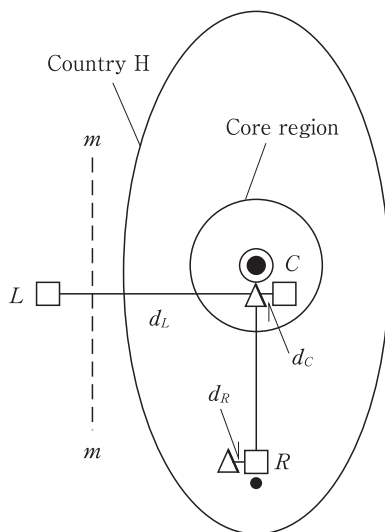


from the core area due to expansions of urbanization diseconomies in the long run. Hitherto, there is a missing discussion regarding the facility location. If the density of demand in the core area disperses to rural areas in the long run, the producer may establish facility branches at these areas. In such circumstances, the product price for consumers can reduce by declines of unit shipping cost as well as by the reduction of the location cost of facility site at the core area. The reduction directly reflects a decline of the variable σ which is the uniform shipping cost for consumers in the revenue function. As a result, the impact of its change on the optimal quantity of product which is processed at the rural area becomes:

$$\frac{\partial q_R^*}{\partial \sigma} = -\frac{a - k_H(c_R + t_D d_R)}{2(b + \sigma)^2} < 0. \quad (4.1)$$

In order to satisfy the above condition, the consumer market has to be dispersed from the core area. This also reduces the physical distance between the processing plant and the facility location. As a result, the previous condition (3.8) can be attainable as shown in Figure 4-1. The figure illustrates that the presence of facility sites at rural areas significantly reduces the shipping cost due to the decline of physical distance d_R .

Figure 4-1 An alternative spatial structure



In other words, if the spatial concentration in the core area remains, the location dispersion of facility site may cause structures characterized by higher prices and costs under the situation where economies of scale are unavailable. As a result, it is important for public policy to discourage the population and economic concentration at the core area.

These would create more efficient localization and activity-complex economies in rural

areas, and those economies improve technological losses k_H during production processes in addition to pecuniary cost-saving opportunities relating to c_R . The impact of change in technological losses on the optimal output level at the rural area is:

$$\frac{\partial q_R^*}{\partial k_H} = -\frac{c_R + t_D d_R}{2(b + \sigma)} < 0. \tag{4.2}$$

However, it should be noted that such cumulative causation is available only if the density of population in the rural area is kept at a secure level. For the case of Japan, while spatial dispersion of the economic activity was observed after 1960s as stated earlier in this paper, a severe spatial concentration at the core area has still been observed. The evidence is shown that the population ratio in the core area of Japan tends to increase at a constant rate as illustrated in Table 4-1, while urbanization diseconomies by the severe spatial concentration have certain impact of disutility both for producers and for households.

Table 4-1 Population at the capital region in Japan (Source: Statistics Bureau, 2005)

Year	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
%	22.65	23.82	25.22	27.18	28.91	30.04	30.5	31.08	31.87	32.17	32.56	33.17

In order to disperse population concentration in the core area, the economic development in rural areas may play important roles. For industrial economic activities, infrastructure development led by localization and activity-complex economies would enhance these policies, and a sufficient system of interregional transportation needs to be developed. Also, rural areas have to supply sufficient conditions of employment and infrastructure in social terms. For instance, social infrastructure elements can include highly-advanced medical, education, cultural and other household-related services. Since some of these services require much larger scale for operation than the scale of local population, it may have difficulty to provide entire services in each rural area.

In such a case, the improvement of accessibility to the core area can be the effective policy remedy. However, as described earlier in this paper, the long and narrow geographical attributes of the country may provide inefficient transportation system for the case of Japan. Besides this, the fundamental infrastructure development on transportation already established during the Comprehensive National Development Acts in the past decades. As a result, additional interregional transportation development between the core and rural areas would provide certain limited impacts for the national economic growth, and the development of rural areas for self-sufficient systems can be more preferred strategy in the long run.

5. Further avenues

When social infrastructure elements cannot be fully organized in a rural area due to insufficient population levels, a cooperative behavior with neighbor regions may be considered. This argument would be relevant to the hierarchical system of economic space on the framework of central-place theory. Regarding the urban system, there are two criteria, namely, the functional and administrative structures. Within this framework, Parr (2007; 2008) found that market-area analysis in Lösch (1944 [1954]) directly refers to the functional structure. Another criterion, the administrative structure, can be partly related to urbanization economies. Since these economies are not reachable in a small scale region, an integration of several neighboring regions can solve this particular problem in scale terms.

A different perspective to consider the sustainability of national economy in developed countries would be the strategies of product differentiation and entry deterrence. When structures of prices and costs are not competitive, the value-added and intellectual production system can be considered as the alternative strategy for the sustainable economic growth. For example, aero-space industries in Toulouse have spatial proximities to various upstream and downstream linked firms with highly qualified research laboratories and engineers in exclusively specialized environment as activity-complex economies. However, product differentiated products such as the German branded vehicles have location strategy to keep headquarter within the country, while assembly plants are dispersed across the world. These considerations should refer to Silva and Hewings (2010) which investigate the recent location decision-making of the U.S. aero-space industry from the standpoint of principal-agent theory by Hart (1995).

While these advanced industrial location structures are useful for firms and establishments, it may not be suitable for economic activities in Japan from the standpoint of sustainable economic growth. The primary reason of this thought is that regional income disparities have never been eliminated due to the market access problem as demonstrated by López-Rodríguez and Nakamura (2011), although minimum infrastructure development has already been done enough in the past decades. This implies that the public policy should initially have a priority on the improvement of social infrastructure elements across the nation, while a question rises regarding the availability of financial sources to support the social-term infrastructure development in rural areas.

Finally, the cost of infrastructure may be included in this model framework. This inclusion can evaluate the spatial policy impact for sustainable national industry of the country. Also, more specifications of each economic factor which is assumed to be constant as well as the cost of infrastructure, may allow an expansion towards the general equilibrium analysis.

Although these are beyond the limitation of this paper, it should be left as further extensions.

6. Concluding comments

This paper has examined the optimal location decision-making of the firm under a severe condition of centripetal forces of the economic activity at the core area. It is revealed that the core spatial concentration can be relieved by the enhancement of rural economic development which includes interregional transportation network or localization and activity-complex economies. However, these may not be sustainable unless rural population growth securely increases, and this can be feasible under the condition where social infrastructure elements such as highly-advanced medical, educational and other household-related services and facilities are sufficiently provided. While these expect additional budget uses for the central government, it is important to solve the problem of decline of the domestic industrial activity before completely losing its recovery force.

Acknowledgement

A preliminary version of the paper was presented at the 57th North American Meetings of Regional Science Association International in November 2010 at Denver, Colorado. The author wishes to express his thank to T. Ishikawa for his valuable comments and suggestions for the completion of this paper. The final version was completed under the ICSEAD research project, partly published as ICSEAD working paper series vol. 2011-02. The usual disclaimer applies.

References

- Hart, O. (1995), *Firms, Contracts, and Financial Structure*, Oxford University Press, Oxford.
- Hoover, E. M. (1937), *Location Theory and the Shoe and Leather Industries*, Harvard University Press, Cambridge, Massachusetts.
- Isard, W. (1956), *Location and Space-Economy*, M.I.T. Press, Cambridge, Massachusetts.
- López-Rodríguez, J. and Nakamura, D. (2011), "Mind the remoteness! Income disparities across Japanese prefectures", *Estudios de Economía*, 38/2, pp. 393-417.
- Lösch, A. (1938), "The nature of economic regions", *Southern Economic Journal*, 5/1, pp. 71-78.
- Lösch, A. (1944 [1954]), *Die räumliche Ordnung der Wirtschaft*, Jena, Germany: Fischer, 1944 (2nd edn). English translation by W. H. Woglom and W. F. Stolper, *The Economics of Location*, Yale University Press, New Haven.
- Marshall, A. (1892), *Economics of Industry: Third Edition*, Macmillan and Co., Limited, London.
- Parr, J. B. (2002), "Missing elements in the analysis of agglomeration economies", *International Regional Science Review*, 25/2, pp. 151-168.
- Parr, J. B. (2007), "On the spatial structure of administration", *Environment and Planning A*, 39, pp. 1255-1268.
- Parr, J. B. (2008), "On Administrative spatial structure: a note on an alternative approach", *Annals of Regional Science*, 42/1, pp. 141-151.
- Silva, C. E. L. and Hewings, G. J. D. (2010), "Locational and managerial decisions as interdependent choices in the headquarter-manufacturing plant relationship: a theoretical approach" *Annals of Regional Science*,

DOI 10.1007/s00168-010-0410-8.

Statistics Bureau (2005), *Population Census 2005*, Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Japan.

Weber, A. (1909), *Über den Standort der Industrien*, Tübingen. Translated and edited by C. J. Friedrich as *Alfred Weber's Theory of the Location of Industries*: Chicago, 1928.