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Retail Productivity in Space

Capturing productivity returns to market potential in the Swedish retail sector

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Abstract

This paper addresses the relationship between productivity in the retail sector and market size. In the paper, the systematic variations between central and non-central retail markets, as well as the systematic variations across different types of retailing activities are investigated. The empirical design utilizes individual level data, where the earnings of individuals working in the retail sector is used as a proxy for productivity. In order to capture urban-periphery interaction in retail markets, a special market potential measure is also utilized which allows for capturing the impact from potential demand in close proximity, in the region and outside the region separately. In the analysis, several characteristics of the retail markets that are accounted for. The main characteristics are 'place in regional hierarchy', 'regional attractiveness', 'labor market characteristics', and 'individual characteristics'. The types of retailing activities in question are food retailing, clothing, household retailing and specialized retailers. The results are in line with the previous theoretical arguments. There is a distinct variation between urban and peripheral retail markets, as well as between different types of retailing activities.

Keywords: retail productivity, market accessibility, urban-periphery

JEL codes: L81, J24, R11

Introduction

This paper poses two complementing but distinct research questions regarding the relationship between market scale and productivity in the retail sector and intends to answer both of them within a single empirical framework. Although retailing constitutes a very significant share of the overall economic activity in advanced nations, there is limited research on the sector as a whole where the entire market is taken into account. Specifically, research on retail productivity is mostly limited to case studies, neglecting the overall spatial conditions. When we look at the larger picture, what we know about the retail sector is that the direction of demand that flow to a spatially limited market plays an important role for the presence of retail clusters and that direction is highly related to a market's place in the regional hierarchy. This implies that it is not only the scale of the market that is important for retail demand, but also what the place of the respective market is in the hierarchical order in the system of regional markets. Based on theory, research relies on the assumption that the demand flows from peripheral (non-central) markets towards the central market in the same region, but usually not the other way around. While taking the absolute market size into account, empirical studies often neglect this type of urban-periphery interaction and its possible impacts. Thus, the first question this research addresses is; "Are there systematic variations between central and non-central markets when we examine the relation between market scale and productivity in the retail sector?" This paper use the finest level of aggregation in the economy, individual earnings, to address this question. In order to answer the question, the empirical analysis aims to identify determinants of productivity in four aggregate categories based on their attributes. These determinants are place in regional hierarchy, regional attractiveness, labor market characteristics, and individual characteristics. In the empirical design, the goal is to isolate the various determinants of productivity to capture the actual impact from the size of the market.

The second research question extends the conversation on the market scale-productivity relationship for different types of retailing activities. The aim here is to capture the variation of the impact from the determinants associated to a market's place in regional hierarchy on the productivity of different types of retailing activities. The location patterns of stores that are engaged in different kinds of retailing activities vary significantly depending on the type of service or good they provide. Previous literature points out that depending on the type of retailing activity in question, dependence on proximity to demand and the scale of demand varies significantly (Dicken and Lloyd, 1990). People's willingness to travel further distances to patronize a retail market is not the same for all kinds of goods and services they purchase. Although this kind of variation is acknowledged and discussed in depth in the previous literature,

empirical applications are limited, and its relation to productivity is understudied. Hence, the second question addressed in this paper is; "Regarding the relationship between market scale and productivity, can we capture a systematic variation between different kinds of retailing activities?"

Economic actors, firms or individuals, are found to be more productive in dense and agglomerated places. The proposition that density is positively associated with the productivity of individuals, and the entities in which individuals create economic value together with other forms of production factors, is not a recent one. Over two centuries ago, Adam Smith (1776) already points out the relative importance of internal scale for productivity, whereas a century ago Marshall (1890) deliberately discusses the positive externalities that are the result from the external scale of the market. However, when we look at the literature that deals with the quantification of the impact from the market scale on productivity levels, we see a rapid development only over the past few decades. Puga (2010) elegantly classifies this new trend for empirical research in the urban economics literature dealing with market scale-productivity relation under three main bullet points. The first stream of literature is focusing on a commonality, showing that highly productive activities are much more 'clustered' in space. The second stream of empirical literature in Puga's classification investigates the 'pattern' in densityproductivity relation by looking at wage levels and/or land rents. Finally the third approach is mainly focused on the 'systematic variations' in productivity across space (Puga, 2010). In broad strokes, this empirical paper positions itself within a framework where the systematic variation of productivity across space with respect to market scale is captured where individual wages are treated as a fine proxy for the productivity levels in the market. Its contribution, however, is that it specifically deals with an economic activity that is heavily bounded by the proximity to the market and a sufficient size of demand: Retailing.

What makes the retail sector especially suitable for this framework is the strong influence of market size and proximity to it on the entire sector, because the consumption of retail goods either occurs where the retail service is provided or in very close proximity. Any reallocation of individuals and households between regions would therefore be expected to influence retail geography. A large body of literature utilizing traditional location theories discusses location pattern of retail stores. Classics like Reilly's (1929) "law of retail gravitation" introduced the idea that the demand flow between retail markets can be explained by their size and the distance between them. Following this gravitational approach, various researchers aimed to determine retail market boundaries (Converse, 1949; Huff, 1964). The flow of demand between market places has been in the core of literature that deals with the hierarchical system of places. Research

on retail location points out the regional hierarchy between retail markets where the demand for services attenuates as we move from core to periphery based on the 'Central Place Theory' framework of Christaller (1933) and Lösch (1940) (Berry, 1967; Berry and Garrison, 1958a; 1958b; Applebaum, 1974). As a complementing approach, 'Bid Rent Theory' argues that the central markets are allocated to the activities that can pay the highest rent (*Haig, 1927; Scott, 1970; Johnston, 1973*). According to the theory, different kinds of retailing activities should be distributed across space with respect to the required intensity of interaction between buyers and sellers (Kivell and Shaw, 1980).

The relation between density and productivity is not a recent subject of study. Numerous scholars have addressed the causes of agglomeration economies and return to the agglomerative forces. In a nutshell, agglomerative forces are found to provide more efficient facility and supplier sharing, greater individual specialization, bigger labor pool, hence, better labor matching opportunities, which all together yield to more productive processes. Besides these well-known advantages, retail has various distinct aspects that can benefit from the market scale in addition. One argument raised in this paper is that individuals working in the sector have greater incentive to increase their performance in order to enjoy sale-based bonuses, which then are not equally common in every type of retailing activity. Another argument is that two individuals with similar job definitions in the same type of retailing activity would still be engaged in different sets of tasks in the markets of different scale. This argument is based on the empirical evidence (also provided in this paper) showing that the relationship between population size in a city and establishment size in terms of employees is not a linear one. This may imply a tendency to be more productive in denser market places given retailers and their employees engage in more complex and intensive tasks. Stores located in larger markets should also have the cost advantage to provide additional services and in-store elements, which can be reflected in the price levels.

Besides being one of the very few empirical attempts to identify the market scale-productivity relationship for retail, this paper contributes to the existing literature by capturing this relationship within a framework where place in regional hierarchy is also taken into account. Rather than bundling all different kinds of retailing activities with heterogeneous features, it decomposes the sector based on the variation in spatial pattern of different types of retailing activities. The empirical analysis utilizes individual level data from Sweden for the years between 2002 and 2008. The country is a very homogenous market as a whole in terms of individual earnings, as well as in the way regions function compared to the rest of the world. Almost all of the regions in Sweden are monocentric with one central market surrounded by several peripheral

markets. Being a heavily unionized economy as a whole, all retail workers also belong to the same union, impact of which is the same in different regions likewise. Together with the unique qualities of the data, and the country in question, the paper provides a rather robust analysis for a very important question.

Findings from the empirical analysis are in line with the theory, where there is a significant and systematic variation across different types of retailing activities, as well as across central and noncentral retail markets in the relationship between market scale and productivity levels. Impact from the potential demand in the immediate market on the level of productivity is found to be important for stores selling goods for frequent purchase, whereas this kind of dependence is not evident for stores selling mostly household goods (e.g. furniture, electronic goods, etc.). Competition effect driven from higher accessibility to the markets in the same region is evident in non-central retail markets for most of the retailing categories in question.

This paper proceeds with discussions on the fundamental components of the theoretical framework, where retail location, returns to market scale and its relevance for retail productivity, and the way market scale is measured are explained in detail under separate headings. Later, a section on the empirical design is presented, under which information on data, variables, methodology, as well as the results from the empirical analyses are available.

Theoretical Framework

Retail location

Retailers specialize in providing services that consumers and producers find useful; such as a range of goods, convenience shopping, customer service, packing and credit facilities (Johnston et al., 2000). One particular characteristic of retailing as an economic activity is its strong sensitivity to location. Due to the nature of economic activities carried out in retail establishments, it is very likely to find these establishments in (or close to) the center of the city regions. One concrete explanation to this commonality is that the transactions in the sector often require face-to-face interactions between buyers and sellers. Although we have observed a significant increase in online shopping over the past decade, retail sector across the world is still dominated by offline stores.

The spatial aspects of retail can be categorized under several lines of theories. Undoubtedly, the first and perhaps the most fundamental one is the central place theory of Christaller (1933). The

main idea behind the central place theory in a retail context is that the distance is a factor that determines the demand for any good in relation with the transportation costs. Following the central place theory of Christaller (1933), many scholars have discussed how demand for almost every good in the retail market declines as the distance to the retail establishments increases (Dawson, 1980). In line with Christaller's 'Central Place Theory', Hotelling (1929) introduced retail agglomeration economies by proposing 'the principle of minimum differentiation'. The theory indicates that the firms selling alike products tend to cluster in the center of a given market to benefit from the scale of that market (Hotelling, 1929). Artle (1959) investigated six retail activities for the Stockholm metropolitan region highlighting the importance of proximity between the suppliers and purchasers. Although clustering in retail is a common phenomenon, it is worth noting that significant differences in the degrees of these retail clusters are observed with respect to the type of the specific retailing activity (Kivell and Shaw, 1980). High order retail activities are known to have the tendency to cluster more than the low order retail activities¹. (Dicken and Llyod, 1990)

Although central place theory suggests that distance is the fundamental factor behind the demand for retail markets, today it is easy to see many consumers travelling further distances to patronize retail markets other than the ones that are located nearby regardless of the similarities in market scale. Despite the highly distance dominant propositions of the central place theory, 'spatial interaction theory' suggests that the attractiveness and the surrounding environment of the retail location might outweigh proximity in some cases (Haynes and Fotheringham, 1984; Fotheringam and O'Kelly 1989; Reilly, 1929, 1931). Suggesting overlapping trade areas rather than a single point, Luce (1959) proposes that the decision of a consumer among various competing shopping destinations is not only dependent on the size but also dependent on the relative utility. Hence capturing a precise impact of market scale on productivity requires isolation of the impact from attractiveness of the location in question. The idea is that the attractive attributes of a region creates a competitive power. This kind of impact is also taken into consideration in the empirical application of this paper.

Another retail location theory emerges around Haig's 'bid rent theory' (1927). It argues that the land is occupied by activities that can pay the highest rent value and therefore the land is in its "highest and best" use (Fujita, 1988; Jones et al, 1991). In line with these presumptions, many scholars have investigated why the city center is allocated to certain economic activities like

¹ Low order retail goods are purchased less frequently than high order retail. Food retailers are a good example for high order retailing, whereas a furniture store would fall under the low order retailing.

retailing. Alonso (1960, 1964) points out the stratification of a city between retail and other industrial activities.

Returns to market scale and retail productivity

The causes of agglomeration economies and possible returns to density have been investigated by previous research under various headings. There are three main categories for the mechanism behind the agglomeration economies, as offered by Duranton and Puga (2004), being *sharing, matching* and *learning*. A more efficient sharing of infrastructure (Scotchmer, 2002), a larger pool of labor (Marshall, 1890; Ellison et al., 2010), intermediaries and input suppliers (Abdel-Rahman and Fujita, 1990; Rosenthal and Strange, 2001) are found to be the advantages, as well as causes of agglomeration economies. Another aspect discussed in the literature is better *matching* between employers and employees, businesses, as well as between buyers and suppliers (Helsley and Strange, 1990; Coles and Smith, 1998; Costa and Kahn, 2000). A more recent aspect of agglomeration as discussed in the literature is the greater *learning* possibilities in cities. It is argued that cities facilitate knowledge spillovers (Glaeser, 1999; Rosenthal and Strange, 2003; Glaeser and Maré, 2001; Duranton and Puga, 2001), and the diverse nature of cities allow for higher level of creativity and productive interaction between individuals (Jacobs, 1969).

How does the location of retailer come into play when examining productivity for this particular sector? Previous research for many years put a great emphasis on the importance of location decision for retailers as it allows an individual store to capture greater demand in agglomerated market places. Sales related measures have been a popular way to look at performance as they are considered to be the output measures for a retailer, which naturally have the tendency to be higher in bigger markets. Output-to-input ratios and their relevance for retail productivity attracted the attention of researchers (Bucklin, 1980, 1981; Lusch and Ingene, 1979; Ingene, 1982). The traditional approach to rely on output levels as a productivity measure is particularly problematic for retailing activities, given that the sector's response to the changing market circumstances may be very rapid. For example an increase in demand in the market may not necessarily lead a retailer to become more productive. Its competence to meet the higher levels of demand by increasing output may be irrespective of its increasing operational efficiency. Hiring more labor, and accommodating more inventories may allow a retailer to meet higher demand without implying any improvement on the cost side. Another problem with relying on an input-output related measure for retail is that for retailers both 'input' and 'output' have a different

connotation. In the case of manufacturing, for example, what comes into the production process as an input, and what goes out in the end can be identified, thus, quantified in a very straightforward way. However, for retailing, although the goods provided by the shops seem similar to how they are after production in a factory, retailers always alter those products into different commodities with the additional 'service' elements they provide. A piece of furniture sold in a store is not the same commodity as it is produced in a factory anymore, neither is a box of strawberries sold in a supermarket the same product as it is in the wholesalers cold storage depot. Depending on the attributes of a store (e.g. customer services, location, and even its atmosphere), pricing of the item may change (Achabal et al, 1984). Also depending on the type of retailing in question, possibilities to embed services to create additional economic value may be limited. This makes using input-output related productivity measures even more problematic for comparison across different kinds of retailing activities.

The aforementioned attributes of retailers that add additional value to a product can be captured by looking at individual earnings, which is also very useful for a comparison across activities of different kind in the sector. Wage being a function of marginal product of labor times price, no employer would be expected to pay more than an employee's economic value creation. Location of a retailer should then have an impact on both the price levels and the scale aspects of production, which may allow higher MPL. Not for every type of retailing, but for some, commodities are sold in different prices in different markets depending on the measures of purchasing power in the market, as well as the scale of demand. Meeting the higher rent costs in bigger cities is one of the motivations for retailers to charge more for what they provide. Also, higher potential demand can allow a retailer to offer customer services with high fixed costs, which would otherwise be too costly to cover in a smaller market. Even when we assume the prices of the products to be constant across space, the number of transactions per employee in a store is likely to be higher in a denser market. The complexity of the tasks, then, may require retailers to seek for higher competence in their employees, which then may be reflected in the wage levels. In addition to this reasoning, for some of the retailing activities, sale bonus is also a common phenomenon, which then also is directly linked to the available market demand for a retailer. From a multi-purpose shopping trip perspective, having a larger and more accessible market with greater variety should also imply greater demand for a retailer, market for the respective retailer being an attractive one for the customers to patronize (Johnston and Rimmer, 1967; Craig, Ghosh and McLafferty, 1984). In markets where we observe higher degrees of colocation between different kinds of retailers, hence, we would see a greater inflow of demand.

This paper doesn't differentiate between the impact from traditional agglomerative forces arising from the scale of the market and those that are exclusive to the retail sector. The variables of interests are the market accessibility measures for different kinds of retailing activities, impact of which can be various once decomposed. By the introduction of other sets of variables, analysis aims to control for the possible determinants of productivity in space other than accessible market size. However, even then, this paper acknowledges that what is contained in the relation between the size of accessible market and productivity can be various. Analysis tries to capture the systematic variation in this relationship rather than identifying the exact sources of the return. A significant share of this impact from market scale may or may not be driven by the traditional aspects of agglomeration. As it tries to capture the urban-periphery interaction, it examines not only certain attributes of a retail market separately but in relation to its rank in the regional hierarchy. Hence, the agglomeration effects should work for the entire region because the region is the Local Labor Market. On the other hand, the affects from the scale of market demand should be different for different markets in the same region, depending on their places in the regional hierarchy.

Market accessibility & place in regional hierarchy

The use of accessible market potential in this paper constitutes the foundation for its contribution. The way empirical design of this paper deals with the relation between market scale and productivity also allows one to observe the interaction between urban and peripheral markets for retail. Many regions consist of one or several central market places surrounded by smaller peripheral markets. Central markets are expected to play a more influential role in the supply of consumer services, as well as many other economic activities that require intensive interaction between economic actors, while the individuals from peripheral markets can be expected to commute to the core in order to consume what is available in the center. This paper uses a central vs. non-central municipality division for Swedish regions. This division is not only relevant for the way empirical analysis is conducted, but also relevant for the way the variables of interest, accessible market potential measures are constructed.

The basis of central and non-central municipalities in a Swedish context is based on integrated labor markets. Municipalities that have intensive commuting in between constitute a functional region, which also corresponds to a local labor market. There are 81 local labor markets in Sweden with one central municipality in the core of each. This means that economic activity within a region is much more intensive than it is across regions (Johansson, 1997). This is one of the advantages of using Swedish data for the respective research questions. Thanks to the monocentric nature of the Swedish regions, we do not only capture the variation in productivity with respect to accessible market size, but also observe how this relation differs in central and noncentral (peripheral) market places. As discussed previously, this kind of urban-periphery relation is particularly important for retailing, where the importance of proximity to the central market differs based on the type of retailing activity in question.

Market potential is a measure for the magnitude of economic concentration and network opportunities within and between regions (Lakshmanan and Hansen, 1965). Johansson and Klaesson (2007) shed some light on the ways to distinguish between internal and external market potentials of functional regions, given that different type of goods and services have different levels of interaction-intensity, meaning interaction between buyers and sellers. Karlsson and Johansson (2001) also mention that these interaction-sensitive goods and services have distancesensitive transaction costs that rise sharply when these transactions take place between regions rather than within.

The study employs each Swedish municipality's accessibility to wage sums as a proxy for the total demand in a market. Calculations are done based on the earlier work of Johansson, Klaesson, and Olsson (2002), which is further developed in Johansson and Kleasson's paper (2011) where they investigate the agglomeration dynamics of business services. Total market accessibility of each municipality is divided into three parts as shown below;

$$A_{m,t}^{tot} = A_{m,t}^{im} + A_{m,t}^{ir} + A_{m,t}^{er} , \forall m, t$$
(1)

In equation-1, $A_{m,t}^{im}$ denotes intra-municipal market access, $A_{m,t}^{ir}$ to intra-regional and $A_{m,t}^{er}$ to extra regional market accessibility for municipality *i* at a point in time, *t*. What is meant by intra-regional in this context is the accessibility from one to the other municipalities within the same functional economic region (FER).

The summation in the equation is not considered to be the relevant measure for an individual municipal market. It gives us the *total* market potential. This reflects the fact that different municipalities compete for consumers within the same geographic footprint. It is argued that the influence of the three components in the given equation differs for different municipalities. The relative size of these components is used to provide different types of municipalities. Assuming $W=\{1,...,n\}$ to be the set containing all municipalities in an economy and R denoting a functional economic region (FER) employing several municipalities (W) within, we can say that

 $R \subset W$. Then $R_{-m} = R \setminus \{m\}$ denotes the municipalities in region R excluding the given municipality *m*. Finally $W_{-R} = W \setminus R$ denotes all municipalities in that economy excluding the ones in R.

Intra-municipal:
$$A_{m,t}^{im} = P_{m,t} e^{\{-\lambda_{im}t(t)_{mm}\}},$$
Intra-regional: $A_{m,t}^{ir} = \sum_{R-m} P_{k,t} e^{\{-\lambda_{im}t(t)_{mk}\}},$ Extra-regional: $A_{m,t}^{er} = \sum_{W-R} P_{k,t} e^{\{-\lambda_{er}t(t)_{mk}\}},$ k, t

P in the formula stands for the wage sums in a given municipality. Travelling time by car between two given municipalities is represented by *t*, and as a time distance decay parameter, λ is used. For each component of the equation, there exists a different λ value². The values are calculated by Johansson et al. (2002) by using Swedish commuting data for 1998.

Accounting for the distance decay is an efficient way to control for spatial dependencies, as well as a superior way to capture the actual scale impact. Figure below represents the three components of measure of market potential, where r is a municipality located in a region, that is then contained in the greater Swedish market. Let's assume that we were using only absolute values for wage sums (or population) of municipalities to construct a market scale measure. In our hypothetical case, let's assume the population of a municipality to be 10, hosting region's population to be 100, and the consumer population of the entire Swedish market to be 500. The municipal market potential then would be 10 for the respective municipality. Discounting this value from the respective region's population we would obtain a value for the regional market potential, we would end up with a value of 400. In this hypothetical case, addition of the three measures would always lead to the same value for the total market potential for every municipality in the economy. Using the time-distances in combination with the distance decay parameter and wage sums, however, gives us a unique total market potential value for each municipality in the economy as explained in the model.

 $^{^{2}\}lambda_{im}$, for intra-municipality 0.02, λ_{ir} (intra-regional) 0.1, and for the λ_{ir} (extra-regional) 0.05



Figure-1: Market potential divided into three parts

Accessible market potential calculation as explained above then provides us with three distinct but related variables for the relevant market potential for a given municipality: *municipal market accessibility, regional market accessibility* and *external market accessibility*. These measures are log transformed in the empirical analysis, along with the income levels (used as dependent variable). Hence the results obtained from the regression analyses for these market variables are elasticities.

The impacts driven from our market accessibility variables are expected to differ between central and non-central market places, as well as between different types of retailing activities in question. For example, one of the hypotheses based on the theory can be that we should see a positive and significant impact from *municipal market accessibility* on the individual wage levels in all types of retailing activities, and both in central and non-central markets given the arguments for the proximity to demand. This kind of impact, however, may or may not be significant, and may or may not be positive with the *regional market accessibility* and *the external market accessibility* depending on the type of retailing activity, as well as the place of the respective municipality in the regional hierarchy.

If it is a retailer selling goods for frequent purchase (e.g food retailing) there is no reason to assume a significant impact from the regional market, and if there is any significant impact, its magnitude then should be negligible. If it is a retailer selling durables (e.g electronics, furnitures and household appliances), we can then expect a negative impact from the *regional market accessibility* in non-central markets, whereas this impact should be positive for central markets. As explained previously, we assume the municipalities in the same region to be in competition for the same pattern of potential demand. Hence, if a central market place is large and accessible enough, the flow of demand would be from the periphery (non-central municipality) towards the central market place. In contrast, due to the competition effect imposed by the large and highly accessible central market, regional market accessibility may then have a negative impact in a non-

central market that is located in the same region as the central one, because of the outflow of demand towards the central retail market.



Figure-2: Accessible market size measures for Swedish municipalities

In Figure 2, we see three maps for the three accessible market size measures. In Sweden, a large share of overall economic activity is clustered in the southern parts of the country. Nevertheless, we see a greater variation for the municipal market accessibility in comparison to the regional and external one.

Another aspect of place in regional hierarchy relates to specialization. One way to capture the relative importance of specialization in retail is to look at the degree of concentration. A market may be relatively small in size but may still exhibit a considerable degree of concentration of a given sector with respect to the other economic activities. Location quotients (LQs) are simple, yet a rather straightforward way to capture this kind of situation. Below, we see a Swedish map where the municipalities are shaded according to the LQ values³ for the retail sector. The calculation of the location quotient is as follows:

employment in retail in municipality i / employment in retail in Sweden all employment in municipality i

³ Location quotients are measure by using the mean employment figures for the years between 2001 and 2008.



Figure-3: Retail Location Quotients for the entire Swedish market

The concentration of retail across large municipalities and metropolitan regions is generally predictable. Besides this predictable concentration, the LQ map also allows us to see how retail is also concentrated across the Norwegian border, implying that the demand is not only driven domestically. Municipalities like Strömstad, Arjäng, Eda are known to attract consumers from Norway given the lower price levels for goods and services. Places like Åre and Härjedalen are popular in terms of winter sports, signaling that the demand for retail is not exclusive to the domestic consumers.

As with economic activity, gross retail employment is clustered in the southern part of the country. Nevertheless, big market places in North still exhibit a considerable level of relative retail concentration. These market places are more likely to be supported by the external market given the degree of retail concentration in the surrounding municipalities. Once again, a location quotient being higher in a municipality doesn't always imply a large scale in absolute terms. The concentration in discussion is subject to relativity. Although we see competitive regions in

retailing in relative terms, Malmö, Stockholm and Gothenburg regions together account for approximately 40 percent of the overall retail employment in the entire country.

Empirical Design

Data and Variables

The study employs different quantitative methodologies to capture the impact of a retail market's place in regional hierarchy on productivity. The data used in the study is micro-data on individual level from Statistics Sweden for the years between 2002 and 2008. It is a publicly audited data, containing information on every individual in the labor market and their work place. The selection of the time period is based on macroeconomic level consistency, as well as the changes in the industrial categorization after 2002. The data initially obtains information on all individuals between the age 18 and 64 with wages higher than zero. One problem with the data is that it doesn't provide information on working hours. In Sweden there is no official amount for the minimum wage either. Hence in order to avoid the disturbance from the extreme values in wages of individuals, outlier-labeling method is applied (for further explanation see: Tukey, 1977). In addition to the micro-data, housing values on regional level are utilized as well. The construct of the variables used in the analysis is displayed below in Figure-3. A descriptive statistics table can be found in the appendix.

Retail Categories

- Food
- Clothi
- Clothing
 Household
- Specialized

Place in regional hierarchy

Municipal Market Accessibility
Regional Market Accessibility
External Market Accessibility
Retail LQ

(specialization)

Regional Attractiveness

- Housing PricesUrban Amenities
- Labor market

labor market

- Share of immigrants
 Average labor productivity in the
- Individual characteristics (control)
- Schooling (in terms of degrees)
 Experience
- Experience
 Experience²
- Job type

Figure-4: Variables with their respective categories

<u>Variables</u>

Individual earnings

In the analysis, log-transformed individual earnings for the individuals working in the selected retailing activities in Sweden are used as the dependent variable in the analysis. As mentioned previously, outliers have been removed and the individuals are constrained to be between 18 and 64 years old, and earning positive wage. A common challenge with a productivity analysis is to find a good enough proxy for productivity. Previous literature discusses the disadvantages associated with using measures that utilizes output per worker and/or per unit capital. Comparing the productivity of different economic activities (even when they belong to the same line of sector) with respect to a set of indicators may lead an inaccurate picture to be drawn given the heterogeneity issues. Individual earnings in that sense have been acknowledged as a better proxy to capture productivity levels.

From a neoclassical perspective in competitive markets, individuals should be earning according to the marginal product they produce, which implies their individual level productivity. Even when the markets are not perfectly competitive, firms being located in the cities despite of the high wage and rent costs should imply cooperative productivity advantages. Being the most disaggregated level of analysis, variation of individual earnings should, thus, reflect the variation in productivity levels in the respective economic activity once controlled for individual characteristics and other spatial indicators associated with earnings (Roback, 1982; Glaeser and Mare, 2001; Puga, 2010). Findings of numerous studies suggest that the spatial characteristics of a firm's or individual's location matter for productivity differences (Combes, Duranton and Gobillon, 2008; Glaeser and Maré, 2001; Ciccone and Hall, 1996; Lippman and McCall, 1976; Yankow, 2006).

Retail categories

The analysis uses four retail categories under which several retail activities are nested with respect to the goods they provide as well as the commonalities in their location pattern. As discussed previously, retail sector consists of very heterogeneous activities. Using the sector as a whole would lead to a coarse analysis. Hence, the empirical analysis aims to provide a framework where the retail categorization coincides with the previous theoretical framework. The first category, *food retailing*, is a unique category where the individuals working in all retail shops that are food dominated are examined together. They are known to be very sensitive to the proximity to

demand because the goods provided by these stores are not very likely to be carried further away from the location they are provided. They are very likely to be found in the city centers, or in very close proximity. Purchases of the goods provided by these shops are more frequent than other forms of commodities provided by the retail market. The second category is *clothing*, which corresponds to a significant share of the retail market. The locations of these stores are variable. As individual stores, they dominate the downtown retail markets, but they can also be found in regional malls, and/or in the out-of town retail clusters. The nature of the goods and services provided by these retailers can neither entirely considered to be durable, nor non-durable. They are purchased less frequently than food, more frequently than big and expensive household items. The third retail category, household, has various retailing activities like retail sale of electronic goods, furniture, construction material, etc. These are the type of retailing activities that require bigger store space. Together with the fact that consumers purchase their goods less frequently and willing to travel to further distances to do so, bigger store space makes them to be located further from the city core. They are often found in the intersection of different markets and regional hubs. They are located close enough to a large enough market to secure sufficient demand while being further from the core in order to enjoy lower rent costs.

As it is in the food retailing, consumers have rather short desire lines in terms of commuting to patronize *specialized* stores, which then constitute the fourth retail category of the analysis. This category is the most heterogeneous one in terms of the goods and services provided by the stores. Each store is specialized in providing one particular line of goods, like opticians, pet stores, flower shops, book stores, music shops, etc. One notable commonality is in their location pattern. They are almost always located in the very core of the market. The store size is often small, which allows them to compensate high rents. A detailed list of retailing activities listed under these four categories can be found in the appendix.

Place in regional hierarchy: accessible market size measures and retail LQ

Being in the core of the analysis, the three measures for accessible market size constitutes the variables of interest together with *Retail LQ*, which is then constructed to capture the impact respective concentration of retail in a market. The three market accessibility measures are Municipal market accessibility, Regional Market Accessibility and External Market Accessibility. (For detailed discussion see the section: *Market accessibility & place in regional hierarchy*)

Regional attractiveness

As discussed in the theoretical framework, a region's certain attributes are acknowledged to play an important role for attracting consumers. These attractive attributes are not always easy to quantify. Previous research relies on several proxies to do so. In his paper, 'Consumer City', Glaeser et al. (2001) argues that cities function as hubs of consumption. Places with higher potential to provide urban amenities to its residents are empirically found to grow faster than low amenity cities. Urban rents going up faster than the wage levels in Glaeser et al. (2001b) analysis is considered to be an indicator of having desire to be in these places for reasons other than high wages. A similar argument can be found in the research of Rosen (1979) and Roback (1982). In order to capture this kind of impact, we follow the approach suggested by previous research where consumption possibilities provided by several service related establishments are considered to be urban amenities and their presence is found to be contributing to the hosting city's attractiveness. The availability of bars, cafes, restaurants, museums, hair-dressers in a city should contribute to attractiveness. The table below lists the services and establishments in a Swedish city that can be considered within this context. In the analysis, the total population in a city is divided by the total number of establishments in the respective categories and log transformed in order to capture elasticities.

In her framework for a spatial equilibrium, Roback (1982) argues that wages and rents are the two indicators on how the workers are allocated across cities with different sets of amenities. Together with the *urban amenity* measure, *housing prices* for the given time period on municipal level is also introduced to the analysis.

Category	Definition
1	Hotels
2	Restaurants and Bars
3	Ferry transportation
4	Airport transportation
5	Movie Theatre
6	Arts
7	Fair centers and Amusement parks
8	Library
9	Museum
10	Botanical and zoological gardens, and nature reserves
11	Sports
12	Beauty and well-being

Table-1: Components of urban amenities

Labor market characteristics

Two variables for controlling for the overall labor market circumstances are introduced to the analysis. First one is the share of the population that is first generation immigrant, *immigrant share*. The impact of a higher share of immigrants can be twofold for the retail case. Due to the late comer disadvantages, the composition of the labor market can be substantially different in markets that are highly populated with immigrants. Labor market participation, as well as unemployment levels, is found to be systematically different in markets with a relatively higher share of immigrants than the country average, and there found to be significant positive and negative impacts from labor migrant inflow to the hosting labor market (Card, 1997; Friedberg and Hunt, 1995). Another aspect of a higher share of immigrants in a labor market can be viewed through "push-pull factor" concept (Baycan-Levent and Nijkamp, 2009). Due to challenges in finding jobs, first generation immigrants are found to have greater incentive to start their own businesses under challenging labor market circumstances, which are very likely to be related to retailing and consumer services.

Another variable is *average productivity*, which is measured in terms of mean wages in a municipality when all the economic activities (other than public and farming-fishery sectors) are taken into account. If there is an overall tendency to have higher wage levels due to some productive advantage, that kind of impact should be captured by this variable. For example, a productive impact led by high share of human capital and knowledge spillovers in a city, or simply by an historical accident, should –at least partially- be captured by this variable.

Individual characteristics

According to the neoclassic theory, workers in the same industry with similar occupations and skills should receive the same wage. Nevertheless, intra- and inter-industry, as well as interregional wage differentials, are widespread phenomena. The most acknowledged method to explain the determinants of income variation is referred to as Mincer's wage equation (Mincer, 1974), which traditionally incorporates education and experience as determinants for wage levels. Returns to education and the problem of unobserved skills have also been investigated by numerous scholars (Bound and Johnson, 1992; Katz and Murphy, 1992; Murphy and Welch, 1992; Griliches, 1977; Willis and Rosen, 1979; Blackburn and Neumark, 1991). As the research on the topic has developed over time, the Mincerian approach has been extended where different combinations of explanatory variables relevant to the respective research question have been incorporated to the original model, which solemnly focused on the impact from individual characteristics.

Following Moretti (2004), this analysis uses *degrees* earned for the respective level of education instead of number of years in schooling since the former is proposed as a better measure for the returns to schooling on city level (Moretti, 2004; Yu, 2013). These variables are *high school, bachelor*, and *master and above*, where anything below a high school degree is used as a base category. *Experience* variable is obtained by subtracting both the total years of *schooling* and the first 6 years of an individual's life from the present age (Mincer, 1974). In addition, traditional Mincer's wage equation proposes the use of *Experience*² variable in order to control for the quadratic relation between age and experience. Theory suggests that a squared experience variable should be introduced to the model to control for the decreasing returns to age from a certain point onwards (Mincer, 1974). Although the original model proposes use of *working hours*, the data in this paper doesn't contain that information. However, in order to avoid –at least to some extent- omitted variable bias, outlier labeling rule is applied, which eliminates the extreme values that is associated to part time employment (or high extreme values).

In addition, in order to control for unobserved ability bias, as well as the heterogeneity across different kinds of occupations, *Occupation Categories* are employed in the analysis. Klaesson and Johansson (2011) suggest a skill categorization based on the occupations of the individuals. The idea behind the categorization of occupations is that certain types of occupations require different skill sets. These categories are employed as dummy variables in this study to control for the variation across occupations of different kind. For example, in retail sector, individuals with occupations that require them to have management and/or administrative skills populate the high-end of the distribution in wages, hence they correspond to a different earning scheme than the other employees. This situation, however, is likely to be captured with cognitive skills in manufacturing sector. Thus, rather than following a binary approach to control for the variation between high and low end occupations, or introducing one dummy variable for each occupation, these categories are introduced to the analysis. In the regression analysis motor skills is used as a base. Categories are explained below in the Table-3.

1- Cognitive Skill Jobs

- Individuals in the natural science related occupations
- Computer scientists
- Engineers

2-Management and Administration Skill Jobs

Chief executive officersManagersMarketing

3- Social Skill Jobs

• Teachers and instructors • Individuals in the health related occupations

• Sales people and brokers

4-Motor Skill Jobs

- Manufacturing workers
- Construction workers
- Machine operators

Figure-5: Skill based occupational categories

Empirical Analysis: Capturing the retail productivity in space

For the empirical application in this paper, both Pooled OLS and municipality-year fixed effect estimations are performed for the four different types of retailing activities, where the individual level data described previously for the years between 2002-2008 is used. Standard errors in the Pooled OLS estimations are municipality clustered. The reason why municipality-year fixed effects are used in addition to the pooled OLS estimations is to check for robustness and also to see if there is a variation over time. Since the variables of interest in this study are on municipal level, municipality-year effects in combination with Pooled OLS are found to be the relevant methodologies to use. Because of too little variation of municipal level variables over time, fixed effect estimations show either insignificant, or negligible estimations for the variables in question. However, the direction of the coefficients and their significant impact mostly appear to be robust. Also looking at the r-squared values from Pooled OLS and fixed-effect estimations, the difference is miniscule, confirming the robustness of the base models.

For the sake of providing a systematic discussion on the systematic variation of retail productivity in space with respect to spatial characteristics in central and non-central markets, the results are provided for each of the four retailing activities separately. Returns to individual characteristics is not in the scope of the study. Hence, variables that are introduced to the model in order to control for the individual characteristics are not presented in the tables; however, detailed results for each variable can be found in appendix.

Food Retailing

Table-2: Food Retailing

FOOD	Central Ma	rket	Non-central M	larket
Dependent variable: Ln_wage	OLS	FE	OLS	FE
Municipal Market Accessibility	0.0229***	0.0116*	-0.00831	0.00256
	(0.00787)	(0.00687)	(0.00900)	(0.00507)
Regional Market Accessibility	-0.00300	-0.00347	-0.0152***	-0.00380
	(0.00438)	(0.00407)	(0.00507)	(0.00336)
External Market Accessibility	-0.00229	-0.00333	-0.00901*	-0.00514
-	(0.00329)	(0.00438)	(0.00477)	(0.00339)
Retail LQ	0.0152	0.00225	0.0299***	0.0290***
	(0.0140)	(0.0134)	(0.00902)	(0.00808)
Housing	-0.0195	0.0135	0.0688***	0.0294***
-	(0.0154)	(0.0133)	(0.0189)	(0.00865)
Urban Amenities	0.0190	0.0536***	0.0704***	0.0190*
	(0.0151)	(0.0153)	(0.0240)	(0.0105)
Share of Immigrants	0.00712	-0.0359	0.0864	0.148**
_	(0.150)	(0.126)	(0.0924)	(0.0745)
Average Productivity	0.0642	0.0835	0.145***	0.148***
	(0.0694)	(0.0620)	(0.0520)	(0.0334)
Degree dummies	Yes	Yes	Yes	Yes
Occupation categories	Yes	Yes	Yes	Yes
Experience and Experience ²	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Constant	6.076***	5.830***	5.723***	5.642***
	(0.498)	(0.425)	(0.381)	(0.221)
Observations	162 325	162 325	143 758	143 758
R-squared	0.199	0.198	0.182	0.172

*** p<0.01, ** p<0.05, * p<0.1; Standard Errors in brackets

The table above presents the regression results for the individual earnings in food retailing. Looking at the base model, Pooled OLS, we see a strong dependence on the municipal market accessibility in central municipalities. In contrast, this kind of relationship is not significant for the non-central markets. As discussed previously, we expect consumers to commute from noncentral markets to central ones to patronize the bigger market. Higher regional market accessibility having a negative and significant impact on the productivity levels in food retailing in the noncentral markets imply the competition effect raised as a result of demand outflow is confirming the theoretical discussion aforementioned. Doubling the market access within region is associated with around a two percent decrease in productivity in food retailing in non-central markets. Same kind of significant negative impact is present for the impact from external market accessibility in non-central retail markets; however, the magnitude of the impact is negligible. Keeping the interaction between the central and non-central markets in mind, we see no significant impact from regional market accessibility and external market accessibility in central retail markets. This implies that the relevant retail market for food retailers in central markets doesn't expand beyond the municipal borders. Retail LQ exhibiting the impact from relative retail sector concentration in these markets have its only significant impact in non-central retail markets and the magnitude of this positive impact obtained from OLS and fixed effect estimations are almost identical. An increase in overall retail concentration in non-central markets is associated with approximately three percent productivity increase in the non-central markets in Sweden. This implies, when the market size is controlled, food retailers in non-central markets can enjoy productivity returns from the relative concentration of the sector in their close surrounding, supporting the importance the multipurpose shoppers and/or interaction between different kinds of retailers in space.

The set of variables introduced to the analysis to control for a region's attractiveness on productivity levels depict a mixed picture. Housing prices do not have a significant impact in central markets, whereas its impact is notable for the non-central markets. Those non-central places with high housing prices may be attracting residents from the close by central hub, or act as touristic destinations. Findings for the presence of urban amenities supports this idea. One interesting result is that, although the housing prices do not have a significant impact in central markets, urban amenities in these retail markets still appear to play a significant role for the levels of productivity of food retailing.

Share of immigrants, and *average productivity* are introduced to control for the overall circumstances of the labor market in the respective municipalities. The only significant impact for the share of immigrants is present for non-central retail markets, where the impact is positive. This is in line with the arguments on greater incentive for first generation immigrants to start their own businesses, which are very likely to be in retail and service sectors. Options are more affluent in bigger and central markets, which may offset the impact from this kind of commonality. Likewise, the impact from *average productivity* has a significant impact for the food retailing in non-central markets only. Doubling the overall productivity level for all economic activities in space while all other indicators are held constant is associated with a productivity increase of 1.5 percent for food retailers in the non-central markets.

<u>Clothing</u>

Table-3: Clothing

CLOTHING	Central Ma	rket	Non-central M	arket
Dependent variable: Ln_wage	OLS	FE	OLS	FE
Municipal Market Accessibility	0.0210**	0.0296***	0.0161	0.0522***
-	(0.00968)	(0.0105)	(0.0148)	(0.0170)
Regional Market Accessibility	0.00936***	0.00778	0.0188*	0.00975
	(0.00322)	(0.00599)	(0.0111)	(0.0110)
External Market Accessibility	0.00463	0.00686	-0.0206*	-0.00709
-	(0.00554)	(0.00672)	(0.0109)	(0.0116)
Retail LQ	0.0554**	-0.0204	0.0522***	0.0816***
	(0.0241)	(0.0231)	(0.0190)	(0.0267)
Housing	0.0369	0.0562***	0.0192	-0.00530
5	(0.0248)	(0.0202)	(0.0300)	(0.0250)
Urban Amenities	0.00533	-0.000952	0.0933**	0.0463*
	(0.0252)	(0.0235)	(0.0402)	(0.0274)
Share of Immigrants	-0.408	-0.447**	-0.121	0.0703
U	(0.291)	(0.194)	(0.185)	(0.221)
Average Productivity	0.0696	0.0531	-0.0398	-0.138
	(0.105)	(0.0974)	(0.0879)	(0.0901)
Degree dummies	Yes	Yes	Yes	Yes
Occupation categories	Yes	Yes	Yes	Yes
Experience and Experience ²	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Constant	5.361***	5.253***	6.303***	6.534***
	(0.894)	(0.670)	(0.578)	(0.627)
Observations	105.718	105.718	45.279	45.279
R-squared	0.227	0.218	0.179	0.159

*** p<0.01, ** p<0.05, * p<0.1; Standard Errors in brackets

The results for *Clothing* exhibits a rather different picture than what we have seen in the case of *Food Retailing*. Here, we see that the *municipal market accessibility* matters both in central and in noncentral markets, where the impact on productivity levels is larger for non-central markets. For example, in central markets, doubling the *municipal market accessibility* is associated with an approximately 2 percent productivity increase. This is not an interesting result. However when we look at the impact from *regional market accessibility* on retail productivity, we see a small but positive impact for the clothing retailers in central municipalities, as well as a somewhat significant impact in non-central markets. This is signaling that relevant market for clothing retailers extends beyond the municipal market. The competition effect from being closed to other markets for the non-central market clothing retailers is observed only when we look at the negative impact from the *external market accessibility*. The situation with the *retail LQ* is quite similar to the municipal market accessibility, where the impact from the concentration of the sector in the respective markets has a positive and significant impact on the productivity levels in both central and noncentral markets. Looking at the variables controlling for the impact from regional attractiveness on productivity, we see a positive and significant impact from *housing* only in central markets. In fact, the relationship is a rather strong one, where doubling the housing prices in central municipalities is associated with a productivity increase of approximately 5 percent. However, when we look at the impact from the *urban amenities*, we see no significant impact in central markets, although this impact is significant and very strong in non-central markets. The elasticity between the urban amenities in non-central markets and productivity is close to one, implying that the availability of attractive properties in non-central markets has a considerable impact on productivity levels of clothing retailers.

Share of immigrants has a negative and significant impact for the clothing retailers in centralmarkets, whereas this kind of impact is insignificant in non-central retail markets. *Average productivity*, on the other hand, is insignificant for both central and non-central retail markets, implying the productivity differences in clothing retailing in central and non-central markets are irrespective of a general trend in the labor market.

Household

Table-4: Household	retailing
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HOUSEHOLD	Central Ma	rket	Non-central M	larket
Dependent variable: Ln_wage	OLS	FE	OLS	FE
Municipal Market Accessibility	-0.00759	-0.00137	-0.0146	0.0204
-	(0.0126)	(0.00722)	(0.00943)	(0.0128)
Regional Market Accessibility	0.0128**	0.0117***	-0.0170***	-0.0108
	(0.00617)	(0.00384)	(0.00494)	(0.00828)
External Market Accessibility	-0.00188	-0.00550	0.00791	0.00391
	(0.00545)	(0.00417)	(0.00609)	(0.00882)
Retail LQ	0.0244*	0.0244**	-0.00105	0.0295
	(0.0144)	(0.0112)	(0.0125)	(0.0211)
Housing	0.0141	0.00109	0.0677***	0.0495**
	(0.0280)	(0.0155)	(0.0186)	(0.0196)
Urban Amenities	0.0353	0.0601***	0.0622**	0.0395*
	(0.0220)	(0.0163)	(0.0282)	(0.0216)
Share of Immigrants	0.197	0.160	0.173	-0.109
_	(0.173)	(0.130)	(0.153)	(0.170)
Average Productivity	-0.0679	-0.0546	0.0701	0.101
	(0.0905)	(0.0675)	(0.0949)	(0.0718)
Degree dummies	Yes	Yes	Yes	Yes
Occupation categories	Yes	Yes	Yes	Yes
Experience and Experience ²	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Constant	7.260***	7.087***	6.385***	5.561***
	(0.694)	(0.470)	(0.618)	(0.486)
Observations	107.765	107.765	64.974	64.974
R-squared	0.166	0.154	0.135	0.132

*** p<0.01, ** p<0.05, * p<0.1; Standard Errors in brackets

Now moving onto the third retailing category, *Household*, we observe a story consistent with the theory albeit a rather different one . This category contains retailing activities like.....

When we look at the impact from *municipal market accessibility*, we see no significant impact on productivity levels neither in central, nor in non-central markets. Retailers of this typehave larger establishments, selling goods for non-frequent purchase and they are often located outside of the city core. Hence, it is not surprising to see that the relevant market size for the *household* retailing is not the municipal one. When we look at the relationship between the productivity levels and *regional market accessibility*, we see that doubling the regional accessible market has a positive impact on productivity level in central markets, which is around two percent. Conversely, a negative impact of similar magnitude is existent in non-central markets, confirming the negative impact driven from demand outflow from the periphery to the central markets. We confirm the theoretical discussion on the willingness of individuals to commute further distances being higher for goods and services provided by such kind of retailers. *External market accessibility* on the other hand is irrelevant for the *household* in both central and non-central retail markets.

Another empirical finding coinciding with the theory is present when we look at the positive impact from retail concentration on *household* retailer's productivity exclusive to the central retail markets. The positive and significant impact from retail LQ is signaling the importance of multipurpose shopping trips, where people enjoy different types of retailing activities once the cost of travelling is already taken. Hence, a central market with greater retail concentration is more likely to be patronized by consumers, not only the ones in the respective region, but also the consumers travelling from other markets. This is in line with what is evident when we look at the impact from urban amenities in these central markets on productivity. Although housing prices in central retail markets appear to have no significant impact, doubling the availability of urban amenities are associated with a six percent increase in productivity. This result is confirming that for the household retailers in central markets, it is not the proximate demand, but the inflow of demand that matters more. Whereas for a non-central retail markets, both housing prices and urban amenities are associated with productivity increase. Looking at the variables that are introduced to control for the overall labor market conditions, we see no significant impact from neither the *share of immigrants* nor the *avarage productivity*.

Specialized Retailing

Table-5: Specialized stores

SPECIALIZED	Central Ma	ırket	Non-central M	larket
Dependent variable: Ln_wage	OLS	FE	OLS	FE
Municipal Market Accessibility	0.0286**	0.0382***	0.0331***	0.0573***
	(0.0117)	(0.0109)	(0.0105)	(0.0106)
Regional Market Accessibility	0.00370	-0.00186	0.0132**	0.0155**
	(0.00391)	(0.00646)	(0.00598)	(0.00699)
External Market Accessibility	0.00596	0.0135*	-0.00112	-0.00329
	(0.00555)	(0.00711)	(0.00533)	(0.00711)
Retail LQ	0.0400**	-0.00365	0.0484***	0.0499***
	(0.0199)	(0.0233)	(0.00947)	(0.0164)
Housing	-0.000159	0.0141	0.00384	-0.00774
	(0.0210)	(0.0207)	(0.0180)	(0.0181)
Urban Amenities	0.0293	0.0574**	0.00141	-0.00776
	(0.0209)	(0.0240)	(0.0228)	(0.0222)
Share of Immigrants	-0.138	-0.197	0.0180	0.0426
	(0.154)	(0.203)	(0.156)	(0.155)
Average Productivity	-0.0664	-0.0279	0.0960	-0.0143
	(0.0871)	(0.0997)	(0.0667)	(0.0680)
Degree dummies	Yes	Yes	Yes	Yes
Occupation categories	Yes	Yes	Yes	Yes
Experience and Experience ²	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Constant	6.517***	5.768***	5.245***	5.673***
	(0.517)	(0.686)	(0.460)	(0.453)
Observations	99.633	99.633	49.752	49.752
R-squared	0.137	0.135	0.118	0.110

*** p<0.01, ** p<0.05, * p<0.1; Standard Errors in brackets

Our final category is the *specialized* stores. These are the type of stores that are very likely to be found in the city core, mostly in downtown, selling a particular line of good or service (e.g. books stores, flower shops, opticians, etc.) One commonality among them is that they often have rather small establishment size and are assumed to depend heavily on the proximity demand. Findings from the analysis are in line with this idea, exhibiting a strong relationship between the municipal market accessibility and productivity in specialized retailing, both in central and non-central markets. This is a very local type of retailing activity, where we see around a three percent increase in productivity as we double the proximate accessible market potential. The impact from regional market accessibility is insignificant for these retailers in the central markets, whereas the impact is significant and positive for the non-central markets. This may be due to the demand inflow between non-central markets to enjoy the goods provided by only in either of them. Probability of finding at least one store for each kind of these specialized stores should be very likely in central markets, whereas depending on the market size, this may not be the case in peripheral markets. Following this logic, it is reasonable to assume that a consumer would travel to the closest distance to enjoy the types of goods provided by the specialized stores, which explains the positive relationship between the regional market accessibility and productivity in specialized

retailing in non-central retail markets. Retail LQ, capturing the impact from overall retail concentration on productivity, however, has a positive impact in both central and non-central markets with similar magnitude.

Housing prices are found to be irrelevant for the productivity levels, whereas the availability of urban amenities in central markets is found to contribute to the productivity of specialized retailers in central markets by a considerable margin. This may be due to the strong co-location of specialized stores in the urban core (Öner and Larsson, 2013). At last, neither share of immigrants, nor the average productivity is found to be relevant to the productivity levels for the specialized stores.

Concluding remarks

This paper addresses the relationship between market scale and productivity in the retail sector. There are two main aspects that are in focus. First one is whether it is possible to capture any systematic variations in the impact of market scale on productivity once different retail markets' place in the regional hierarchy are taken into account. This kind of urban-periphery interaction is not only taken into consideration for the retail markets by examining the central and non-central markets separately, but also via the decomposition of accessible market potential. In order to address this issue, the paper uses finest level of aggregation in the economy, individual earnings, as a proxy for productivity. The advantages from using individual earnings as a proxy for the levels of productivity are also discussed in detail in the paper. Second research question extends the conversation on market scale-productivity relationship for different types of retailing activities. The aim here is to capture the variation of the impact from the determinants associated to a market's place in regional hierarchy on the productivity of different types of retailing activities. The reasoning is that the location patterns of stores that are engaged in different kinds of retailing activities vary significantly depending on the type of service or good they provide.

The empirical analysis aims to identify possible determinants of productivity level and groups them under four main categories with respect to their attributes. These are mainly, *place in regional hierarchy, regional attractiveness, labor market characteristics,* and *individual characteristics.* The analyses are conducted for central and non-central markets, as well as four different types of retailing activities separately.

Findings of the analyses are in line with the previously presented theoretical framework, where the importance of proximity to greater potential demand has been emphasized, and the variation of such kind of impact based on type of retailing, as well as type of market, are discussed. Table-6 below provides the direction of the impact from the variables of interest for different types of retailing activities, as well as for central and non-central retail markets. One can see that the dependence on the proximity to demand is evident for retailers that provide goods for frequent purchase, whereas this kind of impact is not present for retailers providing household goods, like furniture and electronic goods. Knowing these stores are mostly located outside of the urban core, this relationship doesn't appear to be surprising.

We see a strong dependence on the potential demand in the immediate market for food retailers in the central markets, whereas this kind of impact is not evident in non-central ones. Retailers that are specialized in a particular good or service and clothing retailers are found to depend on the proximate market potential. The findings for the impact from regional market potential and external market potential are also in line with traditional location theories. The impact from regional and external market potential on productivity levels in the central retail markets, is either positive or not significant. Whereas when we look at the non-central retail markets the picture is mixed, yet the red thread tying the results for different types of retailing activities is available. For non-central food retailers, a competition effect driven from higher market access to other markets in the same region, as well as outside of the region is present. This is implying a negative impact rising from outflow of demand in the non-central retail markets for food retailers. In contrast, both central and non-central retail markets benefit from higher market accessibility in the case of retailers selling clothing. For the specialized retailers, the relevant market is the municipal one for the central retail markets, however the relevant market extends beyond the municipal border for the non-central retail markets. Concentration of the overall retail market is in most cases found to contribute to the productivity levels.

Results summarized		Municipal market accessibility	Regional market accessibility	External market accessibility	Retail Concentration (LQ)
EOOD	Central	+	0	0	0
FOOD	Non-central	0	-	-	+
CLOTIUNC	Central	+	+	0	+
CLUTHING	Non-central	+	+	-	+
HOUSEHOLD	Central	0	+	0	+
HOUSEHOLD	Non-central	0	-	0	0
SPECIALIZED	Central	+	0	0	+
	Non-central	+	+	0	+

Table-6: Summary of the results

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Appendix 1

Table A-1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln_Income	1173229	7.44	0.69	0	11.82
Ln_Municipal market accessibility	1172708	22.8	1.52	18.64	25.66
Ln_Regional market accessibility	1120658	22.63	1.73	16.03	25.73
Ln_External market accessibility	1172708	21.17	1.13	11.39	23.28
Retail LQ	1172784	1.09	0.35	0.34	3.37
Ln_Housing	1173229	7.39	0.63	1	8.78
Ln_Urban Amenities	1166036	4.91	0.25	3.72	5.75
Immigrant share	1173229	0.13	0.05	0	0.34
Average productivity	1173229	7.79	0.13	7.37	8.18
High school	1173229	0.72	0.45	0	1
Bachelor	1173229	0.12	0.33	0	1
Master and above	1173229	0.02	0.14	0	1
Experience	1173229	18.21	12.44	-2	49
Experience ²	1173229	486.58	555.87	0	2401
Cognitive	1173229	0.04	0.19	0	1
Management	1173229	0.19	0.19	0	1
Social	1173229	0.69	0.46	0	1

Appendix 2

Table A-2: Pair-wise correlations

	Wage	Municipal Market	Regional Market	External Market	Retail LQ	Average Productivity	Immigrant Share	Housing	Urban Amenities	Experience	Experience ²
Wage	1	,048**	,040**	,018**	,025**	,102**	,057**	,071**	,003**	,232**	,187**
Municipal Market		1	,387**	,069**	-,133**	,652**	,558**	,716**	,326**	-,107**	-,097**
Regional Market			1	-,069**	,014**	,529**	,728**	,719**	-,019**	-,072**	-,064**
External Market				1	,056**	,150**	,213**	,089**	,272**	-,010**	-,009**
Retail LQ					1	-,190**	,144**	,085**	-,121**	-,043**	-,045**
Average Productivity						1	,592**	,693**	,235**	-,069**	-,059**
Immigrant Share							1	,742**	,125**	-,101**	-,092**
Housing								1	,083**	-,119**	-,105**
Urban Amenities									1	-,031**	-,030**
Experience										1	,964**
Experience ²											1

Appendix 3

Table A-3: Pair-wise correlations

5-digit SNI	Description	Туре
52111	Retail sale in department stores and the like with food, beverages and tobacco predominating	Food
52112	Retail sale in other non-specialized stores with food, beverages and tobacco predominating	Food
52210	Retail sale of fruit and vegetables	Food
52220	Retail sale of meat and meat products	Food
52230	Retail sale of fish, crustaceans and molluscs	Food
52241	Retail sale of bread, cakes and flour confectionery	Food
52242	Retail sale of sugar confectionery	Food
52279	Retail sale of food in specialized stores n.e.c.	Food
52410	Retail sale of textiles	Clothing
52421	Retail sale of men's, women's and children's clothing, mixed	Clothing
52422	Retail sale of men's clothing	Clothing
52423	Retail sale of women's clothing	Clothing
52424	Retail sale of children's clothing	Clothing
52425	Retail sale of furs	Clothing
52431	Retail sale of footwear	Clothing
52432	Retail sale of leather goods	Clothing
52441	Retail sale of furniture	Household
52442	Retail sale of home furnishing textiles	Household
52443	Retail sale of glassware, china and kitchenware	Household
52443	Retail sale of lighting equipment	Household
52451	Retail sale of electrical household appliances	Household
52452	Retail sale of radio and television sets	Household
52461	Retail sale of hardware, plumbing and building materials	Household
52495	Retail sale of wallpaper, carpets, rugs and floor coverings	Household
52462	Retail sale of paint	Household
52471	Retail sale of books and stationery	Specialized
52472	Retail sale of newspapers and magazines	Specialized
52481	Retail sale of spectacles and other optical goods	Specialized
52482	Retail sale of photographic equipment, and related services	Specialized
52483	Retail sale of watches and clocks	Specialized
52484	Retail sale of jewellery, gold wares and silverware	Specialized
52485	Retail sale of sports and leisure goods	Specialized
52486	Retail sale of games and toys	Specialized
52487	Retail sale of flowers and other plants	Specialized
52488	Retail sale of pet animals	Specialized
52491	Retail sale of art; art gallery activities	Specialized
52492	Retail sale of coins and stamps	Specialized
52493	Retail sale of computers, office machinery and computer programmes	Specialized
52494	Retail sale of telecommunication equipment	Specialized
52453	Retail sale of gramophone records, tapes, CDs, DVDs and video tapes	Specialized
52454	Retail sale of musical instruments and music scores	Specialized

Appendix 4

Table A-4:	Pair-wise	correlations
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Sni – 5 digit	Detailed description	Amenity code	Amenity description
55101	Hotels with restaurants	1	Hotel
55102	Lodging activities of conference centers	1	Hotel
55103	Hotels and motels without restaurant	1	Hotel
55210	Youth hostels and mountain resorts	1	Hotel
55300	Restaurants	2	Restaurant and bar
55400	Bars	2	Restaurant and bar
61101	Ferry transport	3	Ferry transport
62100	Air transport	4	Air transport
92130	Movie theatres	5	MovieTheatre
92310	Artistic and literary creation	6	Arts
92320	Operation of arts facilities	6	Arts
92330	Fair and amusement parks	7	Amusement and Fair
92511	Library	8	Library
92520	Museums, historical sites and buildings	9	Museums, historical sites
92530	Botanical and zoological gardens and nature reserves	10	Botanical and zoological
92611	Ski facilities	11	Sports
92612	Golf courses	11	Sports
92613	Motor racing tracks	11	Sports
92614	Horse racing tracks	11	Sports
92615	Arenas, stadiums etc.	11	Sports
92621	Sportsmen's and sport clubs activities	11	Sports
92622	Horse racing activities	11	Sports
92710	Gambling and betting	11	Sports
92721	Riding schools and stables	11	Sports
93021	Hairdressing	12	Beauty and well-being
93022	Beauty treatment	12	Beauty and well-being
93040	Physical well-being activities	12	Beauty and well-being