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Banks, stability and competition

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To Giovanni

This is yours as much as it is mine

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All remaining errors and omissions are mine.

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Overview

The importance of financial institutions as pivotal for the economy is largely acknowledged. Since they provide specific services, such as issuing loans and collecting deposits, and perform a number of peculiar functions, including maturity transformation and risk diversification, banks and financial intermediaries are often referred to as “special”. However, the risks they face are special as well. Being extremely leveraged institutions, banks walk on a very thin thread and, considering that they are nowadays world-wide connected, instability can rapidly spread over the system, even affecting the real economy. Therefore, traditional economic rules are not entirely suitable for banks, which require a particular attention from regulatory authorities and academics.

This thesis focuses on two areas of remarkable importance, namely financial stability and banking competition, and develops within three chapters, as explained below. The aim of Chapter 1 is to highlight the relevance of financial stability and competition, also asking why regulators are extremely concerned about the two topics. The second and third chapters, then, start from the above premises with a specific focus on the Italian system. This is the backbone of the thesis: Italy is full of specificities, sometimes difficult to understand completely. Nonetheless, it is desirable that these specificities are protected and encouraged, since, very often, they have proven to be a strength.

More in depth, in Chapter 1 we review the main literature, both theoretical and empirical, regarding banking stability and competition.

Ensuring financial stability is nowadays a fundamental in central banks schedule. Indeed, last decades have underlined that banking crises can be extremely costly and disruptive. Besides, financial turmoil is more and more frequent and has a systemic relevance. Therefore, noteworthy efforts have to be undertaken in order to avoid such adverse episodes.

The negative influence of financial instability on the real economy is well established in literature since the “Great Depression”. However, the understanding

of stability has evolved over time, switching from a purely micro-funded definition to a more complex macro-prudential approach. This conceptual change has influenced the regulatory frameworks too, which now conceive the system in a more organic way, albeit not neglecting to control the risk at the single institution level. As a consequence, the methodologies for evaluating and measuring stability and risk have evolved as well, mainly following two lines. Particularly, the academic literature has developed, on the one hand, indices grounding on the measurement of risk at the bank level and, on the other hand, frameworks for the assessment of systemic risk. The topic is now at his very peak.

In the second part of the chapter we focus on banking competition. We have noticed that, while stability is clearly recognized as a goal to achieve, conclusions about competition are not so definite. As a matter of fact, despite a competitive environment is traditionally considered as desirable for the market, because it involves positive outcomes for the economy, this is not entirely true for banking industries, which are characterized by a number of imperfections.

In trying to disentangle the effects of banking competition on the economy, we have focused on two transmission channels, namely market power and efficiency. In this way we have also been able to evaluate the most widespread competition indices, which usually conjecture the existence of one of the aforementioned conduits. Then, we have moved on the direct evaluation of the aftermaths of competition in banking on some specific features, such as economic growth and monetary policy transmission. In both cases a certain level of market power sounds desirable, albeit with few exceptions.

The chapter concludes with a section about the relation between bank competition and financial stability, in which the main theories have been reviewed: the “competition-fragility” theory, according to which competition drains banks’ market power and franchise value, hence harming stability; the “competition-stability” hypothesis, which maintains that competition is likely to promote banking stability. Nevertheless, a more recent literature has evidenced that a third way is possible. Indeed, the two theories are not necessarily colliding, rather the two effects depend on the characteristics of the specific market.

In Chapter 2 we propose and test a new index for assessing banks' insolvency risk. Alternative measures of bank stability and risk appear useful when market-based indicators are not available, or traditional indexes derived from balance sheets variables are not suitable because of collinearity, endogeneity or not comparable data. This is the case of the Italian banking sector, mainly composed by local small non-listed banks, i.e. cooperative banks or BCCs, which operate in accordance with the principle of mutuality. Since BCCs' activity focuses principally on their own members, it is likely that they act to maximize their value rather than profits. Consequently, market-based measures are not fully suitable for the Italian sector, as they would concern only a (small) part of the market. On the other hand, also common accounting measures constructed on profitability appear not appropriate.

Our index, which we call *BVDD*, i.e. 'book-value distance to default', is based on the classic distance to default derived within the Contingent Claim Analysis but entirely constructed on book-value data. In a nutshell, we employ the book-value of assets and its volatility instead of the same values derived from market data.

To test *BVDD*'s reliability, we employ two econometric approaches: a standard logit model, and a survival analysis through a semiparametric Cox model. Working on a sample of 863 Italian banks over the period 1996 to 2013, we find confirmation of its predicting power. In fact, banks with higher *BVDD* are less likely to default, and the evidence seems to be robust to alternative model specifications. Moreover, some insights about the Italian banking system may be inferred: big profitable banks with an adequate level of capitalization and a lower level of non-performing loans show a lower probability of default.

Lastly, in Chapter 3 we turn to competition, assessing the degree of Italian banks' competitiveness between 1989 and 2013.

The Italian banking industry has evolved considerably over time. Since the '80s, many boundaries have been removed (among them, branch limitations, credit quotas and the widespread public ownership), mainly in accordance with the European harmonization. Similarly to other countries, the process has led to a progressive consolidation of the market. At the same time, Italy has experienced a

progressive disintermediation towards a more service-oriented business-model and, in addition, the recent financial crises have deeply affected the system, hitting the most the biggest banks. As a result, banks have started looking for efficiency gains in order to compete in the new globalized market and, above all, to survive.

However, the Italian banking industry has its own peculiarities, especially in terms of dimension and legal form of its intermediaries. As already mentioned, BCCs play an important role and, due to their specificities, enjoy a peculiar kind of market power, i.e. relationship lending. For these reasons, an analysis of the competition grade of the system seems of primary importance given the intense modifications that have taken place in Italy over the last decades, especially to understand if such transformations have played a role.

In this chapter, we apply the Bresnahan (1982), Lau (1982) and Shaffer (1989, 1993) methodology to Italian data in order to estimate an index of competition, called λ , for the banking sector. Typically employed on time series, the methodology is here implemented on a panel. Specifically, we focus on dimensional groups, discriminating between big, medium, small and minor banks, as classified by Bank of Italy. In this way, we are able to observe both the evolution of the coefficient over time and the difference in competitive behaviours among different classes of banks.

According to our results, between 1989 and 2013 the Italian banking sector has been characterized by a substantial degree of competitiveness. Moreover, the level of competition has shown an increasing trend. In detail, our estimates evidence a notable increase occurred in the first Nineties, which can be due to the introduction of the Second Banking Directive (Directive 89/646/EEC), and a contraction over the period 2007-2008, perhaps linked with the upcoming financial crisis. Furthermore, the results seem to confirm the existence of some market power enjoyed by smaller banks, since their level of competition is found lower compared with bigger ones.

Chapter 1

Banks, financial stability and competition

1.1 Introduction

Often referred to as “special”, Financial Institutions (FIs) are essentially intermediaries offering a wide range of services, including loans, deposits and payment services. Their peculiarity lies in the role they play in the economy, in the functions they perform, and in the risks they are exposed to.

According to the classic theory of financial intermediation, credit supply – funded by deposit collection – is the core service provided by banks. By channelling capital from savers with surplus to borrowers with shortage in an environment characterized by information asymmetries, banks operate a number of functions, particularly size and maturity transformation, and risk diversification (Allen and Carletti, 2014). In addition, acting as “delegated monitors” (Diamond, 1984), FIs are able to screen and control borrowers’ and savers’ behaviour, thereby mitigating adverse selection, i.e. the probability of selecting the “wrong” borrower, and moral hazard, namely the possibility that a borrower becomes more risky. Consequently, banks allow a reduction in transaction costs, thus improving the allocation of capital and resource (Goldsmith, 1955; Gurley and Shaw, 1955; Patrick, 1966; King and Levine, 1993; Levine, 2005), and ultimately enhancing economic growth and productivity while reducing inequality and poverty (Demirguc-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998; Levine et al., 2000; Beck et al., 2007).

Besides, FIs (in particular depository institutions) are an important vehicle for the transmission of monetary policy (Bernanke and Blinder, 1988; Peek and Rosengren, 2014) and are increasingly pervasive in providing payment services, both retail and wholesale (Humphrey, 2014).

As a result, financial institutions are exposed to a series of specific risks related to their business, among which liquidity risk, credit risk and interest rate risk that, if not properly managed, can lead to disruptive externalities. Therefore, given all their specialties, financial intermediaries are subject to specific rules aimed at avoiding both the interruption of the services and an excessive exposure to risks, that might end up with heavy consequences for the economy and society. Hence, the increasing interest of academic literature toward the banking sector seems justified.

Since our research focuses primarily on stability and competition, in what follows we will try to clarify the importance of both and illustrate why further studies are needed to understand their nature. This chapter provides a literature review on financial stability and banking competition. Focusing on financial soundness, Section 1.2 evaluates the concept of soundness and its importance, not only for the financial system, but also for the economy as a whole (a survey of the methods used by the academic literature to measure financial stability is also provided). The heart of Section 1.3 is, instead, competition. Here we review the existing research about the link between the degree of competition in the banking sector and the real economy, with particular attention to the transmission channels. We also focus on a subject that has not been extensively evaluated yet, specifically the effect of banking competition on the monetary policy transmission. Section 1.4 critically summarizes the main arguments about the long-debated relationship between competition and stability in banking, both theoretically and empirically. Section 1.5 concludes.

1.2 The importance of financial stability

1.2.1 Why is stability important?

Ensuring financial stability is a primary objective of Central Banks, as also witnessed by the number of published Financial Stability Reports, where Central Banks illustrate risks and exposures in the financial system (Čihák, 2006).

Financial stability matters for many reasons. Basically, banking and financial crises are costly; as a matter of fact, distresses affect economic and income growth (e.g. Calomiris and Mason, 2003b) and involve public debt and fiscal costs (Laeven and Valencia, 2012). Further, they are increasingly frequent and, as the financial system is nowadays world-wide connected, instability of a country may quickly spread to other markets through the so-called contagion effect (Peek and Rosengren, 2000; Degryse and Nguyen, 2007).

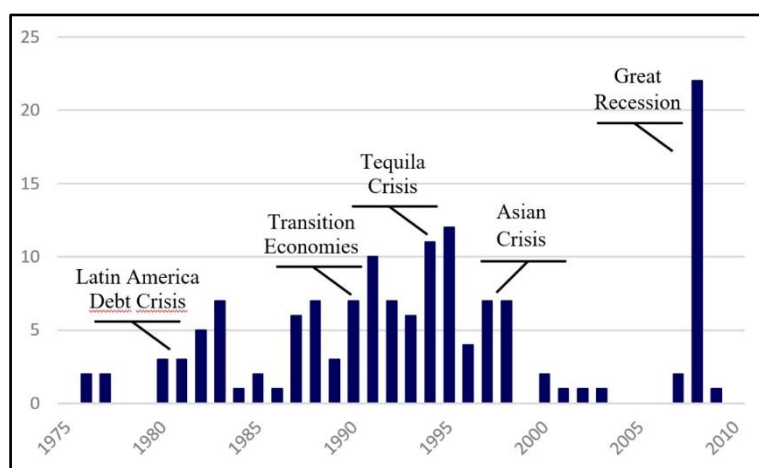


Figure 1.1 – Number of systemic banking crises started in a given year
 Source: Own elaboration on Laeven and Valencia (2012), pp. 24-26.

Together with regulators and policy makers, a long-tradition strand of the literature dating back the “Great Depression” is trying to appraise causes and consequences of banking and financial distresses. For instance, in the 1930s some macroeconomists, such as Keynes (1931) and Fisher (1933), have argued that banking crises worsened the already critical situation during the Depression, because financial intermediaries transmitted their distress to the real economy through the monetary and lending channel. Later, Friedman and Schwartz (1963) have emphasized that bank closures and withdrawal by panicking depositors reduced the aggregate money supply, ultimately affecting the real economy also through the resulting increase in the interest rate. Similarly, a more recent empirical research by Calomiris and Mason (2003a) has evidenced that between 1930 and 1932 a large part of the variation in the state level income growth in US can be explained by variations in the bank credit supply.

Although there was no clear-cut consensus about the mechanism of transmission, early literature has tended to recognize the negative impact of banking sector instability on the real economy. Nevertheless, a change in the perception of the relationship can be detected in some later studies. In fact, when the observation sample has shifted to more recent financial crises, empirical research has started to observe contradictory findings. For example, by evaluating data about 36 banking crises that affected 35 countries between 1980 and 1995, Demirgüç-Kunt et al. (2006) have evidenced that a banking crisis was followed on average by a 4% drop in output growth. However, the depression persisted only in the first year, and the real economy quickly recovered to its pre-crisis level. Therefore, they conclude that, while the aftermaths of financial disruption overwhelm the banking system for years, taking a long time to restore it, the repercussions on the real economy seem to be of short duration.

Fairly different conclusions are drawn by Boyd et al. (2005), who have investigated the real per capita GDP losses associated with 23 banking crises occurred over the period 1976-1998. Their evidences are mixed. Whereas in developed countries a downturn was often not associated with any reduction in the real output growth, for some other countries they have estimated extreme losses bounded between 63% and 302% of real per capita GDP. Interestingly, major losses were related with crisis identified as non-systemic. Further, GDP losses were severely persistent. In fact, 19 out of 23 countries have recovered their pre-crisis level only 17 years after a turmoil.

Such mixed results might be justified by considering that the above papers regard episodes occurred in various parts of the globe, often non-systemic, arisen either long after the Great Depression or long before the global financial crisis. Perhaps, their consequences are not even comparable with those two major events.

Indeed, after the 2007-2009 turmoil, advanced economies experienced their “sharpest declines in the post-war era” (Group of Twenty, 2009). During the crisis and the following recession, worldwide markets saw an unprecedented number of banks bankruptcies, as evidenced in Figure 1.1, and a huge deterioration of wealth.

For instance, in 2009, per capita world GDP, which generally grows by about 2.2% per year, shrank by 1.8% (Claessens et al., 2013).

In a noteworthy study on the social impact of financial distresses, Ötoker-Robe and Podpiera (2013) have highlighted a series of massive consequences attributable to the global financial crisis. We recall their main results.

Since 2007, output and employment conditions have deteriorated, although with significant differences across regions. The consequent weakening of aggregate demand and economic activity has severely hit labour market conditions around the world: about 28 million people have lost their jobs, bringing the total number of unemployed to around 197 million in 2012, among which about 40% were young people. The impact of the increased youth unemployment is even more critical for the economy: a young person who is inactive since his labour market entry is not able to build job experience, hence his possibility to be hired is worsened. Moreover, a long period out of work engenders skills erosion. In addition, besides its direct effects on the person, long-term unemployment affects social cohesion, with consequences for economic and social stability.

In many countries the job market has been also involved by fiscal austerity programs, with cutbacks or freeze in employment and wages, and the average growth of real incomes has reduced by 50% between 2008 and 2009. Furthermore, after an initial increase, social expenditures fell in 2011, due to the drastic cuts in the public spending undertaken by many governments.

The increase in unemployment and the deterioration of revenues have led to a sharp reduction in purchasing power which has contributed, on the one hand, to a further reduction in aggregate demand and, on the other hand, to a redefinition of the basket of consumer goods. According to the Life in Transition Survey (2010, cited in Ötoker-Robe and Podpiera, 2013, p. 13), families in Europe and Central Asia have reduced their consumption of non-essential goods by relocating them to staple food. They also have cut health care, while, fortunately, investment in child education has been not affected much. Consumption reallocation has been stronger for low-income families.

As one would expect from the worst crisis in History, it has posed a milestone also in the economic and banking literature. A relevant research about financial stability has been conducted by Laeven and Valencia (2012) just in the wake of the global financial crisis (and the following European sovereign debt crisis). Identifying 147 banking crises, 218 currency crises and 66 sovereign crises over the period 1970-2011, they have evidenced larger output losses and increases in public debt for advanced economies compared with emerging and developing countries. At the median value, developed countries showed an output loss of about 33% and an increase in public debt of 21% of GDP, over the average values of 23% and 12%, respectively. Their explanation of the effect is that a deeper and more developed banking system makes a banking crisis more disruptive. Another interesting point concerns the use of the fiscal policy, which is typically countercyclical for major countries. In the authors' view, expansionary macroeconomic policies, while supporting banks' growth, encourage a gap between market and book value of banks' equity, hence blurring significant needs for recapitalization, to the detriment of the systemic stability.

1.2.2 Stability: what does it mean?

Although both the economic literature and regulators tend to recognize that financial and banking stability are important to preserve, as already pointed out in Section 1.2.1, there is no clear consensus on what stability is, how it can be measured, and which is the best way to guarantee it.¹ Besides, the three concepts are closely related.

The notion of financial stability has evolved over time, often as a response to the occurred events. Before the sub-prime crisis, the prevalent view was mainly micro-prudential, and financial soundness was defined as the “smooth functioning of the components of the financial system (financial institutions, markets, and payments, settlement, and clearing systems)” (Čihák, 2006). The principal aim of supervisors and regulatory authorities was to reduce the individual risk of failure,

¹ An interesting overview of alternative definitions of financial stability is provided by Schinasi (2016).

without any consideration of their impact on the system as a whole (Altunbaş et al., 2017).

The aforementioned ideas were behind the Basel Capital Accords, a series of guidelines on banks' capital requirements introduced in 1988 by the Basel Committee on Banking Supervision, charged by the Group of Ten,² plus Luxembourg and Switzerland. Briefly, the 1988 Basel Capital Accord (better known as Basel I) settled an international standard of capital adequacy based on a risk-asset ratio approach. Each operating bank was enforced to maintain an amount of "capital related to different categories of assets and off-balance sheet exposure, weighted according to broad categories of relative riskiness" (Basel Committee on Banking Supervision, 1988, paragraph 28). The Accord was amended first in 1996, hence in 1999, when the new framework "Basel II" was proposed.

A first version of Basel II was released in 2006, after a long debate. Its main objective was to set a more risk-sensitive treatment of banks' risk, introducing the concept of 'risk-weighting approach', also fostering the adoption of banks' internal risk ratings and external credit risk assessments. Although heavily criticized and debated, Basel II never became fully effective, because the sub-prime crisis broke out (Casu et al., 2015, pp. 208).

The massive consequences of the Lehman Brothers bankruptcy have suggested that financial stability could have different dimensions, hitherto ignored: a system cannot be considered as the mere sum of its parts, but also its macro-prudential dimension has to be taken into account (Altunbaş et al., 2017). In a more complete view, the banking system can be interpreted as a network. The risk can arise not only from the individual institutions, but also from the relationships among them. Moreover, the network is exposed to exogenous shocks that can affect particular subjects, the relationships across them, and the system as a whole. In addition, spillovers between the financial sector and other markets may happen. Therefore, the need for a different notion of stability has arisen, as well as the

² The Group of Ten, or G-10, is an international organization which reunites the ten largest industrialised countries in the World: Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States (Casu et al., 2015, p. 208).

emergency of new macro-prudential policies focused on the economic system in its entirety.

This new spirit led to Basel III, a new set of reforms approved by the G20 in 2010. The renewed aim of the international regulators was the improvement of the banking sector's resilience, enhancing its capability to counteract shocks, both endogenous and exogenous. In other terms, the reform, which is still being implemented, targets not only individual financial institutions – that have to be stronger, transparent, better managed and capitalized – but also systemic risks that can build up across the system as well as their pro-cyclical amplification over time.

Concluding, a new definition of stability seems to be appropriate and, borrowing Schinasi's (2016) words, "a financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events".

1.2.3 Measuring stability

As the conceptual identification of financial stability necessarily involves the way to measure it, two main categories of indicators can be defined. The first, based on the micro-prudential philosophy, aims to assess the idiosyncratic risk, namely the risk concerning the individual institutions. The second, grounding on the macro-prudential idea, focuses on appraising systemic risk, which can be roughly defined as the risk of a crisis in the financial sector and its spillover to the whole economy (Acharya et al., 2017).

a) Micro-prudential based measures: insolvency risk and probability of default

Regarding the assessment of stability from a micro-prudential approach, empirical banking literature has proposed various methodologies, mainly following two strands: accounting-based measures and market-based measures.

Accounting-based measures are ratios calculated from banks' balance sheets data. Among them, as proxy for credit risk we recall loan loss provisions over total loans and loan loss reserves over total assets, where larger values are associated to

higher risk (Casu et al., 2015, p. 663). Another simple and widespread indicator is the ratio between non-performing loans and total loans, often identified as a significant predictor of insolvency (Demirgüç-Kunt, 1989; Whalen, 1991; Barr and Siems, 1994; Jin et al., 2011; Reinhart and Rogoff, 2011).

However, it is clear that a single ratio, although easy to formulate and interpret, displays just one side of a more complex structure: for example, a high non-performing loans ratio (which would indicate high riskiness of the loan portfolio) could be offset by risk diversification or an increase of the equity capital, which would leave the overall risk unchanged (Berger et al., 2009).

One of the most common accounting-based stability indicators, the Z-score, is a broader insolvency risk index generally ascribed to Boyd and Graham (1986), Hannan and Hanweck (1988), and Boyd et al. (1993). Computed as the sum of return on assets and capital on assets ratios, weighted by the standard deviation of return on assets, the Z-score measures the distance of an institution from insolvency, where the latter is defined as a state in which losses are higher than equity (Laeven and Levine, 2009). Given that the index is positively affected by the level of profitability and capital, but negatively affected by the volatility of the return on assets, higher Z-score values indicate a higher level of bank's soundness, or a lower likelihood to fail (Hannan and Hanweck, 1988; Laeven and Levine, 2009; Strobel, 2011; Lepetit and Strobel, 2013).

The literature reports extensive use of the Z-score for both assessing individual banks' insolvency risk (e.g. Boyd and Graham, 1986; Yeyati and Micco, 2009; Laeven and Levine, 2009; Beck et al., 2013; Fu et al., 2014) and evaluating aggregate financial stability (e.g. Uhde and Heimeshoff, 2009; Molyneux et al., 2014; Ijtsma et al., 2017). The popularity of this index is mainly due to its simplicity. In addition, relying just on accounting data, it can be calculated also for non-listed institutions, differently from market-based measures (Lepetit and Strobel, 2013).

Nonetheless, the Z-score has its own weaknesses. As a balance sheet measure, its quality depends on the characteristics of the various accounting standards, hence cross-country analyses might be affected by differences in institutional structures

between countries (Chiaramonte et al., 2016). When employed together with indicators that are correlated with its own components (e.g. profitability indices), the Z-score might also give rise to spurious correlation (Beck et al., 2013). Finally, it could be unsuitable for comparing different types of banking institutions: for instance, as cooperative banks do not pursue profit maximization, they might be characterized by a lower ROA than, let's say, commercial banks, which would imply a lower Z-score and a possibly wrong indication of lower stability (Čihák and Hesse, 2010; Coccoresse et al., 2017).

The alternative way to assess default risk for financial institutions adopts market-based indicators. There is a broad range of market-based models developed by economists, analysts, and FIs' managers to assess default risk.³

A large part of them relies on the Contingent Claim Analysis (CCA), a methodology proposed by Merton (1974) that defines the event of default as a state in which a firm is not able to cover its liability with its own assets value. Combining accounting and market data, measures developed within the CCA framework – such as the distance to default, the risk neutral default probability, and the expected default frequency – are forward-looking and unlikely to be sensitive to internal policies.

Although widely used in literature (e.g. Vassalou and Xing, 2004; Gropp et al., 2006; Akhigbe et al., 2007; Duffie et al., 2007; Campbell et al., 2008; Anginer et al., 2014; Miller et al., 2015), the Merton model has been strongly criticized for its major shortcomings and its difficulty in application (Hillegeist et al., 2004; Chan-Lau and Sy, 2007; Bharath and Shumway, 2008). For instance, it requires strong assumptions about the assets and liability structure and, by definition, it can be implemented only to publicly traded firms (Kealhofer, 2003; Chan-Lau and Sy, 2007; Agarwal and Taffler, 2008; Guerra et al., 2016).⁴

³ A review of the most common credit risk management methodologies can be found in Crouhy et al. (2000) and Saunders and Cornett (2013).

⁴ A more detailed description of this model can be found in Chapter 2.

b) Macro-prudential based measures: systemic risk

The debate on how to measure systemic risk is in its full swing: since it is not completely understood, nor precisely defined, the identification of its dimensions is nowadays very challenging. For instance, Bisias et al. (2012) have surveyed 31 frameworks appraising systemic risk. Nonetheless, as pointed out by Acharya et al. (2017), many of them lack in economic and theoretical foundation.

Looking at the theoretically based literature, part of the research has developed a structural approach grounded on the contingent claim analysis. For instance, Lehar (2005) has employed a modification of the Merton's approach on a sample of international banks over the period 1988-2002. The system is considered as "the regulators' portfolio", and the individual liabilities of each bank are modelled as contingent claims on the bank's asset. Systemic risk is therefore defined as the probability that banks with total assets exceeding a certain threshold of portfolio assets fail within a certain span of time.

Others have used market data to determine reduced-form indices for systemic risk. Huang et al. (2009) have identified systemic risk as the (theoretical) price of insurance against losses of the banking sector. By assuming a hypothetical portfolio consisting of the weighted average of the credit default swaps (CDSs) of each bank in the system, their index is calculated as the neutral risk expectation of portfolio losses. Tested on 12 major US financial firms, their indicator has been able to detect a peak of systemic risk between March and June 2008, presumably due to the financial crisis.

Acharya et al. (2017) have proposed a micro-funded model in which the contribution of each financial institution to systemic risk can be measured by its SES, i.e. systemic expected shortfall, which represents the individual institution's propensity to be undercapitalized conditional on the undercapitalization of the whole financial sector. SES increases with leverage and the marginal expected shortfall (MES), which is the firm's stock return given that the market return is below its 5th percentile. In other terms, MES represents the extreme loss for the individual firm conditional to the market return in the tail of the system's loss

distribution. Therefore, combining leverage and MES, SES can be estimated with a fair accuracy (their R-squared, calculated for estimates drawn on different samples, range between 20% and 60%).

Adrian and Brunnermeier (2017) have defined the value at risk of the financial system conditional on institutions being under distress as CoVaR. Hence, an institution's contribution to systemic risk is the difference between the CoVaR conditional on the institution being under distress and the CoVaR in the median state of the institution. By testing their proposed index on quarterly data for 357 U.S. bank holding companies over the period 1986-2010, they have evidenced a weak relationship between the individual institution's VaR and its CoVaR. Thus, they conclude that a reduction of the idiosyncratic risk is not sufficient to avoid systemic risk contribution. Moreover, they have also pointed out that the major contributions to systemic risk come from bigger highly leveraged firms, operating with higher maturity mismatch.

1.3 Do we need banking competition?

Competition is traditionally considered by the economic theory as the most beneficial market structure, since it entails efficiency, innovation, quality of production, lower prices, as well as a better resources allocation and an increase in the aggregate wealth. However, it assumes some different facets when discussing banking and financial system.

From a theoretical point of view, greater competition should involve banks' higher efficiency, hence lower costs transmitted to the customers in the form of more favourable lending and deposit rates. Moreover, externalities would also impact positively the real sector, since a competitive banking sector should improve access to finance, hence fostering investments and innovation, also enhancing the overall product quality.

Unfortunately, understanding the real benefits derived from an increase in the level of competitiveness in the banking sector is not that easy. Financial markets are characterized by frictions, such as asymmetric information and entry barriers.

Therefore, the traditional theorems of welfare are not directly applicable to the banking sector (Vives, 2001). In addition, the impact on the real economy is strongly influenced by the channel through which the effects are conveyed: whether an increase in the level of competition translates into an enhanced efficiency or a reduced market power matters. Finally, not only the ultimate effects are not clear, but all the alleged benefits need to be evaluated considering a potential trade-off between competition and stability.

1.3.1 Competition and its transmission channels

a) Competition and the market power channel

The concept that an increased market power allows firms to enjoy excess profits goes back to the SCP (structure-conduct-performance) paradigm when, finding a direct link between industry concentration, price levels and profits in the American manufacturing industry in the late 30s, Bain (1951) ascribed the extra-gains to the exploitation of market power or collusive behaviour. In other terms, the market structure, namely an oligopoly composed by 42 large-share firms, was affecting the final performance in terms of profits through the firms' conduct.

The idea behind the SCP paradigm is essentially a negative interpretation of the market power, which is considered detrimental for customers. However, the empirical assessment of the SCP hypothesis in banking leads to mixed evidence. While studies on US have noticed that banks operating in concentrated markets tend to charge higher loans rates and pay lower deposit rates (e.g. Berger and Hannan, 1989; Hannan, 1991), other findings have been less supportive, evidencing a non-relevant impact of concentration on banks' profitability (Berger, 1995).

To test the SCP hypothesis, empirical literature has largely employed a series of structural indicators, such as concentration ratios, number of banks, and Herfindahl-Hirschman indices (Casu et al., 2015, pp. 647-649). Although easy to compute, those indices are rather crude. An important drawback is that their reliability as measures of competition ends when the hypothesis that concentrated market encourage collusion is rejected. Furthermore, it is now recognized that

firms' conduct is influenced by factors other than concentration and market structure. Consequently, using structural indicators to proxy competition may lead to biased estimates.

The conduct of the incumbent can be affected by other mechanisms, such as the threat of new entries (Besanko and Thakor, 1992) or the general contestability of the market (Rosse and Panzar, 1977; Panzar and Rosse, 1987; Bresnahan, 1989). Therefore, the actual degree of competition can be evaluated only through the direct observation of firms' conduct.

In line with these hypothesis, alternative measures of competition have been developed, many of which inspired by the so-called the New Empirical Industrial Organization (NEIO) literature⁵ (Coccoresse, 2017). Among the others, two assess for the market power channel, namely the Lerner index and the Panzar and Rosse H-statistic.

The Lerner index (Lerner, 1934; Fernández de Guevara et al., 2005; Maudos and Fernández de Guevara, 2007; Coccoresse and Pellicchia, 2010; Williams, 2012; Fiordelisi and Mare, 2014; Fu et al, 2014) measures the level of a bank's market power as pricing power, i.e. the ability to set its price above the marginal cost. Calculated as the difference between the price charged by the bank and its marginal cost, divided by the price, the index is equal to zero under perfect competition, since firms are price takers. Contrarywise its value should increase with a decreasing level of competitiveness. The Lerner index can be calculated at a bank level and observed over time.

The H-index has been developed by Panzar and Rosse (1977; 1987) as a test statistic for discriminating among different competitive markets. It has been widely employed in literature (e.g. Shaffer, 1982, 2002, 2004; Molyneux et al., 1994; Bikker and Haaf, 2002; Coccoresse, 2004, 2009; Claessens and Laeven, 2004; Al-Muharrami et al., 2006; Bikker et al., 2007; Matthews et al., 2007). The indicator empirically assesses the impact of changes in input prices on firms' revenues and grounds on the hypothesis of profit maximization. The H is derived by estimating

⁵ For an overview, see Bresnahan and Schmalensee (1987).

a reduced revenue equation and is equal to the sum of the elasticities of the reduced-form revenues with respect to factor prices. On the assumption of long-run equilibrium, Panzar and Rosse (1987) have demonstrated that H is equal to or less than zero in a monopoly or perfect collusion, because firms set their prices with any regards to costs variations, due to the lack of competitive tensions. Conversely, it is equal to one with perfect competition, because a change in the level of costs is entirely translated into changes in the prices of output. In situations of monopolistic competition, the index lies between zero and one, since prices are only partially affected by cost fluctuations.

The conjectural-variation methodology (Iwata, 1974; Bresnahan, 1982; Lau, 1982) also belongs to the literature field appraising for banks' market power.⁶ The methodology estimates a conduct parameter through a simultaneous model of demand and supply. Although interpreted in many ways, the coefficient basically measures the distance between the current market conduct and the theoretical situations of monopoly (or perfect collusion) and perfect competition. For instance, according to Iwata (1974) the coefficient embodies the deviation in the industry's quantity from the optimal quantity due to a change in the output of an individual firm. Otherwise, Bresnahan (1982, 1989) and Lau (1982) consider the parameter as the divergence of the perceived marginal revenue from the market demand.

Some of the above-mentioned indices (CR-5, HHI, Panzar-Rosse H -statistic and Lerner index) have been used by Casu and Girardone (2009) for assessing competitive conditions for the largest five European banking markets between 2000 and 2005. The EU banking system underwent a process of consolidation, as showed by the CR-5 increase from 37.8% to 42.3%. A similar process has also involved individual countries, even though the banking markets in Germany, Italy and the United Kingdom have remained relatively disaggregated. Turning to market power measures, the average marginal cost has decreased over the period for the whole sample, with Italy and Spain showing the largest contraction. However, their marginal costs have persisted in being the highest. Similarly, the Lerner index has

⁶ A review related to this methodology can be found in Chapter 3.

grown over the period in all countries, hence confirming a decreasing level of competition. Again, for Italy and Spain the Lerner index has increased the most. Coherently, the estimated H-statistics depict monopolistic competition in all countries, with the highest competition in Germany, Spain and the UK, followed by Italy and France.

These outcomes have been confirmed and extended by Sun (2011), who has detected monopolistic competition in the Euro area, the US and the UK banking during the period 1995-2009 through the H-index. The study also points out a convergence in the euro area due to the introduction of the EMU. Nonetheless, it is worth to notice that the H-index has been recently found to be inconsistent by Bikker et al. (2012) and Shaffer and Spierdijk (2015), since it is not able in identifying the degree of market power, neither through its sign nor its magnitude. Therefore, comparisons between values of the H estimated on different markets appear meaningless. However, the convergence across the European banking sectors from 2000 to 2014 has been validated by Cruz-García et al. (2017), with the Lerner index.

b) Competition and the efficiency channel

Linking for the first-time market structure and efficiency, the ‘quiet life hypothesis’ proposed by Hicks (1935) maintains that, as monopoly power grants managers to be free from competitive pressures, an increase in concentration should involve a decrease in efficiency, or, as lately pointed out by Leibenstein (1966), an increase in competition generates a reduction of inefficiency only when managers are properly motivated.

Although dealing with efficiency, both theories have postulated the existence of the market power channel, as evidenced by Berger and Hannan (1998). Testing the quiet life hypothesis on a wide sample of 5,263 banks operating during the decade of the 1980s, they find lower cost efficiency in concentrated market, which is ascribed to numerous channels (such as managers shirking, the pursuit of objective different from profit maximization, strategies to gain market power, or simply incompetence).

The efficiency channel has been proposed by the Chicago School as an alternative to explain the link between concentration and profits. According to the efficient structure hypothesis, more efficient firms, being characterized by lower costs, are able to improve profits and gain market shares, thus increasing market concentration. Therefore, the causality link between competition and efficiency is reversed. When the efficiency gain is attributed to superior management capability, the framework is also known as the X-efficiency hypothesis (Demsetz, 1973). The alternative scale efficiency hypothesis, instead, postulates simply a production at a lower unit costs.

The first empirical test of the two efficiency hypotheses, also combined with the SCP paradigm and the relative market power hypothesis, can be found in Berger (1995). The paper has found support for the X-efficiency hypothesis and the relative market power theory, even if limited, by using a combination of different cross sections for about 4,800 US banks over the 1980s. A negative relationship between concentration and profitability has also been evidenced, hence rejecting the SCP framework.

The efficiency channel has been recognized also in a study conducted on US state-level data between 1975 and 1992 by Jayaratne and Strahan (1998). Their outcome shows that, once constraints on bank expansion were removed, bank performance improved, as testified by the substantial reduction of operating costs and loan losses. The authors conclude that state-wide branching and interstate banking opening has allowed an advancement of the more efficient banks at the expenses of the inefficient rivals.

Confirming the above results, Stiroh and Strahan (2003) have found that deregulation not only allowed the efficient banks to grow, but also let poorly performing banks narrow, and least efficient ones shrank the most. Both studies qualify branching restriction as a market distortion, that protected inefficient banks to the detriment of customers. In fact, Jayaratne and Strahan (1998) notice that the reduction in banks' costs was transmitted to borrowers through lower lending rates. while Stiroh and Strahan (2003) evidence a reallocation of assets to the better banks, that after the deregulation were controlling about 70% of the industry.

The relationship between market share and efficiency has inspired Boone (2008) to propose its own index, based on the hypothesis that performance improves with competition through the efficiency channel. From a cost-efficiency point of view, more efficient banks are better able in increasing their market share, therefore also their profits. Thus, if profitability is directly influenced by competition, when an efficient bank expands its market share and profitability, the greater the competition, the greater the expansion. Eventually, given an average level of efficiency, increasing the level of competitiveness involves, at the same time, a growth for efficient banks' market share and a decline for inefficient ones. Hence, the suggested index captures the market share percentage variation due to a unit percentage change of the marginal cost.

Employing the Boone index, van Leuvensteijn et al. (2010) explore the degree of competition in the lending market for five EU countries, the UK, the US and Japan. Over the period 1994-2004 they detect US to have the most competitive market. Germany and Spain show the highest degree of competitiveness within the European countries, while Italy is characterized by a decline of competition over time. A lower level of competition is found in UK, France and Japan markets.

The idea that efficiency channel and market power channel might be modelled within a unique measure has come to Koetter et al. (2012). By questioning the implicit assumption of perfect efficiency behind the conventional Lerner index, they argue that all divergences between prices and marginal costs cannot be attributable to market power. Thus, they have proposed a modified Lerner index accounting for efficiency, or, more correctly, for inefficiency.

To test the new Lerner, they have compared it with the conventional one by estimating them both on sample of yearly data from all U.S. insured banks between 1976 and 2007. Their results show an efficiency-adjusted Lerner systematically higher than the conventional. Moreover, while detecting a same positive relationship between both measures and cost efficiency, only the adjusted Lerner has showed a negative relation with profit efficiency. Therefore, they conclude that the conventional Lerner lacks in explaining some facets of the market power, hence ascribed to efficiency.

1.3.2 Competition and the real economy

As already pointed out, the ultimate effect of banking competition on the real economy is everything but easy to understand. On the first side, improvements in efficiency rates should ensure an enhancement in economic performance. On the other side, the effect of a change in the level of market power is much less clear. However, literature tends to support the existence of a positive relationship between banking market power and economic growth, albeit with few exceptions.

By evaluating survey data covering 3,404 US small companies active in 1987, Petersen and Rajan (1994; 1995) have evidenced a higher credit availability for small young firms in concentrated markets. Since banking markets are characterized by information asymmetries, relationship lending may help in solving the issue, as long as banks can extract a rent from the long-term agreement. As competition reduces such rents, banks would be discouraged from investing in long-lasting commitments. Hence, higher market power promotes young businesses' growth.

Similarly, Berger et al. (1998) evidence a positive effect on lending supply to small business due to consolidation, but only when the merging banks are small and medium size. Moreover, the negative consequences on lending supply following large banks mergers are partially offset by rivals and by the lending restructuring of the consolidating banks. Their results, obtained on data regarding more than 6,000 U.S. bank M&As occurred between 1980 and 1996, support the importance of the relationship lending especially for informationally opaque borrowers, as young firms.

A more direct impact is detected by Cetorelli and Gambera (2001), who have observed a first-order negative effect of bank concentration on the overall growth for 41 countries and 36 manufacturing sectors between 1980 and 1990. The study only partially supports the literature that relates a lower credit supply to higher concentration, since they have evidenced a different involvement for sectors more relying on external finance. In these cases, a concentrated market facilitates credit access, especially for young business. Therefore, as younger firms are more likely

to produce innovations, the final result is an enhancement of growth. Besides, they have demonstrated once more the importance of relationship lending in connecting concentration and credit availability.

A partially different result is obtained by Beck et al. (2004), who detect a more difficult access to credit in concentrated market, even more problematic for small firms, by exploring firm-level survey data for a cross-section of 74 countries. However, in countries with higher GDP per capita, better developed institutions and credit registry, the link appears not significant. On the other hand, public bank ownership and regulatory market constraints exacerbate the detrimental effect. Therefore, although they claim a support of the structure-conduct-performance and its hypothesis of negative effects of market power, this is true only for less developed countries.

The possibility of a third way is presented by Carbo et al. (2003). By analysing regional economic growth for Spain between 1986 and 1998, their work has observed no significant effects due to changes in competition. This singular result can be explained by considering the preliminary findings of the study, which have evidenced an increase in concentration (measured by the HHI) but no relevant variation in the degree of competition over time. Therefore, their evidence is multi-faceted. First, there is need of major changes in the level of competition in order to generate a relevant effect on the real economy. Second, a consolidation not necessarily leads to a change in competition. Thus, as a measure of concentration, the HHI is not a good proxy for competition.

Claessens and Laeven (2005) have analysed the relationships between banking competition and credit supply for 16 countries by using the Rajan and Zingales' (1998) methodology. The approach makes use of sectoral data, which are interacted with a competition index, i.e. the country's H-statistics. In contrast with the mainstream literature, their results have detected a positive link between competition and growth, hence evidencing that market power might be harmful especially for financial dependent industries. Moreover, the level of concentration is not statistically significant in predicting the level of sector growth.

Coccoresse (2008) has explored the link between banking concentration and economic growth for Italy between 1991 and 2001 from a distinct perspective: he has considered that also an inverse relation may be possible. In fact, the study evidences that, in the short-run, banking concentration has a negative effect on economic growth, while in the long-run is economic growth that reduces banks' market shares. Therefore, the outcome is dual: first, a double side channel is possible; second, econometric models employed to disentangle the relationship need to be correct for potential reverse causality.

Fernández de Guevara and Maudos (2011) have detected a first-order positive effect of financial development on economic growth for 53 European industrial sectors over the period 1993-2003. Besides, they have pointed out that monopoly power affects economic growth in an inverted-U-shape way, that is the positive effect of market power on growth is highest at intermediate values.

Lastly, Coccoresse (2017) estimates two market power indices, namely the conventional Lerner index and a stochastic Lerner index (Coccoresse, 2014) over a wide panel of 11,985 credit institutions operating in 113 countries on the period 1993-2012. Employing a generalised method of moments dynamic panel data approach in order to correct for potential reverse causality, he shows a positive and strong relation between market power and growth, hence supporting that economic development is stronger when banks can rely on some market power.

1.3.3 Competition and the monetary policy transmission

In the monetary policy transmission, banks are the connection point between the Central Bank and the real economy. Three are the channels: the interest rate, the credit channel, and the lending channel. To explain how the three channels work, let us assume, for instance, a tightening monetary policy.

The traditional interest rate – or money – channel pertains the liability side of banks' balance sheet. Open-market operations undertaken by the monetary authority during a monetary policy tighten involve a drop of banks' reserves. Hence, since banks have to meet the reserve requirement, they must reduce reservable deposits encouraging household to shift into other alternatives.

Therefore, the interest rates on these substitutes must rise. When the short-term interest rates increase is transferred to longer-term interest rates, the aggregate demand diminishes. However, the money channel assumes that banks do not retain excess reserves. Since after the financial crisis banks began to expand their reserves, a growing emphasis has been placed on the alternative transmission channels.

According to the broad credit channel, an increase in interest rates engenders a depreciation in firms' net income and net worth, which in turn cause an increase in the external finance premium. As a result, the aggregate demand reduces.

The third mechanism works on the assets side of the balance sheet, and is the one we are interested in. As already mentioned, a reduction in bank reserves following a tightening of monetary policy translates into a smaller number of reserved deposits. Therefore, banks have two alternatives: to replace deposits with other non-reservable liabilities; or, to reduce their assets. The second option, which induces a reduction of the aggregate loans supply, identifies the lending channel (Bernanke and Blinder, 1988; Peek and Rosengren, 2014).

Since banking competition affects lending, it is likely that a change in the degree of market competitiveness involves monetary policy transmission and, according to Olivero et al. (2011a), it can happen in several ways.

As long as larger banks can access more easily alternative sources of funding (Köhler, 2015), they are more able to counterbalance the reserves shrinkage due to a monetary policy tightening. Therefore, a change in competition due to an increase of larger banks' market share may weaken the lending channel, involving a lower reduction of loans supply.

In addition, as pointed out by Petersen and Rajan (1995), a concentrated market encourages banks to establish long-term relations with their borrowers, in order to extract quasi-rent from their informative advantage. As a result, borrowers, especially the opaque ones, are somehow linked to the bank: shifting would be expensive, and alternative sources of funding are not guaranteed. Thus, the reduction of the credit offer following a restrictive monetary policy will result in an excess demand of those who are no longer funded and, the higher the switching costs, the higher the reduction of the aggregate supply.

Finally, a tougher competition generates greater price sensitivity to marginal cost variations. Hence, a change in deposit rates due to a shock of reserves will be more directly transmitted to lending rates, meaning a stronger transmission channel.

In considering the importance of the topic, there is a relative scarcity of literature evaluating the role of banking competition in the transmission of monetary policy, both theoretical and empiric.

The importance of the banking market structure for monetary policy has been underscored in Aftalion and White (1977; 1978) and Vuchelen (1978). Some years later, VanHoose (1983; 1985) has indicated the degree of competition in the deposit market as an important determinant of the monetary policy actions results, also underlining that the federal funds rate is ineffective in competitive banking systems.

More recently, Baglioni (2007) has demonstrated that the effectiveness of the lending channel depends substantially on the market structure, because of the differences in the strategic interactions between banks. In fact, where the interactions show strategical complementarity, such as under monopolistic competition, the aggregate outcome is amplified by the reaction of each individual bank. Conversely, when interactions are characterized by strategic substitutability, like in a Cournot oligopoly, the response of each bank is reduced by the reaction of the others.

Empirical evidences mainly support a negative relationship between both competition and concentration and the effectiveness of monetary policy, even though with a few exceptions.

Gunji et al. (2009) have shown that competition has reduced the effect of monetary shocks on loans supply in 22 countries over the period 1991-2001.

Adams and Amel (2011) have found instead that an increase in market concentration reduced the sensitivity of bank lending to the US federal funds rate between 1996 and 2004. They conclude that market power lessens monetary policy effectiveness. However, their study is limited to the US banking market, and results are meaningful only in rural areas. Moreover, by employing the Herfindahl-Hirshmann index they have rather assessed the impact of concentration on the lending channel.

In two different papers, Olivero et al. (2011a; 2011b) have explored the effect on monetary policy transmission through the bank lending channels of both concentration (measured by the CR5 and the HHI) and competition (assessed through the H-statistics) for 10 Latin American and 10 Asian countries over the period 1996-2006. They have evidenced that either banking competition and concentration reduce the effectiveness of monetary policy transmission, especially for small, less capitalized banks with a lower liquidity.

Amidu and Wolfe (2013) have detected the positive effect of market power, measured with the Lerner index, on the lending channel of a wide panel of 978 banks from 55 different countries during 2000–2007.

Finally, the results about five ASEAN countries between 1999 and 2014 by Khan et al. (2016) are quite mixed. While they find a coherent negative relationship between concentration and effectiveness of monetary policy for each employed proxy (i.e. CR5 and HHI), their results about market power are more confusing. In fact, although the regression with the Lerner index confirms the reducing effect of market power, the assessment with the Boone indicator leads to opposite results. However, their challenging results seems very interesting. As a matter of fact, the study evidences that the market power channel and the efficiency channel may involve two different outcomes regarding monetary policy transmission.

1.4 Banking competition and stability: friends or enemies?

The nature of the relationship between bank competition and financial stability is one of the longest discussed, both theoretically and empirically. The assessment of the actual competitive conditions of the market and the relative impact on stability is crucial for policy makers and regulators, since the effect of any policy may be extremely different depending on whether competition supports financial stability or not. For example, the issue is very relevant regarding mergers and acquisitions, two measures which are typically employed by regulators to avoid banks' default. Since M&As increase market concentration, their suitability as

restructuring actions necessarily involves some evaluations about their impact on systemic stability.

1.4.1 Theoretical literature

Literature typically distinguishes between two theories: the “competition-fragility” view and the “competition-stability” hypothesis. By stating that a more concentrated market is safer, the traditional “competition-fragility” theory deems competition detrimental for banking stability, since it erodes banks’ market power and profit margins. Conversely, the alternative “competition-stability” theory argues that competition (or lower concentration) may better improve the stability of the banking system.

Belonging to the first field, the “charter (or franchise) value” theory (Marcus, 1984; Keeley, 1990) states that higher market power is functional in maintaining a proper charter value, and competition, reducing them both, constitutes an incentive to engage in risk-taking activities. A bank’s franchise value can be interpreted as an opportunity cost in case of bankruptcy, thus the greater the value, the higher the cost. As shareholders want to protect their value, they will encourage managers to improve assets’ quality and hold more capital, hence diminishing the probability of default.

Besides, a concentrated market is constituted by larger banks. Acting as monopolists, they protect the system against sudden shocks and assets deterioration through the buffer provided by their profits, eventually reducing the probability of systemic crises (Allen and Gale, 2004; Boyd et al., 2004). Moreover, big financial institutions are typically more able to exploit scale and scope economies and better diversify their portfolios, hence their individual risk is relatively low (Diamond, 1984; Ramakrishnan and Thakor, 1984; Boyd and Prescott, 1986; Williamson, 1986).

Less competitive markets also allow for more valuable relationships with borrowers. Indeed, long-term agreements grant higher quality information, which translates in a better liability and credit risk management (Petersen and Rajan, 1995; Smith, 1984). Conversely, since competition reduces banks’ informative

advantages, they are less incentivized in investing in borrowers' screening, hence affecting their portfolio credit quality (Chan et al., 1986; Besanko and Thakor, 1993; Boot and Greenbaum, 1993; Allen and Gale, 2000, 2004; Marquez, 2002).

High competition may also become a vehicle of spreading contagion. The theoretical model by Allen and Gale (2000) shows that, when banks are price taker, which is the case of perfect competition, there is no incentive for safe banks in providing liquidity to distressed ones. Hence, their consequent default will put in danger the whole sector. They also consider that the lower is the number of the institutions operating in the market, the easier the monitoring by supervisors, therefore a higher level of resilience is ensured. Furthermore, banks acting in less than competitive markets can strategically agree to rescue troubled banks, while coordination problems arising in dispersed markets make the agreement less easy (Sáez and Shi, 2004).

Lastly, Matutes and Vives (1996) notice that the market structure is relevant also regarding the final effects of protection policies, such as deposit insurance. In fact, if on the one side such policy measure reduces fragility by preventing bank runs, it also engenders moral hazard by providing incentives to banks to engage in riskier activities. Thus, in a more competitive environment, those incentives are exacerbated (Diamond and Dybvig, 1983; Matutes and Vives, 1996).

On the other side of the coin, according to Boyd and De Nicoló (2005), market power allows bank to charge higher loan rates. Since in a market characterized by information asymmetries a borrower who optimally selects investments might decide to assume greater risks (Stiglitz and Weiss, 1981), consequently the amount of non-performing loans could increment, negatively affecting banks' performance and risk of default. Therefore, there is a monotonic decreasing relationship between competition and risk seeking.

From a slightly different point of view, a market consisting of few big systemically relevant banks may be dangerous (Mishkin, 1999, 2006; Barth et al., 2012). According to the "too-big-to-fail" literature, regulators will be more likely to rescue troubled institutions, endangering moral hazard, and consequently risk-taking behavior and financial fragility (Kane, 2010; Rosenblum, 2011). The

expression “too-big-to-fail” appeared for the very first time in 1984 when, in the occasion of Continental Illinois National Bank’s nationalization, the Wall Street Journal reported a list of 11 large banks that regulators would have never allowed to fail. Afterwards, the term has become popular during the subprime crisis, referring to those institutions whose default would endanger the whole system (Molyneux et al, 2014; Moenninghoff et al, 2015).

Concentration can also involve stability through bank size in a different way. Since banks’ size is positively linked with complexity, large banks may be more difficult to monitor than small ones (Beck et al., 2006a, 2006b). Hence, an increase in size may involve a contraction in transparency. A bigger bank is more able to expand across multiple geographic markets and businesses, to use sophisticated (and sometimes opaque) financial instruments, and to build an extremely complex corporate organization. All the above may result into higher operational risk, lower managerial efficiency and corporate control, also reducing market self-regulation and regulatory action efficacy in hampering excessive risk-taking (Cetorelli et al., 2007).

Finally, lower competition may worsen adverse selection, as banks with market power may start predatory lending reducing their screening activities (Caminal and Matutes, 2002).

Nevertheless, the two hypotheses “competition-fragility” and “competition-stability” are not necessarily incompatible. Through a modification of the model by Boyd and De Nicoló (2005) that includes the hypothesis of imperfect correlation between loan defaults, Martinez-Miera and Repullo (2010) find a U-shaped link between default risk and competition. According to their model, the decline in the lending rates due to increasing competition may be followed by two different effects: a risk-shifting effect, that is the reduction in default probability; and a margin effect, that is the reduction in the revenues from the loans. They show that in concentrated market the first effect prevails, then any new entrance in the market enhances stability. In fragmented markets, instead, the second effect is prominent, hence a new entry reduces the soundness of the system.

1.4.2 Empirical literature

The ambiguous nature of the relationship between banking competition and stability has also been confirmed by an extensive empirical literature that has found mixed evidence.

In line with the “competition-fragility” hypothesis, Keeley (1990) suggests that banks with higher market power tend to maintain more capital to protect their valuable charters, and this would result in a lower default risk. Conducted on a sample of quarterly data from 1970 through 1986 for 85 US large holding companies, the study has evidenced that banks with higher Tobin’s q also showed lower risk premiums on large CD’s. As a consequence, a number of the bankruptcies occurred during the ‘80s may be ascribed to deregulation and the following reduction of monopoly rents suffered by banks.

Similarly, by evaluating a sample of more than 100 publicly traded US BHCs between 1986 and 1994, Demsetz et al. (1996) have evidenced that to higher franchise values (calculated as the difference between a firm’s market value and its replacement costs) corresponded both lower systematic risk and idiosyncratic risk. In fact, banks with higher charter value were better capitalized and showed a lower asset risk.

Salas and Saurina (2003) have reproduced Keeley’s model on 21 Spanish commercial banks over the period 1968-1998. They have found a positive relationship between Tobin’s q and the capital on asset ratio, while a negative link between the former and the loan loss ratio. Hence, they have concluded that to higher charter value corresponds a higher solvency and a lower credit risk.

On the opposite side, a large literature also supports the “competition-stability” theory.

Boyd et al. (2006) have highlighted a positive relationship between competition and bank stability by using two different samples: a cross-section of 2,500 US banks operating in June 2003; a panel data set of around 2700 commercial banks active in 134 countries between 1993 and 2004.

Confirming these results on a panel of individual banks data for 133 countries over the period 1993 to 2004, De Nicoló and Loukoianova (2007) have detected an even stronger relationship when taking into account bank ownership, and when state-owned banks have a considerable market share.

Yeyati and Micco (2007) have observed that competition in eight Latin American countries over the period 1993-2002 was heavily affected by two contemporary phenomena: a rising consolidation, led by many important mergers, and a progressive entry of foreign players in the markets. They have noticed neither link between concentration (measured by HHI, CR3 and CR5) and competition (assessed through the Rosse-Panzar H-statistics), nor between concentration and insolvency risk (proxied by the Z-score), rather a negative relationship is highlighted between competition and insolvency risk.

Schaeck and Čihák (2008) have demonstrated that efficiency is crucial in the transmission link between competition and stability. By using a GMM estimator on a sample of more than 3600 European banks and 8900 US banks between 1995 and 2005, they have detected a negative relationship between the Boone indicator and the Z-score, even when controlling for concentration (as measured by the HHI), concluding that competition strengthens bank stability, through the efficiency channel.

Assessing the dynamic link between competition and stability for a sample of 2529 European cooperative banks between 1998 and 2009, both in the short and long run, Fiordelisi and Mare (2014) have found that the Lerner index negatively “Granger-causes” the Z-score, hence concluding that competition increases stability.

Also the hypothesis of a nonlinear relationship between competition and stability has its own empiric support.

Berger et al. (2009) underline that, although market power may promote high credit risk concentration, banks can manage to protect their franchise value with capital injection or other techniques, achieving a reduced overall risk. In fact, exploring a sample of 8,235 banks from 23 industrial countries over 1999-2005, they have found that banks with higher market power (measured by the Lerner

index) had riskier loan portfolios, as indicated by higher non-performing loan ratios. However, their overall risk exposure was lower, as captured by their Z-scores. Moreover, as they have included squared measures for competition, they have detected nonlinearities, hence supporting the theoretical result by Martinez-Miera and Repullo (2010).

A study by Jimenez et al. (2013) has explicitly tested the Martinez-Miera and Repullo's hypothesis on 107 Spanish banks between 1988 and 2003. After controlling for bank specific and macroeconomic variables, they have detected a convex relationship between competition and risk in the loans market, while finding a concave relation in the deposit market. Also including squared measurements for competition, they confirm the non-linearity of the link.

Fu et al. (2014) reach a similar conclusion for a cross-country dataset of 14 countries from Asia Pacific between 2003 and 2010. Estimating the Z-score and the probability of default as defined by Bharath and Shumway (2008) at the bank level, they have discovered a risk that is decreasing in the market power (proxied by the Lerner index) while increasing in the level of concentration (as measured by the CR3). In other words, a lower pricing power fosters bank risk exposure, but higher concentration hinders financial stability.

The empirical studies evaluated so far tend to assess the relationship between competition (or concentration) and financial stability focusing on a bank level perspective, mainly evaluating banks' risk, as credit risk (Jayaratne and Strahan, 1998; Berger et al., 2009; Jimenez et al., 2013), interest rate risk (Delis and Kouretas, 2011), or default risk (Repullo, 2004; Schaeck et al., 2009; Berger et al., 2009; Jiménez et al., 2013; Turk Ariss, 2010; Fiordelisi e Mare, 2014; Fu et al., 2014). Others instead focus on a broader definition of stability, interpreted as absence of crises, or assessing systemic risk.

Among the others, Beck et al (2006a) have used cross-country aggregate data on 69 Nations from 1980 to 1997. In line with the methodology developed by Demirgüç-Kunt and Detragiache (1998a, 1998b), they have employed a dummy variable to classify if a systemic crisis took place. Their results show that a more concentrated banking system leads to less crises but, at the same time, competition

is not likely to increase instability. Therefore, both concentration and competitiveness influence positively the soundness of the system.

Using the same methodology on a sample of 45 countries over the period 1980-2005, Schaeck et al. (2009) have detected that competition, measured by the Panzar Rosse H-statistic, lowers systemic crises' probability, also enhancing time to crisis. At the same time, banking concentration is found to be associated with higher distress probability and briefer time to crisis.

By employing aggregate data for banks from the EU-25 between 1997 and 2005, Uhde and Heimeshoff (2009) assert that a higher national concentration has had a negative impact on European financial stability, as measured by the aggregate Z-score. Their results are not confirmed by Ijtsma et al. (2017) who detect no significant effect of concentration on stability on either bank-level or country-level Z-score.

1.5 Conclusions

Financial Institutions (FIs) are “special” intermediaries that play a pivotal role in the economy, since they promote development and are the transmission hub for monetary policy. However, offering a wide series of specific services, thus performing a series of distinctive functions, they end up incurring in a series of peculiar risks. Therefore, their contribution to the economy has to be carefully considered, since their default can involve terrible consequences. In this chapter we have tried to summarize the main literature about banking stability and competition, highlighting once more the growing importance of financial intermediaries for the economy.

Regarding financial stability, the literature seems to agree about its importance. Since the Thirties of last century, the detrimental effects of instability on the economy have been well documented. Moreover, the latest episodes of turmoil have left an important inheritance, demonstrating that a lack of soundness may involve serious damages. For all these reasons, regulators are extremely concerned about the topic and encourage the development of new methods of

calculating risk on which to rely on a political perspective. In fact, the very concept of stability is changing, evolving from a simple idea of each component soundness, to a more complex and inclusive definition that identifies the system in a more organic way.

About competition, instead, evidences are more blurred, mainly due to the peculiarities of the financial system. On a first side, banks' market power is being redeemed by modern studies, despite it has been long challenged by traditional literature, since considered as a vehicle for collusion. Indeed, a too competitive system seems to worsen both economic growth and monetary policy transmission.

Besides, the relation between competition and stability itself is not completely understood, and a third option between the competition-fragility/competition-stability hypothesis seems possible. Actually, the ultimate effect of the competition degree on the system soundness appears strictly related to the specific features of the particular industry.

Concluding, many hints for new research can be deduced from our review. First of all, there is a large room, and demand, for new financial stability measures, since the usual ones have been too often found inadequate ex-post. The same goes for competition appraisal, especially after the literature has shown the inconsistency of some traditional indicators. Moreover, a lot can be done in trying to combine the two aspects we evidenced concerning competition, namely market power and efficiency.

Chapter 2

Looking for stability: Drawing Merton's distance to default on a book-value framework

2.1 Introduction

How to measure banking sector stability is a long-debated topic, especially in light of the recent financial turmoil. Many approaches and indicators have been developed, ranging from generic definitions of banking crises (e.g. Demirgüç-Kunt and Detragiache, 1998a, 1998b) to accounting-based measurements (e.g. Boyd and Graham, 1986; Hannan and Hanweck, 1988) and complex market-based models (Black and Scholes, 1973; Merton, 1974). However, there is no widespread consensus on any method, either from academic literature or from regulators.

In addition, country-specific market peculiarities also make a difference. For example, in the Italian banking system there is a large heterogeneity between intermediaries, of which many are cooperative banks (BCCs), i.e. local small non-listed credit institutions. Their activity is founded on the principle of mutuality, focuses mainly on members, and represents a valuable support to local economic development: hence, BCCs do not act as profit-maximizing entities. It follows that market-based stability measurements are not adequate for the Italian banking sector. Moreover, even the use of the Z-score – the most conventional accounting-based measure – seems not fully appropriate, as it is based on a profitability index.

This paper proposes a new index for banks' insolvency risk, derived from the "Contingent Claim Analysis" by Merton (1974) and Black and Scholes (1973). This indicator – which we term 'book-value distance to default' (BVDD) – is a modification of the classic distance to default, but entirely constructed on book-value data (Souto, 2008; Blavy and Souto, 2009; Souto et al., 2009; Guerra et al.,

2016), thus overlooking market data. Furthermore, being based on the asset/liability structure, it is suitable also for those companies that do not have profit maximization as their main goal.

We test our stability measure on a sample of Italian banks over the period 1996-2013, working on unconsolidated balance sheet data published by ABI (the Italian Banking Association). We employ two econometric approaches: a logit model, and a semiparametric Cox model (Cox, 1972). We find strong empirical evidence that the BVDD is a reliable measure of bank stability, also when controlling for bank-specific, market, and macroeconomic variables.

The remainder of the paper is organized as follows. Section 2.2 briefly reviews our main reference literature. Section 2.3 develops the theoretical background and the methodology employed to construct the BVDD index. Section 2.4 describes the empirical approach for testing the reliability of BVDD as an insolvency risk measure, whose results are presented and discussed in Section 2.5. Section 2.6 concludes.

2.2 From the Merton model to the book-value distance to default: a literature review

The literature makes a wide use of insolvency risk measures developed on the ground of the Contingent Claim Analysis, both at the bank level (e.g. Vassalou and Xing, 2004; Gropp et al., 2006; Akhigbe et al., 2007; Duffie et al., 2007; Campbell et al., 2008; Miller et al., 2015) and at the country level (Anginer et al., 2014). Moreover, the CCA framework has also been employed to develop empirical credit measures, such as the EDF by Moody's (Bohn and Crosbie, 2003).

Proposed by Merton (1974), the CCA defines the event of default as a state in which a bank is not able to “satisfy some or all of the indenture requirements”. Subsequently, constructing a system of two non-linear simultaneous equations, the Merton model derives key variables from market data in order to estimate two risk indexes, namely the distance to default and the risk neutral default probability.

The charm of the methodology stays in its ability to combine market values with balance sheet items, thus providing a sound theoretical structure for investigating firms' default, which is neither time-dependent nor sample-dependent. Yet, criticisms have been also raised. The main objection is that the model, being structural, requires strong assumptions: for example, stock returns are normally distributed, there is just one single homogenous class of debt (thus failing to capture differences among heterogeneous debts), debt is static and unchanged through the years (Agarwal and Taffler, 2008; Saunders and Allen, 2002, pp. 58-61).

As a matter of fact, the technique presents two peculiar drawbacks: first, results are affected by the empirical methodology employed to estimate the system of equations; second, the model itself can be applied only to publicly traded firms' data, which often makes impossible to analyse large portions of many markets. Moreover, the approach has shown to be rather difficult to implement (Kealhofer, 2003; Hillegeist et al., 2004; Chan-Lau and Sy, 2007; Agarwal and Taffler, 2008; Guerra et al., 2016).

In order to overcome such shortcomings, part of the literature has tried to suggest improvements and simplifications.

A noteworthy contribution has been conducted by Vasicek (1984), who proposed to slightly change the focus of the analysis on the company itself rather than its debt. A real business is more complicated than the firm described by Merton: a company has a number of different classes of equity and liabilities; the debt evolves over time; and, above all, a default may happen also in cases where the value of the debt is lower than the assets value. Thus, main hypothesis of the model is the differentiation between default events and actual bankruptcy. A default event occurs every time the assets' value of a company becomes lower than a 'distress barrier' that takes into account a given level of liabilities. In other terms, combining debts' maturities, they allow the event of default to happen also in cases where the assets value exceeds the whole liability value.

The Vasicek model is nowadays better known as KMV model, since it has been developed afterwards within the KMV corporation. The latter is a company

founded by Kealhofer, McQuown, and Vasicek in 1989 and acquired by Moody's in 2002. The output measure obtained with the Moody's KMV model is the Expected Default Frequency – or EDF – which represents the one-year default probability for any individual firm (Crouhy et al., 2000; Kealhofer, 2003).

From another perspective, Bharath and Shumway (2008) have proposed a simplified version of the classic distance to default, and they call it 'naïve distance to default' (DD). One peculiarity of the naïve DD is that it does not require solving the equation simultaneously, even if it retains the overall structure of the KMV-Merton model. By comparing their index with the Merton's distance to default, they conclude that the latter is not a sufficient statistic to proxy for probability of bankruptcy, while its functional form is suitable for implementing simpler and better performing methods.

Albeit remarkably improving the original structure, both the Moody's KMV EDF and the naïve DD use market volatility, therefore they can be calculated only for listed or publicly traded corporations. A strand of the literature has been recently developed within the CCA with the objective of modelling new default indicators making use of book-value data only. Although not very extensive, its results and evidence seem encouraging.

One of the first applications of this approach can be found in a contribution by Souto (2008), who aims at assessing the vulnerabilities of the Uruguayan banking sector after the 2002 crisis. Because of the absolute lack of market data, and in order to nonetheless incorporate volatility in his analysis, he proposes a variant of the Merton model entirely based on book-value data, showing that the methodology is able to capture the credit risk escalation during the banking crisis period, not only for the financial sector, but also for the corporate sector. Basically, he suggests replacing the implied value of assets with the value of assets from balance sheets (or an estimate of it) and the volatility of assets with the volatility of the book-value assets variation.

This methodology has been then applied by Blavy and Souto (2009), who employ quarterly balance sheet data over the period 1997-2008 for 207 Mexican banks. Investigating macro-financial interconnections in the Mexican banking

sector, they find that both domestic and foreign macro-financial variables are related to banking stability. However, even though the results differ among banks, their book-value risk neutral default probability is found to be a good predictor for the non-performing loans to total loans ratio.

Similarly, Souto et al. (2009) apply the methodology on a sample of 39 Brazilian banks between 2001 and 2007, detecting deterioration in the estimated credit risk indicators following the early 2000s crisis.

Later, Guerra et al. (2016) employ the book-value of assets and its volatility through the adaptation of the Merton model to estimate the distance to default and the probability of default for a group of 65 Brazilian banks on the period 2002-2012. They construct their indicators for both individual banks and the whole group of banks in the system, finding their proposed measure able to foresee banking system distresses, like the global financial crisis of 2008.

Our study provides some key contribution to this literature. Particularly, we propose a new stability indicator – the book-value distance to default (BVDD) – based on the classic distance to default derived within the Contingent Claim Analysis but entirely constructed on book-value data, and we test its accuracy as an insolvency risk measure. To achieve our aim, we employ two methodologies widely used in the empirical literature (Gropp et al., 2006; Duffie et al., 2007; Bharath and Shumway, 2008; Chiaramonte et al., 2016): a standard logit model and a semiparametric Cox model. Both demonstrate that the book-value distance to default is a good predictor for banks' default. Furthermore, as we perform our analysis on a sample of 863 Italian banks over the period 1996-2013, we provide some insights about the Italian banking sector during a period characterized by substantial structural transformations.

2.3 The book-value distance to default

Creating the Contingent Claim Analysis, Merton (1974) proposed to apply a framework borrowed from the theory of options to the corporate risk analysis.

According to the Option Pricing Theory, a European⁷ option is a financial derivative that grants to the holder the right to buy (in this case, the option is said ‘call’) or to sell (hence it is said ‘put’) a certain underlying (goods or financial assets) at a particular price, which is called strike price, at a predetermined maturity.

Recalling briefly the case of a call option, at a time t the holder obtains the right to buy a certain underlying at a future time T (with $T > t$) at a given strike price (S). It appears likely that the holder, as a rational agent, will exercise his right only if at time T the strike price is lower than the current price of the underlying (U_T). In this case, he would obtain a gain equal to $U_T - S$, and the option be said “in the money”.

Let us consider now a bank’s liability as a single debt which requires a payment at a certain maturity (T). In line with the Merton’s hypothesis, the bank will meet its obligation only if, at time T , its total assets value (V_T) exceeds the value of the debt (L); otherwise it will default. In other terms, if at time T the difference between assets value and debt is positive, the bank survives; the difference $V_T - L$ represents bank’s equity (E), and a bank is considered healthy if it is positive.

Employing the option pricing concept above described, Merton conjectured to consider banks’ equity⁸ as the pay-off of a theoretical call option. In fact, as a European call option’s pay-off is positive only if $U_T > S$, similarly banks’ equity is positive only if $V_T > L$.

A further idea was to model the equity value through a modification of the Black and Scholes formula:

$$E_t = V_t N(d_1) - L e^{-r_t T} N(d_2) \quad (2.1)$$

according to which the value of the equity (E) at a time t , contingent on the payment of a debt equal to L at a maturity T , is given by the difference between two factors: the expected value of the assets (V) and the value of the debt (L) at time T . Both factors are contingent on the option finishing in the money (i.e. $V - L > 0$ at time T), risk-adjusted, and, as they are evaluated at time t , discounted at the riskless rate r_t .

⁷ A European option differs from an American option, as the former can be exercised only at maturity, while the latter can be exercised at any time up to the maturity.

⁸ Merton refers generally to firms.

Since E represents a stochastic event, $N(d_1)$ and $N(d_2)$ account for uncertainty, ensuring that at time T “the option will be in the money”.⁹

Focusing on $N(d_2)$, it expresses the probability that the bank will be able to meet its obligations at time T ; hence, the higher its value, the higher the probability of survival for the bank. Therefore, according to Merton (1974), d_2 can be interpreted as the distance from the event of default, and, for a general bank i at time t , it can be defined as:

$$DD_{it} = d_2 = \frac{\ln\left(\frac{V_{it}}{L_{it}}\right) + \left(r_t - \frac{1}{2}\sigma_{it}^V\right)T}{\sigma_{it}^V\sqrt{T}} \quad (2.2)$$

where V_{it} is the value of assets, L_{it} is the face value of the debt (i.e. total liability), r_t is the risk-free rate and σ_{it}^V is the assets' volatility. T represents the time to maturity, i.e. the time at which the bank is required to meet the obligation (Black and Scholes, 1973; Merton, 1974; Jones et al., 1984; Nielsen, 1992; Afik et al., 2016).

In order to apply the framework to a dataset that mostly comprises non-listed banks, our methodology follows Souto (2008), Blavy and Souto (2009), and Guerra et al. (2016), who replace the implied asset value V_{it} with the book-value of assets for the bank i at time t , AV_{it} .

Furthermore, the theoretical model defines the event of default as a state in which the assets value is lower than the value of the whole liability, considered as a homogeneous class of debt with maturity T . Since this is quite unlikely to occur, also considering that banks' liability is typically constituted by different debt categories with different maturity, we adopt the so-called “distress barrier” (Kealhofer, 2003; Guerra et al., 2016). Considering the debt structure of a bank as a portfolio of both long-term liabilities – with a time of maturity longer than T – and short-term (or current) debt – with a time of maturity shorter than or equal to T –, we compute the distress barrier (DB_{it}) as a linear function of the book values of short-term (STD_{it}) and long-term liabilities (LTD_{it}):

⁹ A more exhaustive explanation of the model, with a precise derivation of d_1 and d_2 , can be found in Nielsen (1992).

$$DB_{it} = STD_{it} + \alpha_{it} LTD_{it} \quad (2.3)$$

In line with Guerra et al. (2016), the value α_{it} is set applying a rule identified by Bohn and Crosbie (2003) when determining the EDF, an empirical credit measure relying on the Merton model developed by Moody's (Bohn and Crosbie, 2003; De Servigny and Renault, 2007; Guerra et al., 2016), according to which:

$$\alpha_{it} = \begin{cases} 0.5 & \text{if } \frac{LTD_{it}}{STD_{it}} < 1.5 \\ 0.7 - 0.3 \times \frac{STD_{it}}{LTD_{it}} & \text{if } \frac{LTD_{it}}{STD_{it}} \geq 1.5 \end{cases} \quad (2.4)$$

To approximate the assets volatility, we follow Gambacorta and Song Shin (2016), who use “the standard deviation of the annual percentage change in the book-value of total assets over a three-year window”. Besides, as we are gauging a credit risk measure, we are more concerned about downward peaks of the assets value, whose reductions are more alarming than increases of the same amount. Nonetheless, part of the literature states that also a growth in the assets might engender risk (see for instance Demirgüç-Kunt and Huizinga, 2010; Altunbaş et al., 2011).

Therefore, our assets volatility is calculated as:

$$\sigma_{it}^{AV} = \sqrt{\frac{\sum_{t=1}^3 (v_{it} - \bar{v}_{it})^2}{3}} \quad (2.5)$$

where

$$v_{it} = \begin{cases} \frac{AV_{it} - AV_{it-1}}{AV_{it}} \text{ if } \frac{AV_{it} - AV_{it-1}}{AV_{it}} \leq 0 \\ \theta \frac{AV_{it} - AV_{it-1}}{AV_{it}} \text{ if } \frac{AV_{it} - AV_{it-1}}{AV_{it}} > 0; \theta = 0.1 \end{cases} \quad (2.6)$$

and

$$\bar{v}_{it} = \sqrt[3]{(1 + v_{it})(1 + v_{it-1})(1 + v_{it-2})} - 1 \quad (2.7)$$

In other terms, this is a 'semi-downward' volatility, which considers the entire value of an assets' contraction but only a portion of its increases. In Eq. (2.6) we set $\theta = 0.1$, meaning that an increase of the value of assets could also imply some risk, even if far smaller compared to a decrease. Of course, we acknowledge that our choice of the value of θ can be regarded as subjective, however other (low) values of such parameter do not notably affect the results.

Finally, as we compute the one-year book-value distance to default, $T = 1$, our final formula can be written as:

$$BVDD_{it} = \frac{\ln\left(\frac{AV_{it}}{DB_{it}}\right) + \left(r_t - \frac{1}{2}\sigma_{it}^{AV^2}\right)}{\sigma_{it}^{AV}} \quad (2.8)$$

2.4 Empirical methodology, variables and data

2.4.1 Econometric framework

In order to test the validity of the book-value distance to default, built as defined in Section 2.3, we estimate the following model:

$$FAILED_{it} = \beta_0 + \beta_1 RISK_{it} + \beta_k \mathbf{X}_{kit} + \gamma_r + \phi_t + \varepsilon_i \quad (2.9)$$

Here, $FAILED_{it}$ is a dummy variable taking the value of 1 when the bank i defaults at time $t+1$, and 0 otherwise, and $RISK_{it}$ is our variable of interest, i.e. the book-value distance to default ($BVDD_{it}$) as defined in Eq. (2.8). \mathbf{X}_{kit} is a vector of k bank-specific, market and macroeconomic control variables (later specified). We also include regional and time (year) fixed effects, γ_r and ϕ_t , to control for unobserved heterogeneity.

The above model is estimated by employing two methodologies: a logistic (logit) model (Gropp et al., 2006), and a semiparametric Cox proportional hazard model (Cox, 1972; Gropp et al., 2006; Evrensel, 2008).

The (standard) logit model assumes the usual general form:

$$\Pr[FAILED_{it} = 1 | \mathbf{Z}_{jit}] = \Lambda(\beta_0 + \beta_j \mathbf{Z}_{jit}) = \frac{\exp(\beta_0 + \beta_j \mathbf{Z}_{jit})}{1 + \exp(\beta_0 + \beta_j \mathbf{Z}_{jit})} \quad (2.10)$$

where $\Lambda(*)$ is the cumulative logistic distribution, and \mathbf{Z}_{jit} is the vector of all the variables that are included in the model (i.e. risk, bank-specific, market, and macroeconomic variables).

The logistic specification allows us to evaluate the impact of an increase of our variable of interest on the probability of default. Since *BVDD* measures the distance from the situation of default, we expect a decrease in the likelihood of failure correspondent to a *BVDD*'s growth.

The second methodology we employ is a semiparametric Cox proportional hazard model with the following general form:¹⁰

$$\lambda(t | \mathbf{Z}_{jit}) = \exp(\beta_j \mathbf{Z}_{jit}) \lambda_0(t) \quad (2.11)$$

Here $\lambda(*)$ is the proportional hazard function, $\lambda_0(t)$ is the baseline hazard (which corresponds to the overall hazard when there is no influence of the regressors on the hazard rate), and \mathbf{Z}_{jit} is the general vector of the regressors as defined above.

With the survival analysis we aim at evaluating the effect of a unit increase in *BVDD* for bank *i* at time *t* on its hazard rate, where the hazard rate $\lambda(t)$ for bank *i* at year *t* is defined as the instantaneous risk of the bank's disappearance in year *t* conditional on its existence up to time *t*. We expect that, being a proxy for banks' financial stability, an increase in *BVDD* reduces the hazard rate.

¹⁰ A more detailed analysis of the model can be found in Appendix 2.2.

Given the relationship between the probability of surviving after a certain time and the amount of risk that the bank has accumulated up to that time, the hazard rate measures the degree at which that risk is accumulated.

The relationship between the hazard rate and the risk identifies the hazard function, and its shape is determined by the underlying process that determines the risk. While the risk can vary from the absence of any risk to the certainty of the failure event, the hazard rate can vary from zero to infinity, so that, when there is absence of risk, the correspondent hazard is zero, and when the risk grows (decreases) with time, the hazard rate grows (decreases). As we do not have any information about the shape of the hazard rate, we have opted for employing the Cox methodology, which provides estimates of the β vector avoiding assumptions about the functional form of the hazard over time. The only assumption needed is the 'proportionality hypothesis', i.e. that the hazard function is the same for all banks (Cox, 1972; Pappas et al., 2017).

The Cox model also controls for censoring, which is an unavoidable occurrence when employing the survival analysis. In fact, a basic hypothesis behind any hazard model is that default is a necessary circumstance. Therefore, for each bank only two outcomes are observable: the failure, or the censoring (precisely, right censoring). As a standard approach, the model assumes censoring not to be informative about latent future failures that might occur in a period subsequent the window of analysis (e.g. Wheelock and Wilson, 2000; Gropp et al., 2006; Campbell et al., 2008).

To assess whether our model correctly identifies the events of default, we conduct a further test, estimating Type I and Type II errors in line with Gropp et al. (2006) and Chiaramonte et al. (2016). Type I error identifies missed failures, occurring when the model is not able to predict a failure that actually happened. It is calculated as the ratio of false negative events to the sum of false negative and true positive events. A Type II error, i.e. a false alarm, arises when a bank is indicated as failed by the model even if healthy in reality. It is given by the ratio of false positive events to the sum of false positive and true negative events.

To define whether a bank is forecasted by the survival analysis as defaulted, we need a cut-off point on the distribution of the predicted values: banks above the threshold are considered as defaulted, while all banks below it are treated as survived. It is evident that the position of the cut-off point has an impact on both Type I and Type II errors: lowering the threshold decreases the probability of defining a failed bank as healthy, then Type I error; at the same time, the probability of identifying a healthy bank as failed increases, therefore Type II error is higher. Consequently, the optimal definition of the cut-off point depends on the subjective weights assigned to the two types of errors (Poghosyan and Čihák, 2011; Chiaramonte et al., 2016). To minimize subjectivity, we have conducted the analysis twice, using the 10th and the 20th quantiles as cut-off, respectively.

2.4.2 Dependent variable

Defining the event of extinction might be not so straightforward, as a bank can exit from the market for various reasons. It can be put in compulsory liquidation by regulators, or closing can be voluntary. Moreover, also mergers and acquisitions between institutions tangle the picture, as they involve the cancellation of at least one of the merging intermediaries. In other terms, a bank can quit its activity not only because of a failure or a problematic situation, but also as a strategic choice.

Therefore, in defining a bank as extinct, we follow Maggiolini and Mistrulli (2005): a bank that exited from the market is considered as extinct when either it has been subjected to compulsory liquidation, or it made losses during the last three years before its cancellation from the Bank of Italy's registry. In all other cases, the observation is considered as censored. This procedure represents a standard approach in the empirical literature (e.g. Wheelock and Wilson, 2000; Gropp et al., 2006; Campbell et al., 2008).

Moreover, to preserve the reliability of our analysis, we choose to follow an even more conservative approach: we consider as extinct a bank only when its data are available in the year before its extinction, while in the remaining cases the observation is assumed as censored.

To sum up, our dependent variable $FAILED_{it}$ is a dummy variable taking the value of 1 if the bank is considered as extinct after distress – as above described – and 0 otherwise (i.e. for non-failed banks and censored banks).

2.4.3 Independent variables

In our analysis, the variable of interest is $BVDD$ (as defined in Section 2.3). Since it represents a stability measure (as it quantifies the distance of a bank from its default state), we expect lower $BVDD$'s for more troubled banks. Hence, as already noted, in the logit specification we expect a significant and negative coefficient for $BVDD$, meaning that an increase in the likelihood of default has occurred in the years preceding the event of failure. Similarly, in the hazard model framework we expect a coefficient that decreases the hazard ratio.

For sake of comparison, we also employ another index of banking stability, namely the Z-score ($ZSCORE$). Since it is a generally recognized measure of banks' distance from insolvency, comparing the estimated coefficients for the two indices should allow us to better assess the predictive power of our $BVDD$.

The Z-score is computed as:

$$ZSCORE_{it} = \frac{\mu(ROA)_{it} + \mu(EQASS)_{it}}{\sigma(ROA)_{it}} \quad (2.12)$$

where, $\mu(ROA)$ and $\mu(EQASS)$ are moving averages on a three-year window for the return on assets ratio (ROA) and the equity on assets ratio ($EQASS$), respectively, while $\sigma(ROA)$ is the standard deviation of ROA on the same three-year window (Coccoresse and Ferri, 2017).

Because both $BVDD$ and $ZSCORE$ are highly skewed, we use their natural logarithm (Laeven and Levine, 2009).

Further, a third proxy of stability is here considered, i.e. the non-performing loans to total loans ratio (NPL), commonly employed as an accounting measure of bank credit risk.

To better capture differences in banks' likelihood of default, we add a series of control variables, as identified by a wide literature (e.g. Demirgüç-Kunt, 1989; Gropp, 2006; Demirgüç-Kunt and Huizinga, 2010; Altunbaş et al., 2011; Poghosyan and Čihák, 2011; Chiaramonte et al., 2015).

Banks' capital structure is assessed through the equity to total asset ratio (*EQASS*), while, in order to take into account the assets structure, we consider two variables: the logarithm of total assets (*lnTOTASS*), a proxy for banks' size, and the loans to total assets ratio (*LOANASS*), a proxy for the level of involvement in traditional banking activities. The ratio of non-interest income to total income (*NII*) is included to capture business diversification.

To account for bank profitability, we employ the net interest margin (*NIM*), a variable which focuses on traditional borrowing and lending activities. The *NIM* is typically employed in the stability literature (e.g. Uhde and Heimeshoff, 2009; Fu et al., 2014; IJtsma et al., 2017) as an alternative to the most common *ROA*, especially in models employing the *ZSCORE*, of which is a component. Moreover, as already underlined in Section 2.4.2, our dependent variable defines as 'extinct after distress' a bank that has suffered losses in the last three years before its exit from the market. Therefore, an estimate that uses either the *ROA* or the *ROE* might arise endogeneity issues.

To capture the role of market concentration, we employ the regional Herfindahl-Hirschman index (*HHI*). For multi-region banks it has been computed using banks' branches as weights (Coccoresse and Pellicchia, 2013). We control for macroeconomic factors by means of the logarithm of regional GDP per capita (*GDP_PC*) and regional GDP growth (*GDP_GR*), which help to catch the impact of local economic activity. In case of multi-region banks, both variables are again weighted by banks' branches.

We finally add a set of dummy variables corresponding to the different type of banks: Banche di Credito Cooperativo (*BCC*), Banche di Credito Popolare (*BCP*), Commercial Banks (*COMM*), and Saving Banks (*SAV*).

2.4.4 Data and summary statistics

Our initial sample is made up of 1,174 Italian banks over the period 1993-2013. Unconsolidated balance sheet data come from ABI (the Italian Banking Association). Regional Gross Domestic Product and deflator are available from Istat (Italian Statistical Institute). As a proxy for the risk-free rates we employ the interest rates on 1-year government bonds (source: Bank of Italy).

To focus on institutions that are engaged in the credit intermediation activity, we retain banks with a loans to assets ratio comprised between 20% and 95%. In addition, we drop observations for which *NII* is lower than 1% or higher than 90% and *EQASS* is under 1% or over 75%.

Further, since the calculation of *BVDD* (particularly, assets volatility) requires rolling windows of at least three consecutive values, banks for which less than four observations were available have been discarded.

After this data selection process, our final sample is an unbalanced panel comprising 9,421 observations for 863 Italian banks over the period 1996 to 2013.

Table 2.1 shows the yearly sample distribution of failed and survived banks. Over the period under scrutiny, 83 banks have been designated as failed. It is worth to notice that the largest part of troubled institutions has been acquired or merged, with only 2 banks subjected to compulsory liquidation before their cancellation from the Bank of Italy's register.

< INSERT TABLE 2.1 ABOUT HERE >

Table 2.2 reports yearly descriptive statistics for our estimated *BVDD*'s, while Table 2.3 displays summary statistics for the various control variables.

< INSERT TABLES 2.2 AND 2.3 ABOUT HERE >

In Table 2.4, we provide means and standard deviations for the regressors disentangling between survived and failed banks.

To check whether the difference between the average values for the two groups is statistically significant, we perform a t -test for each variable. The results show that, on average, healthy banks' $BVDD$ is higher at the 1% level of significance. As expected, healthy banks show also greater values of $ZSCORE$ than closed banks (the difference is significant again at the 1% level) and seem to be better capitalized and more profitable. Conversely, the level of credit risk (NPL) is higher for failed banks, which are characterized by larger loans to assets ratios (of about 5%) and non-interest income. They also face a more concentrated market with lower levels of GDP per capita than survived banks.

Table 2.5 exhibits the correlations among variables.

< INSERT TABLES 2.4 AND 2.5 ABOUT HERE >

2.5 Results

The estimation results for the logit model are displayed in Table 2.6. Column (1) refers to the model with $BVDD$ as stability measure and without control variables. The estimated coefficient of $BVDD$ is negative and significant, meaning that – as expected – the higher the banks' stability, the lower their probability of failure. More precisely, as $\beta_{\ln BVDD} = -0.8263$, the correspondent odds ratio is $e^{-0.8263} = 0.4377$, meaning that for every unit increase of $\ln BVDD$ the odds of failure increase by a factor of 0.4377. Within our framework, the odds of failure are defined as the ratio of the probability of the event of failure and the probability that this event does not occur. If the estimated coefficient of a variable is negative, it means that the odds variation is less than one, i.e. that the probability that the bank survives (the denominator) increases more than the probability that it disappears (the numerator). Hence, going back to the estimated values, if two banks are similar in all characteristics but differ on their values of $\ln BVDD$ by one unit, then the bank with the higher value of $\ln BVDD$ has less than one half (more precisely, 0.4377) the odds of failure within one year as the bank with the lower $\ln BVDD$ value. The sign and significance of our stability indicator are robust when controlling for bank

specific variables (column (2)), and market and macroeconomic variables with further bank specific dummies (column (3)).

In columns (4) and (5) we replace $\ln BVDD$ with the other alternative stability proxies. Particularly, in column (4) we employ $\ln ZSCORE$, while in column (5) we use NPL . As expected, the coefficient of $\ln ZSCORE$ is negative while the coefficient of NPL is positive (both significant at a 1% level), meaning that the probability of default is lower when stability (as measured by the Z-score) is higher and credit risk (as measured by the non-performing loans) is lower. Finally, to test whether $BVDD$ has some additional prediction power besides $ZSCORE$ and NPL , in column (6) we use it together with $\ln ZSCORE$, and in column (7) together with NPL .¹¹ Since in both regressions the above covariates are all highly significant, we conclude that $BVDD$ owns further explanatory power for banks' default probability.

Moving to the analysis of the control variables, some interesting insights can be inferred. Consistently with Köhler (2015), $EQASS$ and $\ln TOTASS$ are important determinants of banks' default probability for our sample. In detail, the coefficient of $\ln TOTASS$ is always negative and significant at the 1% level, meaning that larger banks are less likely to fail, essentially because they can obtain better portfolio diversification, greater level of scale and scope efficiency, hence a higher level of internal soundness (Lonzano-Vivas et al, 2011; Molyneux et al., 2014). Similarly, the negative (often significant) sign of the estimated coefficient for $EQASS$ indicates higher resilience for better capitalized banks. According to the theory of financial intermediation, capital reserves provide a buffer against losses. Moreover, by representing the shareholders' investment, a higher capitalization reduces incentives in risk-taking activities (Bhattacharya and Thakor, 1993). For similar reasons, higher equity may involve a better screening activity on borrowers' characteristics, hence leading to a lower level of risk and to an improved stability (Coval and Thakor, 2005). Our results are consistent also with Fiordelisi and Mare (2013), who evidence that assets size and capital adequacy have been negatively related to bank probability of default of Italian cooperative banks between 1997 and

¹¹ A similar methodology has been employed by Bharat and Shumway (2008).

2009. We can notice that *EQASS* is always statistically significant at the 1% level, except in models that incorporate the *ZSCORE* variable; this might be due to the fact that the former is a component of the latter.

< INSERT TABLE 2.6 ABOUT HERE >

We now turn to the time-to-failure hazard estimations, whose empirical evidence is reported in Table 2.7. Column (11) shows the results for the model including only *BVDD*, column (12) adds bank specific controls only, column (13) includes all control variables and the bank specific dummies. Besides, column (14) incorporates *ZSCORE* as alternative stability indicator and column (15) delivers the results for the model with *NPL* as a risk indicator. Finally, columns (16) and (17) present estimates for two models combining *BVDD* with *ZSCORE* and *NPL*, respectively.

Overall, the Cox semiparametric model tends to confirm the result of the logistic specification. The proportionality hypothesis is met across all model's specifications at a 1% level (see bottom of Table 2.7).

The coefficients of *BVDD* are significant for all models, and their negative sign confirms the expected impact on the hazard rate. Results appear robust across the various specifications. More in detail, considering the model in column (11), the estimated coefficient for *BVDD* is $\beta_{\ln BVDD} = -0.7664$. Therefore, as $e^{-0.7664} = 0.4646$, a unit increase of $\ln BVDD$ implies a decrease of the hazard of 53.54% (1-0.4646) (Cleves et al., 2010, p. 131). The coefficient remains negative and significant at the 1% level also when inserting bank specific, market and macroeconomic control variables (column (12) and (13)).

ZSCORE and *NPL* show the expected opposite relation with the hazard ratio. In fact, while an increase in *ZSCORE* implies a decrease in the likelihood of default (column (14)), *NPL* is positively correlated with the hazard (column (15)). Column (16) and (17) confirm the relevance of *BVDD* in predicting banks' distresses, since its coefficient remains highly statistically significant even when

controlling for *ZSCORE* and *NPL*, respectively. Therefore, we can conclude that *BVDD* is a robust predictor for banks' failure probability.

Regarding the control variables, larger banks and those with an adequate level of capital result less likely to fail, as well as more profitable institutions. The coefficients of the remaining market and macroeconomic control variables are not significant, which demonstrates that the banks' business model as well as the ability of managers matter more than macroeconomic or market factors.

< INSERT TABLE 2.7 ABOUT HERE >

In Table 2.8, estimates for Type I and Type II errors, as defined in Section 2.4.1, are reported. Focusing on the 10th quantile cut-off, for the Cox specification that considers only *BVDD* as the stability variable – i.e. column (11) – Type I error occurs with a frequency of 37.34%, while Type II error with a frequency of 9.53%. This means that *BVDD* is not able to identify a failed bank about 37 over 100 times, while it marks a sound bank as risky only in 9.5 over 100 times.

Considering the model including *BVDD* and all bank specific, market and macroeconomic variables – i.e. column (13) – Type I error reduces to 24.09%. Hence, the full model with *BVDD* outperforms the similar definition considering the *NPL* ratio as the risk index (in this case Type I error is 28.91%).

Once again the predicting power of the *BVDD* is confirmed also in column (16) and (17). In fact, by comparing column (16) with column (14), we can see a Type I error reduced by 7% (15.66% against 16.87%). Therefore, a model that combines *BVDD* and *ZSCORE* is more likely to identify a troubled bank than a model that includes only the latter. Likewise, adding the *BVDD* to a full model that already incorporates *NPL* reduces Type I error by more than 29% (20.48% versus the previous 28.91%), as can be seen by comparing columns (17) and (15).

All model comprising *ZSCORE* seem to perform better in terms of both Type I and Type II errors, as evidenced in columns (14) and (16). Yet, a remark is important here. From Section 2.4.2, we have chosen to mark a bank as troubled also when it has recorded a loss during the last three years before its cancellation from

the Bank of Italy's registry. Since *ZSCORE* is computed by using the return on assets ratio, the outperformance may result by construction. After all, a similar behaviour has been also noted for the other component of the Z-score, i.e. the equity on assets ratio.

A further experiment has been conducted employing the 20th quantile as cut-off. It is evident from Table 2.8 that setting a higher threshold has a negative impact on Type I error (which has reduced to 39% from 24.5%), while it enhances Type II error (now about 4.5% against the previous 9.4%). However, results confirm *BVDD*'s predictor power.

< INSERT TABLE 2.8 ABOUT HERE >

2.6 Conclusions

Measuring the stability of the banking sector is a hot topic that concerns both politicians and academics, especially after the recent financial crises. The methodological proposals are numerous and assorted. This is because the appropriate indicator changes according to a number of factors, including the adopted definition of risk and the features of the specific market. Thus, acknowledging an unambiguous index is fairly problematic.

In this chapter we have proposed an alternative measure of banks' solvency risk – the book-value distance to default (*BVDD*) – which is a modification of the Merton's distance to default entirely constructed on balance sheet data. Briefly, we have replaced the value of assets from balance sheet to the implied value derived from market data. Moreover, we have proxied assets volatility through a particular 'semi-downward' volatility, which considers the whole value of the assets' contractions but only a portion of its increases.

To test the reliability of the *BVDD*, we have employed two econometric methodologies, namely a logit model and a semiparametric Cox model. For the purpose, we have used an unbalanced panel dataset composed by 863 Italian banks

over the period 1996-2013. Moreover, to assess the predictive power of BVDD, we have also calculated Type I and Type II errors for the various model specifications.

The main result obtained is that banks with higher *BVDD* are less likely to default. The evidence is robust to changes in model specification and to different empirical methodologies. The estimated coefficients sign and significance are robust also when controlling for other measures of stability and risk, i.e. *ZSCORE* and *NPL*, which proves that *BVDD* has some additional prediction power besides those indices.

Regarding banks' characteristics, we find that small, less capitalized and less profitable banks with a higher level of impaired assets are more likely to default, and that the banks' business model and managers' capability are crucial factors affecting the likelihood to fail.

Concluding, the book-value distance to default appears to be a good predictor for banks' probability of default and may therefore represent a useful complement (if not an alternative) to other measure of banks' soundness.

Appendix 2.1. Tables

Table 2.1 – Yearly sample distribution of failed and survived banks

YEAR	FAILED BANKS	SURVIVED BANKS	PERCENTAGE OF FAILED BANKS	TOTAL
1996	2	439	0.45%	441
1997	2	623	0.32%	625
1998	4	621	0.64%	625
1999	2	597	0.33%	599
2000	4	551	0.72%	555
2001	7	525	1.32%	532
2002	6	507	1.17%	513
2003	1	516	0.19%	517
2004	1	524	0.19%	525
2005	2	503	0.40%	505
2006	1	504	0.20%	505
2007	4	507	0.78%	511
2008	0	501	0.00%	501
2009	3	517	0.58%	520
2010	8	514	1.53%	522
2011	17	498	3.30%	515
2012	11	458	2.35%	469
2013	8	433	1.81%	441
TOTAL	83	780		863

Source: Own elaboration on Bank of Italy data.

Table 2.2 – Yearly summary statistics for estimated $\ln BVDD$

YEAR	MEAN	STD.DEV.	MIN	MEDIAN	MAX	OBS.
1996	3.9552	1.1190	1.3112	4.1132	8.3596	441
1997	4.1536	1.0348	1.2203	4.2609	7.9747	625
1998	3.9859	1.0744	-0.2396	4.1135	7.7084	625
1999	3.9602	1.2262	-0.2941	4.0874	7.4004	599
2000	4.0185	1.2106	-0.1505	4.0063	6.7359	555
2001	3.7699	1.0269	0.1746	3.8863	6.6764	532
2002	4.0108	1.0962	-0.0722	4.1527	7.1749	513
2003	4.2828	1.2008	0.1367	4.3892	7.5315	517
2004	4.4587	1.1695	0.1212	4.6221	7.2240	525
2005	4.5765	1.1623	0.3523	4.7290	8.3636	505
2006	4.5925	1.1604	0.4777	4.6793	9.5905	505
2007	4.5595	1.1223	0.5006	4.7170	7.5271	511
2008	4.4873	1.1697	-0.1329	4.7176	7.1496	501
2009	4.2285	1.2551	-0.4735	4.4533	7.1189	520
2010	3.9019	1.2644	0.0942	4.1110	7.2127	522
2011	3.9099	1.3211	0.6148	3.9584	9.0247	515
2012	3.5840	1.1719	-0.0041	3.6575	7.9223	469
2013	3.4957	1.2003	-0.3564	3.6483	7.1379	441
TOTAL	4.1112	1.2073	-0.4735	4.2628	9.5905	9421

Source: Own calculations on ABI data.

Table 2.3 – Summary statistics

VARIABLE	MEAN	STD.DEV.	MIN	MEDIAN	MAX	OBS.
<i>lnBVDD</i>	4.1112	1.2073	-0.4735	4.2628	9.5905	9421
<i>lnZSCORE</i>	4.0930	0.9118	0.2384	4.0786	9.3035	9421
<i>NPL (1)</i>	2.9128	3.2191	0.1001	1.8605	24.9993	9421
<i>EQASS (1)</i>	11.3337	3.8856	1.1359	10.7824	50.1625	9421
<i>TOTASS (2)</i>	2961.29	17398.41	6.7867	261.51	402143.8	9421
<i>LOANASS (1)</i>	60.0610	15.0997	20.1969	61.1836	94.9725	9421
<i>NII (1)</i>	15.4510	7.4460	1.1591	14.4980	86.2403	9421
<i>NIM (1)</i>	3.1184	0.8942	0.3644	3.0562	7.9620	9421
<i>HHI</i>	661.48	316.90	299.27	632.96	3698.48	9421
<i>GDP_PC</i>	26.7244	6.3467	12.5971	28.2895	35.3464	9421
<i>GDP_GR</i>	0.0023	0.0263	-0.4453	0.0067	0.2393	9421

(1) percentage; (2) mln eur, deflated to 2005 values.

Table 2.4 – Summary statistics by failed and active banks

Variable	SURVIVED BANKS			FAILED BANKS			Survived and failed banks differences
	N. of obs	Mean	Standard deviation	N. of obs	Mean	Standard deviation	
<i>lnBVDD</i>	9338	4.1243	1.2000	83	2.6384	1.1308	1.4859 *** (11.91)
<i>lnZSCORE</i>	9338	4.1077	0.8979	83	2.4389	0.9556	1.6688 *** (15.85)
<i>NPL (1)</i>	9338	2.8864	3.1823	83	5.8824	5.3219	-2.9960 *** (-5.12)
<i>EQASS (1)</i>	9338	11.3557	3.8743	83	8.8577	4.3663	2.4980 *** (5.19)
<i>TOTASS (2)</i>	9338	2970.17	17465.79	83	1962.45	6153.16	1007.72 (1.44)
<i>LOANASS (1)</i>	9338	60.0258	15.0660	83	65.0450	17.9210	-5.0193 ** (-2.54)
<i>NII (1)</i>	9338	15.4178	7.4237	83	19.1846	8.9200	-3.7669 *** (-3.84)
<i>NIM (1)</i>	9338	3.1189	0.8927	83	3.0613	1.0554	0.0576 (0.50)
<i>HHI</i>	9338	665.59	316.16	83	796.16	369.33	-135.88 *** (-3.34)
<i>GDP_PC</i>	9338	26.7431	6.3392	83	24.6190	6.8594	2.1241 *** (2.81)
<i>GDP_GR</i>	9338	0.0023	0.0263	83	-0.0003	0.0280	0.0026 (0.86)

(1) percentage; (2) mln eur, deflated to 2005 values.

A t-test to verify whether the difference between average values for survived banks and failed banks is different from zero for all the variables is presented in the latter column.

* Significance for the parameter estimates = 10% level.

** Significance for the parameter estimates = 5% level.

*** Significance for the parameter estimates = 10% level.

In parentheses, values of t-statistics.

Table 2.5 – Table of correlations

	<i>FAILED=1</i>	<i>lnBVDD</i>	<i>lnZSCORE</i>	<i>NPL</i>	<i>EQASS</i>	<i>lnTOTASS</i>	<i>LOANASS</i>	<i>NII</i>	<i>NIM</i>	<i>HHI</i>	<i>GDP_PC</i>	<i>GDP_GR</i>
<i>FAILED=1</i>	1.00											
<i>lnBVDD</i>	-0.12	1.00										
<i>lnZSCORE</i>	-0.17	0.25	1.00									
<i>NPL</i>	0.09	-0.17	-0.19	1.00								
<i>EQASS</i>	-0.06	0.18	0.22	-0.04	1.00							
<i>lnTOTASS</i>	-0.03	-0.16	-0.08	-0.14	-0.42	1.00						
<i>LOANASS</i>	0.03	0.11	0.02	-0.40	-0.21	0.32	1.00					
<i>NII</i>	0.05	-0.23	-0.10	-0.20	-0.24	0.52	0.39	1.00				
<i>NIM</i>	-0.01	0.05	0.04	0.25	0.29	-0.46	-0.40	-0.50	1.00			
<i>HHI</i>	0.04	-0.17	-0.12	0.36	-0.14	-0.03	-0.24	0.01	0.17	1.00		
<i>GDP_PC</i>	-0.03	0.16	0.14	-0.44	0.09	0.18	0.41	0.11	-0.27	-0.67	1.00	
<i>GDP_GR</i>	-0.01	0.02	0.10	0.09	0.08	-0.08	-0.19	-0.13	0.32	-0.02	0.03	1.00

Values in bold indicate statistical significance at 1% level.

Table 2.6 – Logit results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>lnBVDD</i>	-0.8263 *** (-9.13)	-0.9036 *** (-8.69)	-0.8214 *** (-7.57)			-0.5041 *** (-4.43)	-0.7886 *** (-7.22)
<i>lnZSCORE</i>				-1.5492 *** (-8.85)		-1.3685 *** (-7.49)	
<i>NPL</i>					0.2387 *** (7.72)		0.2297 *** (7.06)
<i>EQASS</i>		-0.2033 *** (-3.07)	-0.2319 *** (-3.76)	-0.7869 * (-1.67)	-0.2642 *** (-4.06)	-0.0713 (-1.45)	-0.2298 *** (-3.83)
<i>lnTOTASS</i>		-0.7113 *** (-5.33)	-0.8873 *** (-5.58)	-0.7311 *** (-4.19)	-0.9376 *** (-4.70)	-0.7229 *** (-4.43)	-0.8711 *** (-5.00)
<i>LOANASS</i>		0.0397 ** (2.18)	0.0255 (1.57)	0.0115 (0.58)	0.0214 (1.25)	0.0132 (0.71)	0.0251 (1.49)
<i>NII</i>		0.0149 (0.80)	-0.0003 (-0.02)	0.0224 (1.27)	0.0322 * (1.84)	0.0096 (0.54)	0.0104 (0.60)
<i>NIM</i>		0.1436 (0.55)	0.2656 (1.09)	0.4740 * (1.79)	0.4923 ** (2.01)	0.3757 (1.45)	0.3524 (1.51)
<i>HHI</i>			0.0006 (0.40)	0.0004 (0.31)	-0.0003 (-0.23)	0.0004 (0.30)	-0.0006 (-0.38)
<i>GDP_PC</i>			0.1313 (1.19)	0.1034 (1.05)	0.1272 (1.17)	0.1282 (1.23)	0.1628 (1.49)
<i>GDP_GR</i>			2.3682 (0.29)	1.7889 (0.24)	-0.5948 (-0.08)	1.3165 (0.15)	0.8415 (0.10)
<i>COMM</i>			0.1856 (0.31)	0.2117 (0.33)	0.2511 (0.41)	0.0914 (0.14)	-0.0261 (-0.04)
<i>BCC</i>			-1.0273 * (-1.80)	-1.0749 * (-1.84)	-1.5738 *** (-2.68)	-0.7995 (-1.30)	-1.1192 * (-1.90)
<i>BCP</i>			0.3865 (0.66)	-0.0024 (0.00)	0.0621 (0.10)	0.0615 (0.10)	0.2253 (0.39)
<i>INTERCEPT</i>	-1.5947 * (-1.86)	1.2717 (0.89)	0.8161 (0.24)	1.9997 (0.64)	-2.3649 (-0.68)	2.2683 (0.70)	-1.5173 (-0.44)
Failures	83	83	83	83	83	83	83
No. of banks	863	863	863	863	863	863	863
No. of obs.	8920	8920	8920	8920	8920	8920	8920
Pseudo R ²	0.1915	0.2822	0.2990	0.3816	0.2923	0.2923	0.3451

Dependent variable: *FAILEDit*

Standard errors are clustered at bank level.

All regressions include fixed regional and time effects.

* Significance for the parameter estimates = 10% level.

** Significance for the parameter estimates = 5% level.

*** Significance for the parameter estimates = 1% level.

In parentheses, values of z-statistics.

Table 2.7 – Semiparametric Cox proportional hazard model results

	(11)	(12)	(13)	(14)	(15)	(16)	(17)
<i>lnBVDD</i>	-0.7664 *** (-7.83)	-0.8824 *** (-7.70)	-0.8256 *** (-7.05)			-0.5560 *** (-4.47)	-0.7644 *** (-6.53)
<i>lnZSCORE</i>				-1.4621 *** (-10.00)		-1.2930 *** (-8.57)	
<i>NPL</i>					0.2016 *** (6.36)		0.1803 *** (5.54)
<i>EQASS</i>		-0.1877 *** (-4.49)	-0.2121 *** (-5.12)	-0.0589 (-1.55)	-0.2288 *** (-5.37)	-0.0458 (-1.14)	-0.1999 *** (-4.86)
<i>lnTOTASS</i>		-0.7267 *** (-6.27)	-0.9612 *** (-6.50)	-0.6951 *** (-4.69)	-0.8623 *** (-5.70)	-0.7677 *** (-5.05)	-0.8757 *** (-5.81)
<i>LOANASS</i>		0.0391 *** (2.95)	0.0239 * (1.81)	0.0099 (0.71)	0.2287 * (1.73)	0.0129 (0.91)	0.0280 ** (2.07)
<i>NII</i>		0.0112 (0.76)	-0.0013 (-0.08)	0.0266 (1.52)	0.0330 ** (2.09)	0.0108 (0.62)	0.0111 (0.69)
<i>NIM</i>		0.2202 (0.98)	0.3491 (1.59)	0.5440 ** (2.49)	0.4692 ** (2.17)	0.4497 ** (1.97)	0.3526 (1.58)
<i>HHI</i>			0.0005 (0.34)	0.0002 (0.11)	-0.0003 (-0.18)	0.0004 (0.28)	-0.0003 (-0.22)
<i>GDP_PC</i>			0.1266 (1.25)	0.0724 (0.75)	0.1213 (1.30)	0.1017 (0.98)	0.1608 (1.58)
<i>GDP_GR</i>			0.9203 (0.13)	-2.3121 (-0.28)	0.0436 (0.01)	-2.5179 (-0.30)	0.4257 (0.06)
<i>COMM</i>			0.5477 (0.86)	0.3537 (0.54)	0.5155 (0.85)	0.0960 (0.14)	0.1302 (0.20)
<i>BCC</i>			-0.8140 (-1.25)	-0.9420 (-1.45)	-1.1270 * (-1.83)	-0.8980 (-1.32)	-0.8923 (-1.36)
<i>BCP</i>			0.8582 (1.31)	0.3620 (0.55)	0.3543 (0.57)	0.3701 (0.54)	0.5198 (0.79)
Failures	83	83	83	83	83	83	83
No. of banks	863	863	863	863	863	863	863
No. of obs.	9421	9421	9421	9421	9421	9421	9421
Pseudo R ²	0.1767	0.2730	0.2929	0.3711	0.2724	0.3966	0.3283
Proportional hazard assumption test							
χ^2	23.83	29.77	42	53.45	38.85	59.42	38.82
d.f.	38	43	49	49	49	49	49
P-value	0.9647	0.9373	0.7504	0.3072	0.8502	0.1464	0.8511

All regressions include fixed regional and time effects.

* Significance for the parameter estimates = 10% level.

** Significance for the parameter estimates = 5% level.

*** Significance for the parameter estimates = 1% level.

In parentheses, values of z-statistics.

Table 2.8 – Type I and Type II errors

	(11)	(12)	(13)	(14)	(15)	(16)	(17)
10 th quantile cut-off							
True Positive	52	61	63	69	59	70	66
False Negative	31	22	20	14	24	13	17
False Positive	890	881	879	873	883	872	876
True Negative	8448	8457	8459	8465	8455	8466	8462
Type I Error	37.34%	26.51%	24.09%	16.87%	28.91%	15.66%	20.48%
Type II Error	9.53%	9.43%	9.41%	9.35%	9.46%	9.34%	9.38%
20 th quantile cut-off							
True Positive	35	47	49	58	50	60	53
False Negative	48	36	34	25	33	23	30
False Positive	436	424	422	413	421	411	418
True Negative	8902	8914	8916	8925	8917	8927	8920
Type I Error	57.83%	43.37%	40.96%	30.12%	39.76%	27.71%	36.14%
Type II Error	4.67%	4.54%	4.52%	4.42%	4.51%	4.40%	4.48%

True positive: the model has correctly predicted the actual event of default;

False negative: the model has failed to identify an occurred event of default;

False positive: the model has indicated as failed a survived bank;

True negative: the model has indicated as non-defaulted a survived bank.

Type I error = $FN/(FN+TP)$

Type II error = $FP/(FP+TN)$.

Numbers in parentheses in the first row indicate the model used to estimate the types of errors, according to Table 2.7.

Appendix 2.2. The semiparametric Cox hazard model

Consider a population of n individuals, banks in our case. A basic hypothesis of survival analysis is that default constitutes an inevitable event. Therefore, for each individual, only two outcomes can be observed, either the failure or the censoring (precisely, right censoring). In the second case, the default will occur after the censorship. Accordingly, given a time-to-failure and a time-to-censorship, the former is greater than the latter.

Let T denote the time-to-default of a bank. $T \in [0, \infty[$ is a random variable, which can be either discrete or continue. $f(t)$ denotes its probability density function while $F(t)$ represents its cumulative density function. We define them as follows:

$$f(t) = \frac{-dF(t)}{dt} \quad (2.13)$$

$$F(t) = \Pr(T \leq t) \quad (2.14)$$

Hence, defining $S(t)$ as the survivor function, i.e. the probability that the bank will survive longer than t , it can be written as:

$$S(t) = 1 - F(t) = \Pr(T > t) \quad (2.15)$$

Let $\lambda(t)$ be the hazard rate, or age-specific default rate. It can be interpreted as the instantaneous risk of the bank's disappearance in year t conditional on its existence up to time t . As it is a rate, it has units $1/t$. The hazard rate identifies the probability that the default event happens in a given interval, conditional upon the observed individual has survived to the beginning of the interval, divided by the length of the interval. That is:

$$\lambda(t) = \lim_{\Delta t \rightarrow 0^+} \frac{\Pr(t \leq T < t + \Delta t | t \leq T)}{\Delta t} = \frac{f(t)}{S(t)} \quad (2.16)$$

The hazard rate is the object of the estimates, and it embodies a time-varying risk of bank failure. It must be non-negative, but no other constrain is necessary ($\lambda(t) \geq 0$) (Cox, 1972; Lane et al., 1986; Pappas et al., 2017). In actuarial statistics, $\lambda(t)$ is defined as “the force of mortality”, while in economics literature its reciprocal is indicated as Mill’s ratio (Lane et al., 1986). There are several technical advantages in estimating $\lambda(t)$ rather than $F(t)$ or $f(t)$; these are discussed in Cox and Oakes (1984) and Lawless (2003).

The hazard rate can vary from zero to infinity, meaning that the risk can vary from no risk at all to the certainty of the failure event at a given instant. Over time it can fluctuate in several shapes. Given the relationship between the probability of surviving after a certain instant and the amount of risk that the individual has accumulated up to that instant, the hazard rate measures the degree at which that risk is accumulated.

The hazard function shape is determined by the underlying process that determines the risk. Hence, when the risk of the event is zero, the correspondent hazard is zero. When the risk grows (reduces) with time, the hazard rate grows (reduces) with time. A typical example is the human mortality linked with aging. After birth, the function yields a dropping hazard, then a long plateau followed by a constant increase, until reaching values approximate to infinity at about 100 years. That is the risk of mortality is very high just after birth, then it quickly decreases and remains stable until a certain age. After this point, the probability of dying starts to increase and becomes nearly one around the 100th year. This form of hazard is called in jargon the “bathtub hazard”.

Once one of the functions identified by (2.13), (2.14), (2.15) and (2.16) is estimated, the other three are fully determined. Especially, it is simpler to derive the probability density function ($f(t)$), the cumulative distribution function ($F(t)$), and the survivor function ($S(t)$) from an estimated hazard function.

To demonstrate this, it is appropriate to define another function, namely the cumulative hazard function. The cumulative hazard function $A(t)$ represents the measure of the amount of risk accumulated by the observed subject up to time t :

$$\Lambda(t) = \int_0^t \lambda(u) du \quad (2.17)$$

In light of (2.16) we can rewrite it as follows:

$$\Lambda(t) = \int_0^t \frac{f(u)}{S(u)} du = \int_0^t \frac{1}{S(u)} \left\{ \frac{d}{du} S(u) \right\} du = -\ln[S(t)] \quad (2.18)$$

Eq. (2.18) shows the relationship between the accumulated risk, $\Lambda(t)$, and the probability of survival, $S(t)$. Therefore, by considering (2.14), (2.13) and (2.15), we obtain:

$$S(t) = \exp[-\Lambda(t)] \quad (2.19)$$

$$F(t) = 1 - \exp[-\Lambda(t)] \quad (2.20)$$

$$f(t) = F'(t) = \frac{d}{dt} \{1 - S(t)\} = -S'(t) = h(t) \exp[-\Lambda(t)] \quad (2.21)$$

In case of left censored data, i.e. when one or more subject are not observed from the onset of risk but from $t=t_0>0$, hence there can be cases of individual who fail during the interval from 0 to t_0 . In that cases it can be needed to deal with the conditional forms of the above functions, as follows:

$$\lambda(t|T > t_0) = \lambda(t) \quad (2.22)$$

$$\Lambda(t|T > t_0) = \Lambda(t) - \Lambda(t_0) \quad (2.23)$$

$$F(t|T > t_0) = \frac{F(t) - F(t_0)}{S(t_0)} \quad (2.24)$$

$$f(t|T > t_0) = \frac{f(t_0)}{S(t_0)} \quad (2.25)$$

(Lane et al., 1986; Cleves et al., 2010).

Considering that each individual is identifiable by a set of variables x_1, \dots, x_k , which can be function of time, Cox (1972) defines the hazard as:

$$\lambda(t|x) = \exp(\beta x) \lambda_0(t) = \exp(\beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k) \lambda_0(t) \quad (2.26)$$

The Cox model provides estimates of the $(k \times 1)$ vector of β , but it does not provide any direct estimate of the baseline hazard, $\lambda_0(t)$ (Cox, 1972; Pappas et al., 2017). Therefore, no assumption about the functional form of the hazard over time is required. The only hypothesis required is that the hazard function is the same for each and every subject. In other words, the hazard of a subject is a multiplicative duplication of the hazard of another subject. Hence, comparing two subjects:

$$\frac{\lambda(t|x_j)}{\lambda(t|x_m)} = \frac{\exp(x_j \beta_x)}{\exp(x_m \beta_x)} \quad (2.27)$$

and assuming x_j and x_m as constant overtime, the above ratio is constant as well.

The Cox model results considerably advantageous when it is not possible to make any plausible assumption about the form of the hazard. Knowing the functional form of $\lambda_0(t)$, of course would allow more efficient estimates for β_x . However, assuming a wrong hazard model would result in a biased estimation of β_x . Therefore, a less efficient but not biased β_x is preferred (Cleves et. al., 2010).

Chapter 3

Bank size and banking competition: some evidence from Italy

3.1 Introduction

Over the last decades, several countries have gone through a process of consolidation of their banking industries. The phenomenon has been fostered by a number of factors, among which an international tendency to capital markets liberalization and a massive technological progress that has notably upgraded the range of available services and distribution channels. As a result, competition among financial institutions has intensified and, to be part of the new global landscape, banks have been called for enhanced efficiency and supply diversification. Therefore, looking for economies of scale and scope, financial intermediaries have grown in size, and banking sectors have become more concentrated (Coccoresse, 2009).

In Europe, the consolidation stream has been accompanied with the broader process of harmonization, started in 1977 by the introduction of the First Banking Directive with the major aim of financial integration among countries. During those years, notable events occurred in Europe, like the liberalization of financial services, the creation of the Economic and Monetary Union (EMU), and the introduction of the Euro, considered as vehicles to achieve efficiency, competitiveness and a stable economic growth (ECB, 2011).

As a European country, Italy has experienced both harmonization and banking sector consolidation, substantially changing its market structure.

Considered as a support for development policies, the Italian banking sector has been employed for several years after the Second World War to overcome some

Italian issues, such as the economic divergence between north and south. It was intended as a tool to redistribute savings across regions and to provide credit to local small and medium enterprises (SMEs) through small and medium-sized institutions. As a result, the system was highly fragmented, overbanked and overspecialized. Moreover, it was strictly regulated, especially through branch opening limitations and credit quotas; public ownership of banks was quite widespread, and ‘special credit institutions’ (i.e. intermediaries entitled to grant medium- and long-term loans) responded to specific laws and were kept separate from the other banks (Monticelli, 1992).

After the start of the deregulation process in the 80s of last century, the system underwent a series of reforms that have modified its structural shape. Credit constraints and lending restrictions were progressively abolished, public sector banks converted into joint stock companies, the formal separation between short and long-term lending institutions removed, and bank mergers started to be encouraged. Then, in March 1990, Bank of Italy abolished branch opening constraints (Jassaud, 2014; Beccalli and Girardone, 2016).

The evolution of the Italian banking system continued also during the following decades. During the early 90s, two important regulatory framework have been introduced: the Second Banking Directive, implemented by the Italian laws through D.L. 481/1992 (Coccorese, 1998); and the “Testo Unico Bancario – D.Lgs 385/1993”, i.e. the Italian banking regulatory pillar that replaced all previous legislation.

Besides, in the first decades of the new millennium the country has been profoundly hit by the global financial crisis and the following sovereign debt crisis, which have engendered a sharp contraction of the system. Between 2008 and 2014, the number of banks fell by 17 percent, especially due to the exit from the market of intermediaries in difficulty and/or relatively less efficient. Moreover, bank employees and branches have decreased by around 17,900 (-5.6%) and 3,400 (-9%), respectively. The drop has been larger for the five largest groups, which have also significantly reduced their market share in the same period. It is likely that the

decline of profits and the high capital requirements have encouraged the search for efficiency gains (Bank of Italy, 2015).

In such a delicate period, an aid (albeit timid) to productivity has come from the technological development, which has allowed the arising of alternative distribution channels, such as internet, mobile and phone banking.

On the same path, a couple of regulatory reforms have been introduced, one regarding the Banche Popolari (BCPs), in 2015, another related to the Banche di Credito Cooperativo (BCCs), in 2016. Their major aim is the improvement of efficiency and soundness of the system. In the case of the BCPs, the main objectives of the legislative framework are the increase in the ability to attract capital and a better diversification of investments in the sector, switching from a governance model based on mutuality to a more hierarchical form of organization. In the case of the BCCs, instead, the reform intends to promote a greater integration in order to maintain an adequate capitalization of the system, especially in the case of smaller institutions. In fact, one of the ultimate intents is to open the cooperative sector to the capital markets through the introduction of a new form of governance, the ‘gruppo bancario cooperativo’ (cooperative banking group) (Bank of Italy, 2015, 2017).

Some data clearly highlight the consolidation trend and the progressive increase of the sector’s importance occurred over time up to the beginning of this century: between 1989 and 2016 the number of banks reduced by more than 40%, dropping from 1,085 to 604; at the same time, the number of branches almost doubled, from about 15,500 to 29,000 (Bank of Italy, 1990, 2017).

According to the last Annual Report published by the Bank of Italy, at the end of 2016 70 banking groups (comprising 129 institutions) and 475 independent banks were operating in Italy. Among these, 53 were commercial banks, 15 BCPs, 325 BCCs and 82 branches of foreign banks. Italian banking groups classified as significant by the Single Supervisory Mechanism (SSM) were 14, and their assets amounted to the 74% of the total (Bank of Italy, 2017).

<INSERT TABLE 3.1 ABOUT HERE>

As an important part of the European financial market, the Italian banking sector shares many features with other EU countries, such as France, Germany and Spain. It is a bank-oriented system, in which banks constitute the first funding resource for the industrial sector. Besides, an increasingly important shift from a system focused on a traditional intermediation toward a more service-oriented industry is occurring (Coccoresse and Pellecchia, 2013).

However, when compared with other European countries, Italian financial market appears quite narrow, as evidenced in Figure 3.1. For instance, in 2016 the domestic credit to private sector was about the 86% of the GDP, while in France was the 98% in Spain the 111% (Source: World Bank).

Moreover, even though concentration has progressively increased over time, as highlighted by the Herfindahl-Hirshmann index that has tripled between 1989 and 2013 (see Table 3.2), the system is one of the less concentrated in Europe, as shown by Figure 3.2.

<INSERT TABLE 3.2 ABOUT HERE>

<INSERT FIGURE 3.1 AND 3.2 ABOUT HERE>

Despite the above-mentioned similarities, the Italian banking system is quite peculiar, especially in terms of diversification between intermediaries, due to both their dimension and their legal form. An important market share is held by mutual banks (BCCs), which hold around 40% of the total active branches. BCCs are small local institutions that play a primary role in providing financial services to small and micro businesses, as artisans. Founded on the principle of mutuality, their activity is focused on members, which are both banks' owners and customers. Therefore, they enjoy a particular kind of market power that makes them more resilient to external pressure, often termed as 'relationship lending' (Petersen and Rajan, 1994; Coccoresse et al., 2017).

Relationship lending can be defined as a long-term contract between a bank and a borrower, by virtue of which the bank collects confidential information, hence creating a tie with its debtor (Elsas, 2005). It is a typical characteristic of systems in which industrial firms rely the most on banks for their funding, and the literature recognizes a number of advantages related to this kind of activity (Angelini et al., 1998; Elsas, 2005). Among the others, borrowers are better able in finding credit, especially in case of opaque applicants, such as SMEs and households. On the other side, the financial institution is able to extract a greater value from the lending relations, due to the long-term rents it can exploit (e.g. Rajan, 1992; Petersen and Rajan, 1995, and Boot and Thakor, 2000). Recent studies have evidenced that relationship lending has had relevant effects in tempering the credit contraction that followed the financial crisis in Italy, both in terms of credit availability and interest rates (e.g. De Mitri, 2010; Gambacorta and Mistrulli, 2014; Bolton et al., 2016).

In the light of the profound structural changes occurred in the Italian banking system over the last decades, but also of the distinctive characteristics of the sector, understanding the evolution of the level of competition becomes a relevant issue. The importance of assessing the actual degree of competitiveness in the market appears crucial especially under a policy perspective. In fact, as we have already evidenced in Chapter 1, competition is commonly regarded as a goal to be achieved, since it involves a number of positive results, such as efficiency, innovation and a superior allocation of resources. However, the issue becomes controversial when it comes to banks, as the effects of competition on some features are not clear. Among these, we recall economic performance, financial stability and the transmission of monetary policy.

Moreover, while empirical studies about the Italian banking sector tend to agree about the Eighties and the first part of the Nineties, detecting an increase in banking competition, results about the second part of the 1990s and the 2000s are not so clear. As suggested by De Bonis et al. (2017), the differences seem to be related to different time spans, empirical strategies and measures of competition.

Recalling briefly the literature on banking competition in Italy, Angelini and Cetorelli (2003) have detected a constant trend of increasing competition over the

period 1984-1997, as indicated by the constant reduction of the Lerner index. They have also provided evidence that a remarkable increment was linked with the introduction of the second banking directive.

Focarelli and Panetta (2003) have pointed out that the consolidation process occurred in the 1990s has led to a decline in interest rates on deposits and that the contraction was larger in the provinces with higher HHIs, thus indicating that the effect of market power was greater in more concentrated markets. Furthermore, by showing an increase in interest rates in the long-run, they have highlighted that the effects of consolidation were harmful in the short term, while positive in the long run.

Analysing data between 1988 and 2005, Coccorese (2009) has highlighted that competition and concentration are not necessarily rival since banks acting as monopolist are able to exploit only a part of the estimated theoretical market power.

De Bonis et al. (2017) have shown that competition among banks reached its highest level in the mid-1990s, after a long growing trend due to the liberalization process in the 80s. In contrast with some other results, they have also detected a decreasing trend after 1996.

A slightly different point of view has been presented by De Bonis and Ferrando (2000) and Coccorese and Pellicchia (2013), who have analysed the Italian banking competition in the light of the multimarket hypothesis and achieve opposite results. The “multimarket contact theory” argues that, when firms compete with a same rival in a number of different markets, they are more likely to collude. Analysing the largest 55 Italian banks between 1990 and 1996, De Bonis and Ferrando (2000) have not found any support for the mentioned hypothesis. Conversely, Coccorese and Pellicchia (2013) have evidenced that multimarket connections increase market power, but are less important in more dispersed markets.

In this paper, we estimate the Italian competition degree over the period 1989-2013, both in the long-run and in the short-run, by means of the Bresnahan (1982), Lau (1982) and Shaffer (1989, 1993) methodology. The framework avoids any hypothesis on the relationship between concentration and competition, and requires

the implementation of a simultaneous demand and supply equations model, by which a conduct coefficient, called λ , is estimated. The latter represents the distance between the average perceived marginal revenue and the demand curve. Because the greater this distance, the more the market will tend to act as a monopoly (or a collusive oligopoly), the parameter can be interpreted as an index of competition.

By using a panel dataset of 100 observations over the period 1989-2013, we are also able to split the time span into sub-periods. Thus, we observe the evolution of the parameter over time and evaluate whether possible modifications in the degree of competition might be ascribed to the changing regulatory framework and/or the structural modifications.

Our main results show that the Italian banking sector is fairly competitive, that the level of competitiveness has substantially increased over time, and that small credit institutions are characterised by a higher level of market power. We discover a significant increase of competition after 1992, probably linked to the adoption of the Second Banking Directive (Directive 89/646/EEC), as well as a sudden drop in the period 2007-2008, which may be ascribed to the dawn of the global financial crisis.

The remainder of the chapter proceeds as follows: Section 3.2 briefly reviews the main studies adopting our methodology, namely the conjectural variation model developed within the NEIO literature; Section 3.3 presents the theoretical model; Section 3.4 describes the econometric approach and data; Section 3.5 discusses the results; Section 3.6 concludes.

3.2 The conjectural variation model: a literature review

Albeit the level of competition of the banking markets has been often assessed through a structural approach, it is nowadays clear that firms' conduct may be influenced also by factors other than concentration and market structure. Accordingly, the non-structural indicators of competition – developed within the so-called New Empirical Industrial Organization (NEIO) – aim to directly measure the actual degree of competition of an industry, without any assumption about the

market structure. In such literature, the most employed non-structural measures of competition are the Lerner index (Lerner, 1934), the Panzar and Rosse H-statistic (Panzar and Rosse, 1987), and the Boone indicator (Boone, 2008).

An alternative way for assessing competition is the methodological approach introduced by Iwata (1974) and developed by Bresnahan (1982) and Lau (1982). It assumes that the conduct of a firm affects each competitor's reaction, and all decisions are made conjecturing such reactions. Therefore, the competition level of the sector should be estimated taking into account the interconnection of all market actors.

By constructing a simultaneous demand and supply model, the method estimates a parameter that embodies the conduct of companies and then identifies the level of market power for each of them. The estimated coefficient, often called λ , can be interpreted in many ways. For example, Iwata (1974) interprets it as a conjectural variation coefficient, or in other words, as a measure of the rivals' response to a change in the quantity produced by a firm (Iwata, 1974; Appelbaum, 1979, 1982; Roberts, 1984). Bresnahan (1982, 1989) and Lau (1982), instead, define λ as the deviation of the perceived marginal revenue schedule of a firm operating in the industry from the demand schedule (Bresnahan, 1982, 1989; Lau, 1982; Alexander, 1988). Defining λ as the conjectural variation elasticity, Shaffer (1983) demonstrates that it can be also interpreted as the percentage deviation of the aggregate output from the competitive equilibrium.

The conjectural variation approach has been employed in a number of banking studies, especially in order to assess variations of the level of competition due to changes in the regulatory framework.

Shaffer (1989) tests for collusion in the US banking sector from 1941 onwards and finds that the market has been historically non-distinguishable from perfect competition. The work uses industry aggregated data rather than national data.

Shaffer (1993) examines the effects of the 1980 Bank Act revisions on the Canadian banking system by employing an aggregate time series of 25 observations from 1965 to 1989 and detects a shift from a competitive state to a "supercompetitive" state, i.e. a state where an excess of aggregate bank assets over

the competitive equilibrium level is offered. Moreover, these findings demonstrate that a competitive conduct is not incompatible with a high concentration: the 5 largest banks accounts for more than 87% of all Canadian bank assets, but the level of competition of the sector is compatible with a Cournot oligopoly in which 250 symmetric banks are active.

Coccoresse (1998) focuses on aggregate Italian data for the time span 1971-1996, hence considering the consequences of the early European integration process, and observes a competitive behaviour.

Neven and Roller (1999) develop an aggregate model for the European banking sector with data from 7 countries for the years 1981-1989. They show that banks' behaviour has become less collusive over time, supporting the theoretical hypothesis that links such changes with the progressive deregulation (Vives, 1991).

Examining panel data for city and regional banks in Japan from 1974 to 2000, Uchida and Tsutsui (2005) discover that competition has increased in the 1970s and in the former 1980s. The latter corresponds to the period when the secondary market for government bonds has arisen. Moreover, they evidence that city banks have been more competitive than regional banks.

Here we aim at assessing the competitive conditions of the Italian banking industry by employing a slight modification of the parametric approach suggested by Bresnahan (1982) and Lau (1982), considering Shaffer (1989, 1993). Typically, the Bresnahan-Lau model is applied on time series of aggregate data, therefore it only estimates an average degree of competition for the market. Here, instead, we employ panel data. Specifically, we focus on dimensional groups, discriminating between big, medium, small and minor banks, as classified by Bank of Italy. Using panel data enables us to estimate various kinds of conduct coefficients: a long-run λ across the sample; some time-varying λ 's for the entire market; and four different firm-varying λ 's, one for each size group. In this way we can evaluate not only the temporal variations in the degree of competition, but also the differences between competitive behaviour of banks of distinct sizes.

3.3 The model

According to the industrial organization theory, in the short-run profit-maximizing firms choose the level of output (or price) where marginal revenue equals marginal cost. The inverse demand function of a given industry can be expressed as follows:

$$P_t = P(Q_t, Y_t, \alpha) \quad (3.1)$$

where P_t is the price, Q_t is the aggregate output, Y_t is a vector of exogenous variables affecting the industry demand (but not the marginal cost function), and α is a vector of other unknown parameters. Let now marginal cost be a function of quantity Q_t , a vector of exogenous variables Z_t (that do not affect the industry demand), and a vector of unknown parameters β :

$$MC_t = C'(Q_t, Z_t, \beta) \quad (3.2)$$

Since in a perfectly competitive market equilibrium price and quantity are identified when marginal revenue corresponds to the demand price, we can therefore write:

$$P(Q_t, Y_t, \alpha) = C'(Q_t, Z_t, \beta) \quad (3.3)$$

In case of perfect collusion, instead, recalling that marginal revenue represents the derivative of total revenue with respect to the quantity Q_t , i.e.:

$$MR_t = \frac{\partial P(Q_t, Y_t, \alpha) Q_t}{\partial Q_t} = P(Q_t, Y_t, \alpha) + P'(Q_t, Y_t, \alpha) Q_t \quad (3.4)$$

the equilibrium levels of price and quantity are determined as follows:

$$MR_t = MC_t = P(Q_t, Y_t, \alpha) + P'(Q_t, Y_t, \alpha) Q_t = C'(Q_t, Z_t, \beta) \quad (3.5)$$

where $P'(*)$ is the first derivative of the inverse demand function with respect to quantity Q_t .

It is worth to notice that, by construction:

$$P'(Q_t, Y_t, \alpha)Q_t = Q_t \left/ \frac{\partial Q_t}{\partial P(Q_t, Y_t, \alpha)} \right. \quad (3.6)$$

Hence, $P'(Q_t, Y_t, \alpha)Q_t$ represents the semi-elasticity of market demand. Generalizing, for firm i at time t , the perceived marginal revenue is:

$$MR_{it} = P(Q_t, Y_t, \alpha) + \lambda_{it} P'(Q_t, Y_t, \alpha) q_{it} \quad (3.7)$$

where λ_{it} is a parameter lying between zero and one, which measures the competitiveness of oligopoly conduct.

When λ_{it} is equal to zero, each firm acts as its perceived marginal revenue coincides with market demand. In other terms, they adopt a perfectly competitive behaviour, and price corresponds to marginal cost. Conversely, when λ_{it} equals 1, firms choose price and level of output in accordance with the industry marginal revenue curve. In this case, there is evidence of joint monopoly or perfect collusive conduct. Between the previous values, an infinite number of degrees of imperfect competition are defined, all characterized by an aggregate output lower than that of perfect competition (Lau, 1982; Coccorese, 1998; Coccorese and Pellicchia, 2013). A negative λ_{it} , instead, would indicate a situation where marginal cost exceeds price, hence a deviation from the long-run equilibrium. In this case, the aggregate output would be higher than the competitive optimum (Gruben and McComb, 2003; Shaffer, 2004).

Since a model with many different firms and time-varying λ_{it} would result over-parametrized, it is possible to overcome such shortcoming by switching to an aggregate λ_t for the industry, which can be regarded as an average value of the individual firms' λ_{it} 's. Recalling that in perfect competition the output level of equilibrium is set by the representative firm where its marginal cost MC_{it} equals the market price P_t , which in turn coincides with the firm's marginal revenue MR_{it} ,

it is possible to aggregate for the N firms operating in the market. Thus, Eq. (3.7) can be rewritten as:

$$P_t - MC_t = -\lambda_t P'(Q_t, Y_t, \alpha) Q_t \quad (3.8)$$

Eq. (3.8) represents the price deviation from marginal cost, therefore from the optimal (competitive) price level. Considering now quantities, the difference between the industry output actually produced and the perfectly competitive level of output can be expressed as:

$$Q_t - Q_t^* = \frac{\partial Q_t}{\partial P_t} (P_t - MC_t) \quad (3.9)$$

Hence, substituting Eq. (3.8) in Eq. (3.9), we obtain:

$$\frac{Q_t - Q_t^*}{Q_t} = -\lambda_t \quad (3.10)$$

Concluding, λ can be interpreted in different ways. First, it is a market power index (Coccorese, 1998). Second, it is a measure of the percentage deviation of the total output of the market from the perfect competition output (Shaffer, 1983). Third, as Bresnahan (1982) demonstrates, λ can be also regarded as the average firm's market share in a Cournot equilibrium.

3.4 Econometric methodology, variables and data

In order to estimate λ , we design a system of two simultaneous equations: the first is a demand equation, the second is a supply relation meeting the first-order condition as defined by Eq. (3.8) (Shaffer, 1993). As already pointed out, since a model with firm-varying and time-varying λ 's would be over-parametrized, we need to estimate an aggregate λ_t for the industry, which represents the average value of the individual λ_{it} 's. The methodology does not require any particular definition of the market, however, the estimate of λ will be unbiased on condition that the

sample covers a complete market. Further, the hypothesis of an equal degree of market power for all firms is not required, as λ represents the average market value. Therefore, different behaviours can coexist in the same market.

For the same reason, in an industry formed by more than one sub-market, λ will depict the average degree of market power if the sum of the different segments corresponds to the total market (Shaffer, 1993). This allows us to employ a panel dataset formed by different aggregations of banks, namely the dimensional aggregates defined by Bank of Italy. In this way, we can estimate not only a unique time invariant coefficient, but also group-invariant/time-variant and group-variant/time-invariant λ 's.

Further, as the estimates are conducted on a time series, λ would be unbiased as long as the average assets quality is stable over time, even if divergences across banks are allowed (Shaffer, 1993; Coccoresse, 1998).

For each dimensional group of banks j at year t we postulate the following semi-logarithmic demand function (Coccoresse and Pellecchia, 2013):

$$\ln Q_{jt} = a_0 + a_1 P_{jt} + a_2 Y_t + a_3 Z_t + a_4 MS_{jt} + \varepsilon_{jt} \quad (3.11)$$

where Q_{jt} is the aggregate amount of loans. and P_{jt} the average loan rate. Y_t is the national income (GDP), which controls for the level of aggregate demand, Z_t is the interest rate of 1-year government bonds, proxying for the price of a substitute for bank loans, and MS_{jt} is the share of loans of each dimensional group which allows to take into account the role of the groups' size. Finally, ε_{jt} is the error term. The semi-logarithmic form avoids us imposing constant elasticities since they are not appropriate when using time-series data. Notice that the coefficient a_1 is an estimate of the average semi-elasticity of demand with respect to price, i.e. $(\partial Q^*/\partial P^*)/Q^*$, or also $1/(P^*Q^*)$.

To write the supply function, we need the marginal cost equation. For this purpose, we start from a trans-log cost function with three generic inputs (deposits, labour, and physical capital) and one output (loans), a functional form that is widely

used in banking studies (e.g. Angelini e Cetorelli, 2003; Coccorese, 2005, 2009; Fu et al., 2014). For a generic group j and time t , its specification is:

$$\begin{aligned} \ln C_{jt} = & b_0 + b_Q \ln Q_{jt} + \frac{b_{QQ}}{2} (\ln Q_{jt})^2 + \sum_{h=1}^3 b_h \ln W_{hjt} + \ln Q_{jt} \sum_{h=1}^3 b_{Qh} \ln W_{hjt} \\ & + \frac{1}{2} \sum_{h=1}^3 \sum_{k=1}^3 b_{hk} \ln W_{hjt} \ln W_{kjt} + b_T \ln TIME + \frac{b_{TT}}{2} (\ln TIME)^2 \\ & + \ln TIME \left(b_{QT} \ln Q_{jt} + \sum_{h=1}^3 b_{hT} \ln W_{hjt} \right) \end{aligned} \quad (3.12)$$

Here C_{jt} and Q_{jt} are total costs and output of each group, respectively, W_{1jt} , W_{2jt} and W_{3jt} are the exogenous input prices, and $TIME$ is a trend included to capture possible effects of technological change over time that can shift the cost function (Zardkoohi and Fraser, 1998; Coccorese and Pellicchia, 2013; Fu et al., 2014). The above cost function is consistent with the “intermediation approach”, according to which deposits are, jointly with other factors, an input for producing loans (Freixas and Rochet, 2008; Saunders and Cornett, 2013; Casu et al., 2015).

By the symmetry condition, it must be $b_{h,k}=b_{k,h}$ for $h, k=1,2,3$. Moreover, the cost function has to be linearly homogeneous, non-decreasing and concave in factor prices, and non-decreasing in output. Since linear homogeneity in input prices requires that $\sum_{h=1}^3 b_h = 1, \sum_{h=1}^3 \sum_{k=1}^3 b_{h,k} = 0, \sum_{h=1}^3 b_{Qh} = 0, \sum_{h=1}^3 b_{Th} = 0$, in order to impose these conditions, we divide total costs and input prices by W_{3jt} . Therefore, we obtain the following final translog cost function:

$$\begin{aligned} \ln \left(\frac{C_{jt}}{W_{3jt}} \right) = & b_0 + b_Q \ln Q_{jt} + \frac{b_{QQ}}{2} (\ln Q_{jt})^2 + b_1 \ln \frac{W_{1jt}}{W_{3jt}} + b_2 \ln \frac{W_{2jt}}{W_{3jt}} \\ & + b_{Q1} \ln Q_{jt} \ln \frac{W_{1jt}}{W_{3jt}} + b_{Q2} \ln Q_{jt} \ln \frac{W_{2jt}}{W_{3jt}} + \frac{b_{11}}{2} \ln \left(\frac{W_{1jt}}{W_{3jt}} \right)^2 + \frac{b_{22}}{2} \ln \left(\frac{W_{2jt}}{W_{3jt}} \right)^2 \\ & + b_{12} \ln \frac{W_{1jt}}{W_{3jt}} \ln \frac{W_{2jt}}{W_{3jt}} + b_T \ln TIME + \frac{b_{TT}}{2} (\ln TIME)^2 \\ & + \ln TIME \left(b_{QT} \ln Q_{jt} + b_{1T} \ln \frac{W_{1jt}}{W_{3jt}} + b_{2T} \ln \frac{W_{2jt}}{W_{3jt}} \right) \end{aligned} \quad (3.13)$$

and the resulting marginal cost function is:

$$MC_{jt} = \frac{C_{jt}}{Q_{jt}} \left(b_Q + b_{QQ} \ln Q_{jt} + b_{Q1} \ln \frac{W_{1jt}}{W_{3jt}} + b_{Q2} \ln \frac{W_{2jt}}{W_{3jt}} + b_{QT} \ln TIME \right) \quad (3.14)$$

Here W_{1jt} is the price of funds, calculated as the ratio between aggregate interest expenses and total deposits, W_{2jt} is the price of labour, computed as the average wage for employee, and W_{3jt} proxies the cost of capital, through the overhead costs averaged by branch. Total costs, C_{jt} , are given by the sum of interest expenses, labour costs and overhead costs. All values are aggregated for each dimensional group j .

In the light of the above, Eq. (3.8) can be rearranged as:

$$P_{jt} = \frac{C_{jt}}{Q_{jt}} \left(b_Q + b_{QQ} \ln Q_{jt} + b_{Q1} \ln \frac{W_{1jt}}{W_{3jt}} + b_{Q2} \ln \frac{W_{2jt}}{W_{3jt}} + b_{QT} \ln TIME \right) - \frac{\lambda}{a_1} + \phi_t \quad (3.15)$$

where λ is the parameter of interest and ϕ_t is an econometric error term.

To sum up, the system of equations we are going to estimate is formed by Eq. (3.11) and (3.15) (Shaffer, 1993; Coccorese, 1998; Coccorese and Pellicchia, 2013). As Lau (1982) demonstrates, in order to identify λ a necessary and sufficient condition is that the demand function (or its inverse) is not separable in one or more of the exogenous variables that are included in the demand function but not in the marginal cost function. In our case the above holds, as from Eq. (3.11) it is

$$\frac{\partial^2 Q_{jt}}{\partial P_{jt} \partial MS_{jt}} = a_1 a_4 Q_{jt} \quad (3.16)$$

which clearly differs from zero.

In our exercise, we estimate a different set of λ 's for the Italian banking industry over the period 1989-2013. Aggregate data are collected from the Bank of Italy. All economic figures have been transformed into real values by using the regional Gross Domestic Product deflator, with 1995 as the base year. Table 3.3 provides some descriptive statistics of the data.

< INSERT TABLE 3.3 ABOUT HERE >

In a first Model, called (1), λ is estimated as a constant over the entire time period. In Models (2), (3), and (4), we try to capture changes in the conduct of banks during time by using dummy variables accounting for different lengths of time periods. More in detail, in Model (2) we define 5 periods of 5 years, in Model (3) 8 periods of 3 years, and in Model (4) 12 periods of 2 years.¹² We also define an alternative framework that focuses on size differences. For this reason, Model (5) derives a behavioural parameter for each dimensional group, as defined by the Bank of Italy.¹³

To estimate our simultaneous systems of equations, we use non-linear two-stages least squares. Consistent with the existing literature, we employ all exogenous variables as instruments. Moreover, to cope with endogeneity of Q_{jt} and P_{jt} , we also add their first lags as instruments. Other instruments are the overall number of banks' employees and the national levels of consumption and investment, which proxy for different market characteristics.

3.5 Empirical results and discussion

Table 3.4 provides the empirical results for the various systems of equations. The upper part shows the estimated coefficients for the demand equation, while the lower part displays those related to the supply function.

< INSERT TABLE 3.4 ABOUT HERE >

¹² In order not to lose observations, in Models (3) and (4) the last period is one year longer.

¹³ Bank of Italy classifies banks into five categories: major, big, medium, small, and minor. However, as the number of the major banks is on average very small compared with the other groups, we have aggregated the first two categories. Hence, we consider four groups of banks, termed as large, medium, small, and minor.

In the demand function all parameters are significant at the 1% level. Moreover, as they are quite similar across specifications, and considering the high values of the adjusted R^2 's, the equations seem properly defined. The negative sign of P (the price of loans) confirms that the demand curve is downward sloping. The estimated coefficient for Z is positive, meaning that the 1-year government bonds may be considered as a good substitute for bank loans. The demand elasticity of P , ε_{QP} , is always higher than the elasticity of Z , ε_{QZ} (in absolute value, calculated at the average point; see bottom of Table 3.4). Hence, as the cross-price elasticity is lower than the own-price one, banks are able to exploit product differentiation to soften price competition (Coccorese and Pellicchia, 2013). The coefficient for MS is significant and positive, indicating that groups of banks with greater market shares enjoy a higher loan demand. Similarly, as expected, loan quantity is positively correlated with the level of GDP.

Turning on the second equation, i.e. the supply relation, the notably high values of adjusted R^2 's seem to prove that the model is appropriate for the data. The coefficients of the variables constituting the marginal cost function are generally significant, except for $\ln W_2 W_3$, which is never meaningful. The estimated coefficients allow us to derive the values of the (average) marginal cost, which varies between 0.0768 euro and 0.0801 euro, depending on the model specification. As it is always lower than the average total cost of loans (amounting to 0.0910 euro), we can infer that, on average, Italian banks have been characterized by scale economies during the sample period.¹⁴ These findings are consistent with a large literature (e.g.: Altunbaş and Molyneux, 1996; Girardone et al., 2004; Coccorese 2009; Coccorese and Pellicchia, 2013).

In the supply equation we also find the parameter measuring banks' market power. Column (1) shows the estimated value of λ when it is considered as a constant over the sample period. Its value amounts to 0.0982, statistically different from zero at the 1% level; hence, the hypothesis of perfect competition can be

¹⁴ We are aware that the comparison would be more accurate if we use the estimated average cost. Unfortunately, our estimate of the marginal cost does not provide us with all the parameters needed to estimate the total cost function.

rejected. However, as indicated by the quite low level of λ , in the time span under inspection banks perceived their marginal revenue being only about 10% of the marginal revenue that would have been considered by a monopoly or a cartel. Therefore, we can reject also the hypothesis of a collusive behaviour, concluding that, on average, Italian banking sector has been a rather competitive environment between 1989 and 2013. A similar conclusion can be drawn considering that λ also represents the average market share in a Cournot equilibrium. In other terms, our market is comparable to a symmetric Cournot oligopoly with about 10 identical banks with an average market share equal to λ . Further, our estimated parameter is a measure of the percentage deviation of the actual total output from the perfect competition output, on aggregate.

Figure 3.3 depicts the Italian loan market when considering Model (1) of Table 3.3, i.e. when $\lambda=0.0982$.

< INSERT FIGURE 3.3 HERE >

Point *E* corresponds to the estimated market equilibrium quantity, i.e. where marginal cost equals perceived marginal revenue. It is worth to notice that banks are fixing the equilibrium quantity where the industry's marginal revenue is negative ($MR=-0.0211$ euro), suggesting that they are perceiving the market demand they face as inelastic. This result is coherent with our estimate of the price elasticity of demand, ε_{QP} , which on average is equal to -0.83 and lower than 1, on absolute value, for each estimated model (see bottom of Table 3.4).

From Figure 3.3 it is evident that the market is neither a cartel nor perfect competitive. In fact, the first case would have implied joint profit maximization, hence fixing the quantity identified by point *M*, i.e. where marginal cost equals marginal revenue. In the second hypothesis, instead, the market equilibrium would have been indicated by point *PC*, namely the perfect competition equilibrium. Therefore, banks are not acting as price takers, since they perceive a distance

between their marginal revenue function and demand function that is represented exactly by λ .

We now turn to the models accounting for time variant λ 's. In column (2), Table 3.4 displays the model considering 5 periods of 5 years (1989-1993; 1994-1998; 1999-2003; 2004-2008; 2009-2013). Overall, the remarkable level of competition is confirmed across the years. However, the decreasing values of λ signal an increasing degree of competition. The major reduction (of about 34%) is detected between the period 1989-1993 (when $\lambda = 0.1394$) and the period 1994-1998 (when it reduces to 0.0920). After a limited increase occurred between the second and the third period, a quite steady decreasing trend brings the estimated λ for the last 5 years to a level very similar to the one in column (1), i.e. 0.0965.

The above results are consistent with those derived in Model (3), where we introduce 8 periods of 3 years. The presence of a good degree of competitiveness is again clear. Moreover, the narrower time windows allow us to better learn the decreasing trend of the conjectural variation parameter over the sample period. In column (3) two major changes in the level of λ are evidenced, one at the beginning of the new millennium, the second between the periods 2004-2006 and 2007-2009. In both cases, λ has grown by more than 25%, hence meaning an increase in the average banks' market power (or a decline in the competitive level).

Model (4) can help in disentangling the above trends even more accurately, since each period is now formed by only two years. Following the evolution of λ over time, this new specification indicates a trend that is less steady compared with the previous ones. In fact, five changes (among reductions and increases) are detected. A first contraction has occurred between the periods 1991-1992 and 1993-1994. They confirm the change already detected by Model (2), which is consistent with an increase in the level of competition due to the introduction of the Second Banking Directive, occurred in Italy at the end of 1992 (Angelini e Cetorelli, 2003).

A further drop is detected over the period 1997-1998, also persistent in the following span, hence indicating an intensification of the competition degree. In a speech to the Parliament in June 1999, the then Governor of the Italian Central Bank, Antonio Fazio, underlined two major changes that have had a notable impact

on the competitiveness of banks in the late 90s: the increasing market share of foreign operators; and the wave of privatization, which brought the market share of the public owned banks from 68% in 1992, to 42% in 1996, and to 17% in 1999.

The Governor also pointed out other two events occurred in 1999 that, at that time, were considered as likely to bear future effects in term of competition. First, banks had been allowed to issue their products also outside their branches, for instance within commercial activities. Second, the euro had been introduced as a virtual currency (Fazio, 1999). Our data tend to confirm his previsions.

Also in column (4) the new millennium advent is depicted as bearing a relevant decrease of the market competition. We need to recall that the euro – as cash – has been introduced in Italy on 1st January 2002. However, since we cannot split the two-years period, it is difficult to clearly understand the reason of the change.

Just after a new decline in the 9th period, where λ reaches its lowest level, i.e. 0.0973, a growth of about 50% is showed in the period 2007-2008. We believe that this fall in the level of competition is due to the global financial crisis and the connected slump in lending activity. It is also interesting to notice that, starting from 2006, the competences in the field of bank competition have been transferred from the Bank of Italy to the Italian Antitrust Authority (AGCM).

Column (5) focuses on the possible differences in market power among banks of different size. In this case, λ 's are estimated as time invariant coefficients, which however vary according to the dimensional groups. It comes out that bigger banks operate in a more competitive fashion compared to the others. Conversely, the groups of small and minor banks appear to be those with more market power. The results are consistent with the theory that recognize some market power to small local institutions, which, thanks to the deeper linkages with local economies and the existence of long-term relationships with borrowers, rely on information advantage (Petersen and Rajan, 1994; Coccoresse et al., 2017).

Overall, our results are in line with previous studies on the Italian banking sector (Angelini e Cetorelli, 2003; Coccoresse, 2008; Coccoresse and Pellicchia, 2013). They seem also not to support the Structure-Performance-Conduct

hypothesis for that industry (Bain, 1951). This paradigm states that market structure, affecting firms' conduct, influences their final performance. Therefore, since more concentration is likely to induce a more cooperative behaviour, a less concentrated market should also be more competitive. Quite to contrary, for Italy we find that λ has a decreasing trend over the sample period (as shown before, especially by column (4)), hence implying an increase in the level of competition. At the same time, as already pointed out, the HHI has tripled between 1989 and 2013 as a consequence of the consolidation within the Italian banking market.

< INSERT FIGURE 3.2 ABOUT HERE >

As a final remark, also considering that the smaller the bank (on average) the higher its market power, consistently with previous literature (e.g. Berger, 1995) we can conclude that competition and concentration are not incompatible.

3.6 Conclusions

Since the 1980s, Italy has been characterized by a series of reforms, both national and at the European level, which have considerably modified the structure of its banking system. Historically characterized by extensive public ownership and stringent regulation, the sector has been thereafter progressively liberalized. At the same time, the technological progress has promoted the development of new products and distribution channels. Further, the contraction of profits and the high capital requirements mainly due to the recent financial crises have required an enhancement of the efficiency level.

The process has implied some important consequences: on a first hand, a relevant process of consolidation, since financial intermediaries have expanded in size looking for economies of scale; on the other hand, a massive development of branch networks, probably due to the willingness of a better territoriality.

Some traditional theories, such as the SCP paradigm, predict that an increase in concentration should result in a decrease in the level of competitiveness of the banking sector, as larger banks would tend to collude and exploit their market power acquired through the consolidation process. Nonetheless, empirical studies have clearly highlighted an increasing competitiveness in the Italian banking sector during the last decades.

In this paper we have empirically assessed the degree of Italian banking competition between 1989 and 2013 by appraising a conduct coefficient, λ , interpreted as a market power index. This has been done through a simultaneous equation model of demand and supply, estimated on a panel of aggregate data, which have allowed us to define both long and short-run competition.

Our results generally confirm the outcome of other previous studies, evidencing that competition among Italian banks is fairly intense despite the consolidation trend experienced by the sector in recent years. More in detail, in a first model, λ has been estimated as a constant over time. Its value, equal to 0.0982 and statistically different from zero at the 1% level has allowed us to reject both the hypothesis of perfect competition and perfect collusion for the Italian banking sector. We have also defined alternative models, in which the sample has been divided into sub-periods. All the different specifications have evidenced a decreasing trend for λ , hence involving an increase in the level of banking competition in Italy over the sample period.

The evidence also highlights a series of changes due to different causes. For example, we have detected an increase of competition following the introduction of the Second Banking Directive, in 1992, and a very sharp contraction during the global financial crisis. Moreover, we have also recognized the remarkable effect in enhancing competition due to the wave of privatizations occurred during the nineties.

When focusing on differences within banks categories, we have underlined that bigger banks tend to compete the most, and that small banks, instead, enjoy some market power.

To conclude, walking through a quarter of a century of Italian banking competition our results clearly highlight that an increase in concentration can be nonetheless compatible with a growth in the level of competition and that not always 'bigger' also means 'more powerful'.

Appendix 3.1. Tables and figures

Table 3.1 – Structure of the Italian banking system

		Members of banking groups	Not members of banking groups	All banks	Branches
		1999			
Banking groups				79	
Banks		208	641	849	27134
<i>of which:</i>	Commercial (SPA)	...	...	239	19978
	BCP	...	...	49	4205
	BCC	...	...	531	2862
	Foreign owned banks	...	...	57	89
		2009			
Banking groups				75	
Banks		217	571	788	34036
<i>of which:</i>	Commercial (SPA)	191	56	247	26422
	BCP	16	22	38	3068
	BCC	9	412	421	4243
	Foreign owned banks	1	81	82	303
		2016			
Banking groups				70	
Banks		129	475	604	29039
<i>of which:</i>	Commercial (SPA)	109	53	162	20544
	BCP	10	15	25	3973
	BCC	9	325	334	4352
	Foreign owned banks	1	82	83	170

Source: Own elaboration on Bank of Italy data.
 “...” means data not available.

Table 3.2 – Herfindahl-Hirshmann index

Year	HHI
1989	112.45
1990	115.37
1991	123.34
1992	142.87
1993	157.62
1994	162.01
1995	165.58
1996	161.78
1997	160.50
1998	157.40
1999	155.92
2000	168.70
2001	190.57
2002	281.06
2003	238.36
2004	221.64
2005	214.07
2006	206.51
2007	238.42
2008	254.82
2009	225.85
2010	328.80
2011	338.03
2012	335.82
2013	337.68

Source: Own elaboration on Bank of Italy data.
The HHI is calculated on banks' branches.

Table 3.3 – Summary statistics

Variable	Description	Mean	Std. Dev.	Minimum	Maximum	Median	N. Obs.
<i>Q</i>	Total national loans (4)	202.77	170.42	31.33	818.02	144.48	100
<i>P</i>	Interest revenue / total loans (1)	0.0933	0.0401	0.0418	0.1681	0.0777	100
<i>Z</i>	Interest rate 1-year government bonds (2)	5.74	4.16	0.99	14.02	4.00	100
<i>Y</i>	Gross Domestic Product (5)	1.0556	0.0839	0.9064	1.1786	1.0865	100
<i>MS</i>	Loans share (2)	25.00	18.26	5.38	69.64	19.58	100
<i>C</i>	Total costs (4)	18.841	15.668	3.921	64.176	13.069	100
<i>W₁</i>	Interest expenses / total deposits (1)	0.0418	0.0209	0.0133	0.0842	0.0337	100
<i>W₂</i>	Labour costs / number of employees (3)	0.0604	0.0150	0.0008	0.0870	0.0616	100
<i>W₃</i>	Other operating costs / number of branches (3)	0.0097	0.0023	0.0049	0.0162	0.0095	100

(1) ratio; (2) percentage; (3) million euro; (4) billion euro; (5) thousand billion euro. Variables are expressed at 1995 constant prices, over the period (1989-2013).

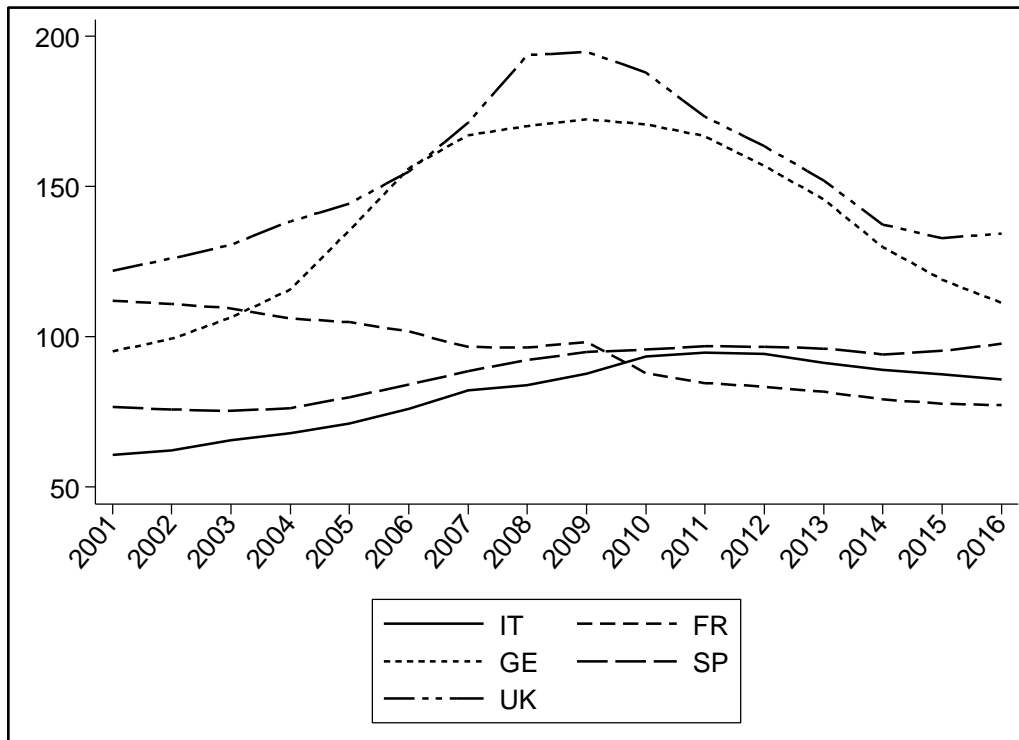
Table 3.4 – Systems estimation results

	(1)		(2)		(3)		(4)		(5)	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z
<i>Demand equation – Dependent variable: lnQ</i>										
Constant	2.4346	3.22 ***	2.3091	3.04 ***	2.1942	2.88 ***	2.1964	2.89 ***	2.2352	2.93 ***
P	-8.9114	-4.15 ***	-9.1128	-4.24 ***	-9.0576	-4.20 ***	-9.0911	-4.23 ***	-9.1019	-4.22 ***
Y	1.9889	3.20 ***	2.1024	3.36 ***	2.1982	3.50 ***	2.1989	3.51 ***	2.1648	3.45 ***
Z	6.1796	3.16 ***	6.6073	3.37 ***	6.7501	3.42 ***	6.7803	3.45 ***	6.7269	3.41 ***
MS	3.8306	30.71 ***	3.8301	30.67 ***	3.8321	30.65 ***	3.8255	30.62 ***	3.8305	30.63 ***
Adj R ²	0.9039		0.8994		0.8958		0.8903		0.9007	
<i>Supply equation – Dependent variable: P</i>										
Constant	1.0490	36.90 ***	0.9959	24.38 ***	0.9873	19.69 ***	0.9728	17.14 ***	0.9455	18.13 ***
lnQ	-0.0468	-8.70 ***	-0.0510	-9.02 ***	-0.0474	-8.07 ***	-0.0444	-7.75 ***	-0.0300	-3.27 ***
lnW ₁ W ₃	0.1178	8.44 ***	0.1289	8.22 ***	0.1235	7.36 ***	0.1109	6.72 ***	0.1289	7.99 ***
lnW ₂ W ₃	-0.0054	-0.59	-0.0043	-0.49	-0.0077	-0.90	-0.0071	-0.89	-0.0008	-0.09
lnTIME	-0.0382	-4.87 ***	-0.0167	-1.70 *	-0.0243	-1.67 *	-0.0232	-1.15	-0.0417	-5.09 ***
λ	0.0982	3.14 ***								
λ (1989-1993)			0.1394	2.78 ***						
λ (1994-1998)			0.0920	2.34 **						
λ (1999-2003)			0.1050	2.89 ***						
λ (2004-2008)			0.1025	2.94 ***						
λ (2009-2013)			0.0965	3.12 ***						
λ (1989-1991)					0.1619	2.77 ***				
λ (1992-1994)					0.1427	2.92 ***				
λ (1995-1997)					0.1218	2.74 ***				
λ (1998-2000)					0.1030	2.87 ***				
λ (2001-2003)					0.1289	3.24 ***				
λ (2004-2006)					0.1056	3.07 ***				
λ (2007-2009)					0.1327	3.36 ***				
λ (2010-2013)					0.1030	3.31 ***				
λ (1989-1990)							0.1836	2.64 ***		
λ (1991-1992)							0.1964	3.07 ***		
λ (1993-1994)							0.1590	2.93 ***		
λ (1995-1996)							0.1575	2.94 ***		
λ (1997-1998)							0.1219	2.85 ***		
λ (1999-2000)							0.1111	3.02 ***		
λ (2001-2002)							0.1364	3.28 ***		
λ (2003-2004)							0.1322	3.33 ***		
λ (2005-2006)							0.0973	2.58 ***		
λ (2007-2008)							0.1452	3.84 ***		
λ (2009-2010)							0.1174	3.03 ***		
λ (2011-2013)							0.1055	2.79 ***		
λ (BIG)									0.0805	2.55 **
λ (MEDIUM)									0.1025	3.25 ***
λ (SMALL)									0.1113	3.17 ***
λ (MINOR)									0.1197	3.15 ***
Adj R ²	0.9942		0.9944		0.9944		0.9954		0.9682	
N. Obs	100		100		100		100		100	
ε _{QP}	-0.8315		-0.8503		-0.8451		-0.8482		-0.8492	
ε _{QZ}	0.3546		0.3791		0.3873		0.3890		0.3859	
MC	0.0801		0.0795		0.0780		0.0768		0.0790	

The system has been estimated by non-linear two-stages least squares.

The instruments used are: levels and logs of first-lagged Q and P; levels and logs of Y, Z, MS, average total costs, W1, W2, W3, number of employees, number of branches, consumption, investment, time trend; size group dummies. Elasticities are calculated at variables' mean values. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Figure 3.1 – Domestic credit to private sector (% of GDP)

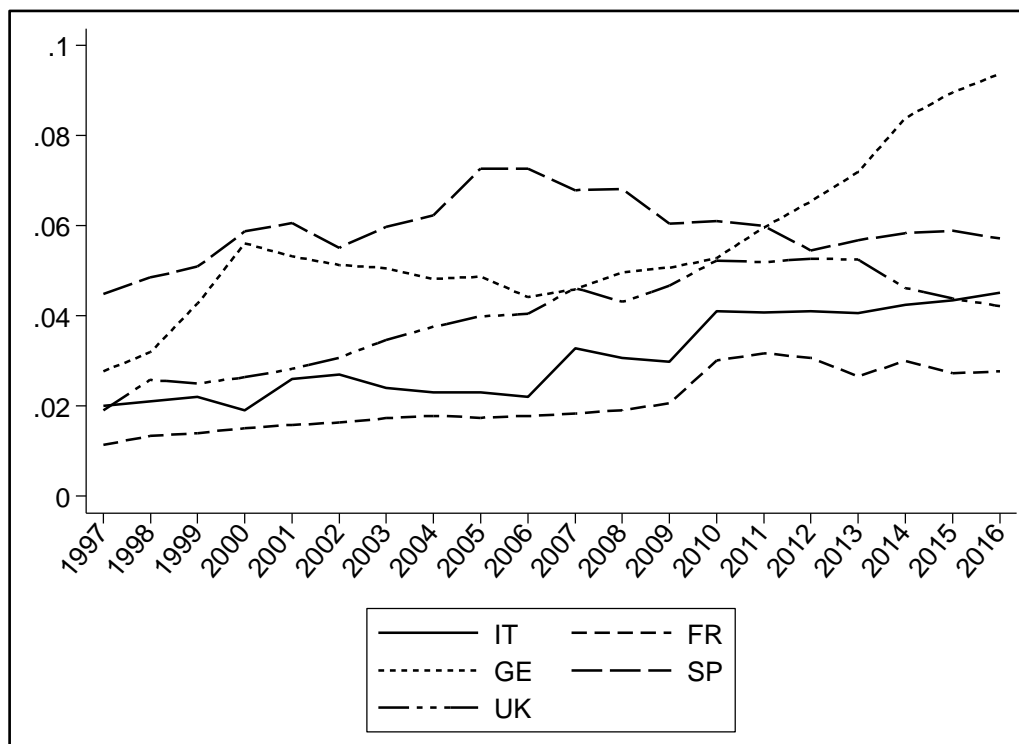


Source: Own elaboration on World Bank data.

Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts.

IT Italy; FR France; GE Germany; SP Spain; UK United Kingdom.

Figure 3.2 – Herfindahl-Hirshmann index growth

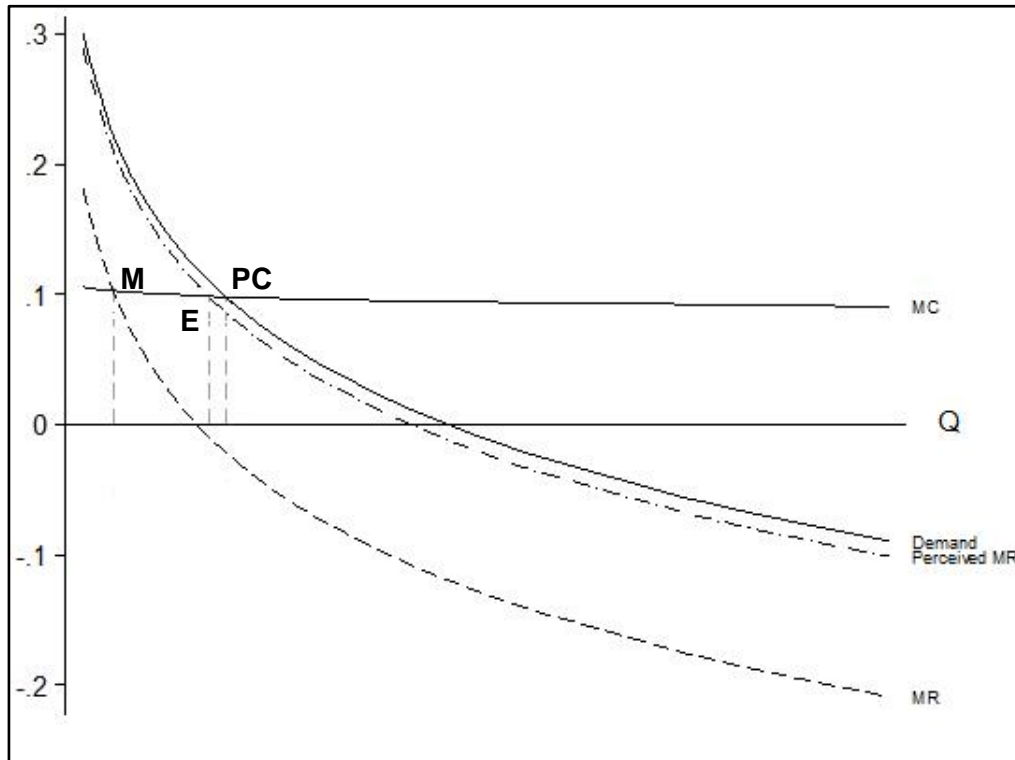


Own elaboration on ECB data.

Herfindahl index for Credit institutions total assets.

IT Italy; FR France; GE Germany; SP Spain; UK United Kingdom.

Figure 3.3 – Estimated demand, marginal cost, and marginal revenues for the Italian banking industry



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