria. Data from those factories that did not meet the standard set by the *Factory Law* are also included in this study. Even so, the Chinese criteria were more stringent than those of Japan. However, the factory share in Korean manufacturing (75.6) seems too high based on the income level in Korea. While we may have good reason to believe that, as already discussed, the colony's economy was largely integrated with the Japanese economy and underwent a much faster industrialization than China, its factory share might not be more than 50 percent of total manufacturing.[7]

TABLE 2

TOTAL AND PER EMPLOYEE GROSS VALUE ADDED IN MANUFACTURING, AND MODERN MANUFACTURING STRUCTURE FOR COUNTRIES IN COMPARISON IN 1935

	USA	China	Japan	Korea
Total manufacturing GVA (in mil US$)[1]	19,496	1,059	1,575	68
Manufacturing GVA by factory[2] (in mil US$)	18,616	121	1,138	51
	(95.5)	(11.4)	(72.3)	(75.6)
GVA per factory employee (US$)[3]	2,246	154	482	307
Structure of factory manufacturing: (%)[4]	100.0	100.0	100.0	100.0
Food, beverage and tobacco	15.0	14.9	11.6	35.8
Textiles, wearing apparel, leather products	13.8	43.1	19.3	11.9
Wood and allied products	4.8	0.2	1.8	3.9
Paper, printing and publishing	6.9	8.1	2.9	4.6
Chemicals and allied products	19.0	13.4	18.6	29.2
Building materials	3.2	6.5	4.3	4.6
Basic and fabricated metals	13.3	4.8	15.9	4.2
Machinery and transportation equipment	19.4	7.8	22.0	2.6
Miscellaneous manufacturing	4.7	1.3	3.6	3.1

Sources: US data are from U.S. Department of Commerce (1935, pp…), Chinese data from Makino and Kubo (2005, pp…), Japanese data from The Ministry of Commerce and Manufacturing (No Shomu-sho) (1935, pp…), Korean data from Kim (2006, pp…). (Some note on China).

Notes:

1) See Table 1 for market exchange rates used for conversion.
2) In the US "factory production" is defined as any enterprise with $5000 or more annual production. In Japan it is defined as any enterprise with five or more workers using power in production. In Korea it is defined as any enterprise with at least 10 workers in production. In the case China, it is defined as production with 30 or more workers using power. Since the Chinese definition is much more stringent, we include factories with less than 30 workers.
3) Since the employment here is based on numbers employed rather than hours worked, this measure should not be taken as a strict measure of labour productivity. See Table 6 for the conversion of industry level numbers employed into hours worked.
4) Output (GDP) shares are calculated in national currencies.

[7] On the other hand the total manufacturing data may have a problem. All these are worth a further investigation.

Growth is inevitably unbalanced within the manufacturing sector during industrialisation. Empirical studies have found that typically, driven by the significant growth of intermediate demand in total production, investment goods industries are the fastest growing industries, followed by intermediate goods industries and then light industries that mainly produce consumer goods (Nishimizu and Robinson, 1984). Such observations should be confirmed by our country cases in the current study.

To help our examination we can roughly reclassify all manufacturing industries into two groups: one that is agricultural or primary resource-based manufactures that largely concentrated on the production of "consumer goods" (including food, textiles, wood and paper products, excluding miscellaneous) and the other that is mineral-based intermediate materials production and machinery manufacturing that focused on the production of "producer goods" (i.e. including chemicals, building materials, metals and machinery). The re-grouping shows that the share of "consumer goods" in China and Korea was indeed high, about 66 and 56 percent of the total manufacturing, respectively, whereas the same share in the US and Japan was much lower or 40 and 36, respectively. As for the share of "producer goods", it was low in China (34) and Korea (44), but high in the US (60) and particularly Japan (64). Obviously, the structure of the Chinese and Korean manufacturing was much "lighter" than that of the US and Japan because they were still at the earlier stage of industrialization, by contrast, the US and Japanese manufacturing were much more "heavier".

Furthermore, the structure of the Korean manufacturing does not suggest that Korea was more industrialized than China. Although Korea had smaller "consumer goods" manufacturing than China, 64 percent of the Korean "consumer goods" engaged in "food" whereas in China 65 percent of "consumer goods" were textiles (taking the group total as 100, Table 2). In the case of "producer goods", 37 percent of the Chinese heavy industries engaged in the production of "metals" and "machinery", whereas only 16 percent in the case of Korea. By contrast, 59 percent of the Japanese "producer goods" industries engaged in "metals" and "machinery", even higher than that of the US (55). However, considering the integration of the Japanese and Korean economies, we argue that the overly "heavy" Japanese manufacturing might be complemented by the excessively "light" Korean manufacturing.

Trade Patterns

The history of modern economic development has shown that countries tend to export primary goods to exchange for manufactured goods especially machinery at the early stage of development. Along with industrialization, their exports will become more concentrated on sophisticated manufactured goods and their imports will be mainly primary goods or (simple) manufactured goods that could be produced cheaply in low income countries. This is reflected by the structure of trade of the countries in our comparison for *circa* 1935. We can divide the commodities traded in Table 3 into three categories: 1) "primary goods" including "food stuff and live animals" and "crude materials, minerals, fuels", 2) "(relatively) simple manufactured goods" that includes all manufactured goods except "machinery and transport equipment", and 3) "sophisticated manufactured goods", that is, "machinery and transport equipment".

As Table 3 shows, with higher level of industrialization compared with China and Korea, the US and Japan exported more manufactured goods than primary goods. It should be noted here that resource endowment plays a role in determining trade patterns. Since the US is relatively resource rich and Japan is excessively resource scarce, the export of primary goods was extremely low in Japan (only 12 percent compared with 40 percent in the US). The case of China and Korea just shows the opposite: 67 percent of the Chinese exports and 76 percent of the Korean exports were primary goods. Again, the Korean case further supports our postulation about the "colonial integration" of the Korean and Japanese economies. It should be noted that China was also an important importer of primary goods (49 percent of total imports). Although China has a much larger territory than Japan, it is not rich in resource endowment on per capita basis; besides, China's poor infrastructure back to the 1930s prohibited lost-cost extraction of natural resources.

Table 3 also shows that 81 percent of the Japanese exports focused on simple or less sophisticated manufactured goods, which looked rather excessive compared with the US (37), China (33) and Korea (23). It is clear that in the mid 1930s, the US was the most important, if not the sole, player in the export of machinery and transport equipment, accounting for 23 percent of its total exports. The Japanese machinery export was about 7 percent of its total exports, whereas only one percent for Korea and nothing for China.

TABLE 3

EXPORT AND IMPORT VALUES FOR CHINA, JAPAN, KOREA AND THE US BY MAJOR COMMODITY GROUP IN *CIRCA* 1935

(In million US dollars; national currencies are converted at market exchange rate[5])

	USA		China		Japan		Korea	
	Export	Import	Export	Import	Export	Import	Export	Import
Total value	2243.1	2038.9	172.8	222.4	979.6	997.7	160.5	193.3
Food stuffs and live animals[1]	458.7	1074.4	37.1	59.5	97.2	583.9	94.4	32.3
Crude materials, minerals, fuels[2]	432.3	312.2	78.5	48.6	21.6	106.5	27.1	32.0
Chemicals	103.1	68.7	3.5	17.9	92.6	96.3	7.1	15.3
Textiles	456.2	306.9	29.1	18.3	474.7	19.0	17.2	54.2
Manufactured goods classified chiefly by material[3]	195.6	177.2	15.5	32.0	117.5	118.2	5.2	13.9
Machinery and transport equipment	520.9	14.5	0.7	17.9	70.8	46.7	1.5	18.4
Miscellaneous manufactured articles[4]	76.3	85.1	8.3	28.2	105.1	27.1	7.9	27.2
Of which:								
"Primary"[6]	0.40	0.68	0.67	0.49	0.12	0.69	0.76	0.33
"Simple manufactured goods"[6]	0.37	0.31	0.33	0.43	0.81	0.26	0.23	0.57
"Sophisticated manufactured goods"[6]	0.23	0.01	0.00	0.08	0.07	0.05	0.01	0.10
As percentage of Gross Value of Output (%)	3.9	3.6	2.5	3.2	22.0	22.4	24.7	29.7

Sources: The US data are for merchandise activities only, including re-export of foreign merchandise, from US Department of Commerce (1937, p.428, Table 496). Data for Japan and Korea are the average of 1934-36, from Yamazawa and Yamamoto (1979, pp…) and Kim (2006, pp...). Data for China are the average of 1933 and 1938 from IER (2000).

Notes:

1) Including beverages, tobacco, and animal and vegetable oils and fats.
2) Excluding edible, including lubricants and related materials.
3) Excluding textiles.
4) Including other commodities and transactions not classified according to kind.
5) See Table 1 for exchange rate in 1935.
6) "Primary" includes "food stuffs and live animals", "crude materials, minerals and fuels"; "Simple manufactured goods" includes all manufactured except "machinery and transport equipment"; "Sophisticated manufactured goods" = "machinery and transport equipment".

Our review so far has drawn a simple background picture about (some of) the economic conditions of the selected countries in *circa* 1935, including their levels of per capital income, patterns of economic structure, patterns of manufacturing structure, and patterns of import and export trade. These patterns are in general logically coherent and suggest different comparative advantages of manufacturing industries in countries, which will be checked when we compare their producer prices that reflect the factor costs of producing the same product in different countries.[8]

3. METHODOLOGY

Methodologically, we follow the standard approach of constructing the industry-of-origin PPPs developed by the International Comparison of Output and Production Program (ICOP) at University of Groningen led by Angus Maddison (Maddison and van Ark, 1988; van Ark 1993) and its recent practices especially in pre-WWII comparisons including an UK/US comparison by de Jong and Woltjer (2007) and two UK/Germany comparisons by Broadberry and Burhop (2007) and by Fremdling, de Jong and Timmer (2007), all for 1935/36.[9]

The methodology and data used in sectoral comparisons differ significantly from the standard International Comparison Program (ICP) procedures. While price data for ICP are largely obtained from extensive price surveys conducted in the participating countries, the industry-of-origin approach relies on price data implicit in the censuses of manufacturing. No separate price surveys are conducted. The product lists and specifications are also drawn from the census data. The aggregation methodology used here is quite simple because there are only bilateral comparisons involving two countries at a time. Largely due to data constraints so that we cannot perform complicated multilateral methods to compute PPPs necessary to convert value aggregates. An important aspect of these production-side PPP comparisons is that along with price data, derived in the form of unit values, we also have quantity

[8] Kyoji, could you please follow this (as you originally suggested) in Section 5? It is to discuss if our PPP results are plausible against the background of trade.

[9] Besides, Choi (2006) and Kim, Duol and Park (2007) compared the labor productivity levels of the Japanese and the Korean manufacturing sector in the pre-war period. Their analysis is based on gross output per worker estimation. There are also some preceding PPP studies focusing on the post-war period for the countries concerned such as Pilat (1994).

data at the product level. Therefore there is no need to use the concept of basic headings[10] which is central to the ICP work.

We begin with some basic notations. Let q and p refer to quantity and price, respectively, and superscripts B and X represent the base country and the country to be compared, respectively. Subscript i refers to manufactured product, j refers to the type of industry, and k refers to the type of manufacturing branch, which is equivalent to the 2-digit level "manufacturing industry" used in ISIC.

In the standard ICOP industry-of-origin studies, prices are in fact unit values (UVs) as they are derived from data on values (v) and quantities (q) for specific manufactured products or broad categories of products, thus, for product i, $UV_i = \frac{v_i}{q_i}$. We can obtain unit value ratios (UVRs) by direct comparison of UVs between two countries, which can be used in deriving PPPs at the branch and sectoral levels. In the industry-of-origin approach, a distinction is made between UVRs and PPPs. UVRs refer to product level price information and PPPs refer to price levels at more aggregated levels, e.g. from manufacturing industries to branches and to the whole manufacturing sector.

The production PPPs are derived using a "pyramid" type approach which consists of three steps. The first step involves the derivation of industry-specific PPPs based on prices of manufactured products belonging to a particular industry and aggregated using output or sales quantities as weights. The second step uses these industry-specific PPPs and aggregated to yield branch level PPPs. Finally, the third step uses these branch-level PPPs and aggregated to derive a single PPP for the whole manufacturing sector.

Step I: Industry-specific PPPs

Let p_{ij} and q_{ij}, respectively, denote the price ($=UV_{ij}$) and quantity of manufactured product i belonging to industry j that is considered to have matching specifications and quality. For all "matched products" which are considered as typical of the industry to which they belong, the PPP for this industry using either country weights are derived as follows:

[10] For the purpose of ICP, basic headings are defined as the lowest level of aggregation at which expenditure share weights are available for the purpose of aggregation.

(1) $$PPP_j^{XB(B)} = \frac{\sum_i^m p_{ij}^X q_{ij}^B}{\sum_i^m p_{ij}^B q_{ij}^B} \quad (i = 1, 2, \ldots, m)$$

for the Laspeyres Index using the base country quantity weights.

(2) $$PPP_j^{XB(X)} = \frac{\sum_i^m p_{ij}^X q_{ij}^X}{\sum_i^m p_{ij}^B q_{ij}^X} \quad (i = 1, 2, \ldots, m)$$

for the Paasche Index using the quantity weights of the country to be compared, respectively.

The Fisher index number formula is used to compute PPPs at the industry level. Taking the geometric average of the so-constructed Laspeyres and Paasche indices we can obtain PPP for industry *j* as a Fisher Index:

(3) $$PPP_j^{XB(\text{Figher})} = \sqrt{PPP_j^{XB(B)} \times PPP_j^{XB(X)}}$$

The choice of the Fisher index is largely guided by the number of desirable statistical, axiomatic and economic–theoretic properties resulting in labels like the "ideal index" and the "superlative index" (Diewert, 1992).

Step II: Branch Level PPPs

At this stage, the so-constructed *j* industry level PPPs are aggregated to *k* branch level PPPs. It is obtained by the weighted average of sample industry PPPs using the gross value of output (GVO) of the sample industries as weights. The following formulas are developed especially to take into account the size effect of industries in aggregation (see van Ark, 1993). The calculation in this step results in two *k* level PPPs, one at the quantity weights of the base country or the Laspeyres weights:

(4) $$PPP_k^{XB(B)} = \frac{\sum_j^n \left[GVO_j^B \times PPP_j^{XB(B)}\right]}{\sum_j^n GVO_j^B} \quad (j = 1, 2, \ldots, n)$$

and the other at the quantity weights of the country to be compared or the Paasche weights:

(5)
$$PPP_k^{XB(X)} = \frac{\sum_j^n GVO_j^X}{\sum_j^n \left[GVO_j^X / PPP_j^{XB(X)} \right]} \quad (j = 1, 2, \ldots, n)$$

Using the same approach to Eq. (3), the Fisher PPP for *k* branch can be derived as follows:

(6)
$$PPP_k^{XB(\text{Figher})} = \sqrt{PPP_k^{XB(B)} \times PPP_k^{XB(X)}}$$

Step III: Deriving PPP for the Manufacturing as a Whole

The derivation of the PPP for total manufacturing follows a similar approach to Step II whereby PPPs are aggregated from the branch level to total manufacturing using the base country and alternative country branch level weights, respectively. The geometric mean of the so-constructed Laspeyres and Paasche indices finally gives the total manufacturing PPP.[11]

4. Data for Constructing PPPs

This section is to be completed.

Coverage and industrial classification

- Which part of the economy we cover for each country, the factory sector vs the traditional sector; their definitions
- How we have classified the manufacturing industries; and how they are compatible across countries in comparison

Prices or unit values

- How prices are treated in the study; cases where no unit values available; cases of final goods for which adjusted consumer prices are used
- The Ministry of Commerce and Manufacturing (No Shomu-sho), *Census of Factories* (Kojo Tokei Hyo), 1935
- Chosen Government-General (Chosen Sotoku-fu), *Statistics on Manufactured Products* (Kosan Tokei), 1935

[11] The methodology section will be extended if we eventually go with the approach of double deflation PPPs.

- US Department of Commerce, *Bicentennial Census of Manufactures*, 1935
- China: D.K. Lieu (1955); Ou (1947); Chen (1961); OIAPS (1956-57)

Gross value of output and gross value added (for industry and branch weights)

- Sources of GVO and GVA and weight problems, by country

5. Discussion of the Estimated PPPs

Following the standard methodology for constructing industry-of-origin PPPs, we first conducted three comparisons, namely, China/Japan and Korea/Japan with Japan as the base country, and Japan/US with the US as the base country. The details of the comparisons are reported in Appendix Tables A1, A2 and A3, respectively.[12] We then use Japan as the bridge country to re-base China and Korea to the US, and report a summary of the US$-based PPP estimates and relative price level by industry in Table 4.

Table 4
Summary of Estimated Purchasing Power Parities by Manufacturing Industry, China/US, Japan/US and Korea/US, in 1935

	China/US		Japan/US		Korea/US	
	PPP Yuan/$ (Fisher)[1]	Relative Price level (MER= 3.01)[2]	PPP Yen/$ (Fisher)[1]	Relative Price level (MER= 3.42)	PPP Won/$ (Fisher)[1]	Relative Price level (MER= 3.42)
Total manufacturing	2.00	0.66	1.82	0.53	1.95	0.57
Food, beverage & tobacco	1.95	0.65	2.80	0.82	2.35	0.69
Textiles, wearing apparel[3]	1.70	0.57	1.24	0.36	1.52	0.44
Wood & allied products	1.54	0.51	1.82	0.53	1.95	0.57
Paper, printing & publishing	2.05	0.68	1.82	0.53	1.95	0.57
Chemicals & allied products	1.57	0.52	1.36	0.40	1.28	0.38
Building materials	1.30	0.43	1.42	0.41	1.39	0.41
Basic & fabricated metals	2.43	0.81	2.36	0.69	1.82	0.53
Machinery[4]	2.39	0.80	2.02	0.59	1.07	0.31
Miscellaneous manufacturing	0.89	0.29	0.63	0.18	0.95	0.28

Source: Authors' calculation. See Appendix Table 1-3 for details.
Notes:
1) Fisher PPP is a geometric mean of Laspeyres and Paasche PPPs (see Eq. 3 for industry PPPs and Eq. 6 branch PPPs).
2) MER stands for market exchange rate. See Table 1.
3) Including leather products.
4) Including transportation equipment.

[12] Note that a summary of the products available, compared, and coverage ratios against the gross value of output of the industry concerned will be reported.

As the results show, the PPP for total manufacturing is the highest for China (2.00 yuan/$), followed by Korea (1.95 yen/$) and Japan (1.82 yen/$). Compared with the prevailing market exchange rate (MER), the PPP-implied relative price level for Chinese manufacturing (i.e. yuan PPP divided by yuan MER) is 0.66, suggesting that the general cost level (as reflected by producer prices in the comparison) of Chinese manufacturing was 34 percent lower than that of the US manufacturing.[13] By the same calculation, we can obtain that the general price level of Korean and Japanese manufacturing as 0.57 and 0.53 or 43 and 47 percent lower than that of the US manufacturing, respectively. The results are plausible because the US economy was richer and more industrialized than other countries in the comparison. Higher income level in the US drove up labour cost and hence the cost of all non-tradables.[14]

However, although the Japanese economy was richer and more industrialized than Korea and China, its general price level in manufacturing was not higher but lower than Korean, especially Chinese manufacturing (i.e. lower relative price level in Japanese than in Chinese manufacturing). This may be due to three factors. The first, and the most likely reason, was that the initial cost of industrialization in China was very high because of high learning cost (apparently China was then at the lower potion of the learning curve). Second, the increase in labour cost in Japan was slower than the pace of industrialization (labour market condition?). Last, the available data may be biased towards low price products in Japan and high price products in China. All these likelihoods deserve further investigation.

Turning to individual industries, still using the US as the reference, it is not surprised to find that "metals" and "machinery" in China, "metals" in Japan, and "food" in Japan and Korea were most expensive to produce. For China, this suggests high learning cost, whereas for Japan and Korea, this suggests high cost of scarce resources. On the other hand, "textiles" in Japan and Korea, and "building materials" in all the three countries were cheapest compared with those of the US.[15] The case of "textiles" may suggest higher productivity in both Japan and Korea. The case of

[13] However, to sensibly derive national manufacturing in PPPs, we may consider separating PPPs of industries whose production could be performed by traditional technologies from PPPs of new industries. We expect that prices in the former case should be lower due to competition

[14] We may need to discuss the rather big gap between PPPs and MERs (see Rao and Timmer, 2003).

[15] Here we have ignored the case of "machinery" in Korea that was in fact found cheapest in our PPP estimation (0.31 of the US level, Table 4). If there is no data problem, this may be due to the Japanese investment and production in Korea. Further investigation is required.

"building materials" may suggest lower labour costs in all the three countries compared with that of the US. Besides, "building materials" are less affect by prices of international market because they are traded in domestic market and used in construction which is largely non-tradable.

Since the level of economic development in China was closer to that of Japan than to that of the US, and historically, China and Japan were competitors, it would be very interesting to examine industry level PPPs using Japan as the benchmark, which are in fact our primary results (Table A1). After rebasing our PPP results to Japan we present the relative price level for each country of total and individual manufacturing industries in Table 5.

TABLE 5
RELATIVE PRICES OF CHINESE, KOREAN AND US MANUFACTURING BY INDUSTRY IN 1935
(Japanese = 1)

	Chinese	Korea	USA
Total manufacturing	1.25	1.07	1.88
Food, beverage & tobacco	0.79	0.84	1.22
Textiles, wearing apparel	1.56	1.23	2.76
Wood & allied products	0.96	1.07	1.88
Paper, printing & publishing	1.28	1.07	1.88
Chemicals & allied products	1.31	0.95	2.52
Building materials	1.04	0.98	2.42
Basic & fabricated metals	1.17	0.77	1.45
Machinery	1.35	0.53	1.69
Miscellaneous manufacturing	1.61	1.51	5.46

Source and *Note*: See Table 4.

First of all, it is not a surprise to see that the US price level was higher than that of Japan for all industries. Our focus here is China. In the case of China, almost all industries, except for "food" and "wood", had higher factor costs (reflected by producer prices) than those of Japan. This is not observed in the case of Korea, thanks to its colonial integration with the Japanese economy, the cost of "machinery" in Korea was only half as that in Japan. The results for China suggest that the high costs in Chinese modern manufacturing industries made it difficult to compete with foreign manufactured goods as well as with the domestic goods that could be produced with traditional technology. On the other hand, the implicit high profits as suggested by the high prices could be one of the major factors that attracted foreign traders and hence motivated them to lobby for government interventions, including using military power, for the opening up of the China market.

6. COMPARATIVE OUTPUT AND LABOUR PRODUCTIVITY

In this section, we apply the industry-specific PPPs in a cross country comparison of output and labour productivity. Output (in terms of gross value added) in PPPs provides an indicator for the size of an industry relative to the base country. Labour productivity measured as output per hour worked in PPPs reflects the level of capital deepening and the level of efficiency compared with the base country. Compared with the output conversion based on market exchange rate, the two indicators are more proper measures of the level of industrialization in an international comparison framework.

The data work required for deriving these indicators is by no means easier than that required for the price comparisons in constructing PPPs because available historical statistics were not compiled in the concept of value added and data required for estimating value added are insufficient. The data work and results reported below are preliminary and will be finalised when the further improvement is done.

Gross value added in PPPs

There are no gross value added data readily available for any country. Based on the available cost data recorded for factories, we define gross value added (GVA) as gross value of output (GVO) minus the cost of materials (*M*) and the cost of energy or electricity (*E*), that is,

(7) $$GVA_i^F = GVO_i^F - M_i^F - E_i^F ,$$

where subscript *i* indicates industry and superscript *F* stands for "factory", because only factory data can satisfy data requirement for the estimation. This approach is similar to what used in the Japanese Long-Term Economic Statistics (Ohkawa, Shinohara and Umemura, 1972). To be consistent, we apply the same approach to all countries.

Since it is impossible to have cost break down data for non-factory or handicraft manufactures, we apply value added ratio (VAR) derived from the factor sector to estimate GVA for handicraft manufactures, that is,

(8) $$GVA_i^N = GVO_i^N \times VAR_i^F = GVO_i^N \times \frac{GVA_i^F}{GVO_i^F} .$$

where superscript *N* stands for non-factory or handicraft manufacturing. However, since value added ratio in the handicraft sector may be different from that in the factory sector and the difference may vary across industries, such a treatment may distort the real GVA and labour productivity for some handicraft industries, hence industries as a whole (factory plus handicraft). This is certainly an area that deserves further research.[16]

For the factory sector, the Japanese manufacturing GVA by industry are estimated based on data from the *Census of Factories* for 1935 by the Ministry of Commerce and Manufacturing (1937? pp…); the US manufacturing GVA by industry are estimated using 1935 data from the *Bicentennial Census of Manufactures* compiled by the US Department of Commerce (? pp..); and the Korean manufacturing GVA by industry are based on data constructed by Kim for 1935 (2006, pp…).

The case of China is a bit more complicated. The most important work on China's national accounts for the mid 1930s was done by Ou (1947). Ou used data from China's factory census conducted by Lieu (1937). Lieu's census intended to cover all factories as defined by China's *Factory Law*, i.e. "enterprises that hired 30 or more workers and used power". However, the census went beyond the original scope largely because there were many factories that could not meet, yet still but close to, the standard set by the *Factory Law*. The number of factories participated the census was from 17,000 to 18,000 (check this…), of which 3,450 met the standard set by the *Factory Law*. The total number is not certain because there is some overlapping of the two categories as detected by Makino and Kubo (1997). Beside this, Ou (1947) used "net national income" that excluded capital consumption. Makino and Kubo made attempts to adjust Ou's estimates for these problems. We directly use the revised data from Makino and Kubo (1997).

Table 6 first presents the so-constructed GVA data in national currencies for individual manufacturing industries and then converts the data to PPPs reported in Table 4. To include the handicraft manufacturing, in the lower panel of Table 6 we report GVA for individual industries as a whole (factory plus handicraft). Besides, to compare with the US, in the last column of each country panel, a country/US index is provided for all industries.

[16] Ideally, if we can find some cost information on handicraft industry i that allows the derivation of a parameter λ to adjust the existing value added ratio derived from the factory sector of the same industry, we can better estimate VAR for the handicraft industry, i.e. $VAR_i^N = \lambda_i \frac{GVA_i^F}{GVO_i^F}$. This λ may be applied to other handicraft industries that likely have similar value added ratios.

TABLE 6

GROSS VALUE ADDED IN NATIONAL CURRENCIES AND IN PPPS BY MANUFACTURING INDUSTRY, CHINA, JAPAN AND KOREA IN COMPARISON WITH THE US, IN 1935

	China			Japan			Korea			US
	GVA[2] (mil. Yuan)	GVA (mil. PPP$)	GVA (US=1)	GVA[2] (mil. Yen)	GVA (mil. PPP$)	GVA (US=1)	GVA[2,3] (mil. Yen)	GVA (mil. PPP$)	GVA (US=1)	GVA
Factories										
Total manufacturing[1]	364	182	0.010	3,893	2,143	0.115	176	90	0.005	18,616
Food, beverage & tobacco	54	28	0.010	453	162	0.058	63	27	0.010	2,789
Textiles, wearing apparel	157	92	0.036	750	606	0.236	21	14	0.005	2,563
Wood & allied products	1	0	0.001	71	39	0.044	7	4	0.004	886
Paper, printing & publishing	29	14	0.011	111	61	0.048	8	4	0.003	1,286
Chemicals & allied products	49	31	0.009	725	534	0.151	51	40	0.011	3,534
Building materials	24	18	0.031	167	118	0.199	8	6	0.010	594
Basic & fabricated metals	17	7	0.003	617	262	0.106	7	4	0.002	2,469
Machinery	28	12	0.003	857	424	0.117	5	4	0.001	3,614
Miscellaneous manufacturing	5	5	0.006	140	224	0.254	5	6	0.007	882
Gross										
Total manufacturing[1]	3,881	1,942	0.104	5,387	2,966	0.159	233	120	0.006	18,616
Food, beverage & tobacco	2,707	1,389	0.498	955	341	0.122	109	46	0.017	2,789
Textiles, wearing apparel	746	439	0.171	974	787	0.307	34	23	0.009	2,563
Wood & allied products	71	46	0.052	117	64	0.073	5	3	0.003	886
Paper, printing & publishing	59	29	0.023	171	94	0.073	7	4	0.003	1,286
Chemicals & allied products	116	74	0.021	859	633	0.179	41	32	0.009	3,534
Building materials	46	36	0.060	231	163	0.274	8	5	0.009	594
Basic & fabricated metals	43	18	0.007	630	268	0.108	9	5	0.002	2,469
Machinery	66	28	0.008	1,434	709	0.196	6	6	0.002	3,614
Miscellaneous manufacturing	26	29	0.033	180	287	0.326	10	11	0.012	882

Source: Both factory and traditional GVA data are from the same sources as in Table 2. PPP converters are the estimates in Table 4.

Notes:

5) For more details of the classification see Table 2.
6) Chinese, Japanese and Korean GVA figures are estimated based on the GVA/GVO ratios of individual countries which are calculated by the authors using information from …., Kim (2006) and Ou (1946).
7) Korean Won = Japanese Yen.

It shows that for the factory sector, the size of Japanese manufacturing was 11.5 percent of the US level in PPP terms, whereas for China and Korea it was only 1.0 and 0.5 percent, respectively. Putting factory and handicraft manufactures together, the size of Japanese manufacturing raised to 15.9 percent of the US level, whereas for China the ratio increased to 10.4 percent of the US level, for Korea it increased to 0.6. It is interesting to pick up the industries in each country that were distinctly larger than the relative size to the US for the manufacturing as a whole. If excluding "building materials" (largely non-tradable), they were "textiles" in China; "textiles" and "chemicals" in Japan; and "food" and "chemicals" in Korea.

Hours worked

Numbers employed can be very different from hours worked. It is due to institutional and political factors such as laws and regulations and labour unions, labour market conditions that are related to demand and supply factors, nature of industry, i.e. level of safety or heath hazard, as well as culture or tradition that developed in history because of climate conditions and farming customs. Since these factors and conditions vary greatly among countries, it is important to convert numbers employed to hours worked in international comparison.

In the current study, data on working hours for Japan, Korea and the US are directly adopted either from government statistics or other studies. The Japanese working hours in manufacturing for 1935 are obtained from the government *Wage Statistics* complied by the Statistical Division of the Commerce and Manufacturing Minister's Office (1936? pp…). The Korean working hours in manufacturing for 1935 are obtained from Chosen Government-General, *Statistics on Manufactured Products* (1939, pp…). The US working hours data are from de Jong and Woltjer (2007).

The Chinese data on working hours are not straightforward. The 1936 Issue of *China Economic Annals*, compiled by the Ministry of Industry, is perhaps the only official publication that colleted almost all then available surveys on working hours and working days in China in different industries and regions over the period 1932-34. Based on the data from these surveys, we estimate total and average annual working hours for individual industries in *circa* 1935.

TABLE 7

NUMBERS EMPLOYED, HOURS WORKED AND ANNUAL HOURS WORKED PER PERSON BY MANUFACTURING INDUSTRY, CHINA, JAPAN, KOREA AND THE US, IN 1935

	China			Japan			Korea			US		
	Numbers employed (x1000)	Hours worked (x1000)	Hours per person	Numbers employed (x1000)	Hours worked (x1000)	Hours per person	Numbers employed (x1000)	Hours worked (x1000)	Hours per person	Numbers employed (x1000)	Hours worked (x1000)	Hours per person
Total manufacturing[1]	784	2,201	2,807	2,361	7,394	3,132	167	407	2,431	8,290	15,062	1,817
Food, beverage & tobacco	71	183	2,577	158	468	2,958	49	108	2,209	929	1,823	1,962
Textiles, wearing apparel	505	1,439	2,850	1,007	3,231	3,209	31	80	2,551	1,806	3,203	1,774
Wood & allied products	2	4	2,790	85	253	2,975	6	23	3,690	632	1,237	1,958
Paper, printing & publishing	44	129	2,914	61	197	3,256	7	22	3,097	475	901	1,896
Chemicals & allied products	63	201	3,167	229	716	3,133	43	83	1,930	1,218	2,304	1,892
Building materials	30	78	2,559	93	278	3,003	10	26	2,573	263	476	1,812
Basic & fabricated metals	23	66	2,895	218	671	3,081	7	19	2,696	1,121	2,032	1,813
Machinery	38	114	2,974	367	1,160	3,158	7	20	2,758	1,492	2,698	1,809
Miscellaneous manufacturing	8	20	2,535	144	443	3,075	6	14	2,380	355	596	1,682

Source:
Notes:

The results are reported in Table 7. It indeed shows that annual hours worked per person were very different among these countries and across industries. On average, the Korean manufacturing workers worked 2,431 hours per year, compared with 2,807 hours in China and 3,132 hours in Japan, which were 34, 54 and 72 percent higher than the US of 1,817 hours, respectively. Intuitively, the working hours in Japan might be overestimated whereas in the US might be underestimated. Some studies have found that long working hours in Japan were indeed a long tradition and only changed very recently (ref, xxxx, pp…). On the other hand, the estimation for the US by de Jong and Woltjer (2007) seems too low. If using the standard of eight hours per working day and six days per week, the average US manufacturing workers only worked for 38 weeks, by contrast the Japanese had to work for 65 weeks a year!

If taking a closer look at some industries in China and Korea, our findings suggest that the long working hours in Japanese manufacturing might not be impossible. In the case of "chemicals" in China the average annual working hours per worker were 3,167, even slightly more than the Japanese average. In the case of "wood" in Korea, it was 3,097, very close to the Japanese average, but in the case of Korean "paper" industry, it was as high as 3,690 or 18 percent more than the Japanese average working hours. Therefore, if the estimates for Japan, China and Korea are plausible for *circa* 1935, the estimates by de Jong and Woltjer (2007) for the US may be too low and hence may exaggerate the labour productivity in the US in 1935.

Labour productivity in PPPs

Based on the estimates for gross value added in Table 6 and hours worked in Table 7, we can easily calculate labour productivity in PPPs in Table 8. Note that the estimates are only for the factory sector. To compare with the US labour productivity, we have also calculated relative labour productivity for China, Japan and Korea with the US as the base (=1). It shows that on average, the Japanese and Korean labour productivity in manufacturing in 1935 was very close, or 0.29 and 0.25 PPP$ per hour, respectively, whereas China was only 0.8 PPP$ per hour. In relative terms, in 1935 the labour productivity in Japanese and Korean manufacturing was about 21-23 percent of the US level (=1.24$ per hour), whereas the labour productivity in Chinese manufacturing was only 6 percent of the US level. Clearly, even if there were underestimation of the hours worked in the US manufacturing, it may not change the pattern significantly. Given all other indicators for the level of development, especially per capital income, we feel that the Japanese labour productivity would not be more than one third of the US level in any case.

At the industry level of each country, it shows that some industries enjoyed higher labour productivity than others as compared with the country average. Importantly, in Japan, we find almost all heavy or “producer goods” industries (i.e. “chemicals”, “building materials”, “metals” and “machinery”) had higher labour productivity than light or “consumer goods” industries, suggesting heavy industries already played a major role at that stage of the Japanese industrialization. This was, however, not yet the case either in China or in Korea. In China, only “wood” and “building materials” enjoyed better labour productivity than the manufacturing average, whereas in Korea “food” and “chemicals” enjoyed better labour productivity than the manufacturing average.

TABLE 8
COMPARATIVE LABOUR PRODUCTIVITY IN PPPS BY MANUFACTURING INDUSTRY,
CHINA, JAPAN AND KOREA IN COMPARISON WITH THE US, IN *CIRCA* 1935

	China[2]		Japan		Korea		US
	Labour productivity (in PPP$)	Labour productivity (US=1)	Labour productivity (in PPP$)	Labour productivity (US=1)	Labour productivity (in PPP$)	Labour productivity (US=1)	Labour productivity (in PPP$)
Total manufacturing[1]	0.08	0.07	0.29	0.23	0.22	0.18	1.24
Food, beverage & tobacco	0.15	0.10	0.35	0.23	0.25	0.16	1.53
Textiles, wearing apparel	0.06	0.08	0.19	0.23	0.17	0.22	0.80
Wood & allied products	0.11	0.15	0.15	0.22	0.15	0.21	0.72
Paper, printing & publishing	0.11	0.08	0.31	0.22	0.19	0.13	1.43
Chemicals & allied products	0.15	0.10	0.75	0.49	0.48	0.31	1.53
Building materials	0.23	0.19	0.42	0.34	0.23	0.18	1.25
Basic & fabricated metals	0.11	0.09	0.39	0.32	0.21	0.17	1.22
Machinery	0.10	0.08	0.37	0.27	0.21	0.16	1.34
Miscellaneous manufacturing	0.27	0.18	0.50	0.34	0.41	0.28	1.48

Source:
Notes:
1) For more details of the classification see Table 2
2) For China, estimation is based on 1933 nominal GVA and 1933-35 price changes.

7. Concluding Remarks

(To be completed)

1. In this sudy, we find that manufacturing PPPs for China, Japan and Korea in 1935 were 66, 53 and 57 percent of the prevailing market exchange rates with the US dollar (Table 4), suggesting much lower production costs in these countries in producing the same or similar products than in the US in that period.
2. The results may suggest the market exchange rates of these countries might be too high given that manufactures are generally tradable goods (Rao and Timmer, 2003). If no sample bias towards low price products in our comparison, this might be due to the demand for imports in these countries were much stronger than the demand for exports from these countries, which might be plausible.
3. To compare with the expenditure PPP estimated by Fukao, Ma and Yuan (2007) for China, Japan and Korea in *circa* 1935 that also used the US as the base country, our production PPP-implied price levels for manufactures are 110, 18 and 36 percent higher than the expenditure PPPs, respectively (the expenditure PPPs are given in the Notes to Table 1). This is in line with what can be predicted by the theory that non-tradables in less developed countries are cheaper than tradables.
4. In terms of the relative size of manufacturing in PPPs in 1935, the Japanese manufacturing was 11.5 percent of the US size, whereas for China and Korea it was only 1 and 0.5 percent of the US size.
5. In terms of comparative labour productivity in 1935, measured as PPP$ per hour worked using the US as the reference country, Japanese and Korean manufacturing on average was 23 and 21 percent of the US level, whereas Chinese manufacturing on average was only 6 percent of the US level.
6. …??

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Appendix Tables

Table A1. Chinese price level (1935, Japanese=1)

			Japanese weight			Chinese weight			Japanese		Chinese		Chinese/		Chinese price level		
			I	II	III	I	II	III	Units	Prices	Units	Prices	ourc	Japanese	Japanese weight	Chinese weight	Fisher average
														exchang rate Yen/Yuan=0.88			
	All industries														**1.559**	**1.003**	**1.250**
	Textiles and their products		*0.295*			**0.474**									1.778	1.371	1.561
	Silk			*0.160*			0.117								0.929	0.929	0.929
厂丝		**Raw silk**			*1.000*			1.000	*kg*	11.352	*dan*	463.963	*a*	0.929			
	Yarn			*0.367*			0.502								1.003	1.137	1.068
棉纱		**Cotton**			*0.748*			0.340	*kg*	1.247	*jian*	162.100	*a*	0.814			
绢纱		**Silk**			*0.058*			0.330	*kg*	5.847	*dan*	323.951	*a*	1.259			
毛线		**Woolen**			*0.194*			0.330	*kg*	2.437	*jian*	642.301	*a*	1.651			
	Fabrics			*0.431*			0.268								2.761	2.840	2.800
斜纹布		**Cotton twill**			*0.135*			0.295	*m*	0.132	*shichi*	0.087	*b*	2.250			
府绸		**Poplin**			*0.125*			0.295	*m*	0.177	*shichi*	0.166	*b*	3.200			
白布		**Calico**			*0.269*			0.295	*tan(10m)*	0.526	*shichi*	0.062	*b*	4.018			
哔叽		**Serge**			*0.471*			0.114	*m*	1.617	*m*	2.948	*b*	2.072			
	Knitgoods			*0.024*			0.082								1.612	1.612	1.612
棉毛衫		**Cotton underwear**			*1.000*			1.000	*dozen*	3.957	*dozen*	5.613	*b*	1.612			
	Cotton			*0.018*			0.030								1.834	1.834	1.834
絮棉		**Cotton wadding**			*1.000*			1.000	*kg*	0.592	*dan*	47.782	*a*	1.834			
	Metals and metal products		*0.174*			0.046									1.392	0.984	1.171
	Metal smelting materials			*0.714*			0.113								1.501	1.414	1.457
生铁		**Pig iron**			*0.079*			0.250	*tons*	35.956	*tons*	64.477	*b*	2.038			
钢板		**Steel Plate**			*0.777*			0.250	*kg*	0.093	*tons*	124.458	*b*	1.524			
紫铜锭		**Copper casting, rough**			*0.090*			0.125	*tons*	738.087	*tons*	624.542	*b*	0.962			
马口铁		**Tinplate**			*0.014*			0.125	*kg*	0.303	*tons*	351.677	*b*	1.317			
铅		**Lead**			*0.012*			0.125	*kg*	0.253	*dan*	14.592	*a*	1.309			
铝锭		**Aluminum**			*0.027*			0.125		1.507	*tons*	1653.450	*b*	1.247			
	Casting			*0.077*			0.095								1.334	1.334	1.334
铸铁管		**Cast-iron pipe**			*1.000*			1.000	*kg*	0.089	*pounds*	0.047	*a*	1.334			
	Other metal products			*0.209*			0.792								1.040	0.916	0.976
元钉		**Nail**			*0.649*			0.250	*barrel*	7.097	*pounds*	0.059	*a*	0.937			
钢笔尖		**Nib**			*0.083*			0.250	*gorss*	4.200	*gross*	1.950	*b*	0.528			
伞骨		**Umbrella bone**			*0.060*			0.250	*dozen*	1.274	*dozen*	1.556	*a*	1.388			
白铁皮		**Zinc plate**			*0.208*			0.250	*kg*	0.186	*tons*	239.417	*b*	1.462			
	Machinery		*0.132*			0.049									1.216	1.490	1.346
	Machinery			*0.721*			0.171								0.941	0.993	0.967
发电机		**Generators**			*0.230*			0.300	*numbers*	997.064	*numbers*	514.771	*a*	0.587			
电动机*		**Motor ***			*0.754*			0.300	*numbers*	115.957	*numbers*	104.882	*b*	1.028			
电风扇		**Fans**			*0.016*			0.400	*numbers*	20.11142	*numbers*	34.701	*a*	1.961			
	Battery and Light bulb			*0.026*			0.266								2.111	1.259	1.630
蓄电池		**Accumulator**			*0.050*			0.300	*numbers*	14.571992	*numbers*	22.500	*b*	1.755			
电池		**Battery**			*0.278*			0.300	*numbers*	0.1198047	*dozen*	0.794	*a*	0.628			
电灯泡		**Light bulb**			*0.672*			0.400	*numbers*	0.065	*numbers*	0.158	*a*	2.751			
				0.026			0.266								2.753	2.151	2.433
体温计		**Thermometer**			*0.063*			0.300	*numbers*	0.575	*numbers*	2.000	*b*	3.950			
交流电压表		**AC voltage table**			*0.380*			0.300	*numbers*	13.665	*numbers*	12.750	*b*	1.060			
钟		**Clock**			*0.557*			0.400	*numbers*	1.594	*numbers*	5.290	*a*	3.771			
	Vehicle			*0.226*			0.296								1.811	1.811	1.811
自行车		**Bicycle**			*1.000*			1.000	*numbers*	24.768	*numbers*	39.475	*a*	1.811			
	Stone, clay, and glass products		*0.027*			0.032									1.242	0.876	1.043
	Glass			*0.284*			0.141								0.997	0.997	0.997
玻璃板		**Glass plate**			*1.000*			1.000	*box*	7.567	*box*	6.640	*b*	0.997			
	Brick and Tile			*0.131*			0.207								0.936	0.893	0.914
黑砖		**Black brick**			*0.127*			0.334	*numbers*	0.014	*numbers*	0.008	*a*	0.648			
火砖		**Common brick**			*0.724*			0.333	*numbers*	0.071	*numbers*	0.046	*a*	0.742			
瓦		**Tile**			*0.148*			0.333	*numbers*	0.043	*10000ge*	807.117	*b*	2.135			
水泥	**Cement**			*0.420*			0.430						*b*		0.610	0.610	0.610
		Cement			*1.000*			1.000	*barrel*	3.213	*tons*	38.192		0.610			
石灰	**Lime**			*0.025*			0.014								4.074	4.074	4.074
		Lime			*1.000*			1.000	*tons*	6.997	*dan*	1.254	*a*	4.074			
	Enamelware			*0.140*			0.208								3.417	3.417	3.417
搪瓷面盆口杯		**Washbasin or Cup**			*1.000*			1.000	*numbers*	0.082	*dozen*	2.957	*b*	3.417			
	Chemicals and allied products		*0.176*			0.070									2.010	0.859	1.314
	Acid			*0.292*			0.015								2.956	2.900	2.928
硫酸		**Sulfuric acid**			*0.758*			0.740	*tons*	38.087	*tons*	92.247	*a*	2.752			
盐酸		**Hydrochloric acid**			*0.069*			0.250	*tons*	36.934	*50kg*	5.553	*b*	3.417			
硝酸		**Nitric acid**			*0.173*			0.009	*tons*	110.220	*tons*	355.420	*a*	3.664			
	Soda			*0.082*			0.105								0.873	0.987	0.929
碳酸苏打		**Carbonated soda**			*0.048*			0.334	*kg*	0.126	*tons*	99.562	*a*	0.900			
烧碱		**Caustic soda**			*0.829*			0.333	*kg*	149.906	*tons*	99.562	*a*	0.755			
漂白粉		**Bleaching powder**			*0.123*			0.333	*tons*	67.397	*50kg*	4.928	*b*	1.662			
	Other industrial chemicals			*0.066*			0.044								3.333	1.872	2.498
纳夫脱（萘）		**Naphthalene**			*0.266*			0.250	*kg*	0.085	*tons*	221.452	*b*	2.977			
酒精		**Alcohol**			*0.208*			0.250	*kg*	0.756	*加仑*	1.114	*a*	8.844			
硅酸盐		**Silicate**			*0.355*			0.250	*kg*	0.070	*dan*	4.616	*a*	1.500			
明矾		**Alum**			*0.170*			0.250	*kg*	77.818	*tons*	67.034	*b*	0.979			
	Dye, Paint and Pigment			*0.082*			0.130								2.052	0.912	1.368
硫化蓝		**Blue sulfide**			*0.492*			0.334	*kg*	0.370	*jin*	0.421	*a*	2.587			
漆液		**Lacquer**			*0.095*			0.333	*kg*	3.252	*pounds*	0.553	*a*	0.426			
油漆		**Paint**			*0.413*			0.333	*kg*	0.540	*pounds*	0.385	*a*	1.788			
	Oil			*0.087*			0.010								3.774	1.947	2.711
汽油		**Gasoline**			*0.255*			0.200	*tons*	59.976	*kg*	0.323	*b*	6.120			
煤油		**Kerosene**			*0.178*			0.200	*tons*	61.487	*kg*	0.218	*b*	4.029			
润滑油		**Lubricants**			*0.470*			0.200	*tons*	91.928	*kg*	0.211	*b*	2.608			
沥青		**Asphalt**			*0.068*			0.200	*tons*	27.636	*tons*	89.982	*b*	3.700			
沥青		**Gelatin**			*0.029*			0.200	*kg*	1.149	*dan*	33.644	*a*	0.665			
	Vegetable oil and fat			*0.045*			0.016								1.040	1.170	1.103
棉清油		**Cotton seed oil**			*0.572*			0.334	*kg*	0.339	*dan*	10.671	*b*	0.715			
椰子油		**Coconut oil**			*0.419*			0.333	*kg*	0.274	*tons*	352.603	*b*	1.460			
桐油		**Tung oil**			*0.009*			0.333	*kg*	0.427	*dan*	39.294	*b*	2.092			
	Fertilizer			*0.191*			0.401								0.681	0.681	0.681
豆饼		**Bean cake**			*1.000*			1.000	*tons*	80.573	*dan*	2.415	*a*	0.681			
	Soap			*0.030*			0.121								1.001	1.001	1.001
肥皂		**Soap**			*1.000*			1.000	*kg*	0.189	*box(30kg)*	5.000	*a*	1.001			
	Pulp			*0.028*			0.007								2.789	2.789	2.789
纸浆		**Pulp**			*1.000*			1.000	*kg*	93.260	*tons*	228.914	*a*	2.789			
	Tannery			*0.047*			0.081								0.777	1.149	0.945
牛皮		**Cowhide**			*0.800*			0.500	*pieces*	7.660	*pieces*	3.874	*a*	0.575			
栲胶		**Acacia extract**			*0.200*			0.500	*kg*	0.428	*gong-dan*	59.679	*a*	1.586			
	Coke, coal			*0.052*			0.070								0.789	0.817	0.803
焦炭		**Coke**			*0.763*			0.500	*tons*	14.995	*tons*	10.040	*a*	0.761			
煤		**Coal**			*0.237*			0.500	*kg*	20.753	*tons*	16.090	*b*	0.881			
	Paper and allied industries		*0.022*			0.045									1.368	1.205	1.284
机制纸	**Paper**			*0.827*	*1.000*		0.542	1.000	*kg*	0.232	*kg*	0.294	*c*	1.443	1.443	1.443	1.443
各种板纸	**Paperboard**			*0.173*	*1.000*		0.458	1.000	*kg*	0.104	*kg*	0.093	*c*	1.008	1.008	1.008	1.008

	Wood products		***0.023***			0.003									0.964	0.964	0.964
木板	**Wood board**			***1.000***	***1.000***		1.000	1.000	*3.3sq,m*	1.980	*3.3sq.m*	1.680	***d***	0.964	0.964	0.964	0.964
	Food and kindred products		***0.115***			0.251									0.967	0.647	0.791
	Liquor			***0.494***			0.234								0.615	0.666	0.640
白酒		**Liquor (Bai jiu)**			***0.768***			0.500	*100L*	40.057	*dan*	9.445	***b***	0.536			
啤酒		**Beer**			***0.232***			0.500	*100L*	46.599	*dan*	18.000	***b***	0.878			
	Flour and Starch			***0.217***			0.497								0.513	0.513	0.513
小麦粉		**Wheat flour**			***1.000***			1.000	*kg*	0.152	*50kg*	1.710	***a***	0.513			
	Cooking oil			***0.044***			0.134								0.862	0.763	0.811
菜油		**Rap oil**			***0.475***			0.340	*kg*	0.367	*dan*	13.646	***b***	0.844			
麻油		**Sesame oil**			***0.081***			0.330	*kg*	0.508	*dan*	13.327	***b***	0.596			
豆油		**Soybean oil**			***0.444***			0.330	*kg*	0.356	*dan*	14.537	***a***	0.929			
	Sugar			***0.173***			0.019								0.803	0.949	0.873
红糖		**Brown sugar**			***0.130***			0.500	*kg*	0.230	*dan*	14.500	***a***	1.430			
白糖		**White sugar**			***0.870***			0.500	*kg*	0.239	*dan*	7.453	***a***	0.710			
	Salt			***0.037***			0.036								6.985	6.985	6.985
食盐		**Salt**			***1.000***			1.000	*kg*	0.046	*dan*	14.070	***a***	6.985			
	Tea			***0.020***			0.008								3.345	3.869	3.597
绿茶		**Green tea**			***0.943***			0.500	*kg*	0.524	*dan*	75.125	***b***	3.259			
红茶		**Black tea**			***0.057***			0.500	*kg*	0.533	*dan*	111.708	***b***	4.760			
	Other food			***0.015***			0.073								3.282	3.282	3.282
冰		**Ice**			***1.000***			1.000	*kg*	6.306	*tons*	18.211	***a***	3.282			
	Miscellaneous industries		***0.036***			0.031									2.221	1.165	1.608
热水瓶	**Thermos bottle**			***0.125***	***1.000***		**0.125**	1.000	*numbers*	0.331	*numbers*	0.628	***a***	2.160	2.160	2.160	2.160
牙刷	**Toothbrush**			***0.125***	***1.000***		**0.125**	1.000	*dozen*	0.491	*numbers*	0.162	***a***	4.505	4.505	4.505	4.505
手帕	**Handkerchief**			***0.125***	***1.000***		**0.125**	1.000	*dozen*	0.476	*dozen*	0.202	***a***	0.482	0.482	0.482	0.482
草帽	**Straw hat**			***0.125***	***1.000***		**0.125**	1.000	*dozen*	3.634	*dozen*	16.926	***a***	5.293	5.293	5.293	5.293
火柴	**Matches**			***0.125***	***1.000***		**0.125**	1.000	*gross*	0.383	*box*	54.356	***a***	0.806	0.806	0.806	0.806
钢笔	***Pen***			***0.125***	***1.000***		**0.125**	1.000	*dozen*	12.247	*dozen*	17.01	***b***	1.578	1.578	1.578	1.578
铅笔	***Pencil***			***0.125***	***1.000***		**0.125**	1.000	*dozen*	0.071	*dozen*	0.145	***b***	2.322	2.322	2.322	2.322
阳伞	**Parasol**			***0.125***	***1.000***		**0.125**	1.000	*numbers*	2.373	*donzen*	15.505	***a***	0.619	0.619	0.619	0.619

Notes: 单价

a.中国工業調査報告　中冊　表14
b.物价资料汇编，批发物价
c. 中国近代工业史料(陈真)
以资料a 为主。其中，a，c 只到1933年，所以利用 b，1933年以及1935年价格的变化，进行外推到1935年。

Weight
大分类以及主要中分类，牧野文夫·久保　亨　（1997）中国工業生産額の推計：１９３３年 COE　D 97-18 推定的近代工厂分行业产出额计算
小分类，利用资料a 中册表14(符合工厂法的工厂)所报告的产出额计算。不足部分，利用资料c 进行补充，比如 化学产业中的中分类—[酸]的小分类，小分类无数据时采用样本数平均

Table A2. Japan's price level (1935, US=1)

	Japanese weight			US weight			Japanese		US		Japanese/ US	Japanese price level		
	I	II	III	I	II	III	Prices	Units	Prices	Units		US weight	Japanese weight	Fisher average
All industries												**0.673**	**0.419**	**0.531**
									ER=3.43 Yen/US$					
Steam turbines and steam locomotives are not included												*0.882*	*0.421*	*0.609*
Textiles and their products	**0.309**			**0.170**								**0.385**	**0.341**	**0.362**
Silk and yarn		**0.545**			**0.216**							**0.476**	**0.533**	**0.504**
Raw silk			0.335			0.01	11.352	kg	2.09	pounds	0.71760328			
Cotton yarn			0.603			0.86	1.247	kg	0.34	pounds	0.48180474			
Spun silk for sale			0.047			0.09	5.847	kg	2.23	pounds	0.34746225			
Twisted silk yarn			0.015			0.03	10.558	kg	2.22	pounds	0.62923447			
Fabrics		**0.431**			**0.757**							**0.351**	**0.234**	**0.287**
Jeans			0.041			0.03	0.132	m	0.12	sq. yards	0.28747594			
Drills			0.070			0.13	0.195	m	0.10	sq. yards	0.49603484			
Other wide cotton fabrics			0.775			0.28	0.168	m	0.21	sq. yards	0.20965829			
All silk fabrics			0.065			0.56	0.425	m	0.29	sq. yards	0.38924499			
Jute bagging			0.002			0.00	0.282	m	0.07	sq. yards	1.06743986			
Rayon fabrics			0.046			0.00	0.269	m	0.19	sq. yards	0.37102009			
Rayon and cotton mixed fabrics			0.000			0.00	0.227	m	0.20	sq. yards	0.31066081			
Hosiery		**0.024**			**0.027**							**0.586**	**0.380**	**0.472**
Underwear			0.074			0.64	13.925	doz.	5.71	doz.	0.71090644			
Total gloves			0.926			0.36	2.330	doz.	1.85	doz.	0.36628887			
Metals and metal products	**0.182**			**0.167**								**0.732**	**0.648**	**0.689**
Metals		**0.714**			**0.506**							**0.644**	**0.624**	**0.634**
Pig iron			0.229			0.62	35.956	tons	16.95	tons (2240 pour	0.61833294			
Ferro-alloys			0.065			0.08	0.221	kg	73.67	tons (2240 pour	0.87586739			
Steel plains			0.173			0.09	0.093	kg	70.92	tons (2240 pour	0.38149155			
Copper casting, rough			0.076			0.01	738.087	tons	168.91	tons	1.27398808			
Copper plate			0.042			0.04	0.816	kg	281.07	tons	0.84621103			
Copper wire			0.165			0.03	0.783	kg	0.14	pounds	0.76319025			
Copper tubing, seamless, and pipe			0.021			0.02	1.006	kg	354.19	tons	0.82824559			
Other copper metals			0.004			0.00	0.756	kg	0.21	pounds	0.47267637			
Zinc casting, rough			0.035			0.01	0.303	kg	98.02	tons	0.90255767			
Zinc plates and sheets			0.011			0.01	0.259	kg	162.84	tons	0.46458196			
Lead			0.001			0.02	0.253	kg	88.24	tons	0.83678428			
Lead plates			0.022			0.00	0.265	kg	133.20	tons	0.57923749			
Lead tubing			0.021			0.00	0.273	kg	145.91	tons	0.54490934			
Aluminum products			0.098			0.05	1.507	kg	0.35	pounds	0.57296858			
Tin			0.038			0.00	3.617	kg	987.77	tons	1.06761142			
Metal products		**0.286**			**0.494**							**0.821**	**0.717**	**0.767**
Cast-iron pipe fitting			0.241			0.14	0.089	kg	47.53	2000 pounds	0.5441018			
Nails, brads, and spikes			0.248			0.12	7.097	casks	3.20	kegs	0.64739371			
Tinplate			0.511			0.74	0.310	kg	0.05	pounds	0.89957585			
Machinery, including transportation equipment	**0.138**			**0.228**								**0.963**	**0.363**	**0.591**
Engines and turbines		**0.148**			**0.042**							**0.777**	**0.560**	**0.660**
Steam engines			0.056			0.08	7774.674	numbers	3117.31	numbers	0.72712331			
Steam turbines			**0.532**			**0.65**	**56423.080**	**numbers**	**5178.39**	**numbers**	1			
Internal combustion engines (General gasoline)			0.334			0.06	186.070	numbers	137.29	numbers	0.39512973			
Water wheels and water turbines			0.078			0.22	12431.677	numbers	########	numbers	0.23434158			
Electric Machinery		**0.412**			**0.404**							**0.872**	**0.206**	**0.424**
Power transformers			0.612			0.14	68.758	numbers	144.10	numbers	0.13911373			
Fans			0.028			0.06	20.111	numbers	4.83	numbers	1.21348509			
Storage batteries			0.046			0.58	14.572	numbers	4.09	numbers	1.03924895			
Dry batteries			0.257			0.14	0.120	numbers	0.03	numbers	1.05337318			
Elevators, winding machines			0.057			0.08	2913.606	numbers	2034.48	numbers	0.41752641			
Transportation equipment		**0.440**			**0.554**							**1.043**	**0.891**	**0.964**
Steam-railroad cars			0.121			0.28	63050.548	numbers	2828.70	numbers	1			
Electric-railroad cars			0.005			0.04	16588.294	numbers	########	numbers	0.34252392			
Motor vehicles			0.386			0.15	2587.950	numbers	331.38	numbers	2.27683369			
Bicycles			0.012			0.13	24.768	numbers	18.36	numbers	0.39327695			
Steel ships			0.451			0.26	249186.677	numbers	########	numbers	0.5862028			
Wooden ships, etc			0.025			0.14	2018.251	numbers	402.33	numbers	1.46250537			
Stone, clay, and glass products	**0.028**			**0.027**								**0.373**	**0.459**	**0.414**
Cement		**0.500**			**0.030**							**0.619**	**0.618**	**0.618**
Portland cement			0.985			0.99	3.213	casks	1.51	barrels	0.62148187			
Natural, puzzolan, and masonry cement			0.015			0.01	2.136	casks	1.42	barrels	0.43811532			
Lime		**0.029**			**0.057**							**0.276**	**0.276**	**0.276**
Lime			1.000			1.00	6.997	tons	7.39	tons	0.27608544			
Glass		**0.338**			**0.693**							**0.361**	**0.361**	**0.361**
Shade Globes			1.000			1.00	0.061	numbers	0.59	doz.	0.36077978			
Clay products		**0.132**			**0.220**							**0.405**	**0.405**	**0.405**
Common brick, Building brick			1.000			1.00	0.014	numbers	10.07	thousands	0.40488385			

Chemicals and allied products	**0.188**			**0.080**								**0.317**	**0.497**	**0.397**
Chemicals not else where classified		**0.254**			**0.029**							**0.904**	**0.854**	**0.878**
Sulfuric acid			0.411			0.39	14.232	tons	7.11	tons	0.5836347			
Nitric acid			0.013			0.03	142.928	tons	87.46	tons	0.47643696			
Soda ash			0.522			0.35	74.998	tons	15.19	tons	1.43972563			
Iodine			0.005			0.00	8.887	kg	1.19	pounds	0.98608483			
Chlorine			0.025			0.10	0.102	kg	38.39	tons	0.77582156			
Carbon dioxide			0.007			0.06	0.145	kg	0.05	pounds	0.37084232			
Alcohols			0.017			0.08	0.756	kg	0.12	pounds	0.80286039			
Ink, printing and writing		**0.095**			**0.013**							**0.416**	**0.416**	**0.416**
Printing and lithographing inks			1.000			1.00	0.680	kg	0.22	pounds	0.41640654			
Soap		**0.078**			**0.085**							**0.618**	**0.553**	**0.585**
Laundry soap (bar)			0.793			0.39	0.189	kg	0.05	pounds	0.52815795			
Laundry soap (powder)			0.207			0.61	0.225	kg	0.04	pounds	0.67545208			
Oil		**0.217**			**0.205**							**0.320**	**0.318**	**0.319**
Fuel oil			0.235			0.62	61.487	tons	0.23	gallons	0.12280569			
Paraffin wax			0.177			0.02	294.822	tons	0.19	gallons	0.70459417			
Asphalt			0.090			0.04	27.636	tons	10.79	2000 pounds	0.74689383			
Cotton seed oil			0.301			0.16	0.339	kg	0.08	pounds	0.54194271			
Linseed Oil			0.158			0.07	0.410	kg	0.09	pounds	0.60649259			
Miscellaneous animal oils and fats			0.039			0.08	0.351	kg	0.06	pounds	0.78944071			
Fertilizers		**0.220**			**0.137**							**0.363**	**0.799**	**0.539**
Chemicals fertilizers			0.835			0.01	55.206	tons	14.75	tons	1.0915278			
Fish scrap			0.012			0.05	0.083	kg	25.52	tons	0.94285268			
Bone meal			0.009			0.02	75.087	tons	25.11	tons	0.87175831			
Oil cake, and meal			0.144			0.92	78.517	tons	33.46	2000 pounds	0.31055949			
Leather		**0.028**			**0.433**							**0.141**	**0.144**	**0.142**
Cattle leather			0.971			1.00	**7.660**	**pieces**	**15.93**	sides	**0.14016582**			
Horse,			0.029			0.00	5.912	**pieces**	1.74	half and whole	**0.99022622**			
Gelatin and glue		**0.006**			**0.010**							0.669	0.622	0.645
Gelatin			0.670			0.68	0.428	kg	0.07	pounds	0.77685464			
Glue			0.330			0.32	1.149	kg	0.34	pounds	0.4421252			
Coke-oven		**0.101**			**0.084**							**0.567**	**0.567**	**0.567**
Cokes			1.000			1.00	14.995	tons	6.99	short tons	0.56700493			
Wood distillation and Charcoal		**0.000**			**0.003**							0.815	0.815	0.815
Charcoal			1.000			1.00	36.487	tons	0.12	bushels	0.81529908			
Food and kindred products	**0.116**			**0.267**								**0.817**	**0.819**	**0.818**
Grain-mill and products		**0.223**			**0.282**							0.540	0.569	0.555
Wheat flour			0.966			0.84	0.152	kg	6.67	barrels	0.58965857			
Noodles, macaroni, spaghetti, etc			0.034			0.16	0.162	kg	0.07	pounds	0.28621065			
Liquors		**0.490**			**0.222**							2.023	2.075	2.049
Wines			0.020			0.09	42.540	100 liters	0.42	gallons	1.12902508			
Beer			0.980			0.91	46.599	100 liters	8.76	barrels	2.11128101			
Sugar		**0.172**			**0.156**							0.726	0.736	0.731
Sugar cane			0.130			0.06	0.230	kg	65.85	2000 pounds	0.92634892			
Refined sugar			0.870			0.94	0.239	kg	88.53	2000 pounds	0.71380652			
Cooking oils		**0.044**			**0.067**							0.625	0.534	0.578
Vegetable cooking oils			0.959			0.62	0.385	kg	0.10	pounds	0.52636644			
Miscellaneous animal oils and fats			0.041			0.38	0.351	kg	0.06	pounds	0.78944071			
Other products		**0.071**			**0.272**							**0.220**	**0.257**	**0.238**
Canned Vegetables							0.771	kg		case				
Salt			0.262			0.01	0.046	kg	0.01	pounds	0.56576603			
Ice			0.738			0.99	6.306	tons	3.88	2000 pounds	0.21529682			
Miscellaneous industries	**0.038**			**0.062**								**0.210**	**0.159**	**0.183**
Hats		**0.732**			**0.711**							**0.151**	**0.149**	0.150
Felt hats			0.893			0.81	6.418	doz.	12.76	doz.	0.1466624			
Straw hats			0.107			0.19	3.634	doz.	6.22	doz.	0.17035231			
Pens and pencils		**0.268**			**0.289**							**0.356**	**0.198**	0.265
Pens			0.341			0.51	12.247	doz.	77.70	gross	0.55140883			
Pencils			0.659			0.49	0.071	doz.	1.67	gross	0.1485276			

Table A3. Korea's price level (1935: Japan=1)

	Korean weight			Japanese weight			Korean	Japanese			Korean price level		
	I	II	III	I	II	III	Prices	Prices	Units	Korean/ Japanese	Japanese weight	Korean weight	Fisher average
All industries											1.169	0.983	1.072
Including *Boilers, Elevators, Winding machines*											*1.137*	*0.973*	*1.052*
Textile and their products	0.125			0.309							1.360	1.104	1.225
Yarn		0.192			0.225						0.930	0.931	0.931
Raw silk			0.964			0.946	10.453	11.352	kg	0.921			
Doupion raw silk			0.001			0.023	5.488	7.423	kg	0.739			
Frison			0.035			0.030	3.269	2.409	kg	1.357			
Spun silk		0.212			0.098						0.800	0.814	0.807
Cotton yarn			0.998			0.973	1.015	1.247	kg	0.815			
Flax yarn			0.002			0.010	0.534	1.093	kg	0.489			
Miscellaneous flax yarn			0.000			0.016	0.114	0.998	kg	0.114			
		0.009			0.025						2.721	3.752	3.195
Cotton (for fishing net)			0.049			0.490	1.304	1.275	kg	1.023			
Cotton (Miscellaneous)			0.951			0.510	5.506	1.265	kg	4.353			
Fabrics		0.331			0.605						1.437	1.313	1.374
Cotton Shirting			0.095			0.400	0.178	0.158	m	1.125			
Sheeting			0.848			0.089	0.210	0.161	m	1.309			
Ogura sheeting			0.000			0.039	0.526	0.283	m	1.857			
Miscellaneous wide cotton fab			0.004			0.068	0.421	0.145	m	2.910			
Canvas			0.006			0.029	0.517	0.432	m	1.197			
White cotton cloth			0.000			0.043	1.351	0.526	tan	2.568			
Stripe cotton cloth			0.000			0.023	1.361	0.953	tan	1.429			
Woven color cotton			0.004			0.006	1.153	0.948	tan	1.216			
Towels			0.000			0.025	0.800	1.071	Dozen	0.747			
Spun silk fabrics			0.002			0.011	0.363	0.300	m	1.211			
Miscellaneous silk fabrics			0.000			0.001	0.259	0.221	*m*	1.168			
Narrow silk crepes			0.000			0.113	9.000	7.418	tan	1.213			
habutae silk			0.001			0.023	4.615	5.183	tan	0.890			
Raw woven silk gauze and gos			0.001			0.007	3.061	6.230	tan	0.491			
Meisen fabric			0.000			0.036	8.333	4.462	tan	1.868			
Shaku Miscellaneous Japanese			0.000			0.013	2.449	8.390	tan	0.292			
Hakama			0.000			0.005	2.809	7.760	tan	0.362			
Flat silk			0.001			0.000	3.727	3.339	tan	1.116			
Miscellaneous narrow raw silk			0.003			0.007	3.424	2.991	tan	1.145			
Silk-cotton mixed fabrics			0.002			0.004	2.059	2.610	tan	0.789			
Hard and bast fiber fabrics			0.001			0.002	4.476	2.142	tan	2.090			
Stripe flax fabrics			0.000			0.001	4.000	2.965	tan	1.349			
Rayon fabrics			0.014			0.040	0.327	0.153	m	2.133			
shaku			0.000			0.014	4.000	1.895	tan	2.111			
Rayon filament mixed fabrics			0.011			0.001	1.916	0.175	m	10.933			
Hosiery		0.043			0.033						3.369	0.848	1.690
Cotton textile underwear			0.024			0.364	8.554	1.195	dozen	7.157			
Woolen, woolen-cotton mixed underwea			0.007			0.193	24.443	15.619	dozen	1.565			
Cotton socks			0.906			0.268	1.203	1.463	dozen	0.822			
Woolen, woolen-cotton mixed socks			0.001			0.092	3.704	3.566	dozen	1.039			
Cotton gloves			0.063			0.041	1.000	1.088	dozen	0.919			
Woolen, woolen-cotton mixed gloves			0.000			0.042	6.000	2.326	dozen	2.579			
Floss silks		0.000	1.000		0.000	1.000	4.403	1.150	kg	3.828	3.828	3.828	3.828
Wadding		0.213	1.000		0.014	1.000	0.942	0.592	kg	1.592	1.592	1.592	1.592
Metal and metal products	0.038			0.182							0.783	0.760	0.771
Metals		1.000			1.000						0.783	0.760	0.771
Pig Iron			0.415			0.076	27.389	35.956	ton	0.762			
Steel (cast)			0.348			0.295	51.182	57.939	ton	0.883			
Steel (Miscellaneous sheets)			0.167			0.163	0.063	0.108	ton	0.579			
Steel (Miscellaneous)			0.069			0.466	0.073	0.092	ton	0.794			
Machinery, including transportati	0.012			0.138							0.648	0.433	0.530
Boilers		0.005			0.108						*0.058*	*0.041*	0.048
Water tube boilers			0.368			0.797	928.571	55025.596	numbers	0.017			
Miscellaneous tube boilers			0.632			0.203	447.200	2047.217	numbers	0.218			
Engines and turbines		0.063			0.216						0.983	0.750	0.858
Steam engines			0.019			0.045	666.667	7774.674	numbers	0.086			
Internal combustion engines													
General gas engines			0.007			0.002	1500.000	3090.000	numbers	0.485			
General gasoline			0.904			0.266	529.308	186.070	numbers	2.845			
General oil engines			0.067			0.626	1286.364	3623.782	numbers	0.355			
Water turbines			0.002			0.062	50.000	12431.677	numbers	0.004			
Elevators		0.000	1.000		0.006	1.000	40.000	2913.606	numbers	0.014	*0.014*	*0.014*	0.014
Winding machines		0.019			0.078						*0.031*	*0.031*	0.031
Winding machines			1.000			1.000	293.423	9607.574	numbers	0.031			
Pumps		0.006	1.000		0.004	1.000	40.828	1121.285	numbers	0.036	*0.036*	*0.036*	0.036
Blowers		0.001	1.000		0.012	1.000	2.618	316.427	numbers	0.008	*0.008*	*0.008*	0.008
Measures		0.105			0.033						1.019	1.077	1.048
Universal measures			0.063			0.181	0.103	0.123	numbers	0.837			
Voltmeters			0.285			0.099	1.128	0.852	numbers	1.324			
Balances and scales			0.652			0.720	2.718	2.658	numbers	1.023			
General lighting bulbs											0.155	0.155	0.155
		0.004	1.000		0.063	1.000	0.010	0.065	numbers	0.155			
Railroad cars and locomotives		0.487			0.159	1.000					0.794	0.823	0.808
Steam Locomotives			0.023			0.509	43640.000	63050.548	numbers	0.692			
Gasoline cars			0.040			0.050	13333.333	6346.336	numbers	2.101			
Parts, attachments and accessories													
Passenger cars and freight cars			0.890			0.442	3023.548	3952.248	numbers	0.765			
Electric cars													

Motor vehicles		0.128	1.000	0.023	1.000	452.912	829.996	numbers	0.546	0.546	0.546	0.546
Bicycles		0.006	1.000	0.007	1.000	19.764	24.768	numbers	0.798	0.798	0.798	0.798
Miscellaneous cars		0.021		0.016						1.514	1.514	1.514
	Carts		1.000		1.000	31.131	20.566	numbers	1.514			
Ships		0.154		0.273						0.817	0.817	0.817
	Miscellaneous (excepting steel ships)		1.000		1.000	1648.333	2018.251	numbers	0.817			
Stone, clay and glass products		0.026		0.028						1.151	0.841	0.984
Clay		0.065		0.237						1.385	1.385	1.385
	Clay pipes		1.000		1.000	0.258	0.186	numbers	1.385			
Glass		0.033		0.046						1.104	1.104	1.104
	Shade, globes		1.000		1.000	0.067	0.061	dozen	1.104			
Bricks		0.083		0.065						0.913	1.036	0.972
	Building brick		0.822		0.250	0.015	0.014	numbers	1.085			
	Fire bricks		0.178		0.750	0.060	0.071	numbers	0.856			
Tiles		0.016		0.023						0.766	0.760	0.763
	Smoked roofing tile		0.992		0.790	0.033	0.043	numbers	0.759			
	Miscellaneous roofing tiles		0.008		0.210	0.040	0.051	numbers	0.791			
Cement (including Portland cement)		0.637	1.000	0.479	1.000	3.493	3.213	tarus	1.087	1.087	1.087	1.087
Cement products		0.057		0.046						0.354	0.161	0.239
	Cement Tiles		0.513		0.142	0.057	0.047		1.207			
	Cement pipes		0.198		0.576	0.430	1.481		0.290			
	Cement slates		0.289		0.282	0.080	1.419		0.056			
Lime		0.020	1.000	0.028	1.000	8.285	6.997		1.184	1.184	1.184	1.184
Enameled iron		0.089		0.077						1.630	1.630	1.630
	Tableware		1.000		1.000	0.134	0.082		1.630			
Chemicals and allied products		0.208		0.188						1.271	0.704	0.946
Chemicals		0.135		0.212						0.374	0.277	0.322
	Sulfate		0.288		0.107	14.157	14.952	ton	0.947			
	Caustic soda		0.001		0.161	34.719	149.906	ton	0.232			
	Iodine		0.001		0.001	7.229	8.887	kg	0.813			
	Oxygen gas		0.019		0.042	0.003	0.221	m3	0.013			
	Hydrogen gas		0.015		0.006	0.080	0.336	kg	0.238			
	Ammonium chloride		0.462		0.154	0.069	0.223	kg	0.308			
	Methanol		0.040		0.006	0.273	0.360	ton	0.757			
	Naphthalene		0.002		0.005	0.028	0.085	ton	0.331			
	Alcohol		0.002		0.004	1.050	0.756	kg	1.388			
	Glycerin		0.141		0.039	1.295	0.991	kg	1.308			
	Chloridation kalium		0.000		0.001	80.000	81.551	ton	0.981			
	Miscellaneous		0.028		0.474	0.417	1.626	kg	0.256			
Synthetic dyes		0.001		0.023						0.579	0.579	0.579
	Miscellaneous synthetic dyes		1.000		1.000	2.067	3.567	kg	0.579			
Paints		0.000		0.023						0.880	0.922	0.901
	Chinese ink		0.278		0.017	0.833	0.783	kg	1.065			
	Miscellaneous ink		0.722		0.983	1.083	1.236	dozen	0.877			
Soap		0.009		0.037						0.787	0.820	0.803
	Bath soap		0.036		0.459	0.769	0.837	dozen	0.920			
	Industrial detergents		0.005		0.070	0.170	0.242	kg	0.703			
	Laundry soap (bar)		0.958		0.373	0.157	0.189	kg	0.831			
	Laundry soap (Powder		0.001		0.097	0.012	0.225	kg	0.051			
Oil		0.023		0.083						0.890	0.997	0.942
	Coal-tar		0.147		0.067	19.567	25.184	ton	0.777			
	Benzol		0.136		0.060	173.509	234.376	ton	0.740			
	Toluol		0.000		0.005	299.250	349.728	ton	0.856			
	Creosote		0.003		0.030	49.914	50.867	ton	0.981			
	Volatile oil		0.008		0.481	79.414	113.223	ton	0.701			
	Light oil		0.054		0.072	84.009	59.976	ton	1.401			
	Machine oil		0.191		0.132	110.240	91.928	ton	1.199			
	Heavy oil		0.058		0.068	34.999	29.044	ton	1.205			
	Paraffin		0.050		0.038	141.370	294.822	ton	0.480			
	Pitch		0.080		0.022	20.986	15.878	ton	1.322			
	Miscellaneous		0.274		0.026	64.780	48.741	ton	1.329			
Vegetable oils		0.016		0.052						0.930	0.978	0.954
	Sesame oil		0.060		0.080	0.663	0.508	kg	1.304			
	Cotton seed oil		0.603		0.186	0.324	0.339	kg	0.955			
	Soybean oil		0.336		0.439	0.348	0.356	kg	0.978			
			0.001		0.295	0.372	0.503	kg	0.740			
Animal oils and fats		0.103		0.009						1.076	1.293	1.179
	Sardine oil		0.992		0.085	0.172	0.133	kg	1.294			
	Sperm oil		0.001		0.093	0.090	0.159	kg	0.566			
	Miscellaneous (fish oil)		0.007		0.530	0.259	0.185	kg	1.404			
	Pupa oil		0.000		0.018	0.153	0.194	kg	0.789			
	Fat		0.000		0.273	0.229	0.406	kg	0.565			
Candles		0.002	1.000	0.003	1.000	0.562	0.466	kg	1.207	1.207	1.207	1.207
Processed oil		0.116		0.023						0.946	0.950	0.948
Hydrogenated oils			0.806		0.770	0.233	0.234	ton	0.996			
Hydrogenated wax			0.071		0.010	0.240	0.287	kg	0.835			
Stearin			0.123		0.220	0.235	0.302	kg	0.777			
Rubbers		0.091		0.087						0.614	0.614	0.614
	Miscellaneous Rubber shoes		1.000		1.000	0.322	0.525		0.614			
Papers		0.041		0.164						4.002	1.235	2.223
	printing paper		0.001		0.887	0.903	0.207	kg	4.354			
	wrapping paper		0.999		0.113	0.271	0.220	kg	1.234			
Fertilizers		0.401		0.183						0.918	0.970	0.943
	Soybean cakes		0.021		0.140	75.817	80.573	ton	0.941			
	Miscellaneous Vegetable oil cakes											
	Fish scraps		0.160		0.015	0.069	0.083	ton	0.838			
	Pupa cakes		0.001		0.004	0.053	0.076	ton	0.699			
	Bone meal		0.001		0.012	71.143	75.087	ton	0.947			
	Super-phosphate		0.028		0.348	30.581	31.212	ton	0.980			
	Ammonium phosphate		0.164		0.000	98.835	41.036	ton	2.409			
	ammonium sulfate		0.625		0.481	81.304	93.520	ton	0.869			

Leather		0.011		0.023						1.643	1.421	1.528
	Cattle leather		0.365		0.523	15.598	7.660	sheets	2.036			
	Sole leather		0.635		0.477	30.071	24.828	sheets	1.211			
Gelatin and glue		0.000		0.005						1.060	1.060	1.060
	Gelatin and glue		1.000		1.000	0.453	0.428	kg	1.060			
Others		0.049		0.073						0.673	0.671	0.672
	cokes											
	Miscellaneous		0.673		0.672	12.163	17.417	ton	0.698			
	Briquettes and briquette balls		0.327		0.328	12.912	20.753	ton	0.622			
Food and kindred products		0.573		0.116						0.959	0.737	0.841
Liquors		0.615		0.436						0.996	0.707	0.839
	Rice wine sake		0.234		0.653	39.768	38.658	100l	1.029			
	Sweet rice wine mirin, including mirin v		0.000		0.022	37.161	56.290	100l	0.660			
	Low-class distilled spirits		0.628		0.085	23.811	40.057	100l	0.594			
	Beers		0.131		0.235	50.555	46.599	100l	1.085			
	Wines		0.006		0.005	34.766	42.540	100l	0.817			
Soy Sauce		0.003	1.000	0.070	1.000	1.125	13.815	100l	0.081	0.081	0.081	0.081
Miso (bean paste)		0.015	1.000	0.021	1.000	0.141	0.103	kg	1.368	1.368	1.368	1.368
Vinegar		0.001	1.000	0.002	1.000	18.622	7.596	100l	2.452	2.452	2.452	2.452
Sake lees		0.009	1.000	0.007	1.000	0.012	0.087	kg	0.136	0.136	0.136	0.136
Flours		0.110		0.178						1.035	1.035	1.035
	Wheat flour		1.000		1.000	0.157	0.152	kg	1.035			
Starch		0.030		0.014						1.637	1.637	1.637
	Miscellaneous Starch		1.000		1.000	0.240	0.147	kg	1.637			
Sugar		0.135		0.153						0.858	0.858	0.858
	Refined sugar		1.000		1.000	0.205	0.239	kg	0.858			
Food cans		0.038		0.050						1.571	1.099	1.314
	Canned beef		0.032		0.104	1.557	0.903	kg	1.723			
	Canned, bottled and potted meat		0.005		0.001	1.181	0.331	kg	3.568			
	Canned mackerel		0.094		0.059	0.275	0.363	kg	0.759			
	Canned Bonito		0.001		0.045	0.556	0.349	kg	1.591			
	Canned Sardine		0.226		0.208	0.835	0.203	kg	4.123			
	Canned Abalone		0.066		0.009	2.045	0.635	kg	3.220			
	Canned Crab		0.482		0.278	0.993	1.113	kg	0.892			
	Canned Fruits		0.001		0.148	0.104	0.379	kg	0.275			
	Canned Vegetables		0.094		0.146	0.208	0.327	kg	0.635			
Seafood		0.028		0.033						0.733	0.633	0.681
	Salt		0.900		0.401	0.028	0.046	kg	0.619			
	Agar		0.071		0.426	2.280	2.592	kg	0.879			
	Dried Bonito (Katsuobushi)		0.029		0.172	0.704	1.109	kg	0.634			
Tea		0.000		0.018						1.305	1.211	1.257
	Green teas		0.828		0.897	0.585	0.524	kg	1.117			
	Green teas		0.074		0.055	0.368	0.322	kg	1.140			
	Brown tea		0.098		0.049	2.636	0.533	kg	4.942			
Ice made		0.008	1.000	0.013	1.000	6.913	6.306	ton	1.096	1.096	1.096	1.096
Noodles		0.009	1.000	0.006	1.000	0.175	0.162	kg	1.080	1.080	1.080	1.080
Miscellaneous industries		0.018		0.038						1.536	1.484	1.510
Tatami matting		0.001	1.000	0.002	1.000	0.800	0.676	sheets	1.183	1.183	1.183	1.183
Straw products		0.101		0.064						3.336	3.336	3.336
	Straw-mats and mat bases		1.000		1.000	2.283	0.684	sheets	3.336			
Leather products		0.707		0.437						2.296	2.290	2.293
	leather footwear		0.926		0.916	6.348	2.800	numbers	2.267			
	Leather bags		0.074		0.084	7.263	2.776	numbers	2.616			
Brushes		0.022		0.063						0.872	0.872	0.872
	Miscellaneous brushes		1.000		1.000	0.988	1.132	dozen	0.872			
Hats		0.168		0.414						0.548	0.545	0.546
	Textile hats		0.216		0.357	1.476	2.624	dozen	0.562			
	Straws		0.784		0.643	1.962	3.634	dozen	0.540			
Japanese-style umbrellas		0.001	1.000	0.020	1.000	0.680	0.400		1.701	1.701	1.701	1.701