Spatial organization of firms: local vs. national firms and the impact of trade liberalization

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Preliminary draft

Toshihiro Atsumi*

School of Economics and GEP, University of Nottingham

Abstract

What is the impact of international trade on cities and rural areas within a country? Existing studies on this topic are built on new economic geography models, which focus on the effect of international trade on the change in the balance between agglomeration and dispersion forces of the manufacturing firms. Recent studies, however, suggest that large cities today can be characterized as specializing in providing business services to host corporate headquarters, rather than as agglomeration of manufacturing. The aim of this paper is then to analyse the impact of international trade on internal cities and rural areas, taking into account the changing spatial organization of firms and the role of cities today. We construct and analyse an urban-rural model with a city hosting headquarters of firms, but allowing for the coexistence of headquarters in rural areas. The balance between the gains from having headquarters in the city with access to business services and the urban cost determines the spatial organization of firms and the corresponding city size. The model is extended to analyse the impact of trade liberalization. In an open economy, the city is likely to grow larger despite the urban costs. However, when exporting requires additional fixed costs in the form of larger headquarters, the result may be reversed; opening up to international trade may work in favour of smaller local firms, leading to a dispersion of economic activities away from the city.

JEL Classifications: F12, R12

Keywords: Spatial organization of firms, trade liberalization

* E-mail: toshihiro.atsumi(at)nottingham.ac.uk
1 Introduction

What is the impact of international trade on cities and rural areas within a country? Existing studies on this topic are built on new economic geography models, which focus on the effect of international trade on the change in the balance between agglomeration and dispersion forces of the manufacturing firms. Recent studies, however, suggest that large cities today can be characterized as specializing in providing business services to host corporate headquarters, rather than as agglomeration of manufacturing. The aim of this paper is then to analyse the impact of international trade on internal cities and rural areas, taking into account the changing role of cities today. The analysis is presented in two steps: the first step is to construct and analyse an urban-rural model with a city specializing in hosting headquarters (hereafter HQ) of firms. In the second step, the model is extended to introduce international trade in order to examine the impact of international trade on the urban-rural structure.

There are various functions within a firm but they are not necessarily located in one place. In fact, different functions of a firm often locate separately in different places. How firms locate their various functions are called spatial organization of firms. (Aarland et al. (2003) and Ono (2003) provide empirical analyses of the spatial organization of firms in the United States.) One most notable aspect of a firm’s spatial organization is the separation of its headquarters (HQ) and factory. The main ingredient for the urban-rural model in this paper is to explicitly introduce the HQs. HQs are typically located in cities while factories can be located elsewhere. According to an empirical study by Davis and Henderson (2008), HQs locate in cities in order to gain best access to various producer services. (Headquarter location decisions are mostly driven by the existence of a large and diverse local supply of business services rather than by the presence of a large number of other HQs.) Duranton and Puga (2005) provide a theoretical explanation for why cities today specialize in different functions rather than have full sets of industries. Cities today can be described as a place that hosts many HQs by supplying producer services.

On the other hand, empirical observations suggest that the separation of HQs and factories are not the only pattern of the spatial organization of firms. Some firms have HQs and factories integrated in the same location, which coexist with the former type of firms. Firms that have separate HQs in cities are typically larger firms, which can be called national firms. Firms that have their HQs and factories integrated in rural areas are smaller, which can be called local firms. In the case of Japan, nearly 70% of multi-unit firms have their HQs in major metropolitan areas and they are twice as large as firms that do not have HQs in metropolitan areas.

The first step of the analysis in this paper is to develop a simple model that explains the observation that firms are separated into two types, national and local, taking into account one of today’s feature of cities that they supply producer services and host corporate HQs. Assuming
that face-to-face communication is important in purchasing producer services it is advantageous for firms to locate their HQs in the city. However, having HQs in the city can be costly because of urban costs such as commuting and land rent. The balance between the gains from having urban HQs and the urban cost determines the spatial organization of firms and the corresponding city size. Initially identical firms are separated into national and local firms, and the HQs of the former form the city.

The second step is to analyze the impact of trade liberalization on an economy with such a geographic structure. Existing studies on trade and internal geography including Krugman and Livas-Elizondo (1996), Monfort and Nicolini (2000) and Paluzie (2001) are all based on new economic geography settings in which there are two locations where manufacturing firms can locate, and have analyzed the impact of trade liberalization without such aspects of spatial organization of firms and the corresponding urban-rural characteristics. The literature on this topic has provided two opposing results. Krugman and Livas-Elizondo (1996) suggest that trade liberalization brings about a dispersed distribution of manufacturing firms. On the contrary, Monfort and Nicolini (2000) and Paluzie (2001) suggest that international trade liberalization leads to agglomeration of manufacturing within the country. This study focuses on the impact of trade liberalization on the spatial organization of firms and the corresponding urban-rural structure by extending the model to an open economy. When there is a foreign market, the city is likely to grow larger despite the urban costs, because the gains from locating HQs in the city to become larger exporters outweigh the costs of increased urban costs. However, when exporting requires additional fixed costs such as foreign market entry costs requiring larger management forces or HQs, the result may be reversed; opening up to international trade may work in favour of smaller local firms, leading to a dispersion of economic activities away from the city.

2 Spatial organization of firms

This section presents some of the characteristics of the spatial organization of firms today using Japanese establishment data. The data in this section is based on multi-unit firms, which employ around half of the total corporate labour forces in Japan. As shown in Table 1, nearly 70% of the firms have their HQs in major metropolitan areas, and they are twice as large as firms that do not have HQs in metropolitan areas.

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1 Behrens et al. (2007) have used a monopolistic competition model with a quasi-linear demand structure to analyse the positive and normative aspects of the international trade and domestic geography issue. However their geographic set up is the same as in Monfort and Nicolini (2000) and Paluzie (2001).
Figure 1a and 1b plot the firm sizes and the shares of employment within the same prefectures as the HQ (as a measure of the degree of the spatial integration of the firms), against the population densities (as a measure of urbanization) of the prefecture in which the HQs locate, respectively. Figure 1a suggests that firms that have HQs in urban areas tend to be larger; figure 1b suggests that firms that have HQs in urban areas have more dispersed spatial organizations, while firms that have HQs in rural areas are more spatially integrated.

Figure 2a and 2b take a closer look by comparing firms with HQs in Tokyo (which is the biggest metropolis in Japan) and those with HQs in Kagoshima prefecture in southwestern Japan which is relatively rural. The regional distribution of ‘Tokyo firms’ in Figure 1a suggest they are operating nationally. (Only 25% of their employees are in Tokyo. The bars in the figure add up to one.) In contrast, ‘Kagoshima firms’ activities are geographically concentrated within the Kagoshima prefecture or neighbouring prefectures (more than 80% are employed locally).

Given the differences in the sizes and the geographic area of operation, firms that have their HQs in large cities have the characteristics of national firms. Other firms may be called local firms.

The breakdown by industry is provided in Table 2. One clear difference is that in agriculture and in mining, unlike other sectors, the majority of firms are rural firms, and the size difference between the urban and rural firms are small. This may also suggest that in these sectors in which products are less likely to be differentiated, locating HQs in cities are less important.

The separation of firms into the two types suggest that there is indeed an advantage in locating HQs in the city, and that the advantage allows the firms with their HQs in the city operate at much larger scales.

**Table 1: Spatial organization of firms in Japan**

<table>
<thead>
<tr>
<th>Location of HQs</th>
<th>Number of firms</th>
<th>Employment</th>
<th>Average firm size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>138,535</td>
<td>19,554,837</td>
<td>141.2</td>
</tr>
<tr>
<td>Rural</td>
<td>61,926</td>
<td>4,068,759</td>
<td>65.7</td>
</tr>
<tr>
<td>Total</td>
<td>200,461</td>
<td>23,623,596</td>
<td>117.8</td>
</tr>
</tbody>
</table>

Note: “Urban” corresponds to firms that have their HQs in the 14 major metropolitan areas in Japan.

Figure 1a: HQ location and spatial organization of firms

Figure 1b: HQ location and firm size
Note: The names in the horizontal axis are the names of the 47 prefectures in Japan.


Figure 2a: Geographic distribution of employment of an average Tokyo firm

Note: The names in the horizontal axis are the names of the 47 prefectures in Japan.


Figure 3b: Geographic distribution of employment of an average Kagoshima firm
<table>
<thead>
<tr>
<th>Location of HQs</th>
<th>Number of firms</th>
<th>Employment</th>
<th>Average firm size</th>
<th>urban/rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>136,535</td>
<td>19,554,837</td>
<td>141.2</td>
<td>2.15</td>
</tr>
<tr>
<td>Rural</td>
<td>61,926</td>
<td>4,068,759</td>
<td>65.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>200,461</td>
<td>23,623,596</td>
<td>117.8</td>
<td></td>
</tr>
<tr>
<td>Agriculture, forestry and fishery</td>
<td>285</td>
<td>16,462</td>
<td>57.8</td>
<td>1.14</td>
</tr>
<tr>
<td>Rural</td>
<td>456</td>
<td>23,162</td>
<td>50.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>741</td>
<td>39,624</td>
<td>53.5</td>
<td></td>
</tr>
<tr>
<td>Non-Agriculture</td>
<td>138,250</td>
<td>19,538,375</td>
<td>141.3</td>
<td>2.15</td>
</tr>
<tr>
<td>Rural</td>
<td>61,470</td>
<td>4,045,570</td>
<td>65.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>199,720</td>
<td>23,583,945</td>
<td>118.1</td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>115</td>
<td>6,759</td>
<td>59.1</td>
<td>1.66</td>
</tr>
<tr>
<td>Rural</td>
<td>181</td>
<td>6,497</td>
<td>35.9</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>296</td>
<td>13,256</td>
<td>44.9</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>11,518</td>
<td>960,023</td>
<td>83.3</td>
<td>1.89</td>
</tr>
<tr>
<td>Rural</td>
<td>7,051</td>
<td>310,700</td>
<td>44.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18,569</td>
<td>1,270,723</td>
<td>68.4</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>26,002</td>
<td>4,873,757</td>
<td>187.4</td>
<td>1.83</td>
</tr>
<tr>
<td>Rural</td>
<td>9,765</td>
<td>1,006,824</td>
<td>102.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35,767</td>
<td>5,874,581</td>
<td>164.2</td>
<td></td>
</tr>
<tr>
<td>Electricity, gas, heat supply, water</td>
<td>134</td>
<td>159,345</td>
<td>1189</td>
<td>4.44</td>
</tr>
<tr>
<td>Rural</td>
<td>66</td>
<td>17,674</td>
<td>267.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>177,019</td>
<td>865.1</td>
<td></td>
</tr>
<tr>
<td>Information and communication</td>
<td>3,767</td>
<td>881,246</td>
<td>233.9</td>
<td>2.32</td>
</tr>
<tr>
<td>Rural</td>
<td>801</td>
<td>86,956</td>
<td>101.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4,568</td>
<td>968,202</td>
<td>209.2</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>6,487</td>
<td>1,418,248</td>
<td>218.6</td>
<td>2.06</td>
</tr>
<tr>
<td>Rural</td>
<td>2,793</td>
<td>296,069</td>
<td>106.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9,280</td>
<td>1,714,317</td>
<td>184.7</td>
<td></td>
</tr>
<tr>
<td>Wholesale and retail</td>
<td>51,671</td>
<td>5,327,742</td>
<td>102.7</td>
<td>1.97</td>
</tr>
<tr>
<td>Rural</td>
<td>25,718</td>
<td>1,338,759</td>
<td>52.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>77,389</td>
<td>6,666,501</td>
<td>85.9</td>
<td></td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>4,058</td>
<td>570,442</td>
<td>704.2</td>
<td>2.81</td>
</tr>
<tr>
<td>Rural</td>
<td>464</td>
<td>116,340</td>
<td>250.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,700</td>
<td>986,782</td>
<td>580.5</td>
<td></td>
</tr>
<tr>
<td>Real estate</td>
<td>5,275</td>
<td>327,926</td>
<td>62.2</td>
<td>2.34</td>
</tr>
<tr>
<td>Rural</td>
<td>1,157</td>
<td>30,674</td>
<td>26.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,432</td>
<td>358,599</td>
<td>55.8</td>
<td></td>
</tr>
<tr>
<td>Restaurant, hotel</td>
<td>7,819</td>
<td>1,391,794</td>
<td>178.0</td>
<td>2.65</td>
</tr>
<tr>
<td>Rural</td>
<td>4,050</td>
<td>272,091</td>
<td>67.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11,869</td>
<td>1,663,885</td>
<td>140.2</td>
<td></td>
</tr>
<tr>
<td>Medical and welfare</td>
<td>1,558</td>
<td>154,264</td>
<td>98.5</td>
<td>2.06</td>
</tr>
<tr>
<td>Rural</td>
<td>493</td>
<td>34,878</td>
<td>47.9</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,050</td>
<td>199,142</td>
<td>108.3</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>2,040</td>
<td>262,796</td>
<td>128.8</td>
<td>2.82</td>
</tr>
<tr>
<td>Rural</td>
<td>709</td>
<td>34,878</td>
<td>49.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,748</td>
<td>297,666</td>
<td>108.3</td>
<td></td>
</tr>
<tr>
<td>Other service</td>
<td>20,420</td>
<td>2,904,004</td>
<td>142.2</td>
<td>2.27</td>
</tr>
<tr>
<td>Rural</td>
<td>8,162</td>
<td>510,486</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28,582</td>
<td>3,414,490</td>
<td>119.5</td>
<td></td>
</tr>
</tbody>
</table>

3 A spatial model of national and local firms

This section introduces a model of city formation based on corporate HQs and the mobility of skilled workers who work for them, and explains the coexistence of the two types of firms – large national firms with dispersed spatial structures and small local firms with relatively integrated spatial structures.

3.1 Assumptions

Activity of manufacturing firms

A manufacturing firm’s activity consists of an HQ and a factory. The HQ manages the factory, and business services are essential for HQs to operate and make decisions. The HQ requires a fixed number of skilled workers. Factory production requires a fixed number of unskilled workers per unit output. Manufacturing firms thus face increasing returns to scale. The total cost of producing a given amount \( q^M \) is

\[
c(q^M) = F_w^s + mq^M w^u, \tag{1}
\]

where \( w^s \) is the wage of skilled workers and \( w^u \) is the wage of unskilled workers. Manufacturing firms are assumed to be monopolistically competitive.

City and rural

There are two locations, city and rural. Producer services are provided at the city. The city is modelled as a special location that provides business services to corporate HQs. (It is assumed that factories do not locate inside the city.) Examples of producer services are financial services, legal services, consultations, marketing, etc. Firms purchase producer services through their HQs. It is assumed that face-to-face contact is important in purchasing these producer services. As Gasper and Glaeser (1998) point out, face-to-face communications are still important in our age of advanced communication technologies.\(^2\)

It is assumed then that the spatial organisation of firms affect the productivity of their factories: the manufacturing firms which have their HQs in the city obtain productivity advantages, and their cost function is

\[
c(q^{\text{SEP}}) = F_w^c + Aq^{\text{SEP}} w^u, \tag{2a}
\]

where \( 0 < A < 1 \) and subscripts \( C \) and \( R \) denote the city and rural, respectively. \( A \) therefore represents the advantage that the firm gains from having its HQ in the city. This type of firms will be denoted as SEP firms hereafter. (The business service sector is not modelled explicitly.) In contrast, local firms have higher marginal costs because of their disadvantaged...
access to (or lack of face-to-face communication with) producer services. The total cost of firms that do not have their HQs in the city is

\[ c(q^{\text{INT}}) = Fw^s_{\text{INT}} + mq^{\text{INT}}w^U, \]

(2b)

where INT stands for Integrated firms in rural areas.

As in standard models of urban economics, the city has an internal geographic structure: the urban workplaces, which are in our case producer service firms and HQs, are located in the centre of the city, or in the central business district (CBD).\(^3\) This implies that the workers living in the city must commute to the CBD from their residences. The CBD itself is assumed to be dimensionless. It is assumed that a fixed lot of land is necessary to live in the city. For simplicity, the opportunity cost of land is assumed to be zero.

The population of the city consists of skilled workers who are working for the HQs. The population of the rural area consists of skilled workers working for other HQs and unskilled workers employed in the factories or in the homogeneous good sector. The share of skilled workers in the city is denoted as \( \lambda \). Correspondingly, the share of skilled workers working in rural HQs is \( 1 - \lambda \). These are summarized in Figure 3.

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3 See for example Abdel-Rahman (2000) on general equilibrium models of cities.
The homogeneous good

Consumers have a positive initial endowment of the homogeneous good that is also produced using unskilled workers only, under constant returns to scale and perfect competition. This good is chosen as the numeraire. (Therefore, \( w^U = 1 \) in equilibrium.)

Trade and communication costs

Unlike the NEG based studies, domestic trade costs are not considered in this analysis (but international trade costs will be considered later).\(^4\) This is because in a modern developed economy, domestic markets are well integrated – efficient distribution networks or supermarket chains exist both in urban and rural areas, leading to lower domestic price differentials of manufactured goods today. In addition, communications costs that typically arise between HQs and factories when they are spatially separated are also not considered. Instead, the focus here is on the importance of face-to-face communication between the HQs and business service suppliers in the city.

Consumer preference

The consumer preference and the corresponding demand structure follows the one developed by Ottaviano et al (2002). All consumers have the same preferences with the following utility function,

\[
U = \alpha \int \left( c_i d_i - \frac{\beta - \delta}{2} c_i^2 - \frac{\delta}{2} \left( \int c_i d_i \right)^2 \right) + c^A \quad (0 < \alpha, \ 0 < \delta < \beta),
\]

where \( c_i \) is the consumption of variety \( i \) of the manufactured good, \( c^A \) is the consumption of the homogeneous good, and \( n \) is the total mass of varieties of the manufactured good. \( \alpha \), \( \beta \) and \( \gamma \) are exogenous parameters. \( \alpha \) represents the intensity of the preferences for the manufactured good, and \( \beta > \delta \) is required for the utility function to exhibit the love of variety. For a given value of \( \beta, \delta \) expresses the substitutability between the varieties. With the budget constraint

\[
\int p_i q_i d_i + q_0 = w^r + \bar{q}_0,
\]

utility optimization yields the following demand function for a typical variety of manufactured good

\[
c_i = a - (b + cn)p_i + cP,
\]

\(^4\) Jacks et al. (2008) demonstrates that international trade costs are still considerably high compared to domestic trade costs.
where
\[ a \equiv \frac{\alpha}{\beta + \delta(n-1)}, \quad b \equiv \frac{a}{\alpha}, \quad c \equiv \frac{\delta b}{\beta - \delta}, \quad P \equiv \sum_{i=0}^{n} p_i d_i. \]

### 3.2 Firm behaviour

Given the demand functions of the individual consumers, the profit of a typical SEP firm can be written as
\[
(p^{SEP} - Am)a - (b + cn)p^{SEP} + cP(S + L) - Fw_c^S.
\]
(6)

The profit maximizing price that the SEP firm sets is then
\[
p^{SEP} = \frac{1}{2} \left( Am + \frac{a + cP}{b + cn} \right).
\]
(7a)

Similarly, the profit maximizing price that the INT firm sets is
\[
p^{INT} = \frac{1}{2} \left( m + \frac{a + cP}{b + cn} \right).
\]
(7b)

This implies a constant price differential of
\[
p^{SEP} - p^{INT} = \frac{m(1 - A)}{2}
\]
(8)
between the SEP and INT firms. (The SEP firms always set lower prices than the INT firms.)

### 3.3 Equilibrium and city formation

Equilibrium is defined as a situation in which all goods and labour markets clear, firms earn zero (pure) profits due to free entry, and all skilled workers in the city and in rural areas achieve the same utility level.

Market clearing of the manufactured goods require
\[
q^{SEP} = [a - (b + cn)p^{SEP} + cP(S + L)],
\]
(9a)
and
\[
q^{INT} = [a - (b + cn)p^{INT} + cP(S + L)].
\]
(9b)

This implies a constant size differential between the SEP and the INT firms:
\[
q^{SEP} - q^{INT} = \frac{1 - A}{2} m(b + cn),
\]
(10)
that is, the SEP firms always operate at larger scales. Given that the SEP firms’ functions are spatially dispersed between the city and the rural area, and the result that they are bigger, the SEP firms have the characteristics as national firms. The INT firms, on the other hand, operate within smaller geographic areas with smaller scales, so they have the characteristics as local
Assuming free entry and exit, the profits are driven down to zero. That is
\[
(p^{\text{SEP}} - Am)[a - (b + cn)p^{\text{SEP}} + cP](S + L) - Fw_C^S = 0, \tag{11a}
\]
and
\[
(p^{\text{INT}} - m)[a - (b + cn)p^{\text{INT}} + cP](S + L) - Fw_R^S = 0. \tag{11b}
\]
The equilibrium skilled wages are then derived as
\[
w_C^S = \frac{1}{4F} \left( \frac{a + cP}{b + cn} - Am \right)[a - Am(b + cn) + cP], \tag{12a}
\]
and
\[
w_R^S = \frac{1}{4F} \left( \frac{a + cP}{b + cn} - m \right)[a - m(b + cn) + cP]. \tag{12b}
\]
Within the city, since all skilled workers are mobile, all residents earn the same disposable income in equilibrium. Therefore, if \( R \) is the land rent in the city centre, \( \theta \) is the commuting cost per unit distance, and \( X \) is the distance to the city edge from the CBD, \( w_C^S - R = w_C^S - \theta X \) should hold. Further, since full employment of skilled workers imply
\[
F \lambda S \lambda S F = \frac{\lambda S}{F} \quad \text{and} \quad n^{\text{INT}} = \frac{(1 - \lambda)S}{F}, \tag{13}
\]
the city population \( n^{\text{SEP}}F \) is equal to \( \lambda S \). The unit land requirement for each city resident implies \( X = n^{\text{SEP}}F \). Therefore in equilibrium,
\[
R = \theta X = \theta \lambda S. \tag{14}
\]
The total land rent is \( RX/2 = \theta(\lambda S)^2/2 \), and it is assumed that this is equally distributed among the city residents (Figure 4). The net urban cost for each individual is therefore \( \theta \lambda S/2 \). In addition, free mobility of skilled workers between rural and the city requires that the skilled workers’ utility in the city and in rural are equalized. That is
\[
w_C^S - \frac{\theta \lambda S}{2} = w_R^S. \tag{15}
\]
3.4 National and local firms and the city size

Because of the obvious advantage of the SEP (or the national) firms, the urban nominal skilled wages are higher than the rural skilled wages. However, sufficiently high urban costs of land rent and commuting lead to an equilibrium in which not all skilled workers work and reside in the city. Figure 5 shows the urban and rural skilled wages as a function of the share of skilled workers in the city, $\lambda$. The two wage curves, $w^S_C$ and $w^S_R$, are downward sloping. This is because competition gets ‘tougher’ or the overall price level, $P$, declines as more firms locate their HQs in the city and become productive. As in (15), equilibrium distribution of skilled workers ($\lambda$) and the corresponding city size is determined at the intersection of the $w^S_C - \theta \lambda S/2$ and the $w^C_R$ curves.\(^5\) It can be confirmed that

$$\frac{\partial w^{\text{SEP}}}{\partial \lambda} - \frac{\partial w^{\text{INT}}}{\partial \lambda} = -\frac{(A-1)^2 cm^2S(L + S)(bF + cS)}{2F^2(2bF + cS)} < 0,$$

so there can be a stable internal solution ($0 < \lambda < 1$), otherwise all HQs will locate in the city.

\(^5\) The analytical solution of $\lambda$ is

$$\lambda = \frac{S + L(1 - A)m}{4F} \left[ 2a - m(1 + A) \left( b + \frac{cS}{F} \right) + \frac{2cS}{F(2bF + cS)} \left[ bF + cS \right] \left[ m + Fa \right] \right],$$

$$= \frac{S + L(1 - A)}{4F^2} \left[ m + \frac{S + L}{4F} \left( 1 - A \right)^2 cm^2 \left( \frac{cS}{2bF + cS} + 1 \right) \right].$$
(λ = 1).

To summarise the (autarky) analysis, with the fundamental assumption that 1) business services are provided in the city and 2) access to business services improves firm productivity, firms locate their HQs in the city in order to gain best access to business services. However, as more HQs locate in the city, the city size increases and the commuting distance and land rent increases. Such urban costs can restrict all firms from locating their HQs in the city, and in equilibrium, there exist two types of firms – large firms with a dispersed spatial organization (SEP/national firms) and small firms with a relatively integrated spatial organization (INT/local) as presented in Section 2. In the next section, we introduce a foreign economy to consider possible impacts of international trade on the spatial organisation of firms and the urban-rural relationship.
4. The impact of international trade on the urban-rural structure

The impact of international trade on the urban-rural relationship is analysed by introducing a foreign economy (or the rest of the world) and international trade costs. For simplicity, the urban-rural dimension of the foreign economy is ignored as in the studies by Krugman and Livas-Elizondo (1996) and Paluzie (2001).

4.1. Firm behaviour in the foreign market

It is assumed that international trade costs \( \tau \) units of the numeraire per unit of the manufactured good. The home SEP and INT firms’ profits from the foreign markets are then

\[
(p_j^{SEP} - Am - \tau)(a - (b + cn^w)p_j^{SEP} + cP_f)(S_f + L_f).
\]

and

\[
(p_j^{INT} - m - \tau)(a - (b + cn^w)p_j^{INT} + cP_f)(S_f + L_f).
\]

The foreign firms’ profit in the foreign market is

\[
(p_f^f - fm)(a - (b + cn^w)p_f^f + cP_f)(S_f + L_f).
\]

Profit maximization of the firms results in the pricing behaviour as in Table 3, where \( p_f^f \) is the local price set by foreign manufacturing firms in the foreign market, and \( m^f > 0 \) is the productivity parameter of foreign firms. Hereafter in the analysis it is assumed that international trade costs are not too high so that both types of firms export.

<table>
<thead>
<tr>
<th></th>
<th>Home market</th>
<th>Foreign market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home SEP (national) firms</td>
<td>( p_h^{SEP} = \frac{1}{2}(Am + \frac{a + cP_h}{b + cn^w}) )</td>
<td>( p_f^{SEP} = p_f^f + \frac{1}{2}(Am - m^f + \tau) )</td>
</tr>
<tr>
<td>Home INT (local) firms</td>
<td>( p_h^{INT} = \frac{1}{2}(Am + \frac{a + cP_h}{b + cn^w}) )</td>
<td>( p_f^{INT} = p_f^f + \frac{1}{2}(m - m^f + \tau) )</td>
</tr>
<tr>
<td>Foreign firms</td>
<td>( p_f = a + cP_f + \frac{(m^f + \tau)(b + cn^w)}{2(b + cn^w)} )</td>
<td>( p_f^f = \frac{1}{2}(m^f + \frac{a + cP_f}{b + cn^w}) )</td>
</tr>
</tbody>
</table>

The comparative statics implies that the reduction in the international trade costs increases the operating profits or the skilled wages \( -\frac{\partial w^{SEP}}{\partial \tau} > 0, -\frac{\partial w^{INT}}{\partial \tau} > 0 \). But since
the gains to SEP/national firms are larger than the INT/local firms.

The impact of the enlarged foreign market size ($L_f$)

Also as for foreign size, it can be confirmed that the larger foreign size relatively increases the operating profits or the skilled wages of SEP/national firms:

$$\frac{\partial W_{SEP}}{\partial L_f} - \frac{\partial W_{INT}}{\partial L_f} = \frac{(1 - A) m (S_f + L_f) [b F + c (S_f + S)]}{2 F^2} > 0,$$

Therefore, trade liberalization, either in the form of lower international trade costs or expanded foreign economy, relatively benefits the SEP/national firms. This induces a relocation of skilled workers and HQs of local firms to the city, until the increased urban costs put a brake on it. An example of a new equilibrium in an open economy is shown in Figure 6.

**Figure 6: trade and urban size**

**Fixed entry cost for exporting to the foreign market**

So is the above result that opportunity for trade leads to a large city the only possible one within the present framework? No necessarily. As has been studied by Roberts and Tybout (1977), Bernard and Jensen (2001), and Bernard and Wagner (2001), typically in real business fixed entry costs into the foreign market are necessary in order to start exporting. Let us assume that additionally $F$ skilled workers are necessary to become an exporting firm, which means that a larger HQ is necessary in order to manage exporting activities. In this case, the local firms are
advantageous in employing additional skilled workers because the rural skilled wage is lower than that in the city. Figure 7 shows that if such additional fixed costs for entering the foreign market exist, some of the city-enlarging effect of international trade may be cancelled out. With higher exporting costs, it is possible that the city becomes smaller with trade than in autarky.

Figure 7: Trade and urban size with fixed costs for entering the foreign market

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6 In fact some of the well-known exporting firms in Japan such as Toyota, Yamaha, Suzuki or Nintendo do not have their headquarters in metropolises like Tokyo.
5. Concluding remarks

The result from the present analysis can be summarized and compared with existing studies as follows.

<table>
<thead>
<tr>
<th>Table 4: Comparison with related studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>This study</strong></td>
</tr>
<tr>
<td><strong>Foundation of city or region</strong></td>
</tr>
<tr>
<td><strong>Mechanism of city/region formation</strong></td>
</tr>
<tr>
<td><strong>Impact of trade liberalization on internal geography</strong></td>
</tr>
</tbody>
</table>
References


