Global Cities and Social Polarization in Japan:

Industries, Occupations and Inequality in Comparison with Other Regions

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1 Introduction

Economic inequality is one of the most important topics in social sciences. It is often measured and explained within a nation-state context, either as the unit of analysis or as a theoretical framework. On the other hand, inequality has a regional dimension in the global context as well. The case of the global economy influencing inequality differently across regions can be exemplified by the world/global city debate. However, the issue of difference between global cities and other national regions has been largely left unaddressed. We focus on this issue by testing the social polarization hypothesis in the case of global cities and other regions of Japan.

We draw on theories suggesting increasing inequality in global cities, in particular the work of Sassen in *The Global City* (1991), in which she also uses Tokyo as an example. According to Sassen's theory, as a consequence of globalization, producer service industries, such as accounting or banking, grow in global cities, while secondary industries related to middle-income groups decline. Furthermore, these industrial changes give rise to the expansion of both upper-level service occupations (managers and professionals) and lower-level ones (sales and services), further amplifying the

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bipolarization of income groups in global cities. The industrial and occupational structure change is deeply interrelated with other factors such as global capital flows, increasing immigration and global competition. Consequently, these factors lead to an increase in income inequality in global cities.

However, the social polarization thesis in global cities is still a contested theory. We aim to reflect on some of the critiques of the social polarization hypothesis in global cities and to further scrutinize this theory. Firstly, many empirical studies have shown that there are limits to the applicability of this model, especially in the case of non-Western cities such as Tokyo. In particular, the strong role of the government and bureaucracy (e.g., Hill and Kim 2000; Machimura 1998) and professionalization (e.g., Tai 2006) are believed to cause a different occupational change in non-Western cities, which can be characterized as "compression" around the middle class (Hill and Kim 2000) rather than increased polarization. We attempt to further verify those claims empirically in the case of global cities in Japan.

Secondly, Sassen, as well as some other researchers (e.g., Alderson and Nielsen 2002), relate the growth of inequality with the process of globalization. In this line of argument, integration of global markets, capital flows and immigration contribute to the growth of inequality. However, it has been also argued that the globalization process in Japan, especially after the burst of the economic bubble in 1991, became relatively restrictive (Itō 1998; Schaede and Grimes 2003). This casts yet another shadow of doubt on the validity of this hypothesis. At the same time, this also means that we need to focus on the changing nature of the processes leading to inequality as well.

Thirdly, in addition to testing the social polarization hypothesis, a primary focus of this paper is identifying the specific proposed characteristics of global cities in terms of social polarization and the processes leading to it in regions other than global cities. Although regions other than global cities have rarely been addressed in the context of this theory, extending the hypothesis to such areas would imply that global cities are more de-industrialized and that the bipolarization of service occupations, and hence income inequality, is also higher in global cities than in other regions of Japan. On the other hand, it has also been suggested that the shrinking secondary industries and outsourcing of lower white-collar services generally increase inequality in developed

countries (e.g., Reich 1991), which implies that these changes are happening not only in global cities but in other regions of developed countries as well. Although this does not necessarily refute Sassen's hypothesis, such questions stress the importance and validity of comparing global cities to other regions.

Considering the abovementioned arguments, we aim to test the distinctiveness of global cities in terms of social polarization processes as described by Sassen in the case of Japan.

2 The global city debate

The specific position of particular cities in the globalizing world started to be discussed and theorized in the 1980s with Friedmann's world city hypothesis (Friedmann and Wolff 1982; Friedmann 1986), which was later formulated into the global city hypothesis by Sassen (1991). Friedmann saw world cities as those with a high concentration of corporate headquarters, international financial and other advanced services. Among other theoretical developments, Sassen further linked the growth of producer services industries (particularly law, banking, accounting and advertising), de-industrialization and bipolarization of the service industries with growth in inequality.

Sassen and Friedmann positioned cities in the global context and their work had a significant impact and response worldwide. Many institutions and research organizations, such as Globalization and World Cities Research Network (GaWC), started to map, define and rank global cities around the world mainly according to economic indicators such as concentration of global enterprises or impact on the global financial markets (Beaverstock et al. 1999; Beaverstock et al. 2000; Beaverstock et al. 2002). On the other hand, this "propensity to concentrate on business and technological process" (Samers 2002) has been regarded as problematic and in general the global city theory invited a lot of criticism as well (for an overview, see, for example, Yeoh (1999)).

Soon after the introduction of the global city theory, Hamnett (1994) criticized the vagueness of the term "polarization" as used by Sassen and showed that empirical findings cannot support her hypothesis in the case of Randstad in Holland. Many other studies verified this hypothesis further in the cases such as Sydney (Baum 1997),

Singapore (Baum 1999), Hong Kong (Chiu and Lui 2004; Lee et al. 2007), Toronto (Walks 2001), Taipei (Wang 2003) or by comparing some of these cities (Hill and Kim 2000; Tai 2006). Despite the fact that growing inequality is found in all these cities, it has been more often interpreted as only partially supportive evidence (Baum 1997) or as a result of professionalization and the growth of a new middle class (Baum 1999; Hamnett 1994; Lee et al. 2007) rather than absolute polarization.

In the case of Tokyo, as one of the prime examples of a global city, social polarization has been addressed from a theoretical, rather than empirical, perspective. Although there is a considerable amount of research focusing on the place of Tokyo in the global city network and its particularities (Hill and Kim 2000; Saitō 2003; Waley 2007), these studies often stress the strong role of government and difficulties with the application of a "one-size-fits-all" concept of a global city. For example, Hill and Kim (2000) propose in their influential work that Tokyo is an example of a state-centred political-bureaucratic type of global city that is different from the market-centred, bourgeois type of global city represented by New York. In terms of social polarization, they claim that the occupational structure in Tokyo is "compressed" around the middle, rather than polarizing into the extremes and disproportionally increasing at the bottom. Consequently, the income inequality in Tokyo is caused primarily by growing inequalities in the middle stratum rather than bipolarization of the income groups. Some of the main reasons they propose for these trends include the relatively high share of middle-class related secondary industries and the low level of immigration. Some recent studies on the growing inequality in Japan have also shown that the influence of factors such as the ageing of society (Ōtake 2005) and the de-standardization of the labour market (Satō and Imai eds. 2011) in Japan can be seen as supporting Hill and Kim's compression-around-the-middle hypothesis rather than Sassen's bipolarization thesis. However, while Hill and Kim showed that there are many particularities that make the one-size-fits-all global city model incapable of sufficiently explaining the "Asian anomalies" (2000: 2186), they only partially deal with social polarization and their suggestions lack more convincing empirical evidence. In other words, many studies, including Sassen herself (Sassen 1999, 2001), have suggested that the case of Tokyo (as well as other cities) deviates from the general global city model; however, to date, not much research has been conducted to scrutinize

the process of social polarization in these cases that deviate from the general model.

Furthermore, despite the fact that Sassen has shown the social consequences of global city status, she and few other studies (e.g., Fainstein 2001) have approached the social polarization issue in global cities and other regions only in terms of spatial polarization among the metropolitan centres and suburbs. In other words, it is not clear whether social polarization and the particular processes leading to it are a distinctive characteristic of global cities as compared to other regions. One of the few examples exploring this difference is Waal and Burgers (2009) and their study of income inequality in Holland. They compared income inequality in Rotterdam, which is not classified as a global city because of its high share of secondary industries, and Amsterdam, which is often referred to as a global city. Their results contradict Sassen's hypothesis, showing that Amsterdam does not show more polarizing tendencies in terms of income groups than Rotterdam.

Similarly, in the case of Tokyo, only few studies have explored the difference in inequalities between the global city and the rest of the country. For example, Machimura and Sonobe (see Fainstein (2001)) showed that social polarization in Tokyo was evident and income inequality grew faster in central Tokyo (i.e., 23 its districts) than in other regions of Japan during the bubble economy period of 1986-91; however, in the mid-1990s, an opposite trend could be seen. This finding suggests an interesting shift in the social polarization process in Tokyo. At the same time, this trend might suggest that Tokyo started to lose its regional distinctiveness in terms of social polarization as well, yet this interpretation needs to be verified over a longer time span. Similarly, in our earlier paper we also argued that Tokyo, as well as some other prefectures identified with global cities in Japan, are not particularly different from other prefectures in terms of social inequality (Yasui et al. 2013) yet this paper focused only on analysis of cross-sectional data from 2005 and did not explore changes over time what is especially important when we consider the time when Sassen's work has been initially written and updated. Moreover, as we have also argued, it is not sufficient to focus only on the difference in income inequalities (see also Machimura (2009)), but to test the distinctiveness of the process leading to the social polarization in the global cities by juxtaposing it with the industrial and occupational change that are also occurring.

3 Hypothesis

As already suggested above, our purpose here is thus twofold. First of all, we intend to verify the social polarisation hypothesis proposed by Sassen but approach this subject from a distinctive and previously neglected perspective. Although Tokyo has been compared with other global cities around the world, its particularities has been emphasized by many scholars (e.g., Fainstein 2001; Hill and Kim 2000) including Sassen herself and her social polarisation hypothesis has repeatedly been questioned, comparing global cities with regions of the same nation has been put to very limited scrutiny. Arguably, such a perspective is necessary since the global city debate in general argues that under the influence of globalization (i.e., supra-national economy and other structures) these cities witnessed particular changes such as its industrial or occupational structure ultimately leading to an increase in social inequality (Friedmann 1986; Sassen 1991). On the other hand, such changes should not be common for other regions, i.e. rural and/or urban areas that are supposedly affected by (especially economic) globalization to a limited extend and should reflect to a higher extent national structures. Justification for the necessity of such perspective can be found in Friedmann's (1986) and Sassen's (1991, 1999) works that acknowledge the specific character of Tokyo and attributes it - at least partially - to the relatively lower extent of its involvement in the global economy what implies that despite representing a global city, Tokyo (and other global cities in Japan) does not necessarily has to be different from other regions. In other words, the question of whether cities such as Tokyo actually represents distinctive case of "global cities" in terms of their industrial and occupational structure and increasing inequality needs to be scrutinized.

As already argued, a lack of such distinctiveness has been suggested by limited number of studies, yet a more holistic analysis including focus on changes in industries, occupations and inequality as well as consideration of changes over longer time span is needed to support such claims and develop them further. Including the focus on all aspects covered by the social polarisation hypothesis, the factor of time change, as well as more recent data represent the second neglected niche that needs to be further explored in the global city debate.

Considering the abovementioned and reflecting the particularities of Sassen's hypothesis, we have formulated the following hypotheses about the trends in global cities in Japan compared with other regions (i.e., other cities and rural areas that were not identified as global cities) of the country: (1) the decline in the share of secondary industries (de-industrialization) and the growth of the share of producer services industries (especially banking, law, advertising and accounting) are both faster in global cities; (2) these changes in the industrial structure lead to a higher growth in both upper and lower service occupations; and (3) these changes in the occupational structure are reflected in a higher growth of inequality in global cities.

In other words, the main objective of this paper is to test whether the specific changes in the industrial and occupational structure as described by Sassen can be ascribed to the global character of particular cities as opposed to rather national character of other regions. Furthermore, we examine whether increased inequality is caused by the bipolarization of occupations and industries as proposed by the original social polarisation hypothesis.

4 Data and method

4-1 Data

As in many other studies on global cities (Short et al. 1996) or comparative, longitudinal studies in general, we had to face the problem of data availability, reliability and consistency. After considering various available sources and measures, especially in the case of inequality, we believe that we have constructed a data set that, despite certain unavoidable analytical limitations, can serve the purposes of our research well.

For our analysis, we use a balanced panel data set of 235 cases representing 47 prefectures in five time periods between the years 1985 and 2005. This data set was constructed from two sources: (1) the Population Census of Japan for the years 1985 to 2005 for the industry, occupation and ageing variables, and (2) the National Survey of Family Income and Expenditure (NSFIE) for the years 1984 to 2009 for the variables for Gini coefficient and average household size. Both surveys are conducted every five years and data were retrieved from the official portal (Statistics Bureau 2008) and

relevant survey reports.

As the dependent variable, we use the Gini coefficient for respective prefectures calculated from the survey reports of NSFIE (1). The fact that the Gini coefficient provided by this survey is not based on disposable income and it does not count single households represents the most serious analytical limitation of our data set (2). Nevertheless, we have chosen this variable considering the data's availability and reliability, as well as the fact that the data can be used to create a relevant indicator of income inequality and its change over time in Japan and has been used by other researchers (e.g., Machimura (2009)) in such a manner. Other important limitation of this data set is that it provides data only for prefectures and not particular cities. Thus, we had to include dummies for global cities (as described below) on prefectural level what implies inclusion of other (i.e., rural and/or regional) parts to some extent as well. While considering this as another analytical limitation posed by the available data, for the sake of clarity we continue to refer to these areas as global cities.

For the variables representing industrial structure, we use the share of secondary industries and the share of producer service industries. The former is calculated as the sum of the manufacturing and construction industries and the latter is comprised mostly of the industries discussed by Sassen—that is, banking, law, advertising and accounting industries (3). Two other variables are included for occupational structure. For upper-level service occupations, we constructed a category of occupations consisting primarily of managers, researchers, legal workers and outsourcing professionals. For the lower-level service occupations, we include sales workers and service workers as the main occupational categories. We calculated all shares from the census data by dividing the number of people working in the particular industry or occupation by the total working population for each prefecture and year. To obtain time consistent measures we also considered the changes in Japan's standard classification of industries (in 1993 and 2002) and occupations (in 1986 and 1997) and constructed coherent categories

(1) Since this survey is held one year prior to the census we have calculated Gini coefficients for years corresponding to the census, assuming that the change between the two survey periods is linear.

(2) The share of single households in Tokyo is particularly high and thus exclusion of these data can lead to "underestimation" of the Gini coefficient in the case of Tokyo.

(3) However, because of limited data availability and changes in standard classification, some other industries from the minor group ("special service industries") are also included.

across years (4).

Two dummy variables are included for Tokyo and Osaka representing Japan's two major megalopolises often identified also as two most prominent global cities in the country. Although other major Japanese cities such as Nagoya or even Kyoto recently appeared in the GaWC (2010) and other reports classifying global cities in the world, only Tokyo and Osaka have been listed in these reports consistently and are ranked in the highest categories. In the case of Tokyo (*Tokyo* dummy), although in the context of global cities central Tokyo or the 23 districts of Tokyo prefecture are most often discussed, in addition to the wider Tokyo area (i.e., Tokyo prefecture), we have also included three neighbouring prefectures (namely Saitama, Chiba and Kanagawa). The main reason for this classification is the demographic, economic and geographic interconnectedness between these prefectures, as well as the fact that we are interested in industrial and occupational structure of, and inequality among, the working population of Tokyo (5), which should be better represented by a wider Tokyo area as defined above.

On the other hand, the Osaka (*Osaka* dummy) only includes Osaka prefecture itself. Our main concern here is data availability and consistency. First of all, it can be argued that cities such as Nara or Kyoto are interconnected geographically and economically with Osaka to a lesser degree than Saitama or Kanagawa with Tokyo. Moreover, since data on inequality are available only for prefectures, inclusion of other prefectures surrounding Osaka, and particularly Kobe, would be problematic because of their relatively large size and the fact that only part of their population resides in its major cities or relatively near Osaka. Finally, it should be noted that we have made calculations with different combination of prefectures in dummies as well, yet those did not bring significantly different results. Thus, we opted for the two dummies as described above that allow us to consider both, the case of Tokyo not limited to its central area and particularities of Osaka as the other important case of global city in

(4) Because of limited data availability, we could not control for all changes and thus, some minor differences in measurement of variables by year occurred.

(5) Even if we limit Tokyo to its 23 districts, a substantial part of its working population consists of non-residents. For example, according to Population Census, in 2005 the total working population of Tokyo's 23 districts was around 6.7 million, of which more than 3 million were residents of different parts of Tokyo prefecture and other prefectures.

Japan and compare these two cities with other, largely non-global regions of Japan (6).

In our model, we also include two control variables. First, average household size was obtained from the NSFIE and represents the average number of household members for each prefecture in the respective years. This variable should control for the negative effect of larger households on the inequality. Furthermore, considering the rapid ageing of the Japanese society and the fact that it also influences inequality (e.g., Ōtake (2005)), we also use the share of population aged 65 years and higher as a control variable.

4-2 Method

For panel data sets like ours described above, random effects model (REM) and fixed effects model (FEM) represent widely adopted methods (Halaby 2004; Hsiao 2003). One of the strengths of FEM over REM is that it controls for the effects of all unobserved time invariant (or time constant) variables. On the other hand, FEM cannot estimate parameters for time invariant variables themselves, which represents a significant drawback in our case, as we need to estimate the effect of a global city (i.e., dummy variables which are constant in time). Because of this, we have chosen the so-called hybrid method, which combines FEM and REM (Allison 2009). Specifically, we have adopted the mean deviation method to estimate fixed effects in hybrid models as described by Allison (2009). In this method, deviations of the independent variables from their prefecture-specific means are calculated according to the following equation:

$$\Delta X_{kit} = X_{kit} - \overline{X}_{ki},$$

where X_{kit} represents the value for kth variable at year t for prefecture i and $\overline{X}_{ki}$ is the prefecture specific mean. A non-transformed dependent variable is regressed against both deviations (ΔX_{kit}) and prefecture-specific means ($\overline{X}_{ki}$) of the independent variables in a random effects model, where data are grouped by prefecture and the random effect

(6) By non-global regions we refer to cities and/or regions of Japan that were not perceived as global in terms of global (or world) city debate. In other words, by using such term, we do not suggest lesser degree of impact by general process of globalization. As already indicated, as the main indicator for assessing the global city status of Japan's regions we used GaWC's reports that consider mainly economic indicators as well as we draw on previous researches dealing with global cities problematic in Japan.

is defined as the constant within each group. Estimated coefficients (and also standard errors) for the deviation variables are the same as in the other FEM methods, but we can also estimate the effect of global city status as a time-invariant predictor of the income inequality.

For the computation of the results, we used the R statistical programming language (R Core Team 2012) and the lme4 package for hybrid models (Bates et al. 2012).

5 Results

5-1 Industrial and occupational change

First, we examine the change in the industrial and occupational structure in Japan. Before considering the statistical models, we explore the graphical representations of the change for each industry and occupation. The graphs in Figure 1 represent the share of particular sectors in five time periods from 1985 to 2005 for the relevant prefectures and the average for Japan. However, since the particularities of Tokyo, and to more limited extent also other prefectures considered to represent global cities in Japan, have been already addressed by Sassen (1991) or Hill and Kim (2000) in terms of international comparison and in our earlier publication (Yasui et al. 2013) in terms of comparison with other prefectures in Japan, we limit our discussion to the description of major trends in changes of these sectors over time that are related to the proposed hypothesis.

Panel A in the Figure 1 representing secondary industries clearly shows that there is a general decline in the share of these industries in Japan, but also that de-industrialization seems to be faster in the global cities. In the case of Tokyo in particular, the share of secondary industries became the second lowest in Japan by 2005. Furthermore, Panel B reveals that the share of producer services industries is indeed high in the global cities and especially in Tokyo, which also supports Sassen's assertions. However, we can also see that the growth of producer services industries occurred only through the mid-1990s, and that the global cities did not seem to develop differently than the rest of Japan since then. A similar tendency can be seen also in Panel C representing upper-level service occupations, although the fluctuation is more notable in this case. Finally, Panel D clearly shows that lower-level service occupations

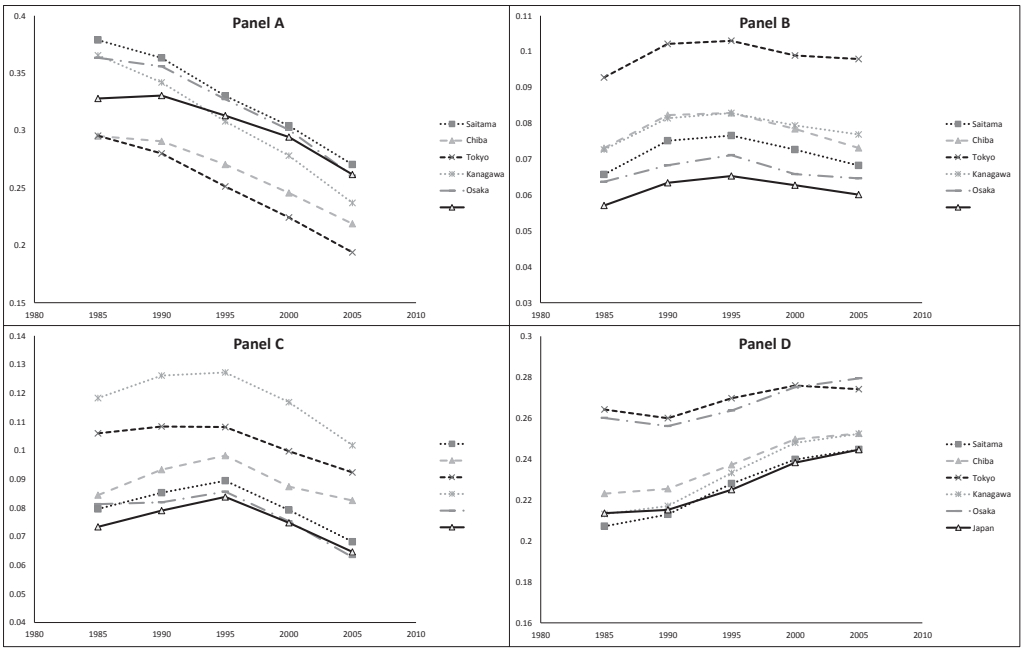

Figure 1: Share of selected industries and occupations in prefectures of Japan (1985-2005)

generally increased and were high both in Tokyo and other global cities, which once again supports Sassen's hypothesis.

However, to test whether these changes in industrial and occupational structure were significantly different in global cities and thus test the proposed hypothesis (1) we need to consider statistical models. Models 1 to 4 in Table 1 are the hybrid models described above with the dependent variable varying but independent variables remaining the same; namely, year and global city dummies and their interaction effects (7). Of particular interest here are the interaction terms between the dummies for global cities and time periods, which indicate whether the change in the particular year and industry or occupation was significantly different from the rest of the Japan. Furthermore, the main effects of the global city dummies control for the initial level of the share of specific sectors and thus allow us to make assertions about the degree of the change in comparison to other regions.

(7) Although Allison suggests not including both main effects and interaction terms with time dummies for time invariant variables because the main terms are without within-prefecture variation (2009: 19), it is crucial for our analyses to keep both, as explained later.

Table 1: Change in industrial and occupational structure (hybrid models)

	Model 1	Model 2	Model 3	Model 4
	Industry		*Occupation*	
	Secondary	*Producer services*	*Upper services*	*Lower services*
Global city dummies:				
Tokyo region	0.019	0.030***	0.037***	0.031**
	(0.029)	(0.004)	(0.005)	(0.010)
Osaka	0.048	0.017*	0.022*	0.064***
	(0.055)	(0.008)	(0.010)	(0.019)
Year dummies:				
1990	0.011***	0.005***	0.006***	0.003**
	(0.002)	(0.000)	(0.000)	(0.001)
1995	0.002	0.007***	0.012***	0.012***
	(0.002)	(0.000)	(0.000)	(0.001)
2000	−0.011***	0.006***	0.004***	0.026***
	(0.002)	(0.000)	(0.000)	(0.001)
2005	−0.044***	0.003***	−0.007***	0.036***
	(0.002)	(0.000)	(0.000)	(0.001)
Interaction terms :				
Tokyo region × 1990	−0.026***	0.004***	0.001	−0.001
	(0.008)	(0.001)	(0.002)	(0.003)
Tokyo region × 1995	−0.046***	0.003**	−0.003	0.004
	(0.008)	(0.001)	(0.002)	(0.003)
Tokyo region × 2000	−0.059***	0.001	−0.005**	0.000
	(0.008)	(0.001)	(0.002)	(0.003)
Tokyo region × 2005	−0.060***	0.000	−0.004*	−0.007**
	(0.008)	(0.001)	(0.002)	(0.003)
Osaka × 1990	−0.019	−0.000	−0.005	−0.007
	(0.015)	(0.002)	(0.003)	(0.005)
Osaka × 1995	−0.038**	0.000	−0.007*	−0.008
	(0.015)	(0.002)	(0.003)	(0.005)
Osaka × 2000	−0.051***	−0.004	−0.010**	−0.011*
	(0.015)	(0.002)	(0.003)	(0.005)
Osaka × 2005	−0.058***	−0.002	−0.012***	−0.017**
	(0.015)	(0.002)	(0.003)	(0.005)
Constant	0.315***	0.046***	0.060***	0.196***
	(0.008)	(0.001)	(0.001)	(0.003)
Log-likelihood	574.940	1005.452	934.925	794.321
BIC	−1057.068	−1918.092	−1777.037	−1495.829
N	235	235	235	235

Note : Numbers in parentheses are standard errors. Estimates for prefecture specific means and random effects were omitted

*p< .05 **p<.01 ***p<.001

In Model 1, which represents changes in secondary industries, the interaction effects show that the decline in these industries is indeed significantly faster than in both the Tokyo area and Osaka. These findings show that de-industrialization in global cities in Japan advances faster than in other regions. On the other hand, the main effects of both global city dummies show that these areas were not highly de-industrialized in 1985 when compared to the rest of Japan. In other words, these results means that

although a high degree of de-industrialization was not characteristic for the global cities of Japan in the 1980s, this process intensified in the following years in those areas, in particular in comparison with the rest of Japan. This finding is consistent with the first part of the proposed hypothesis (1).

However, Model 2 reveals that the decline in secondary industries was not accompanied by a corresponding increase in the producer services industries, which brings rather contradictory results for our hypothesis. On the one hand, the main effect of the Tokyo area dummy only confirms the evident level of the producer services industries in the Tokyo area as shown in Panel B in Figure 1. Moreover, the interaction terms with the years 1990 and 1995 show that producer services were increasing significantly faster in this period. On the other hand, as already suggested by graphs, this increase stopped in subsequent years in the global cities. However, this halt in the increase in producer services seems to only be the case in global cities, as main effects for the year dummies show, the increase remained significant in the following years for the rest of the Japan. The case of Osaka is even more contradictory in terms of our hypothesis since the insignificant interaction terms suggest that it does not differ from the rest of the Japan (excluding the Tokyo area) in terms of the increase in producer services industries. This tendency is even more pronounced in the upper-level service occupations, which are strongly related to producer services. In addition to previous findings, the interaction terms in Model 3 show that the decline in the upper-level service occupations was significantly faster in the both global cities than in other regions of Japan since the late 1990s.

One of the reasons for this tendency can be found in the post-bubble banking sector and its subsequent restructuring. Soaring amounts of bad debt led some banks to seek bankruptcy protection or enter large-scale mergers, especially since the late 1990s, and the Asian financial crisis also contributed to the stagnation of these industries. Moreover, many authors, including Sassen (1999) have argued that there are limitations to the global activities of the Japanese financial sector and the Japanese economy in general. For example, the restrictive and controlled engagement of Japan in the global economy was described by economists Schaede and Grimes (2003), and they aptly referred to the "permeable insulation" of the Japanese economy. This suggests that the producer services industries in Japan cannot accommodate an increasing number

of workers for providing “sophisticated financial services” (Sassen 1991: 86) or special services for “global” (meaning non-Japanese) producers. In other words, producer services industries in Japan are to a large extent limited to the domestic market, which seems to have reached its growth limits in recent years.

Finally, Model 4 representing lower-level service occupations confirms the evident increase in these occupations by the main effects of the year dummies, which increase over time and are significant. The share of these lower-level service occupations is especially high in the case of Tokyo and Osaka prefectures (i.e., metropolitan prefectures), which clearly indicates the importance of lower-level services for global cities. On the other hand, the model does not show supportive evidence for the hypothesis in terms of faster growth of these occupations in the global cities after 1985. On the contrary, the interaction term of the global city dummy variables and years 2000 and 2005 are negative and significant. The negative values of these coefficients can be explained by the changes in the data structure. As the graph also suggests, the rate of change in Tokyo and Osaka in particular has significantly decreased since 1985 (8), which caused the negative values of these estimates. This result means that the growth in the share of lower-level service occupations in recent years was slower in Tokyo and Osaka than in the other parts of Japan. In other words, we can say that a growing share of lower-level service occupations became a characteristic of areas of Japan outside of the global cities over the last 10 to 15 years.

Furthermore, we test the second hypothesis on the relationship between industrial and occupational structural change. The above-mentioned analysis gives some insight into this relationship, yet Models 5 and 6 in Table 2 present this relationship more clearly. Since we are interested in the longitudinal relationship between particular industries and occupations, we included as independent variables only the shares of both industries and dummies for global cities. In Model 5, the main effects of the both the secondary and producer services industries are positive and highly significant. On the one hand, this supports our hypothesis concerning producer services industries, but contradicts the hypothesized impact on secondary industries. This result has the exact

(8) The decrease in variation of this variable can be confirmed also by other descriptive statistics; both range and standard deviation decreased by around one-fourth between 1985 and 2005.

opposite effect on the dependent variable as in the proposed hypothesis. Relatively low and statistically insignificant dummy variables imply that this result applies to global cities as well. In other words, the share of the upper-level service occupations is strongly and positively related to producer services; however, these occupations tend to decrease with de-industrialization.

In the case of lower-level service occupations (Model 6), the effects of both the secondary and producer services industries are significant and in accordance with the hypothesis. Furthermore, the estimates for the dummy variables suggest differences in and among global cities of Japan. The high statistical significance of the estimates suggests that the particular industrial structure affects the level of lower-level service occupations more in both global cities. The difference in the value of the estimates is caused by the share of producer services industries; while it was relatively high and not generally increasing in the Tokyo area, its relatively low share in the case of Osaka suggests the existence of other factors that significantly contribute to the level of employment in lower-level service occupations [9].

Table 2: Industrial and occupational change (hybrid models)

	Model 5	Model 6
	Upper services	*Lower services*
Industries：		
Secondary	0.174***	−0.487***
	(0.009)	(0.025)
Producer services	1.301***	1.330***
	(0.072)	(0.203)
Global city dummies:		
Tokyo region	0.008	−0.030***
	(0.004)	(0.007)
Osaka	−0.001	0.027**
	(0.006)	(0.009)
Constant	−0.011	0.159***
	(0.008)	(0.013)
Log-likelihood	935.079	721.900
BIC	−1821.022	−1394.664
N	235	235

Note：Numbers in parentheses are standard errors. Estimates for prefecture specific means and random effects were omitted

*p< .05 **p<.01 ***p<.001

[9] These results are supported by other models with various combinations of independent variables. For example, if we do not control the share of producer services industries, the estimate for Tokyo becomes insignificant and low (0.002), while the estimate for Osaka dummy is higher (0.038) and remains highly significant.

5-2 Income inequality

Before looking at the relationship between inequality and the structural changes of industries and occupations, we need to consider the position of the global cities in the structure of income variation in all of Japan. We present this both in graphical form (Figure 2) and by statistical models (Table 3). Interestingly enough, Tokyo's level of household income inequality in 1985 (0.289) was very close to the average of all of Japan (0.283), and although it jumped over the next five years to the second highest level (0.312), in the following years it again slowly converged to the average [10]. In the case of other global cities, the trajectory can be characterized by more steady growth in inequality, especially in the last five years in Osaka. Moreover, similarly to lower-level service industries, the variation by region seems to be declining in terms of income inequality as well [11].

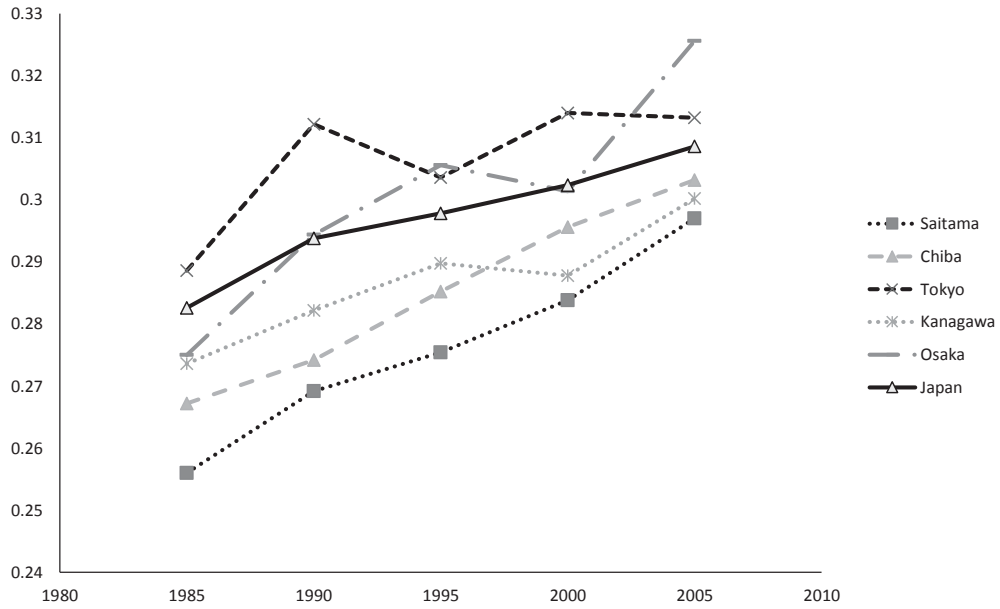

Figure 2: Gini's coefficient of household income inequality in prefectures of Japan (1985-2005)

[10] In 2009, the value even fell slightly (by 0.001 point) below the national average.

[11] We can confirm this decline in variation again by range and standard deviation of this variable; both declined in the measurement period by around one-fifth.

These findings are also well represented in the statistical models. When explaining the variation of the Gini coefficient by prefecture and its longitudinal change, we started with a model with only the main effects of the global city and year dummies (Model 7), then added their interaction effects (Model 8), and lastly incorporated control variables. The main effects of the global city dummies, although varying in the different models, are not statistically significant and confirm the fact that neither of these regions was statistically different from the rest of Japan in 1985. The main effects of the year dummies well represent the increasing trend in the Gini coefficient in Models 7 and 8, but after introducing the control variables, the estimates become unstable. Considering this, together with the Bayesian information criterion (BIC) and the log-likelihood ratio, as indicators of the goodness of fit of the models, we can say that the basic Model 7 represents the data most precisely.

This analysis of goodness of fit also suggests that in statistical terms, the interaction effects of the global city and year dummies, which are our main focus here, should not be included in the model, and this in itself does not support our hypothesis (3). Moreover, even in the models where these effects are included, although positive, they are relatively low and not statistically significant, meaning they did not show that inequality grew in a different way in global cities. There is only one exception to this: the aforementioned last period in the case of Osaka, where the inequality grew significantly faster. Nevertheless, the general trend that can be identified here is that of an increasing level of inequality in Japan and decreasing differences between the global and non-global cities.

The difference between Tokyo and its adjacent prefectures, which can be seen in Figure 2, suggests a certain level of spatial polarization. Groups with relatively similar mid-level income tend to stay in suburban localities surrounding central Tokyo. On the other hand, the groups that tend to stay in central Tokyo have increased income inequality polarization, as they likely constitute high(er)-income groups that are able to pay the higher living costs and low(er)-income groups that opt for lower housing standard in exchange for reduced commuting costs. However, the difference in inequality still seems to be relatively low, which suggests that the effect of spatial polarization is limited and inequality growth needs further clarification.

Firstly, as already suggested, industries in global cities in Japan are not developing

Table 3: Household income inequality in Japan and its global cities (hybrid models)

	Model 7	Model 8	Model 9	Model 10
Global city dummies:				
Tokyo area	−0.002	−0.007	−0.005	−0.008
	(0.007)	(0.008)	(0.007)	(0.009)
Osaka	0.010	−0.003	0.006	0.003
	(0.014)	(0.016)	(0.013)	(0.014)
Year dummies:				
1990	0.007***	0.006**	0.004*	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
1995	0.015***	0.014***	0.005	0.001
	(0.002)	(0.002)	(0.003)	(0.006)
2000	0.019***	0.019***	0.004	−0.003
	(0.002)	(0.002)	(0.004)	(0.010)
2005	0.025***	0.023***	0.005	−0.006
	(0.002)	(0.002)	(0.006)	(0.013)
Interaction terms :				
Tokyo area × 1990		0.007		
		(0.007)		
Tokyo area × 1995		0.003		
		(0.007)		
Tokyo area × 2000		0.005		
		(0.007)		
Tokyo area × 2005		0.009		
		(0.007)		
Osaka × 1990		0.014		
		(0.013)		
Osaka × 1995		0.017		
		(0.013)		
Osaka × 2000		0.008		
		(0.013)		
Osaka × 2005		0.027*		
		(0.013)		
Control variables:				
Household size			−0.033***	−0.034***
			(0.009)	(0.009)
Percentage age 65+				0.101
				(0.121)
Constant	0.278***	0.278***	0.353***	0.372***
	(0.002)	(0.002)	(0.038)	(0.045)
Log-likelihood	688.274	660.475	688.960	686.860
BIC	−1327.411	−1228.138	−1317.864	−1302.745
N	235	235	235	235

Note : Numbers in parentheses are standard errors. Estimates for prefecture specific means and random effects were omitted
*p< .05 **p<.01 ***p<.001

in the polarising way envisioned by Sassen. Although de-industrialization is advancing rapidly, secondary industries that are associated with the middle class are still represented in these prefectures at between 20% to 27% of total employment. Moreover, a lack of growth in producer services that are associated with high-income groups significantly limits the potential for polarization.

Secondly, as already suggested, an immigrant population, which should significantly contribute to the polarizing tendencies in global cities, is largely lacking in the case of Japan. Moreover, in addition to the low number of immigrants, their industrial and occupational structures generally do not contribute to income polarization. According to Population Census of Japan, in 2005 as much as 50% of foreigners were employed in occupations related to production. At the same time, while professionals and engineers are relatively highly represented (13% of all occupations) among immigrant populations and thus could possibly contribute to polarization of income groups, recent studies has shown that the majority of these foreigners are employed predominantly in white-collar language-related jobs (Liu-Farrer 2009; Tsukasaki 2008). In other words, immigrants in general are largely associated with the middle-income group rather than groups at the extremes of the income spectrum.

In summary, similarly to previous findings, the analysis of the household income inequality distribution and its change between 1985 and 2005 did not prove that global cities represent a special case in general. Furthermore, these findings, along with other empirical evidence, question the social polarization hypothesis in general and instead provide supportive evidence for the thesis by Hill and Kim (2000) regarding the compression at middle-income levels.

5-3 Income inequality, industrial and occupational change in Japan

Finally, although the previous results do not support the social polarisation hypothesis, it does not necessarily imply that there is no relationship between income inequality and changes in industrial and occupational structures. Thus, in the final part we continue with exploring this relationship by fitting statistical models in accordance with this hypothesis. Nevertheless, the previous results have an important implication for the statistical models, namely that there is no reason to include global city dummies in the further analysis as we could not verify statistically that global cities (i.e., the independent variable) have an effect on the level of inequality (i.e., the dependent variable). This leaves us with only the time variant predictor (and control) variables, and thus a simple FEM is sufficient here [(12)]. Dummy variables and other

[(12)] In the subsequent analysis we use the dummy variable method to estimate the fixed effects.

predictor variables are estimated by OLS method (Allison 2009; Hsiao 2003).

Furthermore, rather than the two independent variables for both the producer services industries and upper-level service occupations that we used previously, instead we use the principal component scores of these two variables (*Upper services factor*). The reason for this is that both variables are measuring very similar segments of the labour market, just from different perspectives (i.e., by industry versus by occupation) and thus are highly correlated [13]. Although in panel data analyses the problem of (multi)collinearity is rarely paid special attention, including highly correlated independent variables often results in unstable and inaccurate parameter estimations and therefore should be addressed here. To overcome this, we have used in regression the principal component scores for these two variables [14].

In the following analysis, we consider four models. Model 11 represents the basic model including only the independent variables and prefecture dummies. In the subsequent models, we introduce year dummies in Model 12, add additional control variables in Model 14, and include control variables without the year dummies in Model 13.

Firstly, Model 11 shows supportive evidence for Sassen's assertions on the relationship between inequality and industrial and occupational structure; however, not in the case of global cities but rather for all of Japan. In this case, the main effects of all three variables are significant and influence household income inequality in the direction Sassen predicted. However, if we control the year dummies (Model 12), control variables (Model 13) or both (Model 14), the only significant effect remaining in each model is the share of secondary industries. From this, it is obvious that the share of secondary industry reduces Gini coefficients, or, in other words, that the level of de-industrialization increases the household inequality in Japan. Furthermore, from these three models, it is also obvious that we would be unjustified in saying that there is a significant effect of the share of lower-level service occupations on household income

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This method estimate the same parameters as the previously adopted mean deviation method, but uses independent variables in their original form (i.e., not their deviations and prefecture-specific means) and dummy variables for each prefecture (omitted in the results).

[13] Both variables were positively and highly correlated (the correlation coefficient was 0.811).

[14] One component was extracted using principal component analysis with no rotation (since we have only two items and possibly only one component) which explained 91.2% of the variance.

Table 4: Household income inequality, industry and occupational structure (FEM)

	Model 11	Model 12	Model 13	Model 14
Secondary industry	−0.202***	−0.162**	−0.142**	−0.226***
	(0.047)	(0.051)	(0.047)	(0.058)
Upper services factor	0.011***	0.003	0.008***	0.002
	(0.002)	(0.006)	(0.002)	(0.006)
Lower service occupations	0.389***	0.108	−0.088	0.119
	(0.069)	(0.172)	(0.142)	(0.165)
Year dummies:				
1990		0.006*		0.001
		(0.003)		(0.003)
1995		0.010*		−0.012
		(0.004)		(0.007)
2000		0.012**		−0.029*
		(0.005)		(0.012)
2005		0.013		−0.047**
		(0.007)		(0.017)
Control variables:				
Household size			−0.023**	−0.034***
			(0.008)	(0.009)
Percentage age 65+			0.075	0.375**
			(0.066)	(0.136)
Constant	0.281***	0.321***	0.439***	0.449***
	(0.031)	(0.042)	(0.048)	(0.050)
adj. R-squared	0.748	0.756	0.770	0.778
Log-likelihood	805.969	812.014	817.980	824.559
BIC	−1333.500	−1323.751	−1346.603	−1337.922
N	235	235	235	235

Note : Numbers in parentheses are standard errors. Results for prefecture dummies were omitted.
*p< .05 **p<.01 ***p<.001

inequality. Interpretation of the effect of the upper-level services factor, that is, the effect of the share of upper-level service occupations and producer services, depends on which model we adopt.

Regarding only the adjusted R-squared, Model 13 and 14 perform best. Although the difference between these models is very small (only 0.008), it proved to be significant, and thus we should adopt Model 14 [15]. Nevertheless, BIC suggests that the inclusion of additional parameters caused over-fitting of the model rather than a better fit, and thus we can conclude that Model 13 should be adopted.

This means that together with de-industrialization, higher shares of producer services industries and upper-level service occupations increase inequality measured in the terms of household income in Japan. However, while the impact of the former

[15] F-test for the change statistics was significant at p< .05.

is indisputable and widely acknowledged, the effect of the latter is relatively low and could be debatable. This once again suggests that the increasing inequality in Japan is caused by compression around the middle stratum rather than forming occupational polarization. This can be further supported by the findings on the effect of the lower-level service occupations. Firstly, it did not significantly contribute to an increase in income inequality despite its growth. Secondly, this effect was not significant, even though the Gini coefficient is relatively more sensitive to changes in the distribution of the middle stratum (Statistics Bureau 2008). These findings indicate that there are other significant factors contributing to the increasing inequality both in the global cities and other regions of Japan.

6 Conclusions

Indeed, global cities in Japan, and especially Tokyo, remain as strategic sites in terms of the concentration of producer services and related occupations. At the same time, they became some of the most de-industrialized areas in Japan. These findings provide supportive evidence for Sassen's claims on the industrial structure of global cities. However, in terms of the process of change and comparison with other regions, we cannot conclude that the industrial and occupational change in global cities in Japan is occurring in the proposed way.

Firstly, the change in the share of relevant industries and occupations in the global cities was not faster in the period considered here than in all of Japan; hence, hypothesis (1) cannot be adopted. Moreover, the proliferation of lower-level service occupations, proposed by Sassen as typical for global cities, is becoming faster in, and thus a characteristic of, non-global regions of Japan. Secondly, in the case of longitudinal relationships between structural change in the industry and service occupations in the hypothesis (2), we also found only partially supportive evidence. Specifically, industrial structure change as described by Sassen resulted only in higher growth in lower-level, but not upper-level, service occupations. Finally, and most importantly, contrary to hypothesis (3), our results show that these changes in the occupational structure do not lead to higher growth of inequality in global cities in comparison with other regions of Japan. In other words, our analysis has shown

that the extended social polarization hypothesis regarding the structural change in particular occupations, industries and their causal connection to income inequality as a characteristic trait of global cities cannot be adopted in the case of Japan in general. Moreover, our analyses strongly suggest that the social polarization hypothesis cannot be supported in its original, non-extended form either. Besides the fact that the changes in industry and occupational structure were mostly at odds with Sassen's hypothesis, the income inequality in Japan does not seem to be driven by polarization of service occupations in the first place.

A possible explanation for these rather controversial findings can be found in the restrictive nature of the globalization process in Japan. As also suggested by Sassen herself, the role of Tokyo and Osaka in global markets, despite being significant, are relatively restricted to certain functions such as providing "a raw commodity – money" (1999: 86). Thus, the global flows of money, people or ideas are still relatively limited in the "permeable insulation" of the Japanese economy and market. Consequently, both Tokyo and Osaka, while strongly engaging in the global economy, are still heavily influenced by and reflect the national markets. That is to say, although having strong global links, the relevant sectors of the economy are still dominated by domestic links, and thus reflect domestic labour markets. These are different from the typical global cities engaging primarily in a common global economy (see Fainstein (2001)). At the same time, this explains the relative lack of difference with other regions of Japan as well. In a sense, both Tokyo and Osaka seem to still be national or regional centres rather than global cities with "typical" global industries and the associated form of inequality of income distribution.

Inequality in Japan and its global cities seems to be shaped by "compression around the middle", as suggested by Hill and Kim (2000), rather than in the way envisioned by Sassen. In other words, income inequality is indeed growing and is relatively strongly affected by de-industrialization, yet it leads to greater inequalities in the middle stratum rather than bipolarization of the income groups. This can be ascribed to the particularities of the social structures in Japan, such as relatively low number of immigrants, their occupational structure and the increasing de-standardization of employment. These factors and their effects need to be further scrutinized.

Nevertheless, we believe that rather than revealing the changes in inequality

distribution of Japan in detail, our results reveal the necessity of focusing on regional comparison in the global cities discourse. As we have shown here, the specific processes of social polarization as described by Sassen are not characteristic for the global cities in Japan.

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Global Cities and Social Polarization in Japan: Industries, Occupations and Inequality in Comparison with Other Regions

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In this paper, we use panel data on occupations, industries and inequality in Japan between the years 1985 to 2005 and analyse their change in global and non-global regions. Considering the social polarization hypothesis from the global cities theories implying specific character of changes in such cities, our results show that growth of specific occupations and industries in Tokyo and Osaka was not faster than in other regions, that there is only partial support for the proposed casual relation between industrial and occupational change, and most importantly, that these changes in particular occupations and industries do not lead to higher growth of inequality in global regions. Consequently, it can be argued that social polarization in the terms of previous theories is not characteristic for global cities in Japan. Thus, income inequality is indeed growing and is relatively strongly affected by de-industrialization, yet it leads to greater inequalities in the middle stratum rather than bipolarization of the income groups. This leads us to conclude that both Tokyo and Osaka, while strongly engaging in the global economy, are still heavily influenced by, and reflect, the national markets rather than global economy which causes a relative lack of difference with other regions as well.