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Abstract
This paper studies the effects of regulatory and supervisory policies on profitability and risk-taking for European banks over the period 2005 to 2011. As these effects may vary according to the banks, we apply the Generalized Method of Moments (GMM) for dynamic panels to capture further heterogeneous supervision effects before and after the subprime crisis. Accordingly, our findings provide three interesting results. First, strengthening regulations and supervision improves profitability and boosts the stability of European banking systems. Second, our findings highlight a positive correlation between capital adequacy, deposit insurance systems and banks' profitability. Third, we note that stepping up supervisors' powers reduces risk-taking and promotes banking stability.
Keywords: Regulation, Supervision, Profitability, Risk, Dynamic Panel.
JEL classification: G28, G32, G21, C33.

1. Introduction

Banks have long been a major actor in economic systems through their action on liquidity that drives householder's consumption, firm's investment, entrepreneurship, the labor market, financial markets and economic growth. Moreover, in the last few years, banks have developed a number of financial products and derivatives and have covered different sectors through their credit services. The rapid development of the credit market and banking activities has led to an increase in this dependency between banking systems and the real economy (Levine, 2006; Demirguc-Kunt and Levine, 2010). Accordingly, having a safe and strong banking system is crucial to protect investors, financial markets and the whole real economy. Furthermore, the weaker the banking system, the more fragile economic and political institutions are.

For a recent illustration, the origins of the recent global financial crisis (2008-2009) have been associated with banking failure, the liquidity crisis and credit crunch, etc. The recent downturn also highlights the fragility of the banking system and the significant dangers it poses for the whole economic system. Indeed, the collapse of the banking system and the bankruptcy of some leading banks in 2008 (i.e. Lehman-Brothers) was due to a major banking crisis and led to a Great Depression for several major developed and emerging economies, with severe consequences for unemployment, investment and householder's power-parity (Shiller, 2008). Consequently, in several multiple summits (i.e. the G20), economists and policy-makers have suggested the need to reform the banking system through the improvement of regulatory and supervision measures so as to make banks stronger and more robust. Accordingly, new agreements and a number of supervision and regulation rules have been discussed (Basel III), which need to be introduced to better control banks, limit banking activities, and improve banking instruments and risk management. Such measures are liable to directly or indirectly affect bank profitability, risk management, and consequently banking performance.

Before moving on to the discussion of these regulation and supervision measures, we will briefly recall the context and reasons for their introduction. After the subprime crisis and the US housing bubble in 2007, a general, contagious phenomenon appeared to affect several banking systems because of their excessive risk position and their involvement with different subprime products and derivatives. In order to save the banking systems, governments and policymakers put forward several programs, but the latter were not enough and the banking crisis was more severe and rapid than previously expected. Consequently, many banks lost money and some of them went bankrupt. Financial analysts consider that delayed reactions, the status of the central banks and the absence of a centralized banking policy and financial regulations made the interventions less efficient and the crisis more severe. In addition, the decentralized government actions gave rise to more serious debt crises, particularly for European countries, involving serious sovereign risk (Barth *et al.*, 2013). Accordingly, reforming the banking system, and improving financial regulations and supervision were considered more important than ever to protect banks and the economy from future shocks (Aglietta, 2009). Therefore, the central theme in European government agendas became financial regulation and supervision, with the focus on how to promote banking profitability and stability.

In the literature, the investigation of the relationship between regulation, supervision, profitability and stability is not very well developed, although the relative literature has increased, particularly after the recent global financial crisis. In addition, previous studies have provided mixed results (Barth et *al.*, 2001, 2004, 2008, 2010; Leaven and Levine, 2009; Pasiouras *et al.*, 2009; Klomp and De Haan, 2011; Chortareas *et al.*, 2012; Lee and Hsieh, 2013). Indeed, while some studies[1] suggest a positive relationship between supervision and bank profitability, other authors claim that supervision has a negative impact. The heterogeneity of the banking system is one of the factors that could explain the presence of contradictory conclusions, but the econometric modelling used in previous studies has so far been unable to apprehend further heterogeneous effects.

Our paper aims to fill this gap, while investigating the impact of regulatory and supervisory policies on profitability and risk using recent data and appropriate econometric methodology. In particular, we apply panel data modelling to test whether restrictions on bank activities, capital requirement, deposit insurance, supervisors' power, and supervisory authority independence have an impact on the stability and profitability of the biggest European banks. Thus, we contribute at different levels. First, we use an original database collected from the World Bank by Barth *et al.* (2001, 2004, 2006, 2008). Second, we focus on an interesting and original sample including the ten largest European banks in the selected European countries (France, Germany, UK, Spain, Italy and Greece) over the period 2005 to 2011. This period includes the recent subprime and financial shocks, enabling us to assess the effects of recent anti-crisis supervision measures. Third, the sample also includes several countries affected differently by the crisis, providing us with an interesting international comparison. Fourth, the use of panel data modelling (GMM method) and the two-step dynamic panel data approach suggested by Blundell and Bond (1998) enables us to capture further heterogeneity in the data while furnishing us with efficient estimators.

Accordingly, we show that: i) strengthening regulations and supervision improves profitability and boosts the stability of European banking systems; ii) there is a positive correlation between capital adequacy, deposit insurance systems and bank profitability, iii) the reinforcement of supervisors' power reduces risk-taking and promotes banking stability.

The rest of the paper is organized as follows. Section 2 briefly presents the literature review. The data and methodology are presented in section 3, while the empirical results are discussed in section 4. The last section concludes.

2. Literature review

Previous studies have provided mixed evidence regarding the impact of regulatory and supervisory policies on bank performance. Indeed, Barth *et al.* (2004) showed empirical evidence of the impact of specific regulatory and supervisory practices on bank development and stability. Their results suggest that there is no statistically significant relationship between capital stringency, official supervisory power and bank performance. However, they found

[1] See section 2 for more details.

that the regulatory and supervisory practices which work best to promote bank profitability and stability insist on accurate information disclosure, empower private sector monitoring of banks, and foster incentives for private agents to exert corporate control. Using a cross-country setting, the authors highlighted the fact that regulatory and supervisory regimes with these features have suffered fewer crises in the past two decades, have lower non-performing loans and stronger credit markets. Leaven and Levine (2009) focused on the 10 largest publicly listed banks and found that capital stringency has little impact on actual bank risk. In addition, capital requirements affect bank stability through their bank valuations, but do not have an independent effect on bank stability. The authors also suggested that activity restrictions and deposit insurance increase bank risk, confirming the conclusions by Demirguc-Kunt and Detragiache (2002) and Barth *et al.* (2004,2006), while theoretically banking regulations and supervision might be expected to enhance profitability and decrease financial banking risk. Buch *et al.* (2008), who used the database compiled by Barth *et al.* (2001), found that the supervisory systems influence the overall risk of cross-bank mergers. They also concluded that the impact of banking regulations and supervision on performance depends on the factors of influence.

Recently, Barth *et al.* (2010) indicated that tighter restrictions on bank activities exert a negative impact on bank efficiency, while greater capital restrictions are marginally and positively associated with bank efficiency. They also found that although there is no significant relationship between official supervisory power and bank efficiency, there is a significant and positive relationship between the latter and supervisory authority independence. Chortareas *et al.* (2012) investigated the dynamics between regulatory and supervisory policies and bank performance for a sample of European banks over the period 2000-2008. They found that strengthening capital restrictions and official supervisory powers can improve the efficient operations of banks. Their results also indicated that interventionist supervisory and regulatory policies such as private sector monitoring and restricting bank activities can result in higher levels of inefficiency. Thus, the beneficial effects of capital restrictions and official supervisory powers on banks' efficiency are more pronounced in countries with higher quality institutions. A study by Lee and Hsieh (2013) that focused on Asian banks over the period 1994-2008 pointed to a positive relationship between capital and profitability in Asian banks, and concluded that the effects of the influencing factors should be taken into consideration.

Overall, conclusions regarding the impact of regulations and supervision on the banking sector seem to be hybrid and specific to the period and sample under consideration. Such rules also evolve naturally according to economic and financial contexts and per country. In order to apprehend such effects parsimoniously, we investigated this relationship during the last period of the subprime crisis based on a large sample (European banks). We also made use of panel data modelling in order to take other heterogeneous effects per time and per bank into account.

3. Data and Methodology

3.1 Data description

We built an interesting updated database from the one compiled by Barth *et al.* (2001, 2004, 2006, 2008) to examine the effects of financial regulation and supervision on the profitability and stability of banks from selected European countries. Our sample includes six European countries that we broke down into two samples: i) the three countries the least affected by the recent crisis (Germany, UK and France) and ii) the three most severely affected countries (Greece, Spain and Italy). As the applicable entry of International Financial Reporting Standards (IFRS) was in 2005, there are no data available for European banks before this date, so our investigation covers the period 2005 to 2011. For each country in the sample, we identified the 10 largest banks (defined by total assets) that lend money to firms. We did not include central banks or postal banks which generally do not lend money to firms and are described as nonbanking institutions (La Porta *et al.*, 2002).

3.2 Panel Data Methodology

We applied the two-step dynamic panel data approach suggested by Blundell and Bond (1998) and used the GMM method to address potential endogeneity, heteroskedasticity, and autocorrelation issues in the data (Doytch and Uctum, 2011). This gave us a system estimator with a more flexible variance-covariance structure of the moment conditions. Furthermore, the GMM approach is superior to the usual (Ordinary Least Square (OLS) method as it provides more efficient estimators (Driffill *et al.*, 1998). We should recall that for linear GMM estimators, we identify one- and two-step variants. The two-step estimator is generally more efficient than the one-step estimator, especially for the GMM system (Lee and Hsieh, 2013), which explains our preference for it in the current study. Also, the dynamic panel model technique that we use is particularly well-suited to handling short macro panels with endogenous variables as it enables us to reduce the bias induced by omitted variables in cross-sectional estimates and the inconsistency caused by endogeneity. Interestingly, the dynamic GMM technique enables us to check simultaneously for the endogeneity bias induced by reverse causality running from profit (or risk) to banking regulations, supervision and other explanatory variables (Lee and Hsieh, 213).

As for the implementation steps, we adopted the specification test suggested by Blundell and Bond (2000), and then applied the Sargan test of over-identifying restrictions in order to check the instruments' validity. With regard to the latter, the acceptance of the null hypothesis of the validity of over-identifying restrictions implies the instruments' validity and vice versa. Second, we checked several specifications and retained the model that provided us with the appropriate statistical properties for the error term.

Formally, we propose the following dynamic panel model to apprehend the effects of regulation and supervision on bank performance:

$$\begin{aligned} \mathrm{PERF}_{i,t} &= \beta_0 + \beta_1 (PERF)_{i,t-1} + \beta_2 (RESTRICT)_{i,t} + \beta_3 (DEPO\_INSR)_{i,t} + \beta_4 (CAP\_ADQ)_{i,t} \\ &+ \beta_5 (SRP)_{i,t} + \beta_6 (ISA)_{i,t} + \beta_7 (BS)_{i,t} + \beta_8 (CAR)_{i,t} + \beta_9 (LLGL)_{i,t} \\ &+ \beta_{10} (NLTA)_{i,t} + \beta_{11} (NPL)_{i,t} + \beta_{12} (INSQ)_t + \beta_{12} (FD)_t + \beta_{12} (CPI)_t + \beta_{12} (GDP)_t + \varepsilon_{i,t} \end{aligned} \quad (1)$$

Where: *i* refers to the banks in the sample (i = 1, 2, …, 60), and t denotes the time period t = 2005, …, 2011). $ß_i$ refer to the model parameters and ε_{it} is the error term.[2] $PERF_{it}$ refers to the i^{th} bank's profit (or risk) for a given year t. For a robust evaluation, we measured performance through 5 five different proxies: return on assets (ROA) and return on equities (ROE) as proxies of bank profitability; the volatility of the return on assets (VOL_ROA), the volatility of the return on equities (VOL_ROE) and the distance from insolvency (Z_SCORE) as proxies of bank stability.

As in Lee and Hsieh (2012), Chortareas *et al.* (2012), Agoraki *et al.* (2011), Delis *et al.* (2011), Laeven and Levine (2009) and Barth *et al.* (2008), we apprehend financial regulation and supervision through different variables. RESTRICT refers to restrictions on banking activities that measures the degree to which national regulatory authorities allow banks to engage in certain activities. The summation value for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities, (2) insurance activities, (3) real estate activities, and (4) bank ownership of voting shares in nonfinancial firms. These activities can be unrestricted, permitted, restricted, or prohibited, and receive values of 1, 2, 3, or 4 respectively. We create an overall index by calculating the natural logarithm of summation value for the four categories. The higher values indicate higher restrictions on banking activities. DEPO_INSR refers to deposit insurance and is calculated by answering eleven questions.[3] Our method adds the individual zero/one answers, then uses the natural logarithm of the summation value to get an index. According to Demirguc-Kunt and Kane (2002), under the explicit deposit insurance schemes, banks have more incentive for risk-taking. CAP_ADQ refers to capital adequacy and is measured by total equity/total assets (TE_TA) and total Capital Ratio (CAPR) with reference to the IMF (2000). SRP refers to supervisory power, and measures the extent to which official supervisory authorities have the power to take specific action to prevent and correct problems. This variable is determined by adding 1 if the answer is yes and 0 otherwise for each of the six questions presented in appendix 1. ISA (independence of supervisory authority) measures the degree to which the supervisory authority is independent from governments (political influence) and is legally protected from the banking industry (big financial institutions influence). This variable is determined by adding 1 if the answer is yes and 0 otherwise for each of the four questions presented in Appendix 1.

Finally, following Lee and Hsieh (2012), Chortareas *et al.* (2012), Ben Naceur and Omran (2011), Demirguc-Kunt and Huizingua (1999) and Dietrich *et al.* (2010), related external control variables are included: INSQ: institutional quality indicators, which is measured by freedom from corruption (CORRUP), financial freedom (FIN_FRED) and government stability (GOV_STAB). FD: the financial development factors are measured by:

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[2] β_1 enables us to capture further persistence in the performance dynamics. Indeed, a significant β_1 implies that profit (or risk) can persist for one period as in Goddard *et al.* (2004, 2010).

[3] See Appendix 1 for further details.

liquid liability (LL), private credit by deposit money banks and other financial institutions/GDP (PC), stock market capitalization/GDP (SMC), and stock market turnover ratio (SMTR). CPI is the inflation which is measured by Consumer Price Index and GDP, which represents the annual percentage of gross domestic product per capita growth.

4. Empirical analysis

First, we investigate the data properties while computing the descriptive statistics and correlation matrix. Accordingly, we note that correlation significantly varies across variables, suggesting relatively different linkages between the sample variables.[4] Table 1 presents the main descriptive statistics for the dependent and explanatory variables used in the regression model (1). From Table 1, the return on equities (ROE), the volatility of the return on equities (VOL_ROE) and the distance from insolvency (Z_SCORE_) tend to have high values on average. However, also on average, the return on assets (ROA) and the volatility of the return on assets (VOL_ROA) show low values. The average of the overall index of regulations and supervision (GI_RS) reaches the value 2.314, with 1.845 as the minimum value and 2.936 as the maximum.

Table 1: Descriptive Statistics

VARIABLE	OBS	MEAN	STD DEV	MIN	MAX
ROA	328	0.004	0.023	-0.134	0.190
ROE	326	0.142	2.824	-12.493	48.715
VOL_ROE	269	0.271	2.175	0.001	34.418
VOL_ROA	271	0.005	0.013	7.080	0.103
Z_SCORE_	271	8.099	1.551	3.813	13.562
TE_TA	362	5.186	4.479	-3.930	73.300
CAPR	318	12.303	4.417	-5.000	47.000
RESTRICT	420	0.871	0.144	0.602	1.079
DEPO_INSR	420	0.513	0.241	0.000	0.698
SRP	420	0.410	0.222	0.000	0.778
ISA	420	0.518	0.145	0.301	0.778
GI_RS	420	2.314	0.308	1.845	2.936
BS	365	8.312	0.691	5.434	9.412
CAR	380	5.789	1.322	4.100	9.300
LLGL	334	2.919	2.067	0.000	18.840
NLTA	354	62.601	28.119	0.010	223.880
NPL	360	4.088	2.483	0.700	11.500
GOV_STAB	420	8.949	0.634	6.791	9.756
CORRUP	420	0.643	0.132	0.430	0.900
FIN_FRED	420	0.677	0.147	0.380	0.870
LL	420	111.525	33.566	58.786	181.193

[4] The Correlation Matrix is not provided to save space but is available upon request.

SMC	420	69.935	35.098	15.171	141.456
SMTR	420	135.587	53.133	28.170	271.693
GDP	420	0.158	2.829	-6.812	5.121
INF	420	107.326	5.440	100.000	121.109

Table 2 reports the empirical results associated with the regression panel data model (1). In particular, we estimated five different specifications which differ according to the measure of bank performance. Interestingly, this enables us to apprehend the regulation and supervision effects through different proxies for bank performance. The overall index of regulation and supervision is the summation values of restrictions on bank activities, deposit insurance, independence of supervisory authority and supervisors' power. Our findings indicate that the global index (GI_RS) is positively correlated with profitability and negatively associated with risk, which matches those of Lee and Hsieh (2013). In particular, we found that a 1% increase in regulatory and supervisory policies decreases risk (VOL_ROA) by 0.039 and enhances profitability (ROA) by 0.05, and distance from insolvency (Z_SCORE_) by 3.711. This result indicates that if regulators of banking activities consider the problem of insolvency as only one source of banking risk, then they may underestimate the risk level, since the Z_SCORE_ has the highest positive coefficient. This finding also indicates that strengthening regulatory and supervisory policies enhances profitability and boosts European banks' stability.

Table 2: Effects of the global index of regulations and supervisions

	(1)	(2)	(3)	(4)	(5)
	ROA	ROE	VOL_ROA	VOL_ROE	Z_SCORE_
LAG	0.144***	0.003	0.210***	-1.205*	0.077
	(8.800)	(0.010)	(4.270)	(-2.490)	(0.820)
GI_RS	0.050***	-0.512	-0.039***	-2.285	3.711*
	(6.050)	(-0.390)	(-4.880)	(-1.520)	(2.460)
TE_TA	0.001**	0.020	-0.001***	-0.046	0.023
	(3.110)	(0.270)	(-6.320)	(-0.320)	(0.220)
CAPR	0.003***	-0.259	0.001***	-0.004	-0.175
	(7.450)	(-1.620)	(4.300)	(-0.040)	(-1.760)
BS	0.001	1.127	-0.001	0.578	-1.312
	(0.090)	(1.120)	(-0.140)	(0.760)	(-1.250)
CAR	0.003***	0.357*	-0.001	-0.036	0.185
	(3.330)	(1.970)	(-1.580)	(-0.390)	(1.150)
NLTA	-0.001	-0.011	-0.001	0.007	-0.010
	(-1.500)	(-1.350)	(-0.550)	(1.220)	(-0.790)
LLGL	-0.003***	0.204	-0.001	-0.084	0.253
	(-10.800)	(1.590)	(-1.140)	(-0.520)	(1.580)
NPL	-0.005***	-0.211*	0.005***	0.366*	-0.162
	(-5.360)	(-2.210)	(4.550)	(2.370)	(-1.100)
GOV_STAB	-0.125***	2.474	-0.037	-3.839	4.821
	(-3.340)	(0.930)	(-1.590)	(-1.210)	(0.680)
CORRUP	-0.042**	-0.113	-0.003	-1.633	6.439*
	(-2.620)	(-0.040)	(-0.170)	(-0.870)	(2.340)

FIN_FRED	-0.001	-0.296	-0.021*	-2.035*	8.016***
	(-0.030)	(-0.160)	(-2.570)	(-1.980)	(3.580)
LL	-0.001	0.039***	-0.001***	-0.045**	0.027
	(-1.480)	(3.380)	(-4.470)	(-2.940)	(1.950)
SMTR	0.001	-0.001	0.001	-0.001	-0.004
	(1.560)	(-1.330)	(0.240)	(-0.410)	(-1.930)
SMC	-0.001	0.001	0.001*	0.001	-0.005
	(-1.530)	(0.160)	(2.480)	(0.170)	(-0.660)
INF	-0.001*	-0.036	0.002***	0.226**	-0.485***
	(-1.980)	(-0.620)	(4.980)	(2.830)	(-6.410)
GDP	-0.001	0.010	0.001	0.010	-0.193***
	(-1.400)	(0.300)	(0.870)	(0.290)	(-3.860)
_CONS	1.138**	-29.160	0.209	17.760	7.098
	(2.960)	(-1.040)	(0.950)	(0.580)	(0.110)
N	198	199	173	172	173
AR (2)	-0.564	-1.791	-1.398	-0.568	0.521
P-value AR (2)	(0.572)	(0.073)	(0.162)	(0.569)	(0.602)
Sargan Test	27.298	8.814	21.885	7.502	15.096
P-value Sargan	(0.073)	(0.963)	(0.041)	(0.822)	(0.236)

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Otherwise, our findings point to a further memory and persistence effect on bank's profit and risk. Indeed, the coefficients of both ROA and VOL_ROA with one period lag are positive at 1% significance, exhibiting some variables such as ROE and Z_SCORE_ that do not show persistence of profit and risk. Their related coefficients are significantly positive at 0.144 and 0.210 respectively. However, the coefficient of VOL_ROE is negative at 10% significance (-1.205). The influence variables also perform differently. For instance, LLGL, NPL, GOV_STAB, CORRUP and INF are all negatively correlated to profitability (ROA). However, the capital asset ratio (CAR) and liquid liabilities (LL) are positively associated with profitability at 1% significance. Among the risk-taking factors, the effects of NPL, CORRUP and INF are significantly positive. However, the coefficients of FIN_FRED, LL and GDP are negative. Finally, the Sargan and the second order correlation tests do not reject the null hypothesis of correct specification, which means that we have valid instruments and no second-order correlation.[5]

Such conclusions are however conditioned by the presence of global regulation and supervision rules. In order to check the robustness of our findings, we then focused on financial regulations and supervision. We report the main results in Table 3, which provides the empirical results when different categories of regulations and supervision are considered for the full sample. Accordingly, the significantly negative relationship between restriction and profitability is consistently found for the whole of the European banking sector, which matches the findings of Barth *et al.* (2006). However, DEPO_INSR, TE_TA and CAPR are

[5] The number of instruments used to measure profitability (ROA, ROE) is 36, while the number of instruments used to measure risk (VOL_ROA, VOL_ROE, Z_SCORE_) is 30.

positively correlated to profitability (ROA) at 1% significance. Consequently, the supervisors' power (SRP) is negatively associated with VOL_ROA and positively correlated with Z_SCORE. Thus, the existence of a deposit insurance system is positively associated with bank profitability. According to Demirguc-Kunt and Kane (2002), under the explicit deposit insurance schemes, banks have more incentive for risk-taking as they seek to gain more profitability. Thus, the French Court of Auditors (2010) mentioned that at the beginning of 2009, retail banks conducted a "hunt for deposits" to find solid and sustainable funding. In 2009, the deposits/loans ratio was between 80% and 84% for the largest banking groups. Moreover, capital adequacy also enhances the profitability of European banks, which is consistent with the findings of Goddard *et al.* (2004), Iannotta *et al.* (2007), Shim (2010) and Lee and Hsieh (2013). Recently, Barth *et al.* (2013) argued that capital regulations represent a mainstay of banking sector policies around the world.

Table 3: The effects of financial regulations and supervision

	(1)	(2)	(3)	(4)	(5)
	ROA	ROE	VOL_ROA	VOL_ROE	Z_SCORE_
LAG	-0.117***	-1.254**	0.245***	-0.084	0.019
	(-10.210)	(-2.770)	(6.090)	(-0.110)	(0.190)
RESTRICT	-0.591*	-31.640	-1.095	-27.590	56.130
	(-2.280)	(-0.960)	(-0.550)	(-0.680)	(0.630)
DEPO_INSR	0.546***	14.350	0.527	10.330	-31.780
	(3.550)	(1.290)	(0.590)	(0.860)	(-0.600)
SRP	0.008	0.948	-0.037**	-2.722	7.256**
	(1.140)	(0.540)	(-2.870)	(-1.560)	(3.080)
ISA	0.255	13.980	-0.196	8.205	-32.160
	(1.770)	(0.420)	(-0.160)	(0.330)	(-0.380)
TE_TA	0.003***	0.054	0.001	0.011	-0.019
	(6.860)	(0.380)	(0.990)	(0.110)	(-0.230)
CAPR	0.001***	-0.266	-0.001	-0.021	-0.080
	(3.830)	(-1.440)	(-0.210)	(-0.250)	(-0.840)
BS	0.008	0.111	-0.018***	0.051	0.209
	(1.160)	(0.090)	(-5.920)	(0.050)	(0.270)
CAR	0.002*	0.255	0.002**	-0.016	0.019
	(2.380)	(1.520)	(2.750)	(-0.160)	(0.110)
NLTA	-0.001	-0.004	-0.001	0.001	-0.021
	(-1.450)	(-0.260)	(-0.800)	(0.030)	(-1.400)
LLGL	-0.003***	0.185	-0.001	-0.088	0.127
	(-7.090)	(1.850)	(-1.790)	(-0.780)	(0.790)
NPL	-0.004***	-0.243	0.002*	0.226	0.025
	(-5.560)	(-1.840)	(2.050)	(1.560)	(0.130)
GOV_STAB	-0.134*	-10.300	-0.087	-9.474	14.440
	(-1.960)	(-1.370)	(-0.450)	(-0.830)	(0.210)

CORRUP	-0.056***	-3.774	-0.090***	-3.415	11.130**
	(-3.430)	(-1.160)	(-5.620)	(-1.500)	(3.200)
FIN_FRED	-0.001	-1.462	-0.065***	-1.940	7.751***
	(-0.140)	(-0.670)	(-3.870)	(-1.730)	(3.520)
LL	0.001	0.006	-0.001***	-0.038	0.015
	(1.260)	(0.310)	(-4.950)	(-1.820)	(0.700)
SMTR	-0.001	0.001	0.001	-0.001	0.001
	(-0.370)	(0.570)	(1.370)	(-0.380)	(0.060)
SMC	-0.001***	-0.002	0.001	-0.003	0.015
	(-4.110)	(-0.240)	(0.160)	(-0.600)	(1.310)
INF	-0.001	-0.012	0.005***	0.252*	-0.653***
	(-1.170)	(-0.210)	(9.240)	(2.230)	(-6.130)
GDP	0.001	-0.040	0.001	0.016	-0.266***
	(1.700)	(-0.640)	(0.060)	(0.490)	(-3.350)
_CONS	1.324	11.800	1.377	8.800	-8.190
	(1.630)	(1.130)	(0.660)	(0.590)	(-0.120)
N	198	199	173	172	173
AR (2)	-0.473	-0.211	0.231	-0.686	0.140
P-value AR (2)	(0.635)	(0.833)	(0.619)	(0.492)	(0.888)
Sargan Test	20.957	8.583	16.747	4.328	7.286
P-value Sargan	(0.138)	(0.898)	(0.052)	(0.888)	(0.607)

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

We now turn to the effects of specific factors. As illustrated in Table 3, bank-specific indicators have differential impacts on bank profits and risk. Bank size (BS) enters with a negative sign, with VOL_ROA as a proxy of risk-taking. However, the capital asset ratio (CAR) is positively correlated to profitability (ROA) and risk-taking (VOL_ROA). While variables reflecting asset quality (NPL, NLTA and LLGL), institutional quality (GOV_STAB and CORRUP), and financial development (LL) have negative effect on profitability (ROA), they also enter with a negative sign with risk taking. Thus, these influencing factors enhance the financial stability of European banks. Our results are consistent with Demirguc-Kunt and Huizingua (1999) who found that better contract enforcement, an efficient legal system, and lack of corruption are associated with low profitability and greater bank stability. As for the macroeconomic characteristics, we notice that inflation (INF) and economic growth (GDP) have the same impact on bank risk-taking which is measured by the distance from insolvency (Z_SCORE_). These indicators enter with a negative sign at 1% significance, indicating that macroeconomic factors reduce the risk of insolvency and boost financial stability. Finally, we also show that the model seems to fit the panel reasonably well. Indeed, the Sargan test for the validity of over-identifying restrictions in the GMM estimation is accepted for all specifications and the second-order autocorrelation is also rejected by the test for AR (2) errors.

5. Conclusion

This paper investigates the effects of regulatory and supervisory policies on profitability and risk-taking for a large sample of the biggest European banks in a context of financial crisis and economic downturn from 2005 to 2011. Using an original sample of regulatory, supervision and profitability proxies, we carried out and back tested a panel data regression

model. Our findings offer interesting results and extend the literature, while illustrating the impact of bank regulations and supervision on profitability and risk through different specifications. Accordingly, we show that i) increasing European banking regulations and supervision could improve banks' profitability and decrease their risk-taking; ii) however, the restrictions on banking activities decreases profitability, while capital adequacy and the deposit insurance system increases banks' profitability, iii) Finally, reinforcing supervisors' powers reduces risk-taking and promotes banking stability. These results can have different policy implications for bankers as well as for regulators in terms of improving regulatory measures and adapting them to the banking environment and financial context.

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Classification	VARIABLES	DESCRIPTION	SOURCE
Dependent variables PERF	ROA	Return on assets = net income/total assets	Calculated by authors (data from Bankscope)
	ROE	Return on equities = net income/total equities	Calculated by author (data from Bankscope)
	VOL_ROA	Standard deviation of return on assets is calculated using the overlapping ROA data averaged every two years.	Calculated by authors (data from Bankscope)
	VOL_ROE	Standard deviation of return on equities is calculated using the overlapping ROE data averaged every two years.	Calculated by authors (data from Bankscope)
	Z_SCORE_	Z_SCORE_ = Log z-score= Log (ROA + CAR/ δ ROA)	Calculated by authors (data from Bankscope)
Bank regulations	RESTRICT	Restriction on banking activities. The summation value for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities (the extent to which banks engage in underwriting, brokering and dealing in securities, and all aspects of the mutual fund industry), (2) insurance activities (the extent to which banks engage in insurance underwriting and selling), (3) real estate activities (the extent to which banks engage in real estate investment, development and management), and (4) bank ownership of voting shares in nonfinancial firms (the extent to which nonfinancial firms may own and control banks). These activities can be unrestricted, permitted, restricted, or prohibited, and receive values of 1, 2, 3, or 4, respectively. We create an overall index by calculating the natural logarithm of summation values of the four categories.	Bank regulation and supervision database, World Bank; Barth et al., 2001, 2004, 2006, 2008.
	DEPO_INSR	Deposit insurance is calculated by answering the following 11 questions: (1) Is the explicit deposit insurance protection system funded by: the government, the banks, or both? (2) Do deposit insurance fees charged to banks vary based on some form of risk assessment? (3) Does the deposit insurance scheme also cover foreign currency deposits? (4) Are interbank deposits covered? (5) Are nonresidents treated less favorably than residents with respect to deposit insurance scheme coverage (either in terms of coverage for which they are entitled or the actual protection provided)? (6) Who manages the insurance fund? (7) Does the deposit insurance authority make the decision to intervene in a bank? (8) Does the deposit insurance authority by itself have the legal power to cancel or revoke deposit insurance for any participating bank? (9) Can the deposit insurance agency/fund take legal action for violations against laws, regulations, and bylaws (of the deposit insurance agency) against bank directors or other bank officials? (10) Has the deposit insurance agency/fund ever taken legal action for	Bank regulation and supervision database, World Bank; Barth et al., 2001, 2004, 2006, 2008.

		violations against laws, regulations, and bylaws (of the deposit insurance agency) against bank directors or other bank officials? (11) Is participation in the deposit insurance system compulsory for all banks? Our method sums up the individual zero/one answers, and we then use the natural logarithm of the summation values to get an index.	
	CAP_ADQ	Capital adequacy is measured by two ratios: total equity/total assets (TE_TA) and total Capital Ratio (CAPR).	IMF (2000) Data from Bankscope
Bank supervisions	SRP	Supervisors' power: this variable is the natural logarithm of summation values which are determined by adding 1 if the answer is yes and 0 otherwise, for each of the following 6 questions: (1) Does the European central bank (ECB) supervise banks? (2) What body/agency supervises banks? (a) The central bank, (b) A single bank supervisory agency, (c) A Multiple Bank supervisory agency. (3) Is there a single financial supervisory agency for all of the main financial institutions (insurance companies, contractual savings institutions, savings banks)? If yes, what is its name? (4) Is there a single financial supervisory agency for all of the activities in which commercial banks are allowed to do business? (5) Has your country adopted Basel II? (6) Is your country planning on adopting Basel III?	Bank regulation and supervision database, World Bank; Barth et al., 2001, 2004, 2006, 2008.
	ISA	Independence of supervisory authority : this variable is the natural logarithm of summation values which are determined by adding 1 if the answer is yes and 0 otherwise, for each of the following 4 questions: (1) To whom are the supervisory bodies responsible or accountable? (a) the Prime Minister, (b) the Finance Minister or another cabinet-level official, (c) a legislative body, such as Parliament or Congress, (d) other. (2) How is the head of the supervisory agency (and other directors) appointed?: (a) the decision of the head of government (e.g. President, Prime Minister), (b) the decision of the Finance Minister or other cabinet-level authority, (c) a simple majority of a legislative body (Parliament or Congress), (d) a supermajority (e.g., 60%, 75%) of a legislative body, (e) other). (3) Does the head of the supervisory agency (and other directors) have a fixed term? (4) Can the head of the supervisory agency be removed by: (a) the decision of the head of government (e.g. President, Prime Minister), (b) the decision of the Finance Minister or other cabinet level authority, (c) a simple majority of a legislative body (Parliament or Congress), (d) a supermajority (e.g., 60%, 75%) of a legislative body, (e) other.	Bank regulation and supervision database, World Bank; Barth et al., 2001, 2004, 2006, 2008.

	GI_RS	Global index of regulations and supervision = Log (Σ RESTRICT * Σ DEPO_INSR * Σ SRP * Σ ISA) = RESTRICIT + DEPO_INSR+ SRP+ ISA	
Bank specific indicators	CAR	Bank capital to assets ratio	Bankscope
	NPL	Bank nonperforming loans to total gross loan (%)	World Bank (2013)
	NLTA	Net loans/total assets	Bankscope
	LLGL	Loan loss reserve/Gross loans %.	Bankscope
	BS	Bank size measured by the log of total assets.	Bankscope
Macro economic factors	INSQ	Institutional quality indicators are measured by: • GOV_STAB: government stability • CORRUP: freedom from corruption • FIN_FRED: financial freedom.	International Country Risk Guide (ICRG) and Heritage Foundation (2013)
	FD	Financial development is measured by: • LL: liquid liabilities. • SMC: stock market capitalization / GDP • SMTR: stock market turnover ratio. • PC: private credit by deposit money banks and other financial institutions/GDP.	Financial Structure Database (2012)
	INF	Inflation measured by Consumer Price Index	World Development Indictors (2012)
	GDP	The annual percentage of gross domestic product per capita growth.	

Appendix 1: Summary of variables, descriptions, and data sources