
State-Owned and Privately-Owned banks' performance: Is there any difference?

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Biographical Note

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Abstract

The aim of this dissertation is to compare the performances of state-owned banks and privately-owned banks in the European Union, with particular focus on the financial crisis period. We compare the performance of a sample of 319 banks from 27 European countries over the 2004-2016 years employing a GMM estimation technique, which allows to control profits persistence and endogeneity issues. After controlling for bank characteristics, country macroeconomic conditions and industry structure, two main results emerge. First, the profitability of public sector banks is not significantly different from that of privately held banks. Secondly, state-owned banks seem to outperform their private peers during times of financial distress, which can be due to their safer image among investors. Empirical evidence also rejects the general bad view associated with governmental ownership and inefficiency as we find no support for a performance gap between public and private banking institutions.

JEL classification: C23; G21; G32; L2.

Keywords: European Banking, Performance, Financial Crisis, Ownership.

Resumo

Esta investigação tem como objetivo comparar os desempenhos financeiros dos bancos públicos e privados na União Europeia, com particular foco no período da última grande crise financeira. A nossa amostra é constituída por 319 instituições bancárias, naturais de 27 países, e compreende dados referentes ao período de 2004 a 2016. O método de estimação adotado, *System GMM*, permite não só acomodar a índole dinâmica do modelo econométrico utilizado, bem como controlar questões relacionadas com endogeneidade. Tendo em consideração os diversos determinantes internos, industriais e macroeconómicos da rentabilidade bancária, os resultados obtidos permitem a ilação de duas principais conclusões. Primeiro, a rentabilidade dos bancos públicos não é significativamente diferente da dos bancos do setor privado. Em segundo lugar, os bancos controlados pelo Estado parecem ter performances superiores nos anos de crise, o que poderá ser apontado como resultado da associação, por parte dos investidores, de segurança e solvabilidade a estas entidades. Em geral, a evidência empírica rejeita a visão negativa da participação ativa das autoridades públicas no sistema financeiro e ineficiência decorrente.

JEL classification: C23; G21; G32; L2.

Keywords: Sistema Financeiro Europeu, Performance, Crise Financeira, Estrutura Accionista.

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Acronyms list

DWH – Durbin-Wu-Hausman

ECB – European Central Bank

EU – European Union

GDP – Gross Domestic Product

GFC – Global Financial Crisis

GMM – Generalized method of moments

IMF – International Monetary Fund

NIM – Net interest margin

POB – Privately-Owned Bank

ROAA – Return on average assets

ROAE – Return of average equity

SCP – Structure-Conduct-Performance

SOB – State-owned Bank

1. Introduction

Banks and financial markets are key players in the economy. Among others, they perform the essential function of channeling resources within and across economies, offering saving and investment products for individuals, companies, institutions, and governments. As result, their activities are inter-reliant from the real economy and their development has been argued as an important economic growth driver, improving both business and trade.

The financial industry has endured several transformations and developments in the past few decades. From the 80s system deregulation and liberalization to the subsequent internationalization and expansion of the sector, alongside with the privatization wave that took place in the 90s, business models have changed significantly. All across Europe and around the globe, banks and other financial institutions entered capital markets, operating as universal organizations and providing a wide range of retail and investment services to their commercial partners (Ayadi and Groen, 2014; Cull et al., 2018).

Ensuing, the growing complexity and interdependence between banks, financial markets, and economies, increased the risk of systematic crisis and financial distress across multiple branches and geographic areas. Hence, since bank insolvencies impact severely economies' gross domestic product growth and employment, banks' performance has been object to extensive research. It presents an imperative query as its' downside risk affects all different stakeholders (owners, managers, employees, regulators, clients, investors, taxpayers and others).

The 2007-2008 financial crisis and the subsequent economic recession revealed many fragilities in the banking sector regarding excessive risk-taking behavior and unreasonable leverage levels. During this period many European banks registered very low or negative returns and solvability issues as their assets devaluated drastically, credit default started to rose exponentially, and their existing liquidity levels fell short facing their obligations. The pending collapse of the financial system required governmental assistance and direct intervention from the regulatory authorities. While policymakers' first response to this event has been argued as inadequate, focused mainly in the provision of liquidity instead of risk management, it stabilized the situation in the medium term (Shiller and Quinn, 2008; Taylor, 2009). The unprecedented monetary policy measures included the historical reduction of short-term interest rates and the

unlimited liquidity injection in the financial system. Governmental programs included acquisition of banks' equity and toxic assets, aiming to improve their balance sheet, as well as the issue of debt guarantees in order to reestablish the markets and investors' trust.

This public involvement, adding to several bailouts, led to an increase in the already worrying deficit levels in several European countries, and in 2011 the burst of the sovereign debt crisis raised concerns about the wholesale market funds availability as countries struggled to finance themselves. Following, numerous structural reforms took place, particularly within the eurozone.

The troublesome atmosphere of the past years has put a stop to the financial liberalization and privatization trends we've been witnessing since the 90s as regulators and the national governments' interference increased marginally (Cull et al., 2018). Consequently, the debate on the role of the government in the industry, whether as a market participant or as supervisor and legislator, has reopened. Even though a substantial amount of investigation has been done on the influence of banks' corporate governance and capital structure on their poor performance during this time, attributing responsibility to high levels of risk-taking behavior and shareholders' profit maximization, literature lacks a detailed analysis of the impact of state-ownership in banks' performance during these distressful years. With the increasing banks' nationalizations, it seems rather relevant to understand how governmental banks performed during the financial crisis, shedding light on their future default probability and the reasoning behind this apparent solution for private insolvent banks.

Previous studies on state-owned banks performance lack both consensus and econometric consistency. Nevertheless, academics usually examine this question in one of two ways: investigating gains in terms of profitability, cost efficiency, and risk, after privatizations, or comparing different groups directly. As most governmental banks are not listed, market appraisals are generally not available.

This research aims to access the existence of a gap or difference between the performances of European state-owned-banks and privately-owned-banks and its' significance during times of financial distress. Additionally, other hypotheses are modeled for other determinants of banking performance.

In this work we use a fundamental approach, examining the effect of state ownership, hereby defined with a threshold of 50% shareholdings, between 2004-2016, on banks' returns.

We follow (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011, 2014), applying a GMM technique to our panel and accounting for both bank-specific factors as well as for industry and macroeconomic influences.

In short, our findings show no difference in both profitability measures for state-owned banks and privately-owned banks except for the crisis period. Since state default is theoretical impossible, governmental banks might benefit from higher trust on their safety and solvability from their clients and investors, especially during troublesome times (Dietrich and Wanzenried, 2011). Additionally, these results seem to support convergence between the groups, possibly reinforced either by tighter regulation and supervision mechanisms or simply due to market competition, eliminating inefficient banks from the market. On another note, increasing economic development might reduce the social mandate of public banks, hence their closer performance.

This research contributes to the ongoing debate on the influence of government participation in the banking sector, depicting an important feature about their behavior during the financial crisis and conveying important implications for the regulatory and supervisory policies. Moreover, the study it's also valuable for the entities responsible for banks nationalizations and their future potential transfer to privates. The methodology employed also accounts for several problems sometimes overlooked, contributing to more updated results. Our empirical analysis also extends the existing literature regarding the main components influencing banks' earnings and the sector stability.

The remainder of this work is organized as follows. Chapter 2 covers the main literature on the banks' performance. Chapter 3 presents the data and methodology employed. Chapter 4 contains the discussion of the empirical results. Chapter 5 comprises additional analyses and robustness tests. Lastly, conclusions and implications from the study are drawn in Chapter 6.

2. Literature Review

2.1. Government Intervention in the Banking Industry

Firm's ownership, both in nature and concentration, has long been recognized as a form of corporate governance, affecting simultaneously enterprises' business models and management strategies. The degree to which ownership impacts the firms' performance is usually argued as function of the level of agency conflict between shareholders, managers, other environmental questions, and stakeholders.

We can divide ownership structure models in private, public and cooperative. Furthermore, owners can be classified according to their characteristics as individuals, families, groups, corporate, institutional, venture capital and private equity companies, among many others. For the purpose of this study, we'll focus only on state-owned enterprises and privately-owned enterprises, whose main distinction relies on their mission and ultimate goals. Governmental companies are considered stakeholder-oriented while private seek profit maximization and shareholder-value creation.

Shleifer (1998) first discuss the role of public intervention in the economy, pointing out that in theory, private ownership should be preferred when incentives to innovation are strong. Furthermore, he states that market imperfections, such as monopolies and negative externalities, generally justify state intervention while corruption could be controlled with regulation and supervision. On the other hand, public firms are actually managed by bureaucrats, giving rise to conflict of interest and moral hazard as their personal goals often drift from social welfare (Shleifer and Vishny, 1997).

The longstanding and controversial discussion on the presence of the government in financial system offers two very distinct views. In one hand, state intervention could help overcome market failures and develop strategic sectors promoting economic development (Gerschenkron, 1962; Stiglitz, 1993). On the other hand, and contrary to this positive view, some advocate government ownership is associated with resources misallocation and economic inefficiency due to bureaucracy and corruption, slowing down economic growth (Aebi et al., 2012; La Porta et al., 2002; Sapientza, 2004; Shleifer and Vishny, 1997).

With only a handful of studies supporting the benefits of state ownership and its efficiency compared to private peers, the liberalization and deregulation of financial services and goods we witnessed in the last century comes as no surprise. Following, countries eased up compulsory requirements, interest rates ceilings, entry barriers, and incited bank privatizations. Indeed, development of the financial markets and of the banking sector was regarded as an impelling source of long-run economic growth for the capitalist economies (Levine, 1999). However, the issues following the financial deregulation registered in several countries raised serious concerns on the existence of weak institutions, regulatory and supervisory mechanisms, and the increasing possibility of banking crisis with loosened markets. Nevertheless, the government presence in the sector went down significantly and bank asset holdings declined fast, whereas foreign and private ownership rose exponentially (Cull et al., 2017).

In the years that preceded the global financial crisis, henceforth designated GFC, the opinion on state-banks was very negative. They were held as pervasive to the economy and some academics and professionals believed they would soon disappear. Albeit, the major distress and insolvency and liquidity issues unveiled by the GFC demanded public assistance and in Europe several nationalizations took place, increasing governments direct participation in the financial system. Moreover, state-owned financial institutions presented credit countercyclicality during this period unlike their private peers, whose credit channel was tightened, slowing down economies (Bertay, Ata Can et al., 2015; Brei and Schclarek, 2013; Ferri et al., 2014). Thus, evidence supports their existence as a stabilizing tool in periods of financial distress. Whether this funds are allocated to credit-constrained borrowers is a question out of the scope of our study but it should be noted that there's indication of political influence and corruption in resources granting of public banks (Khwaja and Mian, 2005; Micco et al., 2007; Sapienza, 2004).

Notwithstanding, this systematic crash raised some questions on the benefits and terms of the financial liberalization and the future of the industry as well as about the role of the government as market participant and market legislator.

2.2. Public Banks Performance

In this research context, performance comprises a set of financial profitability measures which are subject of comparison within a reference framework.

Bank's performance is usually measured by one or all the following measures: return on average equity (ROAE), return on average assets (ROAA), or net interest margin (NIM), with small variations in the ratios' calculations. There are limitations to all the measures, which sometimes leads academics to use them complementary. The amount of leverage banks use is not included in the ROAE ratio, this means that banks with the same profit but different debt levels present different returns, whereas ROAA usually does not include off-balance sheet items which have become a noteworthy source of income for European banks in the past three decades, with traditional commercial banks expanding their business portfolio to face the increasing competition. The NIM ratio disregards revenues from fees, commissions, among others, which presents a downfall.

Moreover, countries have different tax regimes, hence comparing after-tax profits could produce biased results, that's why many authors choose to use profit before tax when measuring the ROAA, ROAE, and NIM. Banks also face implicit "taxation" as they must comply with reserves and liquidity requirements and while in accounting terms the payment of corporate taxes produces a negative impact on banks' profitability, in reality, evidence suggests banks pass tax costs to customers, at least in industrialized countries as noted by Demirgüç-Kunt and Huizinga (1999) and more recently reinforced by Albertazzi and Gambacorta (2010).

Even though state-owned banks have been perceived as inefficient in several prisms, the empirical evidence is fairly mixed. Earlier studies from the 90s find a negative correlation between government ownership and banks' profitability for a diverse set of countries from different continents (Bourke, 1989; Short, 1979). More recent works find little support of this influence after controlling for countries' level of development (Goddard et al., 2004; Micco et al., 2007). However, in less industrial economies, public banks seem to present lower levels of profitability and higher costs and non-performing loans. In a more recent study, Dietrich and Wanzenried (2014) employ a sophisticated model and reinforce this idea after finding insignificant differences in banks' returns when controlling for governmental ownership in high-

income countries. Following, regional studies found public banks to underperform compared to privates in South-East Asia, Latin America and in the Middle East (Cornett et al., 2010; Cull et al., 2018; Micco et al., 2007). It appears then that richer nations either have more effective regulatory and supervisory mechanisms that allow them to deal better with the agency conflicts surrounding government involvement or they no longer require state intervention to boost economic progress, which could explain similitude between private and public banks' business models.

Iannotta et al. (2007) contradict this theory after comparing the performance and risk of private, public and mutual banks in 15 European countries and finding state-owned banks to be less profitable, in spite of having lower costs, and riskier, regarding both poorer asset quality and higher insolvency levels. Their results suggest state-banks might benefit implicit guarantees as they seem to have lower funding costs when they present lower profit and cost efficiency, and higher loan losses and default risk, compared to both mutual and private banks. Ferri et al. (2015) suggest that there's actually little evidence of a better private performance compared with stakeholder banks in European countries, arguing that many commercial banks pursued riskier strategies taking endeavors in financial markets and resourcing to leverage in excess, which led to worse performance than banks that typically rely more on their traditional business.

Even so, several European individual studies are consistent with the notion that the impact of the governmental presence in the banking sector depends on countries' macroeconomic, institutional and legal factors. In Germany, stakeholder-oriented banks, including state-owned, cooperatives and mutual banks, have better profitability performances than shareholder-oriented banks, and this fact does not seem to be due to lower costs of funding biasing the market (Altunbas et al., 2001; Chakravarty and Williams, 2006). In Greece, (Athanasoglou et al., 2008) find no significant difference in ROE and ROA when testing for the effect of state tenure. More recently, when assessing the differences in the bank determinants in explaining profitability before and after crisis, Dietrich and Wanzenried (2011) find the relationship to be insignificant before crisis and positive after crisis, which might be connected to the general public perception of superior safety and solvability regarding state-owned enterprises.

Cornett et al. (2010) present a similar study to the intended on this work about the Asian financial crisis and the impact of state-ownership throughout the period. The authors base their hypothesis on the contestable-markets perspective from Kane (2000), which suggests that

financial crisis can improve banks' performance, as the increased globalization of financial services and competition result in stronger regulatory constraints and innovation tension, creating discipline pressures for inefficient agents. They find state-ownership to be irrelevant after crisis.

Hence, considering the sparse and inconclusive literature regarding the effect of state ownership in banks' performance and the extreme lack of evidence regarding this relationship during the global financial crisis period, we aim to expand this discussion analyzing this question under recent years in 27 EU countries and applying robust panel econometric methods. We postulate as main hypothesis, the equality of performances between public and private banks. Rejection of this premise might be due to different business' models and corporate governance characteristics.

For the crisis period in particular, we could expect investors to assess governmental banks as safer than privates, even when fundamentals are the same, leading to superior performances. (Dietrich and Wanzenried, 2011). On the other hand, the severe magnitude of the systemic shock could prevail over this effect, in which case we would find no evidence of this theory.

Banking performance is also affected by several other determinants related to more operational and business essentials and to macroeconomic and legal conditions. In the next section, we present a comprehensive survey of the existing literature regarding additional these factors building support for our model.

2.3. Other Determinants of Banks' Performance

The banking literature typically describes banks' profitability as a function of internal and external determinants, entailing industry and macroeconomic influences. Internal factors consider bank-specific variables such as accounting elements related to banks' balance sheets and income statements (operating efficiency, liquidity risk, credit risk, capital structure adequacy, business mix, bank size), and to corporate governance influences, linked to ownership and management structure. External factors are usually associated with the market conditions and countries institutional development and economic growth.

Research can be split in cross-country studies and individual countries' banking systems analysis. The first group includes (Albertazzi and Gambacorta, 2009; Bolt et al., 2012; Bourke, 1989; Demirgüç-Kunt and Huizinga, 1999; Dietrich and Wanzenried, 2014; Goddard et al., 2004; Molyneux and Thornton, 1992; Pasiouras and Kosmidou, 2007; Short, 1979) while the second comprises (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011). As result of significant diversity of datasets, methodologies and economic environments, empirical conclusions seem to vary across studies. Nevertheless, there is enough common ground to point out some reliable determinants of bank's profitability.

2.3.1. Internal Determinants

Operating efficiency is essential for good results in every company. For banks, analysts usually use cost-income ratio or operating expenses to total assets ratio as measure. European banks endured several restructures in the past years to face the financial crisis and subsequent economic recession but it seems no improvement was made on banks' cost efficiency as pointed by Kok et al. (2016). *Ceteris paribus*, we expect a negative correlation with banks' profitability.

Concerning liquidity, researchers generally found no significant/negative influence on banks' profits. As noted by (Bourke, 1989; Pasiouras and Kosmidou, 2007) liquidity represents a "cost" for banks as it yields little return. In the years before the crisis, banks financed their expansion with short-term funds, enjoying low interest rates from the interbank market rather than through customers' deposits, which would be safer and more stable. When financial

markets fell many banks experienced liquidity issues as they weren't available to meet their obligations. This downward trend is now being reverted because short-term market funds are no longer available at cheap prices and due to an increase in regulation introduced by Basel III requirements under the Liquidity Coverage Ratio and the Net Stable Funding Ratio. In theory, liquidity could help banks overcome situations of financial distress and therefore one could expect to have a positive effect on banking performance during crisis periods (Beltratti and Stulz, 2012). Following, we pose no clear expectation on the sign of this variable in our regressions.

Another relevant aspect distressing banks performance that authorities are trying to target is the asset quality as the amount of impaired loans rose significantly during the turbulent years. Credit risk level is usually measured as the ratio of loss loan provisions or reserves to total gross loans or to net interest income. Non-performing loans volume could also be used to assess this question but it's more difficult to obtain complete information. We predict a negative effect of credit risk in banks' profitability.

The capital structure, commonly defined as the total equity to total assets ratio, also impacts banks' profitability and cost efficiency. Well-capitalized banks appear to face lower costs of funding as their prospects of bankruptcy costs are reduced. They're also regarded as safer and more able to resist economic downswings and external shocks (Athanasoglou et al., 2008; Bourke, 1989; Demirgüç-Kunt and Huizinga, 1999; Dietrich and Wanzenried, 2014; Goddard et al., 2004; Molyneux and Thornton, 1992; Pasiouras and Kosmidou, 2007). Regulators were especially concerned with banks' capital adequacy in the beginning of the crisis, having introduced tighter ratios in the multiple Basel accords to improve banks' performance and solvability. Thus, we conjecture a positive influence in our dependent variables. One should note that capital should be modeled as endogenous as pointed by (Athanasoglou et al., 2008; García-Herrero et al., 2009) since more profitable banks can raise equity more easily through retained earnings.

The business mix also appears to impact banking performance. Following a logic of diversification, multiple product lines decrease the correlation between cash-flows, reducing risk and promoting earnings stability. From the banks' perspective, non-interest income such as commissions, fees, and other trading revenues, usually generates higher returns than interest-income from loans and other debt securities. Albertazzi and Gambacorta (2009) find that non-

interest income is not significantly influenced by the business cycle, suggesting that revenue diversification can help soothing banks' profits in difficult times. (Dietrich and Wanzenried, 2011, 2014) support this view when testing for Switzerland banking system and for banks' in countries with different levels of income. Recent reports also point to an increase in banks' business diversification in Europe (Bertay, A.C. and Huizinga, 2017; Kok et al., 2016). However, a cautionary flag must be raised as non-interest income tends to be more volatile. Furthermore, Goddard et al. (2004) found no evidence of this positive relation when testing for off-balance sheet items as an alternative source of income for commercial banks in EU except for the UK. Elder studies for the U.S also contradict the potential benefits derived from diversification and claim retail as the core business income source for commercial banks (DeYoung and Rice, 2004; Stiroh, 2004). Beltratti and Stulz (2012) mention that higher stakes of interest income might be better in the crisis period as market-marked securities devalue significantly. Consistent with this view, Chowdhury (2015) report better performance for traditional banks during the GFC. On the other hand, banks with more loans on their balance sheet during the GFC had to endure a higher level of impaired loans. DeYoung and Torna (2013) analyze the relationship between non-interest income and banks' performance by activity concluding that different sources of non-interest income have different effects on banks' profitability and default probability. Thus, we don't postulate any assumption regarding the expected sign of this determinant.

In theory, banks' size might produce economies of scale and of scope, and funding costs advantages. Additionally, larger banks have stronger brands, increasing market power easier than smaller institutions. Furthermore, they may benefit from the "too-big-to-fail" implicit guarantee. While Demirgüç-Kunt and Huizinga (1999) find a positive correlation between size and banks profitability, the majority of studies postulates size' impact as irrelevant or insignificant (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2014; Goddard et al., 2004; Short, 1979), and some even as detrimental (Pasiouras and Kosmidou, 2007). This finding could be explained by the presence of diseconomies of scale and/or agency conflicts and bureaucratic costs in bigger banks. Academics use a variety of measures for size, from deposits to total assets or their logarithms.

In addition, other strands of literature focus on corporate governance mechanisms, subject to scrutiny in the aftermath of the GFC as the general public began questioning the managers' and boards' role in the depressed performance of banks and other financial institutions.

2.3.2. External Determinants

Industry competition has been regarded as an important feature to improve banks' efficiency and promote systemic stability and credit accessibility to the economy, being strongly promoted by regulators and supervising authorities. Earlier studies on commercial banks' profitability in the 90s measure competitiveness through concentration ratios and indexes, arguing that higher market power and influence of financial conglomerates through collusion generated monopoly profits, political influence in the shaping of regulations and policies, as well as less favorable interest rates to customers. However, the empirical results on this theory, also known as the structure-conduct-performance paradigm, disclose no consensus amongst investigators. While Short (1979); Bourke (1989); Molyneux and Thornton (1992); and Demirgüç-Kunt and Huizinga (1999) have found evidence of a positive relation between banking profitability and industry concentration supporting the SCP hypothesis, Berger (1995) reaches a negative correlation after controlling for superior management efficiency, technology innovation, market share and product diversification of larger institutions. More recent studies, such as Athanasoglou et al. (2008), found no significant relationship between the Greek banking system concentration and the industry performance. In turn, Dietrich and Wanzenried (2011) found a positive relationship before the 2007-2009 financial crisis and insignificant later. The same authors, in 2014, claim concentration to be negatively correlated with banks profitability except for low-income countries. In all, it seems concentration might not be a good measure of competition, at least in more developed countries as tighter regulatory mechanisms might prevent undiscerning policies. Nonetheless, we use the three-firm concentration ratio, percentage assets held by the three largest banks in each country to the industry total.

One important determinant of banks performance is the macroeconomic environment, such as expected inflation, business cycle, institutional factors, financial market development, regulation, and many other aspects. This group of factors can be particularly relevant explaining differences in the performance results across countries. Demirgüç-Kunt and Huizinga (1999) are among the firsts to employ an extensive set of macroeconomic indicators to assess how the economic framework and the systems' structure affect banks' functioning.

Regarding inflation, *ceteris paribus*, it should increase not only banks' interest rates but also banks' costs with wages and other expenses. Thus, its' effect on banks' performance depends on how accurately managers are able to forecast it. Even though most authors find a positive relationship, meaning that managers are successfully able to pass the effect to customers, especially in developed countries where inflation rates are less volatile, from a theoretical point of view no clear sign should be expected (Demirgüç-Kunt and Huizinga (1999), (Bourke, 1989), (Molyneux and Thornton, 1992). Hence, we do not include this variable in our model.

Moreover, literature generally simplifies the business cycle to the gross domestic product growth, which has a positive impact on banks' performance. This pro-cyclicality has a rather intuitive understanding as good economic conditions translate into more investment and consumption, increasing banks' interest income via credit channel and reducing credit losses with borrowers backed by a favorable economic conjuncture (Albertazzi and Gambacorta, 2009). Bolt et al. (2012) point out a higher level of the effect specifically during severe recessions driven by non-performing loans, which can help explain the bad performance of banks after the global financial crisis and the downturn that followed, especially in European markets. In our research, we elected real GDP growth as a measure of the economic environment even though others could have been used such as the output gap and the GDP per capita growth, for example.

The development of financial markets and the importance of banks system to countries' economies appears to be positively related to banks' performance even though there is evidence of some substitutability between financial intermediaries and financial markets as the markets develop (Demirgüç-Kunt and Huizinga, 1999; Dietrich and Wanzenried, 2014; Pasiouras and Kosmidou, 2007). A future strand of literature concerning this topic should relate to the growing of Fintech and non-banking institutions, pressuring competition in the industry and raising some concerns about the traditional banks' response to the technological environment, and their ability to squeeze profits and cut costs but also their endurance to a possible shortening of deposit funding. Nevertheless, we expect more developed countries to present better performing banking institutions.

Regulation and supervision of banking industry were brought to spotlight during the GFC as many blamed the deregulation and loose policies of supervisors for the high risk-taking behavior and excessive leverage of banks. Until 2007, it was generally accepted that higher restrictions on banks' activities and industry-entry barriers were bad for banks' performance,

financial stability and development, as they didn't promote competition (Barth et al., 2004). The same authors find no evidence of a negative relation between capital regulations and banking crisis, even though they reduce nonperforming loans, supporting the previous point. Supervisory indicators such as power (rights of the supervisor to meet and demand information from the auditors, ability to enforce a change on internal structure, among others), independence, and others, also didn't affect banks' performance, and higher deposit insurance schemes seem to pervasively impact banks' profitability. Barth et al. (2004) point out practices that enhance information disclosure and banks' private-sector corporate control and subsequent monitoring as the way to improve the industry stability and performance, in detriment of higher regulatory requirements and more powerful supervising entities.

Beltratti and Stulz (2012), analyze the financial crisis period and find that banks with higher Tier 1 capital ratios and with a more traditional business model, this means more loans and more deposits, had better performance than other banks. Countries with stronger capital supervision and restrictions on activities had also coped better with the distress, contradicting Barth et al. (2004). Supervisory independence from the government seemed to have positive effect in banks performance. Howbeit detecting negative influence of regulation in banks performance, the authors justify it with measures taken by regulators during the crisis that were costly for shareholders, such as the raising of equity funds. Overall, it seems banks from countries with higher capital supervision and stronger regulation on activities fared better than others.

Most of our sample comprises countries from the Eurozone, where regulation and supervision is set up by European Central Bank and the European Commission, applying several common practices to most nations, at least to those in the Eurozone. We also acknowledge that country-specific corporate governance mechanisms can also have different impacts on banking performance.

3. Methodology

3.1. Empirical Framework

The main goal of this study is to test for differences in performance of state-owned banks and privately-owned banks and analyze to what extent is government ownership a determinant of banks' results in times of financial distress. Following the literature, we account for bank specific characteristics as well as macroeconomic and industry factors.

We employ a dynamic linear model, building from (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011, 2014; Micco et al., 2007) and estimating equation (1) for two different performance measures.

$$(1) \quad P_{i,t} = C + \delta P_{i,t-1} + \sum_{j=1}^J \beta_j X_{i,t}^j + \sum_{l=1}^L \beta_l X_{i,t}^l + \sum_{m=1}^M \beta_m X_{i,t}^m + \varepsilon_{i,t},$$

$$\varepsilon_{i,t} = v_{i,t} + u_{i,t}$$

$P_{i,t}$ is the performance measure of bank i at time t , with $i=1, \dots, N$, and $t=1, \dots, T$. We use return on average equity and return on average assets as dependent variables. C is the intercept or constant term. Moreover, we include a one-period lagged dependent variable to control for banks' profit persistence over time as suggested by (Berger et al., 2000), where δ is the speed of adjustment to equilibrium. If δ equals 0, the industry is competitive and profits function is not serial correlated. A value between 0 and 1 indicates a tendency. $X_{i,t}^j$ is a matrix of bank specific controls, $X_{i,t}^l$ represent the industry structure variables and the $X_{i,t}^m$ matrix accounts for macroeconomic factors impacting on banks' performance. $\varepsilon_{i,t}$ is the disturbance term, with $v_{i,t}$ the unobserved bank-specific effects and $u_{i,t}$ the idiosyncratic error.

In order to assess the dynamics of the relationship between government ownership and banks' performance in and out of the crisis period, we add two categorical dummies and their respective product. Hence, $DOS_{i,t}$ takes the value of 1 if the public sector owns more than 50%

of the banks' shares, and 0 otherwise¹. $FCD_{i,t}$ takes the value of 1 if the banks' country is facing a financial or banking crisis in year t, and 0 otherwise. Equations (2) and (3) present the extended versions of the models estimated while table 3.1 provides a detailed description of the variables included.

$$(2) \quad ROAA_{i,t} = c + \delta ROAA_{i,t-1} + \beta_1 CI_{i,t} + \beta_2 LR_{i,t} + \beta_3 AQ_{i,t} + \beta_4 EA_{i,t} + \beta_5 DIV_{i,t} + \beta_6 \log TA_{i,t} + \beta_7 CR3_{i,t} + \beta_8 GDP_{i,t} + \beta_9 DOS_{i,t} + \beta_{10} FCD_{i,t} + \beta_{11} DOS_{i,t} \times FCD_{i,t} + \varepsilon_{i,t},$$

$$\varepsilon_{i,t} = v_{i,t} + u_{i,t}$$

$$(3) \quad ROAE_{i,t} = c + \delta ROAE_{i,t-1} + \beta_1 CI_{i,t} + \beta_2 LR_{i,t} + \beta_3 AQ_{i,t} + \beta_4 EA_{i,t} + \beta_5 DIV_{i,t} + \beta_6 \log TA_{i,t} + \beta_7 CR3_{i,t} + \beta_8 GDP_{i,t} + \beta_9 DOS_{i,t} + \beta_{10} FCD_{i,t} + \beta_{11} DOS_{i,t} \times FCD_{i,t} + \varepsilon_{i,t},$$

$$\varepsilon_{i,t} = v_{i,t} + u_{i,t}$$

Estimation of banks' performance poses a series of different challenges. First, the dynamic nature of relationship specified causes bias and inconsistent estimates when using least squares techniques with fixed or random effects, particularly when 'T' is small (Baltagi, 2008). Furthermore, some explanatory variables might be endogenous to the model introducing reverse causality problems. As mentioned previously, capital should be modeled as endogenous in equations (2) and (3). Additional bank-specific or country and industry-specific characteristics can also be related to omitted variables we do not account for, causing correlation between the independent variables and the error term. As defined by the model we also expect the existence of unobserved heterogeneity across banks.

¹ Micco et al. (2007).

Table 3.1. Variables definition, notation and expected effect of the explanatory variables.

Variable	Measure	Notation	Expected Effect
Dependent Variables			
Profitability	Net Income/ Average Total Assets (%)	ROAA	
	Net Income/ Average Shareholders Equity (%)	ROAE	
Independent Variables			
Bank-Specific			
Cost Efficiency	Cost to Income Ratio (%)	CI	-
Liquidity	Liquid assets / Deposits & Short-term Funding (%)	LR	?
Asset Quality	Loan Loss Provisions/Net Interest Revenue (%)	AQ	-
Capital	Equity / Total Assets (%)	EA	+
Income Diversification	Non-Interest Income/Operating Income (%)	DIV	?
Size	Natural Logarithm of Total Assets (M EUR)	LOGTA	?
Ownership	Dummy variable equals 1 if the bank is state-owned and 0 otherwise.	DOS	?
Industry-Specific			
Market Concentration	Assets of three largest commercial banks as a share of total commercial banking assets (%).	CR3	?
Macroeconomic			
Economic Cycle	GDP real growth rate (%).	GDP	+
Financial Crisis	Dummy variable equals 1 if the banks' country is experiencing financial distress and 0 otherwise.	FCD	-

We address these problems by employing System Generalized Method of Moments (GMM) proposed by (Arellano and Bond, 1991) and (Blundell and Bond, 1998). The estimator not only accommodates possible overlooked heterogeneity and the existence of lagged dependent variable regressors, but it also deals with endogeneity issues. While appropriate instrumental variables can be troublesome to find, this method solves this problem by reasoning that historical values of a variable are correlated with their current level. Thus, we instrument for the endogenous variables with their lagged values, both in levels and in differences. Note that the use of lags of high order can fall short on its' relevance as they're likely to be weakly correlated with the regressor, particularly in the presence of missing data. Additionally, valid instruments should be uncorrelated with the error term. Otherwise, we would be adding more restrictions to our main specification. For validation of the number of lags included and subsequent amount of instruments, we resort to the Arellano–Bond autocorrelation test and the Hansen test for overidentifying restrictions (Hansen, 1982).

This method ensures efficiency and consistency of our parameters' estimates. Variables modeled as endogenous are presented in *italic* in the results' tables.

Furthermore, we perform several additional analyses and robustness tests. First, in order to control for the presence of unit roots, non-stationary variables, we apply a Fisher test for unbalanced panels proposed by Maddala and Wu (1999). We reject the null hypothesis, the presence of a unit root in a times series sample, for all pertinent variables at 1% level of significance. Second, we check for the endogeneity hypothesis of the capital ratio with an augmented regression test, also known as the Durbin-Wu-Hausman test for endogeneity. We regress all exogenous variables to our potential endogenous regressor and add the residuals to the main specification (Baum et al., 2003, 2007). Third, to avoid spurious results driven by a high number of observations from a very specific banking industry, we re-estimate our main regressions dropping all German banks. The outputs of these additional analys are discussed in section 5.

To avoid multicollinearity between the regressors we computed a correlation matrix and removed any variables with a coefficient higher than 0.8

Moreover, we minimize the potential impact of outliers in our dataset by winsorizing the top and bottom 1% of the distribution of each variable.

3.2. Sample and Data Collection

In our analysis we are interested in comparing state-owned banks and privately-owned banks. We dropped any state-owned banks whose specialization was one of the following: cooperative, real estate, investment banking, central banking, other non-banking credit institutions, multi-lateral governmental banks, securities firms and other financial companies. We also tracked banks' history and removed all observations from banks that have undergone nationalizations' processes during the period analyzed. Furthermore, to avoid double counting we excluded any subsidiaries whose parent company is present in the sample. Private banks comprise all commercial banks in the EU with a total amount of assets higher than 25 million EUR. This choice relates to their business similitude with the public banks elected, allowing a consistent comparison between groups. The full list of banks can be consulted in Appendix A.

Accounting data regarding balance sheet and income statement items from 2013 until 2016 was retrieved from Bank Focus while data prior this year, from 2004 – 2012, was recovered from its' previous platform – BankScope. The data provider is Bureau Van Dijk – Moody's Analytics Company in both cases². Information regarding external variables such as banking industry concentration and economic conditions were drawn from the World Bank.

In order to define the crisis period, and noticing it reached countries in different periods and trough several mechanisms, we use the dataset provided by Laeven and Valencia (2012) in their study of systematic banking crisis for IMF.

Our final sample is an unbalanced panel dataset of 319 banks operating in 27 European countries, consisting of 41433 observations over the years 2004-2016. For a detailed description of the data, see appendix B.

Table 3.2 conveys the descriptive statistics for the variables used in our analysis. We report mean, median and standard deviation for the full period, as well as for the crisis years. As expected, the banks in our sample present lower profitability ratios and higher costs in years of financial distress due to weakening of their portfolios, bigger funding costs and bearish market environment. While on average ROAA and ROAE are positive throughout both periods, we

² Bureau Van Dijk reports both unconsolidated and consolidated statements. When both were available we dropped unconsolidated statements.

also observed large negative returns. Additionally, liquidity seems rather stable whereas credit risk increased significantly during the financial crisis. Curiously, even though regulation demanded higher capital ratios, banks seemed to have failed to raise equity during this troublesome period, which might be justified by their low performance. Besides, one could argue this is the result of the “too-big-to-fail” implicit guarantee. Regarding business models, the ratio of non-interest revenue to total income dropped during the crisis. This result might be explained by market-marked securities’ devaluation and commissions and fees decline together with increasing risk and volatility. Moreover, banks’ size and industry competition had remained fairly constant. Also, as a result of the economic recession that followed the GFC, countries’ GDP growth slowed down pointedly. Furthermore, the substantial differences in means and medians are an indication of significant heterogeneity across banks. Table 3.3 presents the correlation matrix for all variables included in our models.

Table 3.2. Descriptive Statistics.

Variable	Full Period			Crisis Period		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
ROAA	0.60	0.49	1.63	0.46	0.39	1.66
ROAE	5.83	6.02	13.71	4.02	5.26	14.59
CI	65.15	62.87	28.56	65.76	63.15	29.31
LR	44.84	26.53	61.22	44.59	27.80	60.74
AQ	26.11	13.95	48.07	28.40	17.95	44.63
EA	12.51	7.74	15.38	11.82	7.00	15.68
DIV	0.37	0.36	0.25	0.36	0.35	0.25
LOGTA	7.92	7.66	2.31	8.12	7.83	2.42
CR3	65.81	64.54	13.72	66.28	63.82	11.21
GDP	1.42	1.62	2.48	0.06	1.08	6.92
DOS	0.20	0.00	-	0.20	0.00	-

Table 3.3. Correlation Matrix.

	ROAA	ROAE	CI	LR	AQ	EA	DIV	LOGTA	CR3	GDP	DOS	FCD
ROAA	1.00											
ROAE	0.75	1.00										
CI	-0.47	-0.46	1.00									
LR	0.07	-0.00	-0.06	1.00								
AQ	-0.47	-0.49	0.06	-0.02	1.00							
EA	0.26	-0.05	-0.04	0.22	0.03	1.00						
DIV	0.13	0.11	0.08	0.11	0.05	0.08	1.00					
LOGTA	-0.13	0.02	-0.15	0.05	0.03	-0.41	-0.07	1.00				
CR3	-0.04	-0.04	-0.00	-0.04	0.01	-0.02	-0.05	-0.01	1.00			
GDP	0.20	0.19	-0.05	0.04	-0.18	0.05	0.02	-0.09	-0.01	1.00		
DOS	-0.06	-0.13	-0.08	0.21	0.06	0.13	0.16	0.16	0.02	0.00	1.00	
FCD	-0.09	-0.08	0.02	-0.00	0.03	-0.05	-0.01	0.08	0.05	-0.30	-0.03	1.00

4. Empirical Results

In a first approach, we provide a univariate analysis testing for differences between means and medians in our performance measures and determinants. Following, we split the data into subsamples by period and by group. The results on can be found in section 4.1.

In section 4.2. we carry out our regression analysis as presented in the previous section.

4.1. Univariate Analysis

For a first impression on the potential asymmetry between state-owned banks and privately-owned banks we compare our main bank-specific variables, testing for differences in means and medians for the full period as well as for the crisis years. Following, we resource to Welch t-tests with unequal variances³ and non-parametric Wilcoxon/Mann-Whitney tests, respectively.

Overall, Table 4.1 shows that state-owned banks are larger, more capitalized and more liquid than their private peers. Even though, governmental banks present higher credit risk and a more traditional business model, these findings don't seem to reflect on their cost efficiency. In fact, privately-owned banks appear to be less cost-efficiency than public institutions. An interesting fact is the insignificant difference between banks' median capital ratios during financial distress. This might be result of equity raisings in this period due to regulators intervention and tighter balance sheet requirements, smoothing out the disparities between groups. Regarding profitability indicators, both tests present consensus concerning a lower return on equity for public banks, but less prominent during the crisis. However, while the mean t-test suggests equality between groups' return on assets cannot be rejected, the median tests report private banks as more profitable at 1%, 5% and 10% significance levels in both periods.

Since in a univariate framework we do not control for multiple factors that might also influence banks' performance and its determinants and assume several conventions regarding variables distribution, independence and variance, ignoring also econometric issues such as

³ Tests for the equality of variances follow (Brown and Forsythe, 1974; Levene, 1960), and are available upon request.

autocorrelation in time-series, heteroscedasticity, and endogeneity, we will rely on the multivariate regression results reported in the next section.

Table 4.1. Comparison between SOBs and POBs performance and its' main internal determinants.

Variable	Panel (1): Mean Analysis				Panel (2): Median Analysis			
	Full Period		Crisis Period		Full Period		Crisis Period	
	SOB	POB	SOB	POB	SOB	POB	SOB	POB
ROAA	0.61	0.60	0.60	0.43	0.29	0.53	0.21	0.43
	-0.12		0.24		6.41***		4.23***	
ROAE	2.88	6.53	2.46	4.36	3.63	6.88	3.12	5.96
	7.54***		2.12***		11.21***		5.19***	
CI	61.28	66.06	60.01	67.00	59.77	63.31	60.05	63.57
	3.97***		3.41***		4.53***		2.66***	
LR	72.02	38.63	71.12	39.12	36.44	24.94	37.29	25.20
	-8.32***		-4.26***		-6.73***		-3.71***	
AQ	30.65	25.02	25.73	29.00	17.55	13.33	17.23	17.98
	-2.48**		1.00		-3.06***		0.618	
EA	16.71	11.52	14.12	11.34	8.56	7.54	7.09	7.00
	-6.64***		-1.87***		-4.97***		-0.37	
DIV	0.29	0.39	0.36	0.37	0.35	0.37	0.34	0.35
	13.25***		-0.39		9.30***		-1.50	
LOGTA	8.60	7.76	9.00	7.92	8.43	7.47	9.43	7.58
	-8.41***		-5.35***		-9.48***		-6.16***	

Panels (1) reports mean values of the different variables per group and period. Panels (2) presents median statistics per variable and per group and period as well. The figures in brackets are the “ t ” and “ z ” statistics for the difference in means and medians tests, respectively. ***, **, * Indicate statistical significance at the 1%, 5% and 10% level, respectively, using a two-tailed test. Please note we do not include external determinants in this analysis as they vary per country and not by bank.

4.2. Multivariate Analysis

Table 4.2 summarizes the main estimation results from equations (2) and (3) using a one-step system GMM estimator⁴. The first column presents the results for banks' return on assets whereas the second reports the estimated coefficients for return on equity.

Overall, our robustness tests indicate good fitness of our model. The Wald-test rejects the null hypothesis of joint insignificance of our explanatory variables. This means the regressors used help explain banks' performance. Furthermore, the Hansen test for overidentifying restrictions in GMM dynamic model estimation in the presence of heteroscedasticity seems to jointly validate our set of instruments⁵. The Arellano-Bond autocorrelation tests reported show evidence of negative autocorrelation in the disturbances. However, this is expected due to the lagged dependent variable term in the regression. As pointed out by Arellano and Bond (1991), our results would be inconsistent if second-order autocorrelation was present, which does not seem the case. Moreover, the use of a dynamic model specification seems justified by the strongly significant coefficient of our lagged dependent variables.

The results for our lagged dependent variable, 0.22 and 0.29 for regression (1) and (2), respectively, are consistent with the idea of a moderate profit persistence for European banks throughout the whole period. One could expect this relationship to not hold due to the major systematic impact of the financial crisis, but this is not the case. Nevertheless, this finding supports earlier evidence from Goddard et al. (2004) and suggests market structure might not be competitive enough to eliminate abnormal returns. Focusing on our other explanatory variables we observe some differences in our regressions, both regarding size and significance of the estimated coefficients.

⁴ Judson and Owen (1999), employing a Monte Carlo analysis, have found that the one-step Arellano-Bond estimator outperforms the two-step estimator both in terms of bias and standard deviation of the estimates.

⁵ Roodman (2007) recommends caution regarding the use of too many instruments and its' impact on this test as adding instruments can inflate p-values to implausible levels. Results seem reasonably stable and comfortable in not rejecting the null hypothesis while our p-values do not cross the author' suggested threshold of 0.25.

Table 4.2. Dynamic regression results for ROAA and ROAE with EA modeled as endogenous for all countries in EU27 (2004-2016).

	ROAA	ROAE
Intercept	0.47 (1.48)	7.28 (11.01)
<i>Lagged dependent variable</i>	0.22 (0.08) ***	0.29 (0.08) ***
CI	-0.02 (0.01) ***	-0.16 (0.05) ***
LR	0.00 (0.01)	-0.07 (0.04) *
AQ	-0.01 (0.00) ***	-0.07(0.03)**
<i>EA</i>	0.04 (0.02) **	0.21(0.16)
DIV	0.75 (0.87)	10.65 (3.16) ***
LOGTA	0.17 (0.11)	0.88 (0.90)
CR3	-0.00 (0.00)	-0.03 (0.03)
GDP	0.02 (0.01) *	0.29 (0.10) ***
DOS	-2.07 (1.31)	3.80 (8.87)
FCD	-0.99 (0.35) ***	-3.45 (1.57) **
DOS*FCD	4.68 (1.98) **	13.32 (8.03) *
Wald-test (p-value)	$\chi^2 = 184.10$ (0.00)	$\chi^2 = 194.65$ (0.00)
Hansen test (p-value)	$\chi^2 = 63.97$ (0.17)	$\chi^2 = 82.15$ (0.17)
AR(1) (p-value)	Z = - 3.63 (0.00)	Z = -4.72 (0.00)
AR(2) (p-value)	Z = - 0.87 (0.38)	Z = -0.86 (0.39)
No. Instruments	67	84

The table presents GMM estimation results for both banking performance variables and the effects of internal and external factors. The variables in italic are instrumented through the GMM procedure using lags. Robust standard errors are reported in brackets. Coefficients marked with . ***, **, * are statistically significant at the 1%, 5% and 10% levels. Additionally, model specification tests' statistics are also summarized. In this case, the values in brackets are the respective p-values.

As expected, our cost-efficiency measure is negatively significant in both specifications, with a much stronger effect on return on equity. This outcome is consistent with several studies and fundamentals reasoning, as more efficient management should reflect in higher profitability, *ceteris paribus*.

While strong liquidity ratios might help avoid insolvency and risk of a bank run in times of financial distress, liquid assets yield lower returns for shareholders as they're less risky, which impacts negatively banking performance. Confirming this last effect, our evidence shows a negative relationship between liquidity for return on average equity. The impact on return on assets seems statically insignificant.

Asset quality, also a measure of credit risk, has a negative influence on both profitability measures. Not surprisingly, higher levels of loan loss provisions mirror worse asset quality and more severe potential losses. During the financial crisis period the amount of loan loss provisions and impaired loans rose exponentially, which led banks to adopt tighter screening and monitoring mechanisms.

The capital ratio variable, hereby defined as total equity over total assets, presents a positive statistically significant impact on ROAA. Indeed, better capitalized banks benefit from a safer perception enhancing investors to reallocate funds and savings to their institutions in times of financial distress. Additionally, as mentioned previously, because they face lower bankruptcy costs and better ratings, they can profit from lower funding costs. More specifically, disregarding the cost of raising equity, in accounting terms, an increase of 1 p.p. of the capital ratio leads to an increase on the average return of assets of 0.04 p.p. This evidence supports the current discussion on the importance of capital adequacy within the banking industry and the new regulatory requirements introduced after the global financial crisis in the European Union. Turning to our other dependent variable, ROAE, we found no similar relationship, which can be explained by the variable definition itself and the profitability boost achieved by financial leverage.

Business diversification, captured by the level of non-interest income, such as fees and commissions from a diverse set of banking operations, doesn't seem to affect banks' profitability in terms of return on assets. This finding supports some previous results from (DeYoung and Rice, 2004; Goddard et al., 2004; Stiroh, 2004). However, results from our second regression show a strong direct relationship between this variable and return on equity. The markets fall

during 2007-2009 as well as in 2011 led to a major decline of this source of income while banks registered some significant losses. Hence, a decrease in this ratio leads to a decline of ROAE. This regressor then captures the volatility the financial underwent in those years, showcasing the extreme sensitivity of banks non-interest revenue to situations of financial distress. Nevertheless, the coefficients are consistent with Beltratti and Stulz (2012) and raise concerns with financial activities management in commercial banks. On the other hand, this highly positive coefficient also sheds light as to why banks have been expanding their traditional operations and entering into capital markets and other financial ventures.

According to prior literature, the estimated equations forecast bank size as irrelevant in explaining banks' performance, which can be an indication of diseconomies of scale and higher agency conflict in the industry. Moreover, and together with the results from our concentration ratio, it signals a controlled competitive environment in the EU, as advocated by the regulatory and supervisory authorities. Following, we also find no support for the SCP theory.

Focusing on the economic conditions, captured by the real GDP growth rate, we find evidence of pro-cyclicality. As predicted by economic reasoning, periods of growth increase banks' business and profitability.

Our dummy variable for the financial crisis negatively impacts banks' performance both in terms of ROAA and ROAE, with an impact significantly higher effect in the second indicator. While some countries with less structural problems and exposure fared better than others, on average, return on equity in this period stayed almost 2 p.p. below the full period statistic of 6.02%. Banks' profitability never bounced back to pre-crisis levels and it's only now starting to increase slightly.

The results of our main hypothesis, no differences in performances from state-owned banks and their private counterparts, show no evidence of better performance or worse profitability for the full period examined. This irrelevance of the ownership variable for both regressions' contrasts with previous findings from (Iannotta et al., 2007; La Porta et al., 2002; Micco et al., 2007) and supports more recent studies (Dietrich and Wanzenried, 2014; Ferri et al., 2014). We find no evidence of the governmental banks' bad view. In fact, state participation in the financial system doesn't seem detrimental to the industry.

More interestingly is the performance of the public banks during the financial crisis. Our results show evidence of significantly better profitability ratios for state-owned banks in

comparison with private peers. Consistent with Dietrich and Wanzenried (2011) and their study for Switzerland, as well as with the implicit guarantees idea mentioned by Iannotta et al. (2007), public banks might be perceived as safer and better than other institutions in times of financial distress, even when fundamentals are the same. Investors expect state-owned banks to be very solvable as the government, at least in theory, could never go bankrupt. Curiously, the end of our financial crisis period marks the beginning of the European sovereign debt crisis raising some doubts about this hypothetical impossible default of the state and its' enterprises.

5. Additional analyses and robustness tests

To confirm the reliability and consistency of our results we perform several preliminary and robustness tests available for consult in appendix C.

As mentioned previously, we check for the presence of unit roots biasing our estimates by applying the Augmented Dickey-Fuller test for unbalanced panels. The tests were implemented in levels with constant and trend terms included with a lag length of 1. Unit roots or non-stationarity is known to influence the validity of standard asymptotic assumptions and hence the rationality of the regression parameters. Additionally, spurious results might arise from having several trending variables. We test the stationarity of all variables except dummies. The findings reported show that our variables are stationary and do not have any unit root processes in the series. Thus, both our internal and external determinants are appropriate to measure banks' performance over the analyzed period.

Additionally, endogeneity, commonly defined as correlation between our explanatory variables and the error term, causes bias and inconsistency in typical estimation procedures and requires proper treatment. We confirm capital is better modeled as endogenous by doing a Durbin-Wu-Hausman augmented-regression test. Under the null hypothesis, the residuals coefficient equals zero and the variable should be considered exogenous. According to our expectations, we reject this hypothesis at a 1% significance level.

Lastly, to understand if results are driven by the significant amount of German observations in our dataset we drop all German banks and re-estimate equations (2) and (3). Results confirm that our main estimates are not the result of specific country influence and that state-owned even outside Germany are not less efficient than private peers and fared significantly better during the financial crisis period. Regarding the other determinants of banking performance, statistics are almost the same as previously appraised. Following, liquidity becomes insignificant in explaining return on equity while capital ratio fails to influence return on average assets. Diversification seems to be significant in both regressions and profits persistence seems to disappear for ROAA.

6. Conclusions

The consequences of the global financial crisis highlighted the importance of tighter and more effective bank supervision and regulation. Alongside, the understanding of banks' performance drivers become rather relevant. Following, the wave of nationalizations that took place in the European financial industry after this event, raised some questions on the role of the state in the industry as well as for the future of government-owned banks and nationalized financial institutions.

In this study we investigate the existence of systematic performance differences between privately and publicly-owned banks, shedding light on the functioning of both groups and their similitude. We also analyze this relationship under times of financial distress to assess which type of bank fared. This helps predict the potential impact of this kind of ownership in the system's overall fragility. Our analysis controls for other relevant determinants of banks profitability, with important policy implications in the restructuring of the financial system.

We apply a GMM estimation technique to an unbalanced panel of banks between 2004 and 2016 which takes into account the dynamic nature of our model, as well as for the endogeneity of the capital ratio and other econometric issues such as heterogeneity, autocorrelation and missing data.

Overall, our results show there are no significant differences between public and private banks' performance, both in terms of ROAA and ROAE. These findings support the idea of a closer financial intermediation business model between groups and contradict some of previous research (Iannotta et al., 2007; La Porta et al., 2002; Short, 1979). On the other hand, our empirical evidence supports seems to be consistent with the social view of state-owned banks and countries economic development. If we regard most of European Countries as financially developed and fairly industrialized, we would expect that government banks development function as no longer needed, as proposed by (Micco et al., 2007). Moreover, our discoveries are in line with others from more recent investigation (Dietrich and Wanzenried, 2014; Ferri et al., 2015).

Furthermore, *ceteris paribus*, we find that state-owned banks significantly outperform their private peers during the financial crisis period. This positive association between government

ownership and banks' profitability might be the result of investors' perception of higher theoretical solvability and safety of the countries' institutions, as in theory they could never default. Hence, there's no evidence of a detrimental effect of the state participation in the financial industry, even in times of financial distress. If we associate this result with public banks' credit countercyclicality pointed out by some authors, their presence in the financial system is rather fitting. These findings actually question the rationality behind the re-privatization of some nationalized institutions as in theory state control would not be harmful.

Regarding other determinants of banking profitability, we find banks with stronger capital ratios, lower credit risk, higher cost-efficiency and a more diversified business structure to perform better. Size and concentration seem to fail in predicting banks' performance and the business cycle has a positive direct influence. Moreover, our baseline results show the existence of minor banking profit persistence in the EU27.

Regarding main limitations, our results rely on the appropriate choice of instruments for the endogenous variables in our model. While there are some key tests that validate our specifications settings' as previously presented, *System GMM* has only recently started to become popular among researchers, hence there are still some challenges concerning the complexity involved and its' ability to correctly predict the effect of our explanatory variables. Additionally, one could argue that there are better proxies for our internal and external factors, as well as for our dependent variables. In our research, we crossed most popular with the ones with more data available, and these might not be necessarily the best indicators.

Nevertheless, having established banks' performance is not significantly influenced by government ownership, further investigation could encompass the analysis of the different corporate governance mechanisms in both groups to assess agency conflicts issues. Moreover, it would be interesting to see if the sovereign debt crisis in Europe influenced both types of banks in the same way. One could also expand the analysis to other ownership classes, such as cooperatives.

Appendix

A. Banks List

Table A.1. Public Banks.

No.	Bank Name
1	AB Svensk Exportkredit-Swedish Export Credit Corporation
2	Abanka d.d
3	Agence Française de Développement
4	Austria Wirtschaftsservice GmbH
5	Banca del Mezzogiorno - MedioCredito Centrale S.p.A
6	Banca Mediocredito del Friuli Venezia Giulia SpA
7	Bank Gospodarstwa Krajowego-National Economy Bank
8	Bank Ochrony Srodowiska SA - BOS SA-Bank Ochrony Srodowiska Capital Group
9	Bank Pocztowy SA
10	Banque et Caisse d'Epargne de l'Etat Luxembourg
11	Bayerische Landesbank
12	Bpifrance
13	Bulgarian Development Bank AD
14	Caisse de crédit municipal de Lyon
15	Caisse de crédit municipal de Nice
16	Caisse de crédit municipal de Nîmes
17	Caisse de crédit municipal de Toulouse
18	Caisse des Dépôts et Consignations-Groupe Caisse des Dépôts
19	Caixa Geral de Depositos
20	Cassa Depositi e Prestiti
21	CEC Bank SA
22	Central Bank of Savings Banks Finland PLC-Säästöpankkien Keskuspankki Suomi Oyj
23	CMP Banque SA
24	COFIDES-Compañía Española de Financiación del Desarrollo SA
25	Croatian Bank for Reconstruction & Development-Hrvatska Banka Za Obnovu I Razvitak - HBOR
26	Czech Export Bank-Ceska Exportni Banka
27	De Volksbank N.V.
28	DEG - Deutsche Investitions-und Entwicklungsgesellschaft mbH
29	Deutsche Kreditbank AG (DKB)
30	Diakhitel Kozpont ZRT.
31	Eximbank Romania-Banca de Export-Import a Romaniei
32	Export-Import bank of the Slovak Republic - EXIMBANKA SR-Exportno-Importna Banka Slovenskej Rep.

33	Finnvera Plc
34	Hungarian Export-Import Bank Private Ltd
35	Institut Catala de Finances
36	Instituto de Crédito Oficial
37	Investitionsbank Berlin
38	InvestitionsBank Schleswig-Holstein
39	Investitions-und Förderbank Niedersachsen GmbH-NBank
40	IRFIS - Finanziaria Per Lo Sviluppo Della Sicilia SpA
41	KfW Bankengruppe-KfW Group
42	KfW Ipex-Bank GmbH
43	Kreissparkasse Herzogtum Lauenburg
44	La Banque Postale
45	Landesbank Saar-SaarLB
46	Landeskreditbank Baden-Wuerttemberg - Förderbank-L-Bank
47	LFA Förderbank Bayern
48	MFB Hungarian Development Bank Private Limited Company
49	Muenze Oesterreich AG
50	Municipal Bank Plc
51	NLB dd-Nova Ljubljanska Banka d.d.
52	Norddeutsche Landesbank Girozentrale NORD/LB
53	NRW.BANK
54	Oberösterreichische Landesbank-Hypo-Bank Oberösterreich
55	Portigon AG
56	Raiffeisenbank Deutschlandsberg eGen
57	Saarlaendische Investitionskreditbank AG
58	Saechsische AufbauBank Forderbank
59	Settlement Bank of The Netherlands NV
60	SFIL
61	SID - Slovene Export and Development Bank, Inc, Ljubljana - SID Bank, Inc-SID - Slovenska izvozna in razvojna banka, dd, Ljubljana - SID Banka, dd
62	Slovenska Zarucna a rozvojova banka spu-Slovak Guarantee and Development Bank
63	Société de promotion et de participation pour la coopération économique SA-Proparco
64	Sparkasse Hannover
65	Thüringer Aufbaubank

Table A.2. Private Banks.

No.	Bank Name
1	Abbey National Treasury Services Plc
2	AEGON Bank NV
3	AIB Group (UK) plc
4	AKA Ausfuhrkredit-GmbH
5	AKF bank GmbH & Co KG
6	Aktivbank AG
7	Aletti & C. Banca di Investimento Mobiliare SpA-Banca Aletti & C. SpA
8	Alior Bank Spółka Akcyjna
9	Allgemeine Beamten Kasse Kreditbank AG
10	Allianz Bank Bulgaria AD-CB Allianz Bulgaria AD
11	Allianz Bank Financial Advisors S.p.A.
12	Allianz Banque SA
13	APS Bank Limited
14	Arbejdernes Landsbank A/S
15	Aresbank SA
16	ASR Bank N.V.
17	Attica Bank SA-Bank of Attica SA
18	Attijariwafa Bank Europe SA
19	AXA Bank AG
20	Axa Banque
21	Baltic International Bank-Baltijas Starptautiska Banka
22	Banca 5 SpA
23	Banca del Fucino SpA
24	Banca del Monte di Lucca SpA
25	Banca del Piemonte
26	Banca di Sassari SpA
27	Banca Emilveneta SPA
28	Banca Generali SpA-Generbanca
29	Banca Ifis SpA
30	Banca Mediolanum SpA
31	Banca Popolare di Milano Spa
32	Banca Popolare di Spoleto SpA
33	Banca Profilo SpA
34	Banca Promos SpA
35	Banca Sella SpA
36	Banco de Castilla-La Mancha SA
37	Banco de Depósitos SA
38	Banco di Desio e della Brianza SpA-Banco Desio

- 39 Banco di Lucca E Del Tirreno SpA
- 40 Banco di Napoli SpA
- 41 Banco di Sardegna SpA
- 42 Banco Industrial de Bilbao SA
- 43 Banco Invest SA
- 44 Banco Popular Espanol SA
- 45 Banco Portugues de Gestão
- 46 Bancofar SA
- 47 Banif Bank (Malta) Plc
- 48 Bank fuer Aerzte und Freie Berufe AG
- 49 Bank für Arbeit und Wirtschaft und Österreichische Postsparkasse Aktiengesellschaft-BAWAG P.S.K. AG
- 50 Bank für Tirol und Vorarlberg AG-BTV (3 Banken Gruppe)
- 51 Bank Mendes Gans NV
- 52 Bank of Scotland Plc
- 53 Bank of Valletta Plc
- 54 Bank Schilling & Co Aktiengesellschaft
- 55 Bankaktieselskab/Alm Brand Bank A.S.
- 56 Bankhaus Carl Spaengler & Co. AG
- 57 Bankhaus Ellwanger & Geiger
- 58 Bankhaus Gebr. Martin
- 59 Bankhaus Krentschker & CO. AG
- 60 Bankhaus Lampe KG
- 61 Bankhaus Max Flessa KG
- 62 Bankhaus Werhahn Gmbh
- 63 Bankia, SA
- 64 Banking Funding Company NV
- 65 BankNordik P/F
- 66 Banque BCP SAS
- 67 Banque Calédonienne d'Investissement - BCI
- 68 Banque Chalus SA
- 69 Banque CIC Est SA
- 70 Banque CIC Sud-Ouest SA
- 71 Banque Commerciale du Marche Nord Europe - BCMNE
- 72 Banque Courtois
- 73 Banque de Nouvelle Calédonie
- 74 Banque de Polynesie
- 75 Banque de Réalisations de Gestion et de Financement SA-Regefi
- 76 Banque de Savoie SA
- 77 Banque de Tahiti
- 78 Banque du Bâtiment et des Travaux Publics - BTP Banque
- 79 Banque Dupuy, de Parseval SA

- 80 Banque EDEL Snc
- 81 Banque Européenne du Crédit Mutuel SAS
- 82 Banque Fédérative du Crédit Mutuel
- 83 Banque Internationale à Luxembourg SA
- 84 Banque Internationale de Commerce SA-BRED
- 85 Banque J. Safra Sarasin (Luxembourg) SA
- 86 Banque Kolb SA
- 87 Banque Laydernier
- 88 Banque Nuger
- 89 Banque Palatine SA
- 90 Banque Pouyanne SA
- 91 Banque Révillon SA
- 92 Banque Rhône-Alpes
- 93 Banque Socredo
- 94 Banque Solfea
- 95 Banque Tarneaud
- 96 Banque Themis SA
- 97 Barclays Bank Plc
- 98 Basisbank AS
- 99 BAWAG P.S.K. Wohnbaubank Aktiengesellschaft
- 100 BCR Banca Pentru Locuinte
- 101 Beobank NV/SA
- 102 Bergslagens Sparbank AB
- 103 Bethmann Bank
- 104 BforBank SA
- 105 BMCE Bank International Plc
- 106 BNP Paribas Nouvelle Calédonie SA
- 107 BNP Paribas Reunion SA
- 108 BPI Bank Polskich Inwestycji SA
- 109 Bradford & Bingley Plc
- 110 Bruell Kallmus Bank AG
- 111 Buergschaftsbank Thueringen GmbH
- 112 Bulgarian-American Credit Bank
- 113 CAF Bank Ltd
- 114 Caixabank, S.A.
- 115 Capital One (Europe) plc
- 116 Cassa di Risparmio di Cesena SpA
- 117 CBC Banque S.A.
- 118 CheBanca SpA
- 119 CIC Iberbanco SA
- 120 CIC Ouest SA

- 121 Clydesdale Bank Plc
- 122 Compass Banca SpA
- 123 Coop Pank
- 124 Credit Agricole Corporate and Investment Bank SA-Credit Agricole CIB
- 125 Crédit Agricole Friuladria spa
- 126 Crédit du Nord SA
- 127 Credit Europe Bank N.V.
- 128 Crédit Industriel et Commercial SA - CIC
- 129 Credito Agricola, SGPS, SA
- 130 Credito Emiliano SpA-CREDEM
- 131 Credito Siciliano SpA
- 132 Cronbank AG
- 133 CSOB Stavebna Sporitelna
- 134 Danone Corporate Finance Services SAS
- 135 DB UK Bank Limited
- 136 Degussa Bank Ag
- 137 Delubac et Cie SCS (Banque Delubac et Cie)
- 138 Demir-Halk Bank (Nederland) N.V-DHB Bank
- 139 Deutsche Bank Mutui SpA
- 140 Deutsche Bank Privat-und Geschäftskunden AG
- 141 Deutsche Postbank AG
- 142 Easybank AG
- 143 Edmond de Rothschild (France)
- 144 Erste Bank der Oesterreichischen Sparkassen AG
- 145 Europabank NV
- 146 Extrabanca SPA
- 147 Farbanca SpA
- 148 FFS Bank GmbH
- 149 FHB Kereskedelmi Bank Zrt-FHB Commercial Bank Zrt
- 150 Fynske Bank A/S
- 151 GE Corporate Finance Bank SAS
- 152 Genebanque SAS
- 153 Generali Bank AG
- 154 Granit Bank Zrt
- 155 Habibsons Bank Ltd
- 156 Helsinki OP Bank Plc
- 157 Hrvatska Postanska Bank DD
- 158 HSBC Bank plc
- 159 Hypotecni banka a.s.
- 160 Ibercaja Banco SA
- 161 IIG Bank (Malta) Ltd

162 ING Bank NV
163 ING-DiBa AG
164 International Asset Bank AD
165 Internationales Bankhaus Bodensee AG
166 Investbank Plc
167 Investec Bank (Channel Islands) Ltd
168 Investec Bank Plc
169 Jadranska Banka dd
170 JP Morgan Limited
171 JSC Latvijas Pasta banka
172 Julian Hodge Bank Limited
173 KBC Bank NV
174 KBL European Private Bankers SA
175 Kingdom Bank Limited
176 Kutxabank SA
177 Länsförsäkringar Bank AB (Publ)
178 Le Crédit Lyonnais (LCL) SA
179 Lloyds Bank Plc
180 Lloyds UDT Limited
181 M.M. Warburg & CO Kommanditgesellschaft auf Aktien
182 MBank Hipoteczny SA
183 MBNA Limited
184 MedMera Bank AB
185 Meridian Trade Bank AS
186 Modra pyramida stavebni sporitelna as
187 Monabanq S.A.
188 Montepio Investimento SA
189 Morgan Stanley Bank International Limited
190 Münsterländische Bank Thie & Co.
191 National Bank of Greece SA
192 National-Bank AG
193 Natixis Bank
194 Natixis SA
195 NIBC Bank NV
196 Nordjyske Bank A/S
197 Nykredit Bank A/S
198 Nykredit Realkredit A/S
199 Oesterreichische Entwicklungsbank AG
200 Oesterreichische Hotel-und Tourismus Bank GmbH
201 Oesterreichischer Exportfonds GmbH
202 Ölands Bank AB

- 203 Oma Saastopankki
- 204 Onderling Beroepskrediet-OBK-Bank C.V.B.A.
- 205 Oney Bank
- 206 OP Corporate Bank plc
- 207 Open Bank SA
- 208 Partner Banka dd
- 209 Paybox Bank Ag
- 210 Pekao Bank Hipoteczny Sa
- 211 Pen-Sam Bank A/S
- 212 Piraeus Bank SA
- 213 Porsche Bank AG
- 214 PPF banka a.s.
- 215 Record Bank SA/NV
- 216 Regionala investiciju banka-Regional Investment Bank
- 217 Reliance Bank Limited
- 218 Rietumu Bank Group-Rietumu Banka
- 219 RSB Retail + Service Bank GmbH
- 220 Sainsbury's Bank plc
- 221 Santander Consumer Bank AG
- 222 Santander Consumer Bank GmbH
- 223 Santander Consumer Bank SA
- 224 Santander UK Plc
- 225 Schoellerbank AG
- 226 Société Anonyme de Crédit à l'Industrie Française SA-CALIF
- 227 Société Générale Calédonienne de Banque - SGCB
- 228 Société Générale de Banque aux Antilles SA-SGBA
- 229 Société Marseillaise de Crédit
- 230 Sofax Banque SA
- 231 Sparbanken Skaraborg AB
- 232 Splitska Banka dd.
- 233 Standard Chartered Bank
- 234 State Street Bank International GmbH
- 235 Stavební Sporitelna České Sporitelny as
- 236 StedBanka d.d.
- 237 Steyler Bank GmbH
- 238 Swedbank Sjuhärads AB
- 239 Tallinn Business Bank Ltd-Tallinna Äripanga AS
- 240 TARGO Commercial Finance AG
- 241 TeamBank AG
- 242 TSB Bank Plc
- 243 UAB Medicinos Bankas

244	Ulster Bank Ireland DAC
245	Union de Banques Arabes et Françaises SA-UBAF
246	Unipol Banca Spa
247	United National Bank Limited
248	United Trust Bank Limited
249	Varbergs Sparbank AB
250	Vimmerby Sparbank AB
251	Volksbank Regio Invest Bank AG
252	Volkskreditbank AG-VKB Bank
253	Wesleyan Bank Ltd
254	Wyelands Bank Plc

B. Dataset Description

Table B. 3. Number of banks per country.

	Full Sample	SOB	POB
by country	no.banks	no.banks	no.banks
Austria	23	4	19
Belgium	7	0	7
Bulgaria	6	2	4
Croatia	6	1	5
Czech Republic	5	1	4
Denmark	9	0	9
Estonia	2	0	2
Finland	5	2	3
France	66	11	55
Germany	48	19	29
Greece	3	0	3
Hungary	5	3	2
Ireland	1	0	1
Italy	34	4	30
Latvia	5	0	5
Lithuania	1	0	1
Luxembourg	5	1	4
Malta	4	0	4
Netherlands	9	2	7
Poland	8	3	5
Portugal	5	1	4
Romania	3	2	1
Slovakia	3	2	1
Slovenia	3	3	0
Spain	14	3	11
Sweden	9	1	8
United Kingdom	30	0	30
Total	319	65	254

Table B. 4. Number of banks and observations per year.

by year	Full Sample		SOB		POB	
	no.banks	no.obs	no.banks	no.obs	no.banks	no.obs
2016	319	3432	65	684	254	2748
2015	319	3418	65	686	254	2732
2014	319	3391	65	696	254	2695
2013	319	3354	65	692	254	2662
2012	319	3406	65	692	254	2714
2011	319	3386	65	655	254	2731
2010	319	3350	65	650	254	2700
2009	319	3262	65	644	254	2618
2008	319	3144	65	623	254	2521
2007	319	3081	65	625	254	2456
2006	319	2996	65	608	254	2388
2005	319	2881	65	569	254	2312
2004	319	2332	65	456	254	1876
	Total	41433	Total	8280	Total	33153

C. Robustness Tests

Table C. 2. Unit Root Test Results.

Variable	χ^2	P-value
ROAA	1068.02	0.00
ROAE	1019.54	0.00
CI	980.67	0.00
LR	945.44	0.00
AQ	1000.86	0.00
EA	869.94	0.00
DIV	814.58	0.00
LOGTA	755.56	0.00
CR3	779.37	0.00
GDP	1030.49	0.00

The table shows the results of the Augmented Dickey-Fuller tests for stationarity in unbalanced panels. The tests were implemented in levels with constant and trend terms included. Lag length – (1) - was selected according to the Schwarz information criteria. The null hypothesis of non-stationarity or existence of unit roots has been rejected for all variables at 1% level of significance. Please note that dummy variables do not require this test.

Table C.2. Endogeneity Test Results.

Variable	DWH statistic	P-value
EA	98.63	0.00

Table C.3. Dynamic regression results for ROAA and ROAE with EA modeled as endogenous for all countries in our sample except Germany (2004-2016).

	ROAA	ROAE
Intercept	1.36 (1.77)	-0.38 (13.66)
<i>Lagged dependent variable</i>	0.13 (0.09)	0.27 (0.08) ***
CI	-0.02 (0.00) ***	-0.11 (0.05)**
LR	0.01 (0.00)	-0.03 (0.03)
AQ	-0.01 (0.00) ***	-0.08 (0.03)**
<i>EA</i>	0.02 (0.02)	0.13 (0.13)
DIV	1.51 (0.78) *	10.11 (2.54)***
LOGTA	0.06 (0.12)	1.09 (1.02)
CR3	-0.00 (0.01)	0.02 (0.04)
GDP	0.03 (0.01) **	0.46 (0.15) ***
DOS	-2.78 (1.76)	2.83 (9.94)
FCD	-0.61 (0.26) **	-5.16 (2.13) **
DOS*FCD	3.08 (1.66) *	27.14 (16.25) *
Wald-test (p-value)	$\chi^2 = 217.18$ (0.00)	$\chi^2 = 181.55$ (0.00)
Hansen test (p-value)	$\chi^2 = 84.23$ (0.15)	$\chi^2 = 66.97$ (0.13)
AR(1) (p-value)	Z = - 3.41 (0.00)	Z = -4.49 (0.00)
AR(2) (p-value)	Z = - 1.46 (0.15)	Z = -0.72 (0.47)
No. Instruments	84	84

The table presents GMM estimation results for both banking performance variables and the effects of internal and external factors. The variables in italic are instrumented through the GMM procedure using lags. Robust standard errors are reported in brackets. Coefficients marked with . ***, **, * are statistically significant at the 1%, 5% and 10% levels. Additionally, model specification tests' statistics are also summarized. In this case, the values in brackets are the respective p-values.

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