Market Structure and Intensity of Price Competition in EU Banking

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Abstract

Goals of this paper are to analyse determinants of market structure as well as intensity of price competition in the EU banking industry. For this purpose, the first part of the paper applies the Sutton's (1991) framework for measuring empirically the relationship between market concentration and market size. Then, the analysis turns on assessing degree of price competition applying a recently developed method of measuring banking competition (Tabacco 2013). Results suggest a null relationship between market size and concentration, and the estimated lower bound to concentration is well away from zero. These two pieces of empirical evidence support Sutton's endogenous sunk costs model. Moreover, empirical estimates of the measure of competition, distance to the lower bound, suggest that the majority of EU National banking markets have evidence of low intensity of price competition. In contrast, Estonia, Netherlands, Finland and Lithuania appear to have the most competitive banking industry.

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I INTRODUCTION

The global financial and economic crisis 2008-2009 initiated in U.S. and then spreads out all over the western economies has brought special attention on the banking industry. There have been emerged among economists and policymakers (e.g. keynote lecture at EARIE 2013 by Dewatripont) debates about how and how much to regulate as well as degree of competition to be in the banking industry, in order to ensure financial stability and to foster economic growth.

In this paper, I provide an assessment of market structure and intensity of price competition in the EU National banking markets from 2007 to 2012. I apply the Sutton's framework (Sutton 1991) to analyse empirical relationship between market size and concentration. One main point of Sutton's work is that much can be learnt about firms' competitive conduct from studying market concentration at differing levels of market size. In addition, I empirically estimate a new measure of banking competition whose theoretical framework is developed in Tabacco (2013) to ascertain how fierce, or how soft, price competition is. In that article, using the body of industrial market structure and firm leadership under endogenous entry developed by Sutton (1991, 1998) and Etro (2006, 2008) respectively, I provide the theoretical framework for the new banking competition measure: distance to the lower bound to concentration, which has a neat monotonic positive relationship with intensity of price competition. This theoretical framework holds for wide class of oligopoly models with various alternative model specifications (homogeneous products, horizontal product differentiation, vertical product differentiation with Bertrand or Cournot competition, simultaneous or sequential entry, single product firms or multiproduct firms, first mover advantage and firms' asymmetries).

Empirical evidence suggests a flat relationship between concentration and market size as well as bringing a lower bound to concentration considerably above zero as market size becomes very large. These results lend support to the endogenous sunk costs model, where banks compete in service quality through sunk costs investments, such as number of branches per square kilometre and number of employees per branch. Moreover, estimates of the new measure of competition suggests that EU National banking markets, apart very few exceptions, show lack of price competition intensity.

This paper is related to various streams of literature. One includes contributions on applying Sutton's endogenous sunk costs model in single industries. Dick (2007) is the first to apply the Sutton's framework to the banking industry. While Ellickson (2007) studies supermarkets, Latcovich and Smith (2001) focus on online book market, and Berry and Waldfogel (2010) investigate newspaper and restaurant industries. In addition to the single industry literature, over the

last twenty years there has been an empirical cross-industry literature about the bound approach[1]. Also, we have had a number of case histories documenting the evolution of structure within the endogenous sunk costs model in specific industries[2].

Moreover, this paper extends the literature on assessing banking competition[3] by providing the empirical implementation of a more theoretically robust, as well as a far less data and econometric demanding method of assessing banking competition. Current methods to measure competition (e.g. concentration and market structure measures within the Structure-Conduct-Performance framework; Lerner 1934; Rosse and Panzar 1977; Panzar and Rosse 1982, 1987; Bresnahan 1982, 1989; and Lau 1982) incorporate several major shortcomings, making the economics literature on assessment of competition quite unreliable.

The rest of the paper is organised as follows. Section 2 reviews the Sutton's framework. Section 3 introduces the dataset. Section 4 provides estimation of the lower bound to concentration. Section 5 assesses intensity of banking price competition. Finally, Section 6 concludes.

II THEORY OF ENDOGENOUS MARKET STRUCTURE: SUTTON'S FRAMEWORK

The starting point of Sutton's (1991) bound approach is to define two broad classes of industries: exogenous sunk costs and endogenous sunk costs industries; then the author develops a theoretical framework for each of the two types of industries in which to analyze the relationship between market size and concentration. Since the theory aims at cross-industry empirical analysis, Sutton controls for a measure of set up costs, amount of capital (fixed costs) required to enter and operate efficiently, at minimum average cost, in a given industry. These set-up costs may greatly differ across industries, and may be correlated with market size; as a result, to prevent bias in the role of market size for each industry, size is divided by the set-up costs.

Exogenous sunk costs industries are those with homogeneous products or with horizontal product differentiation, therefore main competitive weapon is price. In contrast, endogenous sunk costs industries supply goods which are vertically differentiated; consequently, quality plays a crucial role. The key feature is that real (perceived) product quality is enhanced for means of fixed sunk costs investments, for example R&D and advertising. These investments can increase

[1] Giorgetti (2003); Lyons and Matraves (1996); Lyons, Matraves and Moffatt (2001); Robinson and Chiang (1996); Symeonidis (2000); Balasubramanian and Lieberman (2011).

[2] Bakker (2005) researches reasons of the decline of the European movie industries in the endogenous sunk costs escalation mechanism operated by the US industry; Bresnahan and Greenstein (1999) apply the endogenous sunk costs model to the computer industry; Matraves (1999, 2002) explores the global pharmaceutical industry and how European integration has affected market structure in the soft drinks industry respectively; Motta and Polo (1997) studies market structure of television industry.

[3] See, for example, Ausubel 1991; Bikker and Groeneveld 2000; Bikker and Haaf 2002; Bikker, Shaffer and Spierdijk 2012; Calem and Mester 1995; Claessens and Laeven 2004; Coccorese 2009; Shaffer 1989, 1993, 1999, 2002; Shaffer and DiSalvo 1994.

consumers' willingness to pay. Precisely, Sutton's (1991) empirical analysis of twenty industries in the food and drink sector in six major economies is based on the distinction between advertising intensive and non-advertising intensive industries.

Sutton's main novelty is not to derive a unique prediction, but rather, to obtain a range of predictions which hold across a wide class of oligopoly models, abstracting from various factors such as toughness of price competition, degree of horizontal product differentiation, which are difficult to proxy or measure empirically. Fundamentally, Sutton derives a *lower bound*, that is the minimal level of concentration admissible, below which nothing can happen in long-run equilibrium; whereas, on and above the lower bound any market structure is consistent with the theory. Sutton looks for only robust results applicable to a large domain of industries. Motivation for this approach is given by the fact that game theoretic oligopoly models provide conclusions which depend on model's specifications. For instance, the researcher can choose among various equally reasonable assumptions regarding nature of competition (e.g. Cournot or Bertrand); whether firms are single-product or multiproduct; whether entry occurs either simultaneously or sequentially. In addition, these specifications, equally reasonable *a priori* are hard to measure empirically; as a result, often these game theoretic models do not produce empirically testable results.

Different predictions about market structure are associated with each of these two groups of industries. The key findings of the exogenous sunk costs model (Sutton 1991, pp. 308) are: i) a negative relationship market size-concentration; ii) concentration converges to zero as market size becomes extremely large tending toward ∞ ; iii) tougher price competition causes a more concentrated structure at any given market size, all else equal. In other words, for any pair of industries/markets with comparable size but different degree of price competition, the theory predicts that the market with tighter price competition will show higher concentration. As size of the economy grows significantly, firms' entry occurs until the last firm covers fixed sunk costs without incurring in losses (free-entry equilibrium rule). More intense price competition causes profits per firm to fall. Consequently, the number of firms able to survive in the market decreases. Conversely, a situation of collusive behaviour may determine excessive entry of firms leading, thus, to low concentration.

For industries where products are vertically differentiated and thus, quality becomes important, Sutton develops the endogenous sunk costs model. Here, two relevant results are reached (Sutton 1991, pp. 308): i) the traditional negative relation market size-concentration is not monotonic; ii) non-fragmentation as size grows. The basic intuition is that extra competition emerging from a larger market size is channelled mainly into an escalation process of expenditure

in endogenous sunk costs such as advertising; in addition, this property holds also in a context where both vertical and horizontal product differentiation are present (Shaked and Sutton, 1987). Advertising and R&D alter real and/or perceived product quality, so consumers' willingness to pay increases. As product quality is improved, consumers will tend to shift from the outside good to the quality one; consequently, quality enhancements enlarge demand (market size). An implication is that expansion of market size does not attract further entry, but instead induces incumbent firms to increase expenditure in endogenous sunk costs leading to an *escalation process* which determines endogenously economies of scale. At very high levels of investments in such competitive weapons, entry may be even blockaded.

III DATASET

Data used in the analysis of this paper involves market size, measured by population[4], and market shares for constructing five-firm concentration ratios (C5) at national level for the 27 EU countries[5] from 2007 to 2012. I adopt a market definition at national level, which is consistent both to EC antitrust investigations in banking and to ECB data set.

Data for C5 is obtained by the ECB which measures bank size in base of total assets. C5 for each EU Country is the percentage share of its five largest credit institutions in light of total assets, in the sum of the assets of all the credit institutions in the given Member State. More specifically, C5 is calculated considering a host country residence approach and a non consolidated basis. In other words, in the computation of concentration indexes, ECB considers all national and foreign credit institutions and subsidiaries having residence in the given EU Member State, excluding assets of domestic bank branches and subsidiaries resident in foreign countries.

I adopt a measure of market size which is clearly exogenous to bank activity, hence to how C5 is computed by the ECB. Table 1 provides summary statistics for concentration and market size and the estimated measure of banking competition: distance to the lower bound, D.

[4] Total population is based on Eurostat statistics, and counts all residents regardless of legal status or citizenship except for refugees not permanently settled in the country of asylum.
[5] It is considered the period over which EU had 27 State members, hence from January 2007 to December 2012.

Table 1 – C5, Market size and Distance to the lower bound: Summary Statistics

Year	Obs	Mean	Std. Dev.	Min	Max
C5	162	0.60	0.17	0.22	0.96
Market size (000)	162	18479.97	23060.52	405.616	82314.91
D	162	0.59	0.17	-0.19	0.55

IV LOWER BOUND TO CONCENTRATION

In this paper estimation of the lower bound is performed using stochastic frontier. This technique is robust to outliers and allows low concentration disequilibria. The following equation is estimated:

$$ln(C5/(1-C5))_i = \beta_0 + \beta_1/ln(S)_i + v_i + \varepsilon_i \qquad (1)$$

The dependent variable is the natural logarithm of the logistic transformation of $C5$ index, and $0 < C5 \leq 1$. β_0 and β_1 are coefficients to be estimated. The odds transformation ratio for the dependent variable is employed for ensuring that predicted values of limiting level of concentration are between 0 and 1 as well as to prevent heteroscedasticity. The variable S denotes market size. The reciprocal of natural logarithm of size employed in (1) is based on Sutton (1991) and subsequent authors (e.g. Lyons and Matraves 1996, Ellickson 2007).

The set-up costs measure used by Sutton and subsequent authors had the role to provide a homogenization across different industries. Since our analysis involves a single industry, it is reasonable to assume that the costs necessary for obtaining a single plant of minimum efficient scale are homogeneous across all city pair markets.

In the present context, the simple framework consists of a two error structures: a two sided error term (v_i) with a normal distribution for allowing low concentration disequilibria, that is, observations are allowed to be below the lower bound, and a one sided error (ε_i) to reflect the theoretical relevance of the lower bound. There are no strong theoretical reasons for choosing one particular distribution for the one sided error; usually in the literature the truncated normal, half normal, standard exponential[6] estimators have been tried for estimating a lower bound, which all gave similar results in Lyons and Matraves (1996). Below, I report results for the normal/half

[6] It is worth noting that there are no theoretical reasons justifying either these three distributions or any others.

normal model. $\nu \sim N(0, \sigma^2)$ is the i.i.d. two-sided error term normally distributed; whereas, for the one-sided error term we assume three different distributions: $\varepsilon \sim \text{Half} - \text{Normal}\,(\delta)$, $\varepsilon \sim \text{Truncated} - \text{Normal}\,(\varphi), \varepsilon \sim \text{Exponential}(\lambda)$. Following Greene (fifth edition), the stochastic frontier model given by (1) states that a relationship between the concentration measure and market size is defined. For any given value of market size the observed value of concentration must be either equal to or greater than the lower bound function given by equation (1). The one-sided error terms ε_i must be either zero or positive (nothing can happen below the lower bound in the long-run). Whereas, the two-sided error terms ν_i can assume values of both sign and it serves to pick up disequilibria low concentration. Therefore since ν_i is a stochastic component which can take either positive or negative values makes the frontier stochastic. The error term ε_i is a random variable which measures the distance from the bound.

In Table 2, lower bound estimates for the mo indicate that the EU banking industry is of endogenous sunk costs type. In fact, this econometric evidence suggests a null relationship between market size and concentration, and the lower bound ($C5_{it}^{\infty}$) is well away from zero. These findings are consistent with Dick (2007), who provides reasons of why market size does not matter for determining concentration. Firms compete in quality which is increased through boosting endogenous sunk costs outlays. Indeed, she finds some evidence that banks as market size increases enlarge sunk cost outlays such as advertising, branch network, number of employees per branch, U.S. State coverage and salary per employee.

Table 2 – Lower Bound: Stochastic Frontier

$\boldsymbol{ln(C5/1-C5)}$ **Normal/half normal model**	
$\boldsymbol{\beta_0}$	-4.363**
	(2.176)
$\boldsymbol{\beta_1}$	44.902
	(27.797)
$\boldsymbol{C5^{\infty}}$[7]	0.41
Sample: 162 obs.	

**Significance at 5% level;

Standard errors in parenthesis.

[7] $C5^{\infty} = e^{\beta_0}/(1+e^{\beta_0})$

V INTENSITY OF PRICE COMPETITION: DISTANCE TO THE LOWER BOUND

The newly developed measure of banking competition, distance to the lower bound to concentration, applied in this paper is based on structure, and has its theoretical ground on some industrial organization literature about endogenous market structure (Sutton 1991, 1998; Etro 2006, 2008). From this literature Tabacco (2013) shows that there exists a theoretical positive relationship between intensity of price competition and concentration; as a result, providing the theoretical platform on which the measure, distance to the lower bound, is based. In addition, this method of banking competition assessment implies firms' profits maximisation, hence oligopoly behaviour; indeed the first step of estimating the competition measure, estimation of the lower bound to concentration, is derived from a wide class of oligopoly models.

As explained in Tabacco (2013), I compute the distance to the lower bound to concentration as $D_{it} = C5_{it} - C5_{it}^{\infty}$. Where $C5_{it}$ is the observed concentration level in a given Country at certain year, and $C5_{it}^{\infty}$ is the estimated lower bound for each EU Member State at a given year.

Note that, $-1 < D_{it} < 1$. Higher values of D_{it} indicate more intense price competition; whereas, values of zero mean that an observation lies exactly on the lower bound. Negative values, $D_{it} < 0$, occur for observations lying below the lower bound, that is, when $C5_{it} < C5_{it}^{\infty}$. As it is explained in Section 2, the lower bound denotes the minimal level of concentration when market size becomes arbitrarily large for single-product firms behaving collusively. Consequently, the market structure exceeding the lower bound to concentration measures intensity of price competition.

Some descriptive statistics for D is presented in Table 3 below. The measure of banking competition, D, takes negative values in 27 observations and, in one case it is equal to zero (Spain lies exactly on the lower bound in 2007). In all the other 134 observations D assumes positive values.

In base of the measure D, I classify the EU countries in three classes in terms of their degree of competitiveness of the banking industry (Table 4). The first group includes those Countries with a low value of D hence characterized by soft competition, while the second group encompasses the Countries with an intermediate degree of competition, and finally the third group identifies those Countries farthest from the lower bound hence showing more intense price competition. The latter group includes only Estonia, over the whole period, and Netherlands (for years 2007 and 2008).

Finally, table 5 ranks EU National banking markets in terms of their degree of competitiveness; Estonia appears to be the most competitive, while Germany is the least competitive. The measure D has been averaged for each country over the time period under consideration, 2007 – 2012.

Table 3: Distance to the Lower Bound: Summary Statistics

Year	Obs	Mean	Std. Dev.	Min	Max
2007	27	0.19	0.178	-0.19	0.547
2008	27	0.186	0.185	-0.183	0.537
2009	27	0.182	0.182	-0.16	0.524
2010	27	0.183	0.165	-0.10	0.513
2011	27	0.184	0.160	-0.010	0.50
2012	27	0.184	0.161	-0.08	0.486

Table 4 – Competition measure: Distance to the lower bound

Degree of competition across EU	
$-\mathbf{0.19} \leq \boldsymbol{D} < \mathbf{0.25}$ Austria, Bulgaria, Cyprus, Czech Republic, Denmark, France, Hungary, Germany, Ireland, Italy, Latvia (from 2010 onwards), Luxembourg, Poland, Romania, Slovenia, Spain, Sweden, United Kingdom	$\mathbf{0.25} \leq \boldsymbol{D} \leq \mathbf{0.45}$ Belgium, Finland, Greece, Latvia (from 2007 to2009), Lithuania, Malta, Netherlands (from 2009 onwards), Portugal, Slovakia
$\mathbf{0.46} \leq \boldsymbol{D} < \mathbf{1}$ Estonia, Netherlands (from 2007 to 2008)	

Table 5 – Ranking of competitiveness

EU Countries	average D across time in descending order
Estonia	0.52
Netherlands	0.44
Finland	0.41
Lithuania	0.41
Belgium	0.35
Malta	0.31
Greece	0.3
Slovakia	0.3
Portugal	0.29
Denmark	0.24
Latvia	0.24
Cyprus	0.23
Czech Republic	0.22
Slovenia	0.18
Sweden	0.18
Romania	0.15
Bulgaria	0.14
Ireland	0.14
Hungary	0.135
France	0.07
Spain	0.04
Poland	0.034
Austria	-0.027
Italy	-0.05
United Kingdom	-0.09
Luxembourg	-0.1
Germany	-0.13

VI CONCLUDING REMARKS

The goals of this paper have been to infer nature of competition for means of analysing determinants of market structure within the Sutton's framework, as well as studying intensity of price competition by applying a new recently developed framework to assess banking competition.

Results indicate evidence consistent with the fact that banks compete in service quality improved for means of sunk cost outlays. Furthermore, evidence suggests that price competition in EU banking is rather soft for the majority of countries.

An analysis of reasons of lack of competition is beyond the scope of this paper. However, some speculative thoughts may be made. On general grounds, there are three reasons for why an industry, or a whole economy, has low intensity of competition: 1) legal and regulatory context,

which both obstacle entry into the market of efficient firms and foster rent-seeking and lobbying activities that are socially wasteful, 2) State aid to private firms, which makes inefficient firms to survive, 3) weak governance of competition authorities, particularly in reference to methods of recruitment and appointment of executive and board members. All these three reasons prevent the so called "creative destruction" (exit of inefficient firms and shirking of mature industries in favour of entry of new and more efficient firms as well as emergence of innovative industries).

There may be a further reason, specific to the banking industry, in hindering competitiveness: bank corporate governance. Weak governance can be crucial in affecting negatively bank's behaviour and competitiveness of the market. The case of Italy is illuminating. In 1990 Italian banks were privatised, but the State, particularly local politicians, could keep considerable control through bank foundations. A foundation has major shareholding of a given bank; therefore it controls bank's activity. The board of such foundations consists of members chosen by local politicians (City Council Major and members of Province Council "nominate" members of the foundation); as a result, Italian banks often do not provide credit following market rules. This certainly inhibits a competitive environment within the banking industry.

In future research, the empirical framework might be used to evaluate impact of banking competition on economic growth and financial stability.

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