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Regional Interaction and Economic Diversity [1]
- exploring the role of geographically overlapping markets for a municipality's diversity in retail and durables

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Regional Interaction & Economic Diversity

- exploring the role of geographically overlapping markets for a municipality's diversity in retail and durables

by

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Abstract

This paper is devoted to the study of municipal diversity in retail and durables. Specifically, it analyzes how a region's relative market-accessibility in a system (or hierarchy) of municipalities affects the extent of diversity. In the theoretical part of the paper a simple model municipal diversity in retail and durables is introduced, which incorporates the municipality's position in a system of municipalities. Using this model as a point of reference, the paper explores the relationship between market-size and diversity in Swedish regions from 1993 to 2001 by means of a panel data approach. Three types of market-sizes are considered: (i) intra-municipal, (ii) intra-regional and (iii) extra-regional. It is shown that the relationships between diversity and the three types of market-sizes differ between different types of municipalities in the hierarchy, implying that such a classification is warranted. One particular finding that corresponds to the agglomeration shadow-effects usually discussed in NEG-theories is that large municipalities gain from proximity to surrounding municipalities while small municipalities do not.

JEL classification:

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1. INTRODUCTION

In regional and urban economics, a fundamental relationship is that between market-size and diversity. For example, in models building on Dixit's & Stiglitz's (1977) general equilibrium model of monopolistic competition, which in turn draws upon Chamberlin (1933), diversity in inputs generates increasing returns in the aggregate, (see e.g. Fujita & Thisse, 2002). Due to increasing returns of diversity in intermediaries, firms located in a region with a diverse set of input suppliers will experience higher productivity. The analogue reasoning can be applied to consumers: if the utility of consumers has increasing returns in the diversity of goods and services, consumers ought to be attracted to locations that offer a large market, since such locations allow for a diversified supply. In the presence of fixed costs, the extent of diversity depends on size of the market.

A large set of empirical studies support the view that there are positive effects of diversity. In a survey on urban diversity and economic growth, for instance, Quigley (1998, p.136) writes: "…no matter how [empirical] results are described, it remains clear that the increased size of cities and their diversity are strongly associated with increased output, productivity and growth. Large cities foster specialization in production and sustain a broader range of final products, increasing the returns of their firms and the well-being of their residents". This suggests that a region's diversity is an important factor that influences both its productivity and its growth[2].

While the role of diversity is well established, less research has focused on factors influencing a region's diversity. In most studies, diversity enters the analysis on the "right-hand-side". To some extent, plain intuitive reasoning suggests that size and diversity should go hand in hand. Indeed, one stylized fact, for instance, is that larger cities tend to be more diversified than smaller ones, (Duranton & Puga, 2001).

The present paper focuses on diversity in retail and durables. Accessibility to a diverse supply of retail and durables is an important determinant for the attractiveness of a location. The purpose of the paper is to investigates how a region's relative market-accessibility in a system (or hierarchy) of regions affects the extent of diversity in retail and durables. While previous studies most often considers the connection between the *internal* market and diversity, this paper looks at how a region's accessibility to (i) the internal market, (ii) the regional market and (iii) the extra-regional market affect the diversity. In order to distinguish between these three types of market accessibilities, the unit of analysis is the municipality.

An advantage of this decomposition of markets is that it allows for an assessment of the extent of spatial competition. Retail and durables are typical sectors for which a transaction is associated with that the consumer travels to the supplier. This mobility implies that the supply of retail and durables in surrounding municipalities causes a net outflow of consumers who consume in surrounding municipalities instead of the own (or home) municipality. As a consequence, the supply in surrounding municipalities can counteract a diversified supply in a municipality. Such effects are found by Mushinski & Weiler (2002). They study retail industries and find that the number of establishments in an area is affected negatively by the number of establishments in neighboring areas. Their interpretation of this result is that it indicates supply-side spatial competition. However, a key question in this paper is how the

[2] See for instance Ciccone & Hall (1996) and Glaeser *et al* (1992).

influence of the different types of market accessibilities differs between different types of municipalities in the system of regions. Consider for example a municipality with a large intra-regional market relative to the intra-municipal market. Such a municipality can be expected to experience a net *outflow* of customers who capitalize on a greater supply of goods and services in the neighboring municipalities. The mirror image of this is that a municipality with a large intra-municipal market relative to the intra-regional market can be expected to experience a net *inflow* of customers. Thus, there are strong theoretical arguments in favor of that the influence of the three markets is different for different types of municipalities.

This reasoning relates to hierarchical models of system of regions (or cities), e.g. Central Place Systems (CPS), in which it is often postulated that regions of higher order supply goods and services to regions of lower order, (Dicken & Lloyd, 1990). If this indeed is the case, then the range of goods and services produced in higher order regions should be larger than motivated by these regions' own size. In the trade literature a similar phenomenon is usually termed the "home market effect", (see *inter alia* Krugman, 1980, 1996). A complicating fact with this simple reasoning is that the strength of the effects between regions is most certainly influenced by the distances between them. This means that the effect should be stronger the closer a small region is to a larger one. Of two equally sized regions with different size of their respective hinterland the one with the larger hinterland ought to be able to host a wider range of production of goods and services. By the same token, in a smaller region there should be a narrower array of goods and services produced, if a larger region is located close by, since consumers residing in the smaller regions can travel to the larger region to capitalize on the diversified supply. From a consumers viewpoint the larger neighbor region makes home-varieties scarcer. On the other hand total access to goods and services should be more diversified.

To account for the abovementioned effects, three different types of municipalities are analyzed separately. The municipalities are distinguished from each other based on their intra municipal market-accessibility relative to their other two market-accessibilities. Hence, the commonality of the municipalities of the same type is their intra municipal market-accessibility relative to intra regional and extra regional market-accessibility. The effect of the three types of market accessibilities on the diversity in the different types of municipalities is studied 1993-2001 using a panel data approach.

The remainder of the paper is organized in the following fashion: Section 2 discusses how regions' diversity is affected by its position in a regional hierarchy. A simple two-region model is presented that outlines the basic mechanisms discussed. Section 3 describes the methodology of the paper. The results of the estimations are also presented. Section 4, the final section, concludes the paper and offers suggestions for future research.

2. A MODEL OF MARKET SIZE AND CONSUMER SERVICE DIVERSITY

The following model is an extension of the model in Andersson & Klaesson (2004) and shows the relationship between market size and diversity in consumer services. The ideas in the model are related to Dicken's & Lloyd's (1990, p.48) explanation for why consumers residing in low-order regions consume low-order goods in high-order regions:

> "…when making a trip to such centers for high-order goods, consumer may at the same time purchase low-order goods. In effect, this reduces the total travel expenditure: a single trip to a high-order center replaces the need to make separate trips to different centers. […..] One implication of such multipurpose trips is that the spatial range of

low-order goods provided by high-order centers is likely to be greater than the spatial range of the same goods provided form low-order centers."

Inspired by the above, a main assumption in the model is that the market size of a municipality is determined by the relation between its own size and the size of surrounding municipalities. The underlying conjecture for such a formulation is that a large municipality, relative to proximate municipalities, is likely to experience a net inflow of consumers in search for goods and services. However, the zero-sum situation implies that this municipality's gain must be generated at the expense of the other municipalities. Because of this, the relative size of a municipality with respect to surrounding municipalities is of great importance for its ability to attract consumer service firms. Small regions located in proximity to large regions may therefore experience an "agglomeration shadow-effect" (Krugman, 1993) or a "Christaller-effect" (Hugosson & Petersson, 2001). The set-up of the model is based on Dixit and Stiglitz (1977) and builds upon monopolistic competition and increasing returns.

We consider a typical household that resides in municipality m. Each such household is assumed to maximize its utility U_m from a bundle of goods A_m and consumer services S_m that are available to consumers residing in municipality m. The utility function is homogenous of degree one and is specified in Equation (1) below:

$$U_m = A_m^{\alpha} S_m^{\beta} \tag{1}$$

where α and β are non-negative constants and $\alpha + \beta = 1$. The sub-utility function for consumer services that corresponds to equation (1) is characterized by constant elasticity of substitution (CES), as described in Equation (2):

$$S_m = \left(\sum_{i=1}^{n} s_{im}^{1-\frac{1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \sigma > 1 \tag{2}$$

where σ is the elasticity of substitution between n different consumer services s. In order to allow some s_{im} to be zero, σ needs to be larger than one. This means that consumer's do not necessarily need to consume every service that is offered. σ is large when the services are close substitutes to each other. In other words, in situations where σ is large preferences for variety is not very significant and when σ is close to one variety in consumer service provision is important and the services can been seen as complementary to each other. Moreover, all services are symmetric, and hence, have identical cost- and production functions. This assumption makes it possible to simplify Equation (2). The sub-utility function for services can be redefined to read:

$$S_m = n_m^{\frac{\sigma}{\sigma-1}} s_{im} \tag{3}$$

From the simplified expression in Equation (3) it is obvious that S_m becomes small when σ is large (holding n_m and s_{im} constant). On the other hand, as σ approaches one, the power will be of substantial size. This shows that if complementarities are strong between services, the consumer's utility will be positively affected by high accessibility to a large variety of services.

In order to explore the properties of Equation (3) further, we may define M_m as the total amount of services used. Let $M_m = n_m s_{im}$ be the total amount of services used. We can then rewrite Equation (3) as:

$$(4) \qquad \frac{S_m}{M_m} = n_m^{\frac{1}{\sigma - 1}}$$

In Equation (4), S_m / M_m denotes the average utility per service. It is interesting that Equation (4) is an increasing function of n_m, which means that there exist increasing returns with respect to number and, hence, diversity of services. From this it follows that a regional market that can host a large number of services can be assumed to be more attractive for consumers than a regional market with fewer services.

The cost function is assumed to be the same for all firms in the consumer service industry. We assume a very common version of the cost function written as:

$$(5) \qquad TC_m = n_m \left(a s_m + F_m \right)$$

In Equation (5) TC_m is total costs for the production of all consumer services in municipality m, a is variable cost (equal to marginal cost) and F_m is fixed cost. As indicated by the cost function we assume scale economies in the production of services.

Now, we assume that consumers are not forced to purchase services produced in the own municipality only. Consumers are free to buy services from neighboring municipalities as well. However, we assume that the propensity to purchase services from other municipalities diminishes with distance from the own municipality but increases with the size of the attractor in surrounding municipalities. Thus, the probability that a consumer purchases a given service decreases with the time distance to the service provider. From the viewpoint of the producer of consumer-services the market can be viewed as a market-potential surface. The best location for a producer is where the market potential is highest. But, since the fixed costs have to be recovered a certain share of the market has to be secured. This prevents the possibility that all producers locate at the same spot. Since all firms have the same demand on market size it is the market-potential at each location that determines the number of firms that can be accommodated. This requires that at each location (municipality) all n producers of consumer services, aggregate total costs must be equal to the market-potential in that location. This condition can be written as Equation (6) below:

$$(6) \qquad \beta \widetilde{W}_m = TC_m$$

In Equation (6) β is the share of the consumers' budget spent on consumer services, for simplicity assumed to be equal across households, and $\widetilde{W}_m$ denotes the total income spent in municipality m, including the amount spent on goods and services by residents in other municipalities. Thus, we refer to $\widetilde{W}_m$ as the market size or market potential of municipality m. How do we define $\widetilde{W}_m$? The basic inception in the present paper is that the amount spent by consumers in municipality s on goods and services in municipality m is dependent on the attractiveness of municipality m relative to the attractiveness of other municipalities, including municipality s's own attractiveness. Specifically, the share of the income of residents in municipality s spent in municipality m, θ_{sm}, is defined as in Equation (7):

(7) $$\theta_{sm} = \frac{L_m w_m \exp\{-\lambda t_{sm}\}}{\sum_{k \in M} L_k w_k \exp\{-\lambda t_{sk}\}}$$

where the set {1,…,*M*} contains all the municipalities in the economy and $s, m, k \in M$. In Equation (7), the numerator is municipality *s*'s accessibility to income in municipality *m* and the denominator expresses municipality *s*'s total accessibility to income. L_s is the employment in municipality *s* and w_s is the average wage in that municipality. Hence, $L_s w_s$ is the total income in municipality *s*. t_{sm} is the time distance between municipality *s* and *m* and λ is a distance-decay (or distance-friction) parameter that determines the inhibiting effect of distance on consumers' propensity to purchase consumer services at a distance. As is seen in the Equation, attractiveness is defined as the accessibility to total income in municipality *m*. The rationale for using a municipality's total income as its attractor is that it can be regarded as a measure of the size of the municipal economy: the larger, the more goods and services available for consumers. At the same time, the longer the distance to the attractor, the lower the accessibility value.

The formulation in Equation (7) implies the existence of agglomeration-shadow (or Christaller) effects. As previously mentioned, a municipality that is large in terms of total income relative to proximate municipalities is likely to experience a net inflow of consumers in search for goods and services. However, due to the zero-sum situation, this municipality's gain must be generated at the expense of the other municipalities.

Naturally, θ_{sm} in Equation (7) has to sum to one:

(8) $$\sum_{m \in M} \theta_{sm} = 1$$

Equation (7) implies that the amount spent by consumers in municipality *s* on goods and services in municipality *m*, W_{sm} is:

(9) $$W_{sm} = \theta_{sm} L_s w_s$$

With regard to Equation (9), the total outflow of income from a municipality plus the income spent inside the borders of that municipality has to sum up to the total income of the municipality:

(10) $$\sum_{m \in M} W_{sm} = L_s w_s$$

From Equation (9), it is evident that the total income spent in municipality *m*, including the amount spent on goods and services by residents in other municipalities, $\widetilde{W}_m$, can be expressed as in Equation (11):

(11) $$\sum_{s \in M} \theta_{sm} L_s w_s = \sum_{s \in M} W_{sm} = \widetilde{W}_m$$

As a final step, we may observe that consistency requires that the total market potential (or market size) of all municipalities has to sum up to the total income of the municipalities' residents:

(12) $$\sum_{m\in M}\tilde{W}_m = \sum_{s\in M} L_s w_s$$

Having specified the definition of market potential, the next step is to observe that Equation (5) can be rewritten to read:

(13) $$s_m = \frac{1}{a}\left(\frac{TC_m}{n_m} - F_m\right)$$

Equation (6) is then substituted into (13) and the result is further substituted into (3) which yields:

(14) $$S_m = \frac{n_m^{\frac{\sigma}{\sigma-1}}}{a}\left(\frac{\beta\tilde{W}_m}{n_m} - F_m\right)$$

Equation (14) can be rewritten as:

(15) $$S_m = \frac{\beta\tilde{W}_m n_m^{\frac{1}{\sigma-1}}}{a} - \frac{F_m n_m^{\frac{\sigma}{\sigma-1}}}{a}$$

At this point it is possible to optimize the consumer utility of consumer services w.r.t the number, i.e. variety, of consumer services n_m, given the requirements on the market size that follows from the definition of the cost function of a typical firm. This leads to:

(16) $$\frac{\partial S_m}{\partial n_m} = \frac{n_m^{\frac{1}{\sigma-1}}}{(\sigma-1)a}\left(\beta\tilde{W}_m n_m^{-1} - \sigma F_m\right) = 0$$

Observe that since $\sigma > 1$ and $n_m, a > 0$, Equation (16) then implies that $\left(\beta\tilde{W}_m n^{-1} - \sigma F_m\right)$=0. Thus, we have that:

(17) $$n_m = \frac{\beta\tilde{W}_m}{\sigma F_m}$$

From Equation (17) we find that the optimum number of consumer services in a market is determined by the market accessibility, $\tilde{W}_m$, the budget share spent on services by consumers, β, the size of the fixed costs in the consumer service industry, F, and the elasticity of substitution between consumer services, σ. If we assume that β, σ, and F are equal across regions Equation (17) can be rewritten as:

(18) $$n_m = K\ \tilde{W}_m,\ \forall m$$

where $K = \beta/\sigma F$ and m denotes municipality m. Equation (18) says that the number of consumer services in a municipality is proportional to the total accessibility to income in that municipality and that this relationship holds for all municipalities. Recall that the definition of $\tilde{W}_m$ is such that it will be smaller the smaller the size of municipality *m* relative to proximate municipalities. Specifically, based on Equation (7), (11) and (18), the following conjectures can be drawn:

i. A municipality with a *small* market-size relative to surrounding municipalities will have a lower diversity than motivated by its internal market-size because of a net outflow of consumers.

ii. A municipality with a *large* market-size relative to surrounding municipalities will have a larger diversity than motivated by its internal market-size because of a net inflow of consumers.

These two conjectures provide the basis for the model specification and the distinction between different types of municipalities in the empirical part of the paper.

3. DIVERSITY AND MARKET SIZE – AN EMPIRICAL ASSESSMENT

3.1 Definition of market size

To empirically assess the relationship between market size and diversity each municipality's accessibility to population is calculated. Following Johansson *et al* (2002), the total market accessibility of each municipality is divided into three components, as shown in equation (19).

(19) $$A_{m,t}^{tot} = A_{m,t}^{im} + A_{m,t}^{ir} + A_{m,t}^{er}, \ \forall m,t$$

In the above equation, $A_{m,t}^{im}$ refers to intra municipal, $A_{m,t}^{ir}$ to intra regional and $A_{m,t}^{er}$ to extra regional market-accessibility for municipality *i* in time *t*. Intra regional accessibility refers to the market-accessibility to other municipalities within the functional economic region (FER) in which the municipality in question belongs to.

It should be stressed that the summation in Equation (19) is not the relevant measure of each municipality's market, because different municipalities compete for the same geographical pattern of consumers. The summation should be interpreted as the market potential in the absence of competition from other municipalities rather than the actual market. As stated in the previous section, there are strong theoretical arguments in favor of that the influence of the three components in Equation (19) is different for different types of municipalities. The different types of municipalities are given by the relative size of the three components.

Let $W=\{1,\ldots,n\}$ be a set containing all *n* municipalities in the economy and let *R* denote a functional economic region (FER) constituted by some of the municipalities in *W*, so that $R \subset W$. If then $R_{-m} = R \setminus \{m\}$ denotes the set of municipalities in region *R* excluding municipality *m* and $W_{-R} = W \setminus R$ denotes all municipalities in the economy, except those in *R*, we can formally express the three types of market-accessibilities as follows:

$$
\left.
\begin{array}{lll}
\text{i.} & \textit{Intra municipal} & \Rightarrow A_{m,t}^{im} = P_{m,t} e^{\{-\lambda_{im} t(t)_{mm}\}}, \\
\text{ii.} & \textit{Intra regional} & \Rightarrow A_{m,t}^{ir} = \sum_{R_{-m}} P_{k,t} e^{\{-\lambda_{ir} t(t)_{mk}\}}, \\
\text{iii.} & \textit{Extra regional} & \Rightarrow A_{m,t}^{er} = \sum_{W_{-R}} P_{k,t} e^{\{-\lambda_{er} t(t)_{mk}\}},
\end{array}
\right\} \quad \forall m, m \neq k, t
$$

In the formulas above, P is the population in a given municipality. t is the travel time by car between two municipalities and accordingly, λ is a time distance sensitivity parameter[3]. Three different values of λ are used, i.e. one for each component. λ_{im} (intra municipal) is set to 0.02, λ_{ir} (intra regional) to 0.1 and λ_{er} (extra regional) to 0.05. These are the values found by Johansson *et al* (2003), using Swedish commuting data for 1998. These values are applied since they represent the best available information. One can also argue that the nature of the budget constraint is the same for contacts with suppliers of retail and durables as it is for labor market commuting.

3.2 Classification of municipalities

As mentioned in the introduction, three different types of municipalities will be analyzed separately in the empirical part. Municipalities are distinguished from each other based on their intra municipal market accessibility relative to the other two market accessibilities. Hence, the commonality of the municipalities of the same type is their intra municipal market-accessibility relative to their intra-regional and extra-regional market accessibility. Specifically, we follow Johansson (1997) and differentiate between the following three types of municipalities:

i. Central municipalities in FERs $\Rightarrow$ Type I

ii. Other municipalities in large FERs $\Rightarrow$ Type II

iii. Other municipalities in other FERs $\Rightarrow$ Type III

The motivation for distinguishing between these types of municipalities is that previous research has shown that there are substantial differences between them in terms of economic performance and economic structure, (c.f. Johansson, 1997). To illustrate these differences Figure 3.2, presents the population development in the three types of municipalities Sweden 1993-2001.

[3] The time distance within a municipality is the average travel time by car between zones within the municipality.

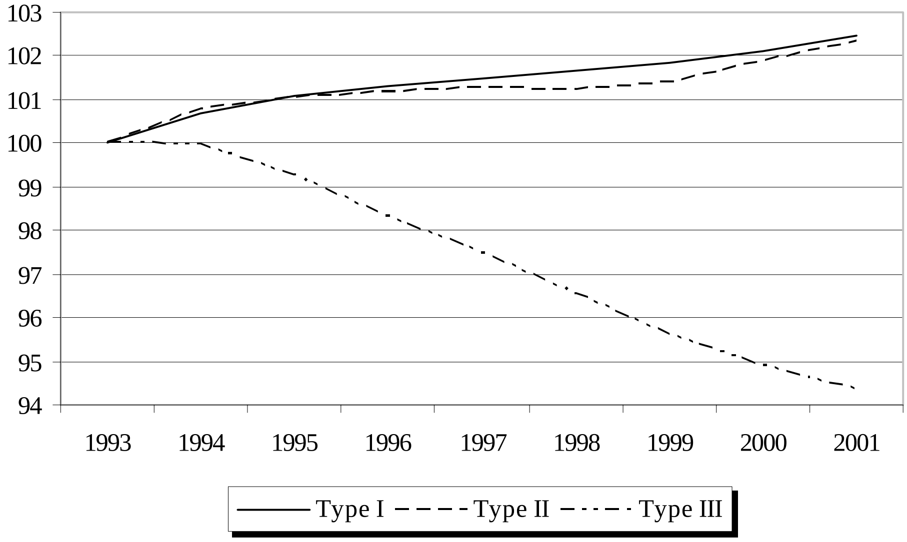

Figure 3.2. *Population development 1993-2001 in the three types of municipalities in Sweden, (index; 1990=100).*

How can the pattern in Figure 3.2 be explained? Type I municipalities constitute the central marketplace in a FER. This is the main property that makes these municipalities attractive. Type II municipalities, i.e. other municipalities in large FERs, are attractive as settlements precisely because of their proximity to such a large central marketplace, i.e. the Type I municipality. The negative development of Type III municipalities can be explained by the lack of a large central marketplace in the region.

Since the different types of municipalities differ in terms of the relation between their three types of market accessibilities, it can be expected that they react differently to them. To illustrate such differences and provide the reader with a feel for the data, Table 3.1 presents the mean and median of absolute and relative values of the three types of market-accessibilities for the three types of municipalities 1993-2001.

Table 3.1. Mean and median of absolute and relative values of the three types of market-sizes for the three types of municipalities 1993-2001.

	Type I (*n*=729)		**Type II** (*n*=1224)		**Type III** (*n*=621)	
Variable	*Mean*	*median*	*Mean*	*median*	*mean*	*median*
A^{im}	44 307	21 192	19 738	13 596	8 557	7 929
A^{ir}	10 098	2 023	60 659	18 446	7 902	4 077
A^{er}	39 697	25 678	48 701	41 946	42 089	34 467
$\omega^{ir/im}$	0.30	0.06	2.70	1.80	0.86	0.52
$\omega^{er/im}$	1.72	1.27	3.98	2.93	5.06	3.68
$\omega^{ir/er}$	0.29	0.04	1.75	0.46	0.50	0.13

*) *Note*: $\omega^{ir/im}$ = intra regional relative to intra municipal; $\omega^{er/im}$ = extra regional relative to intra-municipal; $\omega^{ir/er}$ = intra regional relative to extra-regional.

Table 3.1 reveals that Type I municipalities are large in absolute terms as well as relative to the other municipalities in the same FER while Type II are smaller in both absolute and relative terms. For the latter municipalities, their intra-municipal market accessibility is smaller than their intra-regional one. Type III municipalities have the smallest intra-municipal market accessibility, but the surrounding municipalities in the FER are also small. It is also evident that the distribution of market accessibilities within each type of municipalities is skewed to the right. This can be seen from the difference between the mean and the median.

3.3 Measurement of diversity

The measure of diversity used in the paper is the standard mathematical concept of entropy. The entropy method measures the diversity of a region (or municipality) with respect to the distribution of establishments across the industries in the region (or municipality). The more even distribution, the higher the diversity. When measuring the diversity with this method in a specific sector *x*, which consists of a number of industries *j*, the diversity in this sector *x* in municipality *m*, div_m^x, is expressed as in Equation (20):

$$div_m^x = f_n\left(\delta_{m1}^x, \delta_{m2}^x, ..., \delta_{mn}^x\right) = -\sum_{j=1}^{n} \delta_{mj}^x \log \delta_{mj}^x$$

(20) $$0 \leq \delta_{mj}^x \leq 1 \qquad \sum_{j=1}^{n} \delta_{mj}^x = 1$$

where δ_{mj}^x represents industry *j*'s share of the total number of establishments in sector *x* in municipality *m.* In Equation (20), *n* is the total amount of industries in sector *m*. The formulation in Equation (20) is the standard mathematical formula for the entropy. The measure has the following basic properties, (c.f. Tsaganea, 2002; Attaran & Zwick, 1989):

1) It is non-negative:

$$f_n\left(\delta_{m1}^x, \delta_{m2}^x, ..., \delta_{mn}^x\right) \geq 0$$

2) If all the establishments in a sector are concentrated to one industry, the entropy is 0 indicating zero diversity:

$$\delta_{mj}^x = 1,\ \ \delta_{ms}^x = 0,\ \ (s \neq j),\ \ s = 1,...,n \quad \Rightarrow \quad f_n\left(\delta_{m1}^x, \delta_{m2}^x, ..., \delta_{mn}^x\right) = 0$$

3) The entropy, i.e. the diversity, is maximized when the total number of establishments in a sector is equally distributed across the industries in the sector:

$$\delta_{mj}^x = \delta_{ms}^x,\ \forall j, s = 1,...,n \quad \Rightarrow \quad f_n\left(\delta_{m1}^x, \delta_{m2}^x, ..., \delta_{mn}^x\right) = \max$$

4) The entropy is the same if an industry with zero establishments is added to the total set of industries in a sector:

$$f_{n+1}\left(\delta_{m1}^{x}, \delta_{m2}^{x}, ..., \delta_{mn}^{x}, 0\right) = f_{n}\left(\delta_{m1}^{x}, \delta_{m2}^{x}, ..., \delta_{mn}^{x}\right)$$

Property 4) implies that the maximum value of entropy differs between municipalities with a different amount of industries within a sector. Naturally, the maximum value of the diversity in a municipality is increasing in the number of industries the municipality hosts in the sector.

One advantage of this measure, compared to e.g. comparisons of a national average, is that the uniform distribution is a comparative norm that is fixed, (Attaran & Zwick, 1989). Hence, the norm does not change over time, which is an advantage when analyzing the diversity over a time period.

3.4 Estimation Procedure and Results

The empirical analysis is devoted to diversity in retail and durables. Retail and durables are typical sectors for which a transaction is associated with that the consumer travels to the supplier.

The hypotheses of the relationship between market-size and diversity in the three different types of municipalities are tested by means of a panel data approach on Swedish municipalities over the period 1993-2001. The equation to be estimated for the three types of municipalities takes the following form:

$$\begin{aligned} div_{m,t}^{x} &= \beta A_{m,t}^{im} + \theta A_{m,t}^{ir} + \gamma A_{m,t}^{er} + \delta I_{m,t}^{imir} + \ldots \\ &\ldots + \phi I_{m,t}^{imer} + \xi I_{m,t}^{irer} + \sum_{t=1}^{T} \lambda_t D_t + \varepsilon_{i,t} \end{aligned} \tag{21}$$

where m denotes municipality and t denotes time. The parameters in the model are estimated for each type of municipalities respectively. The variables in Equation (21) are defined and explained in Table 3.2.

Table 3.2. Description of the variables in Equation (21).

Variable	*Parameter*	*Definition*
$div_{m,t}^{x}$	-	Diversity (entropy) in sectoral aggregate *x* in municipality *m* in year *t*
$A_{m,t}^{im}$	β	Intra-municipal accessibility to population for municipality *m* year *t*
$A_{m,t}^{ir}$	θ	Intra-regional accessibility to population for municipality *m* year *t*
$A_{m,t}^{er}$	γ	Extra-regional accessibility to population for municipality *m* year *t*
$I_{m,t}^{imir}$	δ	Intra-municipal times intra-regional accessibility for municipality *m* year *t*
$I_{m,t}^{imer}$	ϕ	Intra-municipal times extra-regional accessibility for municipality *m* year *t*
$I_{m,t}^{irer}$	ξ	Intra-regional times extra-regional accessibility for municipality *m* year *t*
D_t	λ_t	Time-specific dummy variable (=1 if year *t*, 0 otherwise)

In addition to the three market accessibilities, three interaction variables are included in the model. These are used to control for synergy-effects that may arise with respect to the three types of market accessibilities. Moreover, the model includes time-specific dummies to control for unobservable time-effects, (Baltagi, 2003)[4].

Table 3.3 presents the result from the estimation of Equation (21) with respect to retail diversity in the three types of municipalities. The coefficient estimates are based on a least-squares-dummy-variable (LSDV) estimation (fixed effects). The results in the table suggest that all the three types of municipalities benefit from having a high accessibility to the own municipal market. That is, there is a positive relationship between the size of the own market and diversity in retail. However, the accessibility to the regional market affects the retail diversity in the different municipalities differently.

[4] Individual-specific effects are not included due to that the municipalities are divided according to common characteristics and estimated separately. Moreover, the inclusion of such effects implies the loss of a substantial amount of degrees of freedom.

Table 3.3. *Estimation results of Equation (20) for the diversity in retail for the three types of municipalities 1993-2001, LSDV[a].*

	Type I	*Type II*	*Type III*
$A^{im}_{m,t}$	0.84E-05* *20.84*	0.23E-04* *18.26*	0.90E-04* *21.34*
$A^{ir}_{m,t}$	0.74E-05* *4.13*	-0.13E-05* *-4.07*	n.s
$A^{er}_{m,t}$	0.77E-05* *19.75*	0.28E-05* *7.42*	0.45E-05* *6.39*
$I^{imir}_{m,t}$	-0.34E-10* *-15.80*	-0.23E-10* *-4.70*	n.s
$I^{imer}_{m,t}$	-0.74E-10* *-15.72*	-0.13E-09* *-8.35*	-0.51E-09* *-7.48*
$I^{irer}_{m,t}$	-0.11E-09* *3.66*	0.38E-10* *6.61*	-0.75E-10* *-1.97*
N	729	1224	621
R^2	0.59	0.45	0.63

a) Least Squares Dummy Variables estimation (fixed effects).
b) *- denotes significance at the 0.05 level.
c) n.s = not significant
d) Dependent variable = diversity in retail.

For Type I municipalities, the coefficient estimate for the accessibility to the regional market is positive and significant. The positive sign is in accordance with the conjectures in Section 2 and 3. These municipalities' internal market is large relative to the regional market (see Table 3.1), and the surroundings have a positive effect on the retail diversity. On the other hand, the coefficient estimate of the accessibility to the regional market for Type II municipalities is significant and negative. This suggests that these municipalities experience an agglomeration-shadow or Christaller-effect. Since Type II municipalities have a small own internal market relative to the regional market, the interpretation is that the accessibility to the regional market implies an outflow of consumers who capitalize on the greater supply in the other municipalities in the region. Moreover, the accessibility to the regional market has no effect on retail diversity in Type III municipalities. This is most likely due to that the regional market is small. The coefficient estimate for the extra-regional market is positive and significant for all three types of municipalities. Except for Type III municipalities, all the interaction variables are significant. $I^{imir}_{m,t}$ is negate and significant for Type I and Type II municipalities, which suggests a general competition-effect between the markets, i.e. the effect of an increase of the accessibility to the municipal market is reduced if the regional and extra-regional markets are large. The same holds for all three types of municipalities as regards $I_{m,t}^{imer}$. Turning to the results for durables, Table 3.4 presents the result from the estimation of Equation (21) for the diversity in retail for the three types of municipalities. As in Table 3.3, the coefficient estimates are based on a LSDV model.

Table 3.4. *Estimation results of Equation (20) for the diversity in durables for the three types of municipalities 1993-2001, LSDV[a].*

	Type I	***Type II***	***Type III***
$A_{m,t}^{im}$	0.64E-05* *14.20*	0.22E-04* *12.07*	0.82E-04* *13.43*
$A_{m,t}^{ir}$	n.s	-0.15E-05* *-3.16*	n.s
$A_{m,t}^{er}$	0.39E-05* *8.91*	0.14E-06* *2.54*	n.s
$I_{m,t}^{imir}$	-0.25E-10* *-10.54*	-0.21E-10* *-3.04*	n.s
$I_{m,t}^{imer}$	-0.43E-10* *-8.15*	-0.13E-09* *-5.87*	n.s
$I_{m,t}^{irer}$	n.s	0.40E-10* *4.79*	n.s
N	729	1224	621
R^2	0.35	0.23	0.42

a) Least Squares Dummy Variables estimation (fixed effects).
b) *- denotes significance at the 0.05 level.
c) n.s = not significant
d) Dependent variable = diversity in durables.

As was found for retail diversity, all the three types of municipalities benefit from high accessibility to the own municipal market. The larger the municipal market, the greater the diversity in durables. As can be seen from the table, the intra-municipal market is the only significant market for Type III municipalities. For durables, the intra-regional market has no impact on diversity in durables for Type III municipalities. However, the impact remains negative for Type II municipalities. Moreover, as before, $I_{m,t}^{imir}$ and $I_{m,t}^{imer}$ are significant and negative for Type I and Type II municipalities. All the interaction variables are insignificant for the Type II municipalities. The differences between retail and durables can partly be explained by that durable goods (such as white goods) are generally associated with more extensive search (on behalf of the consumers). An average durable good (e.g. refrigerators) are generally more costly than an average retail good (e.g. clothing) and purchased less frequently.

In summary, the results in Table 3.3 and 3.4 verify that the effect of accessibility to the regional and the extra-regional market for diversity in retail and durables is different for different types of municipalities. Specifically, these differences are most distinct for retail diversity. Municipalities with a large regional market relative to the municipal market, Type II municipalities, tend to be less diversified in retail the higher the accessibility to the regional market. At the same time, municipalities whose internal market is large relative to the surroundings, Type I municipalities, tend be more diversified in retail the higher the accessibility to the regional market. The latter municipalities constitute the main marketplace in each functional economic region. Because of this, they have a superior ability to compete with the rest of the municipalities in the regions.

4 CONCLUSIONS

This paper has added to the understanding of how a municipality's position in a system of municipalities affects its diversity in retail and durables. In order to achieve this, municipalities were grouped into three categories according to their accessibility to the intra-municipal market relative to their accessibility to the intra-regional market. The diversity in retail and durables, measured by means of entropy, were then modeled as a function of (i) the municipal market, (ii) the intra-regional market and (iii) the extra-regional market.

The main findings can be summarized as follows:

- The diversity in both retail and durables is positively affected by the accessibility to the intra-municipal market. This holds for all types of municipalities.

- The retail diversity in the central municipality in a region tends to be higher the higher accessibility to surrounding municipalities.

- Retail diversity is negatively affected by high accessibility to the regional market in municipalities who have a small internal market relative to the regional market. This holds for both retail and durables

Since the analysis shows that the relationships between diversity and the three types of markets differ between the different types of municipalities, it implies that the classification used in the paper is warranted.

The results of the paper indicate that improvements in intra-regional infrastructure can have significant effects on the location pattern of retail and durables firms. In particular, the results suggests that improvements of the physical intra-regional infrastructure (such as better road networks) - that increases the accessibility between the central municipality (Type I) and the surrounding municipalities within the region (Type II) - can affect the retail diversity in surrounding municipalities negatively while at the same time affecting the diversity in the central municipality positively. If consumers have a preference for variety, such a development pattern can make the surrounding municipalities more attractive as settlements despite a less diverse supply within the municipality, because of higher accessibility to the central marketplace in the region. These kinds of effects are important to consider by policy makers and regional planners.

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