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Cooperative banks: What do we know about competition and risk preferences?

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ABSTRACT

In the wake of the Global Financial Crisis the discussion on preventive regulatory policies has generally overlooked the role of different business models and goals. Credit institutions with mutual objectives are a case in point that is the object of this study, which focuses on the relationship between competition and financial stability in European cooperative banking between 2006 and 2014. Our results show that there exists a hump-shaped relationship between market power and stability, particularly in the loan market. Interestingly, we also find that, diversification in assets and liabilities significantly increases cooperative banks' solvency.

1. Introduction

Cooperative banks have a specific business model in that their customers are also the members of these credit unions. They represent a sizeable portion of the European banking industry. For example, in Austria they represent 29% of the industry's market share, in Germany 51%, in Italy 61% and in Spain 31%. They also count for a large percentage of loans to the small and medium sized companies in the markets where they operate. They are, however, generally smaller than the average commercial bank. In terms of asset size the average cooperative bank in Austria is one-half the size of the average commercial bank, in Germany it is one-fifth the size, in Italy one-fourth the size, and in Spain the figure is one-tenth.[1] Their size and market niche make them important banking players for smoothing the effects of tight monetary policy (Ferri et al., 2014) and for local economic development (Hakenes et al., 2015). Yet, their importance and specific business model has only begun to receive attention from pundits, regulators and policy makers (Kalmi, 2007) when designing policies to increase the resilience of the European banking market.

Recent regulatory developments in Europe have begun to pay attention to the individual stability of cooperative banks. National bank supervisors maintain the responsibility of supervising Less Significant Institutions (LSI) in cooperation with the European Central Bank. Whenever a bank is likely to fail or declared insolvent, an EU-level resolution authority – the

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[1] The information presented here are authors own estimates based on BvD's Bankscope database.

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Single Resolution Mechanism – is commended to ensure the orderly resolution of the failing credit institution. The two pillars for the orderly resolution of distressed banks rely on the correct assessment of the individual stability of the LSI, the majority of which in Europe are cooperative banks.

Using a large sample of 1535 cooperative banks in European countries between 2006 and 2014 that covers 64% of the overall cooperative banking sample worldwide, we empirically assess the relationship between competition, risk preferences and market structure in cooperative banking. While this issue has been widely debated and investigated by both policymakers and academics for commercial banking, only a handful of studies exist for the cooperative banking industry (see for example Presbitero and Zazzaro 2011; Fiordelisi and Mare, 2014). Ours is the first to consider the specific features related to the cooperative business model.

The theoretical literature on bank stability proposes two contentious views that are based on different premises, but neither really fit the cooperative business model. The competition-fragility view (Marcus, 1984; Keeley, 1990) hinges on the risk-taking incentives of shareholders subsequent to the decline in bank franchise value. This channel is particularly weak in cooperative banks as customers are also members of these credit institutions (Fiordelisi and Mare, 2014). Moreover, cooperative banks create value through the unique nature of their relationships not only with the borrowers, but also with the local environment where they operate. The competition-stability view (Boyd and De Nicolò, 2005; De Nicolo and Lucchetta, 2009) focuses on the lending channel and advocates that, in a classical asymmetric framework, higher interest rate charges exacerbate the adverse selection and moral hazard problems. It follows that lower competition is associated with higher risk in the credit portfolio leading to higher likelihood of bank insolvency. Martinez-Miera and Repullo (2010) extend this reasoning by allowing for imperfect correlation of loan defaults. The authors suggest the existence of two separate effects: a margin effect due to lower prices charged to customers in more competitive markets and a risk-shifting effect favoured by the opacity of the banking business that generates asymmetric information problems. The theoretical and numerical prediction is that there exists a U-shaped relationship between the number of banks and the probability of bank failure (see for example, Jiménez et al., 2013). The reasoning leaves out important aspects for cooperative banks, namely the efficiency in the lending process and the role of competition in the market for deposits. Cooperative banks are constrained in the availability of funding sources as they cannot easily either raise capital or access the wholesale funding market.

In one study that focuses on the cooperative banking sector Presbitero and Zazzaro (2011) suggest that in markets dominated by cooperative banks, the increase in competition leads to higher investments in building long-lasting relationships with customers (i.e., relationship lending). If this is the case, we can speculate that competition increases bank stability because of higher investments in collecting information, screening and monitoring. Eventually, cooperative banks subject to competitive pressures may witness an improvement in the credit quality of their portfolio. In line with this prediction, Fiordelisi and Mare (2014) show that in five cooperative banking markets in Europe (Austria, France, Germany, Italy and Spain) banking competition increases individual bank stability. Liu et al., (2013) focus on regional banking in Europe including cooperative banks and find, similarly to Martinez-Miera and Repullo (2010), a non-linear relationship between competition and stability.

Other studies attempt to address the financial stability of cooperative banks and their contribution to the overall systemic stability. Hesse and Cihák (2007) argue that cooperative banks are more stable than commercial banks due to the lower variability of the cooperative banks' returns. Moreover, in line with the reasoning in Ayadi et al., (2010), Hesse and Cihák (2007) find that banking systems characterised by a higher share of cooperative banks are more stable. Mercieca et al., (2007) analyse the benefits of income diversification in terms of bank profitability. The authors investigate small European banks over the period 1997–2003 and find that there are no direct diversification benefits in terms of performance. Goddard et al., (2008) suggest that a diversification strategy brings positive effects depending on size. The authors analyse a sample of credit unions in the United States between 1993 and 2004 and show that diversification strategies are more effective for the largest credit unions only and lead to higher returns unadjusted for risk. In contrast, Köhler (2015) finds that cooperative banks may become significantly sounder through the benefits of income diversification. In addition, the author finds that retail-oriented credit institutions become less stable if they increase the share of non-deposit funding.

The innovation in this paper is that for the first time (to the best of our knowledge) the specific cooperative business model is incorporated in the testing of the relationship between competition and stability. To this end, we look at the cooperatives' two major markets – the market for deposits and the market for loans. We then use a modified Lerner index to measure the market power of each cooperative in each market. We also test for the significance of diversification captured in three dimensions: assets, deposits and liabilities. Finally, we look at the risk exposure at the bank level as a significant determinant of bank soundness and market stability, and test whether there are non-linear relationships between market power and individual bank soundness. Our contribution is twofold. First, we show that market power increases individual bank stability, but the relationship is non-linear. When we analyse the market for loans and deposits separately, we find that most of the individual bank stability derives from market power in the loan market. We do not find conclusive evidence for market power in the deposit market. Second, we show that cooperative bank solvency is positively related to the degree of diversification in both assets and liabilities.

The remainder of the paper is structured as follows. Section 2 presents the data and variables employed in the analysis. In section 3, we discuss the empirical approach. Section 4 summarises the results from the estimations and the robustness checks. Section 5 concludes.

2. Data sources and variables

Bank financial statements are taken from the Bureau van Dijk Bankscope database. We restrict our analysis to countries in the European Union where data is available for Cooperative banks over the period 2006 to 2014. We select cooperative banks according to Bankscope database definition.

We apply a number of selection criteria to arrive at our final sample. To avoid duplication, we consider unconsolidated data only. We also omit banks for which relevant information is not available (i.e., total assets and total equity) and for which we have information for fewer than three consecutive years, as our risk measure is computed over rolling windows hence we need a minimum number of observations. We also exclude banks where we do not have the complete information to estimate our measures of market power. Lastly we drop countries for which cooperative banks' market share in the banking industry is less than 25%. This yields a sample of around 11,900 observations for 1193 cooperative banks distributed in four European countries.[2] The sample is unbalanced and banks are mainly concentrated in two countries – Germany and Italy, - accounting for 62% and 30%, of the total observations, respectively. Table 1 reports the key indicators for the cooperative banks in the different countries.

We notice that in our sample Austria counts with the biggest cooperative banks in terms of assets whilst Italy on average shows the smallest. On average, Italy and Spain have the highest percentage of loans to total assets and more generally, cooperative banks invest 65 per cent of the total assets in loans. Deposits are the biggest source of funding for cooperative banks though this is not the case in Italy where Banche Popolari use alternative sources of funding. On average, the leverage ratio computed as equity to total assets is 8.8 per cent denoting a high level of capitalization compared to recent regulatory proposals in the European Countries (as for instance, a maximum leverage ratio of 4.95 per cent in boom times proposed by the Bank of England in the UK). Interest income is the main source of revenues standing at almost 80 per cent of total income.

A comprehensive set of variables is considered in the analysis to control for the effect of other factors on the relationship between risk and competition. We include variables such as diversification proxies, and bank-specific variables that can directly affect the relationship between stability and competition. Below, we first describe the main variables of interest in our analysis – the Lerner Index and bank stability – and then the other variables we include in the estimation.

2.1. Measuring competition and market structure

We estimate competition using the Lerner Index of Monopoly Power (*LER*). This indicator represents the extent to which market power allows firms to earn relative margins (price minus marginal cost divided by the price). We explicitly recognise that the core products offered by cooperative banks are interest-bearing assets and interest-bearing liabilities. We therefore investigate separately the different patterns and determinants of the degree of non-competitive behaviour in the two separate markets. The specification is as follows (where subscripts i, and t denote bank and time period):

$$\boldsymbol{LER_{i,t}} = \frac{\boldsymbol{P_{i,t}} - \boldsymbol{MC_{i,t}}}{\boldsymbol{P_{i,t}}} \tag{1}$$

where *P* is the price of the output of the bank, and *MC* is the marginal cost of producing one additional unit of output. We employ the production approach and follow Forssbæck and Shehzad (2015) to estimate the cost function using two outputs (interest-bearing assets and interest-bearing liabilities) to reflect the fact that cooperative banks perform mainly the credit intermediation function. We use pooled ordinary least square and specify a translog cost function to derive the marginal cost with three inputs (borrowed funds, labour and physical capital), two outputs (interest-bearing assets and interest-bearing liabilities), a time trend for technical change and country fixed effects. The final specification is as follows (where subscripts i, c and t denote bank, country, and time period):

$$\begin{aligned}\boldsymbol{ln}\,(\boldsymbol{C_{it}}) = {} & \sum_{j=1}^{3}\boldsymbol{\beta_j}\,\boldsymbol{ln}\,(\boldsymbol{W_{j,it}}) + \sum_{j=1}^{2}\boldsymbol{\gamma_j}\,\boldsymbol{ln}\,(\boldsymbol{Y_{j,it}}) + \frac{1}{2}\sum_{j=1}^{3}\sum_{m=1}^{3}\boldsymbol{\phi_{jm}}\,\boldsymbol{ln}\,(\boldsymbol{W_{j,it}})\,\boldsymbol{ln}\,(\boldsymbol{W_{m,it}}) + \frac{1}{2}\sum_{j=1}^{2}\sum_{m=1}^{2}\boldsymbol{\eta_{j,m}}\,\boldsymbol{ln}\,(\boldsymbol{Y_{j,it}})\,\boldsymbol{ln}\,(\boldsymbol{Y_{m,it}}) \\ & + \sum_{j=1}^{3}\sum_{m=1}^{2}\lambda_{jm}\ln(\mathbf{W_{j,it}})\ln(\mathbf{Y_{m,it}}) + \mu_1\mathbf{Tr} + \frac{1}{2}\mu_2\mathbf{Tr}^2 + \sum_{j=1}^{3}\boldsymbol{\pi_j}\ln(\boldsymbol{W_{j,it}})\boldsymbol{Tr} + \sum_{j=1}^{2}\boldsymbol{\theta_j}\ln(\boldsymbol{Y_{j,it}})\boldsymbol{Tr} + \sum_{c=1}^{C}\boldsymbol{\alpha_c} + \boldsymbol{\varepsilon_{it}},\end{aligned} \tag{2}$$

where ln(*C*) is the natural logarithm of total cost; *W* are the three input prices: price of labour, price of funding and price of physical capital. *Y* are two outputs: Y_1 are interest-bearing assets obtained as the sum of net loans, loans and advances to banks and reverse repos and cash collateral; Y_2 are interest-bearing liabilities obtained as total funding excluding derivatives and trading liabilities; *Tr* is a time trend; α_c are country fixed effects; ε are the errors composed by a random component (v_j) and a systematic deviance from optimal cost due to inefficiency (u_j).[3] Symmetry and linear homogeneity in input prices restrictions are imposed. As in Forssbæck and Shehzad (2015), the operating marginal costs for Y_1 and Y_2 are derived using the following two equations:

[2] The countries remaining after applying our selection criteria are Austria, Germany, Italy, and Spain.

[3] The random component (v_j) is assumed to be identically independently distributed (i.i.d.) with 0 mean and constant variance (σ_V^2). The inefficiency term (u_j) is i.i.d. with half-normal distribution and variance (σ_U^2) independent of the v_j's.

Table 1
Key indicators of cooperative banking sector.

Country	Assets	Loans	Deposits	Short-term liabilities	Equity	Net operating income	Interest income	Personnel Expenses
Austria	1,016,917	58.9%	70.3%	88.2%	7.2%	0.4%	75.7%	39.0%
Germany	962,271	57.2%	75.6%	88.6%	7.4%	0.8%	79.0%	36.6%
Italy	712,395	64.6%	51.2%	62.1%	11.6%	0.6%	82.6%	32.9%
Spain	941,591	64.9%	79.4%	87.5%	10.1%	0.6%	88.9%	23.3%
Total	888,996	59.8%	68.2%	80.6%	8.8%	0.7%	80.3%	35.1%

This table presents the average country values of key descriptive indicators for cooperative banks. Total assets are in thousand dollars. Net loans, deposits, short-term liabilities, equities and net operating income are expressed in percentage of total assets. The interest income and the personnel expenses are expressed in percentage of total income. Source: own calculation using data from Bankscope.

$$\boldsymbol{mc}_{1it} = \frac{\delta C_{it}}{\delta Y_{1,it}} = \frac{\boldsymbol{C_{it}}}{\boldsymbol{Y}_{1,it}}\left[\gamma_1 + \boldsymbol{\eta}_{11}\ln(\boldsymbol{Y}_{1,it}) + \boldsymbol{\eta}_{12}\ln(\boldsymbol{Y}_{2,it}) + \sum_{j=1}^{3}\boldsymbol{\lambda}_{j1}\ln(\boldsymbol{W}_{j,it}) + \boldsymbol{\theta}_1\boldsymbol{Tr}\right], \text{ and} \tag{3}$$

$$\boldsymbol{mc}_{2it} = \frac{\delta C_{it}}{\delta Y_{2,it}} = \frac{\boldsymbol{C_{it}}}{\boldsymbol{Y}_{2,it}}\left[\gamma_2 + \boldsymbol{\eta}_{22}\ln(\boldsymbol{Y}_{2,it}) + \boldsymbol{\eta}_{21}\ln(\boldsymbol{Y}_{1,it}) + \sum_{j=1}^{3}\boldsymbol{\lambda}_{j2}\ln(\boldsymbol{W}_{j,it}) + \boldsymbol{\theta}_2\boldsymbol{Tr}\right]. \tag{4}$$

mc_1 and mc_2 are obtained from Eqs. (3) and (4) and then substituted into Eq. (1) to calculate the Lerner Indexes for bank i at time t, thereby giving us the dynamic change in market power across banks over time.

$$\boldsymbol{LERL}_{it} = \frac{(\boldsymbol{r}_{Lit} - \boldsymbol{r}_{clt} - \boldsymbol{mc}_{1it})}{\boldsymbol{r}_{Lit}}, \text{ and} \tag{5}$$

$$\boldsymbol{LERD}_{it} = \frac{(\boldsymbol{r}_{ct} - \boldsymbol{r}_{Dit} - \boldsymbol{mc}_{2it})}{\boldsymbol{r}_{Dit}}. \tag{6}$$

where r_L and r_D are the individual bank lending and deposit rates, respectively; r_c are the country interest rate on overnight deposits.

2.2. Measuring risk exposure

We employ different measures of risk in order to account for cooperative banks' risk preferences, namely, bank solvency, credit risk and risk-adjusted performance. The Z-index is an indicator of overall bank solvency that has been used extensively in banking studies (e.g., Beck et al., 2013; Forssbæck and Shehzad, 2015). This measure provides an indication of the number of standard deviations by which returns have to diminish in order to deplete the equity of a bank. Following Mare et al. (2017), we compute the Z-Index as it follows:

$$\boldsymbol{Z - Index}_{i,t} = \frac{\boldsymbol{\mu}_{ROA,t} + \boldsymbol{E/TA}_{i,T}}{\boldsymbol{\sigma}_{ROA,t}}, \text{ with } \boldsymbol{t} \in \{1,2,\ldots,\boldsymbol{T}\} \tag{7}$$

where μ_{ROA} is the moving mean return on assets (ROA) computed using the past and current information for each period;[4] E/TA is the ratio equity to total assets for the current period (t); σ_{ROA} is the moving standard deviation of ROA computed using the past and current information for each period. The Z-index is a measure of bank solvency. Higher values imply a higher degree of soundness.

In order to gain a broader understanding of the risk profile of cooperative banks, we consider two other sources of risk. First, since cooperative banks mainly perform the traditional lending function (i.e., provision of loans), we look at credit risk. To this end, we use two financial ratios widely used in the literature that proxy for credit risk. The ratio of loan-loss reserves to gross loans to capture both past performance and the expectation of future performance (Abedifar et al., 2013) as the numerator is a stock measure of current and expected loan losses. The ratio of loan-loss provisions to gross loans account for the flow of losses in a specific year or the impact of past credit risk exposures on the current income statement.

Second, we look at performance risk. To this end, we follow Mercieca et al., (2007) and Turk Ariss (2010) and compute two risk-adjusted performance measures, the risk adjusted return on assets and the risk adjusted returns on equity:

$$\boldsymbol{ROR}_{ROA} = \frac{\boldsymbol{\mu}_{ROA,t}}{\boldsymbol{\sigma}_{ROA,t}}, \text{ with } \boldsymbol{t} \in \{1,2,\ldots,\boldsymbol{T}\} \tag{8}$$

$$\boldsymbol{ROR}_{ROE} = \frac{\boldsymbol{\mu}_{ROE,t}}{\boldsymbol{\sigma}_{ROE,t}}, \text{ with } \boldsymbol{t} \in \{1,2,\ldots,\boldsymbol{T}\} \tag{9}$$

[4] For instance, in order to compute the mean ROA for year 2004, the average ROA is computed over the period 2005–2004.

where ROR_{ROA} and ROR_{ROE} denote risk-adjusted return on assets and risk-adjusted return on equity, respectively; μ_{ROA} is the moving mean of ROA; σ_{ROA} is the moving standard deviation of ROA; μ_{ROE} is the moving mean return on equity (ROE); σ_{ROA} is the moving standard deviation of ROE.

2.3. Diversification measures and control variables

The evidence on the impact of diversification in banking industry is somewhat mixed. Some recent studies suggest that costs may outweigh benefits when banks choose to diversify their product offerings. For example, DeYoung and Roland (2001), Stiroh (2004) and Berger et al., (2010) find that diversification is negatively linked to performance.[5] The studies above focus mainly on commercial banking, but what about cooperative banks? So, one of the objectives of our study is to investigate the role of asset and liability diversification in the explanation of cooperative banking stability. We focus on diversification in assets, in customer deposits, and in sources of funding. Following Berger et al., (2010), we compute three measures of bank diversification, asset diversification (DIVASSET), deposit diversification (DIVDEPO) and liability diversification (DIVLIAB):

$$DIVASSET_{i,t} = \left(\frac{NET\ LOANS}{TOTA\ LASSETS}\right)^2 + \left(\frac{BANK\ LOANS}{TOTAL\ ASSETS}\right)^2 + \left(\frac{TOTAL\ SECURITIES}{TOTAL\ ASSETS}\right)^2 + \left(\frac{LIQUID\ ASSETS}{TOTAL\ ASSETS}\right)^2 + \left(\frac{FIXED\ ASSETS}{TOTAL\ ASSETS}\right)^2 \tag{10}$$

$$DIVDEPO_{i,t} = \left(\frac{CURRENT\ DEPOSITS}{TOTAL\ DEPOSITS}\right)^2 + \left(\frac{TERM\ DEPOSITS}{TOTAL\ DEPOSITS}\right)^2 + \left(\frac{SAVINGS\ DEPOSITS}{TOTAL\ DEPOSITS}\right)^2 \tag{11}$$

$$DIVLIAB_{i,t} = \left(\frac{TOTAL\ CUSTOMER\ DEPOSITS}{TOTAL\ LIABILITIES}\right)^2 + \left(\frac{BANK\ DEPOSITS}{TOTAL\ LIABILITIES}\right)^2 + \left(\frac{LG\ TERM\ FUNDING}{TOTAL\ LIABILITIES}\right)^2 + \left(\frac{OTHER\ LIABILITIES}{TOTAL\ LIABILITIES}\right)^2 + \left(\frac{TOTAL\ EQUITY}{TOTAL\ LIABILITIES}\right)^2 \tag{12}$$

We also incorporate in the main model a vector $\boldsymbol{X}$ of covariates that describe bank-specific characteristics and the macroeconomic environment (see for example, Athanasoglou et al., 2008; Carbó et al., 2009; and Fernandez de Guevara et al., 2005). The size variable is computed as the natural logarithm of bank total assets and it captures cost advantages associated with size and market power associated with size. The financial leverage ratio is built as total liabilities to total equity. Lastly, we control for macroeconomic variables that are expected to influence the relationship between risk preferences and competition. These include the average unemployment rate for the total population and the inflation rate. A summary of the variables used for the empirical investigation is provided in Table 2. Table 3 reports the descriptive statistics for the main variables of interest for the aggregate sample over the observed time period.

3. Empirical approach

We specify the following model to investigate the relationship between solvency risk, market power and diversification in cooperative banking:

$$Risk_{i,t} = f\left(Competition_{i,t}, Diversification_{i,t}, X_{i\mathbf{j},t}\right), \tag{13}$$

where the subscripts i, j and t denote the bank, the country and the time dimension, respectively. In line with previous studies (for instance, Beck et al., 2013), we analyse the economic causality using panel fixed-effects techniques. We specify the following relationship:

$$Risk_{i,t} = \alpha_i + \gamma_t + \beta_1 Comp_{i,t} + \beta_2 Comp_{i,t}^2 + \sum_{h=1}^{3}\omega_h Div_{h,i,t} + \sum_{k=1}^{3}\delta_k X_{k,i,t} + \sum_{\boldsymbol{m}=1}^{2}\boldsymbol{\nu_m M_{m,c,t}} + \boldsymbol{\varepsilon_{i,t}}, \tag{14}$$

where *Risk* is a risk measure: Z-index; loan-loss provisions (or loan i charges) to gross loans; the risk-adjusted return on assets; and the risk-adjusted return on equity. *Comp* is the Lerner Index; *Div* are the three diversification measures ($h \in \{1,2,3\}$): diversification in assets, diversification in customer deposits and diversification in sources of funding. X is the vector of bank-level fundamentals ($k \in \{1,2,3\}$), namely size, financial leverage and the categorical variable for listed institutions; M ($m \in \{1,2\}$) are the unemployment rate and the inflation rate; γ are year fixed-effects; α are bank fixed effects; ε indicates robust standard errors.

We include the squared term of the Lerner Index in our model as we want to capture non-linear effects running from market power on individual bank stability. Martinez-Miera and Repullo (2010) suggest that this is important to capture both the margin effect and the risk-shifting effect. As a preliminary result, Fig. 1 reports the predicted values obtained from a lin-

[5] Recent study by Doumpos et al., (2016) find that effect of diversification is not as straightforward as suggested before.

Table 2
Variables definition.

Variables	Symbol	Definition and calculation method
Risk measures		
Z-Index	ZINDEX	It is built as the sum of bank's average return on assets (ROA) and bank's average equity ratio (equity over total assets) divided by the standard deviation of ROA computed for each bank per year.
Loan loss provision ratio	LLPTL	It is built as net impairment charge in relation to the bank's loans and advances as well as off-balance sheet items during the period as percentage of total gross loans
Loan loss reserves ratio	LLRTL	It is built as reserve against possible losses on impaired or non-performing loans as percentage of total gross loans
Risk-adjusted ROA	ROR_{ROA}	Following Turk-Arris (2010), it is built as the bank's average return on assets (ROA) divided by the bank's standard deviation of ROA.
Risk-adjusted ROE	ROR_{ROE}	Following Turk-Arris (2010), it is built as the bank's average return on equity (ROE) divided by the bank's standard deviation of ROE.
Market power measure		
Lerner Index	LER	It represents the extent to which market power allows the bank to fix a price (P) above its marginal cost (MC).
Diversification measures		
Asset diversification	DIVASSET	It is built as the sum of the percentage squares (with respect to total assets) of net loans, loans and advances to banks, total securities, cash and due from banks and fixed assets. The ratio is computed per each bank in each year.
Deposit diversification	DIVDEPO	It is built as the sum of the percentage squares (with respect to to total deposits) of customer deposits current, savings and term. The ratio is computed per each bank in each year.
Liabilities diversification	DIVLIAB	It is built as the sum of the percentage squares (with respect to to total liabilities) of total customer deposits, deposits from banks, total long term funding, other liabilities and total equity. The ratio is computed per each bank in each year.
Control variables		
Size	ln_TOTA	It is built as the natural logarithm of total assets.
Financial leverage	FL	It is built as total liabilities to total equity.
Unemployment rate	UNEMP	It is the monthly average rate in December of the unemployment rate.
Inflation rate	HICP	It is the annual percentage change in the harmonized consumer price index.

This table reports the name, symbol and definition of the variables employed in the analysis. The source of data is Bureau van Dijk Bankscope and the World Bank.

ear regression of the natural logarithm of the Z-Index on the Lerner index and its square. Both coefficients are statistically significant and there appears to be a hump-shaped relationship between stability and market power.

4. Results

We estimate a panel fixed effects model in order to examine the relationship between competition (measured by *LER*) and cooperative banks' risk while controlling for diversification, bank-level fundamentals and macro variables. We report the results derived from the estimation of Eq. (14) in Table 4.

Our main variables of interest are the Lerner index and the diversification measures. Contrary to Fiordelisi and Mare (2014), we find that market power is positively related to bank stability though there exists a hump-shaped relationship signalled by the negative coefficients of the squared term (Table 4, column 2, row Lerner SQ). We ascribe this difference to the different model specification (e.g., linear relationship between stability and competition), sample and time period (i.e., 1998–2009 vs 2006–2014). The coefficients on our time dummies[6] signal a decrease in stability over time, probably due 2007–2009 global financial crises. Therefore, we may speculate that the margin effect (i.e., increase in competition decreases margins on loans) could take a toll on individual bank stability as high market power may contribute to a build-up of extra-capital buffers to absorb systemic shocks (Fiordelisi et al., 2015), which then in turn could increase individual bank stability in times of crisis. Turning to the results for the loans and deposits market, we notice a positive relationship between loan market power and individual bank stability. The quadratic terms appear to be not statistically significant in all the regressions (Table 4, Columns 3, 4 and 7). We do not find the same mechanism at work for the deposit market as the coefficients are statistically insignificant at the 10 percent level in two of the three specifications. This is also true for all the squared terms.

Further, by looking at the coefficients for both deposit and liabilities diversification we find that they are positive and statistically significant at one per cent or more (Table 4), implying that when cooperative banks employ asset diversification strategies, they increase the individual resilience due to higher margin (Martinez-Miera and Repullo, 2010). This is also true if cooperative banks strike the right balance in the diversification of their liabilities.

[6] For the sake of space, we do not report the coefficient of the time fixed-effects in Tables 4–6. Results are available from the authors upon request and show that, taking as a reference year 2006, cooperative banks' stability has decreased over time.

Table 3
Summary statistics.

Panel A: Key Descriptive statistics

Variable	Symbol	Obs	Mean	Std. Dev.	Min	Max
Z-Index	ZINDEX	10,961	104.492	188.514	4.456	1778.311
Loan loss provision ratio	LLPTL	10,925	0.006	0.010	−0.035	0.049
Loan-loss reserves to gross loans	LLRTL	5051	0.030	0.027	0.000	0.152
Risk-adjusted ROA	ROR_{ROA}	10,961	5.076	47.610	−71.418	4444.042
Risk-adjusted ROE	ROR_{ROE}	10,946	5.097	99.589	−5.190	10203.770
Lerner Index	LER	10,961	0.374	0.121	0.031	0.732
Asset diversification	DIVASSET	10,961	0.471	0.099	0.140	0.934
Deposit diversification	DIVDEPO	10,961	0.572	0.248	0.000	1.000
Liabilities diversification	DIVLIAB	10,961	0.539	0.144	0.116	1.045
Size	ln_TOTA	10,961	13.053	1.109	8.902	17.895
Financial leverage	FL	10,961	11.928	4.538	0.159	79.381
Unemployment rate	UNEMP	10,961	7.743	3.296	4.300	26.000
Inflation rate	HICP	10,961	1.812	0.938	−0.200	4.100

Panel B: Correlations

ZINDEX	1													
LLPTL	−0.032	1												
LLRTL	−0.093	0.597	1											
RORROA	0.326	0.002	−0.006	1										
RORROE	0.071	−0.003	−0.021	0.027	1									
LER	0.056	0.171	0.302	−0.003	0.004	1								
MKT LOANS	−0.061	0.074	0.071	−0.006	−0.001	−0.143	1							
MKT DEP	−0.037	−0.003	0.009	−0.005	−0.002	−0.086	0.876	1						
MKT ASSET	−0.041	0.032	0.055	−0.007	0.000	−0.084	0.795	0.788	1					
DIVASSET	−0.092	−0.087	−0.262	0.005	0.004	−0.476	0.211	0.085	0.043	1				
DIVDEPO	−0.123	0.166	0.160	0.020	0.013	−0.167	0.183	0.036	0.056	0.353	1			
DIVLIAB	0.158	−0.242	−0.278	0.030	−0.004	0.112	−0.197	0.007	−0.115	−0.321	−0.539	1		
ln_TOTA	−0.072	0.008	−0.022	−0.024	−0.001	0.025	0.502	0.564	0.452	0.093	−0.086	−0.123	1	
FL	0.026	0.075	−0.029	−0.005	−0.009	0.028	0.025	0.158	0.146	−0.231	−0.468	0.355	0.268	1

This table presents the descriptive statistics of our sample of cooperative banks in the European banking system between 2006 and 2014 for the main variables used in the model.

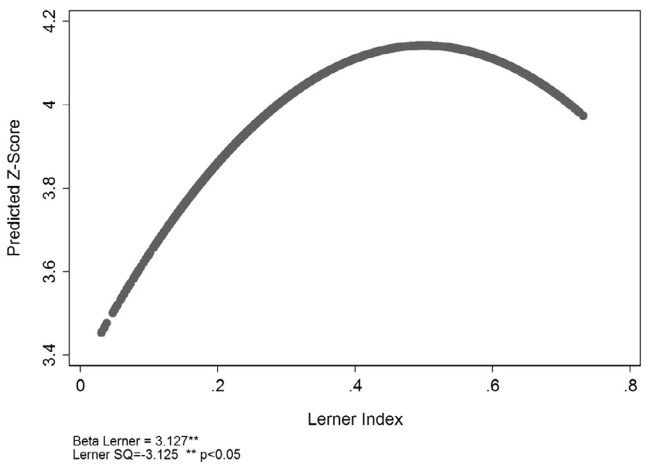

Fig. 1. Lerner index and Z-score.

Leverage, unemployment and inflation are all negative as expected. Higher leverage reflects the higher risk associated with a smaller equity base to protect against losses on risky assets. The negative coefficient on unemployment reflects the increase in the default rate caused by the contraction of the reimbursing capacity of businesses and households as well as a material reduction of demand for new loans, which could lead to a significant deterioration of the ratio between the interest bearing interest assets and liabilities. Finally, the significant negative coefficient on inflation suggests that at least part of the inflation was unanticipated. If inflation is anticipated it will be reflected in the interest rates and should have little or no material effect on bank values and stability. However, if it is unanticipated, the unexpected increase in the price level

Table 4
Estimation results for bank solvency.

Variables	(1) lnZ	(2) lnZ	(3) lnZ	(4) lnZ	(5) lnZ	(6) lnZ	(7) lnZ
$Lerner_{t-1}$	0.603***	1.178***					
	(0.092)	(0.288)					
$LernerSQ_{t-1}$		−0.796**					
		(0.395)					
$Lerner\ Loans_{t-1}$			0.581***	1.917**			1.689*
			(0.201)	(0.946)			(0.939)
$LernerSQ\ Loans_{t-1}$				−0.930			−0.798
				(0.623)			(0.619)
$Lerner\ Deposits_{t-1}$					0.066***	−0.061	−0.041
					(0.016)	(0.083)	(0.081)
$LernerSQ\ Deposits_{t-1}$						−0.015	−0.012
						(0.009)	(0.009)
$Asset\ diversification_{t-1}$	−0.163	−0.112	−0.346**	−0.347**	−0.323**	−0.334**	−0.297**
	(0.148)	(0.146)	(0.147)	(0.147)	(0.150)	(0.151)	(0.150)
$Deposit\ diversification_{t-1}$	0.241***	0.241***	0.228***	0.235***	0.264***	0.262***	0.266***
	(0.076)	(0.076)	(0.075)	(0.075)	(0.076)	(0.076)	(0.076)
$Liabilities\ diversification_{t-1}$	0.356**	0.342**	0.275*	0.269*	0.334**	0.312**	0.308**
	(0.144)	(0.144)	(0.143)	(0.143)	(0.144)	(0.144)	(0.143)
$Size_{t-1}$	0.050	0.051	0.069	0.077	0.059	0.070	0.056
	(0.071)	(0.070)	(0.073)	(0.072)	(0.071)	(0.071)	(0.071)
$Financial\ leverage_{t-1}$	−0.042***	−0.043***	−0.043***	−0.044***	−0.043***	−0.043***	−0.044***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$Unemployment_{t-1}$	−0.054***	−0.053***	−0.054***	−0.054***	−0.059***	−0.058***	−0.055***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
$Inflation_{t-1}$	−0.107***	−0.109***	−0.119***	−0.122***	−0.108***	−0.111***	−0.111***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Constant	4.304***	4.181***	4.047***	3.486***	4.712***	4.367***	3.748***
	(0.920)	(0.922)	(0.930)	(0.987)	(0.925)	(0.929)	(0.983)
Bank FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	9678	9678	9678	9678	9678	9678	9678
R-squared	0.298	0.298	0.292	0.293	0.293	0.293	0.295
Number of BANKID	1260	1260	1260	1260	1260	1260	1260

This table reports the results from the estimation of Eq. (14). We use a panel fixed effects model with robust standard errors clustered at the individual bank level. The sample includes the European cooperative banks in EU5 over the period 2006–2014. The symbols *, **, and *** represent significance levels at the 10%, 5% and 1% respectively. Robust standard errors appear in parentheses.

Table 5
Estimation results using different risk measures.

Variables	(1) LLPTLi	(2) LLPTLi	(3) LLRTLi	(4) LLRTLi	(5) lnRORroa	(6) lnRORroa	(7) lnRORroe	(8) lnRORroe
$Lerner_{t-1}$	0.024***		−0.034**		1.407***		1.403***	
	(0.006)		(0.015)		(0.430)		(0.497)	
$LernerSQ_{t-1}$	−0.025***		0.096***		−0.986*		−0.948	
	(0.009)		(0.024)		(0.570)		(0.625)	
$Lerner\ Loans_{t-1}$		0.032**		−0.077		1.531		1.437
		(0.014)		(0.059)		(1.249)		(1.365)
$LernerSQ\ Loans_{t-1}$		−0.017*		0.085**		-0.795		−0.849
		(0.010)		(0.038)		(0.814)		(0.886)
$Lerner\ Deposits_{t-1}$		0.006***		0.010**		−0.038		−0.132
		(0.001)		(0.005)		(0.127)		(0.140)
$LernerSQ\ Deposits_{t-1}$		0.001***		0.001		−0.010		−0.021
		(0.000)		(0.001)		(0.015)		(0.017)
$Asset\ diversification_{t-1}$	−0.004*	−0.006**	−0.043***	−0.045***	0.049	−0.209	0.139	−0.148
	(0.003)	(0.003)	(0.008)	(0.008)	(0.214)	(0.223)	(0.215)	(0.227)
$Deposit\ diversification_{t-1}$	−0.005***	−0.004**	−0.020***	−0.017***	0.137	0.152	0.254	0.268
	(0.002)	(0.002)	(0.006)	(0.006)	(0.108)	(0.111)	(0.190)	(0.181)
$Liabilities\ diversification_{t-1}$	−0.029***	−0.027***	−0.041***	−0.038***	0.893***	0.838***	0.607***	0.533***
	(0.003)	(0.003)	(0.008)	(0.007)	(0.202)	(0.197)	(0.195)	(0.196)
$Size_{t-1}$	0.004***	0.004***	−0.013***	−0.015***	−0.000	0.023	0.004	0.043
	(0.001)	(0.001)	(0.005)	(0.005)	(0.107)	(0.105)	(0.098)	(0.105)

(*continued on next page*)

Table 5 (*continued*)

Variables	(1) LLPTLi	(2) LLPTLi	(3) LLRTLi	(4) LLRTLi	(5) lnRORroa	(6) lnRORroa	(7) lnRORroe	(8) lnRORroe
Financial leverage$_{t-1}$	0.000	0.000	0.002***	0.002***	0.008	0.007	0.002	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.012)	(0.012)	(0.009)	(0.009)
Unemployment$_{t-1}$	0.001***	0.001***	0.001*	0.001*	−0.064***	−0.067***	−0.058***	−0.062***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.007)	(0.007)	(0.006)	(0.007)
Inflation$_{t-1}$	0.002***	0.002***	−0.004***	−0.003***	−0.134***	−0.142***	−0.154***	−0.165***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.023)	(0.023)	(0.024)	(0.026)
Constant	−0.048***	−0.035**	0.219***	0.272***	0.957	0.527	0.979	0.312
	(0.013)	(0.014)	(0.066)	(0.076)	(1.325)	(1.461)	(1.296)	(1.586)
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9657	9657	4675	4675	9678	9678	9673	9673
R-squared	0.249	0.251	0.567	0.569	0.213	0.209	0.195	0.191
Number of BANKID	1259	1259	1114	1114	1260	1260	1259M	1259

This table reports the results from the estimation of Eq. (14). We use a panel fixed effects model with robust standard errors clustered at the individual bank level. The sample includes the European banks in EU5 over the period 2006–2014. The symbols *, **, and *** represent significance levels at the 10%, 5% and 1% respectively. Robust standard errors appear in parentheses.

Table 6
Estimation results for bank solvency (no Germany or no Italy).

Variables	(1) lnZ	(2) lnZ	(3) lnZ	(4) lnZ
Lerner$_{t-1}$	1.803***		0.969**	
	(0.380)		(0.390)	
LernerSQ $_{t-1}$	−1.110**		−0.807	
	(0.514)		(0.502)	
Lerner Loans $_{t-1}$		7.449***		−1.015
		(1.371)		(1.092)
LernerSQ Loans $_{t-1}$		−4.394***		1.232*
		(0.922)		(0.716)
Lerner Deposits $_{t-1}$		−0.205		0.189**
		(0.129)		(0.089)
LernerSQ Deposits $_{t-1}$		−0.024*		0.011
		(0.014)		(0.010)
Asset diversification $_{t-1}$	0.524***	−0.007	−0.317	−0.434**
	(0.181)	(0.179)	(0.198)	(0.202)
Deposit diversification $_{t-1}$	0.259***	0.237**	0.206**	0.212**
	(0.091)	(0.092)	(0.089)	(0.089)
Liabilities diversification $_{t-1}$	0.791***	0.490***	0.235	0.265
	(0.154)	(0.157)	(0.169)	(0.166)
Size $_{t-1}$	0.182***	0.184***	0.045	0.017
	(0.028)	(0.030)	(0.033)	(0.034)
Financial leverage $_{t-1}$	−0.080***	−0.077***	−0.033***	−0.032***
	(0.008)	(0.008)	(0.005)	(0.005)
Unemployment $_{t-1}$	−0.012*	−0.005	−0.053***	−0.056***
	(0.007)	(0.008)	(0.006)	(0.006)
Inflation $_{t-1}$	−0.012	−0.017	−0.145***	−0.133***
	(0.020)	(0.020)	(0.042)	(0.040)
Constant	1.261***	−1.316*	4.629***	5.753***
	(0.406)	(0.714)	(0.490)	(0.699)
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Observations	3718	3718	6769	6769
R-squared	0.452	0.452	0.198	0.206
Number of BANKID	488	488	880	880

This table reports the results from the estimation of Eq. (14). We use a panel fixed effects model with robust standard errors clustered at the individual bank level. In column (1) and (2), German banks are excluded from the estimation; in column (3) and (4), Italian banks are excluded from the estimation. The symbols *, **, and *** represent significance levels at the 10%, 5% and 1% respectively. Robust standard errors appear in parentheses.

Table 7
Estimation results for bank solvency (including CAMELS indicators).

Variables	(1) lnZ	(2) lnZ	(3) lnZ	(4) lnZ	(5) lnZ	(6) lnZ	(7) lnZ
$Lerner_{t-1}$	0.709***	1.157***					
	(0.099)	(0.270)					
$LernerSQ_{t-1}$		−0.615					
		(0.386)					
$Lerner\ Loans_{t-1}$			0.607***	1.761**			1.600*
			(0.198)	(0.879)			(0.870)
$LernerSQ\ Loans_{t-1}$				−0.803			−0.709
				(0.592)			(0.588)
$Lerner\ Deposits_{t-1}$					0.069***	−0.028	−0.006
					(0.017)	(0.082)	(0.080)
$LernerSQ\ Deposits_{t-1}$						−0.011	−0.009
						(0.009)	(0.009)
$Asset\ diversification_{t-1}$	−0.209	−0.166	−0.421***	−0.420***	−0.390**	−0.398**	−0.363**
	(0.152)	(0.150)	(0.153)	(0.153)	(0.155)	(0.156)	(0.155)
$Deposit\ diversification_{t-1}$	0.104	0.110	0.101	0.111	0.141*	0.140*	0.141*
	(0.080)	(0.080)	(0.079)	(0.079)	(0.081)	(0.081)	(0.080)
$Liabilities\ diversification_{t-1}$	0.399***	0.387***	0.303**	0.296**	0.360**	0.343**	0.342**
	(0.148)	(0.148)	(0.148)	(0.148)	(0.149)	(0.149)	(0.149)
$Size_{t-1}$	0.038	0.040	0.066	0.075	0.060	0.067	0.050
	(0.072)	(0.072)	(0.074)	(0.073)	(0.072)	(0.072)	(0.073)
$Financial\ leverage_{t-1}$	−0.029***	−0.029***	−0.033***	−0.034***	−0.031***	−0.032***	−0.032***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$Unemployment_{t-1}$	−0.049***	−0.049***	−0.051***	−0.051***	−0.056***	−0.055***	−0.052***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
$Inflation_{t-1}$	−0.108***	−0.110***	−0.123***	−0.125***	−0.111***	−0.113***	−0.112***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
L.Cap_adequacy	2.345**	2.348**	1.756*	1.760*	2.199**	2.176**	2.140*
	(1.093)	(1.084)	(1.023)	(1.020)	(1.111)	(1.107)	(1.098)
L.Asset_quality	−2.604***	−2.604***	−1.967***	−1.911***	−1.786***	−1.724***	−1.900***
	(0.597)	(0.596)	(0.585)	(0.582)	(0.596)	(0.595)	(0.596)
L.Mngmt_quality	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.Earnings	−0.902	−0.923*	0.197	0.226	−0.143	−0.162	−0.307
	(0.557)	(0.551)	(0.909)	(0.911)	(0.901)	(0.883)	(0.832)
L.Liquidity	−0.389	−0.434	0.025	−0.053	−0.158	−0.185	−0.389
	(1.038)	(1.039)	(1.051)	(1.051)	(1.079)	(1.074)	(1.062)
L.Sensitivity_MktRisk	0.272***	0.261***	0.268***	0.260***	0.249***	0.245***	0.254***
	(0.084)	(0.084)	(0.085)	(0.085)	(0.085)	(0.085)	(0.084)
Constant	4.067***	3.958***	3.778***	3.278***	4.383***	4.144***	3.591***
	(0.958)	(0.958)	(0.974)	(1.009)	(0.974)	(0.980)	(1.014)
Bank FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	9575	9575	9575	9575	9575	9575	9575
R-squared	0.307	0.308	0.300	0.300	0.301	0.301	0.303
Number of BANKID	1259	1259	1259	1259	1259	1259	1259

This table reports the results from the estimation of Eq. (14) including CAMELS indicators. We use a panel fixed effects model with robust standard errors clustered at the individual bank level. The sample includes the European cooperative banks in EU5 over the period 2006–2014. The symbols *, **, and *** represent significance levels at the 10%, 5% and 1% respectively. Robust standard errors appear in parentheses.

causes a reduction in the exchange value of nominal assets and liabilities in terms of real goods. Since nominal bank assets are typically larger than nominal liabilities, bank owners typically lose wealth when there is unanticipated inflation.

The empirical literature on the nexus of competition and stability underlines potential endogeneity issues in the estimation of Eq. (14) (see for example Koetter et al., 2012; Beck et al., 2013; and Anginer et al., 2014). We tackle this issue by employing different dependent variables that capture diverse aspects of cooperative banks' risk exposure. The results, displayed in Table 5, are qualitatively the same and support the non-linearity in the relationship between market power and individual cooperative banks' stability. Furthermore, the differentiation between the market power in the loans and deposits market is again important to explain cooperative banks' exposure to risk. Diversification measures are again statistically significant but negatively related to increases in loan loss provisions.

4.1. Robustness checks

In order to further confirm the aforementioned findings, we conduct some additional robustness checks. We recognise that two countries dominate the sample and investigate whether this feature can affect the robustness of our results. So,

Table 8
Estimation results using different risk measures (including CAMELS indicators).

Variables	(1) LLPTLi	(2) LLPTLi	(3) LLRTLi	(4) LLRTLi	(5) lnRORroa	(6) lnRORroa	(7) lnRORroe	(8) lnRORroe
$Lerner_{t-1}$	0.019***		−0.044***		1.614***		1.781***	
	(0.006)		(0.016)		(0.417)		(0.495)	
$LernerSQ_{t-1}$	−0.023***		0.080***		−1.132**		−1.147*	
	(0.009)		(0.024)		(0.570)		(0.621)	
Lerner $Loans_{t-1}$		0.035**		−0.105*		1.655		1.505
		(0.014)		(0.056)		(1.190)		(1.326)
LernerSQ $Loans_{t-1}$		−0.021**		0.090**		−0.838		−0.805
		(0.010)		(0.036)		(0.788)		(0.856)
Lerner $Deposits_{t-1}$		0.005***		0.009**		−0.004		−0.103
		(0.001)		(0.004)		(0.131)		(0.146)
LernerSQ $Deposits_{t-1}$		0.000***		0.001		−0.005		−0.019
		(0.000)		(0.000)		(0.015)		(0.017)
Asset $diversification_{t-1}$	−0.005*	−0.005**	−0.049***	−0.046***	−0.020	−0.312	0.160	−0.188
	(0.002)	(0.003)	(0.008)	(0.007)	(0.219)	(0.227)	(0.222)	(0.232)
Deposit $diversification_{t-1}$	−0.005***	−0.005***	−0.020***	−0.017***	0.107	0.125	0.172	0.200
	(0.002)	(0.002)	(0.006)	(0.006)	(0.116)	(0.113)	(0.178)	(0.169)
Liabilities $diversification_{t-1}$	−0.027***	−0.026***	−0.038***	−0.033***	0.847***	0.781***	0.596***	0.506**
	(0.003)	(0.003)	(0.007)	(0.007)	(0.201)	(0.198)	(0.198)	(0.197)
$Size_{t-1}$	0.005***	0.005***	−0.010**	−0.012**	0.023	0.054	−0.054	−0.008
	(0.001)	(0.001)	(0.005)	(0.005)	(0.108)	(0.106)	(0.097)	(0.096)
Financial $leverage_{t-1}$	−0.000	−0.000	0.001	0.001	0.018	0.014	0.013	0.008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.015)	(0.010)	(0.010)
$Unemployment_{t-1}$	0.001***	0.001***	0.000	−0.000	−0.066***	−0.070***	−0.061***	−0.067***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.007)	(0.007)	(0.006)	(0.007)
$Inflation_{t-1}$	0.001***	0.002***	−0.005***	−0.004***	−0.125***	−0.134***	−0.149***	−0.162***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.024)	(0.025)	(0.024)	(0.027)
L.Cap_adequacy	0.014	0.019	−0.202***	−0.190***	1.572	1.154	2.391*	1.951
	(0.014)	(0.014)	(0.054)	(0.055)	(2.022)	(2.057)	(1.239)	(1.260)
L.Asset_quality	0.072***	0.072***	0.315***	0.310***	−2.502**	−1.646	−1.135	0.003
	(0.024)	(0.024)	(0.044)	(0.044)	(1.213)	(1.249)	(1.546)	(1.594)
L.Mngmt_quality	−0.000	−0.000	−0.000***	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.Earnings	0.020	0.017	0.383***	0.473***	−0.253	0.792	−5.016***	−3.840**
	(0.016)	(0.015)	(0.124)	(0.103)	(0.839)	(0.750)	(1.057)	(1.552)
L.Liquidity	0.018	0.015	0.067	0.057	1.143	1.454	−0.334	0.000
	(0.020)	(0.019)	(0.045)	(0.046)	(1.544)	(1.569)	(1.503)	(1.483)
L.Sensitivity_MktRisk	0.003*	0.003*	0.000	0.001	0.048	0.047	0.023	0.010
	(0.002)	(0.002)	(0.005)	(0.004)	(0.144)	(0.146)	(0.144)	(0.146)
Constant	−0.062***	−0.056***	0.212***	0.269***	0.408	−0.027	1.528	0.952
	(0.014)	(0.016)	(0.067)	(0.077)	(1.413)	(1.522)	(1.324)	(1.433)
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9565	9565	4664	4664	9575	9575	9570	9570
R-squared	0.264	0.266	0.598	0.603	0.221	0.215	0.204	0.197
Number of BANKID	1259	1259	1114	1114	1259	1259	1258	1258

This table reports the results from the estimation of Eq. (14). We use a panel fixed effects model with robust standard errors clustered at the individual bank level. The sample includes the European banks in EU5 over the period 2006–2014. The symbols *, **, and *** represent significance levels at the 10%, 5% and 1% respectively. Robust standard errors appear in parentheses.

we estimate Eq. (14) by excluding German banks (Table 6, columns 1 and 2) or by excluding Italian banks (Table 6, columns 3 and 4) from our analysis. We find that the Lerner Index remains highly significant and confirm the hump-shaped relationship in the loans market when German or Italian banks are excluded. In addition, the diversification measures are still statistically significant supporting our view that the diversifications of assets as well as the diversification of liabilities are important determinants of cooperative bank stability.

We also extend our analysis to include the CAMELS indicators in our main model (14). We thank the referee for this useful suggestion. Tables 7 and 8 present additional variables of interest. In all cases, the results remain statistically and economically significant, consistent with our main findings, and suggesting that these concerns do not drive our main results. The results for CAMELS indicators are similar to those found in the literature (see for example, Acharya et al. (2017), Bassett et al. (2015) and Duchin and Sosyura, 2014).

5. Conclusions

Cooperative banks are key credit institutions for the sustainable development of local economies. Despite their importance, only a few studies have assessed the relationship between competition and the individual financial stability

of European cooperative banks. Moreover, these credit institutions deserve specific treatment for the distinctive features that characterize their business model.

Our paper empirically advances the literature by analysing a large sample of cooperative banks in the European Union between 2006 and 2014. We employ a modified Lerner index to disentangle the market power in loans and deposits and account for the specific business model orientation of cooperative banks. We also test whether there exists a non-linear relationship between competition and stability in cooperative banking. In addition, we include in the analysis diversification measures that are better able to explain the exposure to different risk dimensions.

We find that competition decreases individual bank stability but that there exists a hump-shaped relationship, probably driven by market power in the loans market. Market power in the deposits market appears to be linearly and positively related to bank solvency. Diversification measures are significantly and positively related to individual bank stability. Overall our findings show that it is tantamount to carefully account for cooperative banks' specific features whilst assessing the relationship between market power and stability in cooperative banking.

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