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Intensity of competition and Market structure in the Italian Banking Industry

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Abstract

The aim of this paper is to test the predictions of Sutton's model of independent submarkets for the Italian retail banking industry. This industry, in fact, can be viewed as made of a large number of local markets corresponding to different geographical locations. In order to do that, I first develop a model of endogenous mergers that shows how the number of firms is determined by the initial number of firms, by the intensity of competition, and by the degree of product differentiation, and how this in turn affects the one-firm concentration index. Then, in the second part, the number of banks in each submarket is estimated using a truncated model and a Poisson model. The size of the submarkets turned out to be at most provincial. Finally, the one-firm concentration ratio of each province is regressed on the number of banks, also in interaction with market size variables. As argued by Sutton for industries with exogenous sunk costs, a stronger and negative relationship is found as the market becomes larger.

Keywords: Exogenous Sunk Costs, Intensity of competition, Concentration, Truncated and Poisson models

JEL Classification: C24, D43, L11, L89

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1 Introduction

Sutton's model of independent submarkets predicts that equilibrium outcome must involve some minimal degree of size inequality for aggregate submarkets. His 'lower bound' approach emphasizes the strategic choice of sunk costs in a very general framework, focusing on the relationship between market structure, market size and intensity of (price) competition.

Under this scheme, both homogeneous-horizontally differentiated products and advertising-R&D intensive (vertically differentiated products) industries can be analysed. For the former type of industries, with fixed sunk costs, it is possible to show an inverse relationship between market size and market structure. That is, the lower bound to concentration declines to zero as the ratio of market size to setup cost increases. For the latter type of industries, where sunk costs are endogenous, the lower bound to concentration does not converge to zero and does not necessarily decline as market size increases. This is because sunk costs, such as advertising or R&D expenditure, increase with the market size. Such expenditure is a choice variable of (perceived) quality. By increasing the level of advertising-R&D, firms are able to gain (or to maintain) market share. Therefore, as market size increases, an '*escalation mechanism*' could raise fixed costs per firm to such an extent that the negative relationship between market size and market structure will break down.

I analyse the Italian retail banking industry as a special case of the first type of industries. In fact, it consists of a large number of local markets that arise because there are many different geographical locations throughout the country. In every submarket products are fairly good substitutes and banks compete against each other by means of their branch locations. Instead, the degree of substitutability is substantially lower for products and services offered in neighbour submarkets.

First of all, I examine the firm strategic behaviour referring to a three-stage non cooperative game. In the first stage, firms decide to enter the industry, paying a fixed exogenous sunk cost. In the second stage, firms that have entered might merge by forming a coalition. Finally, in the last stage, firms will set quantities. In so doing, it is possible to show that the number of firms - and the incentive to merge to a monopoly - are lead by the intensity of competition and by the degree of product substitution, and how this ultimately determines the one firm concentration index.

In the second part of this paper, after characterizing the Italian banking industry under this scheme, I estimate the number of firms in each submarket using data on the national banks branches location. To take into account that the number of firms is discrete and greater than zero, a truncated model and a Poisson model are used. The analysis confirms that the province (at most) is the size of each submarket. So, at this level, it is possible to compute the one firm concentration ratio and to regress it on the number of banks. Results support the hypothesis of exogenous sunk cost for this industry.

The paper is organized as follows. The next section presents a theoretical framework to analyse the relationship between firm conduct and concentration based on the Sutton approach. Sections 3 and 4 describe the banking industry referring to this framework and the characteristic and the construction of the dataset. In section 5 the econometric model and results are presented. Conclusions are in the final section.

2 The theoretical approach

Sutton (1991, 1997, 1998) describes the impact of firm conduct on market structure identifying two key aspects: the intensity of competition and the level of endogenous sunk costs. Considering these elements, he distinguishes between two general types of industry. One class is characterized by industries that produce homogeneous and horizontally differentiated products. The other category is composed of industries engaged in the production of vertically differentiated products.

In the first type of industries, the only important sunk costs are the exogenously determined setup costs, given by the technology. In such industries Sutton (1998) predicts a lower bound to concentration, which goes to zero as the market size increases and rises with the intensity of price competition. The idea is that as market size increases, profits also increase, and given free entry, other firms will enter the market until the last entrant just covers the exogenous cost for entry. Also, the higher the competition, the higher the concentration index.

In fact, as the competition gets stronger, the entry becomes less profitable and the higher the level of concentration is to be in order to allow firms to cover their entry cost[1].

It is important to underline that the intensity of competition will not simply represent firm strategies but, rather, the functional relationship between market structure and price and profits. It is derived by institutional factors, and therefore is not only captured by the price cost margin. More generally, an increase in the intensity of competition could be represented by any exogenous influence that makes entry less profitable, e.g the introduction of a competition law (Symeodonis (2000), Symeodonis (2002)).

In the second type of industries sunk costs are endogenous. Firms pay some sunk cost to enter but can make further investments to enhance their demand. As market size increases, the incentive to gain market share through advertising and R&D expenditure also increases, leading to higher fixed cost per firm. Even though room for other firms is potentially created, the 'escalation mechanism' will raise the endogenous fixed costs, possibly breaking down the negative structure-size relationship that exists in the other type of industries. For such industries Sutton's model predicts that the minimum equilibrium value of seller concentration remains positive as the market grows[2].

Sutton's model offers very clear predictions for the first group of industries whereas it is not possible for industries where sunk costs are endogenous.

Insofar as it is possible, the next step will be to verify if the empirical evidence for the Italian retail banking industry is consistent with this theory.

2.1 Exogenous sunk cost industries: the model

This section analyses the market size-concentration relationship in exogenous sunk cost industries, explicitly accounting for the intensity of competition. In

[1] A way to model an increase in the 'toughness of price competition' is to consider a movement from monopoly model to Cournot and Bertrand model. For any given market size, the higher the competition at final stage, the lower the number of firms entering at stage 1, and the higher the concentration index (ex-post). See Sutton (2002).

[2] To be more precise, Sutton goes further in distinguishing within the endogenous cost categories between low-α and high-α industries. In the low-α type industries, due to R&D trajectories, we will still observe low level of concentration

such industries, firms will face some sunk cost to enter but cannot make further investment in order to enhance their demand.

Assuming that all consumers have the same utility function over n substitute goods (or n varieties of the same product) as follows:

$$U(x_1, ..., x_n; M) = \sum_k (x_k - x_k^2) - 2\sigma \sum_k \sum_{l<k} x_k x_l + M, \qquad (1)$$

where x_k is the quantity of good k and M denotes expenditure on outside goods whose price is fixed exogenously at unity. The parameter σ, $0 \leq \sigma \leq 1$, measures the degree of substitution between goods[3]. When $\sigma = 0$ the cross product term in the utility function vanishes so that product varieties are independent in demand, whereas if $\sigma = 1$, the goods are perfect substitutes. For the utility function (1), the individual demand for good k is:

$$p_k = 1 - 2x_k - 2\sigma \sum_{l \neq k} x_l \qquad (2)$$

If there are S identical consumers in the market and we denote with x_k the per-capita quantity demanded of good k, market demand for this good is Sx_k.

Considering now a three stage game. In the first stage, a sufficiently large number of ex-ante identical firms, N_0, simultaneously decide whether or not to enter the market incurring an entry cost of ϵ. In the second stage, firms that have decided to enter decide to join a coalition. All the firms that have decided to join the same coalition then merge. In the third stage, firms set their output. All coalitions are assumed to face the same marginal cost of production c, which we can normalize to zero.

2.2 The game: equilibrium analysis

In stage 2, each firm $i \in \{1, ..., N\}$ simultaneously announces a list of players that it wishes to form a coalition with. Firms that make exactly the same announcencement form a coalition together. For example, if firms 1 an 2 both

[3]This is a quadratic utility function and it has previously used by Spence(1976), Shaked and Sutton (1990), Sutton (1997, 1998) and Symeodonis (2000). The banking sector is usually analysed under hotelling-type model. However, it is possible to show that any hotelling-type model is a special case of vertical production differentiation. See Cremer and Thisse (1991).

announced coalition $\{1, 2, 3\}$, while firm 3 announced something different, then only players 1 and 2 form a coalition. Since all firms are initially symmetric, members of each coalition are assumed to equally share the final stage profit.

Let $\lambda = \frac{dx_j}{dx_i}$ represent firm i's conjectural variation, that is its expectation about the change in its competitors production resulting from a change in its own production level, and assume that this conjecture is identical for all firms ($\lambda_i = \frac{dx_j}{dx_i} = \lambda$). We can refer to λ as the competitive intensity of the industry, with lower values of λ corresponding to more intense competition.

Assuming that quantity is a strategic variable, profit maximization requires that $\partial\Pi_i/\partial x_i = 0$. In equilibrium:

$$x_i = \frac{1}{2(2 + (N-1)\sigma(1+\lambda))} \tag{3}$$

and the profit of each of the N firms is

$$S\Pi_i = S\frac{1 + \lambda(N-1)\sigma}{2(2 + (N-1)\sigma(1+\lambda))^2} - F \tag{4}$$

For $F \geq 0$, $N \geq 2$ and $-1 \leq \lambda \leq 1$, and $0 \leq \sigma \leq 1$ each firm's profit is a decreasing function of the number of firms in the industry, its competitive intensity and the amount of fixed costs. Two reasons could lead firms to merge: market power and efficiency. To maintain things simpler, we avoid to account for efficiency gains. In this analysis, firms could not make any further investments to enhance their quality (and hence the demand) of the product offered. We can set $F = 0$. In any case, a clear picture in similar framework is offered by Rodrigues (2001).

Following the traditional backward induction procedure, we analyze the condition under which we get a monopoly in *exogenous sunk cost industries* model.

Quantity setting stage Let N_2, $N_2 \leq N \leq N_0$, denote the number of coalitions of firms at the end of stage 2. From equation (4) firm profits are

$$S\Pi(N_2) = \frac{1 + \lambda(N_2-1)\sigma}{2(2 + (N_2-1)\sigma(1+\lambda))^2} \tag{5}$$

Coalition formation stage At this stage those firms who entered may merge to form a coalition.

I restrict the conjectural variation coefficient to the range $-1 \leq \lambda \leq 1$. In so doing, the possibility of λ being larger than the value that would imply perfectly collusive post-merger behaviour is restricted. A coalition structure is said to be an outcome of a Nash equilibrium if no player has incentive to either (individually) migrate to another coalition or to stay alone (Vasconcelos (2006); Yi (1997))[4].

Consider a coalition structure composed of coalitions of the same size. It is said to be stand-alone stable if

$$\frac{N_2}{N}[S\Pi(N_2|\lambda,\sigma)] > S[\Pi(N_2+1)|\lambda,\sigma] \tag{6}$$

In case of monopoly, $N_2 = 1$. Hence, in order for a single 'grand coalition' to be the outcome of a Nash equilibrium of the coalition formation game in *exogenous sunk cost industries*, the following is a necessary and sufficient condition[5]

$$\Pi(1)/N > \Pi(2) \tag{7}$$

Hence,

$$\frac{(1+\lambda\sigma)}{2(2+\sigma(1+\lambda))^2} < \frac{1}{8N}$$

$$N < \frac{(2+\sigma(1+\lambda))^2}{4(1+\lambda\sigma)} \equiv \bar{N}(\sigma,\lambda) \tag{8}$$

A merger towards monopoly leads to the formation of a single grand coalition with N firms. A firm belonging to the initial wave of N entrants will get a share $1/N$ of the coalition overall profits, whereas by free-riding on its N-1 merging rivals it can obtain duopoly profits. Each time in which the 'grand coalition' is unstable, as market size increases, more firms want to enter and to free ride and form a duopoly instead of joining the grand coalition. That means, as the market size rises, the concentration ratio goes down [6]. This result shows how this process in turn can affect the one firm concentration ratio, $C_1 = \frac{q}{N_2 q} = 1/N_2$.

[4]To be more precise, this latter case in which no firm can unilaterally improve its payoff by forming a singleton coalition is called stand-alone stability. However, stand-alone stability is a necessary condition for Nash stability.

[5]The only possible deviation it is in fact towards the singleton coalition.

[6]It is valuable to remark that in this model it is implicitly assumed that the pre-merger behaviour is not affected by the coalition formation stage.

When λ lies in the range previously defined, and fixed costs are zero, $N(\sigma, \lambda)$ is strictly decreasing in λ. Therefore, the weaker the competitive intensity, the larger the pre-merger market concentration should be for a monopoly to emerge through merger.

In particular, if $\sigma = 1$, we can rewrite equation (8) as

$$N < \frac{1(\lambda + 3)^2}{4(\lambda + 1)} \tag{9}$$

The RHS is strictly decreasing in λ. As λ approaches -1, the value of perfect competition, condition (9) is alway satisfied, and so, merger to monopoly would occur whatever the number of firms in the industry. Hence, the higher the intensity of competition at stage 3, the lower the pre-merger market concentration could be in order for a monopoly to emerge through merger.

When $\lambda = 0$, that is firms behave as in Cournot, monopolization will occur only if $\sigma \geq 0.83$. If this condition is not met and more than two firms enter in stage 1, and merge in a single grand coalition, that equilibrium might not be stable. As σ approaches 1, competition becomes tougher as products are closer substitutes, and the lower bound to the one firm concentration ratio decreases as market size increases.

On the other hand, in perfectly cooperative industries, where $\lambda = 1$, or when demands are perfectly independent, where $\sigma = 0$, merger to monopolization will never occur. However, it is important to remark that we are not considering cost efficiency gains that would probably give an incentive to merge even in the case that market demands are completely independent.

Entry stage At stage 1 firms decide to enter.

If $\sigma = 1$ products are perfect substitutes, a merger to monopoly will occur at the second stage of the game if firms compete very toughly. Then, if firms anticipate that a monopoly coalition structure is going to be formed at stage 2, firms will enter up to a point at which N is the largest integer value satisfying

$$\frac{1}{N}(S\Pi(1)) \geq \epsilon \tag{10}$$

where $\epsilon > 0$ is the entry fee. By the same reasoning, therefore, if the competitive intensity is extremely strong, the firms will merge to monopoly. For any given level of market size, the equilibrium level of concentration is higher. However, entry will occur at the first stage and the lower bound to concentration goes down[7].

If products are imperfect substitutes - and $\lambda = 0$ - a merger to monopoly might not take place. In particular, when $\sigma < 0.83$, a merger to monopoly might not take place since a firm could prefer to get all the profits of a duopolist.

This means that as the market size rises, more firms enter and this makes the monopoly unsustainable as individual firms want to free ride and form a duopoly. Thus, there is an upper bound to concentration that goes down as market size increases (Vasconcelos (2006)).

3 The Italian retail banking industry

I consider now the banking retail industry as belonging to an industry of the first type where sunk costs are exogenous. In fact, it can be viewed as made of a large number of local markets corresponding to different geographical locations. In each one of these independent submarkets, there are several branches of different banks competing against each other, and whose goods are fairly substitutes[8].

In addition, from the demand side, submarkets can be considered as independent: zero cross-elasticities are likely to characterize the geographically separated submarkets, whereas small elasticities are likely to tipify partially overlapping markets (that is, for firms belonging to the same submarket $\sigma \to 1$, whereas for firms from different submarkets $\sigma \to 0$)

3.1 Exogenous or endogenous sunk costs?

In the banking industry we would expect both exogenous and endogenous sunk costs to be relevant, with both horizontal and vertical differentiation. However,

[7]Also, from the previous analysis, since $\partial\Pi/\partial N < 0$ and $\partial\Pi/\partial\lambda > 0$, by applying the implicit function theorem, one concludes that $\partial N/\partial\lambda = \frac{-\partial\Pi/\partial\lambda}{\partial\Pi/\partial N} > 0$. The equilibrium number of firms is decreasing in the intensity of competition at stage 3.

[8]A very similar model is Cerasi (1996). Cerasi develops a model of competition in retail banking in which banks compete first in branching and then in prices. She shows that for small market size unit banks there is an equilibrium whereas branching bank prevails in case of larger market size. In addition, branch deregulation turns out to foster price competition and to imply a higher concentration and larger average branching size of banks.

in this work I am considering the *retail sector* and, therefore, I am not looking at branches as one of the costs in advertising and quality (employee compensation, branch staffing...) that banks will incur in order to enhance consumer willingness to pay. Indeed, as banks become more and more visible through branches, one could consider branches as a form of advertising itself.

On the contrary, I am looking at branches as the main distributional channel of certain banking products. The boundaries of the relevant market depend on the products involved: for retail banking, the local dimension is still relevant since lending and borrowing activities take place mostly whitin a narrow geographical region and operations are similar and repeated during the time. Despite the advances in home and phone banking, the preferences of customers seem to be still biased toward entities with strong regional and local contents. As a result, a customer is likely to shop only at those companies that operate in the neighborhood of the area where he lives and works. As a consequence, retail banking can still be taken as an industry in which banks sell slightly differentiated products competing across many independent geographic submarkets.

However, even in this case there are circumstances in which endogenous costs could arise. As pointed out by Petersen and Rajan (1995) relationship lending may generate severe barriers to entry. Developments in the financial industries however with new contracts and new intermediaries are likely to reduce the role of close bank-firm relationships (Rajan and Zingales (2003)). In addition, the advent of information and communication technologies increased the ability of banks to open branches in distant locations, considerably reducing the cost of distance-related trade and enhancing competition in local banking markets[9]. The opinions are not unique. Whatever the conclusion might be, we can foresee that it will at least influence the structure of the banking system in terms of the local nature of the banks but not the number of branches that could be opened

[9]Berger, for example, has recently taken an opposite view with respect to his previous study (Berger et al. (2003)) where it is claimed that services to small firms are likely to be provided by small banking institutions since they meet the demands of informationally opaque SMEs that may be constrained in the financing by large institutions. He now claims that this vision could be an oversimplification: new transaction technologies are now available enabling large banks to overcome informational constraints. See Berger and Udell (2006) and Affinito and Piazza (2005).

given market demand[10].

In other words, I am assuming that branches of different banks offer similar (bundle of) services despite bank size and, hence, the number of branches in a given submarket could be considered as the number of varieties of services offered by banks. It is obvious that in the industry as a whole both endogenous and exogenous interact with one another to determine market structure. The approach and conclusion could be very different (Dick (2007)).

3.2 Market equilibrium

The predictions of Sutton's model apply to markets in equilibrium. However, when there are discontinuities in the normative (or economic) conditions, a process of consolidation could arise. That makes it difficult to disentangle the relationship between competition and concentration as predicted by Sutton from that caused by the process of mergers and acquisitions, unless we are observing the market at the end of the process of consolidation. This means that we are making the implicit assumption that the retail baking sector reached an equilibrium in 2005. This assumption - though strong - seems reasonable, given the great shake-out experienced especially during the last decade.

Beginning in the 1980s, the Italian Banking system underwent a series of reforms aimed at increasing the competition in the market through liberalizing branching and easing the geographical restrictions on lending. In fact, the opening of new branches had been regulated by the 'branch distribution plan', issued every four years. The last distribution plan was issued in 1986 and, since March 1990, the establishment of new branches has been completely liberalized. The number of branches increased steadily, up to 31.081 in 2005, as well as the number of people served by each branch, 47 per 100.000 inhabitants in 2004 (compared to 59 EU mean). In particular, the number of banks mergers and acquisitions of control per year was 45 in 1990 and decreased substantially to 5 in 2005[11]. At the same time, in more than 50% of the provinces, new banks

[10] To have a picture of the role of local banks and how the probability of branching in a new market depends on the features of both the local market and the potential entrant, see Di Salvo et al. (2004), Bofondi and Gobbi (2004) and Felici and Pagnini (2005).

[11] Referring to March 2005. It is important to remark that the process of consolidation with foreign banks is now gaining relevance. See ICB (2004).

entered the market. This process of new entry, parallel to the process of consolidation, made the average number of banks in each province rise from 29 in 1990 to 34 in 2005.

4 Characteristic and construction of the dataset

The dataset is composed of 103 Italian provinces and 717 banks. In total, there are 84 groups of banks to which 229 banks belong. The greater part of banks, 488, does not belong to any group[12]. For each province I have data on the number of banks and their number of branches for the year 2005 as collected by the Italian Central Bank (Banca d'Italia)[13]. I also have data about GDP, number of inhabitants, density of population as collected by National Institute of Statistics (Istat).

A description of the variables involved in the analysis follows, as well as indications for the theoreticals variables they should account for. The name of the variable that will be used in the empirical assessment is reported in square brakets [ ].

- *Concentration* $= C_1$

  To measure concentration the 'one-bank concentration ratio', [$C1$], is used. The bank concentration ratio is defined as the fraction of the number of branches owned by the largest bank within the market.

- *Market size* $= S$

  It is likely to vary with the level of demand measured by GDP, [VA_pct], and by population, [$CATPOP$], in the province considered[14]. Table 4 shows how variable [$CATPOP$] has been constructed.

[12]Therefore, I observed 572 banks or group of banks over 103 provinces for a total of 2762 observations. However, I do not consider in this count the number of branches belonging to foreign banks. For further information see ICB (2005) and `http://www.bancaditalia.it/pubblicazioni/ricec/relann/rel05/rel05it/vigilanza/rel05_attivita_vigilanza.pdf`

[13]`http://siotec.bancaditalia.it/sportelli/main.do?function=language\&language=ita.`

[14]Since data on GDP for the year 2005 was not available,in the analysis I used the percentage of value added pertaining to each province for year 2004. The relative position of each province is unlikely to markedly change from one year to another. Regarding data on population for the year 2005 I relied on Istat forecasting at `http://demo.istat.it/stimarapida/`

- *Intensity of competition and product differentation* = λ *and* σ

  So as to control for different market features, I control for population density, $[DENS]$, measuring thousands of people per Km^2. The higher the density, the lower the number of banks: comparing two submarkets with the same number of inhabitants, I expect that the number of branches will be less in the submarket with a high population density.

  To measure the intensity of competition and product differentiation, I computed three indices:

  - $[K] = Totalbranches/Km^2$. It represents the monopolistic power of each branch and could be considered as a proxy of the (inverse of) transportation costs. More branches in the same provinces means, for each consumer, a lower distance to cover to reach a branch, a weaker power exerted by bank branch and an overall higher degree of competition.

  - $[P] = Totalbranches/Population$. It is the number of branches for a thousand inhabitants. The higher P, the higher the competition. It can be considered as a proxy for the (inverse of) queueing costs. The less the population served by each branch (or the higher the number of branches for each individual), the lower the cost met by the customers[15].

  - $[CV]$ =*standarddeviation*/*Branchesmean*. It is the coefficient of variation. It is a dimensionless number and it is calculated by dividing the standard deviation by the mean of branches in each province. The higher the CV, the higher the degree of differentiation by branches opening, since some bank has smaller branch network size whereas others have greater branch network size.

- *Market Borders*

  Since the unit of observation is the bank (or group of banks), I also compute for each bank in every submarket (province)

  - the total number of its own branches $[NB\_OWN_{i_m}]$

  - the total number of branches of its competitors $[NB\_COMP_{i_m}]$

[15]It is interesting to note that these two indices, K and P, split the information contained in the density of population, $DENS = population/Km^2$

The same quantities are also computed for all the 'closest' provinces (less than 100 Km) $[NB\_OWN\_OUT_{i_m}]$ and $[NB\_COMP\_OUT_{i_m}]$[16].

5 Intensity of competition and concentration: Empirical model and results

Firms can grow (and differentiate) by expanding their product line or geographical areas (Walsh and Whelan (2002))[17].

Previous works that test the Sutton approach are Sutton (1998) for the US Cement Industry, de Juan (2003) for the Spanish Retail Banking Sector, Buzzacchi and Valletti (2005) for the Italian Motor Insurance Industry, and Asplund and Sandin (1999) for the Swedish Driving Schools Sector.

According to Sutton's model, the number of branches per submarket is a function of the relative size of the submarket, of the intensity of competition and of the cost incurred to entry. As market size increases, profits also increase, and given free entry, other firms will enter the market until the last entrant just covers the exogenous cost of entry. As a consequence, as the previous analysis also showed, the relationship between the number of firms (or concentration) and the market size will in general depend on the intensity of competition and the degree of product differentiation.

An accepted dimension for the market in the Italian retail banking industry is provincial. Using data on the number of branches in 103 provinces, this hypothesis is tested.

In order to estimate the number of banks in each submarket, a truncated model and a Poisson model are used. The truncated model allows us to take into account that the dependent variable, $NFIRMS$ is non negative. The latent

[16] I performed an alternative analysis computing the number of branches of each bank, and those of its competitors, outside the province but in the same region. The reason for trying this specification is to test the alternative regional dimension for market size that is, in general, used by the authorities or in similar studies. The results are substantially analogous.

[17] A key insight of Sutton's analysis is that large companies are large because they have a greater coverage than small companies. In particular, in homogeneous good industries, firm size is mainly determined by the degree to which firms operate over geographical locations, and not by the nature of competition whitin the geographic location (Hutchinson et al. (2006)).

variable, $NFIRMS^*$, is assumed to be

$$NFIRMS^*_{i_m} = X'_{i_m}\vartheta + e_{i_m} \tag{11}$$

where $m = 1...103$ is the submarket, i_m is bank i in submarket m,

$X_{i_m} \equiv (NB\_OWN_{i_m}, NB\_COMP_{i_m}, NB\_OWN\_OUT_{i_m}, NB\_COMP\_OUT_{i_m},$
$CV_m, P_m, K_m, VA_m\_pct)$

and

$$NFIRMS_{i_m} = NFIRMS^*_{i_m} \quad if \quad NFIRMS^*_{i_m} > 0 \tag{12}$$

Since not all of the 572 banks (or group of banks) are active in every province, the subscript i_m goes, for each m, from $N_{m-1}+1$ to N_m, where the total numbers of banks, $N_m = N_{m-1} + n_m$, gets incremented by n_m, the total number of banks in each province and $N_0 = 0$. The overall sample size, $n_1 + ... + n_{103}$, is equal to 2762.

The number of bank branches in each province, $NB\_OWN_{i_m}$ is likely to vary with the level of demand. Therefore, it is reasonable in the estimation to control for the level of demand, represented by GDP, $[VA_m\_pct]$, and the population spread, $[DENS_m]$. Furthermore, to account for different intensity of competition in the province, I computed two indices of competition, K_m and P_m[18]. Then, to take into account the border of submarkets, I consider the number of branches of each bank in each province $[NB\_OWN_{i_m}]$ and outside the province $[NB\_OWN\_OUT_{i_m}]$, and the number of branches of 'other banks', distinguishing them between other bank branches in the same provinces $[NB\_COMP_{i_m}]$ and other bank branches outside the provinces $[NB\_COMP\_OUT_{i_m}]$[19].

The degree of product differentiation is captured by the coefficient of variation, $[CV_m]$, that measures how banks are differentiated in terms of total size of their network of branches inside each province.

Results are reported in table 1.

As expected, the value of the coefficient is higher for branches in the same provinces $[NB\_OWN_{i_m}]$ and $[NB\_COMP_{i_m}]$, and lower and close to zero for

[18]See section 4.

[19]Please see note 14.

banks outside [$NB\_COMP\_OUT_{i_m}$]. This result suggests that province could be considered - in general - as an independent submarket.

The sign for the K coefficient is negative and significant whereas the value of the P coefficient is smaller, positive and significant. These results suggest, as one could expect, that transportation costs are more relevant in the retail market, and, therefore, a higher branch density increases competition lowering the expected (ex-post) number of banks.

The value of the coefficient on CV is positive and significant. In accordance with the model developed in the previous section, the higher the degree of differentiation, the higher the number of banks. Since consumers have preferences about total number of branches, some banks have greater network size with respect to other competitors and are able to capture more consumers by differentiating themselves by opening more branches. In equilibrium, therefore, higher asymmetry in branch size (a higher value of CV) is compatible with a large number of banks. On the contrary, the sign of the coefficient for the density of population and GDP are significant and with unexecpted signs. This is due to a non-linear relationship between these variables and the dependent variable, as it is confirmed by the next analysis.

The drawback with the truncated model is that it does not use the information that $FIRMS$ is an integer variable. An alternative solution, applied to most count data model, is the Poisson model, where the probability that there are exactly N firms in the market, conditional on N being greater than zero, is

$$Prob(NFIRMS_{i_m} = N|N > 0) = \frac{e^{-\gamma_{i_m}}\gamma_{i_m}^N}{N!(1 - e^{\gamma_{i_m}})}, \tag{13}$$

for $N = 1, ..., \infty$ and $\gamma_{i_m} = exp(\delta X_{i_m})$.

The Poisson model implies that both the conditional mean and the conditional variance are equal to the γ parameter. Apart from the specific functional form imposed on the distribution, if this restriction is violated, the coefficients estimated through this model are still consistent but their standard errors are not (Asplund and Sandin (1999))[20]. In addition, in this case we have to correct

[20]Robust standard error are reported. To take into account that the observations are independent across provinces (clusters), but not necessarily within groups, cluster option is also added. In addition, a test for overdispersion reject the null at 5% level.

for the fact that data does not have value of 0. A 0-truncated Poisson model is therefore appropriate. This is to be distinguished from datasets without 0 values, but which may have 0s.

The results of the zero truncated Poisson, table (2), confirm and reinforce those obtained by means of the truncated regression. In particular, we can accept the null hypothesis that both the coefficients of branches belonging to banks outside the province are zero, again strengthening the point of independence among provincial submarkets. Also, even the coefficient on GDP is positive and significant. Finally, the coefficients on K_m, P_m, CV_m, and VA_{m}_pct are all jointly significant[21]. However, our interest lies in measuring the change in the condititional mean of $NBANKS$ when regressors X change by one unit, the so called marginal effects[22]. For reporting purposes, in table (3) a single response value - the mean of the independent variables - is used to evaluate the marginal effects for regression 1 in table (2).

In the end, the estimated number of banks in the zero truncated Poisson model allows to analyse the relationship between the size of the market and the one-firm concentration ratio at the provincial level, relying on a subsample made of 103 observations. In homogeneous industries, the number of firms represents the ratio between market size and sunk costs. As shown in table (5), the results support the hypothesis that the retail banking industry is characterized by exogenous sunk costs, and so, when market size increases, the concentration index goes down. In fact, once the dimension of the market is taken into account, by interacting the number of banks with a categorical variable representing the size of the population, $CATPOP$, the relationship becomes stronger and remains always negative and significant[23].

[21] Regression 2 and 3 in table (2) replicate the previous analysis for the zero truncated Poisson model *i)* for different macro-regions ($REGION1$=Nord, $REGION2$=Centre, $REGION3$=South) in which it is possible to group provinces, and *ii)* for different types of banks ($TYPE1$=BCC, $TYPE2$=BP, $TYPE3$= S.p.A). Though coefficients are significant, the introduction of these variables do not alter any conclusion.

[22] For linear regression marginal effects coincide with the estimated coefficients. For non linear regression this is no longer true. In that case, $E[NBANKS|X] = exp(X'\beta)$, then $\partial E[NBANKS|X]/\partial X = exp(X'\beta)\beta$ is a function of both estimated parameters and regressors.

[23] A better alternative to estimate a model where the dependent variable is a proportion is to use glm with family(binomial), link(logistic) and robust standard errors. Results reported

6 Conclusions

The aim of this work was to test Sutton model of independent submarkets checking his predictions for the Italian retail banking industry and using the framework for the exogenous sunk costs industries. Even though the banking industry as a whole should be considered as characterized by endogenous sunk costs, there are several features that indicate the retail industry to be one of the former type. In particular, as banks branches sell slightly differentiated products in the retail sector, it is possible to look at the number of banks branches as different varieties of the same product offered by banks to their client. In addition, despite the advances of the phone banking, consumers' preferences are still biased toward regional entity, suggesting province as submarket dimension.

The model developed in the first part of the paper indicates which factors should influence the number of banks in each submarket, and as a consequence the one firm concentration ratio: the initial number of banks, the intensity of competition and the degree of product differentiation.

In the second part, a truncated and Poisson model has been used in order to estimate the number of banks in each submarket. This way of proceeding allowed me to check the hypothesis about the size and the independence among submarkets. In fact, the value of the coefficient on the number of branches for banks outside the provinces, but within a radius of a hundred of kilometers, turned out to be insignificant.

These result permitted to examine the one bank concentration ratio at provincial level. Interestingly, the one firm concentration ratio showed to be negatively related with the size of the market. That means that exogenous sunk costs are involved in the Italian retail banking industry. As argued by Sutton, as the dimension of the submarket become larger, and given free entry, the value of concentration ratio has to go down.

in table (6) confirm those obtained by means of standard regression model. An alternative solution is a logit transformation on the data. See Papke and Wooldridge (1996).

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Table 1: Estimation results: Truncated regression
Dependent Variable: Number of Banks - equation (11)

Variable	**Coefficient**	**(Std. Err.)**
Equation 1 : eq1		
NB_OWN	21.727**	(6.005)
NB_COMP	41.581**	(0.645)
NB_OWN_OUT	-1.775	(2.860)
NB_COMP_OUT	-0.689**	(0.175)
CV	1.999**	(0.520)
K	-40.348**	(2.661)
P	23.410**	(0.923)
DENS	8.625**	(0.989)
VA_pct	-13.860	(13.146)
Intercept	3.655**	(0.805)
Equation 2 : sigma		
Intercept	7.621**	(0.106)
N	2762	
Log-likelihood	-9495.753	
$\chi^2_{(9)}$	13913.139	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Table 2: Estimation results: Zero Truncated Poisson
Dependent variable: Numbers of Banks - equation (13)

Variable	**(1)**	**(2)**	**(3)**
NB_OWN	0.587**	0.785**	0.651**
	(0.186)	(0.132)	(0.183)
NB_COMP	0.848**	0.838**	0.881**
	(0.126)	(0.119)	(0.117)
NB_OUT_OWN	-0.089	-0.108	-0.127
	(0.099)	(0.098)	(0.100)
NB_COMP_OUT	-0.009	-0.006	0.005
	(0.018)	(0.016)	(0.017)
CV	0.147	0.154	0.202
	(0.139)	(0.131)	(0.129)
K	-1.532**	-1.487**	-1.379**
	(0.494)	(0.460)	(0.403)
P	0.977**	0.910**	1.263**
	(0.273)	(0.243)	(0.293)
DENS	0.416**	0.406**	0.348**
	(0.134)	(0.124)	(0.109)
VA_pct	1.918	1.807	0.920
	(2.157)	(2.025)	(1.682)
TYPE1	-	0.125**	-
		(0.035)	
TYPE2	-	0.031**	-
		(0.011)	
REGION1	-	-	-0.213†
			(0.113)
REGION2	-	-	-0.248*
			(0.121)
Intercept	2.359**	2.350**	2.245**
	(0.204)	(0.191)	(0.197)
N	2762	2762	2762
Log-likelihood	-9773.618	-9648.630	-9625.714
$\chi^2_{(9)}$, $\chi^2_{(11)}$, $\chi^2_{(11)}$	1252.937	1303.724	1333.29

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Standar errors ()

Table 3: Marginal Effects Zero Truncated Poisson
Predict Number of Banks = 31.10114

Variable	**dy/dx**	**(Std. Err.)**	**z**	**Pr>|z|**	$\overline{X}$
NB_OWN	18.40011	(5.49481)	3.35	0.001	.011365
NB_COMP	26.36771	(3.98064)	6.62	0.000	.439814
NB_OWN_OUT	-2.673699	(2.96687)	-0.90	0.367	.022528
NB_COMP_OUT	-.3173479	(.55019)	-0.58	0.564	.858577
CV	4.569757	(4.3241)	1.06	0.291	1.62084
K	-47.40764	(15.728)	-3.01	0.003	.175495
P	30.41265	(8.70722)	3.49	0.000	.592476
DENS	12.90453	(4.27279)	3.02	0.003	.320723
VA_pct	57.72792	(67.399)	0.86	0.392	.014142

Table 4: Variable: CATPOP

Category	**Population**	**Observations**	**(Perc.)**	**Cum**
CATPOP1	<220.000	20	19.42	19.42
CATPOP2	220.000-350.000	24	23.30	42.71
CATPOP3	350.000-480.000	21	20.39	63.11
CATPOP4	480.000-900.000	26	25.24	88.35
CATPOP5	>900.000	12	11.65	100.00

Source: ISTAT

Table 5: Estimation results: OLS
Dependent variable: One-bank Concentration Index

Variable	**Coefficient**	**(Std. Err.)**
banks	0.475**	(0.155)
CATPOP2*banks	-0.177	(0.150)
CATPOP3*banks	-0.389**	(0.136)
CATPOP4*banks	-0.462**	(0.122)
CATPOP5*banks	-0.474**	(0.131)
Intercept	22.667**	(2.635)
N	103	
R^2	0.172	
$F_{(5,102)}$	4.137	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Table 6: Estimation results: GLM

Dependent variable: One-bank Concentration Index

Variable	**Coefficient**	**(Std. Err.)**
banks	0.023**	(0.007)
CATPOP2*banks	-0.008	(0.007)
CATPOP3*banks	-0.019**	(0.006)
CATPOP4*banks	-0.023**	(0.006)
CATPOP5*banks	-0.023**	(0.006)
Intercept	-1.214**	(0.137)

N	103
Log-likelihood	-41.024
$\chi^2_{(5)}$	24.148

Significance levels : † : 10% $*$: 5% $**$: 1%