Firm Location and Regional Externalities : Access to Economic Markets and Information*

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The problem of firm location can be directly relevant to location decision-making of firms. To attract firms, host regions must have sufficient locational advantages. First, this article studies what constitutes elements for business firms in terms of regional externalities. The structure of a hierarchical urban system may be used to describe the relationship between economies of scale and/or scope and access to economic markets. Then, the argument is expanded to the optimal regional planning strategy according to the type of local characteristics. The final part explores how the limited scale and/or scope of small regions can be spatially competitive against other regions in the borderless global economy. A trigger strategy for cooperative behaviour utilising local allocation of resources is also examined.

1 Introduction

Firm-location analysis has been treated as a part of location decision-making of business firms. In other words, firms can choose where they locate. From another viewpoint, regional policy should take into account the attractiveness of a region to be nominated as a host region for firms. There are various elements of attractiveness. For households, these may be better access to markets and qualified environmental resources, more job opportunities, and so on. For firms, these may be location advantages such as better social and economic infrastructure elements as well as enough access to economic markets and technology (see Nakamura, 2016).

Here, we will demonstrate what kind of regional planning strategy is needed for a particular condition of regional economy. Our hypothetical scenario assumes that there is a non-core or rural region which has no specialised economy as was demonstrated by Nakamura (2022). In such circumstances, Capello (2015) argues that external shocks may create a

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sustainable regional economy. For instance, the emergence of a multinational can expand local employment, regional income, and various other economic opportunities in the local economy. In this article, the export-base model is partly used to examine regional economic growth as well as Marshallian industrial districts (Marshall, 1892).

The export-base model was developed by Tibout (1956), and expanded by Parr et al. (1975), Capello (2015), and so forth. The model can be partly relevant to notions of agglomeration economies. Agglomeration economies, which are spatially-constrained external economies, are classified into urbanisation economies, localisation economies, and activity-complex economies according to Parr (2002). Urbanisation economies are commonly available in large metropolitan areas. Localisation economies and Marshallian industrial districts can be closely related as we will demonstrate later as well as activity-complex economies.

In this article, we initially identify elements of attractiveness for every economic agent through a simple location model with the conceptual framework of externalities. The structure of a hierarchical urban system may be used to describe the relationship between economies of scale and/or scope and access to economic markets. This involves availability of information on both physical and psychological aspects. Then, a regional planning strategy is examined under a particular condition. Finally, an alternative framework is presented which satisfies a variety of location advantages in the borderless global economy. This suggests a trigger strategy for cooperative behaviour, which may not appear autonomously. We attempt to demonstrate a cooperative strategy, which utilises local allocation of resources so that regional competitiveness is established more securely.

2 Location model

First, we identify elements of attractiveness for every economic agent through a simple location model with the conceptual framework of externalities. We employ the structure of an urban system to describe the relationship between economies of scale and/or scope and access to economic markets. First, profit maximisation behaviour in conventional economics is introduced, which is followed by more complex scenarios.

In conventional economics, a representative firm maximises its profit under given technology :

$$\max \quad \pi = py - w_L L - w_K K \tag{1}$$
$$\text{s.t.} \quad y = f(L, K) \tag{2}$$

Under valid first-order necessary and second-order sufficient conditions, the optimal quantity of output can be specified. Equation (1) shows that the firm's profit π is deter-

mined by total revenue minus total cost. Here, total revenue is the product price p ($p \geq 0$) times quantity of product y ($y \geq 0$). Also, total cost is the sum of the unit price of labour w_L ($w_L \geq 0$) times amount of labour L ($L \geq 0$) and the unit price of capital w_K ($w_K \geq 0$) times amount of capital K ($K \geq 0$). Equation (2) represents the given condition of this firm. Quantity of output is determined by the amount of labour and capital, which depends on this firm's given technology.

The market system usually works well as long as firms produce items that are demanded by consumers and these consumers have sufficient funds to purchase them by earning wages, and other factors of production are available under a proper allocation of resources. When firms face shifts in demand and other environmental circumstances that affect their business, they must adjust their operations. They can survive if they adapt to changes in society appropriately, but otherwise may not. Successful adaptation may improve the allocation of resources in society.

Now, imagine there is a business firm which needs to select a location for its economic activity. For a manufacturing firm, locations of economic activity may include its headquarters, research laboratory, processing plant, warehouse, customer support centre, and so on. Based on urbanisation economies, the headquarter location may be a central place of economic activity, partly due to proximity to administrative services. A research laboratory might require a location close to the headquarters but not within the central place. A processing plant might require a large area of low-cost land, and thus not be located in a central place. The same is true for warehouses and customer support centres, which may require good access to places of consumption, whether physically or online.

For rural areas, attractive features for locating processing plants, warehouses, and customer support centres may be key elements, unless the headquarters does not require a central location. In other words, one of the benefits of rural areas may be cost-saving opportunities. Or, rural areas may be selected for other specific conditions such as availability of clean air or water for particular industries. Apart from the availability of such natural capital, we now explore additional elements which are exclusive regional advantages of rural areas.

If there is no specific economic activity in a rural region, it may be possible to become a host district for foreign firms such as multinationals. How should value-added attractiveness be coordinated in rural areas? Rural areas are typically smaller in scale and scope than large metropolitan areas. This may be disadvantageous when competing against other economic areas. However, there are benefits of small scale and narrow scope. For instance, the division of labour may be much easier due to closer relations with one another, including informal information access among local people. In order to capture this opportunity, it is necessary to establish well-organised information among people as

indicated by Nakamura (2022).

When information access requires additional costs, the profit function can be modified as the following equations where I $(I \geq 0)$ is quantity of information and w_I $(w_I \geq 0)$ is unit information access cost. Also, unit additional information may bring a unit cost-saving to a firm as denoted by $b_I(t-1)$ $(b_I \geq 0)$ which can be determined by the situation in the previous period $(t-1)$. For simplicity, parameter I has a constant return to scale for the firm's efficiency. In Eq. (4), the production function is also partly affected because improved information access is expected to lead to a better allocation of resources.

$$\max \quad \pi(t) = py - w_L L - w_K K - I(w_I - b_{I\,(t-1)}) \tag{3}$$
$$\text{s.t.} \quad y = f(L, K, I) \tag{4}$$

The relationship between w_I and b_I can be written as

$$w_I = \tau b_I \tag{5}$$

Equation (5) shows that parameter w_I is balanced with parameter b_I by a conversion index τ $(\tau \geq 0)$. This index can be interpreted as follows. If the index takes a value which is greater than 1, information access is not useful for the firm, and vice versa. However, if a significant effect of technological improvement in Eq. (4) is found, an index value of more than 1 could be treated as a useful outcome in some cases. The following section examines how information access is classified in the interpretation of location economics and how information access is utilised.

3 Regional externalities

In the previous section, we explained the relationship between firm behaviour and information access within our particular model framework. Here, we first examine how information is placed in location economics. Second, we consider how information access is utilised. In location economics, information access can be classified as a part of spatially-constrained external economies, since it may be utilised more with closer physical and/or psychological proximity between economic agents, as expressed by :

$$I = f(d, \sigma) \tag{6}$$

This equation shows that the quantity of information I can be affected by physical distance d $(d \geq 0)$ and psychological distance σ $(\sigma \geq 0)$. There are various types of information, and we limit our analysis to information that can be related to coordinate matching between different economic agents. For instance, information on the local job market may reduce inefficient allocation of resources on labour. Since such coordination might be difficult

solely by individual effort, we need to treat this as an externality.

Externalities may be classified into two types : pecuniary externalities and technological externalities (see Meade, 1952 ; Scitovsky, 1954). Spatially-constrained external economies are urbanisation economies, localisation economies, and activity-complex economies according to the classification of Parr (2002). Urbanisation economies are commonly available in large metropolitan areas where urbanisation diseconomies are also observed in general. There, congestion and friction in the public space may diminish the availability of information.

The Marshallian industrial district (Marshall, 1892) includes the idea of social proximity by means of a specialised economic activity in a local area, which can be partially referred to as localisation economies. Activity-complex economies are also economies in a particular locality but these are input-output interlinkages among complex processing stages and there may be fewer opportunities of social proximity than in localisation economies. An example of an activity-complex economy is the aerospace industrial complex at Toulouse in France. For several types of agglomeration economies, we can set the order of physical distance and psychological distance at an aggregate level for urbanisation (UR), localisation (LC) and activity-complex (AC) types as follows.

$$d_{UR} > d_{AC} \geq d_{LE} \tag{7}$$
$$\sigma_{UR} > \sigma_{AC} \geq \sigma_{LE} \tag{8}$$

Note that localisation economies or activity-complex economies may exist within a large metropolitan area. Unless such a zone is strictly isolated in terms of physical access, we assume that urbanisation economies and diseconomies may have dominant forces at this stage of the analysis.

In this way, non-core regions may have certain benefits in terms of physical and psychological distances with respect to information access. As non-core regions are more difficult to sustain economically without any locally specialised industry, we must examine a case in which there is no specialised industry in a rural region. For instance, Capello (2015) exemplifies the emergence of multinationals and argues that there are two types of relationship between the multinational and the host region : cost-saving opportunity and strategic seeking. Regarding regional economic growth of the host region, strategic seeking should be much more beneficial than cost-saving opportunities. Although the following point is not explicitly indicated by Capello, the cost-saving opportunity may include regional income leakage as is evident by the general notion of the market mechanism. In order to minimise such leakage, a specific regional strategy may be needed.

Hitherto, we revealed that regional economic growth in a weak region requires an effective regional strategy. The possibility as a replacement of solely cost-saving localisation or

activity-complex economies is expected to employ regional externalities. Regional externalities are organised not by a large population and specialised industries, but rather are created by a local cooperative atmosphere among local economic members with sufficient local allocation of resources. In the following section, we will discuss how regional externalities are utilised to attain competitive regional growth.

4 Spatial policies

As examined earlier in this paper, large metropolitan areas may lose efficient information access. This suggests that less congestion and friction in the public space would enhance the availability of information. Moreover, fewer restrictions and constraints regarding market access can require less information access, which could be the case for large metropolitan areas. Otherwise, weaker regions may need to have an effective policy and planning targets. By taking advantage of more cost-saving opportunities, income leakages become larger as already discussed. The opposite scenario, strategic seeking, can be enhanced by information access if local resources include a variety of human resources, advanced level of research institutes, and so on. Those are competitive forces rather than a cooperative atmosphere.

It is necessary to consider what kind of strategy they can apply. One option is to maximise education opportunities as a local public policy, although the effects take time and the target is long term. Another is to attract a variety of human resources to the local area by improving its attractiveness as a place to live. If this is difficult, a further option is a neighbouring centre of higher hierarchical level where various economic activities can be organised. Affiliation can be encouraged by a framework of interregional flows of production factors in the one-sector and two-regions model (see Capello, 2015). Here, we re-examine attractive elements for each economic agent. As is commonly assumed in conventional economic theory, firms and households interact with each other through markets for factors of production and markets for goods and services. Households maximise their utility under a given budget constraint. Budget can be less restricted by earning higher income. Hence, better access to markets and more job opportunities are preferred. In addition, qualified environmental resources should be preferred to less-qualified resources.

The study may include the hierarchical urban system as a relationship between industrial complexes and production-processing structures. Again, firms maximise their profits under given technology. Hence, they should seek location advantages such as better social and economic infrastructure elements as well as better information access. Note that infrastructure development, particularly in terms of hardware, incurs much higher costs than

better coordination of information access. In terms of agglomeration economies, large metropolitan areas may have urbanisation economies. Also, specialised economic areas can enjoy localisation or activity-complex economies. As Capello (2015) argues, specialised economic areas located in a large metropolitan region will be strong.

Next, we consider how non-metropolitan regions, which do not have a specialised economy, can survive severe economic competition. As long as local information access plays an important role for locating firms to engage in productive economic activity, inter-regional competitiveness can be partly determined by the availability of spatially-constrained positive external economies. Let us consider a regional policy and planning targets from the standpoint of host regions under a particular circumstance. An alternative framework to satisfy a variety of location advantages under the borderless global economy is now explored. There is a debate on trigger strategies for cooperative behaviour, which may not appear autonomously. We attempt to demonstrate a cooperative strategy, which utilises local allocation of resources to more securely established regional competitiveness. In other words, to be cooperative within the area is to be competitive outside the area. For details, refer to Fratesi and Senn (2009), who investigated the role of internal and external connections for a competitive region.

Society works as the following linkages. The limitations of an individual can be largely supported by his or her family, and the limitations of a family may be partly supported by the local community or local organisation, and these are partially supported by the political system at the regional level and national level. Also, a nation is often supported by its customs union, if it exists. We examine cooperative coordination which may be valid until certain levels. When the coverage involves many levels, we may be more easily able to reduce risks under uncertainty, and thus expect more productive firm operation and better wellbeing. By backward induction within the framework of game theory, it should be possible to create cooperative coordination. That is the reason why Eq. (3) involves a time-lag for a firm's profit function.

5　Avenues for further research

A spatial economic analysis of stable economic growth under fluctuating shifts in society is needed. So far, location economics have mainly focused on firm behaviour to develop a regional economy. Under a more advanced and complex economy, the notion of 'region' is subjective, as implicitly apparent in this article. Especially, beyond the scope of urbanisation economies, localisation economies, and activity-complex economies as industrial agglomeration economies, it is necessary to determine systematic relationships between local firms, households, and the public sector in terms of perfectness of information and

efficient allocation of local resources. This will require case studies.

A regional economy has both forecastable and unforecastable risks under uncertainty. The former risks include a decline of local workforce population, and the latter may be a natural disaster and pandemic. We intuitively understand that sufficient local information and utilisation of local resource allocations would reduce those risks but a detailed analysis is awaited. In location economics, regional core industries are treated as beneficial economic elements within the region. For instance, this creates local job opportunities, and local spill-over through education and research. It is necessary to clarify how core industries contribute to the region, and vice versa, and to discuss how insufficient functioning thereof can be solved by coordinating spatial remedies.

An integrated framework of an alternative agglomeration economy, which may originate from the regional economies proposed by Parr (2015) or local cooperative behaviour examined by Capello (2015), should be formally represented. Amid the fluctuating situation of society, it is necessary to investigate the effectiveness of regional policies according to the hierarchical order of the urban system.

6 Conclusion

This paper examined the relationship between firm location and regional externalities. While existing studies on firm location have primarily approached profit maximisation behaviour of firms, we examined firm location analysis from the standpoint of host regions. We also re-examined the availability of information access in terms of both physical and psychological elements. This is particularly evident when the local area has no particular specialised economy, and the area could be promoted as a host for foreign firms. Specifically, cooperative behaviour by sending sufficient signals among economic agents within the area may enhance the efficiency of the regional economic system under the condition of competitive strength of the local economy. As was noted in an extension of the examination, further study is needed to clarify the impact of firm location on local well-being, and vice versa.

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