Price Level and GDP in pre-War East Asia: a 1934-36 Benchmark Consumption Purchasing Power Parity Analysis for China, Japan, Korea and Taiwan

*Debin Ma, Kyoji Fukao and Tangjun Yuan

Contact Author:
Debin Ma
GRIPS/FASID Joint Graduate Program
2-2 Wakamatsu-cho, Shinjuku-ku
Tokyo, 162-8677 Japan
Email: debinma@grips.ac.jp
Phone: 81-3-3341-0457

First Draft, August 2004, prepared for the Conference
"Towards a Global History of Prices and Wages"
Utrecht, Holland - August 19-21, 2004

Abstract:

This paper provides estimate of consumption purchasing power parity (PPP) converters for 1934-36 Japan, China, Korea and Taiwan by matching prices of more than 50 types of goods and services with consumption weights derived from household expenditure surveys. We find that the 1934-6 average consumer prices of China, Korea and Taiwan were 0.75, 0.86 and 0.84 times that of Japan respectively. Using our new benchmark PPP estimate, we reexamine the per capita income levels of these four economies in relation to previous studies which were either based on exchange rate conversion or the 1990 backward projected method. In this comparative perspective, our consumption PPP studies gives a higher per-capita income level for China in the 1930s, thus lending some tentative support to a more optimistic assessment of the early 20th century Chinese economy as well as a possibly higher initial condition for China's Communist era.

Price Level and GDP in pre-War East Asia: a 1934-36 Benchmark Consumption Purchasing Power Parity Analysis for China, Japan, Korea and Taiwan

Abstract:

This paper provides estimate of consumption purchasing power parity (PPP) converters for 1934-36 Japan, China, Korea and Taiwan by matching prices of more than 50 types of goods and services with consumption weights derived from household expenditure surveys. We find that the 1934-6 average consumer prices of China, Korea and Taiwan were 0.75, 0.86 and 0.84 times that of Japan respectively. Using our new benchmark PPP estimate, we reexamine the per capita income levels of these four economies in relation to previous studies which were either based on exchange rate conversion or the 1990 backward projected method. In this comparative perspective, our consumption PPP studies gives a higher per-capita income level for China in the 1930s, thus lending some tentative support to a more optimistic assessment of the early 20th century Chinese economy as well as a possibly higher initial condition for China's Communist era.

East Asia, particularly with the rise of China from the late 1970s, has become the model studies in the so-called convergence school of the "new" growth theories. Central to the empirical works of this burgeoning theoretical literature is the compilation of historical national accounts data in purchasing power parity (PPP) terms, exemplified by the masterly scholarship of the Penn World Table group and Angus Maddison. This pertains to the large question on the initial conditions of the post-War East Asian miracles.

For Japan, Taiwan and Korea, an important milestone in this literature is the systematic reconstruction of times series macroeconomic indicators of these three economies in the pre-WWII period using detailed statistics compiled by the Japanese government and its colonial administrations in Taiwan and Korea. This culminated in the publication of the statistical volume compiled by Mizoguchi and Umemura (hereafter referred to as M&U) and published in 1988, which provided annual estimates of GDP and its various components for Taiwan and Korea in the colonial period. For China, the first set of economic statistics that seemed to approximate the standard of national accounts became available only for the 1930s. These statistics became the foundation of a series of pioneering works on reconstructing the 1931-36 Chinese GDP (Ou, Bao san et al and Liu Ta-chung 1947).

These pre-War GDP series were all constructed based on their domestic currencies. For cross-country comparison, exchange rates were the usual converters. However, it has long been revealed by the

purchasing power parity (PPP) doctrine that exchange rate conversion of international per capita income, which fails to incorporate relative price level differences in the non-tradable sector, tends to systematically underestimate the real per capita income level of the lower income countries (in this case China, Taiwan and Korea) (Balassa 1964, Samuelson, 1964, Bhagwati, 1984).

The pre-War GDP series estimated in by the M&U volume and Liu and others also formed the basis of Angus Maddison's national accounts series. To arrive at globally comparable series, Maddison consistently used the 1990 benchmark PPP to project backward using domestic real GDP growth rates. However, as is well-known, there are also index number issues embedded in the backward projection method that ignores long-term relative shifts in a country's terms of trade and economic structure.

This paper launches a full-fledged pre-War consumption PPP for these four economies in 1934-36 through a three way bi-lateral matching of 50 to 60 types of goods and services, with three-level consumption expenditure weights derived from detailed household budget surveys. Our results show that the consumer prices of China, Taiwan and Korea are at about 75%, 84% and 86% of the level of Japan respectively.

This pre-war PPP estimate confirms the PPP doctrine that exchange rate conversion would under-estimate the real per-capita income of the relatively under-developed countries. We show that, considering the much lower relative prices, our consumption PPP would give a per-capita income level for China in the 1930s higher than all the previous estimates, thus lending some tentative support to a more optimistic assessment of the early 20th century Chinese economy as well as a possibly higher initial condition for China's Communist era.

The rest of the paper is divided into two main sections followed by a conclusion. The first section provides a detailed explanation of our PPP estimation procedure and summary findings of the relative price levels. Section II applies our consumption PPP to a comparative analysis of per capita incomes in these four East Asian economies both in relation to the exchange rate conversion method as well as the backward projection estimates.

I. The 1934-36 Consumption PPP

We adopt the methodology used by several rounds of the ICP studies for the post-WWII benchmark periods and present a pre-War PPP for Japan, Taiwan, Korea and China in 1934-36 (For post-War ICP studies, see Heston and Summers 1993 and Maddison 1995).

In our study, we make full use of the unusually rich and high-quality statistical data (by pre-war standards) compiled by the Japanese government and its colonial administration that employed reasonably consistent standards, terminologies and methodologies for their statistical system within the empire. We also benefited from the wealth of information and worksheets accumulated under the Long Term Economics Statistics Project (LTES) initiated by Professor Kazushi Ohkawa at Hitotsubashi University, which produced long-term nominal and real GDP series for Japan and was later extended to colonial Taiwan and Korea by Mizoguchi and others.[1] Retracing the steps they used to construct GDP and consumer price index provides us a shortcut to an otherwise extremely cumbersome PPP computation. We then extend this methodology to China and utilize the rich price data for the 1930s in a multi-volume publication compiled in 1955 by the Communist Chinese government for economic planning. We derive our consumption weights from a series of household budget surveys conducted in China in the 1920s and 30s.

For our estimation, we collected absolute prices for items included in consumers' expenditure for major cities of different regions within these four territories. We treated each country's price as the simple average of the prices of these major cities. For Japan, the cities included are Tokyo, Osaka, Kyoto, Nagoya, Yokohama and Kobe. For Korea, they are Seoul, Mokpo, Taegu, Pusan, Pyongang, Shinuiju, Wonsan, and Chongjin. The Taiwan cities are Taipei, Keelong, Ilan, Hsinchu, Taichung, Changhua, Tainan, Chiai, Kaohsiung, Pingtung, Taitung, Hualiengan, and Makung. For China, the cities are Shanghai, Chongqing, Wuhan, Guangzhou, Beijing, Nanjing, Harbin, Xining, Shijiazhaung Zhengzhou, Erjiazheng and Tienjing.[2]

---

[1] For Japan, there are the 14 volume series LTES publications in Japanese. For the English version, see the abridged one volume by Kazushi Ohkawa and Miyohei Shinohara.
[2] Since our PPP estimate is based on urban prices, we do not exclude the possibility that, considering the more agrarian and self-sufficient economies of Korea, urban-rural price differentials are likely to be larger than in the

We then derive the consumption expenditure weights at three levels of aggregation (upper, medium and lower). Following Mizoguchi's choice of benchmark periods in his construction of the consumer price index, we select the three-year average of 1934-36 as our benchmark period because it was towards the 1930s that reliable Chinese, Taiwanese and Korean household budget and rural surveys with consumption expenditure information became available or plentiful. For Japan and her two colonies, 1934-36 is also a period of relative economic and price stability, interposed between the severe deflation leading to Japan's banning of gold exports in 1931-32 and the late 1930s economic dislocation brought about by the outbreak of the Sino-Japanese War. For China, the 1934-36 followed a major monetary reform in 1933 which led to the abandonment of the traditional silver standard. But evidently, the 1931-36 Chinese per capita GDP estimates were chosen simply because it was the first reasonably reliable historical national accounts for China's pre-War period.

To compute PPP, we use our database of absolute prices that matched altogether 61 types of goods and services for Japan-Korea, 58 for Japan-Taiwan, 51 for China-Japan and 41 for China-Korea. Our database also included the service sector such as utilities (domestic lighting and heating cost). Data on housing and medical expenses are difficult to obtain, thus we follow Mizoguchi (1971, 1975) and use residential construction cost (e.g. wage of construction workers, price of cement and so on) and annual salaries of doctors. Given the above, we believe our study differentiates from some other similar pioneering studies which had to compromise with the narrow set of commodity prices used and simplifying assumptions of consumption expenditure weights due to the data constraint for most non-industrialized countries in the pre-War period (Jan Luiten van Zanden 2002, Bassino and van der Eng 2002, Nakagawa 2000). Table 1 presents the aggregated five-item upper level rural and urban expenditure weights for these three countries.

---

other two economies, thus possibly biasing downward our PPP adjusted real per-capita income for Korea. This problem is partly alleviated by our inclusion of 10 cities in Korea. The extent of the bias can only be ascertained

Table 1. Aggregate Expenditure Weights in 1934-36

	China	Japan	Taiwan	Korea
Food	68.65	40.9	47.99	65.82
Lighting and Heat	8.32	4.8	5.84	9.75
Clothing and Bedding	8.48	10.71	6.87	7.15
Housing Expenses	5.29	10.73	7.67	5.57
Miscellaneous	9.25	32.92	31.63	11.71

Source Notes: The urban expenditure weights for Taiwan and Korea are from Mizoguchi, "Worksheet No. 9," The rural weights from Mizoguchi (1975, p.10). For Japanese weights and data source, see the explanation in Appendix 1. Chinese weights are largely based on Zhang Donggan (2001, p.375-6). The rural share of population in Taiwan and Korea are 52 and 75 per cent respectively, calculated from M&U volume, pp. 235, 237, 263 and 268.

Using the matched prices and the detailed three level consumption weights, we carry out a standard PPP computation of a three way bi-lateral comparison of absolute prices with Japan serving as the numaire country. For n numbers of goods and services, Japan's (sub- or superscripted as J) price level relative to that of country i, (i = China, Korea, Taiwan) is calculated as follows:

$$P_{i,J}^J = \frac{\sum p_n^i q_n^J}{\sum p_n^J q_n^J} = \frac{\sum \frac{p_n^i}{p_n^J} p_n^J q_n^J}{\sum p_n^J q_n^J} = \sum \frac{p_n^i}{p_n^J} \omega_n^J$$

The formule using i country's consumption weights is:

$$P_{i,J}^i = \frac{\sum p_n^i q_n^i}{\sum p_n^J q_n^i} = \frac{\sum p_n^i q_n^i}{\sum \frac{p_n^J}{p_n^i} p_n^i q_n^i} = \frac{1}{\sum \frac{p_n^J}{p_n^i} \omega_n^i}$$

Finally, the geometric average of the two price indices (the Fisher index) $P_{i,J} = \sqrt{P_{i,J}^i \times P_{i,J}^J}$ gives us i country's absolute price level relative to that of Japan.[3]

---

when more rural price data become available.

[3] The summation sign is summed across the n types of goods and services. This will be true throughout the rest of the text.

The detailed price matching, consumption weights as well as data sources and methodologies are explained in Appendix A along with four data tables A1, A2, A3 and A4. Tables A1, A2 and A3 show that the average consumer price levels of 1934-6, China, Korea and Taiwan are 0.75, 0.86 and 0.84 times that of Japan respectively. Table A4, which gives a direct bi-lateral price matching of China and Korea, shows Chinese price level at 0.86 that of Korea. We also conducted the Korea-Taiwan matching (with 41 items) and find the Korea price level at 1.03 times that of Taiwan. These results clearly confirm the transitivity conditions for relative price levels. The summary information of relative price levels is in Table 2.

Table 2 shows that China and Japan as having, respectively, the lowest and highest price level of all the four areas under study. This result, with China, Korea and Taiwan being less developed than Japan for this period, corroborates the theoretical predictions of the productivity and factor proportion differential models. In particular, average price levels for the non-tradable sectors in Taiwan and Korea, being 0.78 and 0.71 respectively, were lower than those for the tradable sectors, which are 0.87 and 0.94 respectively. It is interesting that for food and tradable goods, China emerged as having the lowest price level of all. This is clearly consistent with the fact that Taiwan and Korea, being part of the "free trade' zone forged under Japanese imperialism, were far more integrated with Japan.[4] While Taiwan and Korea were developed as important base for food supply for Japan in exchange for industrial products, Chinese agricultural production were likely to be oriented towards her giant domestic market.

The relatively high price level – at 0.78 of the Japanese level- for China's non-tradable goods and services seemed puzzling. It seems like that the non-tradable goods and services in our

---

[4]Japan acquired Taiwan and Korea as colonies in 1894-5 and 1904-5 respectively. By the 1910s, both colonial Korea and Taiwan were set on a de-facto "Japanese yen exchange standard," – the two colonial Central banks, the Bank of Korea and Bank of Taiwan, issued their bank notes as circulating currency convertible to the Bank of Japan notes which served as the de-facto reserve currency. All three bank notes were denoted as yen evaluated at the 1:1 exchange ratio within the empire   By the 1930s, the three economies under the colonial empire became closer to a free trade bloc protected by a common external tariff (Yamamoto 2000).

Table 2. Relative Price Levels by Sectors (1934-36 Japan =1)

	China	Taiwan	Korea
Total	**0.75**	**0.84**	**0.86**
Food	0.71	0.87	0.94
Lighting and Heat	0.75	0.87	0.82
Clothing and Bedding	0.89	0.94	0.94
Housing Expenses	0.62	0.73	0.88
Miscellaneous	0.86	0.82	0.71
Tradable	0.74	0.88	0.93
Non-tradable	0.78	0.78	0.71

Notes:
1. Tradable goods for Korea: food, coal, firewood, charcoal, oil, cotton, bleached cloth, underwear, socks, shoes, umbrellas, Western umbrellas, cement, kneaded tiles, tea bowls, soap, health pills, writing paper.
Tradable goods for Taiwan: food, firewood, charcoal, coke, cotton, muslin, cotton flannel, cement, tatami mats, kneaded tiles, cedarboard, soap, writing paper, Minogami paper.
Tradable goods for China: food, clothing and bedding, firewood, coal, match, lamp oil, wooden board, washing basin, hygien products, soap, toothbrush, medical alcohol.
2. Relative price levels in the above three categories are calculated using the Fisher formule. For Japan-Taiwan comparison, Japanese and Taiwanese weights used for the tradables are 60 and 63 percent respectively. For Japan-Korea comparison, Japanese and Korean weights used for the same three categories are 62 and 83 percent respectively. For Japan-China comparison, Japanese and Chinese weights are 63 and 89 percent respectively.

urban-based price database could be somewhat biased towards the relatively "modern" items such as electricity, movies, newspapers which were not likely so cheap in China. Considering that the share of the non-tradable sectors in our price data is rather small at 11%, this bias will not affect our Chinese price level. Furthermore, this upward bias is likely to be offset by the fact that our Chinese price data did not include cities in Manchuria which, under Japanese colonial control, were most likely to have higher average price level than those in China proper.

II. East Asian GDP in International Dollars

GDP PPP includes the relative prices of investment and government consumption sectors, besides private consumption. However, for most developing countries, consumption PPP may serve as a reasonable proxy for GDP PPP due to the dominant share of private consumption in GDP, a result

empirically corroborated by the ICP studies for developing countries in the post-War period (Kravis, 1984, p. 27). For Taiwan and Korea, their shares of private consumption in the 1935 were 64, 89percent respectively (M&U p. 234 and 236). For China, this share was said to be above 90 percent (Lui Ta-Chung, 1946, p. 86).[5]

In view of the above, we present our 1934-36 benchmark consumption PPP adjusted per capita GDP of these three economies alongside the exchange rate converted estimates in Table 3. In comparison with the exchange rate conversion, Our PPP converter raised the Chinese, Taiwanese, and Chinese per capita income in 1931-36 from 29, 38 and 66 percent to 39, 44 and 79 percent of the Japanese level respectively.

Table 3. 1931-36 Average per-capita NDPs in East Asia in 1934-36 Japanese Yen (Number in parentheses are per capita NDPs relative to Japan with Japan = 1)

	Japan	Taiwan	Korea	China
Exchange Rate estimate	223	146 (0.65)	85 (0.38)	65 (0.29)
PPP adjusted estimate	223	173 (0.78)	98 (0.44)	87 (0.39)

Sources : Data for Japan are from Ohkawa and Shinohara (1979), Korea and Taiwan from Mizoguchi and Umemura （1996). 1931-36 Chinese per-capita NDP data from Liu and Yeh (p.66) at 57.36 yuan converted to 65 yen at the rate of 1 yuan = 1.14 yen.

Now we would like to examine the 1930s East Asian per capita GDPs in the global context where the U.S and U.S dollars are often used as the benchmark for comparison. In Table 4 below, the first data row shows these four East Asian per capita GDPs in U.S dollars using the 1930s exchange rates. As expected, the exchange rate conversion gives East Asian countries, particularly China, an extremely low per capita income – China was at a mere 3% of U.S level in per capita terms.

---

[5] For Taiwan and Korea, Japanese capital and tradable investment goods such as machinery formed an essential part of capital formation for this period (Yamamoto 2000, chap. 6). Japanese personnel dominated the upper echelons of the colonial administrations in Taiwan and Korea. The wage rates of local construction workers and government employees were roughly comparable between Korea and Taiwan, both important segments of the government sector. All these suggest that relative price levels of the investment and government sectors in these three economies were more likely to be governed by the same forces that shaped the relative price levels in private consumption.

Table 4. East Asian GDP per-capita in 1931-36 in U.S. Dollars (Number in parentheses are ratios relative to U.S with U.S = 1)

	US	Japan	Taiwan	Korea	China
1931-36 US$	540	64 (0.12)	42 (0.08)	24 (0.05)	18(0.03)
1990$ (Maddison)	5360	2064 (0.39)	1157 (0.22)	1137 (0.21)	570 (0.11)
1990 $ (PPP)	5360	2064 (0.39)	1601 (0.3)	909 (0.17)	806 (0.15)

Notes:
1. East Asian per-capita GDPs in 1931-36 US$ are from Liu Ta-chung (1947), p.76. The four East Asian economies were converted to U.S dollars at 1932-36 average exchange rate of 0.29 US$/yen and 0.31 US$/yuan.
2. The Maddison backward projected GDP per capita data from Maddison (2003, p.182).
3. For the 1990 $ (PPP), see the text

The problem of exchange rate bias against developing countries was well-recognized by Liu Ta-Chung, one of the pioneers in the reconstruction of the 1931-36 Chinese per capita GDP. His exchange rate conversion found that the 1931-36 Chinese per capita GDP was at 3.8% of the U.S level (p. 72). To correct for this severe downward bias of the 1930s Chinese per capita incomes, he compared five categories of Chinese and American agricultural crop prices, he derived the Chinese price level at 63% of the U.S. level.[6] This relative price level adjustment enabled him to use the Chinese per capita income from 3.8% of the U.S level to 5.7% (p.76). But recognizing the price level differences in agricultural products were possibly the least of the problems for the downward exchange rate biase, Liu went to adjust for other structural differences between the economies. His final adjustment raised the Chinese per capita income to 9% of the U.S level in the 1930s.

How does Liu's 1947 study compare Angus Maddison's 1990 international dollars GDP series using backward projection based on GDP real growth rates as well as our Japan-based current price PPP computation. In the second data row of Table 4, we present Maddison's latest series. It is notable that Maddison's back projected 1931-36 Chinese per capita income in 1990 US dollars stands about 11% of the contemporaneous U.S level, a level slightly higher than Liu's 9% estimate. In comparison with the exchange rate conversion, Maddison's series raised all the four East Asian per capita incomes significantly – Japanese per capita income went up from only 12% of the U.S level to 39%. The big

---

[6] Calculated from Liu, p. 73 using simple averages.

anomaly in the Maddison series is the Taiwan and Korean per capita GDP for 1931-36 which were almost comparable at 1157 and 1137 dollars respectively. This result is incompatible with both the 1930s exchange rate and our PPP based estimates as well as historical evidences which would rank Taiwanese per capita income significantly higher than that of Korea. This issue is explored in detail in a separate study which examines the possible index number problems inherent in back-projection method, such as terms of trade and Gerschenkron effects (Fukao, Ma and Yuan, 2004).

In the third and final row of Table 4, we apply our East Asian PPP per capita ratio as derived in Table 3 to Maddison's back-projected Japanese per capita income in 1990 dollars. This methodology, using Japan as the bridge country, gives Taiwanese, Korean and Chinese per capita income at 30, 17 and 15% of the U.S level in the 1930s. Thus, our PPP estimates, re-weighted using Maddison's back-projected Japanese series, supply a Chinese per capita income of US$ 806, higher than both the Maddison (2004) estimates and the Liu's 1947 adjusted figure. But intriguingly, in his 1995 book, "Monitoring the World Economy," Maddison's back-projected 1931-36 Chinese per capita income in 1990 dollars **was** 789 dollars, which, at 14.7 percent of the U.S level, was very close to our study (Maddison, 1995, p. 204). This clearly leaves us wonder why Maddison decided to adjust his 1930s Chinese per capita income downward in his later studies.

Were this relatively higher figure of 807 in 1990 dollars true, it would have important implications, as the 1930s Chinese per capita GDP, being the most reliable benchmark estimate for China's pre-Communist era, has been extensively utilized, through back and forward-projection, to infer about historical and Communist era living standards. Our higher estimate lends support to the more optimistic assessment of the early 20th century economic growth in China and could impossibly imply an early 20th century overall Chinese income level not necessarily lower than that of the 18th and early 19th centuries, as is often claimed. In fact, this figure would set the China's 1930s per capita income level roughly comparable to the level in Japan's initial phase of modern economic growth (Maddison, 2003, p. 180).

If we take the now often talked about case of China-India comparison, our Chinese figure of US$ 807 would rank her per capita level slightly higher than that of the 1930s India (Maddison 2003, p.

182). With the 1930s Chinese GDP estimate being utilized extensively as a benchmark for estimating the Communist era GDP in the 1950s, this would also imply a higher initial conditions when Communist China started its rule in the 1950s and thus possibly a lower growth record throughout the 1960s and 1970s.[7]

Conclusion

Our study provides a set of pre-War benchmark conversion standards for comparison of income, consumption as well as other monetary indicators for Japan, China, Korea and Taiwan in the pre-WWII period. Our pre-War consumption PPP confirms that the exchange rate conversion consistently under-estimated China, Taiwan and Korea's per capita income relative to that of Japan as predicted by the factor proportion and productivity differential models. It shows clearly that the under-estimation is most serious in the case of China. Our PPP result also reveals possible biases derived from the 1990 backward projection method. Preliminary application of our PPP estimation, in combination with Maddison's work, we have shown that the 1930s Chinese per capita income might be higher than previous estimates, which would have important implications for examining the long-term growth pattern of the world's largest country. Through this study, we hope to lay the foundation of a framework, which not only insists on a historical view where post-War economic growth should be tied with pre-War economic conditions, but also an integrated East Asian framework.

---

[7] See Liu and Yeh, Perkins for the linking of 1930s and 1950s GDP data. India in the 1950s, according to Maddison (2003, p. 184), had a slightly higher per-capita GDP than China at the time.

Appendix A: Data Source

<u>Price Data:</u>

Japan: Among the three countries, price data on Japan are the best and used as a benchmark for comparison. We relied mostly on the relevant issues of *Nihon Teikoku Toukei Nenkan* (Statistical Annals of the Japanese Empire) and *Bukka Toukei Hyou* (Statistical Tables of Prices) by Shoukou Daijin Kanbou Toukeika (Government Statistics Department of the Ministry of Commerce and Industry). In addition, we also used the relevant issues of *Tokyo Bukka Oyobi Chingin Toukei* (Tokyo Price and Wage Statistics) by Tokyo Shoukou Kaigisho (Tokyo Council of Commerce and Industry), *Senzen Kijun Shouhi Suijun---Tokyo Sanshutu Houhou (1), Toukei Shiryou Dai 78 Go* (Pre-War Standard Consumption Level – Method of Calculation for Tokyo (1), Statistical Materials No. 78) by Keizai Shingichou Chousabu Toukeika (Statistical Survey Department of the Economic Council) (1953), and *Shouwa 11 Nendo Tokyo Shi Toshi Koutuu Toukei Shiryou Dai 2 Kai* (1936 Tokyo Metropolitan Transportation Statistics No.2) by Tokyo Shi Denki Kyoku (Tokyo Electricity Bureau), (1936).

Korea: We used various issues of the *Statistical Annals of the Korea Government-General* published by Chousen Soutokufu. The number of available product prices in 1935 was smaller than after 1936. To match with products for Japan, we often have to use individual year prices instead of the three-year averages. *Chousen Shouhin Torihiki Binran* (A Guide for Korean Products) issued by Chousen Soutokufu Shoukou Shoureikan (1937) contained rich price information for 1936. We also acquired some price data from newspapers, *Chousen Nippou,* and *Chuuou Nippou.*

Taiwan: Available retail prices are not as plentiful. In various cases, we used wholesale prices to match with wholesale prices in Japan and Korea. The price data are mostly from relevant issues of *Taiwan Soutokufu Toukei Shou* (Statistics of the Taiwan Government-General) published by Taiwan Shoutoku Kanbou Chousabu (later renamed as Keikakubu) and *Taiwan Shoukou Toukei* (Statistics of Taiwan Commerce and Industry) published by Taiwan Soutokufu Shokusankyoku, and *Taiwan Sheng 51 Nian Tongji Tiyao* (51 Years of Statistical Summary of Taiwan Province) compiled by the new Chinese Komingdang government in 1946 (Taiwan Sheng Xingzeng Zhangguan Kongsu). Classification of commodities among these publications is also roughly comparable. For service sectors such as expenses for housing, medical care, education, transportation and entertainment, we gathered prices from *Denki Tuushin Youran* (A Summary of Electrical, Transportation and Communication Utilities) by Taiwan Soutokufu Koutuukyoku (various yearly issues), *Taiwan Shakai Jigyou Youran* (A Summary Guide to Taiwan Social Facilities), *Nichinichi Shinbun* (Everyday News) published by Taiwan Soutokufu

Bunkyoukyoku (1935). We also used the following materials from *The Series on Chinese Local Gazette,* No. 160 of "Taiwan Annai," No.183 of "Rakuen Taiwan no Sugata," and No.190 of "Yakushin Taiwan Taikan." This Local Gazette Series was originally published before the War, reprinted in 1985 by Taipei Cengwen Publishing Ltd.

China: most of prices came from "Kongnonye Shangping Bijia Wenti Diaocha Yanjiu Ziliaoji" (Archive Materials for Studies of Industrial and Agricultural Commodity Prices) compiled by the Communist government. This material contains detailed price data by regions. For those commodities that we were able to match, we used simple averages over all the cities to arrive at national average. For some of the services such as electricity, movies and so on, we gathered information from local surveys and newspapers such as "Sichaun Jingji Cankao Ziliao" and "Dakong News."

Expenditure Weights:

Consumption expenditure weights vary by levels of aggregation according to the source of data. We use three levels of weights, the upper (the most aggregated 5 levels), the medium and the lower level, denoted as "U, M, and L" respectively in the Appendix tables. These weights are based on a combination of household budget surveys conducted for cities and rural areas.

Japan: the Japanese upper level weights are the weighted averages of expenditure shares derived from the relevant yearly series of the urban based *Household Expenditure Survey* (Kakei Chousa) published by the Statistical Bureau of the Japanese Interior Ministry, and the rural based *Agricultural Household Economic Survey* (Nouka Keizai Chousa) published by the Economic Recovery Department of the Ministry of Agriculture and Forestry. The weights are assigned according to the actual shares of urban and rural households within Japan. The same methodology applies to both Korea and Taiwan. For the lower level weights we use the result of vol.6, Private Consumption Expenditure of *LTES*. To match with Korea and Taiwan, we constructed the medium level weight from the 113 products used in this volume.

For weights on Taiwan and Korea, we largely follow Mizoguchi (1971):

Korea: As there is no urban household budget survey, we constructed the urban expenditure weights using the *The 1961 Household Expenditure Survey Report,* conducted by the Economic Planning Council of the Republic of Korea in 1962. There are three farm household budget surveys conducted in 1930, 1932-33, and 1937-39. The 1930 survey, [Report on Farm Household Economy], conducted by the Korean Agricultural Association and published in 1932-3, includes several separate volumes for different regions. The two other surveys are the 1932-33 and 1937-39 *Nouka Keizai Gaikyou Chousa* (Surveys on

Economic Conditions of Agricultural Households for Self, part-self-and-part-tenancy and Tenancy cultivators) published in 1940 by the Agricultural Recovery Department of the Ministry of Agriculture and Forestry of the Korean Governor-General (Chousen Soutokufu Nourinkyoku Nourin Shinkouka). Although the sample size of the 1937－39 survey was fairly large, detailed information on consumption weights were missing. Mizoguchi（1971）opted for the 1930 survey.

Taiwan: The Economic Planning Committee of the Taiwan Governor General (Taiwan Soutokufu Kanbou Kikakubu) conducted surveys for urban working households in Nov. 1937 and Oct. 1938, which were published as *Kakei Chousa Houkoku* (Household Expenditure Survey) in 1940. This survey, which sampled 355 families of Japanese migrants and 390 Taiwanese families in urban Taiwan could certainly be considered as fairly large scale by the standard of the time. Unfortunately, there are only expenditure weights at the medium level. For lower level weights, we relied on the 1954-55 urban household budget survey in *Zhonghua Minguo Taiwan Shenn Xinci Jieji Jiaji Tiaoca* published by the Statistics Department of the Taiwan Provincial Government in 1955.

For rural areas, there were two agricultural household surveys in 1918-21 and 1931-33. For the five category upper level weights, we used the 1931-33 survey *Taiwan Nouka Keizai Chousa Houkoku, No. 1 and 2,* also listed as No. 30 and 32 of *Nougyou Kihon Chousasho,* released by Taiwan Soutokufu Shokusankyoku in 1933. For the medium and lower weights, we follow Mizoguchi to apply the result obtained from the urban surveys.

China: for the upper level weights, we largely used Zhang Donggang (2001, pp.375-6) with some adjustments. For medium and lower level weights, we used various local surveys which we divide into urban and rural groups. We multiply these urban and rural weights by their respective urban and rural population in China. In the case of food consumption, we use urban consumption surveys of Shanghai, Tienjin, Nanjing, Wuxi and the rural surveys of Beijing, Dingxian, Jiangnin, Wuxin, Yuliangzhong, Shangxiawuzheng, Xanhu and Wujiang and multiply their averaged weights respectively by the shares of urban and rural population.

References

Ames, Edward and Carlson, John A. (1968) "Production Index Bias as a Measure of Economic Development" *Oxford Economic Papers,* Vol. 20, Issue 1 (March, 1968), 24-37.

Bhagwati, Jadish N. (1984), "Why Are Services Cheaper in Poor Countries?" *Economic Journal* 94 (June 1984): 279-285.

Balassa, Bela (1964) "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy*, vol. 72: pp. 584-596.

Bassino, Jean-Pascal, and Pierre van der Eng (2002) "Economic Divergence in East Asia: New Benchmark Estimates of Levels of Wages and GDP, 1913-1970."Paper presented at the XIII Economic History Congress held in Buenos Aires 22-26 July 2002.

De la Escosura, Leandro Prados (2000) "International Comparisons of Real Product, 1820-1990: Alternative Data Set" *Explorations in Economic History.* Vol. 37, No.1, Jan. 2000.

Directorate-General of Budget, Accounting & Statistics Executive Yuan, *Statistical Yearbook of the Republic of China,* Various Years

Fukao,K. and Ma,D. Yuan,T. (2004) "International Comparison in Historical Perspective: Reconstructing the 1934-36 Benchmark Purchasing Power Parity for Japan, Korea and Taiwan." Discussion Paper Series A No.442. The Institute of Economic Research, Hitotsubashi University, Tokyo.

Heston, Alan and Robert Summers (1993) "What Can be Learned from Successive ICP Benchmark Estimates?" *Explaining Economic Growth*, edited by Szirmai, A., Van Ark, B and Pilat, D. Elsevier Science Publishers.

Kravis, Irving B., Heston, A. and Summers, Robert (1982), *World Product and Income, International Comparisons of Real Gross Product.* Baltimore: Johns Hopkins University Press.

Kravis, Irving B., (1984) "Comparative Studies of National Incomes and Prices" *Journal of Economic Literature* Vol. XXII (March 1984), pp. 1-39.

Liu, Ta-chung (1946) *China's National Income 1931-36, An Exploratory Study.* Washington, D.C. The Brookings Institution.

Liu, Ta-chung and Yeh, Kung-chia, (1965) *The Economy of the Chinese Mainland: National Income and Economic Development, 1933-1959.* Princeton, New Jersey, Princeton University Press, 1965.

Maddison, Angus (1995) *Monitoring the World Economy 1820-1992*, OECD, Paris, France.

_____(1998) *Chinese Economic Performance in the Long Run.* OECD, Paris, France

_____ (2003) *The World Economy: Historical Statistics.* OECD, Paris France.

Mizoguchi, T (1971）"Kakou Keiretu 9" (Worksheet No. 9), Institute of Economic Research, Hitotsubashi University.

_____ （1975）*Taiwan・Chousen no Keizai Seichou---Bukka Toukei wo Chuushin to shite* (Economic Growth of Taiwan and Korea: a Study of Prices). Tokyo: Iwanami Shoten.

Mizoguchi, T. and Umemura, Mataji (eds.) (1988), *Basic Economic Statistics of Former Japanese Colonies 1895-1938.* Tokyo: Toyo Keizai Shinpousha.

Mizoguchi, T. and Nojima, Noriyuki (1996) "Taiwan, Kankoku no Kokumin Keizai Keisan Chouki Keiretsu no Suikei" (Estimation of the Long Term National Accounts of Taiwan and Korea) Asian Historical Economic Statistics Project Discussion Paper: R96-6, Tokyo: Institute of Economic Research, Hitotsubashi University.

Nakagawa, Hironobu (2000) "Estimating Purchasing Power Parity Converters for International Comparisons Across Asian Countries: Prewar Case." *Discussion Paper* No.D99-18, The Institute of Economic Research, Hitotsubashi University.

Ohkawa, Kiyoshi, and Shinohara Miyohei (1979) *Patterns of Japanese Development: A Quantitative Appraisal*, Yale University Press, New Haven, CT.

Ou, Baosan (eds.) (1947) *Zhongguo Guomin Soude* (National Income of China), vols, 1 and 2. Shanghai: Zhonghua sujui,

Perkins, Dwight (1975), "Growth and Changing Structure of China's Twentieth-Century Economy" in Dwight Perkins ed. *China's Modern Economy in Historical Perspective.* Stanford: Stanford University Press.

Samuelson, Paul (1964) "Theoretical Notes on Trade Problems," *Review of Economics and Statistics*, vol. 46: pp. 145-154.

Statistics Bureau, Management and Coordination Agency, *Japan Statistical Yearbook,* Various Issues.

Summers, Robert, and Alan Heston (1991) "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-88."*Quarterly Journal of Economics*, May 1991.

Van Zanden, Jan Luiten (2003) "Rich and Poor Before the Industrial Revolution, a Comparison between Java and the Netherlands at the Beginning of the 19th Century." *Explorations in Economic History* 40 (2003) 1-23.

Yamazawa, Ippei and Yamamoto, Yuzo (1979) *LTES, Vol. 14, Foreign Trade and Balance of Payments.* Tokyo: Toyo Keizai Shinposha.

Yamamoto, Yuzou (2000), *Nihon Shokuminchi Keizai Shi Kenkyuu* (Studies on the Economic History of Japanese Colonies), Nagoya: Nagoya University Publishing House. 2000.

_____ (1989) "Japanese Empire and Colonial Management" in Takafusa Nakamura and Konosuke Odaka eds., *Nihon Keizai Shi* (Economic History of Japan), Vol. 6, Dual Structure. Tokyo: Iwanami Shoten.

Yuan Tangjun, Kyoji Fukao (2002) "The Purchasing Power Parity of Japan, Korea and Taiwan in the 1930s--An International Comparison of Real Consumption," *The Economic Review* Vol.53, 2002The Institute of Economic Research, HitotsuBashi University, in Japanese.

Yuan Tangjun (2004) "The Real Consumption of China in 1930s: An International Comparison based on PPP", Chap.2 in Yuan (2004) *Economic Growth of China--The Initial Condition and The Resource Reallocation*, Unpublished monograph, Graduate School of Economics, Hitotsubashi University, in Japanese.