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Competition and Financial Stability in European Cooperative Banks

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Abstract

Cooperative banks are a driving force for socially committed business at a local level accounting for around one fifth of the European Union (EU) bank deposits and loans. Despite their importance, little is known about the relationship between bank stability and competition for these small credit institutions. Does competition affect the stability of cooperative banks? Does banks' financial stability increase/decrease in case of higher competition? We assess the dynamic relationship between competition and bank soundness (both in the short and long run) in the European cooperative banking between 1998 and 2009. We obtain three main results. First, we support the competition-stability view proposed by Boyd and De Nicolò (2005). Bank market power negatively Granger-cause banks' soundness meaning that there is a positive relationship between competition and stability. Second, we provide evidence of the negative impact of the 2007-2009 financial crisis on the individual risk exposure of cooperative banks although it does not change the relationship between competition and stability. Third, we show that herding behaviour affects positively bank soundness. Our findings have important policy implications for designing and implementing regulations that enhance the overall stability of the financial system.

JEL-Classification: C23, G21

Keywords: Bank soundness, Cooperative banks, Competition, Generalized Methods of Moments.

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1 Introduction

The recent regulatory developments toward a more integrated European banking market point to the establishment of a single supervisor for Eurozone banks. In response to the 2007-2009 financial turmoil, the new regulation introduces the issue of the supervision over highly heterogeneous types of banks. On the one hand the international efforts have been coordinated toward the development of a new regulatory framework to control for systemic risks (e.g., Basel Committee's framework on global systematically important banks). On the other hand, small banks are different from commercial banks and are important for local economic development. This is not recognised in the existing literature as little is known about the relationship between bank stability and competition for small credit institutions and this is important to account for the different specificities of local structures.

Cooperative banks are a driving force for socially committed business at a local level accounting for around one fifth of the European Union (EU) bank deposits and loans. In 2011[1], there were 3,800 cooperative banks with 72,000 branches, more than 850,000 employees, 55 million members, 210 million clients, 3,900 billion Euros of deposits, and 6,900 billion Euros of total assets.

A number of papers have analysed small credit institutions focusing on performance (Goddard et al., 2008a; Kontolaimou and Tsekouras, 2010), diversification (Goddard et al., 2008b; Lepetit et al., 2008; Mercieca et al., 2007, Mckillop and Wilson, 2011), risk of failure (Fiordelisi and Mare, 2013) and ownership structure (Gorton and Schmid, 1999). A

[1] Source of data: European Association of Co-operative Banks (2012).

debated issue is if cooperative banks are more stable than commercial banks. During the recent financial crisis, cooperative banks performed better than cooperative banks, e.g**.** Jose Manuel Barroso **(**President of the European Commission) stated in 2011: *"Co-operative businesses that have stayed faithful to co-operative values and principles and the co-operative banks which rely on members' funds and are controlled by local people have generally been able to resist the crisis very well"*[2] .This is consistent with various papers (Hesse and Cihák, 2007; Ayadi et al., 2010) providing empirical evidence that cooperative banks are more stable than commercial banks as they have a great deal of soft information (which is hard to collect) on the creditworthiness of members/customers, and therefore less likely to make lending mistakes. Furthermore, size appears to be positively related to systemic risk (Vallascas and Keasey, 2012; De Jonghe, 2010) and the majority of cooperative banks are small rural credit institutions. Conversely, there are several studies suggesting that cooperative banks are more fragile than commercial banks (Goodhart, 2004; Brunner et al., 2004; Fonteyne, 2007) and have higher default rates: for instance Fiordelisi and Mare (2013) document that the default rate of Italian cooperative banks was four times higher than default rate of commercial banks in the period before the financial crisis (1997-2006). To reconcile these two opposite views, it is necessary to take into account the supervisory behaviour. Specifically, cooperative banks are likely to have less volatile earnings than commercial banks (as shown by the first view), but supervisors are more inclined to wind up distressed cooperative banks in periods of financial stability rather than

[2] Source: European Association of Co-operative Banks (2012), http://www.eacb.eu/en/cooperative_banks/what_they_say_about_us.html

distressed commercial banks, consistently with the Too-Big-To-Fail policy (as shown by the second view).

Without the aim of entering the debate whether cooperative banks are more fragile than commercial banks[3], the study of the financial stability of cooperative banks entails three key issues that need to be assessed. First, cooperative banks are different from commercial banks and their stability is influenced by different factors[4]. Recent studies have focused on productive performance related to the technological development (Kontolaimou and Tsekouras, 2010), the performance and risk depending on the ownership structure (Iannotta et al., 2007) and cost efficiency and financial structure (Girardone et al., 2009). Second, competition is likely to be one of the key factors influencing banking stability, but its influence is probably different for commercial and cooperative banks. Third, it is necessary to account for banking supervisor's behaviour to assess the link between competition and risk. Surprisingly, whilst there is a substantial literature investigating the link between competition and bank stability focusing on commercial banks, there are no studies that analyse specifically cooperative banks.

Does competition affect the stability of cooperative banks? Does banks' soundness increase/decrease in case of higher competition? The purpose of this study is to empirically address these questions. By analysing a large sample of cooperative banks in the EU between 1998 and 2009, we obtain three main results. First, we show that market power negatively Granger-cause banks' stability meaning that there is a positive relationship (both

[3] This paper does not aim at discussing cooperative bank fragility. Rey and Tirole (2007), Beck et al. (2009), Hesse and Čihák (2007) and Fonteyne (2007) are useful sources from a theoretical, empirical and policy perspective, respectively.
[4] See Boonstra and Mooij (2012) for detailed explanation of the differences between commercial and cooperative banks.

in the short and long run) between competition and stability in line with the competition-stability view proposed by Boyd and De Nicolò (2005). Second, we show that the financial crisis from 2007 has had a negative impact on cooperative bank stability, but this does not change the relationship between competition and stability. Third, we posit that cooperative bank closure policies may suffer from an implicit "Too-Many-To-Fail" problem as suggested by Acharya and Yorulmazer (2007). We provide evidence that there is a statistically significant relationship between the Herding measure and bank stability. This result is particularly interesting for policy makers since the level of industry homogeneity has a positive influence on bank stability.

We estimate competition using the Lerner Index of Monopoly Power, recently used in various studies (Maudos and De Guevara, 2007; Turk Ariss, 2010, Radic et al., 2011, among many others). We use panel data techniques and Generalized Methods of Moments (GMM), to control for endogeneity and country-specific effects, in order to test whether changes in competition predict variations in bank risk measures. We also control for the impact that various factors at the bank level have on the competition-risk relationship, such as bank size, herding behaviour, macroeconomic variables and the occurrence of the financial crisis. We also test the significance of the relationship between the industry concentration in the loan market and bank stability.

The remainder of the paper is structured as follows. Section 2 summarizes the literature review and the research hypotheses. The econometric framework, the data and variables appear in section 3. Section 4 discusses the empirical results and robustness checks and section 5 concludes.

2 Literature review and research hypotheses

We empirically assess if an increase in competition predicts higher instability of cooperative banks. The issue of the relationship between competition and risk is largely covered in commercial banking from both theoretical and empirical standpoints.

From a theoretical perspective, there are two views concerning the impact of competition on financial stability. The 'competition-fragility' view (among others, Marcus, 1984; Keeley, 1990; Allen and Gale, 2004; Beck et al., 2006; Matsuoka, 2013) argues that higher competition leads to more risk in banking and to the erosion of bank charter value. On the contrary, various papers support the idea that higher competition may transform the nature of banking and induce banks to become more relationship-oriented (Boot and Thakor, 2000). As such, the 'competition-stability' view (Boyd and De Nicolò, 2005; De Nicolò and Lucchetta, 2009) contends the negative effects of concentration, claiming that the considerable market power of only few banks will cause them to raise the interest rate on loans, which will induce adverse selection (risky projects are financed) and moral hazard (risk shifting), with a negative impact on the stability of the banking system.

Recently there has been a spurt in empirical studies trying to measure the effects of competition and market power on stability. Several works have tested the relationship between banking market structure and risk focusing on credit risk (Hakenes, and Schnabel, 2010; Fiordelisi et al., 2011), interest rate risk (Delis and Kouretas, 2011) or the broader default risk (Repullo, 2004; Schaeck et al., 2009, Berger et al., 2009; Jiménez et al., 2010; Turk Ariss, 2010) providing mixed evidence. For instance, Boyd et al. (2006) and De Nicolò and Loukoianova (2007) show that financial instability increases in lower

competitive markets, while Jiménez et al. (2010) find opposite evidence (i.e., risk decreases as bank market power increases). Schaeck et al. (2009) analyse banks operating in 45 nations over 1980–2005 and find that more competitive and more concentrated banking systems are less likely to experience a systemic crisis and increase time to crisis. Berger et al. (2009) analyse a large sample of banks in 23 developed countries and observe that, even if an increase in bank market power lead to riskier portfolios, the effect on stability could be offset by a greater franchise value. In an attempt to reconcile the mixed empirical evidence, Beck et al. (2013) show that greater competition is generally associated with larger impact on banks' risk-taking activities in countries with stricter activity restrictions, more herding in revenue structure, less concentrated banking markets and more generous deposit insurance.

While existing literature focuses on commercial banking, as far as we are aware there is a lack of studies on cooperative banking. Cooperative banks are key for the EU economy hence it is paramount to investigate the competition-stability link with a specific focus on these credit institutions. On the same token, the EU policy makers point for differences in setting the new prudential regulation: e.g. Michel Barnier (EU Commissioner responsible for internal market and services) stated in 2011 that *"We are totally faithful to Basel's spirit, letter and level of ambition. But you cannot apply rules to 8.200 banks as you would to 20 banks. That is why we take into account the specificities of the European banking sector, with its mutual or co-operative banks and its bank and insurance groups"*[5].

[5] Source: European Association of Co-operative Banks (2012), http://www.eacb.eu/en/cooperative_banks/what_they_say_about_us.html

There are just few papers loosely related to the research questions addressed in the present study. The closest is Liu et al. (2012) that investigate the link between competition and stability focusing on regional banks (among which cooperative banks) in 11 European countries between 2000 and 2008. Without explicitly focusing on cooperative banks which are substantially different from savings banks, Liu et al. (2012) show that there is a positive link between competition and bank stability and that cooperative banks have a positive marginal effect on bank stability. Hesse and Cihak (2007) analyse the stability of cooperative banks (measured using the Z-score) by estimating a linear regression model with dummy variables capturing for different types of banks. Without taking into account the competition in the banking industry, the authors conclude that cooperative banks are more stable than commercial banks.

Our paper contributes to the existing literature in several ways. First, we focus on cooperative banks: as such, we selected a homogenous data set rather than relying on dichotomous variables to control for differences across commercial, savings and cooperative banks. Second, we estimate stability and competition at individual bank level using the Z-score and the Lerner Index that have been increasingly employed in most recent studies (Boyd et al., 2006; De Nicolò and Loukoianova, 2007; Berger et al., 2009). Third, we account for the impact that regulatory intervention may have on the relationship between competition and bank risks. Whilst the Too-Big-To-Fail or Too-Important-To-Fail views do not apply to cooperative banks, we recognize that cooperative bank closure policies may suffer from an implicit "Too-Many-To-Fail" problem as suggested by Acharya and Yorulmazer (2007). Specifically, when the number of bank failures is large, the regulator finds it ex-post optimal to bail out some or all distressed banks, triggering

incentives to herd and increasing the risk that many banks may concurrently fail together. Similarly to Beck et al. (2013), we investigate the assumption that competition will have a stronger impact on bank stability in more homogeneous banking system (where herding behaviour is more likely).

3 Empirical approach

3.1 Data sources

Bank financial statements are taken from Bureau van Dijk Bankscope database. We restrict our analysis to banks from the five largest cooperative banking sectors in Europe (i.e., Austria, France, Germany, Italy and Spain) over the period between 1998 and 2009. In 2010, cooperative banks in these five countries accounted for 85% of total assets held by all EU cooperative banks.

To avoid duplication, we consider consolidated data where it is possible and unconsolidated data otherwise. We also delete banks for which relevant information is not available (e.g., total costs). After data cleaning, our final sample consists of 17,080 observations for 2,529 cooperative banks in Austria, France, Germany, Italy and Spain (accounting for 4%, 6%, 60%, 28% and 2% of the observations, respectively). Table 1 reports the sample summary statistics.

< INSERT HERE TABLE 1 >

Additional information on economic freedom is obtained from The Heritage Foundation. Country-level information is collected through Eurostat.

3.2 Measuring competition: the Lerner Index

Following recent studies (Maudos and de Guevara, 2007; Casu and Girardone 2009; Turk Ariss, 2010, among many others), we estimate directly competition through the Lerner index of Monopoly Power (*LER*) as a measure of cooperative bank market power. This Index represents the extent to which market power allows firms to fix a price above marginal cost and it is calculated as follows:

$$LER = \frac{p - MC}{p} \tag{1}$$

where p is the price of the output and MC is the marginal cost. Higher values of the index imply greater market power. The price of output Q is calculated as total revenues (interest plus non-interest income) divided by total assets. Following some recent papers, we estimate the marginal cost using a translog cost function with two inputs, one single output and a time trend. The final specification is as follows:

$$\begin{aligned}\ln TC = {} & \alpha_0 + \alpha_1 \ln Q + \frac{\alpha_2}{2} \ln Q^2 + \sum_{j=1}^{2} \beta_j \ln P_j + \frac{1}{2} \sum_{j=1}^{2} \sum_{k=1}^{2} \delta_{jk} \ln P_j \ln P_k + \\ & \frac{1}{2} \sum_{j=1}^{2} \gamma_j \ln Q \ln P_j + \tau_1 T + \frac{\tau_2}{2} T^2 + \tau_3 T \times \ln Q + \sum_{j=1}^{2} \psi_j T \ln P_j + \varepsilon_{it}\end{aligned} \tag{2}$$

where TC is total costs (the sum of personnel expenses, other administrative expenses and other operating expenses); Q is the cooperative banks' single output proxied by total assets; P_1 and P_2 are the price of the inputs employed in the production process: P_1 is the price of labour (i.e., personnel expenses over total assets), and P_2 is the price of physical capital (i.e.,

other administrative expenses plus other operating expenses over total fixed assets). α, β, δ, γ, τ, ψ are coefficients to be estimated; ε_{it} is a two-components error term computed as following:

$$\varepsilon_{it} = u_{it} + v_{it} \tag{3}$$

where v_{it} is a two-sided error term.[6]

From equation (2), the marginal costs can be derived as follows:

$$MC = \frac{TC}{Q}\left[\alpha_1 + \alpha_2 \ln Q + \sum_{j=1}^{2} \gamma_j \ln P_j + \tau_3 T\right] \tag{4}$$

We calculated the Funding Adjusted LER, as suggested by Maudos and de Guevara, (2007) and Turk Ariss, (2010): specifically, MC are derived from the estimation of the cost function that omits funding costs as one of the inputs. This enables us to account for market power that may have previously been exercised in the deposit market: specifically, by excluding funding costs, we obtain a clean proxy of pricing power that is not affected by market power which had previously originated in the deposit market while raising funds. Moreover, the Lerner Index is estimated at bank level, therefore the evolution of market power is analysed across banks over time.

[6] The v_{it} are assumed to be independently and identically normal distributed with zero mean and variance σ^2_v and independent of u_{it}= {u_i *exp[-n (t-T)]*} where u_{it} is a one-sided error term capturing the effects of inefficiency and assumed to be half-normally distributed with mean zero and variance and *n* is an unknown parameter to be estimated capturing the effect of inefficiency change over time. We apply the common restrictions of standard symmetry and homogeneity in prices to the translog functional form.

3.3 Variables

A comprehensive set of variables is considered in the analysis in order to control for the effect of other determinants on the relationship between competition and risk. These are included in the estimation to take into account from the one hand, variables that can affect directly the relationship between stability and competition (heterogeneity, market concentration), from the other hand other factors that may explain bank financial soundness (size and environmental determinants).

We proxy bank stability using the natural logarithm of Z-score (as, for instance, in Iannotta et al., 2007; Laeven and Levine, 2009; Beck et al., 2013). We compute the Z-score at bank level as:

$$Z-Score_{i,t} = \frac{ROA_{i,t} + (E_{i,t} / A_{i,t})}{\sigma(ROA_T)} \qquad (5)$$

where $ROA_{i,t}$ is the return on assets for bank i in year t, $E_{i,t}/A_{i,t}$ denotes the equity to total assets ratio for bank i in year t, $\sigma(ROA_T)$ is the standard deviation of return on assets over the full sample period (T years). The Z-Score provides a measure of bank soundness as it indicates the number of standard deviations by which returns have to diminish in order to deplete the equity of a bank. A higher Z-Score implies a higher degree of solvency and therefore it gives a direct measure of bank stability. We consider in the analysis the natural logarithm of Z-score to smooth out higher values of the distribution.

We compute the Herding Measure and the loan market concentration to control for the effects of other factors on the relationship between stability and competition. The Herding Measure, as in Beck et al. (2013), is built as the within country standard deviation per year of non-interest income (e.g., fee commissions) as a share of total assets. It takes into

consideration the possible incentives for banks to increase their risk-taking following an increase in competition. If the regulator finds it optimal to bail it out a large number of banks when the number of bank failures is high (Acharya and Yorulmazer, 2007; Brown and Dinç, 2011), cooperative banks are more likely to expand their operations outside their core business in response to an increase in competition. The higher the value of this indicator, the lower is the herding behaviour in the cooperative banking sector. We also compute a combined measure using the interaction between the herding indicator and the Lerner Index. The Herd-Lerner is estimated as the product of a dummy variable and the Lerner Index. The dummy takes value of one if the banking sector in a country is in the highest third of the Herding measure distribution (i.e., more heterogeneous sources of revenues), zero otherwise.

The Hefindhal-Hirschman Index (HHI) conveys the information on market concentration on loans. The index is computed per year at country level. The higher the value of HHI, the lower is the concentration of the market. We also calculate a combined measure using the Lerner Index. The HHI-Lerner is computed as the product of a dummy and the Lerner Index. The dummy takes value of one if the banking sector in a country is in the highest third of the HHI distribution (i.e., more concentrated markets), zero otherwise.

We consider a set of control variables. The size variable, computed as the natural logarithm of bank total assets, accounts for the ability to diversify the business in that reducing the bank overall risk. The influence of the macroeconomic environment is proxied by the inflation rate and by the total long term unemployed population (12 months or more). In addition, we employ the overall financial freedom index estimated by the Heritage

Foundation. Higher values indicate greater economic freedom. Moreover, a categorical variable is introduced to take into account the 2007-2009 financial crisis.

< INSERT HERE TABLE 2 >

3.4 Econometric approach

To investigate the relationship between banks' competition (measured using the Lerner Index) and stability (measured by the Z-score), we rely on Granger causality techniques. This approach has the advantage to permit us to test unique time-ordered and signed relationships among pairs of variables[7]. While Granger causality tests have several limitations[8], this approach has been widely used to analyse inter-temporal relationships in the economic literature (e.g. Jaeger and Paserman, 2008; Assenmacher-Wesche and Gerlach, 2008) as well as in banking studies (e.g. Fiordelisi et al., 2011, Fiordelisi and Molyneux, 2010; Casu and Girardone, 2009; Williams, 2004). Specifically, in order to disentangle the inter-temporal relationships between competition and stability, we estimate the following equation:

$$Z_{i,t} = f(Z_{i,lag}, LER_{i,lag}, X_{i,lag}, K_{i,t}) + \varepsilon_{i,t} \qquad (6)$$

where the *i* subscript denotes the cross-sectional dimension across banks; *t* denotes the time dimension; $Z_{i,lag}$ is the Z-score for bank *i* expressing the bank stability; LER_i is the Lerner Index for bank *i* expressing bank market power; X_i are factors that we posit to influence the

[7] Granger's (1969, p. 428) notion of causality states that "… y_t is causing x_t if we are better able to predict x_t using all available information than if the information apart from y_t had been used". Granger's suggestion to regress x_t on its own lags and a set of lagged y_t has become a standard procedure. If lagged y_t provides a statistically significant explanation of x_t, y_t "Granger" causes x_t.
[8] For instance, Granger-testing does not prove economic causation between two variables but identifies gross statistical associations.

relationship between competition and stability, $K_{i,t}$ are control variables (as detailed in Section 3.3) and $\varepsilon_{i,t}$ is the error term.

We use two lags and estimate an AR(2) process for the competition and stability variables. This enables us to test the long-term relationship between competition and risk. While previous study assesses this relationship over one year, we posit that competition can take more than one year to influence bank stability. Following Casu and Girardone (2009), Granger causality is assessed as the joint test of the null hypothesis that the two lags are equal to zero. If the probability is less than 10%, then the null hypothesis that *x* Granger-causes *y* is rejected at the 10% significance level. We also assess the 'long-run effect' of x over the y by testing for the restriction that the sum of all lagged coefficients is zero; a rejection of the restriction implies that there is evidence of a long-run effect of x on y.

The introduction of the lagged bank stability is necessary since it is likely that a bank that has shown high instability in the past is more prone to be subject to financial distress in the next future (Heckman, 1981a, b). The introduction of a lagged dependent variable among the predictors creates complications in the estimation as the lagged dependent variable is correlated with the disturbance (even under the assumption that $\varepsilon_{i,t}$ is not itself correlated). To tackle this problem, we use the Generalized Method of Moments (*GMM*) estimators developed for dynamic panel models (Arellano and Bover, 1995; Blundell and Bond, 1998). Specifically we use the two-step system GMM estimator with Windmeijer (2005) corrected standard error.[9]

[9] The estimated asymptotic standard errors of the efficient two-step GMM estimator are severely downward biased in small samples therefore we correct for this bias using the method proposed by Windmeijer (2005).

4 Results

Granger causality is used in a panel data setting to analyse the relationship between competition and risk. The GMM method gives unbiased estimators of the relationship between the variables employed in the analysis. We run separate regressions with the herding measure and the concentration index to explore further the relationship between competition and stability.

In the base model, we analyse the relationship between competition and stability by considering a set of variables to control for other possible determinants of bank overall risk. We then include the financial crisis variable to explore the effect of this systemic distress. As reported in Table (3), we show that bank market power negatively Granger-cause banks' stability meaning that there is a positive relationship between competition and stability: when competition is low (i.e., market power is high), stability is low. We observe this positive link between competition and stability in all the estimated coefficients for the lagged Lerner index (statistically significant at the 10% level or less). In addition, we find that the long-run effect is highly significant. This in turn supports the competition-stability view proposed by Boyd and De Nicolò (2005). Our finding is consistent with the evidence provided by various studies on commercial banking (Beck et al. 2006; Schaeck et al., 2009, among the others), showing that banks become more risky in less competitive markets thus it provides useful insights for policy makers in the current redesign of the supervisory approach for cooperative banks.

Size is positively related with bank stability meaning that larger cooperative banks are better able to diversify their portfolio in that increasing bank soundness. Higher inflation rate is negatively related to bank stability as it increases pressure to raise earnings. High long-term unemployment increases bank riskiness. The overall financial freedom is not statistically significant at the 10% and it is negatively related to bank stability. In specification (1.2) we account for the effect of the financial crisis to explore whether during a period of market havoc competition is a deterrent of financial stability. Our results provide evidence that although bank stability declined during the financial crisis, the less is the market power of cooperative banks the more they are resilient. This is particularly interesting for policy makers showing that the financial crisis did not change the relationship between competition and stability. In addition, an increase in competition favours bank soundness.

< INSERT HERE TABLE 3 >

We run two regressions to account for cooperative bank closure policies and an implicit "Too-Many-To-Fail" problem as suggested by Acharya and Yorulmazer (2007). Specifically, we investigate the assumption that competition will have a stronger impact on bank stability in more homogeneous banking system (where herding behaviour is more likely). As such, we introduce the Herding measure and a combined measure obtained by interacting the Lerner Index with a dummy capturing the bank herding behaviour. As reported in Table (4), the herding measure is negatively related with bank stability meaning that banks tend to become more stable in more homogenous banking market. Moreover, the combined measure shows that in more homogenous banking markets financial stability is

higher. Our results also confirm the existence of the negative long run-effect between market power and banks' soundness. These findings are particularly interesting for policy makers. First, we show that the level of homogeneity influence the cooperative banking stability. Second, we support the view that the expansion of cooperative banks into non-traditional business lines (i.e., non-interest income activities) could lead to higher insolvency risk[10]. Although diversification should be carefully considered by policy makers for its impact on the safety and soundness of the overall banking system, more homogenous cooperative banking markets seems to be more stable. The combined measure is strongly related to bank stability as the coefficients are statistically significant at the 5% level or less and the sign of the coefficients is stable over time.

< INSERT HERE TABLE 4 >

As robustness test, we run two different regressions to account for the effect of concentration in the loan market. The one-year lag Hefindhal-Hirschman Index is negatively related to the Z-score, implying that bank stability is higher in more concentrated markets: this is consistent with the previous finding suggesting that more competition is likely to happen in more concentrated markets. In addition, this shows another interest parallel with commercial banking (e.g., Fiordelisi et al., 2011). Nevertheless, this index is weakly related to bank stability as only the one lag indicator is statistically significant at the 5% level and the sign of the coefficients is not stable over time (i.e., it is negative for the one year lag and positive for the two year lag). Also, the

[10] See Mercieca et al., 2007, for the negative implications of diversification in the case of small European banks; Goddard et al., 2008, for evidence from the US market.

coefficient of the two-year combined measure is not statistically significant at the 10% level.

< INSERT HERE TABLE 5 >

5 Conclusions

Cooperative banks are a driving force for socially committed business at the local level accounting for around one fifth of the European banking system. Despite their importance, there is a lack of studies assessing the relationship between competition and financial stability in cooperative banking. Our paper empirically fills this void using a large sample of cooperative banks in the European Union between 1998 and 2009.

We show that bank market power negatively Granger-cause banks' stability meaning that there is a positive relationship between competition and soundness: when competition is low (i.e. market power is high), stability is low. The positive link between competition and stability is observed both in the short and long run and support the competition-stability view proposed by Boyd and De Nicolò (2005). We also provide empirical evidence that bank soundness is higher in more homogenous markets where the herding behaviour is higher. Cooperative bank closure policies may suffer from an implicit "Too-Many-To-Fail" problem as suggested by Acharya and Yorulmazer (2007) when the banking system is more competitive because herding behaviour is more likely. This result is particularly interesting for policy makers suggesting that the level of industry homogeneity do influence the cooperative banking stability. We also show that the financial crisis from 2007 has had a

negative impact on cooperative bank stability, but it has not changed the relationship between competition and stability

We consider a combination of measures to account for the herding behaviour in the case of high monopoly market (combination of herding and Lerner Index), and the concentration on the loan market (combination of concentration on the loan market and the Lerner Index). We do not find evidence that there is a statistically significant relationship between these measures and bank stability, at least in the long run and for all the lagged coefficients.

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Table 1

Descriptive statistics

This table presents the descriptive statistics of our sample of cooperative banks in the European banking between 1998 and 2009 for the main variables used in the model. It is at first surprising the Lerner Index is negative for some observations though for 70 observations only. We argue that this could be the case when cooperative banks start operations and bear high fixed costs (e.g., for fixed assets).

Variable	Symbol	Obs	Mean	Std. Dev.	Min	Max
Output Price	P	17,080	0.0571	0.0320	0.0043	2.5915
Marginal Cost	MC	17,080	0.0263	0.0281	0.0012	2.3787
Lerner Index	LER	17,080	0.5380	0.1372	-2.7908	0.9781
Herding measure	HERD	17,080	0.0665	0.0260	0.0123	0.2386
Concentration	HHI LOANS	17,080	0.0578	0.0473	0.0111	0.4501
Z-Score	Z	17,080	13.1631	7.4566	-15.5536	144.4874

Table 2

Variables definition

This table defines the variables used in the paper and the sources of data.

Variables	Symbol	Definition and calculation method	Source
Z-score	Z	The ratio synthesizes a measure of overall banking risk. It is computed as the sum of the return on assets (ROA) and the equity ratio (equity over total assets) divided by the sample standard deviation of ROA.	Own calculations using data from Bankscope.
Lerner Index	LER	It represents the extent to which market power allows the bank to fix a price (P) above its marginal cost (MC).	Own calculations using data from Bankscope.
Output Price	P	Following recent studies (Berger et al 2009 and Turk Ariss 2010) and assuming that banks produce an heterogeneous flow of services that is proportional to their dimension, we use banks' total asset as a proxy of their overall activity (Angelini and Cetorelli, 2003) and we estimate average price as total revenues (interest and non- interest income) on total asset.	Own calculations using data from Bankscope.
Marginal cost s	MC	Marginal cost of the product is estimated using a single output translog cost function, firm-fixed effect to handle the average heterogeneity among banks and a technology shift trend to capture the average changing in production technology over the sample period.	Own calculations using data from Bankscope.
Bank Asset Size	SIZE	It is measured by the natural logharitm of total assets.	Own calculations using data from Bankscope.
Herding measure	HERD	This is a measure of banking industry heterogeneity obtained as the within country standard deviation of the percentage non-interest income (with respect to total assets) as in Beck et al. (2013), per year (t) and per country (i).	Own calculations using data from Bankscope.
Inflation rate	INFL	The annual percentage change in the cost to the average consumer of acquiring a basket of goods and services.	World Bank
Long-term unemployment	LTU	It measures the long-term unemployment (12 months and more) in millons of people looking for a paid job.	Eurostat
Overall Freedom	OVERALL	Overall measure of financial freedom.	The Heritage Foundation.
Financial Crisis	FINCIR	This is a dummy variable for the 2007-2009 financial crisis. It takes value of 1 in 2007-2009, 0 otherwise.	
Concentration	HHI LOANS	Concentration Index (Herfindhal-Hirschman Index) calculated as the sum of the squares of the market shares (considering loans) of each bank (i) in a specific country (c) in a determined year (t). We consider one observation per year (t) per country (c) (i.e. 60 values).	Own calculations using data from Bankscope.
Herd Lerner	HERD_LERNER	Mixed measure that combines the banks with the highest tendency to herd (i.e. lowest third of the distribution of HERD) with market monopoly power.	Own calculations.
Concentration Lerner	HHI_LERNER	Mixed measure that combines banks' concentration index in the loan market with market monopoly power.	Own calculations.

Table 3

The link between bank stability and competition in cooperative banks

The Table reports the results from the estimation of equation (6) to disentangle the inter-temporal relationships between bank stability (measured by the Z-score) and competition. We estimate autoregressive models with two lags for the stability measure and the competition variable. We use the two-step *GMM* estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). A significance level lower than 10% enables to reject the null hypothesis of no causality from *x* to *y*. A coefficient > 0 implies a positive causation from *x* to *y*; a coefficient < 0 indicates a negative causation from *x* to *y*. We report the Hansen test of over-identifying restrictions for the GMM estimators and the Arellano–Bond test for autocorrelation. In the former, the null hypothesis is that instruments used are not correlated with residuals and so the over-identifying restrictions are valid. In the latter, we test the autocorrelation in first differences (AR1), the null hypothesis being no autocorrelation, and the autocorrelation in levels (AR2), the null hypothesis being again no autocorrelation. All variables are summarized in table 1. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively. The sample includes all the cooperative banks in EU-5 over the period 1998-2009.

	(1.1)		(1.2)	
Dependent variable Z: Z-Score	Coef.	Std. Err.	Coef.	Std. Err.
Z_{t-1}	0.748***	0.039	0.747***	0.040
Z_{t-2}	0.221***	0.037	0.233***	0.038
LER_{t-1}	-0.239***	0.039	-0.259***	0.039
LER_{t-2}	-0.050*	0.028	-0.083***	0.031
$SIZE_{t-1}$	0.011***	0.001	0.016***	0.002
$INFL_{t-1}$	-0.008*	0.005	-0.013***	0.004
LTU_{t-1}	-0.006***	0.002	-0.006***	0.002
$OVERALL_{t-1}$	0.002**	0.001	0.004***	0.001
FINCIR			-0.039***	0.006
Intercept	0.020	0.085	-0.149	0.095
Granger long-run effect				
$LER_{-1,-2}$	-5.70***		-6.27***	
Observations:	9,085		9,085	
No. of banks	1,721		1,721	
Hansen test, 2nd step, $\chi(2)$, *p-value*	0.058		0.812	
AB test AR(1), *p-value*	0.009		0.009	
AB test AR(2), *p-value*	0.266		0.264	

Table 4

The link between bank stability and competition in cooperative banks: the herding behaviour

The Table reports the results from the estimation of equation (6) to disentangle the inter-temporal relationships between bank stability (measured by the Z-score) and competition whilst accounting for banks' herding behaviour. We estimate autoregressive models with two lags for the stability measure, the competition variable and the combined herding indicator. We use the two-step *GMM* estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). A significance level lower than 10% enables to reject the null hypothesis of no causality from *x* to *y*. A coefficient > 0 implies a positive causation from *x* to *y*; a coefficient < 0 indicates a negative causation from *x* to *y*. We report the Hansen test of over-identifying restrictions for the GMM estimators and the Arellano–Bond test for autocorrelation. In the former, the null hypothesis is that instruments used are not correlated with residuals and so the over-identifying restrictions are valid. In the latter, we test the autocorrelation in first differences (AR1), the null hypothesis being no autocorrelation, and the autocorrelation in levels (AR2), the null hypothesis being again no autocorrelation. All variables are summarized in table 1. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively. The sample includes all the cooperative banks in EU-5 over the period 1998-2009. The coefficient of the overall financial freedom is multiplied by ten in regression (2.2).

	(2.1)		(2.2)	
Dependent variable Z: Z-Score	Coef.	Std. Err.	Coef.	Std. Err.
Z_{t-1}	0.750***	0.040	0.742***	0.043
Z_{t-2}	0.243***	0.040	0.244***	0.042
LER_{t-1}	-0.272***	0.040	-0.290***	0.039
LER_{t-2}	-0.063*	0.034	-0.061*	0.031
$HERD_{t-1}$	-0.734***	0.180	-0.391*	0.208
$HERD_LERNER_{t-1}$			0.058***	0.013
$HERD_LERNER_{t-2}$			0.023**	0.010
$SIZE_{t-1}$	0.016***	0.002	0.013***	0.002
$INFL_{t-1}$	-0.008	0.005	-0.008	0.005
LTU_{t-1}	-0.004**	0.002	-0.003	0.002
$OVERALL_{t-1}$	0.003***	0.001	0.003	0.001
FINCIR	-0.038***	0.006	-0.024***	0.007
Intercept	-0.115	0.097	0.098	0.111
Granger long-run effect				
$LER_{-1,-2}$	-5.93***		-6.63***	
Observations:	9,085		9,085	
No. of banks	1,721		1,721	
Hansen test, 2nd step, $\chi(2)$, *p-value*	0.537		0.255	
AB test AR(1), *p-value*	0.009		0.009	
AB test AR(2), *p-value*	0.202		0.200	

Table 5

The link between Bank stability and Competition in Cooperative banks: the concentration in the loan market

The Table reports the results from the estimation of equation (6) to disentangle the inter-temporal relationships between bank stability (measured by the Z-score) and competition measured by the concentration in the loan market. We estimate autoregressive models with two lags for the stability measure and the concentration variable. We use the two-step GMM estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). A significance level lower than 10% enables to reject the null hypothesis of no causality from x to y. A coefficient > 0 implies a positive causation from x to y; a coefficient < 0 indicates a negative causation from x to y. We report the Hansen test of over-identifying restrictions for the GMM estimators and the Arellano–Bond test for autocorrelation. In the former, the null hypothesis is that instruments used are not correlated with residuals and so the over-identifying restrictions are valid. In the latter, we test the autocorrelation in first differences (AR1), the null hypothesis being no autocorrelation, and the autocorrelation in levels (AR2), the null hypothesis being again no autocorrelation. All variables are summarized in table 1. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively. The sample includes all the cooperative banks in EU-5 over the period 1998-2009.

	(3.1)		(3.2)	
Dependent variable Z: Z-Score	Coef.	Std. Err.	Coef.	Std. Err.
Z_{t-1}	0.758***	0.045	0.733***	0.035
Z_{t-2}	0.244***	0.043	0.251***	0.034
LER_{t-1}			-0.337***	0.049
LER_{t-2}			-0.045	0.045
HHI $LOANS_{t-1}$	-0.351***	0.081	-0.956***	0.304
HHI $LOANS_{t-2}$	0.458***	0.089	0.406	0.344
HHI_LERNER_{t-1}			1.343**	0.566
HHI_LERNER_{t-2}			0.061	0.607
$SIZE_{t-1}$	0.011***	0.002	0.012***	0.002
$INFL_{t-1}$	-0.056***	0.007	-0.040***	0.006
LTU_{t-1}	-0.003	0.002	-0.004*	0.002
$OVERALL_{t-1}$	0.002*	0.001	0.002**	0.001
FINCIR	-0.032***	0.007	-0.034***	0.007
Intercept	-0.136	0.103	0.059	0.093
Granger long-run effect				
HHI $LOANS_{-1,-2}$	0.890		-0.93	
Observations:	9,085		9,085	
No. of banks	1,721		1,721	
Hansen test, 2nd step, $\chi(2)$, *p-value*	0.000		0.550	
AB test AR(1), *p-value*	0.008		0.010	
AB test AR(2), *p-value*	0.176		0.111	