

A Regional WIO Analysis of the Effect of Non-residents' Consumption: A Comparison between Tokyo and Kyoto

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Abstract - As metropolises are attractive areas for consumers, not only by their residents but also by non-residents such as visitors from other regions. In this study, using the interregional and regional waste input-output analysis, we investigated the impact of the final demands of a metropolis which are especially induced by the consumption of non-resident visitors. Non-residents' consumption induced the industrial outputs, waste emissions, CO₂ emissions and landfill consumptions in the metropolis itself as well as in the other regions. As case studies, we estimated the effect of Tokyo and Kyoto respectively which are both major metropolises in Japan and in which non-residents' consumption is great. We used the 2000 interregional waste input-output table for Tokyo and the 2000 regional waste input-output table for Kyoto respectively in each case study to estimate the impact of the non-residents' consumption activities in a metropolis. In Tokyo, the induced effect in production activities, waste emission and environmental loads of other regions was much larger than those of Tokyo itself. It is because that Tokyo depends heavily on activities in other regions such as economic activities and waste treatment activities. In Kyoto, the rate of the induced production of secondary manufacturing sectors and the induced waste emission of electric industry were clearly larger than those of Tokyo. We found that the induced effect differed between Tokyo and Kyoto according to the difference in economic structure and waste emission structure between them.

Keywords: Interregional waste input-output, Regional waste input-output, Effect of non-residents' consumption

1. Introduction

As metropolises are attractive areas for consumers, not only by their residents but also

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by non-residents such as commuters and visitors from other regions. The increase of consumption induces economic growth in one hand, but it also increases waste emission and environmental loads in a metropolis. Such effects will spill over not only into the metropolis itself but also into the surrounding regions. In this study, using the interregional and regional waste input-output analysis, we tried to investigate the impact of the final demands of a metropolis empirically which are especially induced by the consumption of non-residents' visitors. As case studies, we estimated the effect of Tokyo and Kyoto respectively which are both major metropolises in Japan and where non-residents' consumption is great.

2. A Regional WIO Analysis of the Effect of Non-residents' Consumption

Tokyo is the largest metropolis in Japan and Kyoto is known as one of the most famous sightseeing areas in Japan. Those metropolises are extremely attractive area not only for the residents of the metropolises but also for non-residents who stay there for work, study, shopping or sightseeing. There are two major classes of consumers from other regions; the former one is "commuters" who comes to the metropolis for work or study, and the latter is "visitors" who comes or stays in the metropolis for shopping or sightseeing. In this study, we compared the effect of non-residents' visitors consumption between Tokyo and Kyoto by using the regional and interregional WIO analysis.

2.1. A case study in Tokyo

The empirical WIO analysis deeply depends on the availability of data. Tokyo metropolitan government published sufficient statistical data of waste and economic activities to compile an interregional WIO table. Especially, the 2000 interregional IO

table of Tokyo is very useful as a base statistical data (TMGA 2007). In this table, the non-residents' consumption sectors were compiled as independent sectors in the final demands sectors. In this study, we improved the 2000 interregional WIO table of Tokyo which was compiled in the previous work (Tsukui, Kagawa & Kondo 2010). The 2000 interregional WIO table of Tokyo (2000 IRWIO Tokyo) had 196 industrial sectors, 13 waste treatment sectors, 17 final demands sectors, 96 waste sectors, 7 value added sectors, and 2 environmental loads sectors, in each region, Tokyo and other regions. In this table, we considered CO₂ emissions and landfill volume as the environmental loads. We constructed an extended Isard model (Isard 1951; Kagawa and Kondo 2007) to estimate the impact of the non-residents' visitors consumption in Tokyo.

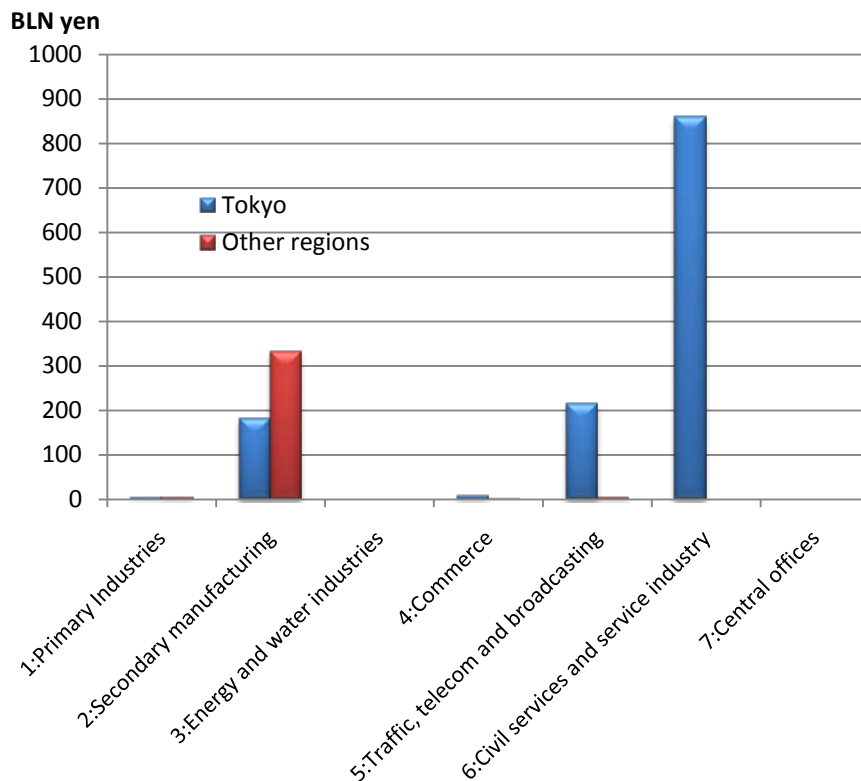


Figure 1. The direct impact of non-resident visitors' consumption in Tokyo

The direct impact is depicted in Figure 1. The non-residents' visitors consumed 1,618 billion yen in Tokyo. About 80% of the consumption was provided from Tokyo.

However, as shown in Figure 2, the induced impact in other region was much larger than that in Tokyo. The main industry of Tokyo is the service industry, to which the production of other regions supplied. The induced economic activities in other regions increased the waste emission, the CO₂ emission and the landfill volume of industrial sectors in other regions as shown in Figure 3 and Figure 4. The effect of the non-resident visitors' consumption in Tokyo was much larger in other region than that in Tokyo, where goods and services were consumed.

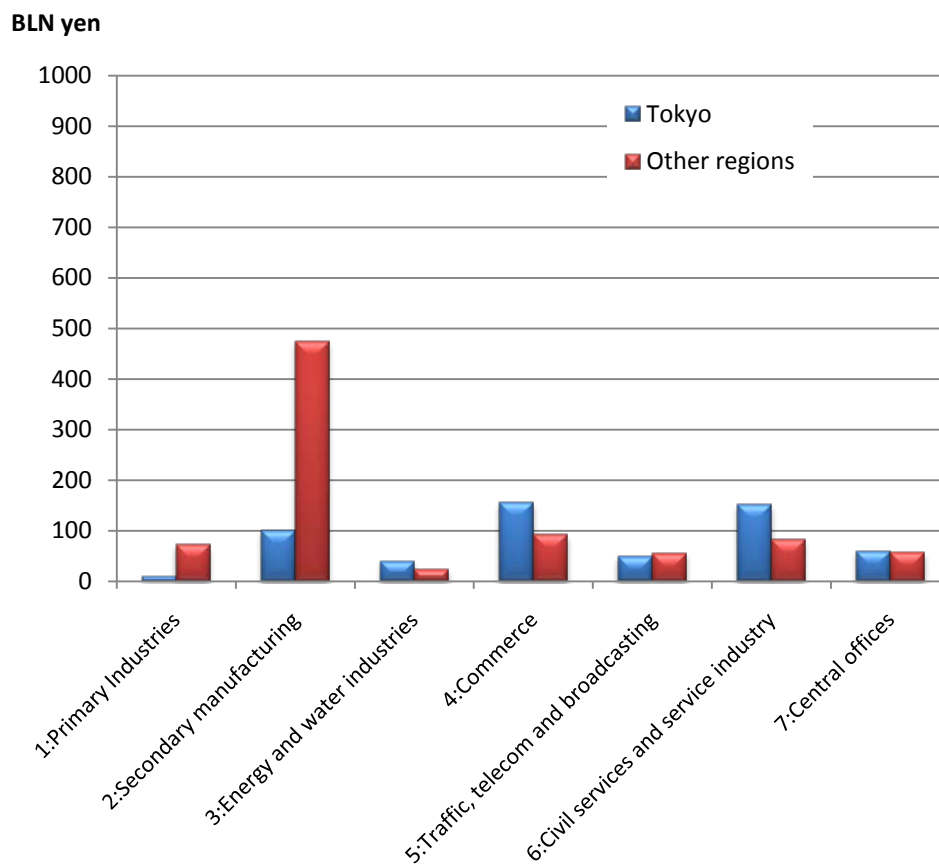


Figure 2. The indirect impact of non-resident visitors' consumption in Tokyo

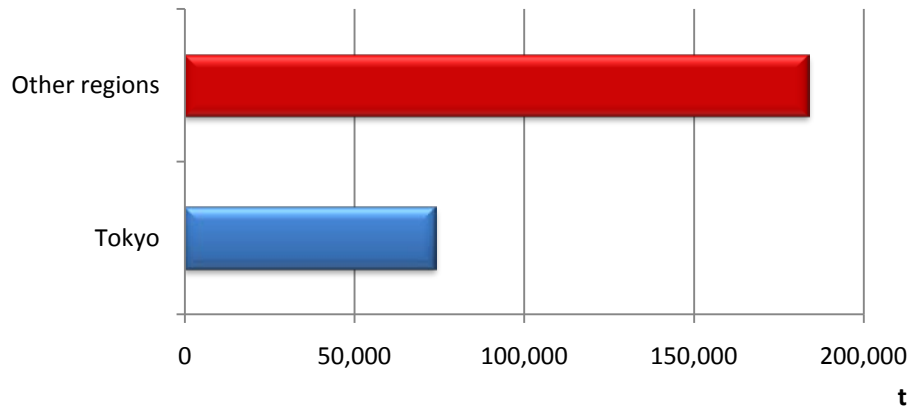


Figure 3. Waste emission of industrial sectors

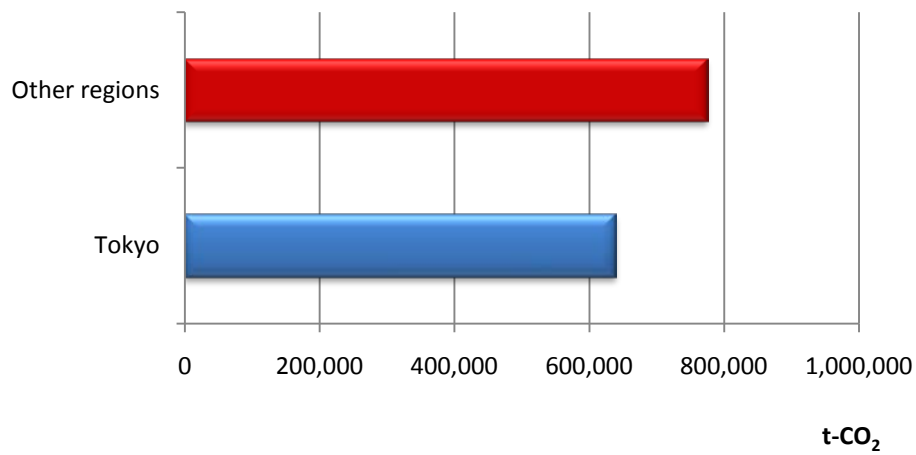


Figure 4. CO₂ emission of industrial sectors

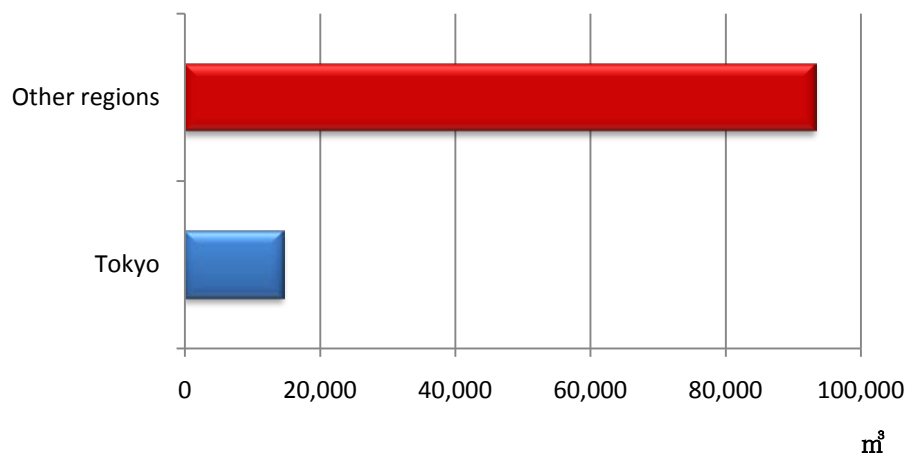


Figure 5. Landfill volume

2.2. A case study : a comparison between Tokyo and Kyoto

The 2000 regional WIO table of Kyoto (Ichikawa, Kagatsume, Tsukui & Hatano 2010; Hatano, Kagatsume, Tsukui & Ichikawa 2010) had 104 industrial sectors, 12 waste treatment sectors, 11 final demands sectors, 92 waste sectors, 8 value added sectors, and 2 environmental loads sectors. In this table, we considered CO₂ emissions and landfill volume as the environmental loads as in the 2000 IRWIO Tokyo. In this table, the non-residents' consumption sectors were included in the consumption expenditure of households sector and were not independent. In this study, we assumed that the rate of the non-residents' visitors consumption in the consumption expenditure of households sector was same as that in Tokyo. We estimated the non-residents' visitors consumption in Kyoto in that way as a numerical example, and conducted a scenario analysis to obtain initial results.

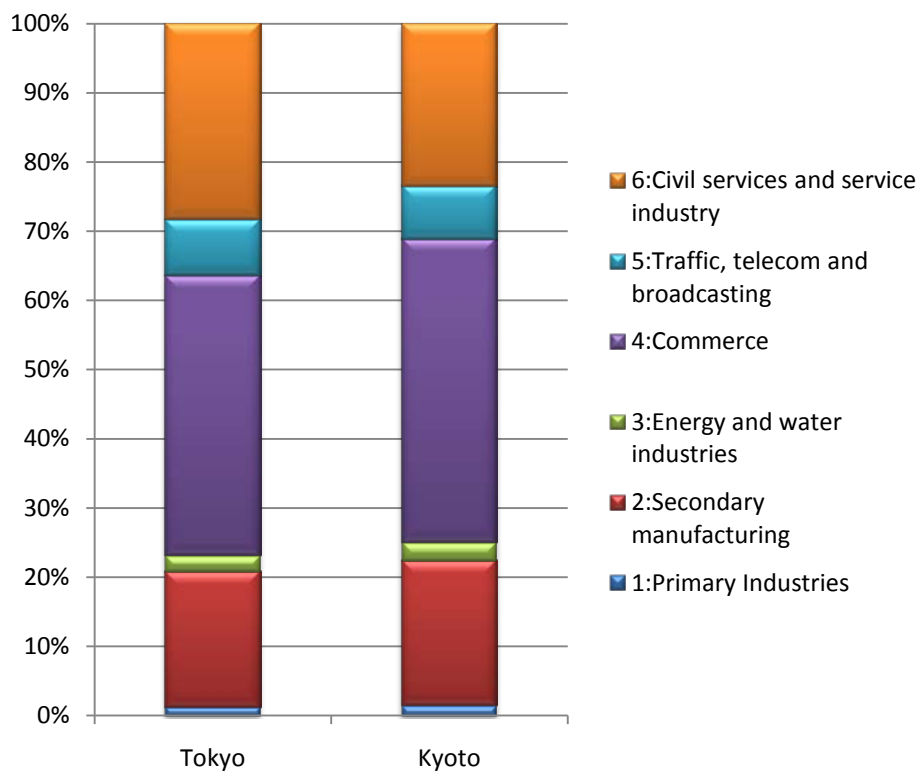


Figure 6. The consumption expenditure of households of Tokyo and Kyoto

The proportion of the consumption expenditure of households of Tokyo and Kyoto was very similar, although the consumption of Tokyo was 37,887 billion yen and that of Kyoto was only 5,441 billion yen. In this study, the non-resident visitors' consumption was assumed to be about 3.35 % of the consumption expenditure of households in each region.

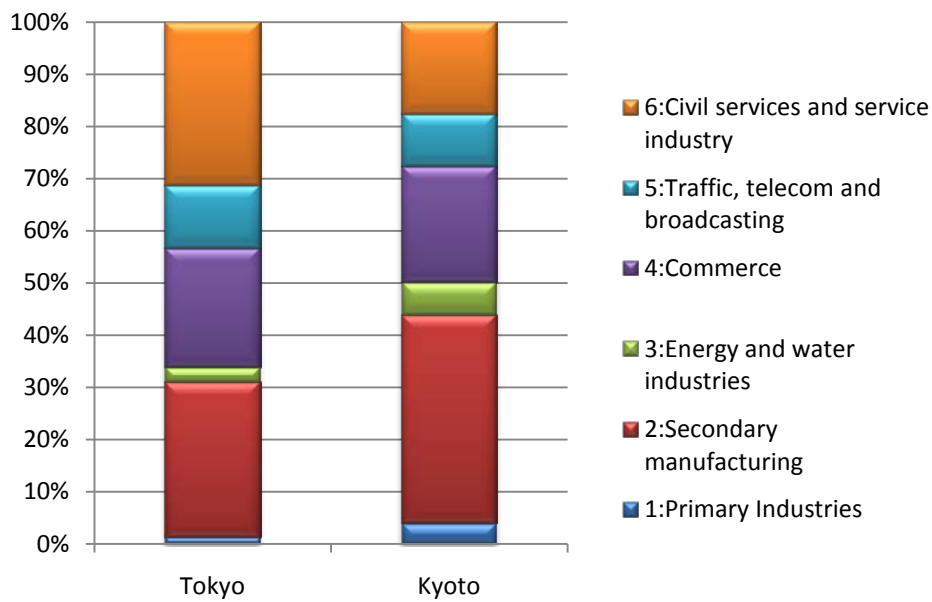


Figure 7. Proportion of the impact of visitors' consumption of Tokyo and Kyoto in industrial sectors

The results of the impact estimation are shown in Figure 7 and Figure 8. The impact of visitors' consumption of Tokyo and Kyoto in industrial sectors reflected the economic structure of both regions. In Kyoto, the importance of the secondary manufacturing was much larger than that in Tokyo and the service industries were relatively less significant. The characteristic of the waste emission of industrial sectors were shown in Figure 8. In Kyoto, the rate of the energy and water industries in waste emission was higher than that of Tokyo. The induced "dust" from the electricity sectors of Kyoto was 1,448 tons, as Maiduru power station in Kyoto used coal as fuel for

electric generation. In Tokyo, most of heat power plants had been shutdown or used manufactured gas recent years.¹

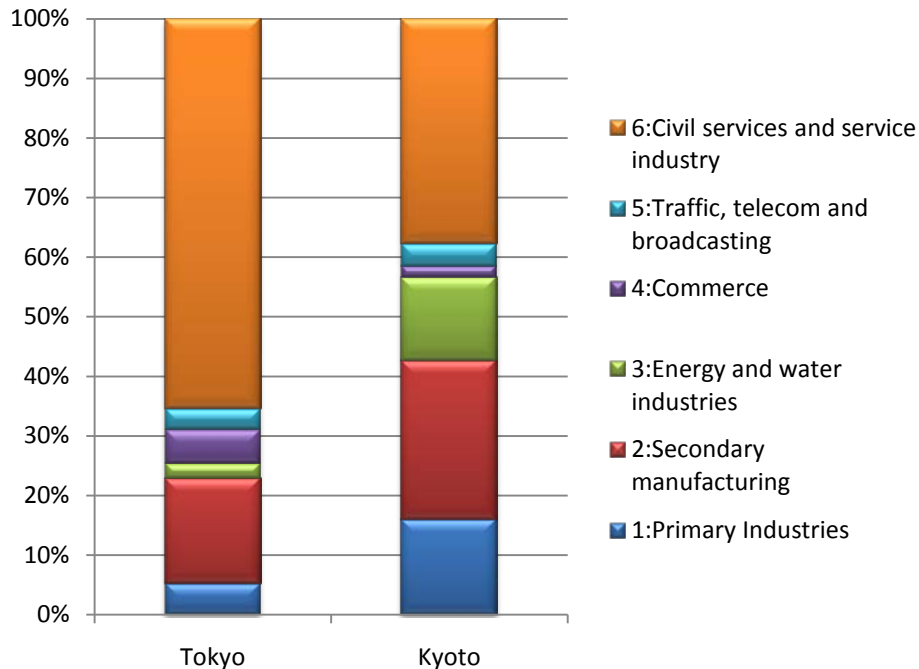


Figure 8. Waste emission of industrial sectors of Tokyo and Kyoto

3. Conclusions

In this study, using the interregional and regional waste input-output analysis, we investigated the impact of the final demands of a metropolis which are especially induced by the consumption of non-residents' visitors. We used the 2000 interregional WIO table in Tokyo to investigate the impact of Tokyo. The increase of the consumption of the non-residents' visitors in Tokyo was seemed to mainly effect to Tokyo. However, the estimation results told us that the effect was much larger in other regions than in Tokyo, because of that Tokyo depended heavily on activities in other regions such as economic activities and waste treatment activities. We also estimated

¹ After the earthquake in eastern Japan, heat power plants in Tokyo were resumed. The waste emission coefficients and CO₂ emission coefficients in Tokyo will change after year 2011.

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the effect of the consumption of non-residents' visitors in Kyoto by using the 2000 regional waste input-output table for Kyoto. We found that the induced effect differed in Tokyo and Kyoto according to the difference in economic structure and waste emission structure between them. In Kyoto, the induced production of secondary manufacturing sectors and the waste emission of electric industry were clearly larger than those of Tokyo.

For the future plan, we would like to improve the impact analysis of the non-residents' visitors consumption in Kyoto with the actual data about the consumption behaviour of visitors. Also, it is interesting to investigate which part of the other regions is affected by the consumption of Tokyo or Kyoto. There are 47 prefectures in Japan; the impact cannot be same in each prefecture.

Acknowledgments

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