Journal of Economics and Business 114 (2021) 105976

Contents lists available at ScienceDirect

Journal of Economics and Business

journal homepage: www.elsevier.com/locate/jeb

Do microeconomic and macroeconomic factors influence Italian bank credit risk in different local markets? Evidence from cooperative and non-cooperative banks

Cristian Barra *, Nazzareno Ruggiero

DISES-Department of Economics and Statistics, University of Salerno, Via Giovanni Paolo II, 84184, Fisciano (SA), Italy

ARTICLE INFO

JEL classification:
G21
G28
C14
D21

Keywords:
Microeconomic factors
Macroeconomic factors
Bank risk taking

ABSTRACT

This paper investigates the role of microeconomic and macroeconomic factors on Italian bank risk taking, paying particular attention on the differences between cooperative and non-cooperative banks. The non-performing loan ratio is used as dimension of bank risk taking. The data refer to a large sample of financial institutions covering the 2001−2014 period. We then assess whether the impact of microeconomic and macroeconomic factors is shaped by the market structure and investigate the effects of the 2008 financial crisis on banks' risk taking. Our empirical findings have several of policy implications and can be summarised as follows: i) capitalisation, volume of credits, volume of costs and intermediation costs are the key micro-economic factors explaining credit quality; b) among the main macroeconomic factors, branch density, deposit density and specialisation have a significant effect on the variable of interest; c) the financial crisis determined an increase in banks' credit rationing. Our results suggest that regulators, in changing banks' incentives, can be effective in improving the quality of credits, therefore enhancing the stability of the financial system. Capital requirements, often considered as a proxy that captures the effects of Basel agreements, have been found to increase credit quality.

1. Introduction and motivation

Deterioration in banks' loan quality is one of the major causes of financial fragility. Past experience shows that a rapid build-up of bad loans plays a crucial role in banking crises (see, e.g., Demirgüç-Kunt & Detragiache, 1998, and González-Hermosillo, 1999). In recent years, the global financial crisis and the subsequent recession in many developed countries have increased households' and firms' default rates, causing significant losses for banks. Regular monitoring of loan quality, possibly with an early warning system capable of alerting regulatory authorities of potential bank stress, is thus essential to ensure a sound financial system and prevent systemic crises. In this regard, the analytical tools currently under scrutiny in the context of macro-prudential regulation emphasise the role of indicators of asset quality.

The financial system is one of the main contexts that allows the transfer of money between savers (and investors) and borrowers. The financial system is therefore crucial for the allocation of resources in modern economies (Allen & Gale, 2001). The recent financial crisis has triggered a debate on performance as determinant of financial stability in different market structures and on the effects of

* Corresponding author.
E-mail addresses: cbarra@unisa.it (C. Barra), nruggiero@unisa.it (N. Ruggiero).

https://doi.org/10.1016/j.jeconbus.2020.105976
Received 25 April 2020; Received in revised form 7 December 2020; Accepted 9 December 2020
Available online 13 December 2020

spillovers, contagion and connectedness in debt markets (De Santis & Zimic, 2018). There are a number of reasons why this debate is taking place now. First, financial intermediaries were at the centre of the recent crisis. Second, the instability of the financial system, associated to non-performing loans (NPLs), has increased in the last years during the crisis, especially for vulnerable Euro-area countries, including Spain, Italy, Portugal, Greece, Cyprus and Slovenia (see Chart 6, page 9 of the ECB (2015) Financial Stability Review Report), signalling the necessity of the implementation of new measures and regulatory instruments. Third, bank performance is an important factor that could influence the phases of financial stability.

Allen et al. (2011) theoretically show that efficient screening and monitoring processes attract less risky investors, reducing bank instability. This theoretical prediction is supported by some empirical studies (see e.g. Wheelock & Wilson, 1995; and Berger & De Young, 1997). Moreover, there is a growing consensus that regulation can be an important tool for ensuring systemic stability. In other words, higher capital reduces the probability of bank failure. Finally, it seems useful, especially for policy reasons, to investigate the role of market structure on financial stability, where both theory and empirical evidence seem to be inconclusive (Mirzaei, Moore, & Liu, 2013), with conflicting and ambiguous results (Canoy, Van Dijk, Lemmen, De Mooij, & Weigand, 2001; Carletti & Hartmann, 2002; Anginer, Demirguc-Kunt, & Zhu, 2014; Allen & Gale, 2004).

Although the role of both microeconomic and macroeconomic factors in determining the quality of credit has been extensively studied in the literature, little is said about the risk-taking propensity for different types of banks. From this point of view, the Italian banking system, based on the partition between Cooperative banks (CBs) and Non-Cooperative banks (NON-CBs), represents a promising field of analysis. Moreover, unlike other existing contributions, this paper also deals with the effects of market structure on bank credit risk, since our dataset allows us to distinguish between different forms of market in which financial institutions operate (i.e. competitive, duopolistic, oligopolistic and monopoly markets). In this way it is therefore possible to understand whether there exists a relationship between the underlying structure of the market and the risk-taking propensity of banks.

In summary, this paper contributes to the existing literature in the following ways: (i) to investigate the effect of microeconomic and macroeconomic factors on bank credit risk giving particular attention to the different typology of banks operating on the Italian territory, i.e. cooperative and non-cooperative banks; (ii) to assess the nexus paying particular attention to the role of market structure and banks' size; (iii) to assess how the financial crisis affected the contribution of microeconomic and macroeconomic factors to bank credit risk.

This paper is structured in the following way: Section 1 describes the main literature that has dealt with the identification of the factors that affect bank risk. Section 2 discusses the data and empirical strategy employed in order to investigate the impact of microeconomic and macroeconomic factors on bank credit risk. Section 3 presents the main findings and robustness checks, highlighting a set of policy measures aimed at strengthening financial stability. Section 4 concludes, discussing the main policy implications.

1.1. Related literature

Over time, a significant economic literature has been devoted to the identification of both the bank-specific and aggregate factors that explain the dynamics of credit quality.

Some studies, carried out both at national (Bofondi & Ropele, 2011; Louzis, Vouldis, & Metaxas, 2012) and cross-country level (Anastasiou, Louri, & Tsionas, 2016; Beck, Jakubik, & Piloiu, 2013; Espinoza & Prasad, 2010; Schwaab, Koopman, & Lucas, 2016; Radivojevic and Jovovic, 2017), widely accept the idea that the macroeconomic environment has a preeminent role in explaining the dynamics of bad loans and agree on the fact that a higher degree of economic activity, either shown by increased GDP or decreased unemployment rate, ameliorates credit quality, reducing the risk of default for firms and households[1] . Nevertheless, beside aggregate GDP and unemployment rate, the existing literature has further emphasised the role of other relevant macroeconomic variables in determining the aggregate amount of bad loans. In particular, these contributions reveal that several other macro-variables, like interest rates (Espinoza & Prasad, 2010; Bofondi & Ropele, 2011; Louzis, Vouldis and Metaxas; 2012; Beck et al., 2013), increased risk aversion (Espinoza & Prasad, 2010), public debt and the quality of management (Louzis et al., 2012), house prices (Bofondi & Ropele, 2011; Beck et al., 2013), and inflation (Radivojevic and Jovovic, 2017) significantly affect the quality of credit.

Quantitatively, most of these variables, notably interest rates, risk aversion, public debt and inflation are shown to be directly correlated with the quality of credit, leading to a worsening in credit quality, while better banks' governance or positive shocks in the housing market improve the quality of credits and reduce the risk that households and firms are unable to meet their obligations.

Although macroeconomic factors have usually had a preeminent role in explaining the determinants of credit risk, a considerable amount of literature, either at cross-country and national level, or for different types of financial institutions, especially commercial and savings banks, has been devoted to the identification of the microeconomic drivers of credit quality, with great emphasis on several different bank-specific dimensions.

Some contributions, most notably Louzis, Vouldis and Metaxas (2012) and Abid, Ouertani, and Zouari-Ghorbel, 2014 have analysed the nexus between banks' management and credit risk, showing that improvements in the managerial structure of banks reduce the probability of undertaking risky behaviours, therefore ameliorating the quality of credits.

Other contributions, like Zribi and Boujelbène, 2011Zribi and Boujelbéne (2011) and Forssbæck, 2011Forssbæck (2011), have focused their attention on the relationship between banks' ownership and risk-taking propensity, suggesting that ownership crucially affects banks' performances and that there exists a U-shaped relationship between ownership structure and credit quality (Forssbæck,

[1] Differently from this literature, in a contribution based on Italy over the 1995−2014 period, Anastasiou (2017) shows that credit cycles have a relatively higher and significant impact on the share of non-performing loans compared to business cycle fluctuations.

2011). Further to this point, García-Marco and Robles-Fernández (2008) have analysed the role of different ownership structures and size of banks upon risk behaviour considering the Spanish context. Their findings suggest a clear evidence of major differences linked to legal form and size.

The contributions of Agoraki, Delis, and Pasiouras, 2011 and Tabak, Fazio, & Cajueiro, 2012Tabak, Fazio and Cajueiro (2012), on the other hand, have emphasised the nexus between market structure and bank risk.

Specifically, while Agoraki, Delis, and Pasiouras, 2011 show that there exists an inverse relationship between market structure and risk-taking propensity, where banks with market power display a lower probability of default, Tabak, Fazio, and Cajueiro, 2012Tabak, Fazio and Cajueiro (2012) find evidence of a non-monotonic relationship between competition and bank risk, further showing that increased competition in the banking industry enhances the stability of the financial system. Finally, the papers of Salas and Saurina (2002), Ghosh (2017) and Chaibi and Ftiti, 2015Chaibi and Ftiti (2015) assess the nexus between inefficiency and banks' risk-taking propensity, showing that a higher degree of inefficiency determines a deterioration in credit quality, therefore increasing the likelihood of bad loans.

This paper contributes to the literature which has investigated the determinants of non-performing loans in three different ways.

First, to the best of our knowledge, this is the first contribution entirely based on Italy which assesses how bank-specific and environmental characteristics affect the amount of non-performing loans for different types of banking institutions, as we partition them according to whether they are cooperatives or non-cooperatives (i.e. commercial and popular).

Given the characteristics and the relevance of these financial institutions in the Italian banking system[2], it seems reasonable to assume that the impact of microeconomic and macroeconomic factors upon the ratio of non-performing loans might significantly vary according to the two main categories of banks scrutinised. In our opinion, the identification of the main microeconomic and macroeconomic drivers of credit quality for different financial institutions does not represent a purely empirical exercise but allows us to get a better and deeper understanding of the functioning of the Italian banking system, hence leading to more accurate policy implications.

Second, as our analysis is developed at a high level of territorial disaggregation, as we rely on Labour Market Area[3] (LMAs) data, we are able to assess whether the impact of both microeconomic and macroeconomic factors on credit quality is somehow shaped by the local degree of competition in the banking sector. Specifically, we identify four alternative forms of market competition, namely monopoly, duopoly, oligopoly and competition, and test whether the estimated parameters vary according to the local degree of competition in the banking market. Through this econometric exercise it is therefore possible to test whether the risk-propensity behaviour of the two types of banks under scrutiny is influenced by the market structure in which they operate, hence allowing us to identify possible sources of local financial instability and the main areas of policy interventions.

Third, we investigate whether the relevant micro and macro parameters change once we consider the 2008 recession. In this way, it is therefore possible to assess whether cooperative and non-cooperative banks reacted unevenly to the adverse shock caused by the crisis. Indeed, as emphasised by Schivardi, Sette, and Tabellini (2017), Italy represents a promising field of analysis as it experienced not only a marked contraction of its Gross Domestic Product (GDP) and a sizeable increase of the ratio of non-performing loans[4], but, most importantly, and differently from other Euro-area countries, did not proceed with the recapitalisation of the banking system, nor gave rise to a bad bank aimed at absorbing credit risk.

2. Empirical design

2.1. Data and variables

The data used in the current analysis were collected from the BilBank 2000 database, distributed by ABI (Associazione Bancaria Italiana), a dataset characterised by a large time extension and with a large amount of information on banks' balance sheets over the 2001−2014 period (see Table 1 for more details on the definition of the variables)[5] . Due to the highly territorially data disaggregation, the financial reforms (privatisation and Second Banking Directive) that occurred after 1990 and the integration of markets, Italy, in our opinion, represents a promising field of analysis.

The sample consists of cooperative, commercial and popular banks.

As these financial intermediaries are *per se* different and pursue different goals, it is worth discussing their main characteristics and their main distinguishing features. The role of cooperative banks in the Italian banking system has received wide attention in the economic literature, see for instance Gutiérrez (2008); Manetti and Bagnoli (2013); Aiello and Bonanno (2016b) and Bruno et al. (2018). According to these papers, the fundamental role of cooperative banks lies in the fact that, though these financial intermediaries are smaller in terms of size compared to commercial banks, they actively contribute to the development of peripheral areas and have

[2] For a comprehensive discussion concerning the characteristics of the different types of banking institutions comprising the Italian banking system, see Section 2.1.

[3] See Section 2.1 for a more detailed discussion of LMAs.

[4] According to Schivardi et al. (2017), the financial crisis caused a cumulative 10% loss of GDP. By December 2013, the ratio of non-performing loans was 16%. By the same month, in 2006, this share was 5.8%.

[5] Unfortunately, information for some of the main variables employed in the paper was not available before 2001 and after 2014. For this reason, our analysis covers the 2001−2014 period. Furthermore, the ABI-dataset is compared with the Bankscope-dataset. The BilBank database was selected because it provides valuable information, such as number of branches and number of workers,

Table 1
Description of the variables.

Variables	*Symbol*	*Description*
Bank risk		
Bank credit risk	NPLL	Non-performing loans to total loans.[a]
Microeconomic Bank Factors		
Credit Policy	GRLO	Growth of total loans (level). [a]
Return on Assets	ROA	Profit to total assets.[a]
Capitalisation	ETA	Equity to total assets.[a]
Dimension of bank	TA	Log of total assets. [a]
Volume of credit market	LTA	Bank loans to total assets. [a]
Volume of cost	DL	Bank deposits to total loans. [a]
Volume of intermediation cost	CTA	Bank cost to total assets. [a]
Macroeconomic Factors		
National income	GRGDP	Growth of gross domestic product (level) at LMAs level. [c]
Deposits density	DD	Territorial aggregate deposits per square kilometre. [b,d]
Branch density	BD	Number of branches per square kilometre. [b,d]
Deposits per branch	DB	Territorial aggregate deposits to number of branches. [b,d]
Specialisation Index	SI	Number of branches over territorial aggregate deposits and loans. [b,d]
Type of banks	TYPE	Cooperative and commercial banks dummies; popular used as benchmark group
Controls		
Macro area	MACRO	South, North-West and North-East dummies; Centre as benchmark group
Timing	TIME	Set of time dummies
Market structure		
Monopolistic dummy	MON	Monopolistic market (assuming 1 if at LMAs level there is 1 bank (CBs or NON-CBs), 0 otherwise). [b,d]
Duopolistic dummy	DUO	Duopolistic market (assuming 1 if at LMAs there are 2 banks (CBs or NON-CBs or both), 0 otherwise). [b,d]
Oligopolistic dummy	OLIG	Oligopolistic market (assuming 1 if at LMAs there are 3 banks (CBs or NON-CBs or both), 0 otherwise). [b,d]
Competitive dummy	CONC	Competitive market (assuming 1 if at LMAs there are more than 3 banks (CBs or NON-CBs or both), 0 otherwise). [b,d]

Note: (a) own calculations upon BilBank 2000 database from ABI; (b) ISTAT (2005); (c) ISTAT (2005) and own calculations from Bureau Van Dijck's AIDA; (d) Bank of Italy (*Bollettino Statistico*).

strong linkages with the territory in which they operate. As emphasised by Gutiérrez (2008), cooperative banks represent the major source of funding for Small and Medium Enterprises (SMEs) and help to mitigate their credit constraints. Given both the proximity with customers and the existence of long-lasting fiduciary relationships, cooperative banks are able to better monitor their borrowers, hence reducing informational asymmetries (Coccorese & Ferri, 2020). With respect to their governance structure, it has been notably summarised by Coccorese and Ferri (2020). Accordingly, the governance model adopted by cooperative banks is based on the principle of mutualism, with the members fully involved in the decision-making process of the intermediary. In particular, beyond the "one-head one-vote" principle, cooperative banks' members can hold an amount of shares no higher than €50,000 and their business activity or domicile must be in the area in which the bank operates. At least 70 % of profits must be used as legal reserves and at least 51 % of risky activities must involve the members, while 95 % of the lending activity must be carried out in the area in which the bank operates. Quantitatively, according to Bank of Italy (2018), by 2017 cooperative banks represented the majority of stand-alone banks in the Italian banking system, with 280 units. By 2019, according to Bank of Italy (2020), cooperative banks accounted for 4235 branches, representing 17 % of total branches, while by 2014 their loan shares were 8.6 % and 9.6 % for households and non-financial corporations respectively (Coccorese & Ferri, 2020). Popular banks, on the other hand, are larger in size compared to cooperatives and not inspired to mutualistic principles, nor do they face territorial constraints. In line with cooperative banks, the one-head one-vote principle applies to these financial institutions as well and they primarily serve SMEs. Nevertheless, differently from cooperatives, shares can be traded on the stock market and a minimum of 10 % of profits must be used as legal reserves. Individual members can hold at most 0.5 % of capital, while the maximum amount that can be held by institutional investors must be at most 10 % (Gutiérrez, 2008). According to Bank of Italy (2018), by 2017 popular banks represented the smallest portion of the Italian banking system, with only 15 stand-alone banks and an amount of branches equal to 1,547, representing 6 % of total branches in the country (Bank of Italy, 2020)[6] . Finally, commercial banks are the largest in terms of size in the Italian banking system and their main objective is represented by profit maximisation. They are not territorially constrained and characterised by dispersed ownership (Mattei et al., 2011). Differently from the two afore-mentioned groups, commercial banks exhibit a lower proximity with their borrowers, are in general riskier and less efficient (Coccorese & Ferri, 2020; Destefanis, Barra, & Lubrano-Lavadera, 2014). From a quantitative perspective, according to Bank of Italy (2018), by 2017 52 commercial banks were operating in the national territory, accounting for more than 18,000 branches,

[6] With the 2015 reform of popular banks, these intermediaries are required to be transformed into joint stock companies, provided that their assets exceed €8 billion.

which represent 76 % of total branches in the country (Bank of Italy, 2020).[7] For the purposes of this paper, we exclude from our sample branches of banks located abroad since they follow both a different regulation, which crucially depends on the country in which they operate, and different local rules as well.

In particular, we use a sample of Italian banks classified by the Bank of Italy as: major (average funds intermediated more than 65 billion euro), large (average funds intermediated between 27 and 65 billion euro), medium (average funds intermediated between 9 and 27 billion euro), small (average funds intermediated between 1.3 and 9 billion euro) and minor (average funds intermediated less than 1.3 billion euro). However, our analysis is focused on the relevance of market structure on bank risk taking, which we consider a topic often disregarded in the literature. Differently from other contributions in the literature, our dataset allows for a better spatial stratification that enables us to capture the differences between geographical areas, therefore obtaining more accurate estimates. Specifically, our analysis is conducted at Labour Market Areas (LMAs) to accurately capture the contribution of local credit institutions or different market structures on financial stability.

According to the Italian Statistical Office (ISTAT), *"Labour market areas (LMAs, 'local labour systems', in Italy) are sub-regional geographical areas where the bulk of the labour force lives and works, and where establishments can find the largest amount of the labour force necessary to occupy the offered jobs. They respond to the need for meaningfully comparable sub-regional labour market areas for the reporting and analysis of statistics. LMAs are defined on a functional basis, the key criterion being the proportion of commuters who cross the LMA boundary on their way to work"*. The official definition provided by the ISTAT implies that a given LMA is composed of groups of two or more contiguous municipalities which represent a single labour market and that can provide comparable statistical information. The procedure adopted by the ISTAT to identify LMAs, which involves all the municipalities in the country, is instead based on a matching algorithm which depends on the amount of bilateral flows of individuals. From a quantitative perspective, the ISTAT has identified 686 LMAs, geographically partitioned as follows: 119 in the North-East, 114 in the North-West, 128 in the Centre and 325 in the South.

National income (GDP) is constructed by updating the LMAs' value added data from ISTAT through the 2006–2014 period with data from the Bureau Van Dijck's AIDA dataset. LMAs-level data for branches, deposits and loans (used to construct deposits density – DD, deposits per branch – DB, branch density – BD, and Branches to territorial aggregate Loans and Deposits – SI) are taken from the Bank of Italy dataset (*Bollettino Statistico*). The other main variables used in our analysis, such as Total Assets (TA), Loans to Total Assets (LTA), Cost to total Assets (CTA), and Deposits to Loans (DL), are from the BilBank 2000 database distributed by ABI (Associazione Bancaria Italiana). All monetary aggregates are in thousands of deflated 2005 Euros. Our sample begins in 2001, because LMAs-level data are not available before that year. Fixed effect regressions are carried out with STATA 13.

Table 2 summarises the main descriptive statistics, partitioning the sample according to both the geographical location and the type of bank. According to Table 2, Italian regions are characterised by high heterogeneity, both in terms of financial development and risk-taking propensity. The proportion of non-performing loans is higher in Southern and Central regions. This result is not surprising and can be explained by the fact that these regions are mostly populated by small and medium enterprises (SMEs) and, especially in the South, with a low level of economic activity and higher unemployment rates, factors that make it hard for both firms and households to repay their debts. When statistics are disaggregated according to the type of bank, we show that cooperative banks exhibit a worse performance compared to non-cooperative banks. The same applies to the growth of loans as well, which has not been homogeneous over the period under scrutiny. More precisely, we observe that, while for North-Western and Southern regions there has been an increase in the amount of loans, all other macro-areas display a contraction in the amount of credits provided. Moreover, it is possible to observe that, while there has been a growth of loans provided by cooperative banks, the opposite holds true for the other types of banks considered in the paper.

Large heterogeneity exists in terms of the returns on assets as well. Results reported in Table 2 show that investments are largely more profitable in the Centre and Northern regions compared to the Southern regions. Even with respect to the ROA, performances between cooperative and non-cooperative banks are quite different. In particular, and not surprisingly, we observe that the ROA is higher for non-cooperative banks. In terms of capital requirements, summarised by the ratio of equity to total assets (ETA), we observe that banks are more capitalised in the North-West and in the South, with the Centre exhibiting relatively lower levels of capitalisation. No significant differences, in this case, exist between the two different types of banks analysed. Also in terms of bank size, several differences arise among the main Italian macro-areas, with large banks located mostly in the North-West and in the North-East and with cooperative banks that are smaller in size compared to their counterparts.

The volumes of credit, as expected, are higher once again in the North, signalling a more developed financial system. Nevertheless, once we consider how the volumes of credit are distributed according to the type of bank, it is possible to observe that they are higher for cooperative banks, a result that can be justified by the fact that these financial institutions have consolidated roots with the territories in which they operate.

The volume of cost is higher in the North and lower in the Centre and, not surprisingly, higher for non-cooperative banks, while the volume of intermediation cost is higher in the North-East and quite similar in the other macro-areas and higher for non-cooperative banks.

Another relevant variable in our analysis is the specialisation index, which is found to be higher in Southern regions and for cooperative banks. All the macro-areas considered have further experienced a marked contraction in the growth of the Gross Domestic Product, signalling that the crisis has been quite severe for the country as a whole. Moreover, such a contraction has been more marked

[7] The remaining 1% of branches is instead represented by Italian subsidiaries of foreign banks. According to Bank of Italy, they account for 134 branches of subsidiaries of foreign banks operating in the national territory.

Table 2
Descriptive Statistics of Variables used in the Analysis.

	NPLL	GRLO	ROA	ETA	TA	LTA	DL	CTA	SI	GRGDP	DD	BD	DB
North-West	0.0158	59,111	0.0090	0.1342	3,364,420	0.6515	2.54	0.0420	0.0290	−7,342,267	3.84	0.1884	16.07
(N = 3038)	(0.0191)	(7,826,409)	((0.0060)	(0.0522)	(24,700,000)	(0.1924)	(94.53)	(0.0286)	(0.0210)	(2,248)	(6.62)	(0.1524)	(8.99)
North-East	0.0150	−113,972	0.0093	0.1235	8,985,327	0.5372	42.96	0.0555	0.0200	−1,958,998	31.16	0.6152	31.49
(N = 1773)	(0.0199)	(9,135,690)	(0.0085)	(0.0754)	(41,800,000)	(0.2598)	(425.03)	(0.0673)	(0.0208)	(3,425)	(44.42)	(0.5597)	(26.21)
Center	0.0216	−125,067	0.0101	0.1162	4,405,901	0.5769	1.23	0.0469	0.0285	−2,927,816	6.19	0.2005	20.81
(N = 1801)	(0.0204)	(2,286,216)	(0.0073)	(0.0487)	(20,000,000)	(0.1900)	(6.52)	(0.0409)	(0.0260)	(5,280,225)	(10.39)	(0.745)	(14.42)
South	0.0288	3,039,464	0.0093	0.1320	961,704	0.4760	1.34	0.0442	0.0385	−2,245,357	3.73	0.1,304	17.82
(N = 1917)	(0.0235)	(372,625)	(0.0070)	(0.0540)	(2,904,656)	(0.1513)	(0.61)	(0.0263)	(0.0369)	(1,607,582)	(11.41)	(0.1963)	(9.74)
CBs	0.0208	7,563,855	0.0089	0.1287	359,905	0.5821	0.95	0.0422	0.0345	−136,234	4.96	0.1843	16.60
(N = 5601)	(0.0192)	(44,256)	(0.0055)	(0.0401)	(517,867)	(0.1781)	(0.46)	(0.0263)	(0.0308)	(2,186,393)	(13.50)	(0.2275)	(11.56)
NON-CBs	0.0177	−100,800	0.0102	0.1257	11,600,000	0.5542	28.45	0.0542	0.0187	−2,641,749	19.77	0.4242	28.44
(N = 2928)	(0.0247)	(11,100,000)	(0.0093)	(0.0819)	(43,400,000)	(0.2619)	(344.93)	(0.0611)	(0.0120)	(4,754,906)	(35.46)	(0.4645)	(21.12)
All Sample	0.0198	−27.968	0.0094	0.1277	4,212,769	0.5725	1039	0.0463	0.0290	−1,781,855	10.17	0.2667	20.76
(N = 8529)	(0.0213)	(6,355,982)	(0.0071)	(0.0580)	(26,000000)	(0.2111)	(202.50)	(0.0420)	(0.0269)	(3,260,016)	(24.70)	(0.3478)	(16.59)

Note: own calculation; see Table 1 for more details about the description and construction of variables included in the regression. All variables averaged between 2001 and 2014. All monetary aggregates are in thousands of Euros (at 2005 prices); N: number of observations (2001−2014); Standard deviation in parentheses;

in the case of non-cooperative banks.

A similar pattern characterises both the deposit density and the branch density, which are higher in the most financially developed regions and lower in the less developed area of the country, i.e. the South. When we consider the summary statistics according to the type of banks, we observe that non-cooperative banks perform better than their cooperative counterparts.

The last summary statistic that we consider is the deposits per branch, where we find that non-cooperative banks and the North-Eastern regions show better performances when compared to the other relevant groups.

2.2. Empirical strategy

In order to assess the impact of microeconomic and macroeconomic factors on bank risk taking, we rely on the application of a Fixed Effects estimator with clustering standard errors, to deal with the presence of group-wise heteroskedasticity. As suggested by the Akaike and the Schwartz information criteria, we use the lagged level of any variables included in our analysis. Formally, our model is specified as follows:

$$NPLL_{i,t} = \alpha_1 NPLL_{i,t-1} + \beta_j MICRO_{i,t-1} + \gamma_j MACRO_{i,t-1} + TIME_t + \varepsilon_{i,t} \quad (1)$$

where *NPLL* is the measure of bank risk, calculated as the ratio of non-performing loans to total loans[12], being one of the most relevant dimensions of financial stability for cooperative and non-cooperative banks; *MICRO* is a vector of microeconomic factors, such as: GRLO: growth of total loans (level), i.e. $Loans_t$-$Loans_{t-1}$, reflecting credit policy; ROA: return on assets, reflecting the profitability of the bank; ETA: equity to total assets, capturing the solvency of the bank and reflecting capital strength of the bank; TA: log of total assets, controlling for the size of banks; LTA: loans to total assets, capturing the volume of the credit market; LTA: loans to total assets, reflecting the volume of the credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of banks' efficiency or volume of intermediation cost.

Among the set of relevant microeconomic factors included in our econometric analysis, we are particularly interested in the impact of credit policy and capitalisation on the amount of non-performing loans. Our interest is essentially motivated by the fact that the relationship between these variables and credit risk is a priori ambiguous and represents an empirical issue. Indeed, one strand of the literature, summarised here by the contributions of Fernández de Lis, Martínez Pagés, and Saurina Salas (2000); Salas and Saurina (2002); Davis and Karim (2008) and Festić, Kavkler, and Repina (2011), has shown that rapid credit growth increases the amount of non-performing loans. This result is confirmed by Vithessonthi (2016), in a paper based on Japan over the 1993–2013 period, though he shows that this effect only holds once the pre-crisis period is considered. After the recession, indeed, the growth of credit ameliorates credit risk. This result is essentially channelled by banks' expectations about the future quality of credit. Indeed, if banks expect a higher amount of non-performing loans in the future, determined by a deterioration of credit standards, credit growth actually reduces credit risk. Similar uncertainty characterises the relationship between capitalisation and problem loans. While Ghosh (2017) shows that higher capital standards increase the amount of non-performing loans, Berger and De Young (1997) suggest that higher capitalisation discourages moral hazard among banks' managers and reduces credit risk.

On the other hand, *MACRO* is a set of macro-characteristics aimed at assessing how the local environment in which the bank operates affects its amount of bad loans and that includes factors like: GRGDP: growth of the Gross Domestic Product (GDP) (level) at LMAs level, i.e. GDP_t-GDP_{t-1}, reflecting the main and most direct measure of aggregate for economic activity; DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branch, controlling for cost associated to any intermediaries; BD: branch density, controlling for the diversification of branches on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation (see Table 1 for a more detailed description of the variables). With respect to the set of macroeconomic factors included in the econometric analysis, our primary empirical interest is to assess the impact of branch density and specialisation on the variable of interest. Indeed, we expect non-performing loans to increase following a growth in the amount of branches. Specifically, following the literature (Aiello & Bonanno, 2016a; Alessandrini, Presbitero, & Zazzaro, 2009; Bernini & Brighi, 2018), it is reasonable to assume that branches' expansion reduces the efficiency of banks and that this lower efficiency is then reflected in a deterioration of credit quality, as shown in Berger and De Young (1997); Williams (2004) and Fiordelisi, Marques-Ibanez, and Molyneux (2011). On the other hand, the impact of specialisation represents another empirical issue of the paper. In particular, while some contributions, see for instance Sinkey and Nash (1993) and Nash and Sinkey (1997) argue that specialisation increases the probability of insolvency and causes higher risk-taking, Eisenbeis and Kwast (1991) show that specialised banks exhibit lower riskiness and lower loan losses.

TIME is the set of time dummies included in the model in order to capture the changes in macroeconomic variables (e.g. the lowering of interest rates) and rules (e.g. the processes of financial deregulation and privatisation in Italy), while ε is the error term. Subscripts i and t refer, respectively, to financial intermediaries and time periods (years). We include the lagged NPL ratio as an explanatory variable because of its significant degree of persistence[8] . This serves also to capture capital reserves built in the previous period. All the variables in our analysis are deflated (at 2005 prices) in order to avoid the price effect on the relationship. Finally, all standard errors are clustered at bank level.

From an empirical perspective, it is relevant to understand which specification or estimator is optimal for the purposes of the paper.

[8] The choice of the lag structure is suggested by some preliminary estimates.

In this regard, it is essential to choose from among the pooled regression, i.e. the fixed-effect and the random-effects models. To do this, the first step is to determine whether individual effects are relevant or not. If the individual effects are not relevant, the pooled regression model is the best option. We then have to choose between the fixed-effects and the random-effects models. The Hausman test provides an answer for the best choice (Hausman & McFadden, 1984; Hausman, 1978). The null hypothesis assumes that the most appropriate model is the random-effects, with the fixed-effect model being the alternative hypothesis[9] . Test results rejected the null hypothesis, thus concluding that the model of fixed coefficients provides the best estimation technique for our data.

2.3. The role of banking market structure

In order to understand whether the impact of microeconomic and macroeconomic factors on credit risk is affected by the degree of competition in the banking sector, we construct a variable equal to 1 when at LMAs level there is 1 bank (MON: MONOPOLISTIC); 2 when at LMAs level there are 2 banks (DUOP: DUOPOLISTIC); 3 when at LMAs level there are 3 banks (OLIG: OLIGOPOLISTIC) and 4 otherwise (COMP: COMPETITION). Formally, the model described in eq. (1) becomes:

$$NPLL_{i,t} = \alpha_1 NPLL_{i,t-1} + \beta_j MICRO_{i,t-1} + \gamma_j MACRO_{i,t-1} + TIME_t + \varepsilon_{i,t} \; if \; market \; structure = \left[MON, DUOP, OLIG, CONC\right] \quad (2)$$

3. Empirical evidence

3.1. Correlation coefficients

Table 3 reports the pairwise Pearson correlations among the main variables employed in our econometric analysis. According to Table 3, among the set of microeconomic factors considered in the paper, we find evidence of an inverse and significant correlation between ROA, capitalisation, volume of cost, volume of intermediation cost, volume of credit and the ratio of non-performing loans. Correlations with growth of loans and size are instead not statistically significant. With respect to the macroeconomic variables considered in the paper, evidence of a negative and significant correlation between specialisation, economic growth, deposit density, branch density and the variable of interest is found, while deposits per branch positively correlate with the ratio of non-performing loans. Moreover, as the main variables included in the econometric analysis do not exhibit strong linear correlations, we interpret this result as a signal that multicollinearity among regressors does not represent a relevant issue, implying that the parameters of interest in our regression analysis are consistently estimated.

3.2. Regression results. The baseline model

In this section we focus on the role of microeconomic and macroeconomic factors upon bank risk (i.e. credit bank risk). In particular, the aim of our empirical analysis is to assess whether the two categories of banks, i.e. cooperative banks (CBs) and non-cooperative banks (NON-CBs), behave differently, further taking into account the existing heterogeneity across macro-areas. With respect to the microeconomic factors, the empirical findings suggest an important role of regulatory credit policy, with the growth of loans that is associated to lower credit risk, especially for CBs. Our results are in line with the predictions of Vithessonthi (2016), who shows that if banks expect an increase in the amount of non-performing loans in the future, driven by a worsening in lending standards, the growth of credits will ameliorate credit risk. In terms of policy implications, evidence reported in Table 4 indicates that measures which improve banks' screening activities would be desirable. Specifically, these policies would allow to select good borrowers, expand banks' credit capacities and reduce the riskiness of their future loans' portfolios. When the analysis is conducted at regional level, we observe that credit policy is effective in reducing credit risk in the Southern and Central regions, while it is not statistically significant in the two remaining macro-areas. We also find that increases in returns determine an increase in credit risk. In particular, this result holds when the whole sample is considered and for both the Centre and South. The direct relationship between returns and credit risk is line with the predictions of Rajan (1994), who shows that banks' managers might manipulate current earnings to signal the market that they are highly profitable, at the cost of having more bad loans in the future. In terms of policy implications, regulatory authorities should therefore enhance the monitoring of banks' managements and give rise to a set of measures to assess whether banks' profitability policies might lower financial stability in the future. Our empirical analysis further reveals that increased capitalisation enhances the quality of credits. Evidence reported in Table 4 seems to be consistent with the findings of Berger and De Young (1997), who show that increased capital standards discourage moral hazard behaviour among banks' managers and reduce the riskiness of their loan portfolios. Moreover, in line with Berger and De Young (1997), Granger causality tests, not reported in the paper but available upon request, suggest that capitalisation Granger-causes non-performing loans. Results reported in Table 4 indicate that policies aimed at increasing capital standards are beneficial for the stability of the financial system as they reduce the riskiness of bank loans. At regional level, capitalisation is shown to be negative and significant only for North-Western and North-Eastern regions. This

[9] Moreover, the inclusion of bank fixed effects in all specifications is useful to solve the omitted variable problem. However, macroeconomic factors are seldom statistically significant in the regression analysis (for example in Table 4), maybe because many macroeconomic-level variables hardly change at yearly frequency. One way to check whether this phenomenon persists is to show regression results without bank fixed effects. For this reason, we show the estimates using OLS estimator. The empirical findings suggest that macroeconomic factors are always statistically significant (for sake of brevity these results are available on request).

Table 3
Pairwise correlations between variables.

	NPLL	GRLO	ROA	ETA	TA	LTA	DL	CTA	SI	GRGDP	DD	BD	DB
NPLL	1.000												
GRLO	−0.0004	1.000											
	(0.9701)												
ROA	−0.0501	0.0126	1.000										
	(0.0000)	(0.2742)											
ETA	−0.1243	−0.0032	−0.0539	1.000									
	(0.0000)	(0.7795)	(0.0000)										
TA	0.0050	0.1476	−0.0101	−0.0493	1.000								
	(0.6452)	(0.0000)	(0.3496)	(0.0000)									
LTA	−0.1242	0.0092	−0.1188	−0.1006	−0.0162	1.000							
	(0.0000)	(0.4269)	(0.0000)	(0.0000)	(0.1348)								
DL	−0.0425	0.0002	−0.0026	0.1565	−0.0074	−0.1278	1.000						
	(0.0001)	(0.9891)	(0.8096)	(0.0000)	(0.4959)	(0.0000)							
CTA	−0.1235	0.0011	−0.2338	0.2027	−0.0326	0.1809	0.0742	1.000					
	(0.0000)	(0.9239)	(0.0000)	(0.0000)	(0.0026)	(0.0000)	(0.0000)						
SI	−0.0192	−0.0046	−0.0946	0.0695	−0.0845	0.0991	−0.0306	0.0448	1.000				
	(0.0813)	(0.6956)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0055)	(0.0000)					
GRGDP	−0.1289	0.1743	−0.0020	0.0330	0.1138	0.0483	0.0053	0.0740	0.0347	1.000			
	(0.0000)	(0.0000)	(0.8606)	(0.0043)	(0.0000)	(0.0000)	(0.6455)	(0.0000)	(0.0031)				
DD	−0.0597	0.0014	0.0416	0.0183	0.1198	−0.2925	0.0772	0.1272	−0.3052	−0.0416	1.000		
	(0.0000)	(0.9080)	(0.0002)	(0.0963)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0004)			
BD	−0.0990	0.0080	0.0347	0.0167	0.1177	−0.2326	0.0780	0.1699	−0.3955	0.0080	0.8984	1.000	
	(0.0000)	(0.4872)	(0.0013)	(0.1234)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.4902)	(0.0000)		
DB	0.0426	−0.0032	0.0704	−0.0196	0.1546	−0.3325	0.0611	0.0406	−0.4985	−0.1278	0.8833	0.7703	1.000
	(0.0001)	(0.7820)	(0.0000)	(0.0750)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Table 4
Bank credit risk and microeconomic/macroeconomic factors.

$y = NPLL_t$	(1) All banks	(2) CBs	(3) NON-CBs	(4) North-West	(5) North-East	(6) Center	(7) South
$NPLL_{t-1}$	0.769***	0.766***	0.736***	0.869***	0.716***	0.812***	0.652***
	[0.0317]	[0.0320]	[0.0669]	[0.0427]	[0.0913]	[0.0425]	[0.0532]
Microeconomic factors							
$ln(GRLO)_{t-1}$	−0.00250**	−0.00689***	−0.00160	0.00101	−0.00182	−0.0118***	−0.00448*
	[0.00124]	[0.00240]	[0.00134]	[0.00381]	[0.00132]	[0.00245]	[0.00254]
ROA_{t-1}	0.0519**	0.0364	0.0263	0.0119	−0.0409	0.102**	0.0972**
	[0.0218]	[0.0392]	[0.0245]	[0.0438]	[0.0480]	[0.0461]	[0.0444]
$ln(ETA)_{t-1}$	−0.00543***	−0.00461**	−0.00551***	−0.00798***	−0.00431**	−0.00163	−0.00231
	[0.00137]	[0.00183]	[0.00173]	[0.00197]	[0.00202]	[0.00333]	[0.00209]
$ln(TA)_{t-1}$	−0.000983	−0.00220	−0.00137	−4.36e-12	−1.20e-11*	4.54e-11**	7.59e-10*
	[0.000834]	[0.00162]	[0.000963]	[1.12e-11]	[6.64e-12]	[2.20e-11]	[3.87e-10]
$ln(LTA)_{t-1}$	−0.00519***	−0.0135***	−0.00358**	−0.00175	−0.00480**	−0.00781***	−0.00528
	[0.00142]	[0.00313]	[0.00176]	[0.00367]	[0.00224]	[0.00144]	[0.00351]
$ln(DL)_{t-1}$	−0.00417***	−0.0119***	−0.00275**	−0.00370*	−0.00405*	−0.00187	−0.00191
	[0.00123]	[0.00196]	[0.00140]	[0.00189]	[0.00209]	[0.00123]	[0.00164]
$ln(CTA)_{t-1}$	0.00281**	0.00641***	0.00209	0.00201	0.00287	0.00170	0.0000874
	[0.00125]	[0.00187]	[0.00150]	[0.00243]	[0.00200]	[0.00186]	[0.00224]
Macroeconomic factors							
$ln(GRGDP)_{t-1}$	−0.000224	−0.000966	0.000129	0.000438	0.00278**	0.0000881	−0.000427
	[0.000520]	[0.000732]	[0.000691]	[0.00168]	[0.00138]	[0.000568]	[0.000905]
DD_{t-1}	−0.0000469	0.000226**	−0.000129**	0.000298**	−0.000158**	−0.0000978	0.000207
	[0.0000542]	[0.0000927]	[0.0000651]	[0.000133]	[0.0000742]	[0.000136]	[0.000396]
BD_{t-1}	0.0101**	0.00190	0.0150***	−0.00184	0.0132**	0.0113	0.00782
	[0.00416]	[0.00752]	[0.00536]	[0.0131]	[0.00609]	[0.0147]	[0.0145]
DB_{t-1}	−0.0000184	−0.000106	−0.0000648	−0.000193	0.000131	0.00000443	0.000195
	[0.0000743]	[0.000120]	[0.0000954]	[0.000146]	[0.000112]	[0.000127]	[0.000278]
$ln(SI)_{t-1}$	0.00310**	0.00160	0.00236	0.00905***	0.00178	0.00371*	0.00368
	[0.00133]	[0.00166]	[0.00227]	[0.00247]	[0.00257]	[0.00205]	[0.00382]
Constant	0.0135	0.0522***	0.0408***	0.0204**	−0.00445	0.0114	0.00207
	[0.00919]	[0.0189]	[0.0142]	[0.00994]	[0.0102]	[0.0107]	[0.0128]
Macro area dummies	Yes	Yes	Yes	No	No	No	No
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014
Observations	7231	4799	2432	2635	1533	1530	1533

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;

result is far from being surprising as the biggest banks are located in this area and are characterised by higher levels of capital. This measure, often considered as a proxy that captures the effects of Basel Agreements, suggests that the latter, at least in the Italian case, were effective in ameliorating the quality of credits. Bank dimension is found to be not significant for both CBs and NON-CBs, while at

the macro-area level it is shown to be negative and significant in all the various regional groups except the North-Western. The inverse relationship between size and non-performing loans is in line with the predictions of Salas and Saurina (2002). In terms of policy, this result highlights that policies aimed at incentivising local banks' mergers and acquisitions would be desirable, as they would enhance the stability of local financial systems. We also find that the volume of credit significantly reduces bank risk, a result which holds for the two main groups of banks. Nevertheless, the coefficient is an order of magnitude higher for CBs. From a policy perspective, our results indicate that measures aimed at increasing the volume of credits would be beneficial for the stability of the financial system. At regional level, an increase in the volume of credits determines an improvement in credit quality in the North-East and in the Centre, while the effect is not statistically significant in other areas. Variations in costs are found to improve the quality of credits for the whole sample and for CBs and NON-CBs as well. This result seems to suggest that regulators might intervene in order to make the liabilities related to deposits less onerous for both CBs and NON-CBs. This, in turn, would make banks more resilient to liquidity squeezes and would reduce credit risk. When we focus on the regional level, the variable is found to be significant only for regions belonging to the North-East and the North-West. Finally, among the main microeconomic factors, intermediation costs are found to increase bank risk, especially in the case of cooperative banks. The policy implication is that measures aimed at reducing the volume of intermediation costs for these financial intermediaries would be beneficial as they would allow these banks to be more efficient in screening and selecting borrowers. With respect to the main macroeconomic factors, evidence concerning the impact of deposit density on credit risk is somewhat mixed. Indeed, while variations in deposit density lead to an increase in the amount of non-performing loans for CBs and for North-Eastern regions, the opposite holds once we consider Non-CBs and North Western regions. Our evidence implies that, while for cooperative banks higher deposits density determines an increase in the interest rates banks have to pay and the credit risk they sustain, in the case of non-cooperative banks a higher amount of deposits ameliorates credit risk. As deposits represent the main source of funding for cooperative banks (Coccorese & Ferri, 2020), the policy implication that can be drawn from this result is that regulators should implement policies which incentivise these banks to truthfully report the amount of deposits held and then compensate them for the increased riskiness of their portfolios. In contrast, branch density worsens the quality of credits, especially when NON-CBs are taken into account (see column 3, Table 4). This result can be motivated as follows: as banks expand their branches, they become less efficient and give rise to a higher-than-optimum number of branches[10] (Alessandrini et al., 2009). This higher inefficiency is then reflected in a larger amount of non-performing loans, in line with the predictions of Berger and De Young (1997); Williams (2004) and Fiordelisi et al. (2011). It turns out that regulators may set limits to the maximum number of branches operating in a given area to avoid that the inefficient proliferation of branches could be translated in an increase in the amount of bad loans. Moreover, our findings seem to exclude any statistically significant contribution of economic growth and deposits per branch on credit bank risk. The non-significant impact of economic growth seems to confirm the findings of Anastasiou (2017), who investigates the impact of both credit and economic cycles on credit risk in Italy over the 1995–2014 period. This contribution indeed emphasises that while credit cycles significantly affect the proportion of non-performing loans, business cycle fluctuations have no impact on credit risk. Finally, increased banks' specialisation is found to have a detrimental impact on credit quality. Our evidence, in line with the predictions of Sinkey and Nash (1993) and Nash and Sinkey (1997), implies that as banks become more specialised, they also become more aggressive lenders and undertake risky projects, hence increasing the share of non-performing loans. It turns out that regulatory authorities should enhance the monitoring of banks' specialisation activities in order to increase financial stability.

3.3. *Does the market structure affect the estimation?*

We now take into account the role of market structure in our empirical exercise.[11] As already pointed out, we are interested in analysing the relationship between microeconomic and macroeconomic factors and bank risk taking in different market structures in order to check whether the spread of bad loans is faster in competitive or non-competitive environments. In order to deal with the contribution of different market structures on bank risk taking, we calculate four dummies: MON (only one bank); DUO (only two banks): OLIG (only three banks) and CONC (more than three banks). The use of these dummies makes our analysis more robust. In this regard, we estimate the models described in eq. 2−5. Then, we focus on the role of microeconomic and macroeconomic factors upon bank risk (i.e. credit bank risk) considering sub-samples related to the different market structures in which banks operate. As before, this exercise allows us to check whether the market structure drives the main results. Results presented in Table 5 are almost unchanged. We can conclude that the different forms of markets in which banks operate do not have influence on the nexus between micro and macro factors and the share of non-performing loans. In line with the estimates reported in Table 4, evidence presented in Table 5 confirms that among the set of relevant microeconomic variables included in the econometric analysis, growth of loans, capitalisation, volume of credit and volume of costs reduce the amount of non-performing loans, while higher profitability and higher intermediation costs have a detrimental impact on credit quality. When we focus on the main macro determinants of credit risk, evidence reported in Table 5 confirms the findings of Table 4. Specifically, we show that both branch density and specialisation are positive and significant across all the different market structures except the NON−CONC.

The same approach is implemented once we examine the behaviour of cooperatives (CBs) and non-cooperative (NON-CBs) banks in

[10] Other contributions, see for instance Aiello and Bonanno (2016a) and Bernini and Brighi (2018), assess the effects of branch expansion on the cost efficiency of cooperative banks, finding that branch expansion reduces banks' efficiency.

[11] Bahri and Hamza (2019), investigating the impact of market power on bank risk-taking in 5 European countries between 2002 and 2015, find that greater competition leads to the instability of the financial system.

[12] Loans must be intented as loans provided to customers and do not include those provided to financial corporations.

Table 5
Bank credit risk and microeconomic/macroeconomic factors. The role of market structure.

$y = NPLL_t$	(1) All banks	(2) NO MON	(3) NO DUOP	(4) NO OLIG	(5) NO CONC
$NPLL_{t-1}$	0.769***	0.777***	0.750***	0.753***	0.758***
	[0.0317]	[0.0395]	[0.0383]	[0.0345]	[0.0339]
Microeconomic factors					
$ln(GRLO)_{t-1}$	−0.00250**	−0.00164	−0.00253*	−0.00250**	−0.00516**
	[0.00124]	[0.00128]	[0.00136]	[0.00127]	[0.00200]
ROA_{t-1}	0.0519**	0.0384*	0.0577**	0.0412*	0.0882***
	[0.0218]	[0.0232]	[0.0251]	[0.0236]	[0.0336]
$ln(ETA)_{t-1}$	−0.00543***	−0.00547***	−0.00636***	−0.00602***	−0.00142
	[0.00137]	[0.00159]	[0.00157]	[0.00153]	[0.00149]
$ln(TA)_{t-1}$	−0.000983	−0.000706	−0.00134	−0.00142	−0.0000156
	[0.000834]	[0.000896]	[0.000982]	[0.000915]	[0.00151]
$ln(LTA)_{t-1}$	−0.00519***	−0.00482***	−0.00521***	−0.00534***	−0.00520*
	[0.00142]	[0.00152]	[0.00153]	[0.00150]	[0.00274]
$ln(DL)_{t-1}$	−0.00417***	−0.00397***	−0.00408***	−0.00434***	−0.00419*
	[0.00123]	[0.00131]	[0.00132]	[0.00130]	[0.00223]
$ln(CTA)_{t-1}$	0.00281**	0.00224*	0.00267*	0.00294**	0.00353**
	[0.00125]	[0.00134]	[0.00139]	[0.00135]	[0.00145]
Macroeconomic factors					
$ln(GRGDP)_{t-1}$	−0.000224	0.0000139	0.000203	−0.000214	−0.00166*
	[0.000520]	[0.000548]	[0.000590]	[0.000536]	[0.000949]
DD_{t-1}	−0.0000469	0.000000294	−0.0000523	−0.0000451	0.000534
	[0.0000542]	[0.0000547]	[0.0000657]	[0.0000574]	[0.000443]
BD_{t-1}	0.0101**	0.00737*	0.01000**	0.0101**	0.0175
	[0.00416]	[0.00417]	[0.00453]	[0.00432]	[0.0157]
DB_{t-1}	−0.0000184	−0.0000869	−0.0000147	−0.0000328	−0.0000370
	[0.0000743]	[0.0000761]	[0.0000951]	[0.0000802]	[0.0000998]
$ln(SI)_{t-1}$	0.00310**	0.00397**	0.00274*	0.00279**	0.00324
	[0.00133]	[0.00170]	[0.00142]	[0.00135]	[0.00202]
Constant	0.0135	0.0338***	0.0358***	0.0170*	0.0291
	[0.00919]	[0.0114]	[0.0116]	[0.00993]	[0.0192]
Macro area dummies	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes
Period	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014
Observations	7231	5563	5708	6419	4003

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;

different market structures (see Table 6). In other words, we replicate the previous analysis allowing for the partitioning between CBs and NON-CBs. In this case, we find that credit policy is effective in improving the quality of credit in all the environments but the NO MON in the case of cooperative banks, while capitalisation is always found to be negative and significnt, regadless the market structure

Table 6
Bank credit risk and microeconomic/macroeconomic factors. The behaviour of CBs and NON-CBs in different market structure.

$y = NPLL_t$	(1) NO MON	(2) NO DUOP	(3) NO OLIG	(4) NO CONC	(5) NO MON	(6) NO DUOP	(7) NO OLIG	(8) NO CONC
	CBs	CBs	CBs	CBs	NON-CBs	NON-CBs	NON-CBs	NON-CBs
$NPLL_{t-1}$	0.783***	0.756***	0.756***	0.743***	0.762***	0.764***	0.766***	0.783***
	[0.0353]	[0.0371]	[0.0339]	[0.0381]	[0.0346]	[0.0326]	[0.0322]	[0.0269]
Microeconomic factors								
$\ln(GRLO)_{t-1}$	−0.00183	−0.00250**	−0.00249**	−0.00228*	−0.00233*	−0.00252*	−0.00251**	−0.00537***
	[0.00127]	[0.00127]	[0.00125]	[0.00126]	[0.00125]	[0.00133]	[0.00125]	[0.00194]
ROA_{t-1}	0.0445**	0.0548**	0.0474**	0.0609***	0.0466**	0.0529**	0.0462**	0.0675**
	[0.0226]	[0.0231]	[0.0221]	[0.0224]	[0.0224]	[0.0235]	[0.0233]	[0.0293]
$\ln(ETA)_{t-1}$	−0.00514***	−0.00573***	−0.00550***	−0.00489***	−0.00577***	−0.00598***	−0.00593***	−0.00307**
	[0.00147]	[0.00147]	[0.00144]	[0.00141]	[0.00147]	[0.00146]	[0.00145]	[0.00142]
$\ln(TA)_{t-1}$	−0.000545	−0.00141	−0.00125	−0.000787	−0.00112	−0.000899	−0.00113	−0.000703
	[0.000847]	[0.000887]	[0.000874]	[0.000830]	[0.000877]	[0.000917]	[0.000870]	[0.00139]
$\ln(LTA)_{t-1}$	−0.00471***	−0.00501***	−0.00510***	−0.00403***	−0.00535***	−0.00537***	−0.00543***	−0.00813***
	[0.00145]	[0.00149]	[0.00145]	[0.00155]	[0.00148]	[0.00146]	[0.00146]	[0.00257]
$\ln(DL)_{t-1}$	−0.00380***	−0.00393***	−0.00405***	−0.00336***	−0.00439***	−0.00431***	−0.00445***	−0.00666***
	[0.00125]	[0.00127]	[0.00124]	[0.00129]	[0.00129]	[0.00128]	[0.00128]	[0.00208]
$\ln(CTA)_{t-1}$	0.00214	0.00244*	0.00271**	0.00256*	0.00297**	0.00304**	0.00305**	0.00381***
	[0.00131]	[0.00129]	[0.00126]	[0.00133]	[0.00128]	[0.00134]	[0.00133]	[0.00129]
Macroeconomic factors								
$\ln(GRGDP)_{t-1}$	−0.0000217	0.0000323	−0.000227	−0.000201	−0.000228	−0.0000911	−0.000215	−0.00108
	[0.000537]	[0.000546]	[0.000530]	[0.000624]	[0.000537]	[0.000559]	[0.000526]	[0.000683]
DD_{t-1}	−0.00000511	−0.0000603	−0.0000475	−0.000164***	−0.0000447	−0.0000365	−0.0000437	0.000194***
	[0.0000526]	[0.0000560]	[0.0000556]	[0.0000582]	[0.0000566]	[0.0000628]	[0.0000559]	[0.0000741]
BD_{t-1}	0.00814**	0.0108**	0.00997**	0.0170***	0.00941**	0.00924**	0.0102**	0.00487
	[0.00399]	[0.00434]	[0.00426]	[0.00434]	[0.00437]	[0.00433]	[0.00421]	[0.00694]
DB_{t-1}	−0.0000918	−0.00000433	−0.0000303	0.0000491	−0.0000102	−0.0000320	−0.0000220	−0.0000690
	[0.0000728]	[0.0000773]	[0.0000768]	[0.0000799]	[0.0000779]	[0.0000901]	[0.0000775]	[0.0000867]
$\ln(SI)_{t-1}$	0.00395**	0.00326**	0.00285**	0.00321**	0.00295**	0.00264*	0.00302**	0.00311*
	[0.00159]	[0.00140]	[0.00134]	[0.00157]	[0.00137]	[0.00135]	[0.00134]	[0.00162]
Constant	0.0323***	0.0391***	0.0159*	0.0323***	0.0142	0.0105	0.0143	0.0156
	[0.0107]	[0.0108]	[0.00966]	[0.0105]	[0.00957]	[0.00987]	[0.00942]	[0.0154]
Macro area dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014
Observations	6056	6135	6642	5292	6738	6804	7008	5942

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7
Bank credit risk and microeconomic/macroeconomic factors. The role of bank size.

$y = NPLL_t$	(1) ALL	(2) NO DIM1	(3) NO DIM2	(4) NO DIM3	(5) NO DIM4	(6) NO DIM5
$NPLL_{t-1}$	0.769***	0.719***	0.751***	0.772***	0.769***	0.768***
	[0.0317]	[0.0948]	[0.0377]	[0.0304]	[0.0319]	[0.0320]
Microeconomic factors						
$ln(GRLO)_{t-1}$	−0.00250**	−0.00191	−0.00240**	−0.00219**	−0.00251**	−0.00289**
	[0.00124]	[0.00327]	[0.00109]	[0.00110]	[0.00125]	[0.00133]
ROA_{t-1}	0.0519**	−0.0758**	0.0757***	0.0534**	0.0517**	0.0526**
	[0.0218]	[0.0379]	[0.0251]	[0.0213]	[0.0221]	[0.0220]
$ln(ETA)_{t-1}$	−0.00543***	−0.00540***	−0.00655***	−0.00524***	−0.00539***	−0.00563***
	[0.00137]	[0.00202]	[0.00175]	[0.00142]	[0.00142]	[0.00145]
$ln(TA)_{t-1}$	−0.000983	−0.00196	−0.00164	−0.000419	−0.000905	−0.00116
	[0.000834]	[0.00159]	[0.00106]	[0.000811]	[0.000895]	[0.000892]
$ln(LTA)_{t-1}$	−0.00519***	−0.00429	−0.00757***	−0.00495***	−0.00515***	−0.00514***
	[0.00142]	[0.00276]	[0.00160]	[0.00137]	[0.00143]	[0.00143]
$ln(DL)_{t-1}$	−0.00417***	−0.00379**	−0.00748***	−0.00343***	−0.00414***	−0.00401***
	[0.00123]	[0.00159]	[0.00182]	[0.00109]	[0.00124]	[0.00123]
$ln(CTA)_{t-1}$	0.00281**	0.00265	0.00236	0.00375***	0.00289**	0.00304**
	[0.00125]	[0.00171]	[0.00192]	[0.00105]	[0.00131]	[0.00130]
Macroeconomic factors						
$ln(GRGDP)_{t-1}$	−0.000224	−0.000763	−0.000238	−0.000188	−0.000171	−0.000263
	[0.000520]	[0.000533]	[0.000598]	[0.000558]	[0.000555]	[0.000524]
DD_{t-1}	−0.0000469	−0.0000337	−0.0000309	−0.0000136	−0.0000542	−0.0000455
	[0.0000542]	[0.0000620]	[0.0000662]	[0.0000626]	[0.0000592]	[0.0000551]
BD_{t-1}	0.0101**	0.00629	0.0122**	0.00863*	0.0107**	0.0102**
	[0.00416]	[0.00520]	[0.00559]	[0.00452]	[0.00433]	[0.00436]
DB_{t-1}	−0.0000184	−0.000166*	−0.00000955	−0.0000430	−0.0000154	−0.0000198
	[0.0000743]	[0.0000871]	[0.0000870]	[0.0000876]	[0.0000821]	[0.0000768]
$ln(SI)_{t-1}$	0.00310**	−0.000245	0.00244	0.00359**	0.00307**	0.00329**
	[0.00133]	[0.00201]	[0.00151]	[0.00140]	[0.00135]	[0.00138]
Constant	0.0135	0.0461*	0.0125	0.0117	0.0125	0.0166*
	[0.00919]	[0.0251]	[0.0116]	[0.00949]	[0.00968]	[0.00958]
Macro area dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014	2001−2014
Observations	7231	1608	6083	6958	7132	7143

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; We alternatively exclude major (NO DIM1), big (NO DIM2), medium (NO DIM3), small (NO DIM4) and minor (NO DIM5) banks; Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;

and the tyoe of bank. Once again, our analysis suggests that more stringent rules on capital requirements are effective in improving the quality of credits. A similar picture emerges when we consider the impact of credit and cost volumes, which are found to be statistically significant across all banks' groups and all the market structures. Increased profitability and higher intermediation costs are associated

with a worsening in credit quality. Once again, our econometric estimates suggest that, among the macroeconomic factors, a key role is played by branch density and specialisation, both the coefficients being positive and statistically significant across almost all the specifications.

Table 8
Bank credit risk and microeconomic/macroeconomic factors. The role of financial crisis.

$y = NPLL_t$	(1) All banks	(2) CBs	(3) NON-CBs
$NPLL_{t-1}$	0.342*** [0.0683]	0.272*** [0.0647]	0.522*** [0.110]
Microeconomic factors			
$ln(GRLO)_{t-1}$	−0.00513** [0.00201]	−0.00717*** [0.00201]	−0.00399* [0.00235]
ROA_{t-1}	0.0982*** [0.0314]	0.0773 [0.0635]	0.0229 [0.0366]
$ln(ETA)_{t-1}$	0.000320 [0.00158]	0.00308 [0.00286]	−0.000501 [0.00233]
$ln(TA)_{t-1}$	−1.15e-10* [5.95e-11]	−4.70e-09** [2.37e-09]	−1.17e-10** [5.69e-11]
$ln(LTA)_{t-1}$	−0.00519** [0.00222]	−0.00806* [0.00432]	−0.00460** [0.00218]
$ln(DL)_{t-1}$	−0.00000428 [0.00101]	0.000257 [0.00280]	−0.000534 [0.000916]
$ln(CTA)_{t-1}$	0.00468*** [0.00147]	0.00605** [0.00234]	0.00274 [0.00275]
Macroeconomic factors			
$ln(GRGDP)_{t-1}$	0.00757*** [0.00283]	0.00595 [0.00390]	0.00432 [0.00343]
DD_{t-1}	−0.0000821 [0.000169]	−0.000318* [0.000165]	0.000135 [0.000188]
BD_{t-1}	0.0125 [0.0143]	0.0257 [0.0199]	−0.0131 [0.0205]
DB_{t-1}	0.000251 [0.000168]	0.000440* [0.000246]	−0.000120 [0.000211]
$ln(SI)_{t-1}$	0.00358** [0.00176]	0.00471** [0.00230]	0.00141 [0.00238]
Constant	0.0271*** [0.00826]	0.0357*** [0.0110]	0.0229 [0.0139]
Macro area dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes
Period	2001−2007	2001−2007	2001−2007
Observations	3527	2421	1106

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;

Table 9
Bank credit risk and microeconomic/macroeconomic factors. The role of market structure and financial crisis.

$y = NPLL_t$	(1) NO MON CBs	(2) NO DUOP CBs	(3) NO OLIG CBs	(4) NO CONC CBs	(5) NO MON NON-CBs	(6) NO DUOP NON-CBs	(7) NO OLIG NON-CBs	(8) NO CONC NON-CBs
$NPLL_{t-1}$	0.418***	0.321***	0.333***	0.357***	0.349***	0.343***	0.348***	0.254***
	[0.0610]	[0.0826]	[0.0740]	[0.0831]	[0.0711]	[0.0694]	[0.0690]	[0.0565]
Microeconomic factors								
$ln(GRLO)_{t-1}$	−0.00457**	−0.00502**	−0.00493**	−0.00450**	−0.00485**	−0.00499**	−0.00496**	−0.00756***
	[0.00228]	[0.00222]	[0.00217]	[0.00220]	[0.00212]	[0.00215]	[0.00212]	[0.00194]
ROA_{t-1}	0.0697***	0.0739***	0.0744***	0.0726**	0.0676**	0.0666**	0.0662**	0.0849**
	[0.0261]	[0.0255]	[0.0253]	[0.0284]	[0.0271]	[0.0276]	[0.0262]	[0.0335]
$ln(ETA)_{t-1}$	−0.000186	−0.000475	−0.000389	−0.00129	0.0000843	−0.000767	−0.000140	0.000464
	[0.00149]	[0.00155]	[0.00159]	[0.00156]	[0.00161]	[0.00160]	[0.00160]	[0.00223]
$ln(TA)_{t-1}$	−0.000952	−0.00187	−0.00140	−0.00108	−0.000982	−0.00154	−0.00133	−0.00199
	[0.00191]	[0.00214]	[0.00206]	[0.00212]	[0.00206]	[0.00203]	[0.00201]	[0.00207]
$ln(LTA)_{t-1}$	−0.00463**	−0.00560**	−0.00530**	−0.00531**	−0.00502**	−0.00535**	−0.00540**	−0.00655**
	[0.00217]	[0.00241]	[0.00232]	[0.00230]	[0.00228]	[0.00228]	[0.00228]	[0.00328]
$ln(DL)_{t-1}$	−0.0000110	−0.000520	−0.000306	−0.000471	−0.000226	−0.000405	−0.000409	0.00115
	[0.000945]	[0.00112]	[0.00103]	[0.00101]	[0.00102]	[0.00103]	[0.00104]	[0.00213]
$ln(CTA)_{t-1}$	0.00369**	0.00395**	0.00462***	0.00507***	0.00470***	0.00507***	0.00472***	0.00272
	[0.00155]	[0.00157]	[0.00158]	[0.00168]	[0.00154]	[0.00154]	[0.00154]	[0.00194]
Macroeconomic factors								
$ln(GRGDP)_{t-1}$	0.00609**	0.00744**	0.00753**	0.00984***	0.00687**	0.00786***	0.00780***	0.00639**
	[0.00301]	[0.00312]	[0.00301]	[0.00306]	[0.00322]	[0.00300]	[0.00289]	[0.00310]
DD_{t-1}	−0.0000495	−0.0000955	−0.0000994	−0.0000494	−0.0000644	−0.000132	−0.000106	−0.000304**
	[0.000159]	[0.000184]	[0.000176]	[0.000208]	[0.000173]	[0.000176]	[0.000173]	[0.000145]
BD_{t-1}	0.00970	0.0180	0.0134	0.0160	0.0169	0.0188	0.0186	0.00954
	[0.0144]	[0.0155]	[0.0154]	[0.0187]	[0.0156]	[0.0152]	[0.0150]	[0.0167]
DB_{t-1}	0.000169	0.000262	0.000266	0.000191	0.000196	0.000309*	0.000253	0.000455**
	[0.000166]	[0.000186]	[0.000175]	[0.000185]	[0.000174]	[0.000184]	[0.000176]	[0.000195]
$ln(SI)_{t-1}$	0.00330*	0.00362**	0.00414**	0.00178	0.00327*	0.00318*	0.00339*	0.00517**
	[0.00180]	[0.00176]	[0.00180]	[0.00227]	[0.00177]	[0.00187]	[0.00179]	[0.00206]
Constant	0.0352	0.0455*	0.0450*	0.0276	0.0378	0.0422*	0.0413*	0.0518**
	[0.0229]	[0.0266]	[0.0254]	[0.0261]	[0.0253]	[0.0250]	[0.0248]	[0.0259]
Macro area dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2001−2007	2001−2007	2001−2007	2001−2007	2001−2007	2001−2007	2001−2007	2001−2007
Observations	3001	2953	3221	2512	3308	3315	3425	2954

Note: NPLL is the measure of bank credit risk calculated through non-performing loans to total loans; Microeconomic factors is the vector of microeconomic factors, such as: GRLO: growth of loans, reflecting credit policy; ROA: return on assets, reflecting the profitability of bank; ETA: equity to total assets, capturing the solvency bank and reflecting capital strength of bank; TA: log of total assets, controlling for size of banks; LTA: loans to total assets, capturing the volume of credit market; LTA: loans to total assets, reflecting the volume of credit market; DL: deposits to loans, reflecting the cost of intermediation; CTA: cost of total assets, reflecting a common indicator of bank's efficiency or volume of intermediation cost. Macroeconomic factors is the vector of macroeconomic factors, such as: economic variable (GRGDP, reflecting the main and most direct measure of aggregate for economic activity) and geographically localisation of bank activity (DD: deposit density, controlling for territorial diversification of the banking operations; DB: deposits per branches, controlling for cost associated to any intermediaries; BD: branches density, controlling for the branches diversification on the territory; SI: branches to loans and deposits ratio, reflecting the specialisation bank index measured by the number of branches over territorial aggregate deposits and loans, controlling for product specialisation); See Table 1 for more detail about the description of the variables; We construct a variableequal to 1 when at LMAs level there is 1 bank (MON: MONOP); 2 when at LMAs level there are 2 banks (DUOP: DUOPOLISTIC); 3 when at LMAs level there are 3 banks (OLIG: OLIGOPOLITIC) and 4 otherwise (CONC: COMPETITION). Standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;

3.4. Does the bank dimension affect the estimation?

As shown before, it appears that the size of the banks has a limited impact on credit risk. To better assess this finding, we now analyse the link between microeconomic and macroeconomic factors upon bank credit risk, considering sub-samples in which banks are ranked according to their size. Indeed, to prevent the lack of information from causing problems in the estimates, we alternatively exclude major (NO DIM1), big (NO DIM2), medium (NO DIM3), small (NO DIM4) and minor (NO DIM5) banks in order to check whether the bank size drives the benchmark results. Results reported in Table 7 are once again almost unchanged. We can conclude that bank size does not have any influence on the nexus. Once again, we show that the Basel Agreements had a positive effect on the amount of non-performing loans and the estimated coefficients are similar, implying that increased capitalisation had positive effects regardless of the bank dimension. While loans over total assets are negative and significant in all the specifications but NO DIM1, deposits over loans are instead found to reduce credit risk, regardless the size. On the other hand, variations in the ROA and in the volume of intermediation costs determine a deterioration of credit quality. Among the macroeconomic factors, our estimates again confirm that variations in the branch density and in banks' specialisation increase the share of non-performing loans.

3.5. Does the financial crisis affect the estimation?

We conclude our empirical analysis by investigating whether the financial crisis forced banks to reconsider their credit policies. Then, we assess the behaviour of CBs and NON-CBs excluding the financial crisis period from our sample. The sign of the coefficients of the variables is confirmed in almost every specification, although the significance is largely lowered. This could be explained by the reduction in the amount of available observations, as our sample only spans a seven-year period.

Nonetheless, pre-crisis estimates show that credit policy had a beneficial effect on credit risk, the magnitude of this effect being higher for CBs. Returns on assets are found to have a detrimental effect on the endogenous variable when the whole sample is considered, although there are no significant effects when the sample is split into the two relevant groups of banks. Total assets and loans over total assets are characterised by a negative and statistically significant coefficient in all estimated models, while variations in the intermediation costs are shown to determine a worsening in credit quality, limitedly to the whole set and cooperative banks. Among the main macroeconomic factors included in our econometric exercise, we find that variations in GDP led to an increase in the amount of non-performing loans when all the banks are considered but this effect vanishes when we partition the sample between CBs and NON-CBs. The specialisation index, over the period considered, is found to be positive and significant for both the whole sample and cooperative banks, while no statistically significant impact is found for NON-CBs. Since the estimated pre-crisis coefficients significantly differ from their full sample counterparts, evidence reported in Table 8 indicates that, with the advent of the 2008 recession, banks changed their credit policies by increasing credit rationing.

In Table 9 we propose pre-crisis estimates partitioning the sample both by market structure and bank type. For the microeconomic factors, the evidence suggests that credit policy and volume of credit were effective in improving the quality of credits, as their coefficients are negative and significant across all the various specifications. A different effect is found with respect to the ROA index and intermediation costs. When we consider the relevant macroeconomic factors that affected the quality of credits before the recessionary period, we find evidence of a direct relationship between GDP, specialisation and the variable of interest, which holds true regardless of the market structure and the type of bank. Once again, the comparison between pre and post-crisis coefficients provides additional evidence concerning an increase in credit rationing from the onset of the 2008 recession.

4. Conclusions and policy implications

The main contribution of this paper has been to investigate the role of microeconomic and macroeconomic factors on Italian bank risk taking, paying particular attention to the differences between cooperative and non-cooperative banks and the market structure in which banks operate. The data refer to a large sample of financial institutions covering the period 2001−2014.

The empirical findings, which we believe are relevant in terms of policy, can be summarised as follows: i) capitalisation, volume of credits, volume of costs and intermediation costs are the key microeconomic factors explaining credit quality; b) among the main macroeconomic factors, branch density, deposit density and specialisation have a significant effect on the variable of interest; c) the financial crisis determined an increase in banks' credit rationing. Our results suggest that regulators, in changing banks' incentives, can be effective in improving the quality of credits, enhancing the stability of the financial system.

It turns out that several policy implications follow from this paper.

First, as increased capitalisation is found to be inversely correlated with the proportion of non-performing loans, it turns out that policies aimed at increasing the capital requirements of banks make moral hazard among banks' managers less profitable, hence reducing the riskiness of banks' loan portfolios.

From this point of view, what emerges from this paper is that, at least in the Italian case, the Basel agreements were effective in reducing credit risk.

Moreover, policies whose goal is to enhance banks' screening activities seem to be desirable as well, as suggested by the negative and significant coefficient for our measure of credit policy. Our results, in line with Vithessonthi (2016), indicate that if banks expect an increase in the amount of non-performing loans in the future, driven by a worsening in lending standards, the growth of credits will ameliorate credit risk. Indeed, these measures allow banks to select good borrowers, expand their credit capacities and reduce the riskiness of their future loans' portfolios.

Evidence reported in this paper further indicates that higher profitability increases credit risk, in line with the findings of Rajan

(1994), who shows that banks' managers might manipulate current earnings to signal the market that they are highly profitable, at the cost of having more bad loans in the future. In terms of policy implications, regulatory authorities should therefore enhance the monitoring of banks' managements and give rise to a set of measures to assess whether banks' profitability policies might lower financial stability in the future.

Our analysis further highlights that variations in the intermediation costs have a detrimental effect on the variable of interest. In view of the above, policies aimed at decreasing such costs may improve the information transmission process and reduce credit risk. With respect to size, as its coefficient is found to be negative and significant only once our analysis is performed at macro-area level, this result implies that the implementation of policies aimed at incentivising banks' mergers and acquisitions at the local level would be desirable, as they would enhance the stability of local financial systems.

Our econometric estimates also reveal that the higher the branch density is, the higher will be the likelihood of having deteriorated credits. From this perspective, regulators may intervene, setting a limit to the number of branches in a given area. This result is symptomatic of the fact that higher branch density determines an inefficient proliferation of branches, which makes banks less efficient, and that this higher inefficiency is then translated in a deterioration of credit quality.

The results presented in this paper emphasise that the impact of deposit density on the ratio of non-performing loans is somewhat mixed. Indeed, while higher deposit density reduces loans' riskiness in the case of non-cooperative banks, it has a detrimental impact upon the amount of non-performing loans held by cooperative banks.

The policy implication that can be drawn from this result is that regulators should implement policies which incentivise cooperative banks to truthfully report the amount of deposits held and then compensate them for the increased riskiness of their portfolios.

Finally, as higher banks' specialisation deteriorates the quality of credit, regulators should enhance the monitoring of banks' activities, to prevent banks to become aggressive lenders and undertake risky projects.

To better assess how microeconomic and macroeconomic factors affect the quality of credit risk, a possible extension of the paper might be to compare the evidence obtained from the Italian context with other comparable economies, in particular those belonging to the Euro area.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Human and animal rights

This article does not contain any studies with human participants performed by any of the authors.

Declaration of Competing Interest

No potential conflict of interest was reported by the authors.

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