43rd Congress of the European Regional Science Association
27-30 August 2003, Jyväskylä – Finland

AGGLOMERATION ECONOMIES IN THE FINNISH MANUFACTURING SECTOR

Draft version: 28 April, 2003

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Abstract:
Regional concentration of population and economic activity is a common phenomenon both in Finland and the other most developed countries, which refers to the existence of agglomeration economies. Two types of economies are usually recognised to be important: specialisation (Marshall externalities) and diversity (Jacobs externalities) economies. The former refer to the geographical concentration of a specific industry and the latter to the industrial diversity of the local system. This paper examines the relationship between agglomeration economies and regional productivity in the manufacturing sector in Finland. A distinction is made between the effects of urbanisation and localisation economies. The production function method is applied to the manufacturing sub-sectors in the 83 NUTS 4-level regions in 1995 and 1999. The results find in favour of regional specialisation more than diversification even if some differences can be seen between the manufacturing sub-sectors. Localisation economies seem to be stronger in the regions where the average size of firms is small, which indicates that regions with smaller firms might profit more from localisation.

1. INTRODUCTION

Technological advances and the development of the ICT infrastructure enable entrepreneurs, other economic agents and the population to become less dependent on location. However, there still seem to be reasons behind clustering activities. The regional concentration of population and economic activity is a common phenomenon both in Finland and in the other most developed countries. Regional concentration seems to be prevalent in almost every industry whose choice of location does not depend on natural resources, and is also closely related to change in the regional production structure.

The primary objective of this study is to examine the relationship between agglomeration economies and regional productivity in the manufacturing sector in Finland. Special attention is paid to the analysis of two types of agglomeration economies: localisation/specialisation (Marshall externalities) and urbanisation/diversity (Jacobs externalities) economies. The former refers to the positive effects due to the geographical concentration of a specific industry and the latter to the benefits gained from the industrial diversity of local system. Many theoretical and empirical studies have demonstrated that agglomeration economies have an impact on production efficiency (e.g. Sveikauskas 1975; Segal 1976; Nakamura 1985; Henderson 1986; Capello 1999, 2002). There is also number of competing views about the nature of these effects. The pattern of the geographical concentration of economic activities is an interesting factor behind regional growth, but in Finland such analysis has been rather neglected.

This study provides new and useful information about the role of geographical concentration and agglomeration economies in regional development. The analysis performed here on specialisation and diversity economies enable us to evaluate whether a policy favouring only a few large growth centres (diversity economies dominate) is more desirable than the policy supporting many small-scale specialised regions. In other words: Is it more important to support regional specialisation or diversification? The results may be of value in planning and targeting regional policy measures.

Finnish economy experienced a period of deep recession around the beginning of the 1990s. This was followed by a marked increase in the speed of movement into a few core areas. In 2001 migration reached the highest level ever, and in only a few regions

has it had a positive net effect during the last years. The most successful regions have been those with university and strong IT sector or other industrial base. The spatial concentration of firms and jobs play a significant role in the migration process. Hence, the accumulation of firms, services and population support each other, creating a self-feeding agglomeration process.

In this study the existence and magnitude of agglomeration economies in the regional growth process are examined on the basis of the production function approach. The emergence of agglomeration effects is analysed at the regional level rather than at the level of individual firms. The data set consists of Finland's 83 mainland sub-regions (NUTS 4-level regional units in EU standards), which are close approximations to commuting areas, and three manufacturing sub-sectors. Service industries are not included because of the lack of data.

The results of this study show more evidence for regional specialisation than diversification. Although there are some differences between the manufacturing sub-sectors, the positive effects of localisation, as measured by a location quotient, can be observed in all sectors. Moreover, localisation economies seem to be stronger in regions where the average size of firms is small, which indicates that localisation economies are beneficial especially for small firms. With regard to the effects of urbanisation on productivity, the results indicate that the urbanisation economies appear to be more beneficial to the manufacture of food, beverages and tobacco than wood/paper and metal.

The paper is structured as follows. Section 2 introduces the theories of localisation and urbanisation economies. Section 3 discusses some of the earlier studies that have investigated the relationship between agglomeration economies and regional productivity. The data and the model used are presented in Section 4 and the results of the estimates in Section 5. The last section concludes.

2. AGGLOMERATION ECONOMIES

Agglomeration economies have been proven to play a significant role in the analysis of regional development, regional growth and industrial location. The concept of agglomeration economies implies that a spatial concentration of economic activity generates positive effects on the productivity of the firms located in the area in question. Agglomeration economies are a form of external economies. Hence, they are not under the control of the firm and the firm itself cannot create them.

The usual classification, introduced by Hoover (1937), and later considered in some detail by Isard (1956), is the distinction between localisation and urbanisation economies (or specialisation and diversity economies, respectively). The former type is characterised by the geographical concentration of a specific industry and the latter by the industrial diversity of the local economic system. Diversity economies can emerge in urban densely populated districts, whereas both urban and smaller non-urban areas can profit from specialisation. If localisation economies dominate in an industry, firms are likely to cluster in those areas where the high specialisation will contribute to their growth. Urbanisation economies, on the other hand, will attract firms and industries that need a diversified environment to grow faster. The results of the studies on this topic are mixed: There has been disagreement on whether diversity or specialisation better promotes economic growth and whether they hinder or contribute to each other (e.g. Nakamura 1985; Henderson 1988; Glaeser & al. 1992; Capello 2002). This lack of agreement makes it difficult to choose the most appropriate policy measures to promote and manage regional growth.

The concept of localisation economies can be traced in the literature as far back as Marshall (1920). He made a difference between internal economies of scale – depending on the organisation and management of the firm's own resources – and external economies of scale (localisation economies), which depend on the development of the whole industry in the region. Hence, localisation economies are external to the firm but internal to the industry. Marshall identifies three sources for industry specific concentration: a pooled labour force with special skills, facilities for the development of specialised inputs and services, and spatial technological spillovers.

First, the pooled labour market is beneficial both to the firms and employees (labour-market economies). A large local base of a specific industry protects workers from business uncertainty and demand-shocks. Local industry concentration offers many other opportunities in the case of layoffs, which means that workers do not have to relocate nor lose their specific skills. On the other hand, the pooled labour force with specific skills lowers the search and recruitment costs of firms. The productivity of firms may even decrease if they are located in regions where certain types of workers are in short supply because they then have to recruit labour from other regions or use the less productive labour that is available locally. Secondly, the proximity of suppliers and customers, or the forward and backward linkages, respectively, help to create a local milieu or network conducive to more effective production and economic growth. High local demand allows a greater number of producers of intermediate inputs to break-even and an increased variety of intermediate goods in turn makes the production of final goods more efficient (Krugman 1991; Ciccone & Hall 1996). Finally, knowledge spillovers, particularly important in the high tech and innovative sectors, may appear in many ways. Knowledge and ideas about new products and production techniques can be transferred by imitation, business interactions, inter-firm circulation of skilled employees or by informal exchanges, without monetary transactions (Saxenian 1994). The larger the number of workers in an industry, the greater is the opportunity to exchange ideas (communication economies). A further item could be added to this traditional list of localisation economies: better availability of (unmeasured) public intermediate inputs tailored to the technical needs of the industry in question (Henderson 1986).

Urbanisation or diversity economies, the broadest form of agglomeration economies, are external to both the firm and the industry (Jacobs 1969). Unlike localisation economies, which emerge as the number of firms in the same industry in a certain area increases, urbanisation economies are a function of city size. They are not related to the size of the individual firm or the industry cluster. Urbanisation economies generate benefits for firms throughout the city, not just firms in a particular industry. (Selting & al. 1994.)

The sources of urbanisation economies are quite diverse. A well functioning infrastructure of transportation (including roads, airport and cargo facilities) and communication offer transfer savings for firms. Moreover, the proximity of markets and easy

access to specialised services (such as financial, legal or accountancy services) facilitate the operations of firms and enable them to allocate their resources more effectively without having to provide all required services on their own. Besides, the proximity of a great number of economic agents from different fields provides better possibilities for face-to-face interaction. As Jacobs (1969) concludes, the urban environment yields a greater return on new economic knowledge and encourages innovation. Finally, benefits can be generated from the existence of a large and flexible labour market. If fluctuations in the labour demands of different industries are not correlated, the city can provide a stable level of total employment. Hence, the possible sources of urbanisation and localisation economies partially overlap.

3. RELATED STUDIES

Measuring the effects of agglomeration economies and distinguishing between urbanisation and localisation economies is not an easy task. It is possible that a city location is not a result of urbanisation economies but localisation economies or even both of these. For example, firms locating in the city may be attempting to be close to other firms in the same industry rather than trying to benefit from city amenities (Selting & al. 1994). The location decision of a firm can also be a random process; in particular, big firms with monopoly status can ignore the potential growth effects of agglomeration. The natural cost advantages cannot be disregarded either when analysing the location patterns of firms and industries (Ellison & Glaeser 1999). Moreover, the impact of external economies has been found to be different depending on the industrial sector or the stage of the production process (Shefer & Frenkel 1998; Viladecans-Marsal 2000; Duranton & Puga 2001; Henderson 2003).

The relationship between agglomeration effects and regional or urban productivity has been a topic of several empirical studies. Depending on the study, agglomeration economies are considered at the level of individual firms or industrial sectors whereas in some cases the overall benefits of the spatial concentration pattern for the whole region are analysed. Due to the vast and diverse literature, only some of them are referred to here (see Selting & al. (1994) or Eberts & McMillen (1999) for a more detailed survey of the agglomeration literature).

Sveikauskas (1975) and Segal (1976) examined whether production resources are more efficient in large than small cities by using the production function approach. Sveikauskas (1975) found that in the average industry the level of labour productivity is six percent higher where the size of the city is doubled. However, he emphasises that the causality behind observed relationship is unclear as it might be that city size itself causes high productivity or that individual cities systematically grow to large size because they are already more productive. In the study by Segal (1976), an agglomeration effect, imbedded in the constant term of the production function for the largest cities, made labour and capital (total factor productivity) eight percent more productive.

Henderson (1986) analysed the nature and extent of agglomeration economies in manufacturing industries, applying the production function method to cross-sectional data from the United States and Brazil. His results indicate the predominance of localisation rather than urbanisation economies of scale. It is also worth mentioning that localisation economies appeared to be stronger for heavy than for light industries (the same conclusion was also reached by Nakamura (1985)) and that localisation economies had declining elasticities or a tendency to peter out as scale increased.

Beeson (1987) used US state level data from the manufacturing sector to evaluate the relationship between agglomeration economies and productivity growth. Her two stage estimation method differs from the usual methods applied in this field. First, the average growth rates of total factor productivity, technical change and scale economies were estimated and then these estimates were used as dependent variables in the analysis of the relationship between agglomeration and productivity growth. Rate of technical change and economies of scale were found to be related to agglomeration, but overall productivity growth was not. Hence, those individual effects tend to be offsetting.

The purpose of Ciccone and Hall (1996) was to explain the differences in labour productivity across the US states paying attention to the spatial density of economic activity as the source of increasing returns. Urban density, rather than size, was considered a more accurate determinant of the level of agglomeration. According to the results, doubling employment density in a county increases average labour productivity by six percent. Baptista (2001) followed the same approach, using manufacturing sector data for the counties of the UK. He reached the same conclusion that increasing returns to den-

sity play a significant role in explaining productivity differences. But besides that, there seems to be an upper limit to the density effect which is possibly due to negative congestion effects.

A recent study by Capello (2002) analysed the role played by urbanisation and localisation economies on the factor productivity of firms. The production function method was applied to a sample of firms in the high tech sector in Milan, Italy. The results indicated that localisation economies play a more important role than urbanisation economies. Capello also found that localisation economies have a positive impact on small firms while urbanisation economies are more advantageous for large firms.

In Finland, the number of empirical studies that actually evaluate the determination of productivity from a regional, and especially from a spatial concentration point of view, is quite limited. Some of the studies where the topic is touched on are quoted here but due to the different methods and data used these results cannot be compared.

The characteristics of the high productivity plants in Finnish manufacturing were investigated by Maliranta (1997). He obtained evidence that geographical location matters. Plants in Southern Finland tended to have higher total factor productivity than plants in Eastern and Northern Finland. Some evidence for the existence of localisation economies was also found. Hence, Maliranta concluded that focusing on specific industries can be advantageous at both a regional and industrial level.

In the study by Böckerman (2002) regional labour productivity was related to industry structure, demographic factors and the variables that capture the reorganisation of labour markets. Highly concentrated ICT manufacturing was shown to be the main factor behind productivity growth. But in contrast to the US and European empirical results, an increase in the density of economic activity had no impact on the growth of labour productivity.

Susiluoto and Loikkanen (2001) investigated the differences in the private sector efficiency scores of 83 Finnish regions in 1988-1999. According to their results, the large size of a region (measured by population) seems to bring some agglomeration advantages that increase efficiency. Another interesting result suggested that the more special-

ised (measured by the Herfindahl index) the structure of the regional economy is, the higher its efficiency. Hence, this study gives some support to both urbanisation and localisation economies in Finland.

4. DATA AND METHOD

Researchers have used different methods when trying to measure the impact of agglomeration economies on regional growth. The production function approach is probably the most popular empirical tool and it serves as a basis for this analysis as well. This study seeks answers to the following questions: How significant is the role of localisation and/or urbanisation economies? How do the effects vary between industries and regions?

The analysis is based on regional rather than firm level data. The data cover the manufacturing sector in the 83 mainland sub-regions (NUTS 4-level) of Finland. These regional units can be considered as approximations to commuting areas. The offshore sub-regions of Åland are excluded because they differ (e.g. production structure) markedly from the mainland sub-regions. Service industries are not included in the analysis because data on the capital were not available. Two periods, the years 1995 and 1999, are examined. The model is estimated separately for three sub-sectors of manufacturing: (1) manufacture of food, beverages and tobacco, (2) manufacture of wood, paper and pulp, printing and publishing, and (3) manufacture of basic metal, metal products (including machinery), electrical products and transport equipment. The source of this regional based data is Statistics Finland.

Before proceeding to the detailed description of the variables applied and to the empirical analysis, a brief discussion about the differences in regional productivity of the manufacturing sector as a whole and the importance of each of the manufacturing sub-sectors in the Finnish economy is provided. Regional differences are presented in the maps contained in Figure 1.

The productivity of the manufacturing sector as a whole is calculated as the mean annual value for the years 1998-2000 (see map (a)). Great variation exists in productivity levels between regions. The high productivity of the manufacturing sector is concen-

trated in the southernmost regions and in those regions which are specialised in the manufacture of wood, paper and/or pulp or in metal or electrical products. The regions with the lowest manufacturing productivity are those with a relatively large agricultural sector or those which rely heavily on services, like tourism (northernmost regions).

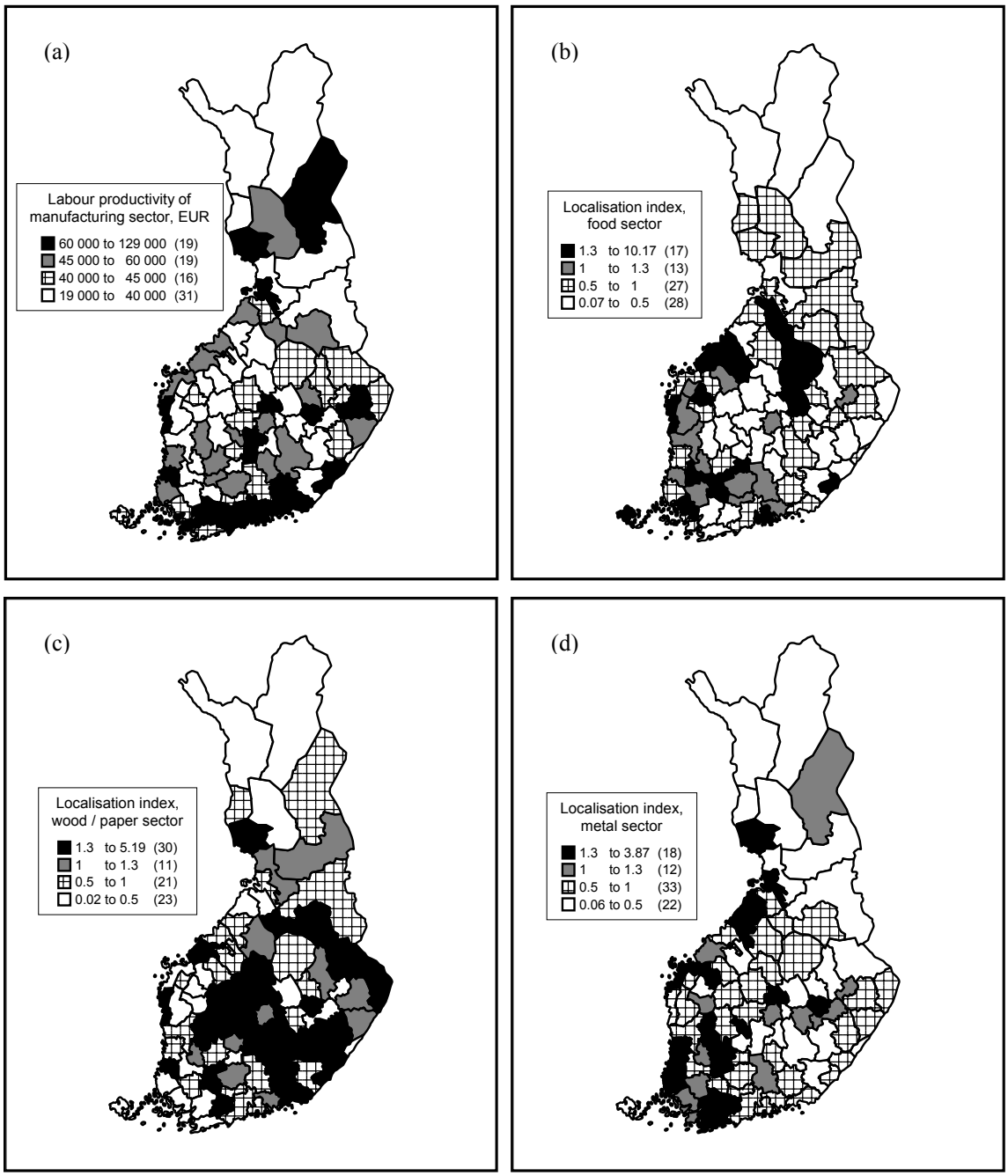
The manufacturing sector as a whole employs one fifth of the national labour force. The regional dominance of each manufacturing sub-sector is analysed by using the simple location quotient (here we use the term localisation index). The method of calculation is described later on in this section. If the index value exceeds one, it indicates that a given region is more specialised in a given sector than on the average in the country, and, alternatively, if the value is below one, the importance of the sub-sector is weaker in the region than nationally. The values of the indices are presented in maps (b), (c) and (d) in Figure 1. The same classification is used in all the maps.

The manufacture of food, beverages and tobacco is not a very large sub-sector in Finland, accounting for two percent of all employees in 1999. The share of workers exceeded five percent in four sub-regions. Hence, production is highly concentrated in a few regions.

The sub-sector of wood, paper and pulp, printing and publishing employs approximately five percent of the Finnish labour force. Paper mills, in particular, employ a large number of people and often have a long history in the region where they are located. In several regions the share of workers in this sub-sector is over 15 percent. This sub-sector seems to be more evenly distributed across the regions than the other sub-sectors analysed here.

The metal sub-sector is the biggest in the manufacturing sector as measured by employment. Apart from basic metal products this sub-sector also includes electrical products. In 1999 nearly ten percent of the Finnish working force made their living from this sub-sector. Employability varied markedly between regions, ranging from one to as high as 35 percent.

Figure 1. Labour productivity (a) and location of manufacturing sub-sectors (b, c and d)



Next, the methods of calculation and the sources of the variables applied are presented. The description of the variables and their descriptive statistics can be found in Tables 1 and 2, respectively. All the variables are calculated regionally for each of the sub-sectors. Regional labour productivity (LPROD) is used as a dependent variable. It is measured by dividing the annual value added in a given region and sector (at 1995 prices) by the number of employees. Because there might be significant variations in the productivity level annually, the variable is calculated by taking the mean value over

three years. The measure of value added is based on the regional GDP and employment accounts constructed by Statistics Finland.

The independent variables include the capital-labour ratio (LRATIO) and the indices which measure the impact of localisation and urbanisation. The capital-labour ratio is calculated by dividing the capital stock of a given region and sector (at 1995 prices) by the number of employees. The capital-labour ratio describes the situation of the year under examination. The capital stock is calculated as a gross value and balance figures are used as a basis instead of investment accumulation data. The calculations are based on the study by Statistics Finland.

Two indices are constructed to describe the effects of urbanisation and localisation. In several previous studies the population in a given region has been used as a proxy for measuring the regional economic activity (urbanisation level). It is assumed that the higher the population in the region, the more diversified the economic structure of that region. In this analysis population is also used but not as an absolute value. The urbanisation index (URBIND) is formed by calculating first the average population in the Finnish regions (total national population divided by number of regional units) and then dividing the population of the region by this mean value. It can be written as

$$\mathrm{URBIND_j} = \frac{pop_j}{pop_c / n} \qquad (1)$$

where pop_j is the population in a given region, pop_c is a total population in the country and n is the number of regions. Thus, the urbanisation index indicates how large the difference is between the actual population of the region and the expected (average) population.

Level of specialisation is analysed by the regional location quotient (LOCIND). The quotient is based on the share of employment of the different sub-sectors in the regions relative to sectors' share of national employment. It is simple to compute:

$$\mathrm{LOCIND_{ij}} = \frac{emp_{ij} / emp_j}{emp_{ic} / emp_c} \qquad (2)$$

where emp_{ij} is employment in manufacturing sector i in region j, emp_j is total employment in region j, emp_{ic} is national employment in sector i, and emp_c is total employment in Finland. If the value of the index exceeds one it indicates that the region is more specialised in a given sector than on the average in the country, and, alternatively, if the value is below one the sector is less represented in the region than nationally.

Because the productivity might vary between the different size of firms, the average size of firms (SIZE) in each sector is included as a dependent variable into the model. It is defined as the average number of employees, or by dividing the number of employees by the number of firms in a given sector and region.

The interaction variables (SIZEURB and SIZELOC) are applied to control for the effects of firm size when defining the impact of urbanisation and localisation economies on regional productivity. They are constructed by multiplying the indices by the average firm size.

Table 1. Description of the variables

Variable	Definition
LPROD	Log of value added in the region divided by the number of employees in the region
LRATIO	Log of capital stock in the region divided by the number of employees in the region
URBIND	Population in the region divided by the average population in all regions (~ expected population)
LOCIND	Location quotient (see the text above)
SIZE	Number of employees in the region divided by the number of firms in the region
SIZEURB	Cross-variable: urbanisation index multiplied by the average size of firms in the region
SIZELOC	Cross-variable: localisation index multiplied by the average size of firms in the region

Table 2. Descriptive statistics

Sub-sector	Variable	MEAN	STD. DEV.	MINIMUM	MAXIMUM
Manufacture of food beverages and tobacco	**LPROD**	10.299	0.376	9.488	11.298
	LRATIO	11.670	0.663	9.798	13.550
	POPIND	1.019	2.176	0.112	19.256
	LOCIND	1.064	1.325	0.076	10.169
	SIZE	15.007	15.674	2.550	86.242
	SIZEPOP	26.999	106.49	0.435	957.89
	SIZELOC	33.476	110.55	0.262	873.60
Manufacture of wood, paper and pulp, printing and publishing	**LPROD**	10.715	0.482	9.681	11.887
	LRATIO	11.725	0.815	10.214	13.471
	POPIND	1.019	2.176	0.112	19.256
	LOCIND	1.282	1.072	0.026	5.190
	SIZE	16.985	16.282	0.833	86.392
	SIZEPOP	17.560	29.113	0.198	217.09
	SIZELOC	37.433	69.908	0.022	406.00
Manufacture of basic metal, metal/electrical products and transport equipment	**LPROD**	10.599	0.317	9.745	11.866
	LRATIO	11.068	0.575	9.152	12.675
	POPIND	1.019	2.176	0.112	19.256
	LOCIND	0.936	0.686	0.062	3.864
	SIZE	14.568	10.661	1.129	64.869
	SIZEPOP	19.524	56.323	0.197	495.82
	SIZELOC	19.792	33.536	0.075	250.63

Generally, two different approaches are used in the measurement of agglomeration economies through production functions: as parallel shifts in the production function (the constant term) or as differences in the returns to scale parameters (Eberts & McMillen 1999). In this study the former is applied. The model proposed here employs a Cobb-Douglas production function which restricts the sum of the exponents on capital and labour to one. In addition to the basic production function, the factor which represents the scale effects is included in the model. This format is partly based on earlier studies (e.g. Segal 1976; Nakamura 1985; Henderson 1986; McCoskey & Kao 1999; Capello 2002). The function to be estimated is the following:

$$Y_{ij} = A_{ij}\left(cap_{ij}^{\alpha_1} emp_{ij}^{1-\alpha_1}\right) \quad (3)$$

where Y_{ij} is value added in manufacturing sector i in region j, cap_{ij} is capital stock in sector i in region j and A_{ij} measures the agglomeration effects.

$$A_{ij} = e^{\alpha_2 * URBIND_j + \alpha_3 * LOCIND_{ij} + \alpha_4 * SIZE_{ij} + \alpha_5 * SIZEURB_{ij} + \alpha_6 * SIZELOC_{ij} + \varepsilon} \quad (4)$$

Dividing the basic production function by the number of employees and taking the natural logs with the assumption of constant returns to scale forms the following estimation model:

$$LPROD_{ij} = constant + \alpha_1 * LRATIO_{ij} + \alpha_2 * URBIND_j + \alpha_3 * LOCIND_{ij} + \alpha_4 * SIZE_{ij} + \alpha_5 * SIZEURB_{ij} + \alpha_6 * SIZELOC_{ij} + \varepsilon \quad (5)$$

The coefficients can be interpreted as follows. If one or other (or both) coefficients of the agglomeration indices (α_2, α_3) turns out to be positive and statistically significant, it means that productivity is higher in the regions where urbanisation (diversity) and/or localisation (specialisation) level is high. The coefficients of the interaction variables (α_5, α_6) measure the effect of the size of firms on the role of agglomeration economies. A positive and significant coefficient indicates that urbanisation and/or localisation effects are stronger in regions where the average size of firms is large. Alternatively, when the coefficient gets a negative value regions with small firms benefit most from urbanisation and/or localisation.

5. RESULTS

Table 3 presents the results for two specifications. The specifications differ in whether the variables reflecting the size effects are included or not. The diagnostics reported test the normality of the disturbance term, heteroskedasticity and functional form of the model. Most of the estimated equations would seem to suffer from heteroskedastic residuals, hence White's heteroskedasticity consistent standard errors are used. The problem of non-normalised residuals was encountered in the estimation of the metal sector, which may complicate the hypothesis testing of the parameter estimates. The RESET test of functional form did not reveal any serious problems.

The results of the OLS estimation for the year 1999 seem to lend support to the theory of localisation economies, whereas no such a clear evidence is found for urbanisation economies. The results also show that the effects of the size of firms cannot be totally ignored. The year of comparison (1995) gives quite similar results and for that reason they are not reported here. Next, the results will be interpreted separately for each of the sub-sectors.

The manufacture of food, beverages and tobacco seems to profit from both urbanisation and localisation economies. In the first specification both variables have a positive and statistically significant impact on productivity but in the second one the significance of localisation effects vanishes. Inclusion of the effects of size raises the explanatory power of the model from 40 to 52 percent. Size effects get a negative sign in both cases, which indicates that regions with smaller firms might profit more from both types of economies. However, it must be taken into consideration that manufacture of food, beverages and tobacco is rather a narrow sector in Finland and its role is significant in only a few regions. This may bias the results.

A large part of wood, paper and pulp manufacturing is heavily capital-intensive. Owing, at least in large part, to capital intensity, the explanatory power of the capital-labour variable is highly significant and the goodness of fit measure (R^2) exceeds 0.72 in both specifications. The localisation effects seem to be positive and significant whereas there is no any indication of urbanisation economies. This means that specialised regions seem to offer greater possibilities for growth. In addition, the regions where the average size of firms is small seem to be profiting more from high localisation than the regions with larger firms.

The third sub-sector in this analysis is the manufacture of basic metal, metal products (including machinery), electrical products and transport equipment. Thus, this sector also consists of several high tech products, but they cannot be separated from the data. The diagnostic tests revealed quite significant problems with the assumptions of normality and homoskedasticity. These results lend strong support to the existence of localisation economies which suggests that the productivity of the metal sector is higher in the regions specialising in that sector. The impacts of urbanisation are ambiguous and the sign patterns are mixed. In *specification I* the coefficient of the urbanisation index is positive and significant but in *specification II* its sign is negative and no longer significant. As regards the size effects, the results of this sector support the findings of the other two sectors. The localisation economies seem to be stronger in the regions where the average size of firms is small whereas there is no indication that the average size of firms would affect the profitability of urbanisation economies.

Finally, to give a concrete picture about the effects of localisation economies on regional productivity in a given sector, some calculations based on the results of *specification II* are done. If the number of employees in a specific sector and region is doubled, while holding the unweighted average values of the other variables constant (e.g. the capital-labour ratio or average size of firms does not change), the response is approximately a two percent growth in productivity. The sectoral differences in these effects of localisation economies seem to be quite small. Compared with the effects of the change of capital stock on productivity, the significance of localisation economies is considerably smaller. In the highly capital intensive wood/paper sector an increase of only about ten percent in capital stock corresponds to a change of the same magnitude in productivity, whereas in the food sector the capital stock would need to increase by 50 percent and in the metal sector by even more to reach the same, two percent, growth in productivity. Naturally, these estimates should be interpreted cautiously.

Table 3. Estimation results (dependent variable: LPROD)

	Manufacture of food, beverages and tobacco		**Manufacture of wood, paper and pulp, printing and publishing**		**Manufacture of basic metal, metal / electrical products and transport equipment**	
	Specific. I	***Specific. II***	***Specific. I***	***Specific. II***	***Specific. I***	***Specific. II***
Constant	6.784 (9.16)	7.641 (10.01)	6.069 (12.20)	6.590 (11.80)	8.042 (12.48)	8.096 (15.20)
LRATIO	0.295 (4.45)	0.198 (2.74)	0.381 (8.24)	0.327 (6.40)	0.210 (3.47)	0.196 (3.95)
URBIND	0.031 (2.20)	0.236 (2.51)	0.007 (0.65)	-0.052 (-1.50)	0.032 (3.91)	-0.052 (-0.70)
LOCIND	0.043 (2.01)	0.103 (1.29)	0.136 (3.42)	0.155 (2.28)	0.212 (2.98)	0.232 (2.05)
SIZE		0.012 (2.85)		0.010 (1.22)		0.015 (1.86)
SIZEURB		-0.005 (-2.59)		0.005 (1.56)		0.003 (1.01)
SIZELOC		-0.002 (-1.95)		-0.003 (-2.10)		-0.005 (-2.35)
R^2	0.402	0.517	0.728	0.761	0.579	0.641
N	83	83	83	83	83	83
χ^2 (2) (normality)	0.34	1.65	3.11	1.88	12.23	14.17
White (heterosked.)	5.54	1.37	1.75	1.94	9.52	12.95
RESET (functional form)	1.35	0.49	0.36	2.73	1.69	2.20

6. CONCLUSIONS

The results differ for the three sub-sectors studied but as a whole they support the regional specialisation more than diversification. There are probably many different factors behind this phenomenon but, especially for manufacturing firms, the availability of land, suppliers and a workforce with specific skills are generally among the most important.

Hence, the existence of localisation economies is an encouraging result for small regions which do not have the resources either to extend their economic activity or to diversify their production structure. However, in this context it is important to mention also some of the drawbacks of the one-sided production structure. A highly specialised region is heavily dependent on the success of the given sector, and thus, such regions can be very sensitive to national or global economic fluctuations. In addition, strong reliance on and contribution to a given sector can prevent the creation of new economic activity in the region. It could be concluded that what is beneficial to firms is not always of benefit to the region as a whole.

The effects of urbanisation economies vary greatly between the sub-sectors. The manufacture of food, beverages and tobacco seems to profit from urbanisation even more than localisation. Due to the nature of food and beverage products, easy access to large markets could be one explanation for the economies of urbanised location. The impacts of urbanisation on productivity are somewhat ambiguous in the other two sub-sectors. There is even some evidence for negative effects. These findings are in line with those of Henderson (1984) who also found that localisation economies dominate in the manufacturing sector. However, it must be noted that the rate of urbanisation in Finland is still quite low and it is possible that to obtain urbanisation economies more urbanised regional units are needed.

The significance of the size effects also varies between the sub-sectors. Localisation economies seem to be stronger in regions where the average size of firms is small, which indicates that localisation economies are beneficial, especially for small firms. The own resources of small firms are often rather limited and thus the presence of firms in the same sub-sector may help to support their activities. Capello (2002) found that

localisation economies have a positive impact on small firms while urbanisation economies are more advantageous for large firms. The results of the present study are less unambiguous regarding the size effects of urbanisation.

Finally, it has to be noted that high aggregations of industries are used in this study which may lead to bias the results, thus restricting their application. It would also be interesting to analyse agglomeration effects in the service sector owing to its growing significance in the economy.

Acknowledgements: The author wishes to thank Professor Hannu Tervo for his helpful comments and suggestions. Financial support from the Local Development Foundation of Finland and the Academy of Finland is also gratefully acknowledged.

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