



Comparative output and labor productivity in manufacturing between China, Japan, Korea and the United States for ca. 1935 – A production-side PPP approach [☆]

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ABSTRACT

Following the standard industry-of-origin methodology to measure production-side purchasing power parities (PPPs), this study for the first time provides a set of unit value ratios (UVRs) of manufacturing products between China, Japan, Korea and the US, based on which it derives PPP estimates for individual manufacturing industries for these East Asian countries with the US as the benchmark for ca. 1935. The estimated PPP for total manufacturing suggests that the relative level of the producer price in China, Japan and Korea was about half to two thirds of the prevailing market exchange rates, respectively. The estimated PPPs are used to calculate comparative output and labor productivity for individual industries of these countries for ca. 1935. It shows that the size of factory manufacturing in Japan was 12 percent of the US level and in China only about one percent of the US level. In terms of comparative labor productivity, measured as PPP\$ per hour worked, Japanese and Korean manufacturing was 24 and 23 percent of the US level, whereas Chinese manufacturing was only 7 percent of the US level.

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1. Introduction

The post-World War II rapid economic growth 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 manufacturing that plays a key role in modern economic development.

The level of a country's real per capita GDP measured by expenditure-side purchasing power parities (PPPs) is by nature a measure of the country's welfare level relative to that of the benchmark country. While it may suggest the country's relative stage of economic development, it does not *directly* benchmark the country's industrialization level and (industry-specific) labor productivity.¹ It has been widely accepted that the "industry-of-origin" or production-side PPP approach is a more appro-

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

priate and direct method for measuring such conditions between countries (see Rostas, 1948; Paige and Bombach, 1959; Maddison, 1970, 1983).² This is because the production approach measures the real factor costs of production at industry level relative to those of the benchmark country, which takes into account the prices of both tradables and (implicitly) non-tradables, and therefore it can shed important light on the country's comparative advantage and international competitiveness.

This study attempts to fill this gap in the literature by constructing production-side PPPs for manufacturing industries to measure pre-WWII comparative output and labor productivity for three major East Asian economies, China, Japan and Korea, with the US as the reference country for ca. 1935 – the best pre-war period. This is particularly important for the understanding of the pre-WWII economic conditions in China. Compared with Japan and Korea,³ historical macroeconomic statistics for China are sketchier. 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 (1947a,b), Liu (1946), Liu and Yeh (1965) and Yeh (1977). 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 (currently 1935) is insufficient to anchor the long historical course of China's industrialization that began towards the end of the Qing Empire following the First Opium War, but it is an important starting point.⁴

Like many production-side PPP studies, this 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 is the major motivation behind most studies. Among all industries, manufacturing plays the most important role especially at the early stage of industrialization. It is the most dynamic sector because manufactured goods have a relatively high income elasticity of demand; they are highly tradable and have greater potential to gain from specialization and economies of scale through trade. Manufacturing growth is also the most important factor behind innovation and hence technological progress. Therefore, as found in many studies, the substantially rising share of manufacturing is almost a universal feature of rapid structural transformation at the early stage of industrialization (Kuznets, 1971; Chenery et al., 1986).

In addition, a production-side PPP study can help crosscheck existing expenditure PPP estimates for the same countries during the same period. In particular, this study may crosscheck and complement recent studies for Japan/China, Japan/US and China/US for ca. 1935 using the expenditure PPP approach (for example, see Fukao et al., 2007).⁵ In theory, a country's PPP GDP estimated by expenditure and production approach, respectively, should be well reconciled and the difference, if there is any, should be explained by the terms of trade effect (Feenstra et al., 2008). A production-side PPP study on manufacturing is one important step towards that goal.

This paper proceeds as follows. In Section 2 we provide a general picture of the economies of China, Japan, Korea and the US in terms of output and employment structures as well as 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 the key 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 industries between countries in comparison. In Section 6, we apply the estimated PPPs to cross country output and labor productivity comparisons. Finally, we conclude this study in Section 7.

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

The selected countries in this study are fairly representative of 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 industrialization that began during the Meiji period (1868–1912).⁶ China's modern industrial development was motivated by its successive defeats in wars with the Western powers since the First Opium War (1840), as well as domestic rebellions of increasing severity,⁷ but this development had been slow and largely defence-oriented. Japan's rise as the major regional military power in response to China's military build

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 Angus Maddison at the 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 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 Such a historical benchmark study is also significant for checking PPP estimates for the modern Chinese economy. See studies on China/US production PPPs for manufacturing industries by Szirmai and Ren (2000) and Wu (2001).

⁵ Fukao et al. (2007) constructed expenditure PPPs for Japan/China, Japan/US and China/US ca. 1935. Earlier studies by these authors (Fukao et al., 2006; Yuan and Fukao, 2002) also constructed expenditure PPPs for Taiwan and Korea for 1935.

⁶ The Meiji Restoration (1868) was the catalyst for 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 Ohkawa and Shinohara (1979), Beasley (1995) and Fukao and Saito (2006).

⁷ The Taiping Rebellion (1851–1864) was certainly the most destructive and costly rebellion to the regime. Lesser rebellions at that time include Miao Rebellion (1860–72) and Nien Rebellion (1851–68).

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