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# An Analysis of the Spatial Allocation Policy for the Long-run Sustainable Economic Growth in Japan<sup>†</sup>

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## Abstract

The long-run sustainability of the national economy has been a great concern for several decades in Japan. However, the spatial economic structure still includes a number of insufficient allocations. These are characterized as severe spatial concentration in the core in addition to extremely long and narrow geographical attributes. As a result, it is necessary to reexamine an ideal spatial allocation for the long-run sustainable economic development across the nation. In this paper, we initially introduce an overview of recent economic geography of Japan, which is followed by an alternative spatial model framework in terms of the central-place system, market access and agglomeration economies. Finally, a consideration is given to policy implications and potential difficulties of these practices. Also, further extensions of the analysis are provided.

**JEL Classification:** D85; L22; O18; Q56; R58

**Keywords:** Central-place system; market access; agglomeration economies; transportation costs

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## 1 INTRODUCTION

The analysis of sustainable economic growth has mainly concerned to developing countries. However, as recently seen in Japan, many developed countries now face serious situations to survive against severe cost competition against other neighbor developing countries. While central-place theory tends to be avoided to employ in empirically-based spatial studies, the notion of central-place system may play an important role to solve several issues on the efficient allocation of the economic space. Central-place theory has the following two criteria. One is market-area analysis, which examines how goods and services are distributed to an economic plane (Lösch, 1954). Another framework is supply-area analysis, which shows how inputs are collected to the production plant from the economic plane (Lösch, 1938).

While these approaches are commonly discussed at micro level, the notion of centrality may also be examined at the macro standpoint of view. Those are relevant to administrative and functional structures. While the former has the administrative center such as Edinburgh - the capital city of Scotland, the latter owns the financial center such as Glasgow (Parr, 2007; 2008). In Japan, the administrative and functional structures are overlapped with each other in the capital city, Tokyo. As a result, it is natural to form a severe spatial concentration in the core area. The long and narrow spatial attributes may also enhance the regional income disparities. López-Rodríguez and Nakamura (2010) investigated the role of market access in the spatial distribution of income across Japanese prefectures for the period 1996-2005. They revealed that market access plays an important role in the spatial configuration on income across prefectures, being their results in line with the vast majority of the established empirical literature in new economic geography which analyzes these issues.

In this paper, we demonstrate that the existing spatial configuration in Japan needs to be reformed for the purpose of long-run sustainable economic growth. The remaining part of the paper is structured as follows. In section 2, the historical overview of the spatial planning across the nation will be examined. In section 3, an alternative spatial model framework is considered. The analysis then explores policy implications for both the core and local regions in section 4, which is followed by an extension and concluding comments.

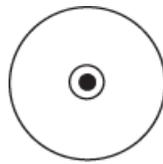
## 2 AN OVERVIEW

Based on the investigation by Murata (1980a) and Kuroda et al., (2008), Japanese official regional policy was given by the Comprehensive National Development Act, 1950, which was followed by the development of power resources and elimination of various physical bottlenecks during 1950s. The National Income Doubling Plan was then launched particularly for manufacturing industry with location policy, i.e., the Pacific Coastal Belt. This specific belt has a good market access and well-equipped infrastructure. The plan was amended in 1962 to prevent excess urbanization as well as to correct regional imbalance. In order to avoid severe spatial concentration in Tokyo and its surrounding area, the New Comprehensive National Development Plan was established in 1969. While more improved plans were developed as the Third in 1977, the Fourth in 1987 and the Fifth Plan in 1998, spatial dispersion sufficiently did not work as expected. Although the Land Formation Plan was newly settled in 2005, the core (Tokyo) and regional (Sapporo, Sendai, Hiroshima and Fukuoka) disparities could not be solved properly. Those may be caused by heavy dependency on the central governing structures. In addition, the law and regulation systems at regional levels solely contribute to internalized industrial activities but not to local economies which are external to the firms and industries.

The losses of attractions in local regions have generated further hollowing-out problems for particular industries. Also, as shown in Murata (1980b), the available area for utilization in Japan is only 18% of the land due to its mountainous geography. This fact as well as achieving a higher level of GDP may imply that the country constantly has a severe spatial concentration in particular areas, which generates more regional income disparities between the core and local regions. Also, the structures of higher price and cost have been observed in the Japanese economy as a common developed country. Besides this, the scarcity of natural mineral resources needs to rely on certain volume of foreign imports.

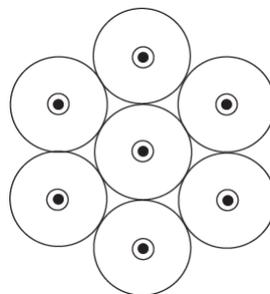
### 3 THE MODEL

An ideal spatial configuration is given in Fig. 1 as a circle. Here, the conditions are assumed that the economic plane is not occupied by any economic agent, the plane is absolutely flat without any geological obstacles, and consumers are evenly distributed across the plane. In the figure, the final product is distributed radially from the center in terms of market-area analysis, and the relevant inputs are collected to the central place in order to assemble this particular product with respect to supply-area analysis.



**Fig. 1 Central place and market access**

As a result, the double-circled center can be the core of administrative and functional structures. This simple system is the same as a historical town in Europe where there is a church at the center of the town and several goods such as vegetables, fish, meat and clothes are sold nearby the church. If the optimal size exceeds the maximum market-area and supply-area radii, then other centers may be created as illustrated in Fig. 2. In this way, both market and supply areas have the maximum market-area radius and supply-area radius. If there are other areal constraints such as the presence of spatial competition and the pre-arranged network of transportation system, the spatial configuration can be triangle, square and hexagon. More details should refer to Lösch (1944 [1954]).



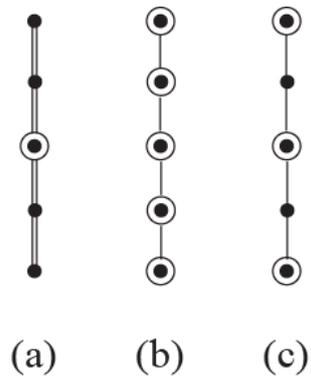
**Fig. 2 Regular circular multi-center systems**

Now a concern is given to the administrative and functional structures. In Japan, both centers of structure are coincident to each other in the capital city, Tokyo. As a result, the core and periphery structures can be drawn as Fig. 3. In the figure, the doubled-circle shows Tokyo and other smaller circles express other local regions in Japan. The solid line illustrates the network of transportation and communication. This case implies that economic plane can be used only for the vertical direction but not the horizontal space. In such a case, the distant locations from the center may have certain inefficient accessibility to the core region (i.e., Hokkaido, Shikoku and Kyushu). From this evidence, the following argument can be considered. The regional income disparities may be caused by an economic concentration in particular areas. In order to reduce these disparities, the concentrated spatial structure needs to be dispersed. Otherwise, local regions cannot achieve enough regional growth and development due to insufficient scale and the number of populations. Once the spatial allocation is well-balanced across the nation, the sufficient scale and the number of populations may enable local regions to receive the optimal economies of scale, scope and complexity both on producers and households. Without such spatial policy, the excess size and the number of populations in the core region may cause more severe congestion, pollution and highly price of land. Moreover, other less populated regions can lose several opportunities to obtain goods and services. In this way, the core region owns a sufficient market access but with various elements of urbanization diseconomies. By contrast, other local regions have insufficient market access with a lack of administrative accessibility and infrastructure organization, a limited variety of labor supply, and non-advanced systems of transportation and communication. Those are caused by both physical distances between the core and local regions as well as the smaller number of populations.



**Fig. 3 Spatial configuration with restrictions**

In this circumstance, three alternative scenarios can be considered as illustrated in Fig. 4. The initial diagram (a) shows a core and four local regions with well-established interregional network of transportation and communication across the country. However, further development may have difficulty, if the geological attributes contain a number of physical obstacles. The second figure (b) depicts a case where all regions work as the core hierarchy. Although this scenario is preferred to solve regional income disparities and self-sustained economy without establishing further network of transportation and communication, it is available only if there are sufficient space and the number of populations in each region.



**Fig. 4 Alternative spatial configurations**

Finally, the pattern (c) represents a complex scenario where previous both cases can be partly available. While the pattern (c) loses scale merit than the case (a), the accessibility between any non-core regions and the core region properly improves. As revealed by Lopez-Rodriguez and Nakamura (2010), regional income disparities have

still been expanding in Japan. This is generally more evident for local regions which have long distances to Tokyo. As a result, it may be important to have other cores in addition to the core region.

In order to provide an index of the policy decision-making, the following expression can be considered:

$$a_{i1}x_1 + a_{i2}x_2 + a_{i3}x_3 \leq \frac{\sum_{j(\neq i)} a_{j1}x_1 + a_{j2}x_2 + a_{j3}x_3}{i-1} \quad (1)$$

where  $a_{i1}$  = variable-cost factor for pattern  $i$  ( $i$  = pattern (a), (b) or (c) in Fig. 4) which directly reflects economies of scale,  $a_{i2}$  = interregional transportation-cost elements of pattern  $i$ ,  $a_{i3}$  = setup or fixed cost to organize pattern  $i$ ,  $x_k$  = variable weight of particular factor  $k$  ( $k = 1, 2, 3$ ) and the subscript  $j$  = all other patterns except  $i$ . Regarding  $x_k$ , the following scenarios can be observed. First,  $x_1$  will be increased as the country more relies on central-place system in the core and there are a smaller number of populations in other local regions. Secondly,  $x_2$  may increase if the interregional network of transportation and communication has already been well organized and the smaller number of populations in other location is identified. Finally,  $x_3$  will be higher as the development is a more mature stage and the smaller number of populations in other location is observed.

#### 4 POLICY IMPLICATIONS

Three types of alternative spatial allocation are examined in the previous section. A concern is now given to apply these scenarios for the actual circumstances in recent economic structure in Japan. First, the hollowing-out problem of the part of national economy for particular industries has been commonly seen across the country. Secondly, the significantly higher price and cost structures cause more serious issues with international cost-reduction competitions against lower-wage developing countries. Perhaps this is closely related to the hollowing-out problem discussed above. Finally, the geographical constraints interrupt establishing efficient systems of interregional

transportation and communication network. In these circumstances, it is necessary to consider a comprehensive economic development across the nation.

Due to disadvantageous market access in physically distant local regions, the population level cannot be maintained at a level where the regions become self-sustained. The local population may be increased either by enhancing infrastructure development of physical and communication network to the core region or by completing whole functions of the core region at that local region. If the former is feasible, the case (a) in Fig. 4 may be considered. By contrast, if the latter is available, the pattern (b) can be taken into account. If both are partly unavailable, the case (c) should be the appropriate for the long-run stable regional economic development policy. In this circumstance, agglomeration economies can play important roles to enhance these impacts.

The establishment of essential services in a local region such as schools, hospitals, transportation network and other systems are solely able to provide by public policy. Those can be established only if there is the sufficient number of populations at that region. Also, the Japanese core-peripheral spatial structure together with the irregular spatial configuration may enhance more severe concentration in the core and regional income disparities in local regions. This can become more difficult to increase migration to local regions from the core area, which implies that infrastructure development cannot be organized enough in local regions. Moreover, it should also be noted that a completion of regional infrastructure development does not guarantee the long-run sustainable economy at that region.

## 5 AN EXTENSION

The hypothetical scenarios in previous sections can also be expanded to the estimation of perspective national land reform initiatives. There are several land reform proposals in the Japanese central government. First, the Administrative Reform Proposal is led by the Ministry of Internal Affairs and Communications and the main objective is to divide Japanese regions into wider groups, which can be referred to the case (b) in Fig. 4. Also, the Ministry of Land, Infrastructure, Transport and Tourism

processes the wider-regional land and economic proposal, which remains existing prefectural structure therefore the case (b) may be related to this framework.

Both proposals have certain advantages on the sufficient size of the region with holding the enough number of populations. These advantages enable the local economy to enhance more advanced infrastructure development as well as reducing the level of regional income disparities by taking advantage of the economies of scale, scope and complexity. However, there may be disadvantages of this reformation on the regional accessibility for both producers and households. For instance, several overlapping administrative services can be integrated in a single location. In that case, producers and households those who need to access there have to travel much longer distance than the existing spatial structures.

Regarding the disadvantageous respects, the discussion should be given to the fundamental role of the public sector. The main difference between the private firm and the public sector is to take into account either of producer's surplus or social surplus. If the above stated potential problem is anticipated, then the policy maker should provide a compensating method such as an enhancement of regional transportation network. While this discussion is beyond the scope of the analysis, it is important to remind the role played by the public sector for supplying sufficient infrastructural services to local producers and households which are not available to organize by individuals.

## 6 CONCLUDING COMMENTS

In this paper, a concern is given to reveal physical spatial constraints for the long-run ideal spatial configuration and the economic structure in Japan. Also, it is shown that international competition tends to be much more severe than previous decades, therefore, proper domestic spatial policy may be important to establish across the country. The examination can be expanded to the impact analysis of the infrastructure development as shifting the weight from the core to local regions by the economies of agglomeration. Although it is beyond the scope of this analysis, the impact analysis should be evaluated by the long-run revenue potentials as well as existing cost-minimization strategies. For revealing the long-run economic sustainability, it is encouraged to consider a theoretical approach under the risk and uncertainty in quality terms of commodities regardless the

consideration of the short-run market price competition. Moreover, it should be reminded that regional development and environmental protection are always trade-off to each other, which may be referred to the combined economic-ecologic system in input-output analysis in Isard (1975: 341-371) as an earlier implication in this respect. Finally, this paper focuses the discussion on a simple theoretical framework in order to grasp the principle idea of the reallocation effects of the administrative and functional structures. However, it is necessary for practical cases to consider more complex structure of the model framework.

### *References*

- Isard, W. (1975) *Introduction to Regional Science*, Prentice-Hall, New Jersey
- Kuroda, T., Tabuchi, T., and Nakamura, R. (2008) *Urban and Regional Economics*, (in Japanese), Yuhikaku, Tokyo
- López-Rodríguez, J. and Nakamura, D. (2010) “Mind the remoteness: income disparities across Japanese prefectures”, *FUNCAS Working Paper*, Fundacion de las Cajas de Ahorros (FUNCAS)
- Lösch, A. (1938) “The nature of economic regions”, *Southern Economic Journal*, 5/1: 71-78
- Lösch, A. (1944 [1954]) *Die räumliche Ordnung der Wirtschaft*, Jena, Germany: Fischer, 1944 (2<sup>nd</sup> edn). English translation by W. H. Woglom and W. F. Stolper, *The Economics of Location*, Yale University Press, New Haven
- Murata, K. (1980a) “The role of industrial location policy” in K Murata ed., *An Industrial Geography of Japan*, London: Bell and Hyman
- Murata, K. (1980b) “Industrial development and environmental issues” in K. Murata ed., *An Industrial Geography of Japan*, London: Bell and Hyman
- Parr, J. B. (2007) “On the spatial structure of administration”, *Environment and Planning A*, 39: 1255-1268
- Parr, J. B. (2008) “On Administrative spatial structure: a note on an alternative approach”, *Annals of Regional Science*, 42/1: 141-151