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THE UNFOLDING OF EURO AREA BANKS' PROFITABILITY – A COMPARISON BETWEEN PERIPHERAL AND CORE COUNTRIES

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Resumo

Neste estudo analisamos os fatores específicos aos bancos, à indústria e à economia, que afetam a rentabilidade de 3.046 bancos da zona Euro entre 2006 e 2015. Para o efeito, dividimos a nossa amostra entre bancos dos países periféricos e dos países centrais e incluímos um número significativo de bancos não cotados, dado representarem a maioria dos bancos na União Europeia.

Os nossos resultados confirmam a relevância das provisões de crédito, das receitas não decorrentes de juros, rácio de eficiência, crescimento do total dos ativos, parcela dos depósitos, crescimento do PIB e taxas de juro, como determinantes significativas da rentabilidade dos bancos da zona Euro, quando analisados em conjunto. A este respeito, uma vez atenuado o uso da política monetária menos convencional, que promoveu a existência de taxas de juro muito baixas por longo tempo, e encontrada uma solução para o problema Europeu do crédito vencido, espera-se que os lucros dos bancos sejam impulsionados. Inversamente, quando os bancos periféricos e dos países centrais são analisados em separado, encontramos efeitos assimétricos entre os grupos. O peso das provisões de crédito é, em média, pelo menos 3 vezes superior nos bancos periféricos. Similarmente, o impacto das provisões de crédito nos níveis de rentabilidade durante o período da crise financeira entre 2008 e 2013 foi significativamente agravado nos bancos periféricos. Por fim, verificamos que a melhoria dos níveis de eficiência e uma maior concentração bancária aumentam os lucros dos bancos periféricos. Em contrapartida, o efeito positivo dos depósitos de clientes sugere que os bancos dos países centrais fazem melhor uso desta fonte de financiamento.

Classificações JEL: G21, G28

Palavras-chave: Rentabilidade dos bancos, Zona Euro, países periféricos, países centrais, provisões de crédito

Abstract

In this paper, we analyze how bank-specific, industry-specific and macroeconomic determinants affect the profitability of 3.046 banks across 19 Euro area countries, from 2006 to 2015. We split our sample of Euro area banks into peripheral and core countries' banks and include a significant number of unlisted banks, as they represent most banks in the European Union.

Our results confirm the relevance of loan loss provisions, non-interest income share, cost-to-income ratio, total assets growth rate, deposit funding share, GDP growth and interest rates as important drivers of banks' profitability, when all Euro area banks are analyzed together. In this respect, once eased the unconventional monetary policy measures, which stimulated a low interest rates environment for a long time, and a solution for the European non-performing loans problem is found, banks' returns are likely to boost. Conversely, when peripheral and core countries' banks are separately assessed, we find an asymmetric effect of some components between both groups. The loan loss provisions burden is, on average, at least 3 times larger in peripheral banks. Similarly, the impact of loan loss provisions on profitability levels during the 2008-2013 financial crisis period was significantly more severe in peripheral banks. Finally, our results suggest that the improvement of efficiency levels and higher bank concentration increase the returns of peripheral banks. In contrast, the positive effect of customer deposits suggests that core countries' banks make better use of this source of funding.

JEL Classification: G21, G28

Key Words: Bank profitability, Euro area, peripheral countries, core countries, loan loss provisions

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Acronyms

AR(1)	First-order autocorrelation
AR(2)	Second-order autocorrelation
AR(3)	Third-order autocorrelation
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CRR	Capital Requirements Regulation (EU) No 575/2013
DGS	Deposit Guarantee Scheme
EBA	European Banking Authority
ECB	European Central Bank
EFSF	European Financial Stability Facility
EMU	Economic and Monetary Union
ESM	European Stability Mechanism
ESS	Efficient-structure Hypothesis
EU	European Union
EUR	Euro currency
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HHIIC	Herfindahl–Hirschman index of industry concentration
IASB	International Accounting Standard Board
IFRS 9	International Financial Reporting Standard 9
LLP	Loan Loss Provisions
NPL	Non-performing Loans
OLS	Ordinary Least Squares
ROA	Return on Assets
ROAA	Return on Average Assets
ROAE	Return on Average Equity
SCP	Structure-conduct-performance
SIFI	Systemically Important Financial Institutions
SRM	Single Resolution Mechanism
SSM	Single Supervisory Mechanism
VIF	Variance Inflation Factor

1 Introduction

The Economic and Monetary Union (EMU), in 1999, represented a major step in the integration of European Union (EU) economies. The process of economic and financial integration lowered the obstacles to cross-border investments in the Euro area debt markets and fostered capital flows across EU Member States. Specifically, countries with public accounts surpluses (core countries) significantly increased their exposure to countries with public account deficits (peripheral countries), triggering a period of credit boom and relatively cheap financing.

Credit booms are not rare and usually precede financial crises posing several challenges to macroeconomists and regulators. In Europe, the Greek sovereign-debt crisis, initiated in 2009, quickly spread to the country's banking system. Other financially stressed countries, instead, had the private financial sector at the epicenter of their crisis which later extended to their sovereign debts. The two-way interaction between banks and sovereigns is stressed by Caruana and Avdjiev (2012) which reveal that, due the inter-dependence of European economies, the misjudgment of risks by the banking sector can undermine the financial stability of all Member States. As a matter of fact, Constâncio (2014) argues that the Euro area crisis was first and foremost a banking crisis.

Against this background, the European banking system has been observing a growing trend of non-performing loans (NPL) over the past years, weighting on the low aggregate profitability of banks (Constâncio, 2017). Nowadays, the Euro area banking sector continues to struggle to restore confidence and the profitability remains a major challenge, with the European banks failing to get back on the path of sustainable level of profits (EBA, 2016). Indeed, the evolution of banks' profitability has been quite uneven between peripheral and core countries banks. Therefore, although the NPL problem assumes a clear European dimension that amounts to over 9% of the Euro area GDP at end-2016, the behavior of profitability between these two banking systems has been quite distinct and deserve greater attention.

The asymmetries across Europe is a topic that assumes greater importance in the context of Banking Union. Following the creation of the Single Supervisory Mechanism (SSM) and the Single Resolution Mechanism (SRM), the harmony in the supervision calls for a third pillar, the Deposit Guarantee Scheme (DGS). However, a common DGS has been a topic of increasing debate, with critics arguing that a mutualized scheme cannot be conceived until risks inherent to national banking sectors are contained and become more homogeneous.

The existing literature on banking theory is quite large. Previous studies provide a comprehensive assessment of bank profitability based on bank-specific, industry-specific and

macroeconomic determinants. Regarding European banks, however, most of the papers study this topic within a single-country perspective (e.g., Athanasoglou *et al.*, 2006; Iannotta *et al*., 2007; and Mergaerts and Vennet, 2016), or consider Europe as a whole (e.g., Athanasoglou *et al*., 2008; Chiorazzo *et al*., 2008; and Dietrich and Wanzenried, 2011). The common belief in these studies is that risks in the banking sectors of EU members have become increasingly homogeneous due to increased financial integration (Poghosyan and Čihak, 2011). To the best of our knowledge, there is no specific empirical investigation that compares the potential differences in the determinants of bank profitability between peripheral and core countries' banking systems.

Our study builds on the work of Athanasoglou *et al.* (2008), Flamini *et al.* (2009) and García-Herrero *et al.* (2009) that accommodate the use of a dynamic linear model and analyze the effect of bank-specific, industry-specific and macroeconomic determinants on bank profitability. The definition of peripheral countries, or financially stressed economies, and core countries, or non-financially stressed economies, groups is made in accordance with Constâncio (2014, 2015) and ECB (2017b).

Therefore, the main purpose of our study is threefold. First, we aim to investigate to what extent the effects of the determinants of all Euro area banks' profitability are significantly asymmetric between peripheral and core countries' banks. Second, in line with the sharp rise of peripheral banks' NPL levels, we investigate if the analogous contribution of loan loss provisions (LLP) on banks' returns is greater on peripheral banks. Lastly, we test whether the 2008-2013 financial crisis period introduced a significant change in the relationship of LLP and banks' profitability across peripheral and core countries' banks.

In order to do so, we use a large sample of 3.046 banks across 19 Euro area countries over the period 2006-2015. We conduct a generalized method of moments (GMM) model, as developed by Arellano and Bover (1995) and Blundell and Bond (1998), with Windmeijer (2005) finite-sample corrected standard errors that controls for the persistence of banks' profitability over time and potential endogeneity problems. The robustness of the results is performed using a fixed effects model with robust standard errors that controls for both bank and time fixed effects. This alternative approach relies on the work of Ahamed (2017), Athanasoglou *et al.* (2006) and Demirgüç-Kunt and Huizinga (2010).

Our results confirm the statistical relevance of loan loss provisions, non-interest income share, cost-to-income ratio, total assets growth rate, deposit funding share, GDP growth and interest rates as explanatory variables of banks' profitability, when all Euro area banks are assessed

together in both models. In this respect, interest rates and loan loss provisions stand out as the components that more contribute to explaining the variation of banks' profitability levels.

Nevertheless, our results point out to asymmetric effects of these components between peripheral and core countries' banks. The contribution of LLP on banks' profitability is, at least, 3 times higher on peripheral banks when compared to core countries' banks. Likewise, we provide empirical evidence concerning the worsened effect of LLP on the profitability ratio (ROAA) of peripheral banks during the Euro area financial crisis. These results not only reflect the steep increase of NPL level on these economies, but also confirm, to some extent, the procyclical feature of provisioning policies in economic downturn periods.

Finally, we identify other determinants of banks' profitability that are statistically different between peripheral and core countries' banks. Our results suggest that the improvement of efficiency levels significantly increase the returns of peripheral banks in comparison to core countries' banks. In the opposite side, the positive effect of customer deposits on core countries' banks returns suggest they make better use of this type of funding and have greater success in passing the cost to fleet-footed customers. As to bank concentration, only in the peripheral banking systems the levels of profitability appear to benefit most from greater market share.

In this study, we examine these results and draw some policy considerations with respect to monetary policy, prudential regulation, accounting standards and risk measurement practices. From a monetary policy angle, we contribute with the finding that banks are likely to boost their profits once eased the unconventional measures carried out by the European Central Bank (ECB), such as applying negative short-term interest rates. On the other hand, from a micro and macroprudential perspective, credit risk exposure continues to be the bank-specific leading source of problems in financial institutions. Consequently, not only the NPL issue must be solved with the appropriate urgency, but also credit granting and management practices should be significantly improved and subject to greater attention by regulatory and supervisory authorities.

Similarly, the efficiency levels are also a driver of banks' return. Our considerations envisage, however, higher benefits on peripheral banks returns. As to the sustainability of more conventional banks' business models, competent authorities need to promote an efficient management of customers' deposits as the main source of funding and reduce the risk of banks following unsustainable business models. This insight is of particular interest to peripheral banks, for which, in contrast to core countries' banks, no positive relationship between customer deposits and banks' profitability is found.

Finally, since bank concentration in peripheral banking systems is found to induce higher banks' profitability, regulators need to be cautious with the "too-big-to-fail" institutions and their side effects.

The remainder of this dissertation is structured as follows. Section 2 surveys the relevant literature on the reasons underlying Euro area financial crisis and the creation of Banking Union, addresses the importance of credit risk and its cyclical pattern during downturn periods and identifies additional components of banks' profitability. Section 3 formulates the hypotheses under analysis. Section 4 describes the data and the measures of profitability, while Section 5 outlines the regression framework. Section 6 presents the results of our empirical analysis and Section 7 exhibits the robustness checks. Section 8 concludes.

2 Theoretical background

2.1 Banking Union: A legacy of the Euro area financial crisis?

The creation of the EMU, in 1999, is a milestone in the integration of EU economies. It denoted an important systemic change that involved the coordination of economic and fiscal policies, and the implementation of a common monetary policy and a common currency, the Euro. In view of this change, banks reassessed their strategic orientation and the EU banking systems changed to a more competitive environment, a greater internationalization, geographical diversification and bank consolidation. However, the increased bank competition triggered by financial liberalization had also a negative impact on prudent bank behavior (Hellmann *et al.*, 2000).

In mid-2008, the global financial crisis emerged in the aftermath of Lehman Brothers collapse, with the EU relatively unscathed by its effects. Evidence of the success of Euro was ample, contrasting with the gloomy view of some economists about the feasibility of a European common currency (e.g., Feldstein, 1997; and Friedman, 2007). Yet, in the fall of 2009, warning alarms sounded loud to the European financial markets after the Greek government announcement of a fiscal deficit (15.6%) much higher than the 6% projected and the government bonds interest-rates steep upward trend (Provopoulos, 2014). The eminent Greek sovereign-debt crisis quickly spread to the banking system and the Greek banks were not left unaffected (Gibson *et al*., 2014).

The two-way interaction between banks and sovereigns can be uncovered through several channels (BIS, 2011; Caruana and Avdjiev, 2012). For instance, the hidden weaknesses in the balance sheets of banks during credit booms contribute to an economic activity slowdown. The consequent collapse of tax revenues and increase of social expenditures weaken the government fiscal accounts, enhancing public debt levels. Additionally, the deadlock situation of systemically important financial institutions (SIFI) facing the threat of bankruptcy leave no room for governments but to provide financial support to such institutions, thereby increasing governments financial obligations.

Conversely, pressures on public accounts also affect banks in several ways. Caruana and Avdjiev (2012) stress the home bias situation, which involves direct exposures of banks to home government bonds, and shed light to the large amounts of domestic government bonds held by national banks in countries with a high public debt ratio. Similarly, to the extent that sovereign securities are used by banks as collateral to secure funding, a deterioration of sovereign risk

increases funding price. Last, but in a subtler way, a government in a weak fiscal position might raise doubts regarding its ability to back up banks in financial distress. This side effect tends to be reflected in downgrades of bank ratings by the credit ratings agencies.

In contrast to the Greek financial crisis, other financially stressed Euro area countries began their financial crises from within the banking sector (Provopoulos, 2014). The process of financial integration that followed the consolidation of EMU lowered the obstacles to cross-border investments in Euro area debt markets, fostering capital flows across EU Member States. The large capital flows from countries with account surpluses to countries with account deficits[1] is, indeed, pointed out as one of the motives for the large imbalances between peripheral and core countries[2] (Beck *et al.*, 2016; Caruana and Avdjiev, 2012; Honkapohja, 2014; Provopoulos, 2014).

The crisis revealed in particular that the misjudgment of risks by the banking sector can undermine the financial stability of the entire Member States. The architecture of stability in the Euro area exposed critical gaps and in the years preceding the crisis important measures have been undertaken. Crisis-ridden economies implemented adjustment programs and financial support measures, such as the European Financial Stability Facility (EFSF) and European Stability Mechanism (ESM), were developed as part of the comprehensive policy response. The return to healthy banks' balance sheets and the removal of risks affecting economies under stress, however, came along with a precondition: the creation of a single supervisory mechanism (SSM), the first pillar of the Banking Union.

This mechanism aims to facilitate a more systemic approach to tracking the buildup of risk concentrations and contributes to achieve a comprehensive macro prudential oversight of the Euro area. Notwithstanding, the Banking Union introduced two more pillars, the Single Resolution Mechanism (SRM) and the deposit guarantee schemes (DGS) Directive. The SRM was created with the purpose of allowing a bank resolution to be managed effectively through a single resolution board and a single resolution fund financed by the banking sector. In this way, an orderly resolution of failing banks with minimal costs to taxpayers and to the real economy is expected. This procedure ensures, therefore, that a bank failure does not harm the broader economy or cause financial instability.

[1] In this regard, Constâncio (2015) notes that the exposures of banks from core to peripheral countries more than quintupled between 1999 and 2008.

[2] Although Constâncio (2014) refers initially to stressed and non-stressed countries, he published later an article where the denomination is changed to peripheral and core countries, respectively (Constâncio, 2015). In both papers, the ECB Vice-President delimits stressed economies to Ireland, Portugal, Spain, Italy, Greece, Cyprus and Slovenia. This scope is also used in ECB (2017b).

Summarily, the European project for the banking sector with a common supervisor, resolution mechanism and safety net is expected to lay the foundation for long-term stability, and reverse the fragmentation of sub-zones of greater or lesser confidence (Goyal *et al*., 2013).

Nowadays, the third pillar of the Banking Union, a common DGS, still remains to be raised. This topic has been the subject of increasing debate with critics arguing that a mutualized scheme cannot be conceived until risks inherent to national banking sectors are contained and become more homogeneous. In this regard, the existing literature supports the view that a common deposit guarantee can generate perverse effects. Indeed, the provision of protection to market participants may diminish the costs of pursuing riskier strategies and encourage excessive risk taking – the moral hazard problem (Chan *et al.*, 1992; Keeley, 1990; Ngalawa *et al.*, 2016).

2.2 The importance of credit risk and the strategy of the Banking Union to tackle non-performing loans

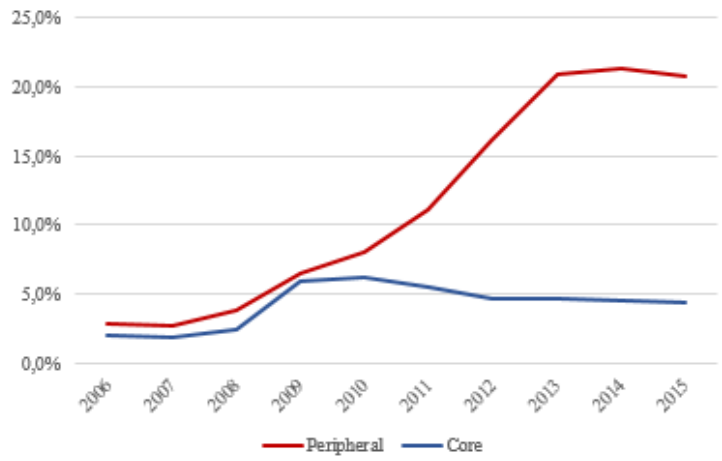
The financial crisis of 2008 made it clear that the period of credit boom and relatively cheap financing in the Euro area until then was not accompanied by rigorous credit granting and monitoring processes. The importance of bank governance on credit risk is not new and has long been associated to bank failures (Campbell, 2007). Importantly, it has been widely studied in recent years (e.g., Pathan, 2009; Shehzad *et al*., 2010; and Wang *et al*., 2012) and subject to higher scrutiny and regulation from banking supervisors and regulators (e.g., BCBS, 2014).

The scope of credit risk management, however, extends beyond the proper functioning of the banking sector and plays a crucial role on the economy as a whole (Boussaada and Labaronne, 2015). In this vein, the side effects of weak credit risk management practices are typically reflected in higher levels of NPLs, which draws attention to regulatory and supervisory issues concerning impaired assets. In what concerns the Euro area banking system, Carbó-Valverde *et al*. (2015) place the private financial sector at the epicenter of peripheral countries financial distress. Constâncio (2014) also supports this view and underlines, in addition, the opposite directions followed by public and private debt ratios of countries under sovereign severe pressure during the 1999-2008 period. Succinctly, these authors argue that, with the exception of Greece, the Euro area crisis was first and foremost a banking crisis.

As shown in Figure 1, the evolution of NPL ratios stood at low or manageable levels prior to the financial crisis of 2008, peaked in 2013 and reveal a sluggish reduction since then. In nominal terms, Constâncio (2017) quantifies the NPL problem as of end-2016 in approximately

EUR 1 trillion, or over 9% of the Euro area GDP, and draws attention to the dramatic weight on the low aggregate profitability of European banks. In view of this, the size of the NPL problem and its determinant influence on banks profitability embraces a European dimension that calls for an immediate and practical discussion concerning its solution.

Figure 1 - Evolution of peripheral and core countries' banks NPL ratio



Source: World Bank (2017) and authors' own calculations

The project to trigger corrective supervision actions and clear any remaining doubts about asset valuations was long awaited in Europe. Nowadays, with the ECB in the lead for ensuring an effective and consistent European banking supervision, the Banking Union assumes a greater role in the financial system stability. In this context, with assets quality concerns being brought to the fore by the financial crisis and the observed rising NPL ratios since the inception of the crisis, the ECB promptly brought the topic to the agenda (e.g., ECB, 2015; ECB, 2016; and ECB, 2017b). As a result, the central bank has outlined a wide range of solutions deemed essential to NPLs resolution and shaped a set of structural reforms to be worked on.

On the one hand, the range of options available to banks and policymakers encompass on- and off-balance sheet solutions. For instance, the on-balance sheet measures include the internal workout by originating banks, asset protection schemes typically state-backed or even securitization operations. The off-balance sheet options, instead, comprises the creation of asset management companies or simply the direct sale to investors (Constâncio, 2017).

On the other hand, the reform package is more country-specific oriented and addresses the reduction of costs and duration of debt enforcements, the improvement of insolvency options range, the increase of judicial and out-of-court capacity and the better access to financial

information by investors. The greatest challenge though lies on the specificities of the economic and legal framework within each country, which makes a transversal and harmonized solution for such a comprehensive problem in the Euro area harder to achieve.

2.3 The cyclical feature of loan loss provisions

The literature on LLP is extensive and encompasses a wide range of related empirical studies, as documented by Ozili and Outa (2017). Examples of such studies are the provisioning behavior during business cycles and crisis periods, the mitigation of the LLP procyclical feature using provisioning dynamic models, or yet bank manager's provisioning discretionary power under different accounting and regulatory regimes. The extent to which heterogeneity reflects individual banks and home-country characteristics, and how the sensitivity of LLP to economic fluctuations depends on such heterogeneity, is, however, of utmost importance for regulators and policy makers in the ongoing task to create a level playing field in the Banking Union.

In our study, the cyclical term refers to the relationship between the amount of LLP and economic fluctuations. The procyclical and countercyclical nature, instead, varies with the business cycle. We summarize the procyclicality of LLP as banks choosing to increase LLP during economic downturns, but to reduce LLP during economic booms. The countercyclical effect refers to the opposite approach, i.e. releasing LLP during a recession and increasing LLP during economic booms. The cyclicality of LLP, however, is noted by Olszak *et al.* (2016) to vary from bank-to-bank as well as from country-to-country, implying a diversity, despite the same economic factors, Basel minimum requirements and accounting standards European banks are subject to.

The growing literature on the behavior of LLP highlights the procyclical feature of LLP during fluctuating economic conditions, for which the common explanation is given by the asymmetries between borrowers and lenders. Borio *et al.* (2001) argue that when economic conditions are depressed is harder to achieve an adequate risk calculation which leads to a decrease in credit lending, deflated collateral values, artificially high lending spreads, and to relatively high levels of capital and provisions held by banks. In addition, an increase of bank provisions during downturn periods will decrease even more bank overall profit and consequently worsen the situation of banks. The authors conclude that financial stability would be enhanced by provisions and capital ratios increasing in economic booms, acting as a built-in stabilizer.

Laeven and Majnoni (2003), in turn, draw attention to different cyclical patterns of LLP that prevail according to banks geographical location. The authors found empirical evidence that many banks around the world delay provisioning for bad loans until too late, which enhances its consequences during cyclical downturns, such as amplified losses and harsher capital shocks. Additionally, they found an undesirable negative relation of LLP with loan growth and GDP growth. Beatty and Liao (2009) also shed some light on the timeliness of LLP recognition. The authors conclude that banks with less timely LLP recognition are more subject to capital crunches in recessionary periods in comparison to timelier banks.

Agénor and Zilberman (2015) compare two different provisioning systems and show that, under a backward-looking provisioning model, LLP depend on non-performing loans, the current economic conditions and the loan losses reserves to total loan ratio. The dynamic system, however, is closer to a forward-looking approach and is found to smooth provisions over the cycle and be less affected by the current state of economy and non-performing loans. As a result, the authors conclude that the type of provisioning system and the fraction of non-performing loans influence directly the behavior of the loan rate.

Olszak *et al.* (2016) draw attention to bank's different risk management approaches and their non-uniform sensitivity to business cycles. In their study, the authors show that LLP are more procyclical in large, publicly-traded and commercial banks, as well as in banks reporting consolidated statements. More restrictive capital standards and better investor protection, in turn, are linked with weakened procyclicality of LLP.

The European region is specifically focused in some studies (e.g., Bonin and Kosak, 2013; Ozili, 2017) for which it is concluded that the propensity for European banks to manipulate LLP is mostly influenced by procyclical macroeconomic conditions. In fact, the growing literature that studies the behavior of LLP during fluctuation economic conditions generally concludes for the procyclicality of LLPs because it exacerbates the state of the economy. As Bouvatier and Lepetit (2008) state, banks take greater risks in economic booms while during cyclical downturns they are excessively pessimistic. Asea and Blomberg (1998) reinforce that idea by showing that banks change their lending standards from tightness (downturn periods) to laxity (expansion periods) systematically over the cycle.

Complementary conclusions that support the procyclical pattern of LLP are well documented in the literature (e.g., Arpa *et al*., 2001; Bikker and Hu, 2002; Floro, 2010; Packer and Zhu, 2012; and Pain, 2003).

2.4 The literature on the other determinants of bank profitability

The existing literature that attempts to examine the major determinants of bank profitability is quite extensive and goes back to Short (1979) and Bourke (1989). In the following years, several empirical studies varying in nature of datasets, time span, geographies and estimation methods have enriched this research. Among the investigations that used panel data sets composed by banks from miscellaneous countries throughout the world are the papers of Albertazzi and Gambacorta (2009), Demirgüç-Kunt and Huizinga (1999, 2010), Dietrich and Wanzenried (2014), Flamini *et al*. (2009), Micco *et al*. (2007) and Mirzaei *et al*. (2013).

There is also a widespread literature focused on European cross-country banks performance (e.g., Athanasoglou *et al.*, 2006; Goddard *et al*., 2004a, 2004b; Iannotta *et al*., 2007; Mergaerts and Vennet, 2016; Molyneux and Thornton, 1992; Pasiouras and Kosmidou, 2007; and Staikouras and Wood, 2004) or, in turn, European country-specific investigations (e.g., Athanasoglou *et al*., 2008; Chiorazzo *et al*., 2008; Dietrich and Wanzenried, 2011; Mamatzakis and Remoundos, 2003; and Trujillo-Ponce, 2013) Additionally, still at the country-level but outside Europe are the papers of Ahamed (2017) and García-Herrero *et al*. (2009).

The empirical results, though quite spread, bring forward common drivers. In short, the strand of the existing literature measures bank profitability using the return on average assets (ROAA) or return on average equity (ROAE) ratios and is usually expressed as a function of two sets of determinants, the bank-specific and the industry-specific or macroeconomic variables. In the following sub-sections, we present a selective overview of bank profitability and respective explanatory variables.

2.4.1 Bank profitability

Following the banking literature, we use two common accounting measures of bank profitability which are the ROAA and the ROAE. The former reflects the ability of bank management to generate profits from total assets. The latter refers to the return to shareholders on their equity and equals the ROAA times the financial leverage, given by the total assets-to-equity ratio. Both measures are an indicator of how profitable banks are, however, once our analysis to ROAE disregards financial leverage and its associated risk[3], we follow Athanasoglou *et al*. (2008) and consider the ROAA as our key ratio for the evaluation of bank profitability. The ROAE will therefore be considered as a complementary measure of

[3] Several studies address the capital-risk relationship such as Hellmann *et al.* (2000) or Kim and Santomero (1988).

profitability. We use average values in order to capture changes in total assets and total equity during the year.

2.4.2 Bank-specific determinants

2.4.2.1 Income-based determinants

The context of increased competition, concentration and restructuring in the EU banking system has been behind the major changes of European banks' balance sheets. In an attempt to curb the decline in interest margins, banks have sought to increase the appetite for sources of income other than just interests. These sources of alternative income assume mostly the form of commissions, fees or trading; the greater is the share of these revenues the more diversified the bank is.

Our study is related to the wide body of literature that analyze the impact of income diversification on banks' profitability and their different conclusions. DeYoung and Roland (2001) find that earnings volatility increase with the share of revenues generated by fee-based activities, which goes against the conventional wisdom that fee-based earnings are more stable than interests-based earnings[4]. Goddard *et al.* (2008), in turn, study the impact of revenue diversification by US credit unions on various financial performance measures. They find that the positive effects of higher returns from non-interest bearing activities are outweighed by the negative impact of lower returns if a credit union was more diversified than specialized. Other investigations also found little evidence of diversification benefits of non-interest income either in the case of US banks (e.g., Stiroh and Rumble, 2006), or the European banking sector (e.g., Mercieca *et al.*, 2007; and Lepetit *et al.*, 2008).

But the discussion of the effect of non-interest income on bank profitability is controversial. In fact, Chiorazzo *et al.* (2008) state that income diversification significantly increases risk-adjusted returns for Italian banks. In the same vein, Demirgüç-Kunt and Huizinga (2010) and Elsas *et al.* (2010) show that an expansion into non-interest income-generating activities increases the rate of return of assets; more recently, Busch and Kick (2015) conclude that risk-adjusted returns of German universal banks are positively affected by higher share of non-interest income activities.

The second bank-specific determinant in the income structure group is bank efficiency. The optimization of human resources and advances in information, such as financial technologies

[4] DeYoung and Roland (2001: 55) state that many bankers, bank regulators and bank analysts "*believe that fee-based activities are less sensitive to movements in interest rates and to economic downturns*".

and digitalization, are important steps in the path of banks to perform more efficiently. Albertazzi and Gambacorta (2009), for instance, state that the cost-to-income ratio has been declining almost everywhere, though at different degrees. In this regard, Constâncio (2017) provides the example of Scandinavian countries as a prominent example of banking sector with high profitability rates and almost inexistent burden of excessive cost inefficiency. In contrast to other determinants, this is a matter on which the existing literature reaches some level of agreement regarding the positive (negative) and significant effect of efficiency (inefficiency) on profitability (e.g., Athanasoglou *et al.*, 2008; Dietrich and Wanzenried, 2011, 2014; Goddard *et al.*, 2013; and Pasiouras and Kosmidou, 2007).

2.4.2.2 Asset-based determinants

The growth rate of total assets of a bank is shown in studies as bound to affect profitability. To the extent that banks adequately monitor the risk underlying their assets, a higher share of interest-bearing activities should increase banks' profitability as long as interest rates are liberalized and the bank applies markup pricing (García-Herrero *et al.*, 2009). In this vein, among the studies that report a significant and positive relationship between assets growth and profitability are Ahamed (2017), Demirgüç-Kunt and Huizinga (2010) and Stiroh (2004).

However, the agency problem arises when bank managers suddenly shift their strategy and pursue an expansionist policy, taking excessive risk in relation to what is accepted by shareholders. In this regard, the rapid business growth is likely to come from an aggressive commercial policy, such as a low spread strategy targeted to attract more customers from competitors, thereby reducing bank margins. In this respect, Stiroh (2004) finds a negative and significant relationship between assets growth and profitability when the return on equity is used.

As for bank size, the shocks produced by SIFI in the real economy led the Basel Committee on Banking Supervision (BCBS) to quickly adopt a set of reforms to improve resilience of banks and banking systems. For instance, the introduction of Basel III required SIFIs to hold additional capital buffers and subordinated liabilities, in order to enhance their resilience and absorb losses in resolution cases. But early work goes back to Short (1979), who argues that size is closely related to capital adequacy since larger banks are able to easily raise less expensive capital, and thus be more profitable. In line with this insight, Iannotta *et al*. (2007) state that "too-big-to-fail" banks benefit of an implicit guarantee that decreases their cost of funding, which allow them to pursue riskier assets.

Recent studies, however, have shown that the influence of bank size as a determinant of profitability is not clear. On the one hand, larger banks may benefit from economies of scale to reduce costs, or economies of scope from the joint provision of related services (Goddard *et al.*, 2004b; Smirlock, 1985). On the other hand, increasingly complex banks might suffer of finance-specific technologies and potential agency problems (Jensen, 1986), representing the downside of size. Athanasoglou *et al.* (2008), in addition, found evidence of a non-linear (U-shaped) effect of bank size on profitability.

Consequently, the empirical evidence is mixed and includes positive (e.g., Berger and Bouwman, 2013; Berger *et al.*, 2005; and Goddard *et al.*, 2004b), negative (e.g., Barros *et al.*, 2007), and non-linear relationships (e.g., Athanasoglou *et al.*, 2008). In other studies, however, the relationship between bank size and profitability is found to differ according to the economic development level (e.g., Micco *et al.*, 2007; and Mirzaei *et al.*, 2013).

2.4.2.3 Capital structure

The need for capital regulation is based, among other reasons, in two central issues: the moral hazard problem of bank shareholder's incentives to take excessive risks without bearing the burden of downside risk (Chan *et al.*, 1992), and the deposit insurance system, which is found to reduce market discipline on banks by their creditors (Demirgüç-Kunt and Huizinga, 2004).

Since capital is the main line of defense against negative shocks, it is not a surprise that claims for more bank capital and reform proposals on how to prevent future crises tend to emerge after they occur (e.g., Acharya *et al.*, 2016; Admati *et al.*, 2013; BCBS, 2011, 2013; Calomiris *et al.*, 2011; and Kashyap *et al.*, 2008). A common premise underlying these proposals is that the safety net provided to banks can be improved by requiring banks to operate with more capital. Capital Accords (i.e. Basel I, II and III) were therefore designed to foster prudent bank behavior and reduce bank risk, ensuring that bank shareholders assume a share of their risky investments. Nevertheless, as claimed in the literature, holding more capital requires higher returns due to its considerable expense (García-Herrero *et al.*, 2009; Hakenes and Schnabel, 2011).

The conventional risk–return hypothesis sustains an implicit negative relationship between capital and bank performance, but there are also reasons to believe higher capitalization levels induces higher profitability. For instance, Berger (1995b) challenges the conventional wisdom that better capitalized banks exhibit a lower return on equity rate and finds empirical evidence of a positive relationship instead. The author alludes to the expected bankruptcy cost hypothesis

to relate higher capital ratios to better creditworthiness, which reduces funding costs and, consequently, has a positive effect on expected returns.

In the same spirit, capital is typically used as a buffer to risky assets downside. When the trade-off between these assets and return is beneficial to banks, we should expect higher profitability rates (García-Herrero *et al.*, 2009).

Among the numerous empirical studies observing the positive relationship between capital and profitability are Athanasoglou *et al.* (2006), Berger and Bouwman (2013), Bourke (1989), Demirgüç-Kunt and Huizinga (1999), Iannotta *et al*. (2007), Mirzaei *et al.* (2013), Molyneux and Thornton (1992), Pasiouras and Kosmidou (2007), and Staikouras and Wood (2004). Nevertheless, Goddard *et al.* (2004a) detect a negative and statistically significant relationship, while Dietrich and Wanzenried (2011) and Mergaerts and Vennet (2016) find no evidence of such relationships.

2.4.2.4 Funding structure

The way bank performance and funding strategies are related is crucial to address the empirical debate concerning optimal banking model and to shape adequate regulatory policies. The existing literature points out to the bright side of wholesale funding and the particular case of EMU creation, which sustained favorable conditions to cross-broader financial flows and unveiled a wide range of borrowing and lending alternatives to European banks. In theory, this form of funding allows sophisticated money lenders to carry on market discipline and fosters the refinancing of unexpected deposits withdrawals.

The financial crisis, however, has exposed the risks of banks' excessive reliance on wholesale money markets. Huang and Ratnovski (2011), for instance, state that theoretical advantages were not observed in the last financial crisis and suggest that non-deposit lenders were likely to have low incentives to conduct costly monitoring, as they could easily withdraw their funds based on noisy rumors of bank insolvency. Therefore, it is not surprising that a large number of studies focus on the impact of funding sources on bank risk and profitability.

Demirgüç-Kunt and Huizinga (2010) carried out a study where they conclude non-deposit, wholesale funding, lowers the rate of returns on assets even though it can reduce risk at lower levels. For most banks, however, these funding strategies are predominantly associated to greater instability. Similarly, Altunbas *et al.* (2011) show that banks with greater reliance on wholesale funding were more likely to fail during the crisis and associate strong deposit based institutions to significantly reduced risk. García-Herrero *et al.* (2009) find that banks with a

relatively larger share of deposits tend to be more profitable, whereas Berger and Bouwman (2013) and Khan *et al.* (2016) provide empirical evidence on the positive relationship between retail deposits and survival rate. In fact, the inertia of customer deposits, sustained by slower repricing and higher stability, is a well-evidenced fact that is motivated, at the very least, by deposit insurance schemes (Mishkin, 2005).

Demirgüç-Kunt and Huizinga (1999), nevertheless, report evidence on banks' profitability being negatively affected by higher customers' deposits shares, and justify stating that deposits apparently entail high branching and other expenses.

2.4.3 Industry-specific and macroeconomic determinants

The levels of concentration in the banking industry is another important determinant of bank profitability according to two theoretical models. The structure-conduct-performance (SCP), or market power paradigm, asserts that more concentrated industries generate monopoly profits, reflecting non-competitive pricing behavior. The efficient-structure hypothesis (ESS), or cost efficiency theory, in turn links higher concentration to more operational efficiency, better management or better production technologies. The rationale behind suggests that more efficient cost structures gain a larger market share due to efficiency gains that consequently have a positive impact on profits.

The policy implications of these two hypotheses, however, follow distinct directions. Under the SCP, antitrust regulation is welcomed in order to eliminate competitive imperfections of monopolized markets, which typically are less favorable to consumers (Berger, 1995a; García-Herrero *et al.*, 2009). By contrast, under the ESS, policies restricting mergers and acquisitions might result in losses of efficiency which negatively impacts banks performance and consequently are less favorable to consumers.

The overall effect of market concentration on profitability is indeterminate. The results of Bourke (1989), Maudos and de Guevara (2004) and Molyneux and Thornton (1992) provide empirical evidence for a positive and statistically significant relationship between bank concentration and profitability. Also, the results of Demirgüç-Kunt and Huizinga (1999) show that banks in countries with less competitive banking sectors are more profitable.

However, Berger (1995a) and Athanasoglou *et al*. (2008) find no evidence supporting SCP and ESS. Pasiouras and Kosmidou (2007), in their study of the factors that influence the profitability of domestic and foreign commercial banks in the 15 European Union countries, conclude that, depending on whether banks are domestic or foreign, the relationship between concentration

and profitability is negative but statistically insignificant or positive and statistically significant, respectively. Finally, studies of Dietrich and Wanzenried (2014) and García-Herrero *et al.* (2009) show that market concentration is negatively related to profitability which seems to suggest that higher bank concentration is a result of tougher competition.

The last group of profitability determinants deals with macroeconomic factors whose variables (GDP growth, GDP, interest rates and inflation) are recurring in the existing literature. We include the GDP growth rate in order to control for business cycle fluctuation and economic conditions. Favorable economic conditions not only improve the solvency of borrowers, thereby reducing the amount of LLP banks have to set aside to cover credit risk, but also increase the credit demand with a theoretical positive effect on banks' profitability. During downturn periods, we typically observe the inverse. Among the studies that find a positive and significant relationship between banks' profitability and GDP, are Demirgüç-Kunt and Huizinga (2010), García-Herrero *et al.* (2009), Iannotta *et al*. (2007) and Mirzaei *et al*. (2013). In turn, Dietrich and Wanzenried (2014) demonstrate that depending on the country income category, the effect of GDP growth in bank profitability is significantly positive (middle-income countries), or negative but insignificant (high- and low- income countries).

As to GDP, we consider it in our study as an index of the overall level of economic development in line with the reasoning presented in some studies (e.g., Albertazzi and Gambacorta, 2009; Demirgüç-Kunt and Huizinga, 1999, 2010; and Stiroh, 2004). The existing results are mixed with Demirgüç-Kunt and Huizinga (1999) finding GDP not to be significantly influent on interest margins, but positively significant in respect to return on assets (ROA). However, in a later study based on a sample of 1.334 banks in 101 countries, Demirgüç-Kunt and Huizinga (2010) find no significant influence of GDP on ROA. Dietrich and Wanzenried (2014) in turn demonstrate that, depending on the country income category, the effect of GDP in bank profitability is significantly positive (low-income countries) or negative but insignificant (high-income countries). However, if net interest margin is used as a proxy of profitability, the authors find the effect to be negative and significant. In this respect, Goldberg and Rai (1996) argue that countries with higher GDP are assumed to have a banking system that operates in a mature environment which, consequently, involves more competitive interest and profit margins.

We include inflation which is generally associated with higher profitability as long as it is fully anticipated by bank's management in the adjustment of interest rates (Perry, 1992; Revell, 1979). But even predictable increases in the inflation rate can interfere with the ability of banks to allocate resources effectively (Boyd *et al*., 2001). Since an increase in the inflation rate

diminishes the real rate of ROA in general, including money, agents have no longer incentives to lend but to borrow. Consequently, credit lending is rationed, resource allocation is less efficient and bank activity diminishes with adverse implications in profitability. Boyd *et al*. (2001) provide empirical evidence of the negative relationship between inflation and bank performance. More recent studies, however, find a positive relationship between the two variables (e.g., Athanasoglou *et al*., 2008; Demirgüç-Kunt and Huizinga, 1999; and García-Herrero *et al.*, 2009).

Finally, a low interest rate environment together with a flat yield curve and negative premia have been shown to negatively impact banks profitability. Indeed, the monetary policy carried out by the ECB in the last years has been subject to hasty judgements; in particular, investors argue that the central bank has sent the equilibrium real interest rate, to which savings match investments in an economy operating at its potential, to below its natural level (Mersch, 2017). Against this background, the side effects on banks will be more pronounced the longer these unconventional measures last. Borio *et al*. (2015) investigate the influence of monetary policy on bank profitability for 109 large international banks over the period 1995-2012, and find a positive and significant relationship between the level of interest rates and bank profitability. Moreover, the authors conclude that the negative impact of LLP on bank profitability is overcome by the positive impact of the interest rates structure on net interest income and that the effect is stronger the lower the interest rate level. Additional studies that assess the impact of interest rates on bank profitability and find a positive relationship are Albertazzi and Gambacorta (2009), Demirgüç-Kunt and Huizinga (1999), Mergaerts and Vennet (2016) and Trujillo-Ponce (2013).

3 Formulation of hypotheses

Following the creation of the SSM and SRM in the Banking Union, the harmony in the supervision calls for a third pillar, the DGS. However, a common DGS has been a topic of increasing debate, with critics arguing that a mutualized scheme cannot be conceived until risks inherent to national banking sectors are contained and become more homogeneous. In this connection, our first hypothesis assesses to what extent factors that explain banks' profitability are statistically different between peripheral and core countries.

Hypothesis #1 – The determinants that explain banks' profitability differ between peripheral and core countries of Euro area.

Bearing in mind the period of relatively cheap financing and credit boom in the Euro area, that ultimately lead peripheral countries to financial distress, along with the theoretical importance of LLP on banks low aggregate profitability, our second hypothesis is directly linked with the magnitude of LLP effects between peripheral and core countries.

Hypothesis #2 – The effect of LLP on banks' profitability is greater in peripheral banks compared to banks from core countries.

Finally, the cyclical feature of LLP is well documented in the literature (e.g., Laeven and Majnoni, 2003; Olszak *et al.*, 2016; and Ozili, 2017). For instance, Laeven and Majnoni (2003) draw attention to different cyclical patterns of LLP that prevail according to the geographical location of banks and the amplified losses during cyclical downturns. In this study, we test to what extent the financial crisis affected the relationship between LLP and bank's profitability across peripheral and core countries of Euro area. By doing so, we expect to contribute to the discussion on whether the accounting paradigm should be rethought by policymakers in favor of a provisioning system with greater financial stability that smooths LLP cyclicality. Accordingly, we define the following hypothesis for testing.

Hypothesis #3 – The financial crisis introduced a significant shift in the relationship of LLP and banks' profitability across peripheral and core countries of Euro area.

4 Data and measures

4.1 Sample

The dataset consists of bank panel data for 19 Euro area countries (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain) over the period 2006-2015. While the other non-euro currency countries are also a critical part of the European economy, we focus mainly on the participating Member States of SSM. The reasoning is based on the ultimate responsibility of ECB for the prudential supervision of all credit institutions in these Members States and its ability to ensure the EU's macro prudential policy to preserve financial stability is implemented in a coherent and effective manner.

We construct a large panel dataset containing both bank-level and industry and macroeconomic variables with annual frequency. Balance sheet and income statement data of banks are retrieved from SNL Financial (2016) and Bankscope (2013). Industry and macroeconomic indicators are obtained from ECB (2017a) and World Bank database. In what concerns bank-level information, we gather year-end financial statements since these are subject to greater scrutiny by supervisory agencies such as regulators and auditing firms. Also, we use data from consolidated accounts when available and from unconsolidated accounts otherwise in order to avoid double-counting. Merged banks, in turn, are considered separate entities before the merger and a single entity afterwards. These procedures help us to reduce the probability of introducing bias in results. Nevertheless, we are conscious of the limitations or potential bias that might emerge from the use of accounting measures. As Altunbas *et al.* (2007) state, these metrics are backward looking and can benefit of time discretion.

In contrast to the literature, which usually examines listed banks (e.g., Demirgüç-Kunt and Huizinga, 2010), our panel includes listed and unlisted banks that offer similar banking services such as commercial banks, savings banks, cooperatives banks and real estate and mortgage banks. We believe this is important since, on the one hand, unlisted banks represent the majority of banks in the EU and, on the other hand, many unlisted banks typically have a more retail-oriented business model.

Investment banks are disregarded from this study due to their fundamentally different risk characteristics (DeYoung and Torna, 2013; Köhler, 2015). For instance, the core activity of investment banks does not rely on deposit taking and the assets value of investment banks are highly exposed to market prices fluctuations. On the contrary, more traditional banks are

exposed to business risk such as higher competition, substitute products or macroeconomic conditions.

Regarding the data collection process, we consider the SNL Financial (2016) as our primary source of data. This database, however, is only robust in terms of bank data reporting from 2010 onwards. Thus, we use Bankscope (2013) as a complementary database since our objective is to obtain a dataset as extensive as possible for the time span covered in the study. Considering this, the initial data extraction comprises 3.940 banks from SNL Financial (2016) and 5.393 banks from Bankscope (2013). We use the unique identifier code, the Legal Entity Identifier, to match banks from both databases and obtain a total of 2.757 active banks. We further identify 2.117 banks either in the inactive, dissolved, merged or bankruptcy status which implies that a full period observation is not available for these banks. Therefore, our initial sample comprises a total of 4.874 banks.

Following the merger of both databases, we check for the consistency of data at the bank level and, as far as possible, disregard banks whose activity diverge substantially from those falling into the theoretical discussion above. In this regard, we adopt Mergaerts and Vennet (2016) criterion that seeks to exclude institutions not focused on financial intermediation by ruling out banks with ratios of loans to total assets and deposits to total assets below a 5% threshold. The robustness checks are outlined in Table 1.

Additionally, in order to mitigate the impact of outliers we follow Köhler (2015) and winsorize all bank level variables at the 0.5- and 99.5-percentile. After completing these procedures, we obtain a final dataset consisting of an unbalanced panel[5] with 3.046 banks. This is a short panel, which means that it includes data on many cross section observations over a relatively short time period (10 years of annual observations). Thus, we assume the time series dimension is held fixed and the cross section dimension is allowed to grow.

The final dataset comprises a total of 21.851 bank-year observations, with an annual maximum of 2.393 in 2011, as shown in Appendix I. Germany and Italy are the most representative countries with a total of 12.167 and 4.710 observations, respectively. By bank type (see Appendix II), cooperative banks predominate (59% of total observations), followed by savings banks (26%), although commercial banks hold a greater market share (67%).

[5] The panel is unbalanced since it contains banks entering or leaving the market during the sample period (e.g., due to insolvencies, mergers and acquisitions). As Baltagi (2001) refers, incomplete (unbalanced) panels are more likely to be the norm in typical economic empirical settings, such as studies of country-specific units. Most of the existing literature, however, deals with balanced panels.

Table 1 - Additional criteria and data quality checks for sample selection

Criteria	Banks excluded	Final sample
Initial sample		**4.874**
Zero assets during the whole sample period	1.437	3.437
Zero gross loans during the whole sample period	78	3.359
Low relative amount of gross loans (< 5% of total assets)	81	3.278
Zero deposits during the whole sample period	17	3.261
Low relative amount of deposits (< 5% of total assets)	117	3.144
Different activity classification between SNL Financial (2016) and Bankscope (2013) for the same bank (e.g., Commercial bank vs. Other banking)	39	3.105
Difference in the amount of total assets > 1% between SNL Financial (2016) and Bankscope (2013) for the same bank	59	3.046
Sample after filtering and data quality check procedures	**1.828**	**3.046**

Source: Authors' own calculations

Finally, with the purpose of studying Hypothesis #3 we define a crisis dummy variable to interact with the LLP variable in order to allow for shift changes in the slope of coefficient. The interaction term is intended to measure the incremental effect of LLP on banks' profitability during the crisis. Thus, if we take the example of the crisis period (crisis≡1), the influence of LLP is equal to the sum of its parameter and that of the product of the crisis dummy variable with the LLP. A statistically significant dummy implies a different influence of LLP on bank profitability during the crisis period.

The definition of the crisis period, however, is not straightforward as it might encompass several episodes. Indeed, the existing literature is not consensual on the period that represents the crisis and most of the times that time span is reported as global financial crisis. For instance, Ivashina and Scharfstein (2010) consider the crisis period from August 2007 to July 2008, while Acharya and Naqvi (2012), Dietrich and Wanzenried (2014), and Leung *et al.* (2015) suggest that crisis period spanned from 2007 to 2009. Haq and Heaney (2012) studied the determinants of European bank risk during the 2008-2010 crisis period and more recent studies such as Baselga-Pascual *et al.* (2015) and Maudos (2017) consider a wider period from 2008 to 2012. Allegret *et al.* (2017), in turn, study the impact of the European sovereign debt crisis on banks stocks comprising the time span between 2007 and 2013.

Bearing in mind that our study focuses on Euro area banks, whose profitability registered a sudden decrease from 2008 onwards, and that the last Euro area GDP's negative annual growth was observed in 2013, the crisis period considered in our study is selected to start in 2008 and extended until the end of 2013.

4.2 Definition of variables

As dependent variable, we use two average measures of profitability widely accepted in the banking literature. The main variable is ROAA, which encompasses the average returns obtained from the assets a bank holds. This measure can also be seen as a measure of efficiency or operational performance, though its value may be misleading due to returns obtained from off-balance sheet items. The ROAE, in turn, is considered as a complementary measure of profitability since we disregard the leverage nature of each individual bank. We consider the average values since they allow us to capture changes observed during the year.

The use of LLP as the main explanatory variable is based on its crucial role in assessing the stability and soundness of financial system. In theory, an asset quality deterioration produces a lower economic value which must be covered with LLP if it is found to be below the book value. To the extent that we aim to study the impact of credit risk deterioration on banks' profitability across core and peripheral countries, and assess how different their magnitude is, we use the ratio of loan loss provisions to total net loans. This ratio relates the yearly amount of credit provisions to net loan portfolio.

The remaining explanatory variables are divided into two groups: i) the bank-specific variables, and ii) the industry-specific and macroeconomic variables. To analyze the effect of revenue diversification on profitability, we use the proportion of non-interest income to total income. The cost-to-income ratio, in turn, is used as a proxy of efficiency to assess to which degree more efficient banks are more profitable. This ratio measures the operating costs of running a bank in relation to its operating income.

We calculate the total assets growth to capture potentially different strategies of faster growing banks to generate profits. As to bank size, often considered an important determinant of banks' profitability, we measure it by the natural logarithm of total assets. We follow the academic literature that shows the distribution of firm size within many industries and countries can often be approximated by various skewed distributions, of which the most widely used is the lognormal (Staikouras and Wood, 2004). Although we are aware that some banks have important off-balance sheet activities which makes this measure not optimal, we need a standard measure applicable to all banks in our study.

We account for bank capitalization using the ratio of bank equity in total assets. In theory, all banks in our sample are subject to Basel III capital adequacy regulations; however, we use this very rough measure due to the lack of prudential data (e.g., own funds and risk-weighted assets) for a large number of banks.

To analyze the effect of funding structure on profitability of banks, we use the ratio of customer deposits to total liabilities. This ratio explores not only the greater stability of customers funding when compared to wholesale funding, but also the impact of a "deposit war" event on banks' returns.

With respect to industry-specific and macroeconomic variables, we measure bank concentration in terms of a Herfindahl–Hirschman index (HHIIC). As a general rule, an HHIIC below 1,000 signals low concentration, while an index above 1,800 indicates high concentration. For values between 1,000 and 1,800, an industry is considered to be moderately concentrated (ECB, 2013). We obtained the data on the HHIIC in the Euro area countries from the ECB (2017a).

We use the annual growth rate of GDP in order to control for business cycle fluctuation and economic conditions and measure the overall level of economic development through the natural logarithm of GDP. The effect of inflation on bank profitability, in turn, is considered using the GDP deflator.

The impact of interest rates on banks' profitability is measured using the short-term ECB main refinancing operations rate. This rate consists of one-week liquidity-providing operations which we have collected on a daily basis to obtain an average annual rate.

Finally, we include dummy variables to control specific bank and time effects, the financial crisis period effect and to split our full sample into two groups, peripheral and core countries' banks. The former captures the influence of potential time-varying factors that may affect bank profitability but are not included in our equation. The second unbundle the shift change on the relationship between LLP and banks' profitability during the 2008-2013 financial crisis period. The third dummy variable allows us to perform the Wald test in order to assess the existence of a structural break between the two groups and further test their coefficients equality.

We present a full description, the expected signs and the respective data gathering source of each variable in Appendix III.

5 Regression framework

In this section, we adopt a comprehensive approach regarding the assumptions and decisions made in the empirical method applied in our study. Considering the aim of this investigation, we use a data set that combines cross section with time series, i.e. panel data or longitudinal data. According to Wooldridge (2002), having data over time for the same cross section units has several advantages. The most important rely on the possibility to firstly look at dynamic relationships, something we cannot do with a single cross section, and secondly control for unobserved cross section heterogeneity. Therefore, we start with a general empirical model of the following form:

$$y_{it} = \alpha + \beta_1 LLP_{it} + \beta_2 B_{it} + \beta_3 C_{it} + \gamma_t + \varepsilon_{it} \quad (1)$$

where the profitability measure, y_{it}, given by ROAA or ROAE of bank *i* at time *t*, is written as a function of the interest-variable, LLP_{it}; a set of bank-level variables, B_{it}; and a set of industry-specific and macroeconomic variables, C_{it}, which are common to banks. Time effects, γ_t, are expressed in years, and the disturbance term, ε_{it}, contains the unobserved bank-specific time-invariant effect (η_i) and the idiosyncratic error (v_{it}). This general model will be augmented with specific theoretical and empirical elements as the empirical analysis goes on.

An essential concern in estimating Eq. (1) using a fixed effects model, raised by the recent literature focus, is the tendency of banks' profitability to persist over time[6], which signals that the market structure is not perfectly competitive (Flamini *et al.*, 2009). Berger *et al.* (2000) define an industry's persistence of firm-level rents as the tendency for individuals to remain in the same place of the industry's performance distribution. The authors suggest that information opacity, impediments to market competition and sensitivity to regional/ macroeconomic shocks are strong drivers of persistence. For instance, without market power, relatively high performance would be eliminated as other banks enter the local market, and the competitive pressure increases. Similarly, banks in a region subject to regional/macroeconomic positive shocks, to the extent these are serially correlated, would tend to remain in the high end of the performance distribution. Finally, Goddard *et al.* (2011) report that persistence of profitability is weaker for banks in developing countries than for those in a higher stage of development.

[6] Apart from the recent literature, few earlier studies considered profit persistence in banking (e.g., Eichengreen and Gibson, 2001; Goddard *et al.*, 2004b; and Roland, 1997) in contrast to others studies that found weak evidence of the phenomenon of persistence in profitability (e.g., Mamatzakis and Remoundos, 2003).

However, if profitability indeed persists, the choice of a dynamic empirical model (i.e. one including a lagged dependent variable) is well-justified.

Therefore, the endogenous character of certain factors is a problem that shall be taken with caution in the estimation of a regression model. Econometrically, endogeneity implies that the explanatory variables are correlated with the error term ε_{it} and earlier shocks, but uncorrelated with $\varepsilon_{i,t+1}$ and subsequent shocks. Stock and Watson (2007) note that when a model contains a variable η_i that captures all unobserved and time-constant factors that affect y_{it}, generically called an unobserved effect[7], heterogeneity bias can be found if regressors are correlated with explanatory variables. For instance, endogeneity might bias the results if bank profitability causes banks to adjust their business model. Köhler (2015) states this would be the case if banks became riskier and decide to increase their structure of liquid assets to protect themselves against premature withdrawals of funds, while Fahlenbrach *et al.* (2012) draw attention to industry exposure or risk culture. Therefore, we need to control for these unobserved effects.

Considering the above line of reasoning, we follow Athanasoglou *et al.* (2008), Flamini *et al.* (2009) and García-Herrero *et al.* (2009), and use a dynamic linear model, which is a variant of Eq. (1), given by the following equation:

$$y_{it} = \alpha + \delta y_{i,t-1} + \beta_1 LLP_{it} + \beta_2 B_{it} + \beta_3 C_{it} + \gamma_t + \varepsilon_{it} \qquad (2)$$

$y_{i,t-1}$ is the one-period lagged profitability and δ measures the speed of adjustment to equilibrium. A value of δ statistically equal to 0 implies that bank profitability is characterized by a high speed of adjustment, while a value equal to 1 means the adjustment is very low. Therefore, values between 0 and 1 suggest that profitability persists but will eventually return to its normal (average) level.

The estimation of Eq. (2) using some traditional panel data estimators, such as Pooled ordinary least squares (OLS), fixed effects or random effects, produce biased and inconsistent estimators. As noticed by Baltagi (2008), the OLS estimator is biased and inconsistent even if ε_{it} is not serially correlated. The random effects estimator is also biased in a dynamic panel data model, and even the within (demeaning) transformation in the fixed effects model does not eliminate the dynamic panel bias (Nickell, 1981). However, as time series get larger, the problem tends to disappear and the fixed effects estimator becomes consistent. The problem is that, in

[7] Wooldridge (2013) states that in applications η_i can also be referred to as unobserved heterogeneity or individual heterogeneity.

simulations, Judson and Owen (1999) find a bias equal to 20% of the coefficient of interest, even in large time series.

Thus, one solution to this problem involves taking first differences of the original model. With the fixed effects swept out, instrumental variable estimators such as those proposed by Anderson and Hsiao (1981) and Arellano and Bond (1991) can be used. These two estimators are consistent, but the Arellano-Bond generalized method of moments (GMM) estimator, or the one-step estimator, is more efficient (Castro, 2013). Later, Arellano and Bover (1995) and Blundell and Bond (1998) proposed another variant of the GMM estimator, the two-step estimator (system-GMM), which is asymptotically more efficient than the one-step estimator and relaxes the assumption of homoscedasticity.

This estimation technique is particularly suitable for samples with small time and large cross-sectional dimensions, is robust to heteroskedasticity and autocorrelation within individuals, but not across them, and allows to instrument the endogenous variables with their own lags. This is particularly useful because it accommodates the potential endogeneity between banks' profitability and some of the right-hand side variables by using appropriate instruments. In particular, following the existing literature (e.g., Athanasoglou *et al.*, 2008; Delis and Kouretas, 2011; García-Herrero *et al.*, 2009; and Köhler, 2015), we treat bank-specific regressors as endogenous variables. Industry concentration and macroeconomic variables, in turn, are treated as strictly exogenous.

The validity of the instruments used in the moment conditions is also crucial for the consistency of the GMM estimates. Therefore, we use the Hansen (1982) *J* test statistic for overidentifying restrictions to test the validity of instruments. Finally, as Roodman (2009) refers, although first-order autocorrelation (AR(1)) is presumed to exist, higher order autocorrelation is not.

The empirical results reported in Appendix V show that we obtain a model that is well fitted with statistically insignificant results for both second- and third-order autocorrelation (AR(2) and AR(3)) and Hansen *J*-statistics of over-identifying restrictions[8] for all regressions. However, we have to include the first, second and third lags of the dependent variable[9] in order to obtain valid statistics.

[8] The null hypothesis states that the instruments, as a group, are exogenous.

[9] In this regard, we follow Roodman (2009) in order to ensure the values of δ in our system-GMM regressions lie in the range between values of the lagged dependent variable, $y_{i,t-1}$, of the OLS regression and within-groups transformation. The author states that when running either an OLS regression or within transformation, the lagged dependent variable and the error are still correlated. However, while in the case of the OLS regression the lagged dependent variable estimate is upward biased, the opposite is verified in the within transformation. Therefore, in line with Bond (2002), good estimates of the true parameter should lie in or near these bounds.

To test our first hypothesis, we follow Gould (2017a, 2017b) and add to our baseline model the assumption that certain characteristics vary within the group. Thus, we follow a risk-based approach, namely whether the national economies, and consequently the banking systems, were subject to financial distress or not, and divide the baseline model in two groups. In a generalized way, under the hypothesis that each group's behavior is unique, we have separate equations, as follows:

$$\begin{aligned} y_1 &= \beta_1 X_1 + \varepsilon_1 && \text{equation for peripheral banks group} \\ y_2 &= \beta_2 X_2 + \varepsilon_2 && \text{equation for core banks group} \end{aligned} \tag{3}$$

where y_i is the dependent variable for banks' group i and is written as a function of the explanatory variable, *X*, and the error term, ε_i. Our objective is to test whether the behavior for one group is the same as for another, which is equivalent to test whether $\beta_1 = \beta_2$. However, instead of testing coefficients across separately fitted models, we can convert the multiple equations into one equation (combined model):

$$\begin{aligned} y = (\alpha_0 + \sigma_0.Periphery) + (\delta_1 + \sigma_1.Periphery).y_{i,t-1} + (\beta_1 \\ + \sigma_2.Periphery).LLP_{it} + (\beta_2 + \sigma_3.Periphery).B_{it} + (\beta_3 \\ + \sigma_4.Periphery).C_{it} + \gamma_t + \varepsilon_{it} \end{aligned} \tag{4}$$

where *y* is the set of all outcomes (y_1, y_2), $Periphery$ is the dummy variable added to our baseline model that distinguishes between peripheral and core countries' banks and σ_i is the corresponding coefficient to be considered when the dummy variable equals one (Periphery=1). This dummy variable is interacted with all the explanatory variables and tested for the equality of the coefficients within groups[10], as shown in Eq.(4). For that purpose, we employ a Wald test, as given by Judge *et al.* (1985), which performs a chi-square test to jointly linear restrictions applied to the baseline model.

In order to test our Hypothesis #2, we apply the same methodology, though we test individually each coefficient and assess whether they are statistically significant between both groups.

Finally, for the purpose of testing Hypothesis #3, we create a dummy variable which is one for the period of 2008-2013, and zero otherwise. The LLP variable for each group is interacted with the crisis dummy variable and its statistical significance will determine whether the effect of LLP on bank profitability during the crisis period observed a structural shift or not.

[10] This procedure was performed using the Stata "test" command which tests linear hypotheses after estimation.

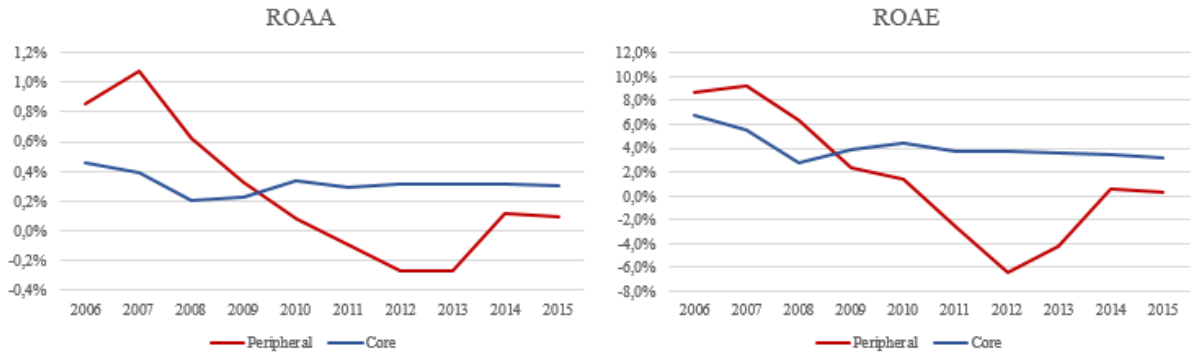
6 Empirical results

In this section, firstly we carry out univariate tests in order to explore some basic relationships in our data. We further perform regression analyzes and explore the empirical results for our profitability measures, ROAA and ROAE.

6.1 Descriptive statistics

As displayed in Figure 2, we find a disruptive pattern in terms of ROAA and ROAE between peripheral and core countries' banks. In what concerns core countries' banks, the evolution of these measures is smoother, contrasting to the abrupt fall in peripheral banks from 2007 onwards. Likewise, the effect of financial crisis is only remarkable in the pattern of these measures for peripheral countries. We present full descriptive statistics in Appendix IV that allows us to explore the basic relationship among variables in our data, and to get some preliminary insights.

Figure 2 - Evolution of peripheral and core countries' banks ROAA and ROAE



Source: Bankscope (2013) and SNL Financial (2016)

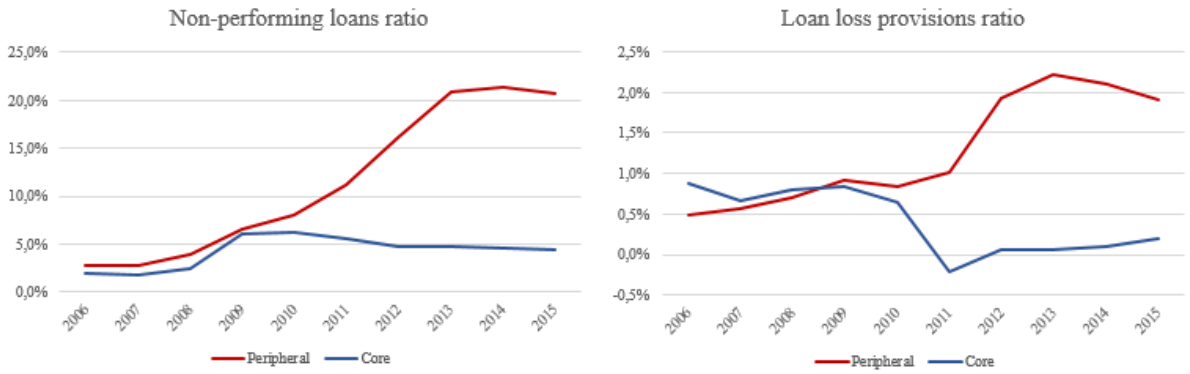
Regarding ROAA, in 2006 the value of this profitability indicator for banks from peripheral countries (0.84%) was, on average, almost twice higher than for core countries (0.44%). The 2008 financial crisis, however, marked a major turning point and in 2015 banks from core countries were yielding a ROAA around 3.3 times higher than banks from the periphery, standing at 0.30% and 0.09% respectively.

In terms of ROAE, the values are more expressive since this indicator presents higher values than ROAA, though the pattern observed is similar. For our sample time span 2006-2015, the ROAE decline in peripheral banks was more pronounced, showing a sharp drop of approximately 96%, and even reaching negative values between 2011 and 2013. Banks in core

countries, however, felt a decrease in ROAE of about 49%, though its value remained, on average, always above the 2% level. In nominal values, this represents a decrease in peripheral banks from 8.55% in 2006 to 0.39% in 2015, and in core countries' banks from 6.58% in 2006 to 3.38% in 2015. However, considering only the financial crisis period (2008-2013), it is worth noting the resilience of core countries' profitability to this more adverse scenario. In the opposite side, peripheral banks recorded, on average, their lowest profitability in the last decade. The differences are statistically significant at the 1% level.

The evolution of LLP, shown in Figure 3, has also been very expressive in the past years where, once again, the pattern between peripheral and core countries' banks is clearly distinct. Banks from peripheral countries registered a substantial increase in yearly losses provisioning (288%), while core countries' banks eased that burden (-83%). Annually, banks in the periphery provisioned, on average, 1.2% of loans portfolio while in core countries this percentage amounted to 0.4% approximately. This result seems to indicate a lower quality of the credit portfolio, and respectively the granting and monitoring processes, in the peripheral banks when compared to core countries' banks.

Figure 3 - Evolution of peripheral and core countries' banks NPL and LLP ratios



Source: World Bank (2017) and author's calculation

The remaining regressors also exhibit statistically significant differences in means between peripheral and core countries' banks. The revenue diversification variable indicates which part of banks total income comes from non-interest-bearing operations. On this matter, peripheral countries seem to depend more on these sources of income (29.6%) than banks from core countries (28.5%). In fact, the increasingly tighter profitability rate in peripheral banks might have forced them to find alternative sources of revenue to remain sustainable. This insight is supported by the considerable increase (44%) of income stemming from other sources than interests during our sample period. Core countries' banks, instead, seemed to have focused their

strategy on the interest margin optimization by reporting a decrease of approximately 35% in the non-interest income share.

As to cost-to-income ratio, both peripheral and core banks observed a decrease in their efficiency. When compared to 2006, ratios increased by 3.1% and 5.3%, respectively, though peripheral countries seem to hold, on average, a better cost-efficient structure (67%) than core countries' banks (68.8%).

The figures related to business growth, proxied by the total assets growth rate, indicate that banks in peripheral countries grew faster, reaching an average value of 7.4% per annum. In line with the theoretical background, this might be explained by the significant financial flows that transited from core countries to peripheral countries, having created conditions for loans portfolio boost and, consequently, an expansion of banks' total assets. On the opposite side, the 2006-2015 evolution rate of total assets is much lower in peripheral banks (-92.4%), which might reflect the sudden break on credit granting and the impact of credit losses in the aftermath of the financial crisis.

Regarding the size of banks, peripheral countries appear to have, on average, larger banks. The average size, presented in the logarithmic form of total assets, is higher in peripheral banks (13.67) when compared to core countries' banks (13.57). Although minimal, this difference is statistically different at the 1% level. In monetary terms, peripheral banks have, on average, a balance sheet with approximately EUR 15bn in total assets, while core countries' banks present an average of EUR 9 bn. These statistics, however, are driven by the large number of cooperative and saving banks established in core countries which, typically, have a smaller dimension.

In what concerns the capitalization of banks, expressed by the simplified equity-to-assets ratio, banks in peripheral countries hold a higher average ratio (10.4%) than core countries' banks (7.8%). However, the evolution of this measure is profoundly more favorable to core countries banks which, probably due to capital increases or income retention, report a significant increase (35.6%) compared to 2006. In contrast, peripheral banks exhibit a negative trend (-7.7%) which is likely to reflect the impact of negative returns in equity during the 2011-2013 period.

As to funding source, banks in peripheral countries seem to make higher use of wholesale markets to fund their activities, as can be assessed by the lower share of customer deposits in comparison with banks in core countries, with 61.3% and 76.8% respectively.

As an additional set of explanatory variables, we control for industry-specific and macroeconomic factors. We observe that bank concentration, expressed by the Herfindahl index

for credit institutions total assets, not only is higher in peripheral countries as its evolution is also more remarkable (79%), which suggests a higher consolidation of the baking system in these countries in the past decade.

As to GDP growth rate and the logarithm of GDP, we observe a negative trend between 2006 and 2015 for both peripheral (-40.3% and -0.7%, respectively) and core countries (-54.7% and -0.1%, respectively), which reflects the severe economic and financial conditions faced by Euro area countries during the 2008-2013 financial crisis. The inflation rate, instead, is positive for both peripheral and core countries, on average, though its evolution was negative for peripheral countries.

Finally, on an attempt to discourage investors' savings glut behavior and foster economic growth in the Euro area, the interest rates of ECB's main refinancing operations present a negative evolution, having decreased from 3% in 2006 to 0.05% in 2015; this is in line with the monetary policy followed by the central bank and is a shared reality across all Euro area countries.

6.2 Basic results

In this section, we investigate the hypothesized causality relation between the profitability measures, ROAA and ROAE, and the explanatory variables. The output of the baseline model that fits all Euro area countries is presented in Appendix V. In line with the literature, we find that all regressors considered in our baseline equation, with the exception of inflation, are statistically significant when either the ROAA or ROAE are considered.

However, in order to assess our first hypothesis, we interact a dummy variable that distinguishes between peripheral and core countries' banks with each explanatory variable (Appendix VI), and perform a Wald test to the joint homogeneity of parameters between these two groups. The outcome of the chi-square statistics, presented in Appendix VII, rejects the null hypothesis of the joint multiple coefficients equality at the 1% significance level. This result confirms the existence of a structural break in our baseline model for the two groups. Therefore, we test individually each coefficient equality, as shown in Appendix VIII, and draw some conclusions concerning the degree of heterogeneity between these two groups' profitability level.

More specifically, and following the recent literature, we observe in the general specification of the model that the persistence of banks' profitability is found to be significant at the 1% level of significance in the first and third lags when the ROAA is considered. Likewise, the persistence of all lags of ROAE is shown to be significant, though at different levels of

significance. Our results support the view of Flamini *et al.* (2009), that the market structure of Euro area is not perfectly competitive, and that, to some extent, banks tend to remain in the same place of the performance distribution. Nevertheless, when we introduce the peripheral dummy variable in our baseline model, which originates the combined model, the profitability lags lose their statistical significance in both groups, contrasting to our previous findings that supports the profitability persistence.

In what concerns the effect of LLP on banks' profitability, we observe that LLP has a significant negative and rather strong effect on both profitability measures. This result braces the argument of Constâncio (2017) that endows the NPL problem a European dimension from a macroprudential perspective. We note that an increase in 1 percentage point (p.p.) of LLP represents a decrease of approximately 0.21 p.p. in ROAA and 1.94 p.p. in ROAE. The signal and significance of the variable at the 1% level is strongly consistent with the literature. Indeed, considering that the average values of ROAA and ROAE for the sample period are 0.3% and 3.7%, respectively, the effect of LLP proves to be quite significant.

As part of the LLP analysis across all Euro area banks together, we make use of the model with the interacted dummy variable (combined model) to assess Hypothesis #2 regarding the greater impact of this variable on peripheral banks' profitability compared to core countries' banks. We find that the magnitude of the LLP coefficient diverges significantly between the two groups, as exhibited in Appendix VIII. Both country categories exhibit a negative and significant relationship at the 1% level concerning ROAA and ROAE. However, the magnitude of LLP coefficients for peripheral banks (-0.63 and -8.64, respectively) is significantly different, and around 3 times larger when ROAA is observed, in comparison to core countries' banks (-0.21 and -5.19, respectively) at the 1% level of significance. Thus, we are able to conclude that despite the European dimension of NPL, peripheral banks' profitability levels are significantly more affected by the lower credit quality of their loan portfolios.

With the opposite effect, and despite its small magnitude, we find a positive and statistically significant impact of a larger share of non-interest income activities, such as fees, commissions and net trading income, in both profitability measures of our Euro area's baseline model. This result is consistent with the outcomes of Busch and Kick (2015) and Demirgüç-Kunt and Huizinga (2010), and shows that an expansion into non-interest income-generating activities increases the ROAA and ROAE. Indeed, considering the context of increased competition and restructuring in the EU banking system, our results signal the proactive behavior of banks with a more traditional business model, as those that heavily depend on the net interest income, in

the search for alternative sources of income to curb the decline in interest margins. In concrete terms, an increase of 1 p.p. in the share of non-interest income yields an increase of ROAA and ROAE in approximately 0.01 p.p. and 0.07 p.p., respectively. Although the combined model shows this variable is only significant on peripheral banks' profitability, the Wald test indicates that the difference between the two groups is not significant. Therefore, this result suggests that the contribution of non-interest income share on banks' profitability has been similar across peripheral and core countries' banks, which might be a result of the generalized low aggregate profitability that Euro area banks are facing, as sustained by Constâncio (2017).

The cost-to-income ratio, a proxy to banks efficiency, in turn has a negative and statistically significant impact on banks' profitability in the baseline model which comes across our expectations that more efficient banks present higher profitability. In line with other studies, such as Athanasoglou *et al.* (2008) and Goddard *et al.* (2013), we show that an efficient cost management is a prerequisite to increase profitability of banks in the Euro area. Therefore, high costs or overbanking are challenges deemed to be better managed. The combined model, however, shows that peripheral banks stand out in comparison with core countries' banks. This outcome, along with the rejection of the null hypothesis of the individual Wald test, suggests that the efficiency issue is most of a matter of peripheral banks' profitability. Thus, in case a peripheral bank manages to lower 1 p.p. in its inefficiency level, the expected average increase on ROAA and ROAE stands at approximately 0.04 p.p. and 0.49 p.p., respectively.

In respect to the assets growth rate, we confirm in the baseline model this is a variable bound to positively affect profitability, which might be explained by a higher share of interest-bearing activities in banks' balance sheet. Our results confirm the existing literature, such as Ahamed (2017), Demirgüç-Kunt and Huizinga (2010) and Stiroh (2004), that finds a positive and significant relationship and quantify each additional 1 p.p. in the business growth to drive higher ROAA and ROAE in approximately 0.01 p.p. and 0.21 p.p., respectively. However, in our combined model this trend is diverging between peripheral and core countries' banks. In this respect, we find that peripheral banks' profitability is negatively affected by higher total assets growth rates. To the extent that faster growth business rates might be associated to more aggressive commercial policies and, consequently, a lax of credit practices during expansions periods, as Asea and Blomberg (1998) observe, banking profitability's drawbacks of peripheral banks might be directly related to a lack of a proportional and sound practices of risk management.

As to bank size, we find a negative impact on banks' profitability level in the baseline model, which supports the argument that costs of increasingly complex banks overcome both the economies of scale and the benefits in the cost of funding from the "too-big-to-fail" guarantee, as hypothesized by Iannotta *et al*. (2007). Our result follows that of Barros *et al*. (2007) and is maintained in the combined model, though its statistical significance is only retained in peripheral banks. In practical terms, our model shows that a 10% increase of bank's size reduces the level of ROAA and ROAE by approximately 0.03 p.p. and 1.21 p.p.[11], respectively. Therefore, to the extent that the Euro area policymakers and regulators observe a growing trend of mergers and acquisitions in the banking system, special attention needs to be paid mainly to large banks or financial conglomerates.

In what concerns the capital ratio, the risk-return hypothesis on one side and the creditworthiness benefits on the other side imply an ambiguous effect on profitability. In our baseline model, better capitalized banks and higher returns are negative and significantly related when the ROAE is observed. In fact, to the extent that holding higher capital ratios induces banks to follow lower risk strategies, we could expect a negative relationship between higher capital ratios and banks' returns, with the conventional risk-return hypothesis to overcome the reduced funding costs that arise from better creditworthiness ratios. However, although in line with the findings of Goddard *et al.* (2004a), our results go against the main literature stream that finds a positive relationship between capital and profitability. In what concerns the results in the combined model, even though the significance of the negative relationship is only found on peripheral banks, a Wald test on the equality of coefficients does not reject the null hypothesis of statistical difference between peripheral and core countries. Therefore, we find no difference regarding the negative impact of higher capital ratios between both groups.

The funding structure in our full sample of Euro area banks is characterized by a relatively high proportion of customer deposits (72.5%) and the outcomes from our baseline model suggest a positive and significant relationship with banks' profitability. Since our study focus on banks with a more traditional business model, it is therefore crucial to assess the ability of banks to generate positive net interest margins. In this regard, our combined model reports a negative and significant relationship between customer deposits and peripheral banks' profitability, which shall raise some concerns to Euro area policymakers. Our results indicate that an increase in 1 p.p. of customer deposits funding share decreases the ROAA of peripheral banks in

[11] Since we use the log(total assets), the economic significance of this coefficient for a 10% increase is estimated for ROAA and ROAE in the following form: (-0.273*log(1.10)) = -0.026 and (-12.71*log(1.10)) = -1.211.

approximately 0.01 p.p.. In the opposite side, the ROAA of core countries' banks increases by 0.01 p.p.. The Wald test to the equality of coefficients in our combined model rejects the null hypothesis at the 1% level of significance.

The theoretical background might resort to the concerns about peripheral banks' sovereign debt and doubts over the quality of loans portfolio, implying higher financing costs and liquidity constraints as the investors' risk perception deteriorates. Faced with the difficulties in financing their activities at sustainable borrowing rates on wholesale funding markets, banks scoop up customer savings heating up to the so-called "deposit war". To the extent that this source of funding is found to be more stable (Altunbas *et al.,* 2011), competent authorities need to be cautious and promote an efficient management of this funding source at the risk of banks following unsustainable business models.

The results regarding industry-specific and macroeconomics determinants are as follows. The effect of bank concentration is positive and statistically significant for ROAA and ROAE in both baseline and combined models. For instance, under the SCP paradigm, market structure drives an important role in the capacity of banks to set up interest rates that directly affect their performance. The empirical results in our study support the expected output that greater bank concentration leads to higher bank profit rates, a conclusion already obtained by Maudos and de Guevara (2004). However, this effect is more meaningful in peripheral banks with the difference in relation to core countries' banks to be significant at the 5% level.

The GDP growth is also found to be positive and significantly related to banks' profitability. Following our expectations and the literature (e.g., Demirgüç-Kunt and Huizinga, 2010; García-Herrero *et al.*, 2009; and Iannotta *et al*., 2007), business cycle fluctuations and favorable economic conditions foster banks' higher returns. Although this variable loses its significance in the combined model for both peripheral and core countries' banks, we do not find a significant difference in this determinant's coefficient between the two groups.

As to GDP, the effect of this variable in our baseline model is found to be negative and significantly related to Euro area banks' ROAA. According to Goldberg and Rai (1996), to the extent that Euro area's banking system has reached a mature stage, the competitive environment might induce tighter interest margins. Nevertheless, the combined model shows a significant difference between these two groups. In this case, despite the small magnitude of the coefficient[12], peripheral banks are found to benefit of higher economic development. In the

[12] 0.185*log(1.10)=0.018.

opposite side, we find evidence that core countries' banks are the more negatively affected the greater is the national economic development.

Inflation, in turn, is not shown to be significant in our baseline model though it gains some statistical relevance at the 1% level for peripheral banks, when this variable is assessed separately from core countries' banks. Against this background, an increase of inflation in 1 p.p. is reflected in approximately more 0.08 p.p. of ROAA and 1.45 p.p. of ROAE.

Last but not least, the interest rate variable is shown to be the most relevant regressor, confirming the dependence level of these banks' business model on the net interest margins. Our baseline model reports a similar outcome to Borio *et al*. (2015). Firstly, the level of short-term rates and banks' profitability are positive and closely related. Secondly, the positive effect of the interest rate structure on profits dominate the one of LLP and non-interest income together. Indeed, our baseline model signals that a 1 p.p. increase in the interest rates leads to an increase of 2.77 p.p. in ROAA, quite above the absolute effect of 0.21 p.p. and 0.08 p.p. of the LLP and net-interest income share, respectively. In addition, we do not find evidence of a structural break of the impact of the interest rates between peripheral and core countries' banks profitability. Consequently, our results suggest that the unconventional measures undertaken by the central bank regarding the monetary policy are strongly conditioning the ability of banks to invert the low aggregate profitability situation.

Finally, with regard to Hypothesis #3, the outputs presented in Appendix IX show a significant shift in the relationship of LLP and peripheral banks' ROAA at the 1% level of significance. In particular, during the 2008-2013 financial crisis period, each 1 p.p. increase of LLP worsened the effect on peripheral banks' ROAA in approximately 0.14 p.p.. This effect represents an increase of 40% to the existing 0.36 p.p. outside that period. Core countries' banks, instead, seem to have escaped unscathed to the credit crunch following the financial crisis.

7 Robustness checks

In Section 5, the problem of endogeneity introduced by the inertia of profitability persistence over time, $y_{i,t-1}$, was addressed using the Arellano and Bover (1995) and Blundell and Bond (1998) GMM. However, the output of our combined model does not exhibit any empirical evidence of profits' persistence, suggesting this assumption might not hold. Following this insight, there is empirical literature that seeks to explain the variation in banks' profitability without considering the inertia of banks' profits, though keeping in mind the problem of endogeneity. In this regard, the unobserved effect, η_i, that captures all the unobserved and time-constant factors that affect y_{it}, is captured in a fixed-effects panel data model.

Even though pooled OLS regression is a valid estimation method to deal with panel data, its estimates are biased and inconsistent if bank-specific effects, η_i, time effects, γ_t, or both, are not compliant with the assumptions of exogeneity, homoscedasticity and non-autocorrelation (Wooldridge, 2010).

Since these effects can be analyzed by either fixed or random effects models, we follow Park (2011) and conduct formal tests. First differencing is just one of the many ways to eliminate the fixed effect, η_i. As Wooldridge (2013) states, an alternative method which works better under certain assumptions is called the within transformation. The name comes from the fact that OLS uses the time variation in y and x within each cross-sectional observation which, by applying the time demeaning data transformation, the unobserved effect, η_i, disappears.

Wooldridge (2002) refers that above three-time periods both estimators do not yield the same results, although they are both unbiased and consistent. Therefore, for large cross-section with small time periods the choice between first differencing and within transformation hinges on the relative efficiency of the estimators. In this regard, Wooldridge (2002) suggests that when ε_{it} is serially uncorrelated and homoscedastic, the within transformation leads to more efficient estimates and the standard errors reported are valid. Additionally, one consideration arises when we are dealing with unbalanced panel data. Though the within transformation has no problem with that, the first differencing transformation loses two observations when there is one period missing in the sequence of observations for a determined unit.

We start by estimating two fixed effects model, one with bank fixed effects and another with time fixed effects. These two regressions include respectively a bank-specific and a year-specific time invariant component which are allowed to be correlated with the other explanatory variables and hence a limited form of endogeneity is permitted. The separate tests for bank and time fixed effects of the null hypothesis, in which all dummy variables except for the reference

group are jointly zero, are conducted using the F-test. The results show that the null hypothesis is rejected in both regressions, confirming the statistical support that a two-way fixed effects (with both bank and time fixed effects) model increases the goodness-of-fit and is better than the Pooled OLS.

The random effects model, on the other hand, assumes that the unobserved effect, ε_{it}, is uncorrelated with each explanatory variable. Breusch and Pagan's (1980) Lagrange Multiplier test examines whether bank-specific or year-specific variance components are zero. Once again, the null hypothesis is rejected so we can conclude there is a significant random effect in the panel data and the random effect model is able to deal with heterogeneity better than the Pooled OLS.

Finally, the Hausman (1978) specification test compares fixed and random effects. If the null hypothesis of no correlation between individual effects and any regressor is rejected, then bank-specific effects, η_i, and time effects, γ_t, are significantly correlated with at least one explanatory variable in the model and thus the random effect model is problematic. The outcome of this test shows a rejection of the null hypothesis, meaning the fixed effects model is more appropriate.

Considering the empirical estimation in Eq. (1), the results of tests above performed and following the existing literature (e.g., Ahamed, 2017; Athanasoglou *et al.*, 2006; and Demirgüç-Kunt and Huizinga, 2010), we estimate as a robustness test the following regression model:

$$y_{it} = \alpha + \beta_1 LLP_{it} + \beta_2 B_{it} + \beta_3 C_{it} + \gamma_t + \eta_i + \varepsilon_{it} \quad (6)$$

in which all the specifications already stated in Eq. (1) are maintained and only the bank-specific fixed effect, η_i, is brought out from the disturbance term to the regression model.

In order to ensure valid statistical inference, we test other critical assumptions. To confirm the issue of multicollinearity is not a concern in our model, we use the Variance Inflation Factor (VIF), based on a rule of thumb of 10, which is set, for example, by Kennedy (1992). The highest VIF among all regressors is 1.82 which supports the evidence of no multicollinearity problems. The normality assumption, on the other side, is not a necessary condition for estimator's consistency. As Wooldridge (2013) refers, the Central Limit Theorem is used to conclude the OLS estimators satisfy asymptotic normality, which means they are approximately normally distributed in large enough sample sizes. Since this is the case in our sample, we relax on this assumption without further transformations.

The homoscedasticity assumption states that the variance of the unobserved error term, ε_{it}, conditional on the explanatory variables, is constant. Following Greene (2000), we conduct a Modified Wald test[13] for groupwise heteroskedasticity in the residuals of a fixed effects regression model. Since the null hypothesis of homoscedasticity is rejected, the standard errors of the estimates will need to be corrected.

The problem of serial correlation in the error term, ε_{it}, is not critical as far as the consistency of estimates are concerned, though the efficiency and inference are strongly affected. As Wooldridge (2013) states, the usual OLS standard errors and test statistics are no longer valid. In this respect, since the Wooldridge (2002) test for autocorrelation[14] rejects the null hypothesis of no first-order at the 1% level, we carry out a fixed effects model that allows for intragroup correlation[15].

Lastly, we draw attention to the issues of cross-sectional dependence and non-stationarity. The impact of cross-sectional dependence in estimation, also known as contemporaneous correlation, is referred by De Hoyos and Sarafidis (2006) as being dependent on the magnitude of the correlations throughout cross sections and the nature of cross-sectional dependence itself. For instance, if we assume that cross-sectional dependence is caused by the presence of unobserved common factors, and therefore felt through the disturbance term, but uncorrelated with the regressors, then the standard fixed effects and random effects estimators are consistent, although not efficient. On the other hand, if the unobserved factors that create interdependencies across cross-sections are correlated with the included regressors, fixed effects and random effects estimators will be biased and inconsistent.

In that respect, however, Baltagi (2008) states that cross-section dependence is more an issue of macro panels with long time series[16] and not so much of micro panels, as these are randomly sampled and hence not likely to be correlated. In fact, micro and macro panels require different econometric care which leads to our second issue of concern, non-stationarity processes. The author argues that while long time series for macro panels require one to deal with issues of non-stationarity, like unit roots and cointegration, in micro panels one does not deal with non-stationarity issues, especially in cases where time series are short for each individual (bank).

[13] The Modified Wald test for groupwise heteroskedasticity developed by Greene (2000) is appropriate for panel data, is robust when the assumption of normality is violated and is workable in unbalanced panels.

[14] Drukker (2003) simulation evidences that this test has good size and power properties in reasonable sample sizes.

[15] This option is performed using the Stata command xtreg with the vce(robust) option which is equivalent to specifying the vce(cluster) option, the appropriate command to deal with intragroup correlation.

[16] Baltagi (2008) provides a reference of 20-30 years for a panel data to be considered as having long time series.

Considering the above reflection of our empirical approach, we employ a fixed effects model with bank and year fixed effects and clustered standard errors at the bank-level (Appendix X). In line with Hoechle (2007), this approach allows us to obtain standard error estimates that are robust to disturbances being heteroskedastic and autocorrelated of type AR(1). Additionally, we follow the same methodology as in Section 5 in order to answer our set of hypotheses.

Thus, we first include a dummy variable to our baseline model that distinguishes between peripheral (Periphery=1) and core countries' banks and interact it with all the explanatory variables (Appendix XI). Secondly, we perform a Wald test to the jointly linear restrictions applied to the baseline model (Appendix XII). We further employ an individual Wald test to each coefficient and assess to which extent they are individually significant between both groups (Appendix XIII). Lastly, we create a dummy variable which equals one for the period of 2008-2013 and zero otherwise, and test the shift change of the LLP variable in relation to the effect on banks' profitability in each group (Appendix XIV).

Overall, our baseline model using the fixed effects approach confirms the signal and significance of most explanatory variables, except in what concerns size, bank concentration and GDP that change the signal of its relationship with banks' profitability. Capitalization and inflation, in turn, not only retain their signal as gain statistical relevance.

The Wald test to the jointly linear restrictions applied to the baseline model also confirms a structural break between both groups. Although our baseline model seems to explain adequately all Euro area banks' profitability when assessed together, our results show that when groups are individually assessed a significant difference in the determinants explanatory power is found. Summarily, our previous results on the differences between peripheral and core countries' banks are robust to LLP, cost-to-income ratio, deposit funding share and bank concentration.

Finally, our alternative model supports the harsher effect of LLP on peripheral banks' profitability during the 2008-2013 financial crisis period at 1% level of significance. In line with our previous finding, our results show that this significant change was not observed for core countries' banks.

8 Concluding remarks

In a context where European banks struggle against low profitability and NPL reach unprecedented levels, the creation of the Banking Union was an important step towards a consistent application of EU banking rules and a common coordination envisaging a solution.

This study empirically investigates which factors drive profitability of banks in the Euro area and to what extent they differ between peripheral and core countries' banks. Importantly, our investigation gives some scope to credit risk effect due to our focus on banks with more traditional business models and, consequently, its crucial role on the assessment of banks' profitability and solvency levels. The evidence of that was the financial crisis, and the credit crunch that followed, which placed credit risk management into the regulatory spotlight. Therefore, we further assess the difference in the contribution of LLP on banks' profitability between peripheral banks, established in financially stressed economies, and core countries' banks, established in non-financially stressed economies, and how the recent financial crisis on Euro area has affected that relationship.

We also analyze the effect of other bank-specific, industry-specific and macroeconomic determinants that have been proven to influence bank profitability and group them into the following categories: asset quality, revenue diversification, efficiency, assets structure, size, capitalization, funding diversification, market structure, economic development and interest rates.

This study contributes to the existing literature in various directions. Firstly, by applying a system-GMM as our primary model and a fixed effects model as an alternative approach, our study provides empirical evidence of the importance of LLP, non-interest income share, cost-to-income ratio, total assets growth rate, deposit funding share, GDP growth and interest rates as important drivers of banks' profitability, when all Euro area banks are analyzed together. In this respect, interest rates and LLP stand out as the components that more contribute to explaining the variation of banks' profitability levels.

Secondly, we find that the contribution of LLP on banks' profitability is, at least, 3 times higher on peripheral banks than on core countries' banks. Accordingly, we provide empirical evidence concerning the worsened effect of LLP on the profitability ratio (ROAA) of peripheral banks during the 2008-2013 Euro area financial crisis. This outcome is likely to reflect the growing trend of NPL stock on these economies and, to some extent, also confirms the procyclical feature of provisioning policies in economic downturn periods.

Thirdly, we found mixed evidence regarding the persistence of profitability over time. In line with the recent theoretical and empirical literature, our system-GMM model provides evidence of the persistence of profitability over time when all Euro area banks are assessed together. However, we find no evidence of profitability attrition when peripheral and core countries' banks are individually assessed.

Finally, our study identifies other determinants of banks' profitability that are statistically different between peripheral and core countries' banks. Our findings are supported by robustness tests and include the effect of cost-to-income ratio, deposit funding share and bank concentration.

In this regard, our results suggest that the improvement of efficiency levels will significantly increase the returns of peripheral banks in comparison to core countries' banks. In the opposite side, the positive effect of customer deposits on core countries' banks returns suggest they make better use of this type of funding and have greater success in passing the cost to fleet-footed customers. As to bank concentration, only in the peripheral banking systems the levels of profitability appear to benefit most of greater market shares.

We contend that these findings point out to policy considerations toward seven main directions. First and foremost, once the unconventional measures taken by the ECB, such as the monetary policy easing, which is reflected by a decrease in short-term interest rates and/or flat yield curves, are eased, banks in the Euro area are likely to boost their profits. Against this background, the monetary policy followed by the central bank might provide a crucial contribute on the reversal of Euro area banks' low aggregate profitability situation.

Secondly, from a micro and macroprudential perspective, credit risk exposure continues to be the bank-specific leading source of problems in financial institutions, assuming a vital importance in their sustainability. Its impact, however, is not limited to the stability of the financial system as it also has repercussions in the credit-granting process to the real economy. Therefore, though the economic recovery might play an important role on the NPL resolution, regulatory authorities, in particular, should address the issue of NPL with the appropriate urgency due to their promising benefits on profits throwback.

Consequently, our third consideration brings to light banks' credit granting and management practices. The reasons underlying bank difficulties over the years are not limited to one single factor; however banking drawbacks continue to be directly related to lax of credit practices, poor portfolio risk management, economic issues or other factors not properly addressed by banks. Thus, it urges the need of competent authorities to have a keen awareness of banks'

sound practices that enable them to identify, measure and monitor credit risk. Despite the cross-cutting nature of this consideration, our findings suggest it to be primarily suitable to peripheral banks.

In the light of the above, the assessment of credit risk management best practices shall not be disregarded of a sound and adequate provisioning policy. The methodology underlying the measurement of LLP emerges therefore as an important policy implication, due to its broader significance for supervisors, policy makers and standard setters. Contrary to the prudential perspective set out by Basel III/CRR framework, in which capital requirements for credit risk rely on detailed principles and rules, no similar requirements exist in the international accounting standards set by IASB. Even the forthcoming IFRS 9 "expected credit loss model" falls short of a more detailed measurement methodology. Rather, there is considerable room to management discretion in determining the level of LLP. It seems an opportune moment for bank regulators to make use of their regulatory power and enhance the scrutiny of LLP estimates.

Fifthly, the prosperity of Euro area banks' profitability should not rely exclusively on the low interest rates environment reversal and NPL resolution. Our results point out to asymmetrically effects of some determinants of bank profitability between peripheral and core countries' banks. Importantly, low returns are also driven by lower efficiency levels which might be a result of high costs or overbanking. The promotion of digitalization and optimization of human resources and branch networks by competent authorities can be a strong incentive to improve efficiency ratios. Our considerations envisage, once again, higher benefits on peripheral banks returns.

Our sixth consideration is set towards business models of more traditional banks, which rely heavily on customer deposits as the main source of funding. To the extent that this source of funding is found to be more stable, competent authorities should promote an efficient management of this funding source and reduce the risk of banks following unsustainable business models.

Finally, though on a smaller scale, our results suggest that bank concentration in peripheral banking systems induces higher banks' profitability. Nevertheless, as far as mergers and acquisitions are fostered, regulators need to be cautious with the "too-big-to-fail" institutions, due to their adverse effects, such as the moral hazard problem.

Beyond the scope of this study, other relevant issues might require further research. In this respect, we highlight the study on whether the introduction of a provisioning counter-cyclical buffer, in the light of the accounting standards, would help on avoiding the severe impact of

LLP on banks' profitability during downturn periods as an interesting subject to be included on the research agenda.

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Appendixes

I. Sample used: number of observations summary

	Year										
Country	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Austria	141	153	142	146	153	158	150	141	73	69	**1,326**
Belgium	18	18	14	15	17	19	16	16	8	8	**149**
Cyprus	7	5	7	7	7	6	8	8	8	7	**70**
Estonia	4	5	5	5	6	6	7	7	7	7	**59**
Finland	4	5	7	8	10	14	16	15	14	15	**108**
France	124	119	121	116	130	130	131	129	122	121	**1,243**
Germany	1,074	1,056	1,044	1,090	1,167	1,344	1,372	1,379	1,335	1,306	**12,167**
Greece	14	14	15	15	17	12	11	9	7	7	**121**
Ireland	9	7	6	5	6	7	6	7	6	6	**65**
Italy	483	502	505	493	480	488	472	457	427	403	**4,710**
Latvia	7	8	6	8	8	11	9	10	11	11	**89**
Lithuania	8	8	8	8	8	7	6	6	5	6	**70**
Luxembourg	7	13	14	15	14	18	21	18	20	17	**157**
Malta	2	2	4	4	4	4	4	4	4	4	**36**
Netherlands	10	10	11	16	16	16	18	19	18	17	**151**
Portugal	12	13	13	15	15	15	15	14	13	11	**136**
Slovakia	9	10	11	11	12	13	13	12	11	10	**112**
Slovenia	13	12	13	14	14	14	14	13	13	12	**132**
Spain	109	99	106	108	107	111	92	85	72	61	**950**
Total	**2,055**	**2,059**	**2,052**	**2,099**	**2,191**	**2,393**	**2,381**	**2,349**	**2,174**	**2,098**	**21,851**

II. Sample used: statistics by type of institution

	Year										
Type of institution	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Number of observations											
Commercial Banks	320	314	317	327	337	362	362	347	314	299	3,299
Cooperative Banks	1,223	1,235	1,222	1,215	1,275	1,384	1,375	1,371	1,283	1,238	12,821
Real Estate & Mortgage	24	27	26	28	28	31	33	33	27	25	282
Savings Bank	488	483	487	529	551	616	611	598	550	536	5,449
Total	**2,055**	**2,059**	**2,052**	**2,099**	**2,191**	**2,393**	**2,381**	**2,349**	**2,174**	**2,098**	**21,851**
Distribution of observations (%)											
Commercial Banks	16%	15%	15%	16%	15%	15%	15%	15%	14%	14%	15%
Cooperative Banks	60%	60%	60%	58%	58%	58%	58%	58%	59%	59%	59%
Real Estate & Mortgage	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Savings Bank	24%	23%	24%	25%	25%	26%	26%	25%	25%	26%	25%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Market share (%)											
Commercial Banks	70%	68%	64%	65%	65%	66%	66%	66%	72%	72%	67%
Cooperative Banks	22%	22%	23%	22%	22%	21%	21%	21%	19%	20%	21%
Real Estate & Mortgage	2%	2%	2%	3%	3%	2%	3%	3%	2%	2%	2%
Savings Bank	7%	8%	11%	10%	10%	11%	10%	9%	7%	7%	9%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Variables	Category	Description	Expected effect	Source
Dependent				
ROAA	Bank profitability	Net profits over average total assets (in %)	n.a.	SNL Financial and Bankscope
ROAE	Bank profitability	Net profits over average total equity (in %)	n.a.	SNL Financial and Bankscope
Independent				
Bank-specific determinants				
Loan loss provisions	Asset quality	Loan loss provisions over total net loans (in %)	-	SNL Financial and Bankscope
Non-interest income share	Revenue diversification	Total non-interest income over total income (in %)	+/-	SNL Financial and Bankscope
Cost-to-income ratio	Efficiency	Total expenses over total income (in %)	-	SNL Financial and Bankscope
Total assets growth	Asset structure	Growth of total assets (in %)	+/-	SNL Financial and Bankscope
Log (Total assets)	Size	Logarithm of total assets	+/-	SNL Financial and Bankscope
Capitalization	Capitalization	Equity to total assets (in %)	+/-	SNL Financial and Bankscope
Deposit funding share	Funding diversification	Total customer deposits over total liabilities (in %)	+/-	SNL Financial and Bankscope
Industry-specific and macroeconomic determinants				
Bank concentration	Market structure	Herfindahl index for credit institutions total assets	+/-	ECB Statistical Data Warehouse
GDP growth	Economic development	Growth of GDP (in %)	+	The World Bank Data
Log (GDP)	Economic development	Logarithm of GDP (in US$)	+/-	The World Bank Data
Inflation	Economic development	Inflation GDP deflator (in %)	+/-	The World Bank Data
ECBMRO	Interest rates	Rate of ECB main refinancing operations	+	ECB Statistical Data Warehouse

This table reports the expected effect of each variable, as supported by the literature review in Section 2. The label "n.a." stands for not applicable; the positive signal, "+", refers to an expected positive effect; the negative signal, "-", refers to an expected negative effect; and the label "+/-" refers to either a positive or negative expected effect.

This table reports summary descriptive statistics of the variables used in the regression analyses for banks in peripheral and core countries. For the notation of the variables, see Appendix III. The full sample includes 21.851 observations from 3.046 banks and 19 countries. The period covers the years 2006-2015. Differences between the means of the two groups are based on the two-sample *t* test using unequal variances (Welch's *t*-test) and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

	(1) All countries						(2) Peripheral countries						(3) Core countries						
Variables	**Δ06-15**	**Mean**	**Median**	**Max**	**Min**	**Std. Dev.**	**Δ06-15**	**Mean**	**Median**	**Max**	**Min**	**Std. Dev.**	**Δ06-15**	**Mean**	**Median**	**Max**	**Min**	**Std. Dev.**	**Sign. of mean diff. btw (2) and (3)**
ROAA (%)	-55.5%	0.3%	0.3%	2.6%	-4.2%	0.6%	-89.0%	0.3%	0.4%	2.9%	-7.2%	1.1%	-31.1%	0.3%	0.3%	2.5%	-2.3%	0.4%	***
ROAE (%)	-62.7%	3.7%	3.6%	30.2%	-58.9%	8.1%	-95.5%	2.4%	4.1%	32.9%	-105.0%	13.7%	-48.6%	4.1%	3.5%	29.6%	-37.3%	5.8%	***
Loan loss provisions (%)	-29.2%	0.6%	0.5%	7.5%	-4.1%	1.2%	288.0%	1.2%	0.8%	10.4%	-0.7%	1.4%	-82.9%	0.4%	0.3%	5.0%	-4.7%	1.0%	***
Non-interest income share (%)	-18.4%	28.8%	25.9%	85.3%	0.0%	13.7%	44.2%	29.6%	27.9%	87.0%	0.0%	13.8%	-34.8%	28.5%	25.2%	84.2%	0.0%	13.6%	***
Cost to income ratio (%)	5.2%	68.3%	67.9%	156.6%	26.2%	14.2%	3.1%	67.0%	65.1%	214.3%	22.8%	20.0%	5.3%	68.8%	68.8%	125.3%	28.0%	12.0%	***
Total assets growth rate (%)	-60.1%	5.1%	3.3%	95.1%	-23.6%	11.9%	-92.4%	7.4%	5.5%	116.8%	-23.7%	14.5%	-33.7%	4.3%	2.8%	92.3%	-23.5%	10.9%	***
Size (logarithm)	2.0%	13.6	13.4	19.9	10.1	1.8	2.8%	13.7	13.3	20.2	9.9	2.0	1.8%	13.6	13.4	19.9	10.2	1.7	***
Capitalization (%)	16.5%	8.5%	7.8%	32.2%	2.1%	3.8%	-7.7%	10.4%	9.4%	54.9%	1.3%	5.6%	35.6%	7.8%	7.3%	25.0%	2.2%	3.0%	***
Deposit funding share (%)	10.2%	72.5%	77.0%	98.3%	15.4%	17.5%	4.7%	61.3%	58.4%	98.2%	21.5%	16.7%	9.7%	76.8%	80.5%	98.3%	14.3%	15.9%	***
Bank concentration	26.7%	441	317	3,700	178	402	78.9%	481	410	2,254	220	276	4.8%	421	301	3,700	178	450	***
GDP growth (%)	-51.0%	0.9%	1.1%	26.3%	-14.8%	2.8%	-40.3%	-0.2%	0.4%	26.3%	-9.1%	2.7%	-54.7%	1.4%	1.6%	11.9%	-14.8%	2.7%	***
GDP (logarithm)	-0.3%	28.3	28.6	29.0	22.8	1.0	-0.7%	28.1	28.4	28.5	23.7	0.8	-0.1%	28.4	28.9	29.0	22.8	1.1	***
Inflation (%)	-6.1%	1.4%	1.5%	20.1%	-9.8%	1.1%	-71.7%	1.4%	1.4%	4.9%	-5.3%	1.1%	69.4%	1.5%	1.7%	20.1%	-9.8%	1.1%	***
Interest rates (%)	-98.3%	1.5%	1.1%	3.9%	0.1%	1.3%	-98.3%	1.5%	1.1%	3.9%	0.1%	1.3%	-98.3%	1.5%	1.1%	3.9%	0.1%	1.3%	

V. Arellano and Bover (1995) and Bundell and Bond (1998) regression outputs – baseline model

Variables	ROAA	ROAE
L.ROAA	0.173***	-
	(0.000)	
L2.ROAA	0.015	-
	(0.415)	
L3.ROAA	0.045***	-
	(0.005)	
L.ROAE	-	0.217***
		(0.000)
L2.ROAE	-	0.038*
		(0.087)
L3.ROAE	-	0.048**
		(0.029)
Loan loss provisions	-0.209***	-1.942***
	(0.000)	(0.000)
Non-interest income share	0.008***	0.072*
	(0.002)	(0.050)
Cost to income ratio	-0.011***	-0.038
	(0.000)	(0.388)
Total assets growth rate	0.008*	0.214***
	(0.064)	(0.000)
Size	-0.158***	-1.823***
	(0.000)	(0.000)
Capitalization	0.001	-0.372***
	(0.919)	(0.002)
Deposit funding share	0.005***	0.094***
	(0.007)	(0.001)
Bank concentration	0.000***	0.003***
	(0.001)	(0.007)
GDP growth	0.014*	0.310***
	(0.090)	(0.007)
GDP	-0.035**	-0.332
	(0.033)	(0.192)
Inflation	0.013	0.110
	(0.505)	(0.681)
Interest rates	2.777***	26.60***
	(0.000)	(0.007)
Observations	14,444	14,444
Nr. of banks	2,570	2,572
Nr. of instruments	52	52
z_1	3,119	1,726
z_2	0.000	0.000
AR(1)	0.000	0.000
AR(2)	0.102	0.203
AR(3)	0.423	0.924
Hansen test	0.199	0.297

This table reports results from a two-step GMM dynamic panel estimator (system-GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) of the effects of bank-specific, industry-specific and macroeconomic characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and the return on average equity (ROAE). Except for Bank concentration, GDP growth, GDP, Inflation and Interest rates, all variables are considered endogenous in our model. z_1 and z_2 are Wald tests of the joint significance of the reported coefficients and of the omitted year dummies, asymptotically distributed as χ^2 under the null hypothesis of no significance. AR(*i*) is a serial correlation test of order *i* using residuals in first differences, asymptotically distributed as $N(0,1)$ under the null hypothesis of no serial correlation. *Hansen* is a test of the overidentifying restrictions, asymptotically distributed as χ^2 under the null hypothesis of no correlation between the instruments and the error term. For the notation of the variables please to refer Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. We use Windmeijer (2005) finite-sample corrected standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

VI. Arellano and Bover (1995) and Bundell and Bond (1998) regression outputs – combined model

Dependent variable : ROAA			
L.ROAA (Periphery=1)	-0.046	L.ROAA (Periphery=0)	0.109
	(0.444)		(0.199)
L2.ROAA (Periphery=1)	-0.003	L2.ROAA (Periphery=0)	-0.006
	(0.906)		(0.875)
L3.ROAA (Periphery=1)	-0.009	L3.ROAA (Periphery=0)	0.022
	(0.830)		(0.487)
Loan loss provisions (Periphery=1)	-0.631***	Loan loss provisions (Periphery=0)	-0.208***
	(0.000)		(0.001)
Non-interest income share (Periphery=1)	0.019***	Non-interest income share (Periphery=0)	0.006
	(0.006)		(0.278)
Cost to income ratio (Periphery=1)	-0.043***	Cost to income ratio (Periphery=0)	-0.007
	(0.000)		(0.190)
Total assets growth rate (Periphery=1)	-0.018**	Total assets growth rate (Periphery=0)	0.0164**
	(0.026)		(0.034)
Size (Periphery=1)	-0.273***	Size (Periphery=0)	-0.0315
	(0.003)		(0.436)
Capitalization (Periphery=1)	-0.014	Capitalization (Periphery=0)	-0.010
	(0.614)		(0.555)
Deposit funding share (Periphery=1)	-0.006*	Deposit funding share (Periphery=0)	0.0140**
	(0.076)		(0.012)
Bank concentration (Periphery=1)	0.001***	Bank concentration (Periphery=0)	0.000138*
	(0.002)		(0.060)
GDP growth (Periphery=1)	0.004	GDP growth (Periphery=0)	0.00966
	(0.702)		(0.413)
GDP (Periphery=1)	0.185***	GDP (Periphery=0)	-0.0671***
	(0.002)		(0.000)
Inflation (Periphery=1)	0.077***	Inflation (Periphery=0)	-0.0321
	(0.001)		(0.324)
Interest rates (Periphery=1)	1.562**	Interest rates (Periphery=0)	1.578**
	(0.050)		(0.039)
Observations	14,444		
Nr. of banks	2,570		
Nr. of instruments	65		
z_1	4,263		
z_2	0.000		
AR(1)	0.000		
AR(2)	0.059		
AR(3)	0.834		
Hansen test	0.352		

Dependent variable : ROAE			
L.ROAE (Periphery=1)	-0.119	L.ROAE (Periphery=0)	0.064
	(0.634)		(0.745)
L2.ROAE (Periphery=1)	0.001	L2.ROAE (Periphery=0)	0.061
	(0.992)		(0.323)
L3.ROAE (Periphery=1)	-0.018	L3.ROAE (Periphery=0)	-0.009
	(0.845)		(0.819)
Loan loss provisions (Periphery=1)	-8.635***	Loan loss provisions (Periphery=0)	-5.186*
	(0.003)		(0.086)
Non-interest income share (Periphery=1)	0.491*	Non-interest income share (Periphery=0)	0.143
	(0.065)		(0.428)
Cost to income ratio (Periphery=1)	-0.486**	Cost to income ratio (Periphery=0)	-0.078
	(0.027)		(0.691)
Total assets growth rate (Periphery=1)	0.143	Total assets growth rate (Periphery=0)	0.231
	(0.502)		(0.344)
Size (Periphery=1)	-12.71**	Size (Periphery=0)	-0.255
	(0.035)		(0.901)
Capitalization (Periphery=1)	-2.483**	Capitalization (Periphery=0)	-0.826
	(0.020)		(0.194)
Deposit funding share (Periphery=1)	0.009	Deposit funding share (Periphery=0)	0.248*
	(0.951)		(0.088)
Bank concentration (Periphery=1)	0.041**	Bank concentration (Periphery=0)	0.001
	(0.037)		(0.610)
GDP growth (Periphery=1)	0.600*	GDP growth (Periphery=0)	0.429
	(0.076)		(0.103)
GDP (Periphery=1)	5.665*	GDP (Periphery=0)	-1.677**
	(0.055)		(0.014)
Inflation (Periphery=1)	1.452*	Inflation (Periphery=0)	-0.971
	(0.059)		(0.101)
Interest rates (Periphery=1)	42.30	Interest rates (Periphery=0)	38.18
	(0.187)		(0.198)
Observations	14,444		
Nr. of banks	2,572		
Nr. of instruments	49		
z_1	1,471		
z_2	0.000		
AR(1)	0.000		
AR(2)	0.779		
AR(3)	0.882		
Hansen test	0.274		

This table reports results from a two-step GMM dynamic panel estimator (system-GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) of the effects of bank-specific, industry-specific and macroeconomic characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and the return on average equity (ROAE). Except for Bank concentration, GDP growth, GDP, Inflation and Interest rates, all variables are considered endogenous in our model. All variables are interacted with a dummy variable that identifies peripheral banks (Periphery=1) in order to test for a structural break between both groups. z_1 and z_2 are Wald tests of the joint significance of the reported coefficients and of the omitted year dummies, asymptotically distributed as χ^2 under the null hypothesis of no significance. AR(*i*) is a serial correlation test of order *i* using residuals in first differences, asymptotically distributed as $N(0,1)$ under the null hypothesis of no serial correlation. *Hansen* is a test of the overidentifying restrictions, asymptotically distributed as χ^2 under the null hypothesis of no correlation between the instruments and the error term. For the notation of the variables please refer to Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. We use Windmeijer (2005) finite-sample corrected standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

VII. Wald test to the joint equality of coefficients using the Arellano and Bover (1995) and Bundell and Bond (1998) regression

Dependent variable : ROAA

H0:
(1) LLPNL_periphery - LLPNL_core = 0
(2) NNINCshare_periphery - NNINCshare_core = 0
(3) CIR_periphery - CIR_core = 0
(4) GrowthTA_periphery - GrowthTA_core = 0
(5) Size_periphery - Size_core = 0
(6) CAR_periphery - CAR_core = 0
(7) DepTL_periphery - DepTL_core = 0
(8) BankConcentration_periphery - BankConcentration_core = 0
(9) GDPgrowth_periphery - GDPgrowth_core = 0
(10) GDP_periphery - GDP_core = 0
(11) Inflation_periphery - Inflation_core = 0
(12) InterestRate_periphery - InterestRate_core = 0

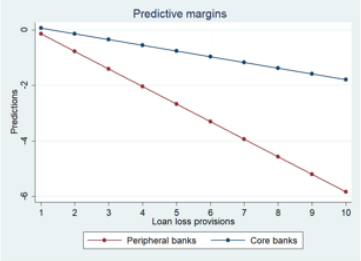
chi2(12) = 71.94
Prob > chi2 = 0.0000

Dependent variable : ROAE

H0:
(1) LLPNL_periphery - LLPNL_core = 0
(2) NNINCshare_periphery - NNINCshare_core = 0
(3) CIR_periphery - CIR_core = 0
(4) GrowthTA_periphery - GrowthTA_core = 0
(5) Size_periphery - Size_core = 0
(6) CAR_periphery - CAR_core = 0
(7) DepTL_periphery - DepTL_core = 0
(8) BankConcentration_periphery - BankConcentration_core = 0
(9) GDPgrowth_periphery - GDPgrowth_core = 0
(10) GDP_periphery - GDP_core = 0
(11) Inflation_periphery - Inflation_core = 0
(12) InterestRate_periphery - InterestRate_core = 0

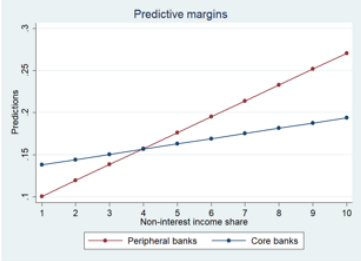
chi2(12) = 28.28
Prob > chi2 = 0.0050

VIII. Covariates marginal effects in ROAA and Wald tests on the single coefficients equality - Arellano and Bover (1995) and Bundell and Bond (1998) regression



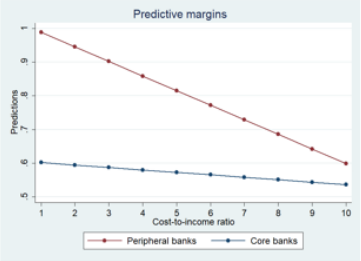
(1) H0: LLPNL_periphery - LLPNL_Core = 0

chi2(1) = 15.00
Prob > chi2 = 0.0001



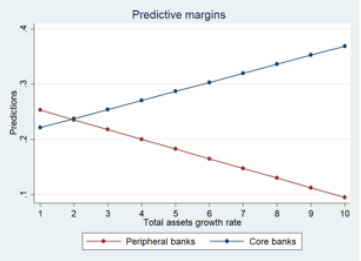
(2) H0: NNINCshare_periphery - NNINCshare_core = 0

chi2(1) = 2.25
Prob > chi2 = 0.1338



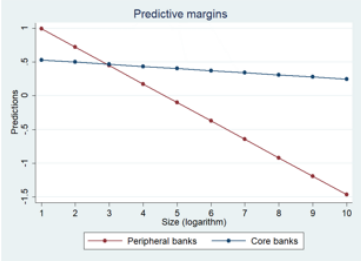
(3) H0: CIR_periphery - CIR_core = 0

chi2(1) = 20.72
Prob > chi2 = 0.0000



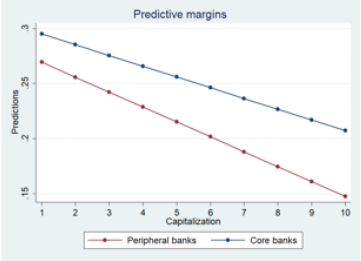
(4) H0: GrowthTA_periphery - GrowthTA_core = 0

chi2(1) = 9.09
Prob > chi2 = 0.0026



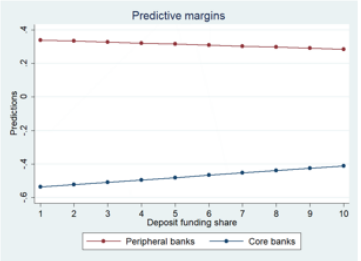
(5) H0: Size_periphery - Size_core = 0

chi2(1) = 6.02
Prob > chi2 = 0.0142



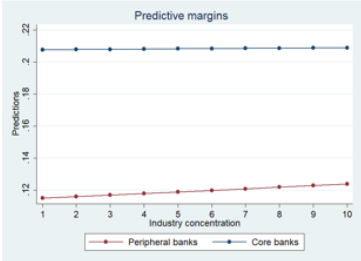
(6) H0: CAR_periphery - CAR_core = 0

chi2(1) = 0.01
Prob > chi2 = 0.9038



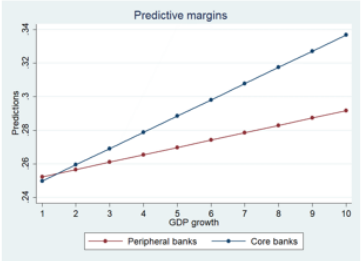
(7) H0: DepTL_periphery - DepTL_core = 0

chi2(1) = 9.92
Prob > chi2 = 0.0016



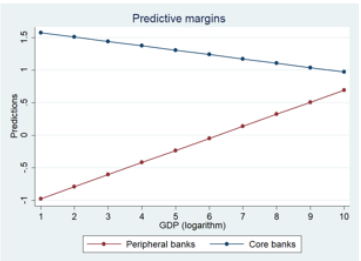
(8) H0: BankConcent_periphery - BankConcent_core = 0

chi2(1) = 6.46
Prob > chi2 = 0.0110



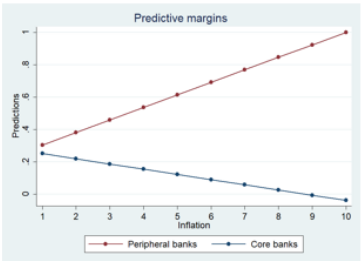
(9) H0: GDPgrowth_periphery - GDPgrowth_core = 0

chi2(1) = 0.35
Prob > chi2 = 0.5542



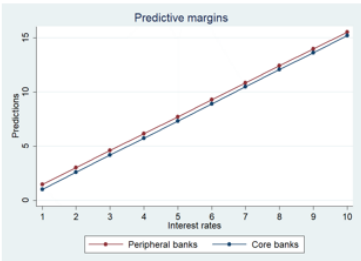
(10) H0: GDP_periphery - GDP_core = 0

chi2(1) = 17.33
Prob > chi2 = 0.0000



(11) H0: Inflation_periphery - Inflation_core = 0

chi2(1) = 7.64
Prob > chi2 = 0.0057



(12) H0: InterestRate_periphery - InterestRate_core = 0

chi2(1) = 0.03
Prob > chi2 = 0.8678

IX. Arellano and Bover (1995) and Bundell and Bond (1998) regression outputs – financial crisis effect

Dependent variable : ROAA			
L.ROAA (Periphery=1)	0.049	L.ROAA (Periphery=0)	0.147*
	(0.374)		(0.051)
L2.ROAA (Periphery=1)	0.011	L2.ROAA (Periphery=0)	-0.017
	(0.689)		(0.637)
L3.ROAA (Periphery=1)	0.002	L3.ROAA (Periphery=0)	0.034
	(0.955)		(0.248)
Loan loss provisions (Periphery=1)	-0.359***	Loan loss provisions (Periphery=0)	-0.095
	(0.003)		(0.126)
Loan loss provisions (Periphery=1)*crisis	-0.142***	Loan loss provisions (Periphery=0)*crisis	-0.073
	(0.005)		(0.175)
Non-interest income share (Periphery=1)	-0.001	Non-interest income share (Periphery=0)	0.002
	(0.949)		(0.715)
Cost to income ratio (Periphery=1)	-0.033***	Cost to income ratio (Periphery=0)	-0.004
	(0.000)		(0.436)
Total assets growth rate (Periphery=1)	-0.003	Total assets growth rate (Periphery=0)	0.021***
	(0.664)		(0.002)
Size (Periphery=1)	-0.193**	Size (Periphery=0)	-0.029
	(0.015)		(0.440)
Capitalization (Periphery=1)	-0.007	Capitalization (Periphery=0)	-0.007
	(0.780)		(0.678)
Deposit funding share (Periphery=1)	-0.005	Deposit funding share (Periphery=0)	0.012**
	(0.175)		(0.018)
Bank concentration (Periphery=1)	0.001*	Bank concentration (Periphery=0)	0.000*
	(0.057)		(0.079)
GDP growth (Periphery=1)	0.012	GDP growth (Periphery=0)	0.008
	(0.328)		(0.463)
GDP (Periphery=1)	0.128**	GDP (Periphery=0)	-0.074***
	(0.017)		(0.000)
Inflation (Periphery=1)	0.089***	Inflation (Periphery=0)	-0.036
	(0.000)		(0.228)
Interest rates (Periphery=1)	1.643**	Interest rates (Periphery=0)	1.683**
	(0.024)		(0.019)
Observations	14,444		
Nr. of banks	2,570		
Nr. of instruments	69		
z_1	4,225		
z_2	0.000		
AR(1)	0.000		
AR(2)	0.065		
AR(3)	0.887		
Hansen test	0.131		

Dependent variable : ROAE			
L.ROAE (Periphery=1)	0.064	L.ROAE (Periphery=0)	0.414*
	(0.735)		(0.088)
L2.ROAE (Periphery=1)	0.058	L2.ROAE (Periphery=0)	0.115
	(0.277)		(0.227)
L3.ROAE (Periphery=1)	0.048	L3.ROAE (Periphery=0)	0.082
	(0.389)		(0.220)
Loan loss provisions (Periphery=1)	-6.188**	Loan loss provisions (Periphery=0)	8.586
	(0.012)		(0.251)
Loan loss provisions (Periphery=1)*crisis	-1.114	Loan loss provisions (Periphery=0)*crisis	-6.136
	(0.241)		(0.223)
Non-interest income share (Periphery=1)	0.198	Non-interest income share (Periphery=0)	-0.225
	(0.280)		(0.449)
Cost to income ratio (Periphery=1)	-0.259	Cost to income ratio (Periphery=0)	0.068
	(0.140)		(0.816)
Total assets growth rate (Periphery=1)	0.240	Total assets growth rate (Periphery=0)	0.647
	(0.162)		(0.113)
Size (Periphery=1)	-2.236	Size (Periphery=0)	1.532
	(0.661)		(0.623)
Capitalization (Periphery=1)	-0.720	Capitalization (Periphery=0)	0.183
	(0.320)		(0.888)
Deposit funding share (Periphery=1)	-0.004	Deposit funding share (Periphery=0)	0.268
	(0.978)		(0.298)
Bank concentration (Periphery=1)	0.012	Bank concentration (Periphery=0)	-0.001
	(0.406)		(0.761)
GDP growth (Periphery=1)	0.359	GDP growth (Periphery=0)	0.425
	(0.277)		(0.125)
GDP (Periphery=1)	3.055	GDP (Periphery=0)	-0.449
	(0.241)		(0.503)
Inflation (Periphery=1)	0.602	Inflation (Periphery=0)	0.472
	(0.402)		(0.665)
Interest rates (Periphery=1)	-25.95	Interest rates (Periphery=0)	-21.92
	(0.589)		(0.624)
Observations	14,444		
Nr. of banks	2,572		
Nr. of instruments	51		
z_1	1,488		
z_2	0.000		
AR(1)	0.023		
AR(2)	0.254		
AR(3)	0.325		
Hansen test	0.099		

This table reports results from a two-step GMM dynamic panel estimator (system-GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) of the effects of bank- and industry-specific and macroeconomic characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and the return on average equity (ROAE). Except for Bank concentration, GDP growth, GDP, Inflation and Interest rates, all variables are considered endogenous in our model. All variables are interacted with a dummy variable that identifies peripheral banks (Periphery=1) in order to test for a structural break between both groups. The dummy variable "crisis" represents the 2008-2013 financial crisis period. z_1 and z_2 are Wald tests of the joint significance of the reported coefficients and of the omitted year dummies, asymptotically distributed as χ^2 under the null hypothesis of no significance. AR(*i*) is a serial correlation test of order *i* using residuals in first differences, asymptotically distributed as $N(0,1)$ under the null hypothesis of no serial correlation. *Hansen* is a test of the overidentifying restrictions, asymptotically distributed as χ^2 under the null hypothesis of no correlation between the instruments and the error term. For the notation of the variables please refer to Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. We use Windmeijer (2005) finite-sample corrected standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

X. Fixed effects regression – baseline model

Variables	ROAA	ROAE
Loan loss provisions	-0.230***	-2.955***
	(0.000)	(0.000)
Non-interest income share	0.00301***	0.0587***
	(0.000)	(0.000)
Cost to income ratio	-0.0231***	-0.277***
	(0.000)	(0.000)
Total assets growth rate	0.00208***	0.0367***
	(0.000)	(0.000)
Size	0.105**	0.523
	(0.042)	(0.502)
Capitalization	0.0240***	0.162**
	(0.000)	(0.029)
Deposit funding share	0.00268***	0.00347
	(0.003)	(0.765)
Bank concentration	-0.000139**	-0.00168*
	(0.043)	(0.074)
GDP growth	0.0324***	0.486***
	(0.000)	(0.000)
GDP	0.773***	2.498
	(0.001)	(0.444)
Inflation	0.0296***	0.484***
	(0.000)	(0.000)
Interest rates	0.0386***	0.663***
	(0.001)	(0.000)
Constant	-21.92***	-59.06
	(0.001)	(0.525)
Observations	22.049	22.043
Nr. of banks	2.718	2.717
Adjusted R^2	0,536	0,454
Bank dummies	Yes	Yes
Time dummies	Yes	Yes

This table reports results from fixed-effects estimations of the effects of bank-specific, industry-specific and macroeconomics characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and return on average equity (ROAE). For the notation of the variables please refer to Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. We use robust standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

XI. Fixed effects regression – combined model

Dependent variable : ROAA			
Loan loss provisions (Periphery=1)	-0.446***	Loan loss provisions (Periphery=0)	-0.126***
	(0.000)		(0.000)
Non-interest income share (Periphery=1)	0.007***	Non-interest income share (Periphery=0)	0.003***
	(0.000)		(0.006)
Cost to income ratio (Periphery=1)	-0.030***	Cost to income ratio (Periphery=0)	-0.017***
	(0.000)		(0.000)
Total assets growth rate (Periphery=1)	0.002*	Total assets growth rate (Periphery=0)	0.002***
	(0.073)		(0.004)
Size (Periphery=1)	0.194**	Size (Periphery=0)	0.008
	(0.017)		(0.877)
Capitalization (Periphery=1)	0.036***	Capitalization (Periphery=0)	0.009
	(0.000)		(0.240)
Deposit funding share (Periphery=1)	-0.000	Deposit funding share (Periphery=0)	0.003***
	(0.794)		(0.009)
Bank concentration (Periphery=1)	0.000***	Bank concentration (Periphery=0)	-0.000***
	(0.000)		(0.003)
GDP growth (Periphery=1)	0.034***	GDP growth (Periphery=0)	0.039***
	(0.000)		(0.000)
GDP (Periphery=1)	-0.401	GDP (Periphery=0)	0.093
	(0.218)		(0.789)
Inflation (Periphery=1)	0.002	Inflation (Periphery=0)	0.057***
	(0.880)		(0.000)
Interest rates (Periphery=1)	0.107***	Interest rates (Periphery=0)	0.018
	(0.000)		(0.142)
Constant	1.634		
	(0.866)		
Observations	22.049		
Nr. of banks	2.718		
Adjusted R^2	0,631		
Bank dummies	Yes		
Time dummies	Yes		

Dependent variable : ROAE			
Loan loss provisions (Periphery=1)	-5.624***	Loan loss provisions (Periphery=0)	-1.687***
	(0.000)		(0.000)
Non-interest income share (Periphery=1)	0.109***	Non-interest income share (Periphery=0)	0.057***
	(0.000)		(0.000)
Cost to income ratio (Periphery=1)	-0.315***	Cost to income ratio (Periphery=0)	-0.249***
	(0.000)		(0.000)
Total assets growth rate (Periphery=1)	0.048***	Total assets growth rate (Periphery=0)	0.026***
	(0.000)		(0.000)
Size (Periphery=1)	1.416	Size (Periphery=0)	-0.640
	(0.414)		(0.416)
Capitalization (Periphery=1)	0.412***	Capitalization (Periphery=0)	-0.109
	(0.001)		(0.203)
Deposit funding share (Periphery=1)	-0.044**	Deposit funding share (Periphery=0)	0.018
	(0.017)		(0.211)
Bank concentration (Periphery=1)	0.006***	Bank concentration (Periphery=0)	-0.003***
	(0.005)		(0.008)
GDP growth (Periphery=1)	0.460***	GDP growth (Periphery=0)	0.499***
	(0.000)		(0.000)
GDP (Periphery=1)	-8.683*	GDP (Periphery=0)	-2.766
	(0.061)		(0.558)
Inflation (Periphery=1)	0.460**	Inflation (Periphery=0)	0.777***
	(0.014)		(0.000)
Interest rates (Periphery=1)	0.979***	Interest rates (Periphery=0)	0.347*
	(0.005)		(0.075)
Constant	143.5		
	(0.277)		
Observations	22.043		
Nr. of banks	2.717		
Adjusted R^2	0,530		
Bank dummies	Yes		
Time dummies	Yes		

This table reports results from fixed-effects estimations of the effects of bank-specific, industry-specific and macroeconomics characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and return on average equity (ROAE). For the notation of the variables please refer to Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. We use robust standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.

XII. Wald test to the joint equality of coefficients using a fixed effects regression

Dependent variable : ROAA

H0:
(1) LLPNL_periphery - LLPNL_core = 0
(2) NNINCshare_periphery - NNINCshare_core = 0
(3) CIR_periphery - CIR_core = 0
(4) GrowthTA_periphery - GrowthTA_core = 0
(5) Size_periphery - Size_core = 0
(6) CAR_periphery - CAR_core = 0
(7) DepTL_periphery - DepTL_core = 0
(8) BankConcentration_periphery - BankConcentration_core = 0
(9) GDPgrowth_periphery - GDPgrowth_core = 0
(10) GDP_periphery - GDP_core = 0
(11) Inflation_periphery - Inflation_core = 0
(12) InterestRate_periphery - InterestRate_core = 0

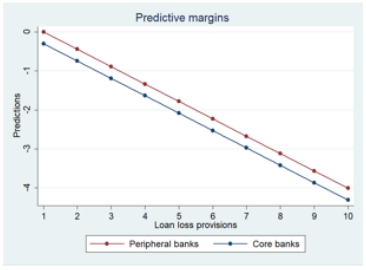
F(12, 2717) = 46.60
Prob > F = 0.0000

Dependent variable : ROAE

H0:
(1) LLPNL_periphery - LLPNL_core = 0
(2) NNINCshare_periphery - NNINCshare_core = 0
(3) CIR_periphery - CIR_core = 0
(4) GrowthTA_periphery - GrowthTA_core = 0
(5) Size_periphery - Size_core = 0
(6) CAR_periphery - CAR_core = 0
(7) DepTL_periphery - DepTL_core = 0
(8) BankConcentration_periphery - BankConcentration_core = 0
(9) GDPgrowth_periphery - GDPgrowth_core = 0
(10) GDP_periphery - GDP_core = 0
(11) Inflation_periphery - Inflation_core = 0
(12) InterestRate_periphery - InterestRate_core = 0

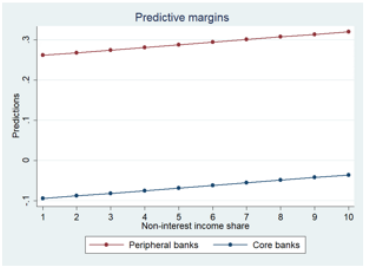
F(12, 2716) = 29.58
Prob > F = 0.0000

XIII. Covariates marginal effects in ROAA and Wald tests on the single coefficients equality - fixed effects regression



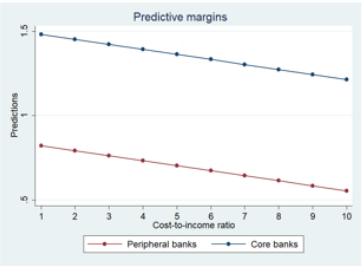
(1) H0: LLPNL_periphery - LLPNL_Core = 0

F(1, 2717) = 363.36
Prob > F = 0.0001



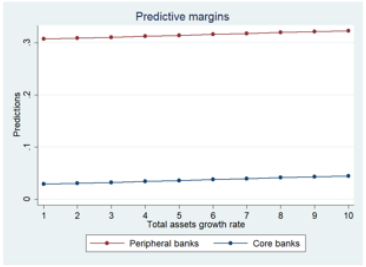
(2) H0: NNINCshare_periphery - NNINCshare_core = 0

F(1, 2717) = 8.60
Prob > F = 0.0034



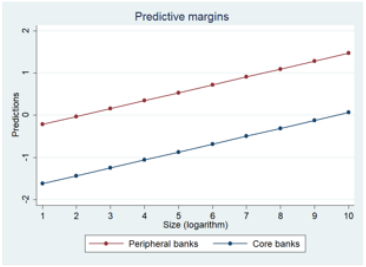
(3) H0: CIR_periphery - CIR_core = 0

F(1, 2717) = 50.63
Prob > F = 0.0000



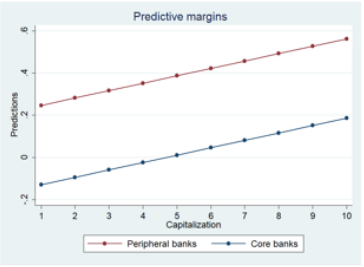
(4) H0: GrowthTA_periphery - GrowthTA_core = 0

F(1, 2717) = 0.00
Prob > F = 0.9641



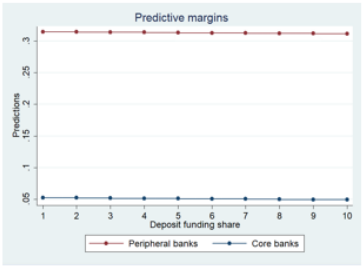
(5) H0: Size_periphery - Size_core = 0

F(1, 2717) = 4.12
Prob > F = 0.0425



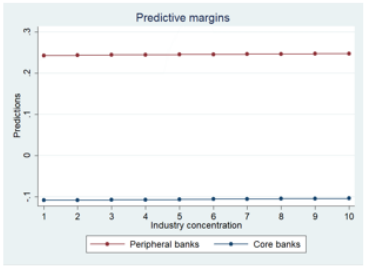
(6) H0: CAR_periphery - CAR_core = 0

F(1, 2717) = 4.27
Prob > F = 0.0389



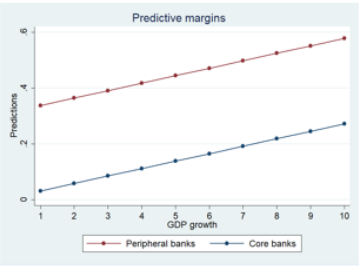
(7) H0: DepTL_periphery - DepTL_core = 0

F(1, 2717) = 4.39
Prob > F = 0.0363



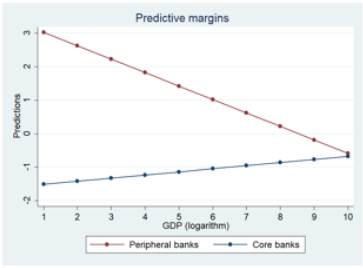
(8) H0: BankConcent_periphery - BankConcent_core = 0

F(1, 2717) = 22.02
Prob > F = 0.0000



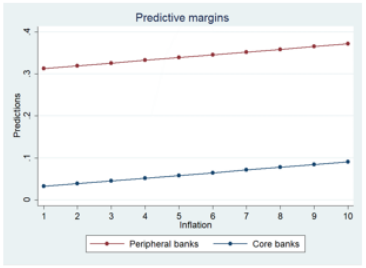
(9) H0: GDPgrowth_periphery - GDPgrowth_core = 0

F(1, 2717) = 1.49
Prob > F = 0.2224



(10) H0: GDP_periphery - GDP_core = 0

F(1, 2717) = 11.77
Prob > F = 0.0006



(11) H0: Inflation_periphery - Inflation_core = 0

F(1, 2717) = 10.83
Prob > F = 0.0010

(not estimable)

(12) H0: InterestRate_periphery - InterestRate_core = 0

F(1, 2717) = 25.36
Prob > F = 0.0000

XIV. Fixed effects regression outputs – financial crisis effect

Dependent variable : ROAA			
Loan loss provisions (Periphery=1)	-0.412***	Loan loss provisions (Periphery=0)	-0.124***
	(0.000)		(0.000)
Loan loss provisions (Periphery=1)*crisis	-0.0565***	Loan loss provisions (Periphery=0)*crisis	-0.00255
	(0.001)		(0.878)
Non-interest income share (Periphery=1)	0.00652***	Non-interest income share (Periphery=0)	0.00288***
	(0.000)		(0.004)
Cost to income ratio (Periphery=1)	-0.0297***	Cost to income ratio (Periphery=0)	-0.0173***
	(0.000)		(0.000)
Total assets growth rate (Periphery=1)	0.00175*	Total assets growth rate (Periphery=0)	0.00183***
	(0.076)		(0.003)
Size (Periphery=1)	0.187**	Size (Periphery=0)	0.00900
	(0.018)		(0.861)
Capitalization (Periphery=1)	0.0351***	Capitalization (Periphery=0)	0.00960
	(0.001)		(0.230)
Deposit funding share (Periphery=1)	-0.000359	Deposit funding share (Periphery=0)	0.00319***
	(0.743)		(0.008)
Bank concentration (Periphery=1)	0.000518***	Bank concentration (Periphery=0)	-0.000232***
	(0.000)		(0.003)
GDP growth (Periphery=1)	0.0267***	GDP growth (Periphery=0)	0.0370***
	(0.000)		(0.000)
GDP (Periphery=1)	-0.0500	GDP (Periphery=0)	0.0328
	(0.879)		(0.925)
Inflation (Periphery=1)	0.00651	Inflation (Periphery=0)	0.0591***
	(0.578)		(0.000)
Interest rates (Periphery=1)	0.0928***	Interest rates (Periphery=0)	0.0186
	(0.000)		(0.134)
Constant	0.147		
	(0.988)		
Observations	22.049		
Nr. of banks	2.718		
Adjusted R^2	0,632		
Bank dummies	Yes		
Time dummies	Yes		

Dependent variable : ROAE			
Loan loss provisions (Periphery=1)	-4.922***	Loan loss provisions (Periphery=0)	-1.590***
	(0.000)		(0.000)
Loan loss provisions (Periphery=1)*crisis	-1.158***	Loan loss provisions (Periphery=0)*crisis	-0.106
	(0.000)		(0.668)
Non-interest income share (Periphery=1)	0.0937***	Non-interest income share (Periphery=0)	0.0588***
	(0.000)		(0.000)
Cost to income ratio (Periphery=1)	-0.312***	Cost to income ratio (Periphery=0)	-0.248***
	(0.000)		(0.000)
Total assets growth rate (Periphery=1)	0.0479***	Total assets growth rate (Periphery=0)	0.0259***
	(0.000)		(0.000)
Size (Periphery=1)	1.270	Size (Periphery=0)	-0.617
	(0.462)		(0.434)
Capitalization (Periphery=1)	0.391***	Capitalization (Periphery=0)	-0.104
	(0.001)		(0.224)
Deposit funding share (Periphery=1)	-0.0449**	Deposit funding share (Periphery=0)	0.0187
	(0.013)		(0.186)
Bank concentration (Periphery=1)	0.00680***	Bank concentration (Periphery=0)	-0.00259***
	(0.001)		(0.008)
GDP growth (Periphery=1)	0.306***	GDP growth (Periphery=0)	0.464***
	(0.006)		(0.000)
GDP (Periphery=1)	-1.611	GDP (Periphery=0)	-4.106
	(0.736)		(0.384)
Inflation (Periphery=1)	0.559***	Inflation (Periphery=0)	0.823***
	(0.003)		(0.000)
Interest rates (Periphery=1)	0.703**	Interest rates (Periphery=0)	0.354*
	(0.046)		(0.069)
Constant	116.3		
	(0.381)		
Observations	22.043		
Nr. of banks	2.717		
Adjusted R^2	0,533		
Bank dummies	Yes		
Time dummies	Yes		

This table reports results from fixed-effects estimations of the effects of bank-specific, industry-specific and macroeconomics characteristics on bank profitability. The dependent variables are the return on average assets (ROAA) and return on average equity (ROAE). For the notation of the variables please refer to Section 4.2 and Appendix III. The period covers the years from 2006 to 2015. The dummy variable "crisis" represents the 2008-2013 financial crisis period. We use robust standard errors, *p*-values are in brackets and significance levels at the 1%, 5% and 10% level are marked with ***, **, and *, respectively.