Regional Inequality and Migration in Prewar Japan, 1890-1940

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Abstract

We analyze the changing patterns of regional inequality during the initial phase of Japanese industrialization on the basis of new estimates of industry-level Japanese GDP constructed for the benchmark years 1890, 1909, 1925, 1935, and 1940 for each of the 47 prefectures. No "Kuznets" inverted U-curve is observed during the period 1890-1940 in terms of the coefficient of variation of prefecture-level per capita GDP, but rather a slow decline, reflecting a contraction in within-industry productivity across prefectures. We also estimate in- and out-migration by prefecture and find that sizable population flows took place from the poorest rural areas to the industrializing urban areas. We estimate the contribution of changes in productivity, industrial structure, and population to the observed convergence and find that internal migration played an important role, as it did during the two decades of high-speed economic growth in the 1950s and 1960s.

Keywords: spatial inequality, migration, convergence, industrial structure,
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Regional Inequality and Migration in Prewar Japan, 1890-1940

> *In a homogeneous and infinitely mobile society with economic motivation supreme, regional differences in per capita income would be negligible. The geographic distribution of population would be substantially the same as that of income and, with rates of natural increase everywhere the same, constant over time.*
>
> *But productive factors are heterogeneous and imperfectly mobile, and economic considerations do not rule alone. [...] The real world presents a picture of differences among regions in the level and trend of per capita income, and of disparate and changing regional distributions of population and total income.*
>
> Easterlin (1960: 73)

1. Introduction

A key area of interest in the study of economic development is the development of income inequality over time. Studies on inequality across countries, for example, show that the combined effects of barriers to mobility and differences in endowments resulted in a process of international divergence in national average per capita incomes during the 20th century (Pritchett 1997). A similar phenomenon is observed when looking at *personal* inequality at the global level, albeit with some convergence during recent years, mostly due to rapid economic growth in China (Bourguignon and Morrisson 2002). In contrast, studies focusing on *regional* inequality within countries suggest that developed countries today generally experienced convergence in per capita incomes in the 20th century. This is the case for the United States (Easterlin 1960) as well as most parts of Europe, where regional inequality often followed a Kuznets inverted-U curve pattern (Kuznets 1966), as shown in the seminal paper by Williamson (1965) covering a large sample of countries, and in further studies focusing on specific national experiences.

Although the role played by within-country regional integration in the economic development of Europe and the United States in the 19th and 20th centuries is well documented, the economic literature seems to have overlooked the experience of Asian countries during the same period. In a number of Asian countries, particularly China, striking regional differences in income and productivity levels can be observed. When rapid development of high productivity activities takes place in the most affluent regions, the persistence of internal barriers to domestic migration, as well as to trade and the flows of capital and technology, appears to play an important role in keeping income levels in lagging regions low.

Japan has a number of features that make it particularly attractive as a case study for the investigation of the pattern of regional convergence and the role of migration. The first non-western nation to embark on a successful process of industrialization, Japan was still a low-income country as late as the start of the process in the 1870s and 1880s. Anecdotal evidence points to striking spatial inequalities in living standards in the 1870s (see, e.g., Bird 1911) that were not primarily due to differences in natural endowments but rather to the lasting effects of political barriers restricting trade and migration that were abolished as a result of the Meiji revolution in 1868.[1]

The Japanese experience indicates that, when political circumstances allow, an almost complete defragmentation of regional markets is possible within a short time span. For major commodities, regional prices converged rapidly in the 1870s and 1880s, first with a drastic decline in price volatility and then a sharp reduction in transaction costs as reflected by unit-price differences. However, spatial inequality in nominal and real wages persisted in prewar Japan due to agglomeration effects, as well as to informal barriers restricting trade, capital flows, technology transfers, and particularly migration. Informal barriers to domestic migration can have a significant impact when production is labor intensive and initial conditions are characterized by sizable regional differences in real wages.[2] Hayashi and Prescott (2008) argue that informal barriers to exit from the

[1] It should be noted, however, that the institutional barriers that existed in Tokugawa Japan (1603-1868) between the different semi-independent domains did not prevent some migration of skilled and unskilled workers. Vaporis (1994) highlights that large numbers of commoners were already traveling all around Japan in the 18th and early 19th century, particularly under the justification of long distance pilgrimage.

[2] Saito (2006) measures regional wage differences among agricultural laborers, carpenters, metal workers, and general laborers using rice as a deflator, and presents results showing that although labor markets became increasingly integrated between the 1890s and the 1930s, resulting in a steady trend of regional convergence in nominal and real wages, sizable spatial differences persisted.

agricultural sector, due to patriarchal institutions, hindered economic growth in the 1920s and 1930s, suggesting that domestic migration flows were small and did not affect regional differences in per capita GDP in the interwar period.[3]

The aim of this paper is to assess spatial inequality in prewar Japan and to re-examine the role of domestic migration. We take advantage of the abundance and reliability of data at the prefecture-level (47 prefectures) for prices, income, labor force, and population to conduct a quantitative analysis. Building on new estimates of industry-level Japanese GDP constructed for the benchmark years 1890, 1909, 1925, 1935, and 1940 for each of the 47 prefectures (Yuan et al. 2009, Bassino et al. 2010), we analyze the changing patterns of spatial inequality during the initial phase of industrialization. Our estimates indicate that per capita GDP in the poorest Japanese prefectures was only slightly above subsistence level in 1890 and 1909.

We then investigate whether regional convergence occurred in prewar Japan. Barro and Sala-i-Martin (1992) have shown that a steady regional convergence in average per capita income took place in Japan in the 1960s and 1970s. The present study shows that this process in fact started (albeit at a slow pace) during the initial phase of industrialization in the prewar period, when a contraction in regional differences in labor productivity took place. When calculating the coefficient of variation in per capita GDP across prefectures, no "Kuznets" inverted U-curve is observed for the period 1890-1940. Instead, we find a gradual decline in spatial inequality.

We also estimate implied in- and out-migration by prefecture and find that sizable population flows took place from the poorest rural areas to the industrializing urban areas of Tokyo-Yokohama, Osaka-Kobe and, to a lesser extent, to Nagoya, and Fukuoka-Kitakyushu. This suggests that convergence in per capita GDP was driven by changes in both the numerator (GDP) and in the denominator (population). In order to measure the respective contributions of various factors, we decompose (changes in) differences in prefecture-level per capita GDP. The results show that economic catch-up in the lagging regions as indicated by shrinking within-industry labor productivity differentials as well as migration from rural regions to industrializing urban areas played a major role.

The remainder of the paper is organized into five sections. Section 2 discusses the available evidence on, and some explanatory factors of, regional convergence and divergence in the United States, Europe, and Japan since the 19th century. Section 3

[3] Aoki (2008) shows that a model that does not assume barriers to labor mobility can explain the change in prewar and postwar agricultural employment.

investigates the impact of regional convergence in terms of poverty eradication in Japan between 1890 and 1940. Next, Section 4 presents a decomposition analysis of variations in prefecture level per capita GDP, while Section 5 focuses on domestic migration flows and their role in regional convergence in prewar Japan. Section 6 summarizes the results and considers the relevance of the Japanese experience for present-day developing countries.

2. Historical patterns of regional divergence and convergence in the United States, Europe, and Japan

This section reviews the available evidence on historical patterns and determinants of regional convergence and divergence in the United States and Europe, and casts the Japanese experience in this perspective. In the United States and most European countries, a Kuznets-style inverted U-curve can be observed, with turning points around 1900 in the United States (Easterlin 1960) and in the mid-20th century in European countries such as Britain (Craft 2005), Spain (Martínez-Galarraga 2007), and Italy (Felice 2011).[4] One difficulty, however, is that in some cases, including the studies on Britain and Spain, divergence and convergence are measured using an income approach, while in other cases, in particular the studies on the United States and Italy, a production approach is adopted and the analysis is based on estimates of regional value added. District-level value added and income series cannot be expected to be identical.[5]

Our study on Japan is based on industry-level calculations of value added, including a breakdown by sector for manufacturing, for the benchmark years 1890, 1909, 1925, 1935, and 1940 for each of the 47 prefectures.[6] This approach allows us to examine regional convergence and investigate the contribution of changes in industrial structure, changes in within-industry productivity, and other factors. Such a decomposition has been performed by Kim (1998) and Mitchener and McLean (1999) for the United States,

[4] A notable exception is Sweden, which experienced a more or less continuous decline in regional income inequality from 1860-1980 (Enflo and Rosés 2012).

[5] In addition, the different components of income do not necessarily evolve in the same manner. Wages converged in Spain in the late 19th and early 20th century (Rosés and Sanchez-Alonso 2004), whereas total income diverged.

[6] More details on the construction of the underlying data are provided in Yuan et al. (2009) and Bassino et al. (2010).

and more recently by Felice (2011) for Italy.[7] Results of a similar exercise for Japan are presented in Section 4. The remainder of this section is limited to descriptive statistics.

At least for the period for which we have data so far, the pattern of convergence in prewar Japan is characterized by the absence of an inverted U-curve (Figure 1).[8] Regional inequality was not much higher during the prewar than the postwar period and followed a downward trend, with the exception of the period 1925-1935. The coefficient of variation of per capita GDP for 1890 is 0.41 and the per capita GDP of Osaka prefecture, the richest at the time, was 5.1 times that of Okinawa, the poorest, and 3.4 times that of Iwate prefecture, the poorest prefecture on the four main islands of Japan.[9] The coefficient of variation declined to 0.28 in 1925, indicating growing equality. Moreover, the ratio between Osaka and Okinawa, still the richest and poorest prefectures, respectively, had declined to 3.8, while that for Osaka and Aomori, in northern Japan, the poorest prefecture on Japan's four main islands in that year, had fallen to 2.7.

The only period when the coefficient of variation increased is that from 1925 to 1935, when the relative price of agricultural products fell and the heavy and chemical industries developed.[10] In this context, it is useful to refer to a study by Barro and Sala-i-Martin (1992), who used developments in the standard deviation of the log of state per capita personal income to examine trends in interregional income inequality in the United States from 1880 to 1988. They showed that, in the long-run, interregional inequality declined, but that an increase in equality could be seen during the Great Depression. They argue that the increase in inequality was caused by the fact that the decline in the relative price of agricultural products during this time worsened the terms of trade of agricultural states that were already poor to begin with. It is likely that the temporary increase in inequality in Japan from 1925 to 1935 suggested by our results

[7] Other factors contributing to regional divergence and convergence in the United States have been identified, in particular the influence of institutions and physical geography characteristics on productivity (Mitchener and McLean 2003), as well as that of natural endowments and spillover on the localization of manufacturing activity (Kim 1998). Tabellini (2010) also argues that culture played an important role in the formation of clusters in European regional convergence.

[8] Among other things, we are currently in the process of constructing data for the 1870s and 1880s, which may produce an inverted U-curve after all.

[9] A map of Japan and the 47 prefectures is provided in the Appendix.

[10] On the deterioration in the agricultural terms of trade due to the decline in agricultural prices during the Great Depression, see Odaka (1989: 146-151).

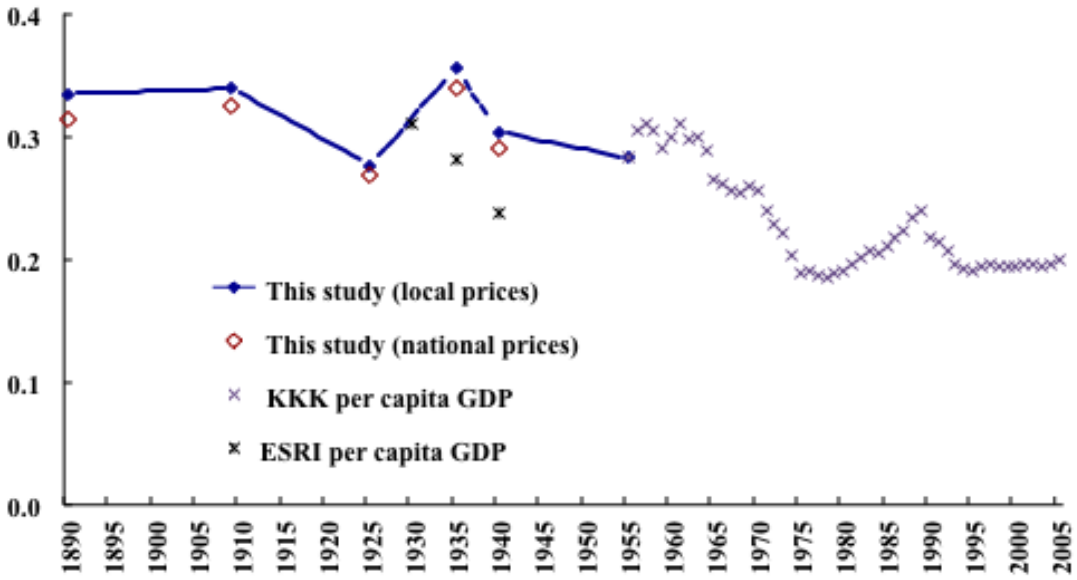
was due to similar reasons, given the decline in the price of agricultural products during this period.

The initial phase of divergence observed in the United States and in most European countries resulted from changes in industrial structure in the process of shifting to modern economic growth, with a concentration of high productivity activities such as manufacturing in urbanized areas or new industrial districts benefiting from endowments in natural resources.[11] By contrast, in the case of Japan, most prefectures experienced an expansion in manufacturing (Figure 2). On the one hand, centers of traditional cottage industries, such as Tokyo, Osaka, and Kyoto shifted toward modern manufacturing activities using imported technology; on the other, new major industrial centers emerged: Fukuoka on the basis of natural endowments (coal mines), and Yokohama and Kobe (in Kanagawa and Hyogo prefectures, respectively) in relation to maritime transportation activities and, later, the manufacturing of and trade in exportable goods. [12]

[11] See, for instance, Kim (1995).

[12] Both were new harbors opened to international trade in 1858 as part of the "unequal treaties" with Britain, France, the Netherlands, Russia, and the United States.

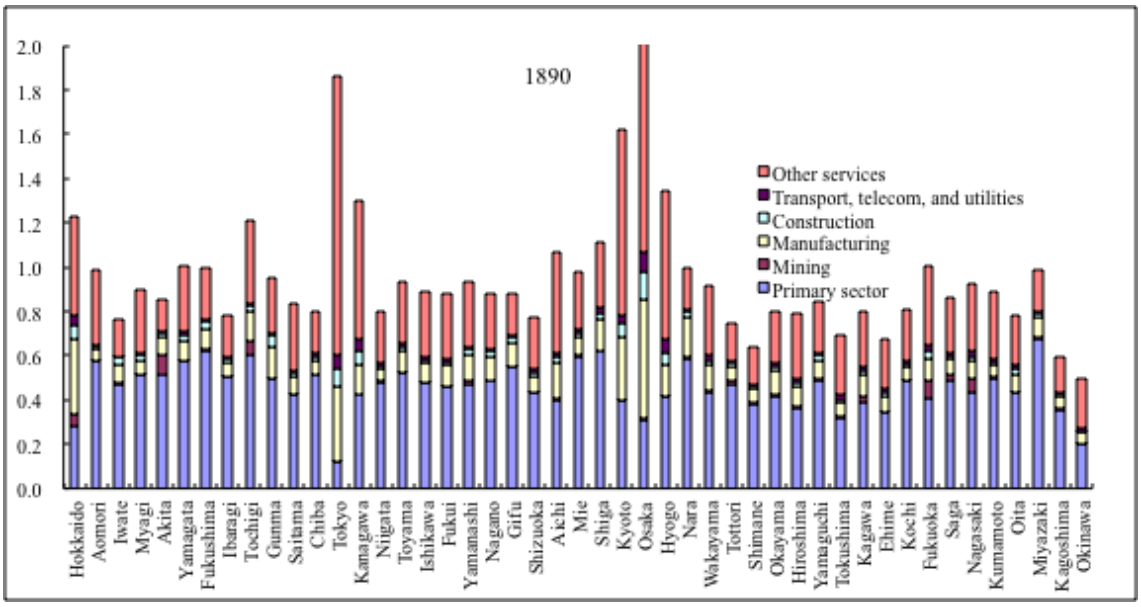
Figure 1. Coefficient of variation of per capita prefectural GDP, 1890-2005



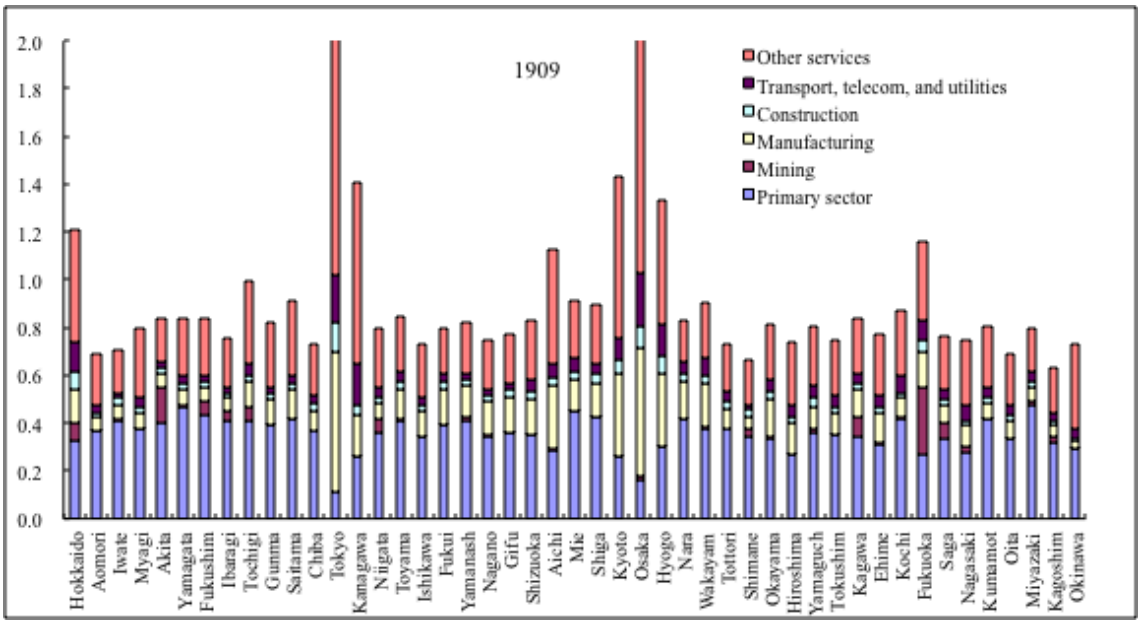
Notes: The data in this study are an updated version of series presented in Yuan et al. (2009) and Bassino et al. (2010). "KKK per capita GDP" for 1930, 1935, and 1940 refers to the per capita gross prefectural product estimates by the Kokumin Keizai Kenkyu Kyokai (1956) and are provided here for comparison, although, as shown in Bassino et al. (2010), they are problematic for a number of reasons. "ESRI per capita GDP" figures are based on data from the *Kenmin Keizai Keisan Nenpo* [*Annual Report on Prefectural Accounts*] (various years) published by the Economic and Social Research Institute, Cabinet Office (formerly, Economic Planning Agency, EPA). The postwar *Prefectural Accounts* are available in local prices only. The *Prefectural Accounts* for 1955-1969 are based on the 1953 SNA, while those for 1970-1989 are based on the 1968 SNA, and those for 1990-2005 are based on the 1993 SNA. Values from 1965 onward are on a fiscal year basis, while those before that are on a calendar year basis.

Figure 2. Value added per capita by sector by prefecture relative to national average per capita GDP (Japan=1)

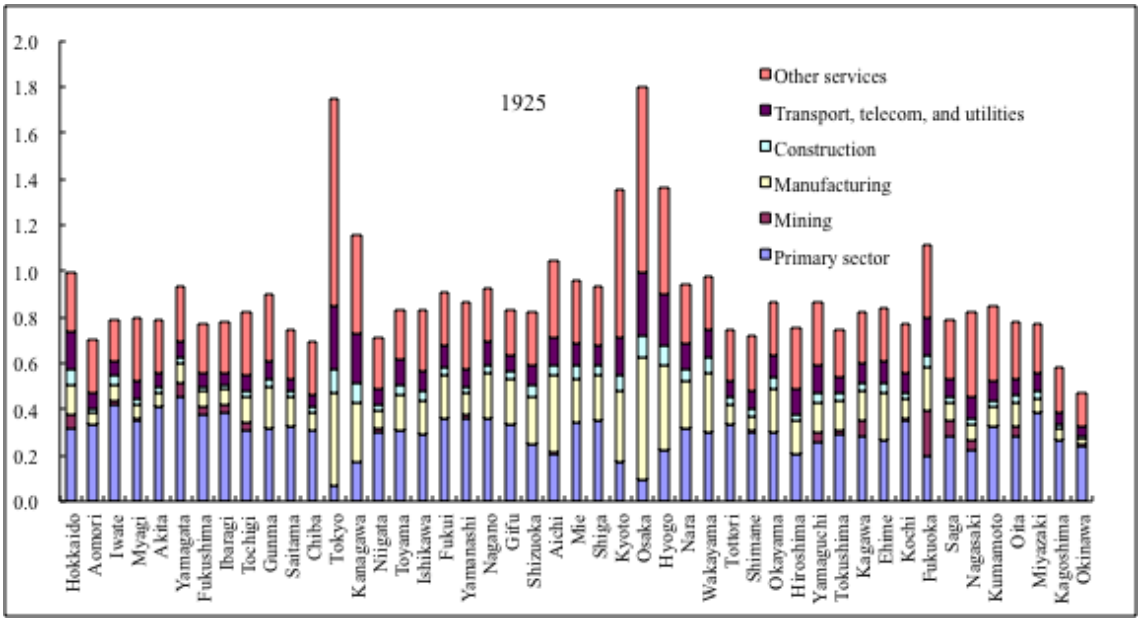
(a) 1890



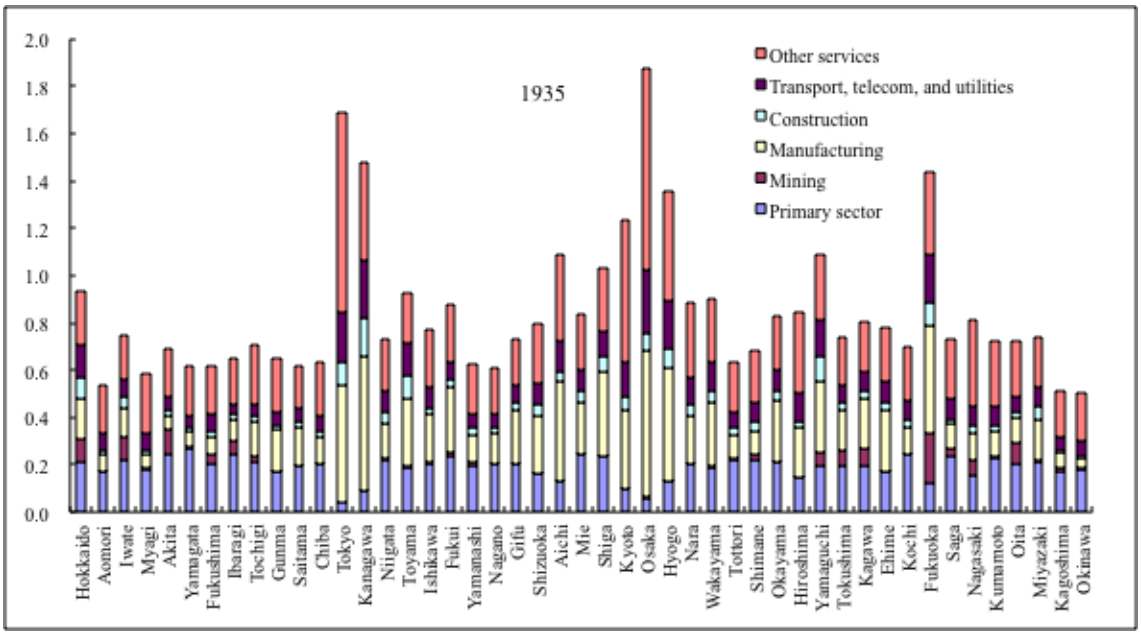
(b) 1909



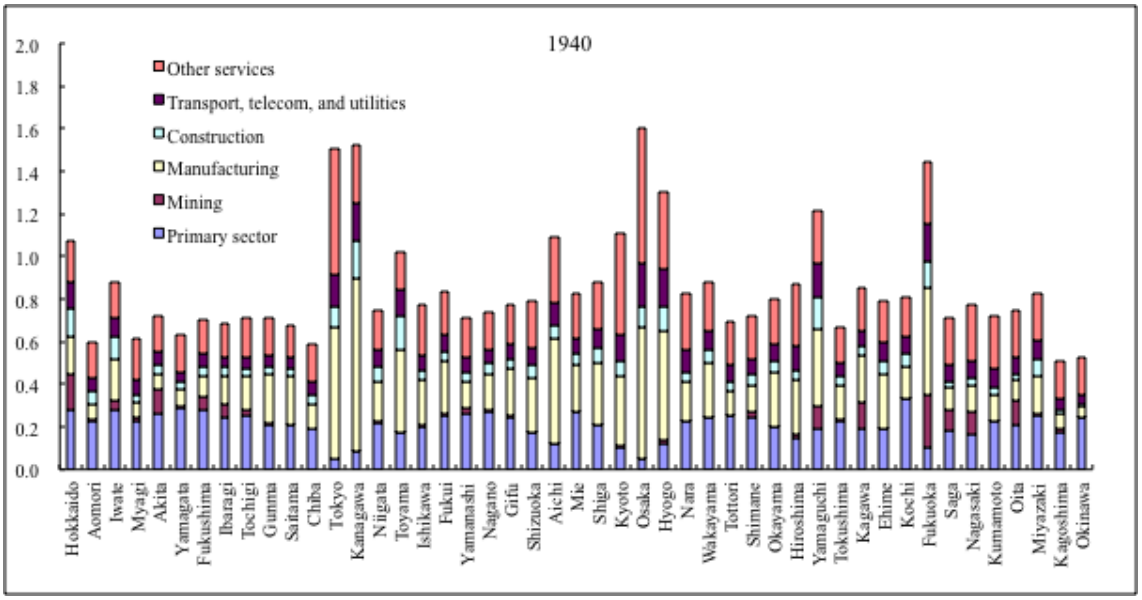
(c) 1925


1925
Other services
Transport, telecom, and utilities
Construction
Manufacturing
Mining
Primary sector
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Hokkaido
Aomori
Iwate
Myagi
Akita
Yamagata
Fukushima
Ibaragi
Tochigi
Gunma
Saitama
Chiba
Tokyo
Kanagawa
Niigata
Toyama
Ishikawa
Fukui
Yamanashi
Nagano
Gifu
Shizuoka
Aichi
Mie
Shiga
Kyoto
Osaka
Hyogo
Nara
Wakayama
Tottori
Shimane
Okayama
Hiroshima
Yamaguchi
Tokushima
Kagawa
Ehime
Kochi
Fukuoka
Saga
Nagasaki
Kumamoto
Oita
Miyazaki
Kagoshima
Okinawa

(d) 1935


1935
Other services
Transport, telecom, and utilities
Construction
Manufacturing
Mining
Primary sector
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Hokkaido
Aomori
Iwate
Myagi
Akita
Yamagata
Fukushima
Ibaragi
Tochigi
Gunma
Saitama
Chiba
Tokyo
Kanagawa
Niigata
Toyama
Ishikawa
Fukui
Yamanashi
Nagano
Gifu
Shizuoka
Aichi
Mie
Shiga
Kyoto
Osaka
Hyogo
Nara
Wakayama
Tottori
Shimane
Okayama
Hiroshima
Yamaguchi
Tokushima
Kagawa
Ehime
Kochi
Fukuoka
Saga
Nagasaki
Kumamoto
Oita
Miyazaki
Kagoshima
Okinawa

(e) 1940



The spatial diffusion of technological innovations can be regarded as an important factor of regional convergence. This is also the case for Japan, for which Fukao and Saito (2006) have shown that the national averages of value added per worker in secondary and tertiary sectors in 1874 were already about twice as high at that in the primary sector, even when by-employments in the latter are considered, and this ratio rose further to about 2.5 in the 1930s. Because the tradability of construction and tertiary industry output tends to be low, regional specialization in high value added activities in these sectors is less likely to arise. On the other hand, agricultural and manufacturing products are highly tradable, allowing regional specialization. Given the higher value added in manufacturing than in agriculture, the expansion of manufacturing therefore resulted in rising prefectural per capita GDP.

Thus, like in the United States and Europe, modern economic growth in Japan was characterized by the rise of manufacturing and technology diffusion. However, whereas in the United States and Europe, modern economic growth initially gave rise to divergence before convergence, Japan experienced a gradual convergence throughout (at least during the period for which we have data so far). This is the result of trends in both the numerator and the denominator, which will be examined in detail in Sections 4 and 5 respectively. Before that, however, it is worthwhile to look at what economic development during this period meant for the escape from poverty in Japan.

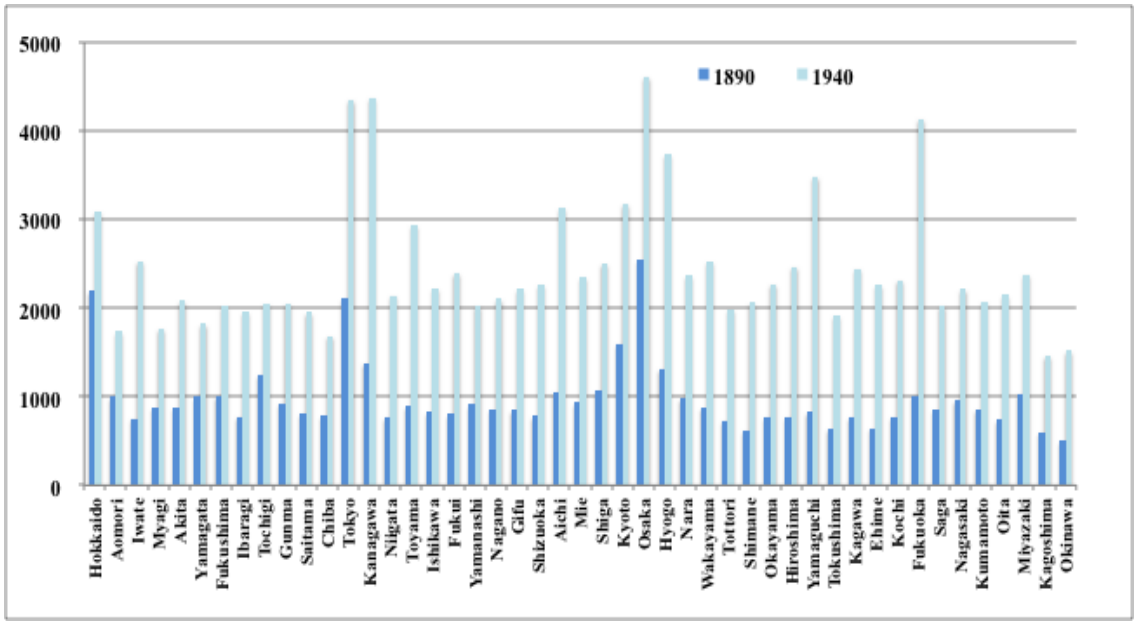
3. The escape from poverty

In this section, we focus on poverty, and the escape from it, and consider whether other indicators of inequality and well-being evolved in the same direction as per capita GDP. In the case of relatively large and populous nations, country-level averages can hide sizable regional differences in living standards and the presence of poverty pockets. That was the case in late 19th and early 20th century Japan. Estimates by Maddison (2003) suggest that average per capita income in Japan (in 1990 international dollars) was $1,012 in 1890 and $1,301 in 1909. The figure for 1890 implies that average per capita GDP in Japan was about a third of the average level of the most affluent European countries of comparable size (Britain, $4,004; Germany, $2,428; and France, $2,376), lower than in southern European countries that were also poor and latecomers in the industrialization process (Italy and Spain; $1,667 and $1,624), but at a level close to the poorest European countries (Finland, $1,280; Portugal, $1,128; and Greece, $1,087). Average per capita income in Japan was, however, about twice as high as in China ($540), India ($584), and well above that in Indonesia ($612) and Thailand ($784).

On the basis of estimates of national average figures (Maddison 2003), and relying on available information on local prices in prewar Japan, we can generate purchasing power parity adjusted prefecture level per capita GDP in 1990 international US dollars (Figure 3). The result indicates that, in 1890 and 1909, per capita GDP in the poorest Japanese prefectures was not far above what Maddison describes as the subsistence level ($400) and close the Asian levels. Specifically, in 1890, per capita GDP in the poorest prefectures, Kagoshima and Okinawa, was only $605 and $500 respectively, with 14 other prefectures (out of 47) below $800 and another 19 below $1,000. By contrast, in the richest prefectures, average per capita GDP was on par with the most advanced European countries: Tokyo and Osaka, the largest urban areas, registered $2,111 and $2,549 respectively, while sparsely populated but resource rich Hokkaido registered $2,196.[13]

[13] Hokkaido at this time was frontierland with abundant natural resources and hence a large stock of natural capital per head, so that it was a special case.

Figure 3. Average per capita GDP in 1890 and 1940 in 1990 international US dollars



Source: See text.

It should be noted, however, that average income among the social elite of landlords and former bureaucrats of the now-defunct feudal domains,[14] who accounted for about 5 percent of the population, was well above the prefecture level. Their revenues came mostly from land rent in the case of the former and taxes (in particular land taxes) in the case of the latter. Both land rents and taxes tended to reduce the disposable income of peasants, who on average had a lower labor productivity than other workers. Land tax paid by agricultural producers accounted for around a third of value added in the late 19th century. Although per capita GDP for Japan as a whole was well above that of most other Asian countries, the extraction ratio, as defined by Milanovic (et al. 2011), was high by international standards. A sizable share of the rural population was barely above subsistence level, particularly in the poorest areas, where few cash crops existed, which

[14] Living standards remained very low in the prefectures corresponding to the feudal domains that had been at the forefront of the military uprising leading to the Meiji revolution, Saga, Satsuma, Chochu, respectively part of the prefectures of Kagoshima, Tosa, and Yamaguchi (in 1890, $605, $621, and $828, respectively). This indicates that the former bureaucrats of samurai status from these domains, who were prominent in the Meiji government oligarchy and the higher ranks of the civil and military service, were not particularly prone to use their political clout for promoting the welfare of commoners in their region of origin.

restricted opportunities for specialization. Evidence of low living standards in a number of rural prefectures around 1890 can be found in surveys on food consumption conducted in 1883 and 1886. The returns of these surveys show that non-rice grains and roots (in particular sweet potatoes), which were the less preferred staples, accounted for the bulk of total intake in some rural areas – for instance 90 percent in Okinawa and 67 percent in Kagoshima – whereas rice, the most preferred and expensive staple, accounted for 64 percent and 67 percent respectively of staple consumption in rural areas in Nara and Kyoto, which were among the most affluent prefectures of Japan (Umemura et al. 1983, Table 18).

By 1909, per capita income was above $800, twice the subsistence level, in all prefectures, and only 15 prefectures were still in the range between $800 and $1,000. And by 1925, per capita income was above $1,000 in all prefectures except Okinawa (where it was $896, that is, about 50 percent higher than in 1890). Finally, by 1940, per capita income was above $1,400 (3.5 times the subsistence level) in all prefectures and below $1800 in only five prefectures (Aomori, Chiba, Kagoshima, Miyagi, and Okinawa).

The spatial distribution of income and GDP are not necessarily identical, and living standards are better reflected by average per capita income levels than per capita GDP. Thus, we have to take into account the rise of personal income inequality identified by Moriguchi and Saez (2009) in the interwar period using national-level fiscal data. Because a sizable share of revenues originating from agriculture, mining, and manufacturing was received by non-residents, per capita GDP figures tend to overstate living standards in the poorest prefectures, particularly in the interwar period, when personal income inequality reached historical peaks. In particular, cross-prefecture revenue flows from mining and manufacturing contributed to high income levels in Tokyo and Osaka, where large companies were incorporated and major stockholders were resident.

A rise in the dispersion of personal income inequality at the national level does not necessarily imply that the same trend occurred in prefectures with a low average per capita GDP. Unfortunately, measuring income distribution at the prefecture level using the same methodology as Moriguchi and Saez (2009) is not possible due to data limitations, so that alternative indicators of living standards need to be used. One such measure is the prefecture-level average height of Japanese conscripts measured at age 20 between 1892 and 1937, which points toward a trend of general improvement over the period with a high correlation between per capita GDP and average height, and

faster rates of growth of height in prefectures were the initial level was lowest (Bassino 2006). This indicates that regional poverty pockets tended to disappear.

In sum, in 1890, the first year of the period we examine, Japan's average per capita GDP was roughly on par with that of the poorest European countries (Finland, Portugal, and Greece), but about one-and-a-half to two times as high as that of other Asian countries. However, this average hides considerable regional variation, with average per capita GDP in some of the poorest prefectures barely above the subsistence level. In subsequent decades, average prefectural per capita GDP rose rapidly, including in the lagging prefectures, so that only 20 years later, in 1909, it was twice the subsistence level in all prefectures. Although these prefectural averages may still mask considerable personal income inequality, other indicators, such as body height, point at improvements in living standards across the board.

4. Changes in industrial structure, labor productivity, and regional convergence: a decomposition analysis

As mentioned at the outset, the gradual convergence in regional per capita GDP in prewar Japan was driven by changes in both the numerator (GDP) and the denominator (population). That is, convergence in per capita GDP was driven by a process of economic catch-up in intraindustry labor productivity in lagging regions as well as migration from lagging (low per capita GDP) to leading (high per capita GDP) regions. This section focuses on the first aspect by focusing on changes in industrial structure and intraindustry labor productivity. To do so, we concentrate on the ratio of the per capita GDP of the wealthiest prefectures (the top 20 percent or top 10 percent in terms of cumulative population) to that of the poorest prefectures (the bottom 20 percent or bottom 10 percent) and decompose the logarithm of that ratio into (1) differences in the ratio of the gainfully occupied population, (2) differences in labor productivity due to differences in industrial structure, and (3) differences due to intraindustry differences in labor productivity.

Specifically, denoting the average of the wealthiest group of prefectures by subscript *T* and the average for Japan as a whole by subscript *J*, we can decompose the logarithm of the ratio of the per capita prefectural GDP of the wealthiest group of prefectures, y_T, to the average per capita prefectural GDP for Japan as a whole as follows:

$$
\begin{aligned}
\ln\left(\frac{y_T}{y_J}\right) &= \ln\left(\frac{\frac{L_T}{N_T}}{\frac{L_J}{N_J}}\right) + \ln\left(\frac{\sum_{n=1}^{N}\theta_{n,T}a_{n,T}}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right) \\
&= \ln\left(\frac{\frac{L_T}{N_T}}{\frac{L_J}{N_J}}\right) + \ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(a_{n,T}+a_{n,J}\right)\left(\theta_{n,T}-\theta_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}} + \frac{\sum_{n=1}^{N}\frac{1}{2}\left(\theta_{n,J}+\theta_{n,T}\right)\left(a_{n,T}-a_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right) \\
&= \ln\left(\frac{\frac{L_T}{N_T}}{\frac{L_J}{N_J}}\right) + \ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(a_{n,T}+a_{n,J}\right)\left(\theta_{n,T}-\theta_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right) + \ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(\theta_{n,J}+\theta_{n,T}\right)\left(a_{n,T}-a_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right) \\
&+ \varepsilon_{T,J}
\end{aligned}
$$

where N_T and L_T stand for the population and the gainfully occupied population of prefecture group T, $\theta_{n,T}$ is the share of those occupied in industry n in the total gainfully occupied population in prefecture group T, and $a_{n,T}$ represents labor productivity in industry n in prefecture group T (where labor productivity is gross valued added in national average prices divided by the gainfully occupied population). All variables with subscript J represent the average for Japan as a whole. Denoting the average of the poorest group of prefectures (the bottom 20 percent or top 10 percent in terms of cumulative population) by subscript B, we can also decompose the logarithm of y_B/y_J using the same equation above.

Consequently, we can decompose the logarithm of the ratio of the average per capita prefectural GDP of the wealthiest prefectures and of the poorest prefectures, y_T/y_B, as follows:

(1) Differences in the ratio of the gainfully occupied population

$$\ln\left(\frac{\frac{L_T}{N_T}}{\frac{L_B}{N_B}}\right)$$

(2) Differences in labor productivity caused by differences in industrial structure

$$\ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(a_{n,T}+a_{n,J}\right)\left(\theta_{n,T}-\theta_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right)-\ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(a_{n,B}+a_{n,J}\right)\left(\theta_{n,B}-\theta_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right)$$

(3) Differences caused by intraindustry difference in labor productivity

$$\ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(\theta_{n,J}+\theta_{n,T}\right)\left(a_{n,T}-a_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right)-\ln\left(1+\frac{\sum_{n=1}^{N}\frac{1}{2}\left(\theta_{n,J}+\theta_{n,B}\right)\left(a_{n,B}-a_{n,J}\right)}{\sum_{n=1}^{N}\theta_{n,J}a_{n,J}}\right)$$

(4) Residual

$\varepsilon_{T,J}-\varepsilon_{B,J}$

We distinguish the following four industries: agriculture, forestry, and fisheries (hereafter, “agriculture” for short); mining, manufacturing, and construction (hereafter, “manufacturing” for short); trade and services; and transport and communication. Table 1 provides summary statistics for the share of the gainfully occupied population in the total population and labor productivity by industry for the top and bottom 20 percent of prefectures as well as the national average, on which the factor decomposition is based. The table shows the following. First, comparing labor productivity across industries for Japan as a whole, we find that differences in labor productivity between agriculture on the one hand and manufacturing as well as transport and communication on the other tended to increase, while those between agriculture on the one hand and trade and services on the other shrank considerable. This reflects the fact that whereas labor productivity in manufacturing as well as transport and communication increased through capital accumulation and technological improvements, it stagnated in trade and services.

Comparing differences in labor productivity within each industry between the wealthiest and poorest prefectures, we find that in all industries labor productivity in the wealthiest prefectures is almost twice as high as in the poorest prefectures. Moreover, looking at the change in the difference over time shows that the difference increased in

agriculture, while in the other industries it generally decreases. For example, in manufacturing, the regional difference diminishes from a factor of 2.58 (=2.86/1.11) in 1890 to 1.43 (=4.42/3.10) in 1940.

Comparing the shares of the gainfully occupied population, these tend to be higher in poorer prefectures than in wealthier ones. Known as the "first Douglas-Arisawa law" (Douglas 1934, Arisawa 1956), this reflects that the lower the income level of household heads, the higher is the ratio of employment among wives and other family members, and that especially in the early phase of economic development, those employed in agriculture often are engaged in by-employments in handicraft industry and trade and services (for the case of Japan, see, e.g., Settsu 2009). However, as Table 1 shows, this kind of interregional difference in the share of the gainfully occupied population gradually decreased.

Next, we examine the factors contributing to the interprefectural differences in per capita GDP.[15] Table 2 presents the results of our decomposition of the logarithm of the ratio of average per capita prefectural GDP of the wealthiest prefectures to that of the poorest prefectures, y_T/y_B, into the factors (1) to (4) listed above. The results show that interprefectural differences in the share of the gainfully occupied population, which tends to be higher in poorer regions, had the effect of decreasing differences in per capita prefectural GDP in all periods. On the other hand, interprefectural differences in industry structure and differences in labor productivity within the same industry both were important sources in bringing about the observed differences in per capita prefectural GDP. For example, looking at the top and bottom 20 percent prefectures in 1890, per capita prefectural GDP differed by a factor of 2.1 (=exp(0.733)). 91 percent of this difference was brought about by differences in labor productivity within the same industry and 45 percent was caused by differences in industry structure, while differences in the share of the gainfully occupied population had the effect of shrinking the difference in per capita prefectural GDP by 27 percent.

[15] While the rows do not show a clear convergence, their pattern is relatively similar to Figure 1 and we certainly do not find any divergence.

Table 1. Share of gainfully occupied population in total population and industry differences in labor productivity

	1890			1909			1925			1935			1940		
	Top 20% average	Bottom 20% average	Japan average	Top 20% average	Bottom 20% average	Japan average	Top 20% average	Bottom 20% average	Japan average	Top 20% average	Bottom 20% average	Japan average	Top 20% average	Bottom 20% average	Japan average
Share of occupied persons in population (%)	42.56	51.95	50.03	42.45	48.99	47.60	42.40	47.52	45.37	42.44	48.25	45.48	43.09	47.41	46.30
Agriculture, forestry, and fisheries	1.12	0.81	1.00	1.25	0.87	1.00	1.29	0.84	1.00	1.44	0.84	1.00	1.98	0.87	1.00
Mining, manufacturing, and construction	2.86	1.11	1.63	3.68	1.65	2.53	3.08	1.41	2.35	5.95	2.49	4.54	4.42	3.10	4.15
Domestic trade and services	14.44	6.46	8.88	5.03	2.84	3.66	3.54	2.44	2.86	4.50	2.94	3.69	3.49	2.27	2.84
Transport and communication	2.08	1.05	1.42	6.15	2.88	4.22	7.39	4.37	5.73	12.26	7.34	9.77	7.91	5.28	6.62

Notes: Labor productivity is calculated as gross value added/number of gainfully occupied persons. The figures show relative productivity levels setting the average productivity in agriculture for all Japan to 1. “Top 20% average” and “Bottom 20% average” refer to the averages of the top 20 percent and bottom 20 percent of prefectures in terms of cumulative population. The salt industry falls into “Agriculture, forestry, and fisheries” for the calculation of the share of occupied persons in the population, but into “Manufacturing” for the calculation of gross value added. Moreover, public administration falls into “Manufacturing and construction” for the calculation of the share of occupied persons in the population, but into “Transport and communication” calculation of the share of occupied persons in the population.

Table 2. Factor decomposition of differences in per capita prefectural GDP

	1890	1909	1925	1935	1940
	Comparison of top and bottom 10% of prefectures in terms of cumulative population				
Differences in average per capita prefectural GDP (logarithm)	0.926	0.972	0.965	1.089	0.955
	(100)	(100)	(100)	(100)	(100)
(1) Contribution of differences in the share of the gainfully occupied population	-0.262	-0.165	-0.119	-0.104	-0.071
	(-28.27)	(-17.00)	(-12.29)	(-9.58)	(-7.47)
(2) Contribution of differences in labor productivity due to differences in industrial structure	0.463	0.581	0.526	0.569	0.565
	(49.96)	(59.78)	(54.45)	(52.23)	(59.16)
(3) Contribution of differences in labor productivity within the same industry	0.852	0.674	0.614	0.631	0.449
	(91.98)	(69.33)	(63.63)	(57.91)	(47.03)
(4) Residual	-0.127	-0.118	-0.056	-0.006	0.012
	(-13.67)	(-12.10)	(-5.79)	(-0.57)	(1.28)
	Comparison of top and bottom 20% of prefectures in terms of cumulative population				
Differences in average per capita prefectural GDP (logarithm)	0.733	0.808	0.789	0.997	0.844
	(100)	(100)	(100)	(100)	(100)
(1) Contribution of differences in the share of the gainfully occupied population	-0.199	-0.143	-0.114	-0.128	-0.095
	(-27.18)	(-17.73)	(-14.43)	(-12.85)	(-11.31)
(2) Contribution of differences in labor productivity due to differences in industrial structure	0.327	0.421	0.434	0.559	0.519
	(44.65)	(52.07)	(55.08)	(56.04)	(61.53)
(3) Contribution of differences in labor productivity within the same industry	0.668	0.595	0.497	0.569	0.419
	(91.16)	(73.63)	(63.07)	(57.01)	(49.69)
(4) Residual	-0.063	-0.064	-0.029	-0.002	0.001
	(-8.62)	(-7.98)	(-3.71)	(-0.19)	(0.08)

Notes: Figures in parentheses show the contribution of each factor to differences in per capita prefectural GDP in percent. The calculations are based on estimates in average national prices.

Next, looking at changes in the contribution of the three factors over time, we find that the impact of regional differences in industry structure on per capita prefectural GDP differences slightly increased over time, while the offsetting effect of interprefectural differences in the share of the gainfully occupied population weakened over time with the decrease in such differences. These two factors thus worked in the direction of *widening* interprefectural differences in per capita GDP. On the other hand, differences in labor productivity within the same industry shrank considerably during the period, working in the direction of convergence. For example, comparing the top and bottom 20 percent prefectures, labor productivity within the same industry differed by a factor of 1.95 (=exp(0.668)) in 1890, but by 1940, this had shrunk to a factor of 1.52 (=exp(0.419)).

From a theoretical point of view, the "catch up" in labor productivity in the lagging prefectures that these figures suggest must be the result of capital deepening, the accumulation of human capital, and/or increases in total factor productivity (TFP) as a result of improvements in production efficiency and technology. Unfortunately, because estimates of capital input and education levels by prefecture and industry are unavailable, we cannot conduct a detailed analysis of this issue. However, it seems likely that increases in the capital-labor ratio and technological catch-up in the poorer prefectures made a substantial contribution to the reduction of labor productivity differentials. An important point in this context is that labor migration from poorer to wealthier regions would lead to a decrease in interregional differences in capital-labor ratios and, as a results of this, a decrease in differences in labor productivity. As the next section will show, such migration did indeed take place on a substantial scale.

Next, let us consider the increase in economic inequality between 1925 and 1935. First, the results in Table 2 suggest that the main reason for the increase in inequality during this period is that the contribution of regional differences in industrial structure to differences in prefectural per capita GDP increased. Because we measure gross value added per worker on the basis of (national average) current market prices, part of this reflects the impoverishment of agricultural prefectures through the decline in the relative prices of agricultural products during this period. Second, the contribution of regional differences in within-industry labor productivity to economic inequality also increased. The increase in regional differences in labor productivity during this period was particularly pronounced in agriculture and manufacturing (Table 1). Possible reasons for this include changes in intraindustry relative prices within agriculture and within manufacturing as well as the growing regional specialization within the manufacturing sector.

In sum, the analysis in this section suggests that there were considerable differences in labor productivity between the richest and the poorest prefectures within all four major sectors that we can distinguish, but such differences declined over time in all industries with the exception of agriculture. Further, the decomposition analysis showed that both differences in industrial structure and in within-industry labor productivity were important factors underlying differences in average prefectural per capita GDP. However, while the contribution of differences in industrial structure increased slightly over time, that of differences in labor productivity within the same industry showed a clear declining trend. In other words, economic catch-up through intraindustry productivity convergence – presumably as a result of technology diffusion and declining differences in the capital-labor ratio – played an important role in the convergence in prefectural per capita GDP described above.

5. Migration as an engine of regional convergence

Convergence or divergence in per capita GDP can be driven by changes in both the numerator (GDP) and in the denominator (population). In turn, changes in the share of a given prefecture in Japan's total population result from the combined effects of differences in fertility and net migration across prefectures. This sections briefly describes the procedure we employed for estimating migration across prefectures and attempts to investigate to what extent these flows reduced regional inequality in the period 1890-1940, with a comparison with the postwar period.

We start by describing our procedure for constructing migration series at the prefecture level. The first Japanese population census was carried out in 1920. We can obtain reliable figures on population and migration from that date onward,[16] but there is no consensus on populations estimates for earlier years. We therefore have to rely on figures based on family registration (*koseki* in Japanese) constructed by governmental authorities each year before 1897 and every 5 year between 1898 and 1918. Households were required to declare life-cycle events, such as birth, marriage, death, and migration, to civil officers. But it is well known that registration was often delayed and in some

[16] Prefecture level figures for the period from 1920 to 1940 are reported in Japan Statistical Association (2006), Table 2-6: Natural Increase and Net Migration of Population – Prefectures (1920-2000).

cases never occurred.[17] Estimates on migration are affected by such errors and omissions, as evidenced by inconsistencies between the total national-level in- and out-migration. In an attempt to measure actual residential populations, the government instructed people moving from their official place of residence in which they were registered (*honseki chi*) to other places in Japan (or abroad) for more than 90 days to submit a registration for out-migration (*de-kiryu todoke*) to the local administration in the place of origin and an in-migration registration (*iri-kiryu todoke*) in the place of destination.[18] In principle, after adjustment for international flows, the total number of in- and out-migrants across regions in Japan should be the same; however, in practice, the number of in-migrants exceeded the number of out-migrants by 1.7 million in 1898, 1.9 million in 1903, 2.4 million in 1908, 2.2 million in 1913, and 2.4 million in 1918.[19] Moreover, another problem is the modification of migration accounts (*kiryu seiri*), which should be taken into account. Local governments, especially in urban area, were aware of the discrepancies and modified their migration accounts to grasp the exact current residential population in their region. This results in discontinuities in urban population time-series.

Takahashi and Nakagawa (2010) have attempted to estimate net migration flows, that is, the social growth in the population of each prefecture in Japan before 1920 using the following approach:

$$\Delta P_s = \Delta P_{res} - \Delta P_{reg},$$

where ΔP_s is the social population growth in the prefecture, ΔP_{res} is the change in the current residential population in the prefecture, and ΔP_{reg} is the change in the registered population in the prefecture.

The crucial assumption in this estimation is that the difference in the number of birth and death registrations, that is, the increase in the population that has its family registry

[17] For example, in the early Meiji era, parents may have "skipped" both birth and death registration in the case of infant death. According to Takase (1991), this situation improved after 1884, since when death certification was required to cremate a body.

[18] When people moved to yet another destinations, they had to apply for a transfer of their registration (*ten-kiryu todoke*), effectively cancelling the registration at the first destination, and submit a new in-migration registration at the new destination. The details of this registration system are explained in Umemura et al. (1983: 52-54) and Saito (1973).

[19] Umemura et al. (1983: 54).

in a particular prefecture (*honseki chi jinko*) can be regarded as the natural increase in the population of that prefecture.[20] If we subtract their estimates from current residential population (*genju jinko*) in each prefecture, we can obtain net migration figures. Takahashi et al. (2010) made adjustments for discontinuities, although not for the case of Tokyo in 1908-1909. Residential population estimates for Tokyo using the methodology presented in Bassino et al. (2010) are used to generate net migration figures for this prefecture.

Figure 4 summarizes the information available by showing net flows relative to total population by prefecture. A high rate of in-migration to the major urban centers of Tokyo, Osaka, and the adjacent prefectures, respectively Kanagawa (containing Yokohama and Kawasaki) and Hyogo (containing Kobe), can be observed. The only other prefectures that experienced sustained in-migration are Aichi (containing Nagoya), Fukuoka, and Hokkaido during the early period when it was "opened up." Most other prefectures experienced sustained out-migration even as the rate of overall population growth slowed. In fact, in 21 of the 47 prefectures the *absolute* population shrank between 1935-1940, although Japan's total population continued to increase. The remainder of this section provides a quantitative assessment of the role of migration in regional convergence in prewar Japan.

In order to assess the contribution of migration to changes in regional inequality, we perform a decomposition analysis at the macro-level, i.e., without taking into account the role of changes in industrial structure and sectoral productivity in each prefecture.

We assume a constant-returns-to-scale production function:

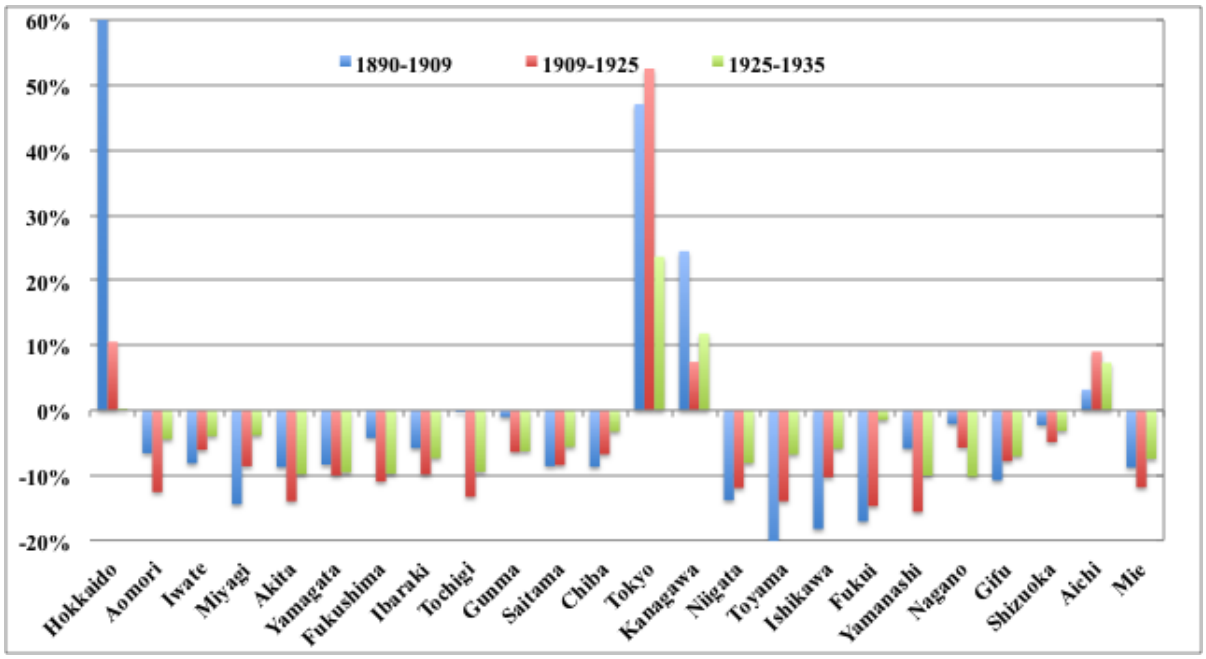
$$Y_{i,t} = F(K_{i,t}, H_{i,t}L_{i,t}) \qquad (1)$$

where $H_{i,t}$ denotes the level of the Harrod-neutral productivity index for prefecture *i* in year *t*. We assume that the production function is constant and identical across prefectures.

[20] However, this assumption is problematic, since it was not uncommon for people not to change their place of family registration (*honseki chi*) even after moving permanently to another place.

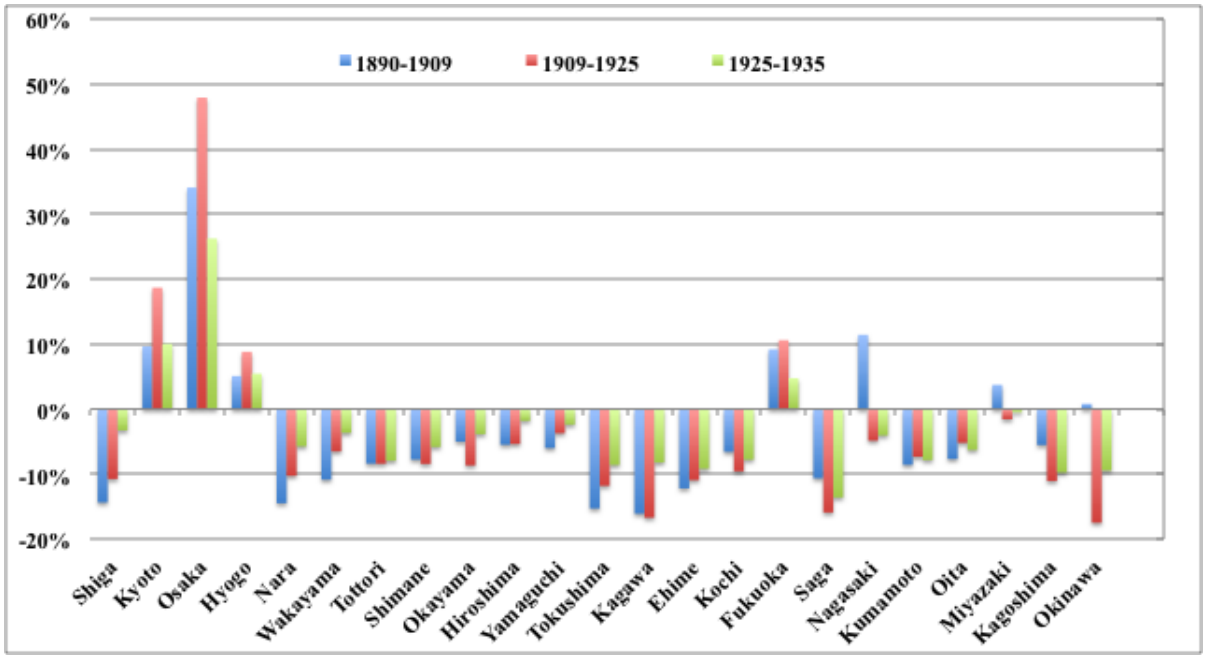
Figure 4. Net migration by prefecture

(a) Hokkaido to Mie



Note: +150% in Hokkaido and -24% in Toyama during the period 1890-1909.

(b) Shiga to Okinawa



Sources: See text.

Dividing both side of (1) by the total population of prefecture i, $N_{i,t}$, we obtain

$$\frac{Y_{i,t}}{N_{i,t}} = F\left(\frac{K_{i,t}}{L_{i,t}}, H_{i,t}\right)\frac{L_{i,t}}{N_{i,t}} \tag{2}$$

Employing a log-linear approximation of equation (2), we obtain

$$\begin{aligned}\ln\left(\frac{\frac{Y_{i,T}}{N_{i,T}}}{\frac{Y_{i,0}}{N_{i,0}}}\right) &= \theta_K \ln\left(\frac{\frac{K_{i,T}}{L_{i,T}}}{\frac{K_{i,0}}{L_{i,0}}}\right) + (1-\theta_K)\ln\left(\frac{H_{i,T}}{H_{i,0}}\right) + \ln\left(\frac{\frac{L_{i,T}}{N_{i,T}}}{\frac{L_{i,0}}{N_{i,0}}}\right) \\ &= \theta_K \ln\left(\frac{K_{i,T}}{K_{i,0}}\right) + (1-\theta_K)\ln\left(\frac{H_{i,T}}{H_{i,0}}\right) + (1-\theta_K)\ln\left(\frac{\frac{L_{i,T}}{N_{i,T}}}{\frac{L_{i,0}}{N_{i,0}}}\right) - \theta_K \ln\left(\frac{N_{i,T}}{N_{i,0}}\right)\end{aligned} \tag{3}$$

where θ_K denotes the capital income share, which we assume to be constant and identical across prefectures.

The right-hand-side terms of equation (3) respectively denote: (1) capital deepening effects, (2) TFP growth effects, (3) the effects of changes in the labor participation rate, and (4) the effects of population changes. When all other factors are constant over time, a population increase will reduce per capita income by reducing the per capita capital stock. Since we do not have data on capital stock, we cannot evaluate the first and second term, but we can evaluate the third and fourth term.

Using equation (3), let us examine how changes in the population contributed to convergence between the bottom 10 percent (or 20 percent) prefectures and the top 10 percent (20 percent) prefectures. The annual average convergence rate between the top income group of prefectures (group A) and the bottom income group (group B) can be expressed by

$$\frac{1}{T}\left(\ln\left(\frac{\frac{Y_{A,T}}{N_{A,T}}}{\frac{Y_{B,T}}{N_{B,T}}}\right)-\ln\left(\frac{\frac{Y_{A,0}}{N_{A,0}}}{\frac{Y_{B,0}}{N_{B,0}}}\right)\right)=\frac{1}{T}\theta_K\left(\ln\left(\frac{K_{A,T}}{K_{A,0}}\right)-\ln\left(\frac{K_{B,T}}{K_{B,0}}\right)\right)$$

$$+\frac{1}{T}(1-\theta_K)\left(\ln\left(\frac{H_{A,T}}{H_{A,0}}\right)-\ln\left(\frac{H_{B,T}}{H_{B,0}}\right)\right)+\frac{1}{T}(1-\theta_K)\left(\ln\left(\frac{\frac{L_{A,T}}{N_{A,T}}}{\frac{L_{A,0}}{N_{A,0}}}\right)-\ln\left(\frac{\frac{L_{B,T}}{N_{B,T}}}{\frac{L_{B,0}}{N_{B,0}}}\right)\right) \quad (4)$$

$$-\frac{1}{T}\theta_K\left(\ln\left(\frac{N_{A,T}}{N_{A,0}}\right)-\ln\left(\frac{N_{B,T}}{N_{B,0}}\right)\right)$$

As mentioned, we cannot evaluate the first two terms on the right-hand side of the equation (the effects of differences in capital accumulation across regions and the effects of differences in TFP growth across regions).[21] However, we can evaluate the last two terms (the effects of differences in labor participation changes across regions and the effects of population growth differences across regions).

The results of the decomposition are shown in Table 3 and this time include the postwar period for comparison. As already seen in Table 2, the gap in per capita GDP between the top and bottom prefectures widened in the periods 1890-1909 and 1925-1935. In most of the other periods, the gap narrowed. Specifically, the table shows: (1) the annualized speed of convergence in per capita prefectural GDP between the top and the bottom 10 percent of prefectures in terms of cumulative population (the left-hand side of equation (4)); (2) the contribution of changes in the share of the gainfully occupied population to the convergence (the third term on the right-hand side of equation (4)); and (3) the contribution of population growth differences to the convergence (the fourth term on the right-hand side of equation (4)). Similarly, Table 4 shows the results for the top and bottom 20 percent of prefectures. In both cases, we assume that the capital income share, θ_K, is 1/3.[22] In addition, when calculating the left-hand side of equation (4), we assume that the GDP deflator of all prefectures changed in a similar manner (i.e., the inflation rate in terms of the GDP deflator is identical across prefectures).

[21] However, for the postwar, it is possible to evaluate all four factors. See Fukao and Yue (2000), who do so estimating the capital stock for each prefecture, for details.

[22] For the post-World War II period, we took the data used in Fukao and Yue (2000), which are available at <http://gcoe.ier.hit-u.ac.jp/english/research/database/japan_pref.html>, and updated these.

Looking at the factors that contributed to these developments, changes in the share of the gainfully occupied population widened the gap in per capita GDP between the top and bottom prefectures in most periods. As seen in Table 1, in the case of the prewar period, the share of the gainfully occupied population was higher in the bottom prefectures than in the top prefectures.[23]

On the other hand, differences in population growth narrowed the per capita GDP gap in most periods. Population growth in the top prefectures was higher than that in the bottom prefectures in almost all periods. One notable exception is the period 1940-1955, when population growth in the top prefectures was lower than that in the bottom prefectures as people left the major cities following the destruction brought about by air raids during World War II.

It is important to note that the higher population growth in the top prefectures contributed greatly to the convergence of per capita prefectural GDP. The contribution was particularly large in the periods 1909-1940 and 1955-1970. However, it should also be noted that during the period 1955-1970, Japan's high-speed growth era, the contribution of differences in population growth to convergence was largely canceled out by changes in the share of the gainfully occupied population. In contrast, during the prewar period, the contribution of differences in population growth to convergence was much larger than the effects of changes in the share of the gainfully occupied population. Moreover, the contribution of differences in population growth to convergence was also very large relative to changes in differences in average per capita prefectural GDP between the top and the bottom prefectures. In other words, it appears that migration was the main engine of convergence in the prewar period.[24]

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[23] However, this difference declined over time and the situation reversed in the period 1955-1970: since this period, the share of the gainfully occupied population in the bottom prefectures has actually been lower than in the top prefectures. Moreover, the gap has continued to widen over time, reflecting the fact that it is mostly the young that migrate from poor to rich regions, leaving behind older populations in the poor regions.

[24] Apart from the role of migration in convergence, a topic of considerable interest is the forces underlying the regional patterns of migration and agglomeration, i.e., the growing concentration of economic activity and population especially in Greater Tokyo, Greater Osaka, and the industrial belt between them. A particularly noteworthy study in this context is that by Davis and Weinstein (2002), who argue that both locational fundamentals and increasing returns play an important role in explaining the spatial distribution of Japan's population over the millennia. Of particular interest is their finding that variation in regional population densities in Japan declined sharply during the Tokugawa era (1603-1868),

Table 3. Contribution of changes in the share of the gainfully occupied population and population growth to convergence in prefectural per capita GDP (top and bottom 10%, annual rate)

(a) 1890-1940

	1890-1909	1909-25	1925-35	1935-40
Changes in differences in average prefectural per capita GDP (logarithm)	-0.280%	-0.592%	1.167%	-3.843%
Contribution of changes in the share of the gainfully occupied population	0.002%	0.344%	0.090%	0.034%
Contribution of population growth difference	-0.377%	-0.779%	-0.830%	-0.734%

(b) 1940-2009

	1940-55	1955-70	1970-85	1985-2000	2000-09
Changes in differences in average prefectural per capita GDP (logarithm)	-2.235%	-0.394%	-0.428%	0.152%	-0.869%
Contribution of changes in the share of the gainfully occupied population	0.224%	0.746%	0.500%	0.109%	-0.270%
Contribution of population growth difference	0.504%	-1.098%	0.064%	-0.075%	-0.199%

i.e., the two-and-a-half centuries before the period we focus on, but then increased again. Given that a notable feature of the Tokugawa era is that this was a period of national isolation when Japan closed itself off to international trade, this probably reflects a shift in locational fundamentals (the importance of being close to the sea), which was reversed following the opening up of Japan to international trade during the 1850s and the onset of industrialization, i.e., the period that our analysis focuses on.

Table 4. Contribution of changes in the share of the gainfully occupied population and population growth to convergence in prefectural per capita GDP (top and bottom 20%, annual rate)

(a) 1890-1940

	1890-1909	1909-25	1925-35	1935-40
Changes in differences in average prefectural per capita GDP (logarithm)	-0.244%	-0.752%	0.832%	-3.226%
Contribution of changes in the share of the gainfully occupied population	-0.104%	0.172%	0.098%	0.304%
Contribution of population growth difference	-0.465%	-0.620%	-0.667%	-0.742%

(b) 1940-2009

	1940-55	1955-70	1970-85	1985-2000	2000-09
Changes in differences in average prefectural per capita GDP (logarithm)	-0.521%	-1.222%	-1.401%	-0.012%	-0.805%
Contribution of changes in the share of the gainfully occupied population	0.379%	0.716%	0.174%	0.106%	-0.159%
Contribution of population growth difference	0.459%	-0.640%	-0.125%	0.015%	-0.170%

6. Conclusion

The main findings presented in this paper can be summarized as follows. On the basis of new estimates of industry-level Japanese GDP constructed for the benchmark years 1890, 1909, 1925, 1935, and 1940 for each of the 47 prefectures, no "Kuznets" inverted U-curve is observed during the period 1890-1940 in terms of the coefficient of variation of prefecture-level per capita GDP, but rather a slow decline, reflecting a contraction in within-industry productivity gaps across prefectures. We also estimated in- and out-migration by prefecture and found that sizable population flows took place from the poorest rural areas to the industrializing urban areas. We estimated the

contribution of changes in productivity, industrial structure, and population to the observed convergence and found that internal migration played an important role, as it did during the two decades of high-speed economic growth in the 1950s and 1960s.

These results can be regarded as relevant for analyzing the implications of spatial inequality in developing countries, in particular China and other Asian countries enjoying rapid economic growth. Although, from a theoretical viewpoint, the net benefits resulting from economic integration within and across countries are in essence comparable, the consequences tend to differ in terms of the distribution of welfare gains among residents. When initial conditions are characterized by obstacles to internal migration, residents from the poorest areas are likely to be among the major winners from regional integration. Residents of the richer regions, who are usually the major winners from international integration, could also gain if their initial advantage in per capita income reflects a higher level of human capital and labor productivity. In other words, while international integration is likely to be a pro-rich policy in a country where internal barriers exist, domestic integration is usually a pro-poor policy.[25]

The political economy of liberalization also suggests that the magnitude of the gains could well be larger with internal than international integration. Transaction and opportunity costs are generally lower when liberalizing domestic rather than international trade, investment, or migration. In addition, the social and political costs of opening previously fragmented regional markets for goods, capital, and labor are usually lower, and the benefits larger, than in the case of a reduction in international barriers. Furthermore, building institutions enforcing fair access of all agents to the different markets is reasonably easy to achieve within a single polity.

In comparison, international regional, bilateral, or multilateral agreements are gradual and imply long and costly repeated games with multiple players in each country. International agreements are therefore marred by exemptions and delays in their application, reflecting the bargaining power of various internal lobbies, and equally slow and painful negotiations have to take place if the big players do not behave fairly, which tends to be the rule rather than the exception.

[25] That being said, integration tends to benefit owners of capital stock in rich regions, but be disadvantageous for owners of land or capital stock in poor regions.

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Appendix. Map of Japanese prefectures