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Entry and Competition with Product Differentiation: The Case of Swedish Concentrated Markets

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Abstract:

Empirical investigations into competitive behaviour on different markets is important since it does not exist one single theoretical model of competition. This thesis empirically investigates the competitiveness in a number of Swedish concentrated markets by leveraging the relationship between market entry and market size using the adjusted entry threshold framework developed by Schaumans and Verboven (2015). Compared to the standard entry threshold framework developed by Bresnahan and Reiss (1991), the adjusted entry threshold framework takes product differentiation into account and thus captures both market expansion and business stealing following entry of a new firm. The estimated entry thresholds allow us to make inferences on the degree and structure of competition. The three sectors we analyse are real estate agents, restaurants, and plumbers. We find that entry has a positive effect on competition and when taking market expansion into account we find that the magnitude of this effect increases. The largest effect for all sectors occurs when a market goes from monopoly to duopoly. These results are in line with previous studies.

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1 Introduction

The benefits of competition, to consumers and society in general, is one of the basic principles in modern economics. Common theory states that welfare in a society is maximized in competitive markets since the price equals marginal cost at the competitive equilibrium (Perloff, 2014). Understanding whether firms behave competitive or not lies at the heart of competition regulation. In the meantime, limitation in firm-level data prevents us from measuring the marginal cost directly, which is the key parameter in determining market structure and competitive behaviour. A number of empirical approaches have been developed in the industrial organization literature, that are built on economic models to overcome the data challenges (Bresnahan, 1982; Bresnahan & Reiss, 1991).

One approach, pioneered by Bresnahan and Reiss (1991), infers the effects of entry on competition in local service markets by leveraging the relationship between market entry and market size. The intuition is that if the market size measured by the size of the population has to increase disproportionately to support the entry of additional firms, then entry can be interpreted to intensify the degree of competition. On the contrary, if the market size only requires a proportionate increase to support the entry of additional firms, then entry should be interpreted to not intensify the degree of competition.

An example would be if the smallest market size in terms of population required to support one firm is one thousand (i.e. the entry threshold for one firm). Then the market size required to support two firms should be higher than two thousand if competition reduces the profit per unit of market size (i.e. per capita). If the market size would increase proportionally, i.e. if two thousand is enough to support two firms, this could be interpreted as no increase in competition from additional entry. If we observe that e.g. a population of three thousand is required to support a second firm and that the market size had to increase disproportionately to induce a new entrant, this suggests that competition is intensified.

To quantify the relationship between market entry and market size, Bresnahan and Reiss introduced the Entry Threshold Ratio (ETR) framework, which computes the per-firm market size increase required to support an additional firm. An estimated threshold greater than one implies that entry increases competition. To exemplify, if the ETR between a market with two firms and a market with one firm is estimated to be 1.20, this would indicate that in order to support two firms instead of one, the market size per firm would have to increase by 20% (i.e.

the total market size would need to increase by 120%). One of the key strengths of the standard ETR model is that the data requirement is relatively limited, at least in its most basic form. The data required is a cross-section of local markets with the number of firms in each market, the population size of the market and other relevant demographic variables.

One crucial assumption in the standard ETR approach is that firms produce homogeneous goods. The consequence of this assumption is that entry only causes some consumers to switch to the new entrant, leading to business stealing among firms. In the theoretical case where the firms and products in a market are perfectly homogeneous (including e.g. spatial location), then the size of the total market is unaffected by entry. This means that every customer gained by the entrant is lost by the incumbent firm(s) (business stealing). If this is the case, the value of the ETR could be interpreted as the ratio between markup used by the firms present in the market pre versus post entry. To exemplify, consider that the value of ETR is 1.20. This would suggest that the markup in a market with one less firm is 120% of that of a market with one more firm.

However, if a new firm produces a differentiated good, there is likely to be market expansion in addition to business stealing. Consider a local town with one pizza restaurant. Now a new restaurant, which sells sushi, enters the market. Some pizza restaurant customers will continue to buy pizza, while some switch to the sushi restaurant, resulting in business stealing. More importantly, some that do not like pizza, and therefore did not buy it previously, might now go to the sushi restaurant. This would be an example of market expansion.

Apart from the different products the new entrant offers, the physical location of a new entrant also creates a significant source of differentiation. Those who previously did not want to buy pizza because of distance, might go to a new pizza restaurant if it is located next door. In both of these cases the total revenue in the market would increase when the new firm enters, i.e. the combined revenue of the two firms are higher than the revenue of the incumbent firm when it had a monopoly.

If we analyse the competition effects by using the standard ETR approach, ignoring the possibility of heterogeneous goods, we might obtain biased estimates. The estimates will be biased because any unobserved market expansion will counteract the reduction in markup caused by the increased competition. A new firm will be able to profitably enter the market at a lower market size if it can replace some of the anticipated reduction in markup with more total revenue. Thus, if there is market expansion present, the standard ETR cannot be interpreted as the ratio of the markups. The results would be biased towards a lower estimated drop in the markup than is the case and the effect on competition from entry would be underestimated.

In order to capture product differentiation and correct for the potential bias, Schaumans and Verboven (2015) developed a framework that allows for market expansion with an adjusted ETR. To do so, they proposed to augment the standard entry model with a revenue equation. This is done by estimating the elasticity of revenue with respect to the number of firms, which measures the relative degree of business stealing or market expansion.

Purpose, Hypothesis and Main Results

The purpose of this thesis is to investigate the effect of entry on competition empirically in a number of local service sectors in Sweden by allowing for product differentiation in market entry using the framework proposed by Schaumans and Verboven (2015). Specifically, the following research question will be used: what is the effect of entry on competition in Swedish local service markets?

Our hypothesis is that entry increases competition in the standard ETR framework, and that the magnitude of this effect is larger when taking market expansion into account in the adjusted ETR framework. Furthermore, we hypothesize that the largest effect on competition occurs when markets go from a monopoly to a duopoly, which is in line with previous research.

We investigate a number of potential service sectors and select those suitable for analysis with this method. In our final analysis we investigate the plumbing sector, the real estate agent sector, and the restaurant sector in a number of separate geographical markets in Sweden. These three sectors have been studied in other countries using the same or similar framework (Bresnahan & Reiss, 1991; Schaumans & Verboven, 2015). This allows us to compare the effect of entry on competition in local Swedish markets with the effect of entry in other countries.

Our main results are as follows.

When analysing the data using the standard ETR framework, we find that competition increases due to entry in all investigated sectors when markets go from a monopoly to a duopoly. We find that it is smaller in magnitude than the effect from entry when using the adjusted ETR framework, which suggests some degree of market expansion.

The results suggest that the main competition effects occur with the second entrant, with diminishing effects as more firms enter the market, which is in line with previous studies. We observed a lower degree of market expansion in our data compared to that presented by Schaumans and Verboven (2015), likely because we used a broader definition of our markets. We believe this result suggests that the results presented by Schaumans and Verboven are not necessarily as damning towards previous studies that did not control for market expansion, as long as the investigated markets are likely to be relatively isolated and products are homogeneous.

Our results are in line with our hypotheses. Furthermore, we find that our results are robust when changing the sample to include firms that does not report revenue. Our primary contribution is that we present standard ETRs and adjusted ETRs for Sweden that are comparable to recent research from another country. Secondly, we use a different definition of market which is larger in geographic area and in our opinion more appropriate for the analysis.

2 Literature Review

In classical economic theory, two basic models of competition are the Bertrand model and the Cournot model (Bertrand, 1883; Cournot, 1838). These models are often used as a benchmark to predict the consequences of entry in the case of perfect competition. In the case of the Bertrand model, which assumes price competition and a high degree of flexibility in choosing output levels, the model predicts that the price should fall from the monopoly level to the competitive level as soon as a second firm enters the market. In the Cournot model on the other hand, output is fixed in the short run but flexible in the long run. The model predicts that the price markup, defined as the difference between the marginal cost and the price of a good, will fall in proportion to the number of firms in the market. Thus, in a duopoly the markup would be the monopoly markup divided by two and in a triopoly it would be the monopoly markup divided by three etc. approaching the marginal cost as the number of firms increases.

Since it does not exist one-single theoretical model of competition, empirical investigation into competitive behaviour on different markets becomes important in order to discriminate between different models. In practice, however, it might be hard to place a market on the continuum between different theoretical types of competition.

Most theoretical models of competition indicate that competition should increase by new entry, though with diverse predictions on the competitive effects (Bresnahan & Reiss, 1991). If empirical findings would indicate that more firms do not lead to increased competition, this could suggest that some form of anti-competitive behaviour, implicit or explicit, is being performed by the firms in the market.

There have been a number of empirical studies made that investigates competition in concentrated markets using a range of varying but similar methods to the one proposed in this thesis. What most of them have in common is the analysis of entry thresholds; often with data that has been augmented in different ways to solve the issues with the standard ETR and to add other information of interest. Examples of additional data that has been used is prices, capacity units, spatial information, and revenue. We discuss the most relevant of these studies below.

Bresnahan and Reiss (1991)

In the study by Bresnahan and Reiss, in which the core method for analysing and constructing the ETR was developed, a number of local service sectors in the US were analysed. In this first study, no additional data were included directly in the model, however, the authors used price data for one of the sectors in order to separately test the predictions of the model. In the study doctors, dentists, druggists, plumbers, and tire dealers were investigated and the result showed that ETR values from one to two firms of between 1.5-2 for all sectors, except for plumbers which was close to one. The values then levelled off relatively quickly as the number of firms increased, with only druggists and tire dealers showing any substantial effect of going from two to three firms. The results were further corroborated by a separate analysis using price data for tire dealers which showed that additional entry in concentrated markets had a negative effect on prices, thus increasing competition.

Asplund and Sundin (1999)

Asplund and Sundin investigated competition in local/regional markets amongst driving schools in Sweden, using the standard ETR framework developed by the previously described article by Bresnahan and Reiss (1991). In addition to using the number of firms as a dependent variable and identifying the per firm entry threshold they used capacity units (number of cars available to driving schools in a given market) to identify capacity unit entry thresholds. This further development of the model provides additional evidence that competition increases in larger markets. The idea is that the entry threshold per capacity unit (i.e. the minimum market size per driving school car required for the addition of an additional car to the market) should decrease in market size. This would provide evidence of increasing competition: either because prices are lowered, leading to increased demand and capacity requirement per capita; or because the firms are competing through availability, which requires some over-capacity per capita in order to have available time slots when it suits the consumer. Both of these alternatives suggest a lower profit per capita.

The estimations showed that the entry threshold per firm increased in the number of firms and that per capacity unit entry threshold decreased in market capacity. These results suggest increased competition in larger markets. As in earlier studies, most of the effect seem to occur at low market size levels, i.e. the entry thresholds increase (decrease) at a reduced rate as the number of firms (capacity units) increase.

The study also tested different econometric model specifications in addition to the ordered probit used by Bresnahan and Reiss (1991). The authors used a Poisson model and a Tobit model and concluded that estimated entry thresholds were insensitive to the econometric specification used.

Schaumans and Verboven (2015)

The study by Schaumans and Verboven (2015) developed the method: both in terms of simplifying the econometric specification for estimating the basic ETR; and by developing a method to identify the change in markup from entry, which was only possible under certain quite strict assumptions in previous models.[1] In short, they used revenue data to identify

[1] The method described in this article is the one that will be used in our thesis.

potential market expansion caused by new entry and used this to isolate the effect on the markup.

The authors investigated a number of local service markets in Belgium, focusing on the sectors: architects, bakeries, butchers, florists, plumbers, real estate agents and restaurants. They identified quite large levels of market expansion, especially in some sectors, which challenges the results of previous studies. However, the direction of the bias caused by not controlling for market expansion is towards lower estimates of entry thresholds; thereby the ETR in earlier studies might be underestimated, meaning that the true effect of competition was higher.

We believe that there are some reasons to believe that market expansion might not always be as problematic as this article suggests.

Firstly, the estimated market expansion differed for the different sectors, with e.g. real estate agents showing almost only market expansion and bakeries showing almost no market expansion. A key difference between these sectors is that the bakery is geographically bound to its physical location, whilst real estate agents can operate relatively far away from their office building, making it easier to expand their geographical market in the face of new entry.

Secondly, the study used postal codes as the definition for local markets, which is a very narrow definition. In Belgium, which is densely populated, there is likely to be adjoining postal code areas that is, at least partially, in the same actual local market. This holds especially when considering spatial differentiation. Such differentiation can be exemplified with a new restaurant that opens close to the border of a postal code, and thereby is likely to attract customers from “outside” the market.

In earlier studies the sectors investigated tended to be more geographically bound and the market definition were wider and more isolated, which should indicate that the degree of business expansion is relatively low. Because of this, one could argue that some of the critique raised by Schaumans and Verboven (2015) towards earlier studies might be exaggerated. That being said, their method is a significant improvement since it allows the study of different types of sectors and more fuzzy market borders.

In the end, the results from this study were mostly in line with that of earlier studies, with significant effects on competition from new entry but with reduced effects as the number of firms increased.

Lábaj, Morvay, Silanič, Weiss and Yontcheva (2018)

In a new article by Lábaj et. al. the authors investigates a number of local service markets in Slovakia. In order to deal with market "spillovers" they extend the analysis by including spatial autocorrelation which allows for the fact that the decision to enter or exit a market is influenced by conditions in neighbouring regions and markets.

They note that failure to account for spatial spillover effects, if they are present and significant, will bias the estimated entry thresholds. They will not necessarily bias the entry threshold ratios if the bias does not significantly differ for markets with different numbers of firms.

The study found presence of spatial interaction effects that had a significant influence on entry and exit decisions. These effects, however, varied in their sign for different sectors, reflecting the fact that different kinds of spillover effects varied in importance depending on characteristics of the sectors. The authors also found that the effect on entry thresholds were nonlinear in that the threshold for a first firm to enter a market showed a larger influence from neighbouring market conditions than the thresholds for subsequent entry. The effect was also nonlinear in the sense that the marginal effect from additional population in neighbouring villages decreased with the population size in those villages, likely reflecting a higher competitive pressure in larger markets.

The study also included a time dimension, as the analysis was made using data from three points over the last three decades (1995, 2001 and 2010). This is especially interesting since this time period captures the transition of the Slovak economy from a planned economy to a market economy. The authors show that entry barriers in general had fallen and competition had increased across different sectors. This constitutes, in our opinion, a very good usage of the entry threshold framework, since it is often more informative to investigate how market structure and competition has changed over time as compared to one snapshot in time which might be hard to interpret.

3 Theoretical Framework

We adopt the theoretical framework presented by Schaumans & Verboven (2015) and Bresnahan and Reiss (1991).

For a firm to enter the market there must be a positive profit (not considering uncertainty). When the market size increases, and there are no other firms entering the market, the potential profit of an entrant should increase. Thereby we can write profit per firm for a given number of firms (N), "π_N", as a function of market size “S”, with the threshold entry condition being $\pi_N(S_N) = 0$:

$$(1) \qquad \pi_N(S_N) = [P_N - AVC(q_N, W)]d(Z, P_N)\frac{S_N}{N} - F = 0$$

Where P_N is the price given the number of firms in the market e.g. if N=1 then P_N would be the monopoly price. AVC is the average variable cost that depends on the quantity per firm q_N and the vector W that are factors affecting the cost. Demand for a representative consumer, d ,depends on the price, P_N, and the vector Z of factors affecting individual demand, total demand is given by multiplying with market size S_N.[2] F are the fixed costs.

We can simplify by setting $v(N, W, Z) = [P_N - AVC(q_N, W)]d(Z, P_N)\frac{1}{N}$

$v(N, W, Z)$ is the per capita variable profits per firm, dependant on the number of firms, N, and the vectors of variables included in W and Z.

Using equation (1) and rearranging terms gives:

$$(2) \qquad S_N = \frac{F}{v(N,W,Z)} \equiv S(N)$$

Indicating that the market entry threshold is the ratio of fixed cost to the firm per capita variable profit i.e. the higher fixed cost or lower variable profits, the greater the market size required to support N firms.

The entry threshold ratio (ETR) is the per firm entry threshold required to support N firms divided by the per firm entry threshold to support $N - 1$ firms:

[2] S_N is the value of S such that π = 0 for a given value of N.

$$(3) \qquad ETR \equiv \frac{\frac{S(N)}{N}}{\frac{S(N-1)}{N-1}} = \frac{\frac{F}{v(N,W,Z)}}{\frac{F}{v((N-1),W,Z)}} = \frac{v((N-1),W,Z)}{v(N,W,Z)}$$

As we can see above, the ETR is simply equal to the ratio of the per firm and capita variable profit when there are $(N-1)$ firms over the case when there are N firms in a market.

The hypothesis used to test for the presence of competition effects with the standard ETR framework is defined as follows:

H0: $ETR(N) = 1$

HA: $ETR(N) \neq 1$

This means that if the estimated value of ETR is significantly different from one, we can infer that entry of a new firm has a significant effect on competition.

Adjusted ETR

We use revenue data in order to control for market expansion, following Schaumans and Verboven (2015). They derive the following relationship between the change in markup from entry and the ETR:

$$(4) \qquad \frac{\mu(N-1)}{\mu(N)} = ETR(N)\frac{R(N)}{R(N-1)}$$

Where $R(N)$ is the total industry revenue per capita in a market, i.e. the sum of the revenue of the number of firms, N, divided with the population in the market. Equation (4) is the expression we refer to when we talk about adjusted ETR. The intuition is that if the market revenue per capita is larger in markets with more firms, this is due to market expansion following entry. If there is no market expansion, then $\frac{R(N)}{R(N-1)} = 1$, and the standard ETR is an accurate measure of the markup change. If this is not true, then the ratio is the size of the bias.

The hypothesis used to test for the presence of competition effects with the adjusted ETR framework uses the expression from equation (4) and is defined as follows:

H0: $\frac{\mu(N-1)}{\mu(N)} = 1$

HA: $\frac{\mu(N-1)}{\mu(N)} \neq 1$

This means that if the estimated difference in markups is significantly different from one, we can infer that entry of a new firm has a significant effect on competition.

Discussion regarding the choice of framework

To summarize the difference between the frameworks; in the standard ETR framework, proposed by Bresnahan and Reiss (1991), we identify the actual entry threshold, which by themselves corresponds to the actual thresholds for the firms in our sample. However, in order to draw conclusions regarding the effect on competition in the markets, we would like to know the effect of entry on markup. In the standard ETR framework the entry threshold ratio corresponds directly to the markup change only in the special case when products are homogeneous, and entry does not lead to any expansion of the total revenue in the market.

Schaumans and Verboven (2015) provides a framework that allows the researcher to identify the markup change even in the more general case when products are allowed to be heterogeneous. This relaxation, of a quite stringent assumption, does come at a price. One of the key benefits of the original model was that the data requirements were low, which changes substantially in the adjusted framework. In the standard framework, it was sufficient with the number of firms in a given sector and market, the population size of the market, and some demographic control variables. The adjusted framework, on the other hand, requires micro-level data regarding individual revenue for all firms in the different sectors.

Even though revenue data in most cases is easier to collect than price or cost data, this dramatically reduces the number of sectors that is possible to analyse using publicly available data. Most firms report revenue in their financial statement, but only at company level and not at the level of the workplace, which makes it difficult to investigate sectors that are characterised by chains.

In summary, we believe the adjusted ETR framework is preferable if revenue data is available. However, we also believe that the standard ETR framework is still valuable because it does allow accurate estimates of entry thresholds, in terms of population required to support a given number of firms. In certain markets, where product homogeneity is plausible, it is still possible to make inferences regarding the effect on competition from entry.

4 Empirical Framework

4.1 Estimating Standard Entry Threshold Ratio

In order to econometrically evaluate the model, we adopt the framework presented by Schaumans & Verboven (2015):

We start with the profit function for each firm in a market with N firms:

$$\pi(N) = v(N)S - F \qquad (5)$$

Where $v'(N) < 0$, since the variable per firm profit per capita is diluted when there are more firms.

If free entry is assumed, then in equilibrium it can be inferred upon the observation of N firms in a market that N firms are profitable but $N + 1$ are not, i.e. it is assumed that if $N + 1$ were profitable an additional firm should enter the market:

$$v(N+1)S - f < 0 < v(N)S - F \qquad (6)$$

By a logarithmic transformation we get the following (first divide with *F*):

$$ln\frac{v(N+1)}{F} + lnS < 0 < ln\frac{v(N)}{F} + lnS \qquad (7)$$

We continue to follow Schaumans & Verboven (2015) and specify the log of the ratio of variable profits over fixed costs as:

$$ln\frac{v(N)}{F} = X\lambda + \theta_N - \omega \qquad (8)$$

Where X is a vector of observable market characteristics[3], λ is a vector of parameters to be estimated, θ_N is the fixed effects of having N firms in the market and ω is the unobserved error term. We assume that $\theta_{N+1} < \theta_N < \cdots$ since $v'(N) < 0$.

We can now rewrite the entry condition as:

$$X\lambda + \theta_{N+1} + lnS < \omega < X\lambda + \theta_N + lnS \qquad (9)$$

[3] X is the subset of observable variables included in W (variable cost shifters) and Z (individual demand shifters) used previously as well as observable variables potentially affecting fixed costs F.

We can now estimate the model with maximum likelihood. We start by assuming that ω is normally distributed $N(0, \sigma)$. Using the standard ordered probit model, we can infer bounds of the unobserved latent profit variable by estimating the probability of observing N firms.

$$(10) \qquad P(N) = \Phi\left(\frac{X\lambda + lnS + \theta_N}{\sigma}\right) - \Phi\left(\frac{X\lambda + lnS + \theta_{N+1}}{\sigma}\right)$$

In this model θ_N is the "cut points" and can be interpreted as the entry effects. We are able to identify and correct for the variance of the error term since the coefficient of lnS is assumed to be 1 (variable profit increase proportionally with market size, ceteris paribus). Thus, the estimated coefficient of lnS is $\frac{1}{\sigma}$.

Extracting standard ETR

We can now extract the entry thresholds by using equation (7) and (8), evaluating ω at zero

$$(11) \qquad S(N) = exp\ ((-X\lambda - \theta_N)\ /\frac{1}{\sigma})$$[4]

The Entry Threshold Ratios using equation (3) are:

$$(12) \qquad ETR(N) = exp\ (\theta_{N-1} - \theta_N)\ \frac{N-1}{N}$$

In this final step, we obtain an expression which shows that the entry threshold ratio is determined only by the estimated cut points from equation (10).

4.2 Estimating Adjusted Entry Threshold Ratio

With revenue data, it is possible to separate the effect from a change in markup and the effect on revenue (in Bresnahan and Reiss (1991) the total market revenue was assumed to remain constant). Consider the following profit function, analogous to equation (5)**:**

$$(13) \qquad \pi(N) = \mu(N)r(N)S - F$$

where per capita profit is separated into a markup component $\mu(N)$ and a revenue component $r(N)$: $v(N) = \mu(N)r(N)$. By following the same steps as in the previous section, we can now infer the following when N firms are observed:

$$(14) \qquad ln\frac{\mu(N+1)}{F} + ln\, r(N+1)\ + lnS < 0 < ln\frac{\mu(N)}{F} + ln\, r(N)\ + lnS$$

[4] Note: $\frac{1}{\sigma}$ is the coefficient of lnS. It will cancel out in equation 12 so it will only affect the nominal entry threshold but not the threshold ratio, the same is true for $X\lambda$.

Since the per firm revenue is observed, we can specify a separate equation describing how revenue depends on the number of firms $r(N)$. Schaumans & Verboven (2015) suggests the two following alternative econometric model specifications:

$$(15) \qquad ln\, r(N) = X\beta + \alpha ln\, N + \xi$$

$$(16) \qquad ln\, r(N) = X\beta + \alpha_N + \xi$$

Where $ln\, r$ is the natural logarithm of the per firm and capita revenue in a given market, i.e $ln\, r = ln\left(\frac{R(N)}{N}\right)$, and X is a vector of observed market characteristics. Of particular interest are the values of α and α_N. The parameter ξ is the error term.

The value of α in the first model is the constant elasticity of the effect of the number of firms (N) on the per firm and capita revenue, r, if there are no business expansion the per firm revenue should fall proportionally with the number of firms and $\alpha = -1$. If business expansion is present the fall in revenue should be less than proportional, suggesting $\alpha > -1$ (lower in absolute value).

The second model specification is a fixed effect model for the number of firms, i.e. dummies are included for $N = 1$, $N = 2$ etc. α_N in this case is the effect of there being N firms present in the market on the per firm and capita revenue r as compared to the benchmark of $N = 1$.

The fixed effects model is more flexible since it allows differentiated effects on the revenue for markets with different levels of N, but with cost to statistical power since more parameters need to be estimated which introduces more standard errors to take into account. The constant elasticity model, on the other hand, have a more interpretable α and more statistical power, but at the cost of less flexibility since more structure is introduced that the estimation must follow. This could result in specification error if the implicit assumptions that the added structure rests on is faulty, in this case that the "true" elasticity of N with regards to r is close to constant.

Both of the models discussed above could be estimated through a normal OLS regression. However, there is likely an endogeneity problem as unobserved characteristics that affect the revenue per capita are also likely to affect the number of firms in a market. One example is if firms are more likely to enter markets where they believe demand will be high, this would lead to a positive correlation between r and N.

Estimating adjusted ETR with simultaneous estimation

In order to estimate the markup change from new entry, consider the following specification:

$$(17) \qquad ln\frac{\mu(N)}{F} = X\gamma + \delta_N - \eta$$

This is very reminiscent of equation (8). X is a set of market characteristics, δ_N is the effect of there being N number of firms in the market on the ratio of markup over fixed costs and η is an unobserved market specific error term.

This equation cannot be estimated directly since $\frac{\mu(N)}{F}$ cannot be observed directly, but since we can disentangle the revenue component $r(N)$ from equation (13) we can still calculate the parameters of interest. If we substitute equation (17) and (15) or (16) into (14) we get:

$$(18) \qquad [X\gamma + \delta_{N+1} - \eta] + [X\beta + \alpha ln\ (N+1)\ + \xi] + lnS < 0$$
$$< [X\gamma + \delta_N - \eta] + [X\beta + \ \alpha ln\ (N)\ + \xi] + lnS$$

In equation (18), we exemplify with the constant elasticity revenue specification. To simplify this expression, we collect terms and add/subtract the error terms. Then we define:

$\lambda \equiv \beta + \gamma$

$\omega \equiv \eta - \xi$

$\theta_N \equiv \alpha ln\, N + \delta_N$ (constant elasticity revenue specification)

$\theta_N \equiv \alpha_N + \delta_N$ (fixed-effects revenue specification)

This results in the following expression:

$$(19) \qquad X\lambda + \theta_{N+1} + lnS < \omega < X\lambda + \theta_N + lnS$$

Which is the entry equation (same as in equation (9) in the previous section 4.1) that will be estimated through ordered probit.

The following simultaneous system of equations will be estimated:

For $N = 0$:

r is unobserved

$X\lambda + \theta_1 + lnS < \omega$

For $N > 0$:

$ln\, r(N) = X\beta + \alpha ln\, N + \xi$ or $ln\, r(N) = X\beta + \alpha_N + \xi$

$X\lambda + \theta_{N+1} + lnS < \omega < X\lambda + \theta_N + lnS$

As is mentioned above, there is an endogeneity problem in the revenue equation as the number of firms, N, is likely to be correlated with the error term, ξ, which contains unobserved market specific variables that affect revenue.

Econometrically the error term for the entry equation can be written as $\omega \equiv \eta - \xi$ which is correlated with the error term ξ from the revenue equation since they contain the same component ξ. This relationship arises since the revenue equation is a part of the entry equation, as is illustrated in equation (18). Because of this correlation between the error terms, the endogeneity problem can be solved by estimating the models together in a simultaneous maximum likelihood estimation.

The "true" effect of N is identified in the revenue equation through the assumption that population S is correlated with the number of firms N but does not affect the per capita revenue and is therefore a natural exclusion restriction for N (Schaumans & Verboven, 2015). This works since S enters the entry equation but is assumed to have no effect and is excluded from the revenue equation. Given that this natural assumption holds, when the equations are estimated simultaneously the population size functions as an instrument for N, removing the endogeneity. For similar methods see Schaumans and Verboven (2015), Berry and Waldfogel (1999) and Ferrari et. al (2010).

Extracting adjusted ETR and markup drop

In order to calculate the ETR, we can still use equation (12):

$$ETR(N) = exp\,(\theta_{N-1} - \theta_N)\ \frac{N-1}{N}$$

To calculate the markup change, which is the adjusted ETR, we begin with equation (17). When using a similar procedure as in section 4.1.2, we get the following:

$$(20) \qquad \frac{\mu(N-1)}{\mu(N)} = exp\ (\delta_{N-1} - \delta_N)$$

In the case of the constant elasticity revenue specification, using the definition $\theta_N \equiv \alpha ln\ N + \delta_N$, the percentage markup change can be expressed in terms of estimated parameters:

$$(21) \qquad \frac{\mu(N-1)}{\mu(N)} = exp\ (\theta_{N-1} - \theta_N)\ \left(\frac{N-1}{N}\right)^{-\alpha}$$

Which can be simplified using the definition of the ETR (equation (12)):

$$(22) \qquad \frac{\mu(N-1)}{\mu(N)} = ETR(N)\left(\frac{N}{N-1}\right)^{1+\alpha}$$

In the case of the fixed effects specification, using the definition $\theta_N \equiv \alpha_N + \delta_N$, we get the following expression:

$$(23) \qquad \frac{\mu(N-1)}{\mu(N)} = exp\ (\theta_{N-1} - \theta_N)\ exp\ (-(\alpha_{N-1} - \alpha_N))$$

Which, once again, can be simplified:

$$(24) \qquad \frac{\mu(N-1)}{\mu(N)} = ETR(N)\frac{N}{N-1} exp\ (\alpha_N - \alpha_{N-1})$$

We will estimate the change in markup with both specifications as presented in equation (22) and equation (24).

5 Data Collection

5.1 Selection of Sectors and Markets

Similar to Schaumans and Verboven (2015), we investigate non-urban markets in order to avoid problems with market overlap. To increase comparability with their findings we use the same selection criteria as they did on market size. This means that our sample only contain markets with a population of less than 15,000 people.

We select local service sectors which we can compare to previous research and that are suitable for our analysis in Swedish markets. To compare with Schaumans and Verboven (2015) we investigate the restaurant sector, the plumbing sector and the real estate agent sector. The plumbing sector can be further compared with findings by Bresnahan and Reiss (1991). To illustrate why some of the sectors investigated by Shaumans and Verboven are not suitable for analysis in Swedish markets, we include an example of such an analysis in appendix 1.

5.2 Firm Data

Revenue data for all firms in Sweden is collected in Statistics Sweden's Business Register. In this register, information from the Swedish Tax Agency, the Swedish Companies Registration Office and Statistics Sweden are included. Though access to this register is not freely available, we can access the same data from private business registers. We use Retriever Business, a database managed by “Retriever Sverige AB” which uses and presents data from the Swedish Companies Registration Office and Statistics Sweden.

We analyse three different local service sectors. We identify firms within a specific sector by looking at their SNI-code, which is the Swedish industry standard economic classification system. All firms in Sweden have at least one SNI-code which describes their business, though some firms have several codes. In the Swedish system there are 821 different codes in total at level six, which is the level with highest detail. These codes are hierarchically sorted into 615 subgroups, 272 groups, 88 main groups and 21 divisions with less level of detail. The Swedish classification system is identical to the system used in the European Union, the NACE classification system. The only difference is that the Swedish system has six levels with 821 codes in total whereas NACE have five levels with 615 codes in total.

We want to identify firms that are restaurants (SNI-code 56.100), real estate agents (SNI-code 68.310) and plumbers (SNI-code 43.221). We export data for each sector from the database Retriever Business for the year 2018, which is the most recent year with complete data available during the spring of 2020. We obtain firm-level revenue in Swedish kronor (SEK) for the year 2018, geographical location and number of workplaces. Using this information, we create datasets which show how many firms there are in a specific geographical market and calculate the revenue per firm per capita.

With firm data we encounter two challenges. First, data on revenue is only available for certain types of firms. Second, data on revenue is only available at firm level and not at the level of the workplace.

When it comes to revenue data, it is available specifically for limited companies (“aktiebolag”). All firms of this type must send their annual report to the Swedish Companies Registration Office. Some other types of firms are not required to do this, and their exact revenue is not available at Retriever Business. Even if most firms in the sectors we investigate are limited companies, there is a sizable share of other types of firms. Specifically, we find that there are a lot of sole proprietorships (“enskild firma”). In order to get an indication of the revenue of these firms, we are able to export revenue intervals from Retriever Business.

There are seven revenue intervals and all firms are categorized accordingly, including sole proprietorships. The intervals range from zero to one thousand SEK, one thousand to five hundred thousand SEK, five hundred thousand to one million SEK, one million to ten million SEK, ten million to fifty million SEK, fifty million to five hundred million SEK and finally, five hundred million SEK and higher. Most of the firms we investigate have a revenue within an interval of five hundred thousand to ten million SEK.

In our main sample we will only include markets where all firms report revenue and exclude markets with firms that only report revenue intervals. For example, if there are three firms in a specific market but one of the firms only reports revenue interval, the market will not be included in the main sample. Our main sample will only contain markets where we can accurately measure the level of total revenue. However, we include firms with a revenue interval in a robustness analysis. The result from the robustness analysis gives us confidence that this approach does not bias the sample to any significant degree.

When it comes to revenue data at firm level, this becomes problematic if there are companies operating as chains with high revenues and many workplaces since we cannot determine from which workplaces the total revenue of the firm is attributable to. We define chains as a firm with more than one workplace and the problem is primarily in the restaurant sector with fast-food restaurants.

Schaumans and Verboven (2015) handles this problem by selecting sectors with few chains and restricting attention to companies with at most two establishments in Belgium. We select the same sectors and use a similar approach regarding chains in these sectors. First, we identify the firms with more than one workplace. Second, we create a list of markets where these workplaces are located. We find that most of the markets with workplaces are large in terms of population, and since our final sample only contain non-urban markets, this does not cause any significant problem. By dropping the few non-urban markets with workplaces of chains, we obtain a final sample which accurately measures the number of firms in each market.

Another minor problem but with chains is that some of them are large and have many workplaces with different SNI-codes. This becomes a problem if most of their other establishments have another SNI-code. For example, if there is a large firm with one workplace which has a restaurant but five other workplaces which offer cleaning services, the firm is arguably not mainly a restaurant. In order to make sure that we do not include these types of firms, which could impact our results due to their presence in many localities that would unnecessarily be dropped from our sample, we manually inspect the largest firms for each sector make sure that the majority of their establishments have the correct SNI-code.

5.3 Market Data

We use locality ("postort") to define the geographic markets where we can identify the market demand from the size of population and the number of firms. A locality consists of several postal codes and is slightly larger in geographic area than a Swedish town, since it might contain a few postal codes located outside of the town. Thereby the definition of our market is larger than the definition used by Schaumans and Verboven (2015).

We are able to find and use the population size of each locality in the year 2012 from Statistics Sweden (2012), but updated versions of this data are not freely available. This poses two challenges. Firstly, some of the localities might have been changed since 2012 in terms of mergers or no longer being used. Secondly, the population in these localities might have changed over time.

When it comes to potential changes in the localities, we start by investigating publicly available information on current localities in March 2020 (Postnummerservice, n.d). We then create a dataset of all these localities with corresponding municipalities and counties. For localities that are included in several municipalities, we assign them to the municipality in which they have their largest geographical area. With this data, we identify 1,715 localities in Sweden. By comparing the localities in 2012 with our dataset of localities in 2020, we identify and drop localities which have been discontinued or changed during the time period.

When it comes to the population data, we argue that data from 2012 is still useful. The largest increase in the Swedish population from 2010 to 2016 is concentrated to densely built-up areas

(Statistics Sweden, 2018). Our sample consist of non-urban localities with a population of less than 15,000. Furthermore, when looking at population data on the municipal level from Statistics Sweden, we find that 164 out of 290 municipalities in Sweden had a growth in population of less than 5% from 2012 to 2018. 262 of the municipalities had a growth in population of less than 10%. This indicates that population growth has been moderate in the majority of the Swedish municipalities over the time period.

Based on this, we argue that the population change should be small in both absolute and relative terms from 2012 to 2018 in the non-urban localities we have in our sample. To further strengthen this argument, we drop a small number of localities from our sample based on the fact that they are located in municipalities with a growth or decline of more than 10% over the time period.

5.4 Summary Statistics

Table 1 presents definitions for the population variable and the control variables obtained from Statistics Sweden (n.d.). This table shows our base sample of 1,084 markets. The markets included in this sample are, initially, the same for all our industries and constitute the localities that remain after all non-sector specific selection criteria has been applied, such as a population of less than 15,000. In the final estimations, additional and differing markets will have been dropped for the different sectors due to the presence of chains and non-reporting firms.

Table 1. Definition of variables

Name	Definition	Mean	SD
population	; Population in locality (2012-12-31)	2887.0	(2907.4)
income	; disposable mean income (TKR)	288.6	(53.50)
norrland	; equal to 1 if located in "Norrland" region	0.299	(0.458)
pop_growth	; %Change in population 2012-2018	0.042	(0.032)
Kids	; % age 0 – 14	0.171	(0.018)
Youngadults	; % age 15 – 34	0.224	(0.026)
Adults	; % age 35 – 64	0.367	(0.012)
Old	; % age 65 and over	0.238	(0.037)
Observations:		1084	

In table 2, we present the distribution of the number of firms present in the markets for our sectors. The first column categorises markets by number of firms. The numbers under the sector names describes how many markets there are, in that sector, that consists of the corresponding number of firms. To exemplify: there are 107 markets containing exactly two plumbers and 182 markets containing exactly one restaurant. In the bottom row the total number of markets included in the final sample is presented for each sector (note that it is not the total number of firms).

Table 2. Number of markets in final sample with a specific number of firms for each sector

Number of firms	Plumbers	Real Estate	Restaurants
0	381	756	307
1	235	138	182
2	107	39	81
3	67	22	39
4	30	7	17
≥ 5	40	22	33
Total markets	860	984	659

In table 3, we present some additional summary statistics for the sector-specific variables. We show the mean value as well as the standard deviation (in parenthesis) for the number of firms and per firm revenue for the markets included in the final sample that has a non-zero number of firms. The number of observations showed in the bottom row of table 3 corresponds to the total number of markets presented in table 2, minus those markets where N is zero. This is the sample that is used in the estimation of the revenue model.

Table 3. Summary statistics for each sector.

	Plumbers		Real Estate		Restaurants	
Firms ; Mean #firms per market	2.113	(1.548)	2.07	(2.228)	2.176	(2.141)
Revenue ; Mean revenue per firm (TKR)	3362.7	(2289)	1796.5	(1709)	2800.4	(2052)
Observations:	479		228		352	

6 Results and Analysis

This section is structured as follows. First, we present estimated standard ETR for all sectors and present an illustrative example how these estimates could be biased due to market expansion. Second, we mitigate this bias by estimating adjusted ETR for all sectors using two different specifications and elaborate on the importance of simultaneous estimation. Third, we present a robustness analysis where we increase our sample size and include firms that report only revenue intervals.

6.1 Standard Entry Threshold Ratio

In the table 4, we present the results from estimating the ordered probit model in equation (10) with maximum likelihood**.** We observe that population is positive and significant, meaning that higher population increases likelihood of entry in all sectors. When looking at the other parameters, we see that the age parameters have a significant effect on entry of real estate agents. We see that all coefficients are negative, which means that likelihood of entry is lower if there are less adults between 35 and 64 in the locality, which is the benchmark age group. We also see that higher income seems to increase likelihood of entry by plumbers in the locality.

Table 4. Results from Ordered Probit Entry Model

Single Entry Equation						
N	Plumbers		Real Estate		Restaurants	
lnpop	1.0279	***	0.8497	***	1.0134	***
	(0.0573)		(0.0604)		(0.0714)	
lninc	0.8482	***	0.5417	*	0.5345	*
	(0.2815)		(0.3230)		(0.2955)	
norrland	0.1882	*	-0.0936		0.0784	
	(0.1082)		(0.1326)		(0.1251)	
%Popoulation Growth 2012-2018	2.2915		4.9045	*	-0.4867	
	(2.1644)		(2.5218)		(2.5166)	
% Kids 0 - 14	-1.9842		-26.5944	***	-7.3639	
	(6.1588)		(7.2331)		(7.1726)	
% Young adults 15 - 34	-4.4672		-20.8142	***	-6.9423	*
	(3.7331)		(4.2599)		(4.1910)	
% Old 65 and over	-0.5266		-16.5534	***	-3.1659	
	(3.9281)		(4.5388)		(4.4875)	
θ_N	Yes		Yes		Yes	
Observations	860		984		659	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

We do not show the estimated cut points (θ_N) in table 4, but we use them to calculate standard entry thresholds using equation (11) and equation (12). As mentioned earlier, the effect of population and control variables are the same for all entry thresholds and only the cut points determine the difference between them. Thereby, when dividing the entry threshold for N firms with the entry threshold for N-1 firms, the resulting ETR will only be determined by the difference in the cut points. In table 5, we present estimated standard entry thresholds and the standard ETRs for all sectors.

Table 5. Standard Entry Threshold and Entry Threshold Ratios for all sectors.

Single Entry Equation						
	Plumbers		Real Estate		Restaurants	
ET1	1280		3522		1181	
ET2	3131		8981		2849	
ET3	5466		14635		5055	
ET4	9295		22487		7808	
ET5	13823		27312		10251	
ETR2	1.223	***	1.275	**	1.206	**
ETR3	1.164	***	1.086		1.183	**
ETR4	1.275	***	1.152		1.159	**
ETR5	1.190	**	0.972		1.050	
N	860		984		659	

All Entry Thresholds are significant at 1% level; For the ETR * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

In the case of plumbers, we find that the critical market size in a locality for a plumber to open business is at 1,280 people. In order for an additional plumber to establish in the same locality, the critical market size is 3,131 people. Thereby, when the second plumber enters the market with only one incumbent plumber, the total market size has to increase by approximately 122.3% as shown in ETR2. The fact that the market size required to support the second firm was larger than the market size to support one firm illustrates that competition increases.

We also estimate entry threshold ratios higher than one for a third and fourth entrant, significant at a 1% level. These differ in magnitude, meaning that the market size per firm has to increase by 116.4% for the third entrant and 127.5% for the fourth entrant. For the fifth entrant, we estimate a slightly less significant difference at 5% level. Thereby our results indicate that competition increases with each entering plumber at slightly different magnitudes.

For real estate agents, we estimate that the entry threshold ratios are significantly different from one when a second firm enters the market, which requires a market expansion of 127.5%, significant at a 5% level. With the third, fourth and fifth entrants, the ETR is not significantly different from one. This means that we cannot determine whether competition increases when a third, fourth or fifth firm enters the market.

In the case of restaurants, we estimate ETR2 to be higher than one, significant at a 5% level. This means that competition increases when a new restaurant enters a market with only one incumbent firm, since the market size has to increase 120.6%. With the third and fourth firm, competition increases but at a lower magnitude. With the fifth firm, we cannot determine if entry has a significant effect on competition.

Motivation for using adjusted ETR

In table 5, we assume that firms offer homogenous goods and that there is no market expansion due to entry of additional firms. This is problematic, as presented in the example of the sushi and pizza restaurant in section 1. Let us elaborate on the hypothetical example using the findings in table 4. Assume that the first restaurant in a locality is a pizza restaurant and the second firm is a sushi restaurant. Then we might observe the values we estimated in table 4, which showed a critical market size for the first pizza restaurant is 1,181 people and the critical market size for the second sushi restaurant is 2,849 people. We thereby observe an ETR2 = 1.206.

However, in the case of a market with an incumbent pizza restaurant and an entering sushi restaurant, it is possible that the total size of the market increases since the products are differentiated and not homogenous. The concept of market expansion is presented in equation (4) in the section 3. Let us assume that the industry revenue per capita with one restaurant, the pizza restaurant, was 1,000 SEK. Let us further assume that the industry revenue per capita with two restaurants offering differentiated meals is 1,200 SEK. In this case there has been a market expansion. The industry revenue per capita has increased which means that people in the locality spend an additional 200 SEK on restaurants when there is a second differentiated restaurant in the locality. We then find that $R(1)$ = 1,000 and $R(2)$ = 1,200. This shows that the expression $R(2)$ / $R(1)$ = 1,200 / 1,000 = 1.2. In order to determine whether this results in effect of competition, we look at the percentage drop in the markup as presented in equation (4) in section 3.

In this hypothetical example, this expression would be equal to 1.206 * 1.2 = 1.4472. The value of 1.4472 shows that the industry markup before the entry of the second sushi restaurant was

44.72% higher than after. Thereby, we find that the effect on competition due to entry is larger than we previously estimated if there would have been market expansion.

6.2 Adjusted Entry Threshold Ratio

Estimating the revenue equation

Estimating adjusted ETRs is more complicated than estimating standard ETRs since we need to estimate the revenue equation simultaneously as the entry equation as shown in equation (19) in section 4.2. We use two different specifications for the revenue equation, as presented in equation (15) and (16) in section 4.2. The first is constant elasticity specification and the second is the fixed effect specification. Both of these specifications are useful and will be presented in our conclusion**.**

We are mainly interested in the results from the simultaneous estimation of the revenue equation and the entry equation. However, in table 6, 7 and 8 we also present the revenue equation estimated separately in a single estimation. The reason for including both is that we can observe if they are different and thereby determine to what degree the single estimation is affected by endogeneity.

In the table 6, the results for both specifications of the revenue equation for the restaurant sector are shown when estimated individually and estimated simultaneously with the entry equation. As we can observe there are some effects on the coefficients for the control variables across specifications, albeit most remain insignificant.

Table 6. Revenue equation for the restaurant sector with single equation and simultaneous estimation.

Restaurants								
lnRf	Constant Elasticity				Fixed Effects			
	Single		Simultaneous		Single		Simultaneous	
lnN (α)	-0.0826		-0.7469	***	Fixed		Fixed	
	(0.1071)		(0.1268)		-		-	
lninc	0.8123	*	1.2979	***	0.7050	**	1.1215	***
	(0.4236)		(0.4736)		(0.3577)		(0.4003)	
Norrland	-0.0549		0.0591		-0.0496		0.0688	
	(0.1858)		(0.2044)		(0.1847)		(0.2032)	
%Popoulation Growth 2012-2018	-3.2490		-5.2313		-2.7114		-4.2597	
	(3.7346)		(4.1102)		(3.5480)		(3.8997)	
% Kids 0 - 14	-1.8991		-3.3549		-8.5749		-11.5582	*
	(10.6839)		(11.7079)		(5.7708)		(6.4143)	
% Young adults 15 - 34	-3.0665		-6.4679		-8.0092	**	-11.8241	***
	(6.0804)		(6.7343)		(3.2677)		(3.6612)	
% Old 65 and over	2.3617		-2.2287		-2.4573		-7.7365	**
	(6.5679)		(7.2537)		(3.3835)		(3.7818)	
Constant	-3.9274		-4.8281		-		-	
	(5.2674)		(5.7833)					

Note: The standard errors are obtained using the delta method; * indicates $p<0.1$; ** indicates $p<0.05$; *** indicates $p<0.01$

The key change is the effect of entry on revenue, captured in the constant elasticity case by α. As mentioned in selection 4.2 regarding the constant elasticity specification; if α is -1, then there is no business expansion when another firm enters the market and only business stealing. If the fall in revenue is less than proportional and the value of α is lower in absolute value, this suggests some degree of business expansion.

When the equation is estimated individually α is insignificant with a value close to zero at -0.083 which would indicate that entry almost only leads to market expansion and not business stealing. However, when estimated simultaneously with the entry equation, α is highly significant at -0.747, radically changing the interpretation suggesting that new entry mostly leads to business stealing. To interpret the coefficient directly with $\alpha + 1$= 0.253 (the market expansion elasticity), a 10% increase in N leads to an increase in the total market revenue with 2.53%. This result shows that the degree of market expansion is greatly overestimated when the revenue equation is estimated individually.

Similar results are obtained for plumbers, shown in table 7. The value of α increases in absolute terms from -0.1589 in the individual estimation to -0.7707 in the simultaneous estimation. In the simultaneous estimation the estimate is significant at 1% level. Thereby the level of business expansion seems to have been overestimated for restaurants and plumbers in the single equation estimation.

Table 7. Revenue Equation for the plumbing sector with single equation and simultaneous estimation.

	Plumbers							
lnRf	Constant Elasticity				Fixed Effects			
	Single		Simultaneous		Single		Simultaneous	
lnN (α)	-0.1589	*	-0.7707	***	Fixed		Fixed	
	(0.0928)		(0.1062)		-		-	
lninc	0.0457		0.4218		-0.0897		0.3204	
	(0.3914)		(0.4292)		(0.3262)		(0.3574)	
Norrland	0.103		0.1666		0.1254		0.1921	
	(0.1588)		(0.1707)		(0.1582)		(0.1703)	
%Population Growth 2012-2018	1.4652		2.7795		2.8294		4.0983	
	(3.1501)		(3.3945)		(3.0150)		(3.2462)	
% Kids 0 - 14	6.8974		4.2746		-1.2816		-3.5417	
	(8.9143)		(9.6155)		(5.0210)		(5.4752)	
% Young adults 15 - 34	3.585		-1.3014		-2.0741		-7.0303	**
	(5.3792)		(5.8231)		(2.9323)		(3.2145)	
% Old 65 and over	10.1715	*	5.4199		4.8657	*	0.1149	
	(5.6367)		(6.1027)		(2.9272)		(3.2090)	
Constant	-4.5814		-4.3299		-		-	
	(4.6148)		(4.9934)					

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

In table 8, the results do not present a significant estimate of α for the real estate agents in the simultaneous estimation. The interpretation of this is that new entry in this sector results in market expansion rather than business stealing. Schaumans and Verboven (2015) encountered the same situation and argued that the market definition could be broader than town level for the real estate sector. Even though we use a larger market definition than what was used in their study, we still find that the real estate agent sector is characterised by market expansion.

Table 8. Revenue Equation for the real estate sector with single equation and simultaneous estimation.

Real Estate				
lnRf	Constant Elasticity		Fixed Effects	
	Single	Simultaneous	Single	Simultaneous
lnN (α)	0.0193	-0.2006	Fixed	Fixed
	(0.1426)	(0.1452)	-	-
lninc	-0.1673	0.1599	-0.4149	0.1595
	(0.6913)	(0.6831)	(0.5497)	(0.5545)
Norrland	-0.242	-0.2244	-0.1911	-0.2061
	(0.2758)	(0.2720)	(0.2769)	(0.2735)
%Population Growth 2012-2018	-7.2075	-5.3056	-5.6204	-4.7205
	(4.9771)	(4.9438)	(4.7811)	(4.7455)
% Kids 0 - 14	3.5165	-4.8092	-3.4257	-8.9287
	(13.5641)	(13.5960)	(8.2008)	(8.1982)
% Young adults 15 - 34	8.6519	-0.0516	4.4489	-2.5853
	(7.9128)	(8.0567)	(4.5180)	(4.6870)
% Old 65 and over	8.4739	1.1258	4.6128	-1.3216
	(8.4477)	(8.5311)	(4.8392)	(4.9231)
Constant	-4.3865	-1.7826	-	-
	(7.2929)	(7.2451)		

Note: The standard errors are obtained using the delta method; * indicates $p<0.1$; ** indicates $p<0.05$; *** indicates $p<0.01$

Adjusted ETR

In table 9 we present the adjusted ETRs for all sectors with the constant elasticity specification and in table 10 we present adjusted ETRs with the fixed effects specification. As shown in equation 4 in section 3, the notation for the adjusted ETR is the change in markups ($\frac{\mu(N-1)}{\mu(N)}$). The value of α for each sector is the same as the value in the simultaneous estimation for each sector in table 6, 7 and 8.

Table 9. Adjusted ETR for all sectors with constant elasticity specification.

Constant Elasticity						
	Plumbers		Real Estate		Restaurants	
α	-0.7707	***	-0.2006		-0.7469	***
	(0.1062)		(0.1452)		(0.1268)	
$\frac{\mu(1)}{\mu(2)}$	1.5099	***	2.0011	***	1.5	***
	(0.1268)		(0.2293)		(0.1469)	
$\frac{\mu(2)}{\mu(3)}$	1.3119	***	1.4368	***	1.3184	***
	(0.0773)		(0.1187)		(0.0911)	
$\frac{\mu(3)}{\mu(4)}$	1.3525	***	1.3838	***	1.2286	***
	(0.0831)		(0.1159)		(0.0828)	
$\frac{\mu(4)}{\mu(5)}$	1.2183	***	1.1308	*	1.1057	
	(0.0794)		(0.0769)		(0.0718)	
N	860		984		659	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

In the constant elasticity case for plumbers, we find that α is -0.77. Once again, this estimate indicates that additional entry in a local market for plumbers mainly involves business stealing, hinting that products may not be differentiated. We estimate that markups were 51% higher before the entry of the second plumber which indicates that competition has increased. Markups continue to drop with the third, fourth and fifth entrant and all estimated ETRs are significant.

In the constant elasticity case for real estate agents, we find that α is -0.20 but insignificant, indicating market expansion. We estimate that markups were 100% higher before the entry of a second firm, which is a lot higher than the standard ETR estimation. Thereby we find that markups are reduced due to competition, but that the market expansion allows more real estate agents to enter the market with a lower markup.

Finally, in the case of restaurants, we find that α is -0.74. This indicates that the market is characterized by business stealing. We find that competition increases for the second, third and fourth entrant at a higher magnitude than in the standard ETR estimation.

In table 10, we present the adjusted ETR for all sectors using the fixed effect specification. In this case we do not present a single value of α, since this is different depending on the number of firms.

Table 10. Adjusted ETR for all sectors with Fixed Effect Specification.

Fixed Effects						
	Plumbers		Real Estate		Restaurants	
$\frac{\mu(1)}{\mu(2)}$	1.8313	***	1.9786	**	1.8949	***
	(0.2439)		(0.4627)		(0.3018)	
$\frac{\mu(2)}{\mu(3)}$	1.3849		1.9396		1.1141	
	(0.2387)		(0.6620)		(0.2436)	
$\frac{\mu(3)}{\mu(4)}$	1.1022		1.461		1.0184	
	(0.2626)		(0.8075)		(0.3240)	
$\frac{\mu(4)}{\mu(5)}$	1.0633		0.5534		1.4979	
	(0.3303)		(0.3559)		(0.5987)	
N	860		984		659	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

In the fixed effects specification, we have larger standard errors and thereby less significant estimates. We find that when markets in all sectors go from a monopoly to a duopoly, the markups were 90% higher in the monopoly. Similarly to the constant elasticity specification, we find that the effect on competition is larger in magnitude than in the standard ETR framework. We do not find significant result for the third, fourth and fifth entrant. Thereby the results indicate that the largest effect on competition occurs with the second entrant.

In summary, the results from the fixed effect specification combined with constant elasticity also show presence of competition effects with a higher magnitude than in the standard ETR framework. Both specifications indicate that the largest effect on competition occurs when markets go from a monopoly to a duopoly.

6.3 Robustness Analysis

As discussed in section 5.2, all firms do not report precise revenue information, which depends on how they are incorporated. This is especially problematic in the case of restaurants where approximately a third of the firms do not report this data. In our main analysis we have chosen to remove all markets that have firms that do not report revenue.

However, in our data we do have intervals for the revenue of these firms. We can therefore test the robustness of our results with regard to the inclusion/exclusion of markets containing non-revenue reporting firms by assigning proximate revenue values to these firms.

Since the same revenue intervals are reported also for the firms that do report revenue in our data, we assign the mean revenue of reporting firms to non-reporting firms in the same revenue interval. To exemplify, non-reporting restaurants with a revenue interval of five hundred thousand SEK to one million SEK are assigned a revenue of 740 thousand SEK, which is the mean revenue from reporting firms within the same interval. We then do the same analysis as before but with all markets and firm types included and with this proxy revenue value for some of the firms.

In table 11 we see that when the original sample of 659 markets is compared to the alternative sample with 955 markets for the restaurant sector, the value of α still indicates business stealing and the magnitude of the adjusted ETRs for both specifications are reminiscent to those reported in table 9 and table 10.

Table 11. Revenue Equation for the restaurant sector with simultaneous estimation with original sample and alternative sample

	Restaurants							
	Constant Elasticity				Fixed Effects			
	Original		Alternative		Original		Alternative	
α	-0.747	***	-0.760	***	Fixed		Fixed	
	(0.1268)		(0.0701)		-		-	
$\frac{\mu(1)}{\mu(2)}$	1.500	***	1.448	***	1.895	***	1.807	***
	(0.1469)		(0.0932)		(0.3018)		(0.2033)	
$\frac{\mu(2)}{\mu(3)}$	1.318	***	1.293	***	1.114		1.278	
	(0.0911)		(0.0597)		(0.2436)		(0.1851)	
$\frac{\mu(3)}{\mu(4)}$	1.229	***	1.147	***	1.018		1.115	
	(0.0828)		(0.0466)		(0.3240)		(0.2058)	
$\frac{\mu(4)}{\mu(5)}$	1.106		1.100	**	1.498		1.108	
	(0.0718)		(0.0420)		(0.5987)		(0.2420)	
N	659		955		659		955	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

In table 12 we see that when the original sample of 860 markets is compared to the alternative sample with 909 markets for the plumbing sector, the value of α still indicates business stealing and the magnitude of the adjusted ETRs for both specifications are reminiscent to those reported in table 9 and table 10.

Table 12. Revenue Equation for the plumbing sector with simultaneous estimation with original sample and alternative sample

Plumbers								
	Constant Elasticity				Fixed Effects			
	Original		Alternative		Original		Alternative	
α	-0.771	***	-0.763	***	Fixed		Fixed	
	(0.1062)		(0.0990)		-		-	
$\frac{\mu(1)}{\mu(2)}$	1.510	***	1.515	***	1.831	***	1.846	***
	(0.1268)		(0.1204)		(0.2439)		(0.2345)	
$\frac{\mu(2)}{\mu(3)}$	1.312	***	1.318	***	1.385		1.405	*
	(0.0773)		(0.0735)		(0.2387)		(0.2261)	
$\frac{\mu(3)}{\mu(4)}$	1.353	***	1.366	***	1.102		1.130	
	(0.0831)		(0.0790)		(0.2626)		(0.2524)	
$\frac{\mu(4)}{\mu(5)}$	1.218	***	1.188	***	1.063		1.052	
	(0.0794)		(0.0690)		(0.3303)		(0.2988)	
N	860		909		860		909	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

Finally, in table 13 we see that when the original sample of 984 markets is compared to the alternative sample with 1007 markets for the real estate agent sector, the value of α still indicates market expansion and the magnitude of the adjusted ETRs for both specifications are reminiscent to those reported in table 9 and table 10.

Table 13. Revenue Equation for the real estate agent sector with simultaneous estimation with original sample and alternative sample

Real Estate								
	Constant Elasticity				Fixed Effects			
	Original		Alternative		Original		Alternative	
α	-0.201		-0.198		Fixed		Fixed	
	(0.1452)		(0.1304)		-		-	
$\frac{\mu(1)}{\mu(2)}$	2.001	***	1.991	***	1.979	**	2.046	**
	(0.2293)		(0.2082)		(0.4627)		(0.4473)	
$\frac{\mu(2)}{\mu(3)}$	1.437	***	1.424	***	1.940		1.879	
	(0.1187)		(0.1076)		(0.6620)		(0.6096)	
$\frac{\mu(3)}{\mu(4)}$	1.384	***	1.322	***	1.461		1.437	
	(0.1159)		(0.0962)		(0.8075)		(0.6730)	
$\frac{\mu(4)}{\mu(5)}$	1.131	*	1.164	**	0.553		0.567	
	(0.0769)		(0.0754)		(0.3559)		(0.3012)	
N	984		1007		984		1007	

Note: The standard errors are obtained using the delta method; * indicates p<0.1; ** indicates p<0.05; *** indicates p<0.01

As we can see in table 12, 13 and 14, the results are robust to this alternative sample selection for both model specifications. The standard errors tend to be lower in the alternative specification, leading to higher significance levels on some estimates. This is mostly due to the larger sample size, but it should be noted that the standard errors in the alternative specification likely should be higher since we do not account for the variation within the revenue intervals for non-reporting firms. The numerical estimates are within a few percent in almost all cases, this is especially true for the estimates that are statistically significant.

The result from this robustness analysis gives us confidence that the limitations in our data concerning non-revenue reporting firms are adequately solved by removing markets containing these firms and that this does not bias the sample to any significant degree.

7 Discussion and Conclusion

The purpose of this thesis has been to investigate the effect of entry on the structure of competition in local Swedish service markets. To do this, the framework of standard ETRs and adjusted ETRs as presented by Schaumans and Verboven (2015) was used. The research question we formulated was as follows: what is the effect of entry on competition in Swedish local service markets? The sectors we investigated in our empirical analysis were real estate agents, plumbers, and restaurants.

The results from the adjusted ETR, which is our main model, show that the effect from entry in a monopoly is larger in magnitude than the effect estimated in the standard ETR framework. In the fixed effect specification, we estimate a change in markup at around 1.9 when then the market goes from a monopoly to a duopoly for all sectors we investigate. With this specification, we do not find significant ETRs for the third, fourth and fifth entrant.

In the constant elasticity specification, we estimate a change in markup of 1.5 for the plumbing sector and the restaurant sector, and a change of 2.0 for the real estate agent sector. With this specification, we find significant ETRs for the third, fourth and fifth entrant which are lower in magnitude, indicating less effect on competition with each subsequent entrant. When combining the results from the two specifications we conclude that when markets go from a monopoly to a duopoly, the markup was between 50% and 100% higher before the entry of the second firm.

We find standard ETRs of approximately 1.2 for all investigated sectors when markets go from one firm to two firms. Except for plumbers, we do not find significant competition effects with the third, fourth and fifth entrant. The fact that the adjusted ETRs are higher than the standard ETRs indicate that we underestimate the effect of competition when we do not take market expansion into account.

When comparing our findings to previous research, we note that both our standard ETR and unadjusted ETR are generally higher in magnitude than those of Schaumans and Verboven. They present standard ETRs that are close to one for the second entrant in the same sectors and unadjusted ETRs around 1.3, meaning they only find effect on competition in the adjusted ETR framework. We estimate a higher effect on competition in both frameworks. We also estimate a lower degree of market expansion in the Swedish markets relative to the market expansion in Belgian markets, presented by Schaumans and Verboven. These differences are likely because we used a broader geographic definition of our markets.

For the plumbing industry, Bresnahan and Reiss (1991) presented standard ETR for plumbers that were close to one for the second, third, fourth and fifth entrant in geographically concentrated markets in the western United States. In the Swedish markets, we found significant standard ETRs at around 1.2 for the second, third, fourth and fifth entrant. This could indicate that the effect of entry on competition in Swedish local service markets is higher than in US markets. We do not know the effect of entry on markup in the US markets and we cannot draw further conclusions from this comparison.

In our thesis, we used data on population on the level of locality that was freely available. With more recent data on localities, we could have increased the size of our sample with more localities and reduced a potential source of measurement error. The question regarding availability of reference data for Swedish addresses and postal codes can be compared to the case of Danish Address data. In a study from 2010, The Danish Business Authority found that there were large social benefits from switching to a free-of-charge agreement in 2002, meaning that the price of obtaining the Danish address data was zero while the government maintained the data. If such a setup would be adopted in Sweden, we believe that the thresholds for future research in local geographical markets would be lowered.

In future research, we would suggest that one relates the entry thresholds to that of the competitive level, e.g. the ETR/adjusted ETR in urban areas as well as more isolated rural areas. This would allow the researcher to get a better understanding regarding the actual strength of competition at different market concentrations in addition to the more relative measures presented in this thesis. This would also make it easier to compare the results to theoretical predictions. Other suggestions would be to include multiple years in the analysis, similarly to Lábaj et. al. (2018), to determine how the effect of entry in local service sectors change over time.

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Appendix

A1 Sectors not suitable for analysis in the Swedish setting**.**

Below are shown some statistics as well as preliminary results for two sectors, bakeries and butchers, that we initially looked into but deemed unsuitable for analysis, a glance at the tables below will show why.

Table A1. Number of markets with a specific number of firms for Bakeries and Butchers

N	Bakeries	Butchers
0	758	1015
1	98	54
2	19	3
3	1	1
4	1	0
≥5	0	0
Total	877	1073

As we can see in table A1, there are very few markets that have more than one or maybe two firms in these sectors, and some values of N is lacking completely. From an a priori basis, these statistics does not suggest that any reliable results can be obtained, and we chose to drop these and some other sectors, for similar reasons, from our analysis.

In order to show how this lack of data would translate into results we have made the first stage of analysis with bakeries and butchers. The results from the standard ETR model is shown in table A2.

Table A2. Simple Entry Threshold and Entry Threshold Ratios for all sectors.

Single Entry Equation		
	Bakeries	Butchers
ET1	11215	106031
ET2	53565	1536595
ET3	263550	4833732
ET4	398073	N/A
ET5	N/A	N/A
ETR2	2.388	7.246
ETR3	3.280	2.097
ETR4	1.133	N/A
ETR5	N/A	N/A
N	877	1073

What especially stands out in table A2 is the entry thresholds. For bakeries, the suggested entry threshold for a second entrant is over 53,000 and considering that the largest market size included in our sample is 15,000 this result is associated with a very high degree of uncertainty. For Butchers, the result is even more extreme, with the suggested entry threshold for even one firm being over 100,000. Since we cannot, comfortably, draw any conclusions from predicted values that lays outside the range of our sample, dropping these sectors from our analysis was correct.