The effects of Capital, Provisions and Size on bank risk: new evidence for the European Banking System

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Abstract: After the eruption of the global financial crisis the banking sector has gone through profound changes: the excessive risk taking of banks has forced regulators to increase regulatory tightness in order to safeguard the stability of the entire financial system. Based on a sample of 62 listed banks in the European Economic Area Region, during the period 2005q1-2018q4, this paper investigates the impact of provisioning policies, capital and size on several measures of bank risk. We provide further empirical evidence of a convex relationship between different measures of bank capital and risk. Moreover, results show how provisions represent a crucial factor in explaining bank risk: our findings report a positive association between provision and bank risk. Finally, we find mixed evidence regarding the role of size, results show how larger bank reflect a lower level of idiosyncratic risk while the impact on the systematic risk component is positive. Our findings are robust to different model specifications.

Keywords: Bank capital; Loan Loss Provisions, Bank Regulation, Bank risk, Bank size

1. Introduction

In this paper we investigate simultaneously the impact of provisioning policies, capital and size on banks risk profiles in the European Economic Area Region (EEAR).
The recurrent banking crisis across the last two decades has shown the importance for regulators to address micro and macro prudential policies with the aim to limit the excessive risk-taking of banks (EBA, 2016).
Indeed, over the last decade NPLs stock surged at 900 billion euros by the end of 2016 in banks under ECB direct supervision; the *non-performing* loans ratio jumped from just under 3% in 2005 to more than 7% in 2016, with significant differences among the various countries in the Eurozone (Costancio, 2017). According to the World Bank (2018), although the NPL amount fell in June 2018 (3,8%), the NPL ratio in EU is significantly higher compared to other advanced economies (1,0% in US and in Japan in 2017). Deterioration in the loan portfolio quality is considered one of the principal causes of financial instability (Demirguc-Kunt, 1998; Gonzalez-Hermosillo, 1999). Moreover, high levels of NPLs require bank to detain additional capital cushions in order to cover loan losses and enhance lending to the real economy (Espinoza and Prasad, 2010; Klein, 2013). In such context, recently the ECB tackled the issue underling the importance of punctual provisioning and write-off policies, as fundamental strategy for strengthen banks' balance sheets and promote a more resilient banking sector. These concerns led the Central Bank to publishing the March 2018 *addendum* on the NPL draft guidance, highlighting the quantitative expectations concerning the levels of coverage on non-performing exposures. In a nutshell, banks are expected to set a 100% of coverage for the unsecured part after two years of NPE vintage and after seven years for the secured part (ECB, 2018). Nonetheless, this regulatory framework casts several challenges for bank management regarding timely provisions and the calibration of capitalization levels, with the assessment of market expectations as a fundamental driver of the overall bank approach to NPL reductions.

In addition, our analysis puts in the spotlight the recent development of the banking sector in Europe, which after the creation of the Economic and Monetary Union (EMU) have seen the constant raising of the concentration level of the industry, with a substantial reduction of number but increased size of EU banks (Haq and Haeney, 2012). It has therefore become crucial explore the dynamics of risk about those banks which have become too-big-to-fail and incorporate the building blocks of the risk exposure in the EU banking sector (Laeven et al., 2016).
We aim to contribute to the ongoing policy debate on large institutions. Indeed, the questions of limiting bank excessive growing restricting individual size, the imposition of additional capital requirements to large banks (IMF, 2010; French et al., 2010) as well as the need of reducing the market risky activities within the balance sheets of systemic institutions (Vickers, 2011; Liikanen, 2012) represent burning issues that are actually under investigation by bank regulators.

Our paper provides several contributions to a wide body of post-crisis literature that renewed the interest on loan loss provisions (LLPs), the capital- stability issue and the size factor as crucial driver of bank risks in EU.
First, our work represents the continuum of previous studies focused on the analysis of the external regulation mechanism on capital and its impact on banks risk (Godlewsky, 2005; Altunbas et al., 2007; Anginer et al., 2018, Bitar et al., 2018).
The limited number of studies focused on the relationship between capital and risk especially in EU and the ambiguous sign of such relationship motivates the necessity to provide further empirical evidence about the effectiveness of capital in preserve banks stability.
Thus, following (Aiyard et al., 2015) on the need of replacing the Basel III rules with a set of incentive-robust rules based on market information, we test how bank capital, provisioning policies and size impact on several market-based measures of risk. In line with Stiroh (2006) we use market measures of risk because can provide a more transparent evaluation of risks. There is a significative

lack of studies which investigate at the same time these factors as key determinants of risk in the European banking system.
Then, we focus on LLPs due to the key role played within the financial statement of banks in relation with the high level of information they channel: indeed LLPs represent a tool that banks use to signal future firm perspectives, as well as for capital management and earnings management practises (*see* Curcio and Hasan, 2012; Ozili and Arun, 2018; among others). Moreover, the actual attention towards the provisioning system is maximum, in fact the International Accounting Standard Board (IASB) has recently moved from an incurred loss perspective (IFRS/IAS 39) to a forward-looking approach based on the expected loss mechanism (IFRS 9), and has further proposed to deduct from capital any shortfall in these provisions to provide an incentive against under-provisioning (European Parliament, 2019). Thus, our results, here, elicit consideration on the right balance of capital and provisions for coping with troubled loans and managing the risk-stability relation.
As a second contribution, we put in the spotlight the Texas ratio as a measure of bank insolvency risk which mixes the role of capital and provisioning policies (Siems, 2012). With most of the works on that studies focusing on the US market (*see* Jesswein, 2009), our paper draws on a sample of European banks. We aim to test its the signalling effect, i.e. how markets react to departures from the 100% coverage level which is considered the level beyond which the bank is in turmoil (ECB, 2017).
As a third contribution, we verify whether there are different market responses depending on the locus of banks in our sample on the risk frontier, i.e. we break down our sample into subsamples representing different quartiles of our risk variables, or the bank size and over crisis periods. As previous studies found, at least the responses to capitalization levels can diverge across bank sizes and over crisis periods (Berger and Bouwman, 2013).
Basing on quarterly data over the 2005q1-2018q4 period, allows us to have an adequate time depth in order to breaking down our timeframe and consider the mid and long-term effects of the regulatory initiatives that followed the global financial crisis.
The rest of the paper is organized as follows: section 2 discusses the literature review and develops the research hypotheses. Section 3 presents the empirical strategy. Section 4 describes the results. Section 5 discusses the policy implications and the conclusions.

2. Theoretical framework and hypotheses development

The financial crisis of 2007-2008 revealed all the weaknesses of the regulatory architecture and regulators around the world responded introducing a program of financial reforms aimed at strengthening the banking sector and constraining moral hazard by to-big-to-fail institutions. The consequences of externalities and the social costs borne by society in relation with banks distresses are generally considered as the main justifications for regulating financial institutions. Regulation includes both direct mechanisms as the capital regulation, with the establishment of minimum capital requirements as well as the treatment for LLPs after the introduction of the IFRS standards in 2005 aimed to increase the accounting transparency of reporting. In addition, further to these consolidated schemes of regulation scholars are actually arguing regarding the necessity to introduce tailored mechanisms of regulation to systemic institutions.
Thus, our analysis relies on the prolific literature focused on the determinants of bans risk in Europe.

2.1. Bank capital

The issue of how capital impacts on bank risk is actually an outstanding question (Anginer and Demirguc-Kunt, 2014; Bitar et al., 2018).
Literature has long investigated the relations between capital requirements and risk-taking. It is acknowledged that the main purpose of the regulation on banks' capital is to provide both an adequate cushion of equity during recessive economic cycles and an exogenous mechanism able to contain the

excessive risk-taking of institutions, in order to prevent bank insolvency and safeguard the stability of the financial system (*see* Rochet, 1992; Dewatripont and Tirole, 1994; Milne et al., 2011). However, the traditional theoretical literature on the capital-risk relation is not unanimous when it comes to the implications of capital regulation in the banking industry. Supporting the idea that greater capitalization levels serve as a fundamental cushion for absorbing future losses, hence safeguarding firms' stability, the so-called "*regulatory hypothesis*" (Shrieves and Dahl, 1992; Jacques and Nigro, 1997; Murinde and Yaseen, 2004) opposes the predictions of the "*moral hazard*" argument which tenets are that higher level of capital may shrink bank's stability. The Koehn and Santomero (1980 and 1988) argument that risk-based capital ratios only, as opposed to flat capital requirements, are effective in constraining risk-taking incentives, constitute the theoretical underpinning of Basle capital accords. Jacques and Nigro (1997), basing their study on a sample of US commercial banks, found that risk-based capital standards are effective in increasing capital ratios and reduce the riskiness of the loans' portfolio. Berger and De Young (1997) investigate the moral hazard incentives finding that the level of troubled loans is negatively related to capitalization levels with higher levels of NPLs being associated to a sharp decrease in cost efficiency. Similar results are those of Salas and Saurina (2002) who find that the major variation in NPLs stock in a sample of Spanish banks is significantly explained by the total capital ratio, bank size, GDP growth and unemployment with credit quality rapidly deteriorating during economic booms.
Murinde and Yaseen (2004) find that regulatory pressures on capital have a positive effect on risk-taking level decisions in the sense that banks with a capital ratio near to the minimum ratio imposed by regulators are forced to raise their capital and reduce riskier exposures.
Other research focuses on the relations between capital, risk a bank efficiency. Altunbas et al. (2007) reveal that low efficiency is associated to more capital and a prudential risk-taking behaviour, although with differences according to the bank type.
Laeven et al., (2016) find a negative association between bank capital and systemic risk exposure, while Berger and Bouwman (2013) provide evidence of a positive association between capitalization levels and bank's survival probability, with high capitalization levels benefiting small banks at all times and large banks over crisis periods
Saunders et al., (1990) do not find a significative relationship between capital and risk whereas Calem and Robb (1999) and Haq and Haney (2012) provide empirical evidence of a U-shaped relationship between capital and risk: combining the two streams of literature which have shown mixed results they suggest that when capital is low, as soon the capital increases banks assume less risk, compliant with the regulatory effect, but when capital continues to raise, in line with the moral hazard hypothesis banks are incentivized to assume more risk.
Thus, the two-shaped hypothesis can mix the two streams of literature about the relationship between capital and risk. Thus, we formulate the following hypotheses:

$H1_a$ = *The relationship between capital and risk is convex, hence while initially capital decreases bank risk, subsequently when capital raises, for the moral hazard effect, the risk increases.*

2.2. Provisioning policies

Recent accounting, regulatory and supervisory interventions to cope with bad loans and provisions thereon provide another interesting setting for investigation. The ECB-mandated coverage of troubled loans with capital and provisions, referred to as the Texas Ratio, provide a good case for investigating the relations between provisioning policies and bank risk.
Our paper relates to a body of post crisis literature that renewed the interest in loan loss provisions and capitalization levels in several directions pointing to the risk-stability implications. Recent investigations add to the traditional literature on LLPs investigating the role of provisions under the income smoothing, capital management and signalling hypothesis. Pinto and Ng Picoto (2018)

investigate the effects of the financial crisis on the quality of financial reporting in European banks; results show that in the period 2007-2014 European banks used LLPs for income smoothing and capital management reasons both in the crisis period and in the post crisis period. A number of studies accounted for a positive effect of discretionary provisions and future cash flows or stock returns (Wahlen, 1994; Bouvatier and Lepetit, 2008; Curcio and Hasan, 2012). Should the signalling hypothesis hold, managers may think at using loan loss provisions to convey to the market information that the bank's future earning capacity is expected to increase.
The idea that provisions might drive investors' expectations has significant implications on a managerial perspective. However, that of the signalling power of loan loss provisions is still an open issue in academic research, at least as the relations between provisions and trends in capitalization levels.
Testing for the earnings management hypothesis and signalling effects of provisioning for non-performing assets, Vishnani et al. (2019) find evidence of income smoothing in a sample of Indian banks but fail to prove the presence of signalling practices.
One of the limitations of most of previous works on provisioning and accounting practices lays in constraining the focus on earning responses, while lacking consideration of market reactions and their implications in terms of market risk exposure.
Bushman and Williams (2015) move a step further and test for the hypothesis of delayed expected loss recognition as a manifestation of opportunistic loan loss provisioning leading to lower market transparency. Consistent with their hypothesis, authors provide evidence of higher stock market illiquidity and higher illiquidity risk associated with delayed recognition.
Kruger et al. (2018) examine the impact of provisions policies on capital requirements at light of the new IFRS 9 approach; focusing on a sample of US American bonds between 1991 and 2013, the study provides further evidence of the procyclical reduction of Tier 1 capital, due to provisioning policies; however, the pro-cyclical impact of LLPs is mitigated in presence of a lower level of NPLs hence a higher asset quality.
Ozili and Arun (2018), while finding evidence of income smoothing behaviour G-SIBs, show that income smoothing is more evident for banks with a higher level of non-performing loans, a greater level of profitability and more capitalized.
Those evidences would arguably point to a managerial problem of choosing the right balance of provisions and capitalization levels, possibly envisaging a trade-off between an eventual signalling power of provisions and the merits of high capital ratios as a mean of preserving bank stability. Focusing on the capital-systematic stability relation for a sample of public traded banks, Anginer et al. (2018) find that bank capital contributes to reducing systematic fragility, where the effect is reinforced in countries suffering of lower transparency levels or inefficient monitoring systems of financial institution, which lead the author to stress the role of the institutional environment. By contrast, they find that loan loss provisions as a proxy of asset quality turns to be positively related to systemic risk. At the same results reach the studies of Wong et al., (2011) and Ma and Song (2016) who provide empirical evidence about the hypothesis that loan-loss provisioning is procyclical and represents a key determinant of systemic risk exposure in the banking sector.
Therefore, at light of the extant literature we formulate the following hypotheses:

$H0_b$: *High coverage ratios on troubled loans act as a signalling mechanism, hence increasing market transparency and reducing overall stock volatility.*

The alternative hypotheses are:

$H1_b$ *High levels of coverage on troubled loans leaves room for increases in asset riskiness, hence rising equity risk exposure and harming bank stability.*

$H2_b$: *There is an asymmetric response in equity risk exposure, in the sense that higher levels of coverage on troubled loans lead banks to increasing idiosyncratic risk relative to systematic risk exposure.*

2.3. Size

The global financial crisis raised a deep debate about the role of size as key determinant of risk in the banking sector. These for three reasons: first, large banks were in the eye of the storm during the recent global financial turmoil, second, the continuous process of mergers and acquisition has increased the size of bank groups over the last decade. Finally, large banks have the tendency to be lower capitalized, present a more volatile funding compared to small banks and the business model is mostly focused on risky market-based activities rather than the traditional loans business (Laeven et al., 2014).

The empirical literature concerned on the relationship between size and risk has provided quite mixed results, hence, the sign of the relationship is still ambiguous.

A first strand highlighted as large bank are more diversified, can benefit of economies of scales and present a lower level of idiosyncratic risk (Konishi and Yasuda, 2000; Stiroh, 2006). On the other hand, a second vein found a positive relationship between bank size and systematic and total risks, highlighting as larger banks are more exposed to certain firm-specific profiles (credit, operating and exchange risks) and are more sensitive to the dynamics of the markets (Anderson and Fraser, 2000; Vander Vennet et al., 2005).

In addition, literature has dedicated devote attention in the recent years about the contribute of the size factor in terms of systemic risk, delineating different theories. The too-big-to-fail hypothesis underlies large banks are incentivized to assume a moral hazard behaviour, taking on excessive risk taking expecting public bailouts. In this strand Cabrera et al. (2018) show that the designation as Global Systemically Important Banks (G-SIB) has a positive association with the realized volatility of stock returns as a proxy of the market's perception of bank riskiness, although causalities are not clear. Similarly, Alfonso et al. (2014) provide support to the moral hazard argument associated to the perception of a bank as TBTF.

A second theory refers to agency costs showing the large banks assuming excessive risk taking suffer from an opaque mechanism of corporate governance and managerial control (Laeven and Levine, 2007). According to this theory banks have a natural propensity to grow up involving in risky activities sharing the building blocks of the systemic risk exposure such as high level of leverage and interconnectedness (Laeven et al., 2016).

The third theory, the *volatile funding hypothesis* suggest that large banks which rely on short term funding are more sensitive to liquidity shocks and market failures (Kashyap et al., 2002; Gennaioli et al., 2013). Thus, at light of the theories and the empirical literature concerned on the relationship between size and risk we formulate the following hypotheses:

$H1_c$ = *There is an asymmetric response in equity risk exposure, meaning that larger banks show a lower level of idiosyncratic risk, while the systematic risk exposure increases with bank size.*

$H2_c$= *Larger banks pose a higher level of stability.*

3. Empirical strategy

3.1. The Sample

Our study is based on a sample of 62 listed European banks selected according to the following methodology. Starting from the entire ensemble of listed banks located in Eastern and Western Europe, we run the Equity Screening command on the Bloomberg Professional Platform with the aim to include only listed banks in line with the Industry Classification Benchmark (ICB) principle. Then, in order to exclude less significant institutions, we introduce 6 filters, requiring banks to comply with at least one of these.

First, we require banks to be directly supervised by the European Central Bank (ECB) and to be subjected to Stress Test exercise either Transparency Test, carried out by European Banking Authority (EBA). Subsequently, we extend our sample incorporating: Global Systemically important banks (G-SIBs), Global Systemically important institutions (G-SIIs) and Other Systemically important institutions (O-SIIs), as defined by the Financial Stability Board (FSB). Finally, we perfect our sample excluding all the banks for which quarterly data were not available. The finale sample consists of 62 banks, covering 22 countries within the European Economic Area region.

Thus, we gathered consolidated on-balance sheet quarterly data from Bloomberg Professional Database, on a timeframe spanning the period 2005q1-2018q4. Therefore, we are able to cover three crucial sub-periods of the last decade: the mortgage sub-prime crisis, the euro area sovereign debt crisis and the post-crisis period. Furthermore, these periods mirror the developing of the regulation frameworks (e.g. Basel accords, EBA 2011 Capital Exercise, ECB *draft guidance on NPLs* and the successive *addendum to draft guidance on NPLs*).

Summary statistics of the sample are outlined in table 1.

(Please, insert table 1 about here)

3.2. Risk variables

Crucial in our study for testing our hypotheses is the identification of the appropriate variables which capture different dimensions of risk in the banking sector at light of the extant literature.

Our risk variables include three equity risk measures: idiosyncratic, systematic and total risk, exploiting a two-factor model (Flannery and James, 1984).

The firm's equity risk measures are the idiosyncratic, systematic and total risks. Understanding the dynamics of idiosyncratic risk and total risk is crucial for regulators which target to preserve financial stability. Shareholders with a diversified portfolio aim to consider especially the systematic risk component, while bondholders are supposed to be sensitive to banks probability of default, hence are interested about idiosyncratic and total risks.

Following the traditional CAPM, being the cost of capital function of the market-risk premium and firms beta, the latter can be extrapolated by the sensitivity of the firm equity return respect to the return of the market portfolio:

$$R_{e_{i,t}} = \alpha_i + \beta_{e,i} R_{m,t} + \varepsilon_{i,t} \qquad (1)$$

where, $R_{e,i}$ is the monthly equity stock return of bank i, R_m is the monthly return of the market portfolio represented by the Euro Stoxx 600 index and $\varepsilon_{i,t}$ is the error term, whose standard deviation represents the contribute to total risk in terms of idiosyncratic component (Smaga, 2014; Akovali and Yilmaz, 2016). We do not apply multi-factors model as the Fama-French model because the literature which assesses bank equity return using this approach is significantly scant (Viale et al., 2009). We exploit the market equity beta β_e as proxy of banks systematic risk exposure. Then, collecting from

Bloomberg Professional service monthly data, we proxy equity overall risk using the 30 days stock volatility, calculated as follows:

$$30d\ stock\ volatility = \sqrt{\frac{1}{N}\sum_{t=1}^{n}(R_{i,t} - AVR_i)^2} \qquad (2)$$

where, *30d stock volatility* is the standard deviation of equity return for bank *i*, $R_{i,t}$ is the monthly return for bank i, AVR_i is the average equity return for bank i, and N is the number of observations.
To identify banks financial stability, we use the Merton's Distance to Default (DtD) (Kabir et al., 2015).
DtD represents the difference between the market value of assets and the default point, divided by asset market value multiplied for assets 'volatility. We gather from Bloomberg Professional Services the default probability at 1 year (PD). Then, we calculate the DtD by inverse cumulative distribution function of the PD.
In formal terms, according with Paltrinieri et al., (2018): considering DtD a standard normal distribution, $DtD \sim N(0,1)$, the probability of default PD is CDF (-DtD): $\phi(-\mathrm{DD}) = 1 - \phi(\mathrm{DtD})$

$$\phi(DtD) = \frac{1}{2}\left[1 + erf\left(\frac{DtD}{\sqrt{2}}\right)\right] \qquad (3)$$

Using the Bloomberg default probability at 1 year (*PD*) and applying the inverse of the cumulative distribution function, we obtain the DtD:

$$DtD = \phi^{-1}(PD) = \sqrt{2}\, erf^{-1}(2PD - 1) \text{ with PD} \in (0,1) \qquad (4)$$

3.3. Explanatory variables

This paper aims to explore the role of bank capital, provisioning policies and size as critical factors impacting on different dimensions of bank risk in the European Economic Area Region (EEAR). As we have outlined in section 2.1 the literature concerned on the relation between capital and risk, has provided mixed results. Thus, it still represents an outstanding question and it is significantly far from being resolved, hence further empirical evidence is required. Indeed, to the two strands of literature which demonstrate the standalone effects of bank capital in increasing or reducing bank risk, another has been added, initiated by Calem and Robb (1999) and followed by Haq and Haeney (2012) which introduces the hypothesis of a convex relationship between capital and risk.
In order to further test the existence of squared relationship on a sample of EU banks, at light of the recent Basel III regulatory framework on capital we employ two definitions for capturing capitalization levels. First, we follow the Basel III regulatory framework exploiting the total capital ratio measure, computing at the denominator the risk-weighted assets. Basel II defines the total regulatory Capital as the sum between Tier 1 and Tier 2 components. The former represents the sum between shareholders' funds and perpetual non-cumulative preferred shares, while the latter incorporates subordinated debt and hybrid instruments. Thus, we divide the Total capital with the risk-weighted assets in order to obtain the Total Capital ratio.
In addition, as underlined by (Demirguc-Kunt et al., 2013) the relation between capital and default risk is stronger when capital is measured by non-risk-based measures as the common leverage ratio. Thus, exploiting Basel III instructions which propose the leverage ratio as measure able to limit bank risk in a context of imperfect information about bank asset value (Dermine, 2015), we include in our

study the traditional Equity-to-Asset ratio as capital measure. In order to test the quadratic relationship between capital and risk we include in our analysis a squared term of bank capital.

Then, we employ several measures which capture the asset quality and the provisioning policies of the banks included in our study. The literature generally underlies as significative amounts of NPLs increase bank risk and jeopardise financial stability (Schaeck and Cihak, 2014; Paltrinieri et al., 2018; Beltrame et al., 2018). Our study aims to deepen the role of provisioning policies and coverage levels on troubled loans and their effects on several bank market risk measures.
As underlined by our literature review and by our research hypotheses, the effect of provisions policies on troubled loans could act with double effects being perceived by the market in two directional ways: first, according to the signalling theory (Akerlof 1970; Beaver et al., 1996) as a exhibitions of a prudential behaviour which might reduce bank riskiness, and in line with the expectations of bank authorities (*see* ECB *addendum*, 2018) either as signal that banks expect higher losses from their loans portfolio hence possible increasing the level of risk.
The first asset quality measure we include in our study is the Texas ratio (Jessewein, 2009; Siems, 2012), which determines the level of coverage on troubled loans. It is traditionally calculated considering the gross value of *non-performing* loans divided by the sum of the loan loss reserves (LLR) and the available tangible common equity (TCE). The level of LLR expresses, through an internal bank's estimation, the expected loss, that is the level of *non-performing* loans without a recovery value and already absorbed through write-downs.
TCE, instead, provides the cushion able to absorb the unexpected losses. The current regulatory framework imposed by the ECB substantially imposes to maintain a level of Texas ratio equal to one which represents the equilibrium level, expressing that the gross value of NPLs is totally covered by capital and reserves. Indeed, if on one side the expected loss of loans has been already accounted through loans loss provisions in the income statement, on the other side, the Basel's regulatory capital framework under Pillar I, expects to cover the unexpected loss with high quality capital. Therefore, we run the following econometrical equation in order to estimate the residual term $\varepsilon_{i,t}$ (i.e. Texas ratio spreads), which represents a proxy of the departure from the equilibrium level (100%), which is considered as the limit beyond which the bank is in turmoil: indeed in this case the gross value of NPLs is higher than the sum between LLR and TCE. This result that loan loss reserves and tangible capital are not able to absorb possible shocks on the loan portfolio. This approach allows us to test the market sensibility towards this indicator, thereby we want to verify the signalling effect of the index and its impact on banks risk.

$$\frac{NPL_{G_{i,t}}}{TA_{i,t}} = \alpha_{i,t} + \beta_1 \frac{LLR_{i,t}}{TA_{i,t}} + \beta_2 \frac{TCE_{i,t}}{TA_{i,t}} + \varepsilon_{i,t} \qquad (5)$$

Then, we include the Loan loss Provisions ratio (LLP/GL). It assesses the cost of loans on total gross loans; it's a measure of trouble on loan portfolio. Higher levels of provisioning determinates that a higher part of risk is already been accounted in the profit and loss statement.
In addition, we consider the coverage ratio% on troubled loans (LLR/GL), which is the ratio between loan loss reserves and the gross value of non-performing loans. It represents the total amount of funds set aside by bank to cover the expected loss on its loan portfolio.
Finally, to capture potential bank size effect we proxy banks size using the natural logarithm of total assets (Pasiouras et al., 2008; Tan, 2016; Laeven et al., 2016).

3.4. Control variables

We include several control variables (CV) which possibly can influence the main variables of this study and give a general view of the banks' position. We include a variable which assesses banks

liquidity position: the ratio between gross loans and short-term funding and deposits. According to Chiaramonte and Casu (2015) the relation with risk variables can be interpreted in different ways; if the market perceives negatively banks with a lower level of deposits and liquidity, this aspect leads to an increase in equity risk. Conversely, if the market exploits banks with a higher level of loans for a given level of deposit, we expect a negative sign with bank risk variables. Moreover, as measure of funding structure, we consider the ratio between short term debt and total liabilities. Banks that are dependent on short term debt are more vulnerable to liquidity shocks and subtend a higher level of risk. Thus, we expect a positive relationship with risk variables.
In addition, we include the efficiency ratio given by the ratio between operating expenses and total revenues. We expect that banks that have a higher level of operational efficiency perform better than the others and exhibiting a lower level of risk.
consider in our study as macro control variable the variation rate of the gross domestic product (Δ%GDP). We expect that positive variations of the gross domestic product reduce the overall risk of banks loans portfolio, hence lowering banks risk (Imbierowicz and Rauch, 2014). As measure aimed to capture the impact of the monetary policy on bank risk, we include the 3-month Euribor rate which mirrors market expectations about future conditions of financial markets. Finally, we incorporate in the models the Herfindahl-Hirschman index (HHID) calculated as the sum of the squared market share in terms of total assets in each country. Higher levels of HHID are associated to a higher level of market power.

4. Model Specifications and main results

Given a balanced panel data, in order to examine our hypotheses, we follow Berger and Bouwman (2013), Anginer et al., (2013) and Bitar et al., (2018) running the following baseline pooled OLS regression model:

$$f(Risk)_{ij,t} = \alpha + \beta \cdot CAP_{ij,t-1} + \gamma \cdot CAP^2{}_{ij,t-1} + \delta \cdot PROV_{ij,t-1} + \theta \cdot SIZE_{ij,t-1} + \vartheta \cdot BC_{ij,t-1} + \sum_{j=1}^{n} \tau_j \cdot C_j + \sum_{t=1}^{T} \varphi \cdot T_t + \varepsilon_{ijt} \qquad (6)$$

where the dependent variables refer to our risk variables, as defined in section 3.2., in country j at time t. CAP and CAP^2 are capital and squared capital measures respectively; $PROV$ is the vector of provisioning and coverage policies variables and BC are the bank controls. All the variables are winsorized at 99% level. C and T are the country and time fixed effects. We include country and time dummy fixed variables in order to avoid eventually omitted variables effects in relation to “country” either “quarter” specifications (Anginer and Demirguc-Kunt, 2014). We apply the Modified-Wald test which shows the presence of heteroskedasticity cross-sectional. Therefore, we estimate equation (8) using the Huber-White sandwich estimators in order to obtain standard errors that are robust to cross-sectional heteroskedasticity and within panel correlation. Robust standard errors with robust variance-covariance matrix are clustered at bank level in order to address for residual cross-sectional autocorrelation (Petersen, 2009).
Table 2 shows the descriptive statistics of all variables included in our study. Table 3 reports the pairwise correlations among explanatory and control variables. These are generally low, smaller than 0,4, which is the limit from which the collinearity problem becomes more important (Kennedy, 1985). Finally, to further check for multicollinearity problems that are not captured by the pairwise correlation matrix we consider the Variance Inflation Factor (VIF), including only variables with VIF ≤ 4.

(Please, insert table 2 about here)
(Please, insert table 3 about here)

Table 4 reports the baseline results of the pooled OLS regression model.

(Please, insert table 4 about here)

Regarding bank capital results in the odd models (1,3,5,7) show how bank total capital ratio and book leverage ratio are effective in reducing idiosyncratic risk and improving banks financial stability expressed by the DtD.

However, our empirical evidence brings out two asymmetries between the two measures of capital, which regard market betas and total equity risk. Indeed, while the risk-weighted capital measure does not have a statistically significant impact on betas and even a positive but not significant impact on equity volatility, the traditional equity-to-asset ratio appears effective in reducing the systematic risk exposure of banks. This result could be consistent with the idea that more compound capital ratios allows banks managers to manipulate risk weighted asset, complying with the capital adequacy requirements imposed by capital regulatory requirements in a way that does not reflect the real risk exposure (Cathcart et al., 2015; Bitar et al., 2018). On the contrary, our result exploits the introduction of the simple book leverage ratio which seems able to capture bank riskiness along different dimensions (Dermine, 2015).

In the even columns (2,4,6,8) we test for the non-linear relationship between capital and risk.

Our results confirm the existence of a U-shaped relationship between leverage ratio and idiosyncratic and insolvency risks and between total capital ratio and systematic and total risk, given the statistical significance of the squared terms. These findings provide confirmation of the results of Calem and Robb (1999), Blum (1999) and Haq and Haeney, (2012) highlighting that, for low levels of capital, increases in capitalization levels initially lower bank risk, but eventually further raises in the capitalization level produce an increase in bank riskiness, supporting our hypothesis 1a.

Taking into accounting provisioning and asset quality measures, empirical results show as higher level of provisions and coverage levels on troubled loans increase bank risk. Therefore, we reject our hypothesis $H0_b$ and find confirmation to $H1_b$. Specifically, the loan loss provisions ratio worsens all the bank risk profiles we include in our study. An increase of the level of loans loss provisions is perceived by the market as an assumption of incorrect level of coverage on banks loan portfolios, thereby expressing a higher level of risk (Agusman et al., 2008; Ng-Roychowdhury, 2011). Market, therefore, seems to perceive provisions as a crucial variable for the assessment of bank risk. However, this result raises some concerns regarding the implementation of the recent 2018 ECB *addendum* which substantially forces banks to act on the provisioning lever to tackle the issue of *non-performing* exposure. Moreover, we find strong confirmation regarding the significance of the Texas ratio spreads which assess the degree of coverage on NPLs mixing provisions and capital levels. Indeed, empirical results show how positive departures from the level of 100%, which stand for an insufficient level of coverage on non-performing exposures, are associated to higher levels of idiosyncratic and insolvency risks. Our findings corroborate the role of the ratio which appears to have a strong relationship with bank risk, even at light of its rapid acceptance in examining potential banks failures within the global assessments carried out by bank authorities. Hence according to Jesswein (2009), the idea that moves the index is solid and it can be designed with only minimum effort.

Finally, we find only partial confirmation of our hypothesis $H2_b$. Indeed, whether provisions and coverage variables significantly increase banks idiosyncratic risk in the case of systematic risk the sign of the relationship remains positive but not significative in the case of Texas ratio spreads and coverage ratio.

Turning on the role of size our baseline results report a statistical relevance at 10% of the size factor in explaining bank idiosyncratic risk risk. The coefficient of the relationship is negative in the case of idiosyncratic risk, and positive looking at systematic risk exposure confirming our hypothesis $H2_c$ and the findings of Demsetz and Strahan, 1997; Anderson and Fraser, 2000 and Haq and Haeney, 2012. For the other models the size factor results insignificant.

Further, looking at the control variables the liquidity measure is negatively associated with bank insolvency risk, suggesting that banks which maximize the level of loans when deposits and therefore liquidity are low are perceived riskier by the market, expressing a higher insolvency risk (Chiaramonte and Casu, 2013).
Moreover, the funding structure of banks, captured by the ratio between short term funding and total liabilities assumes statistical significance in all the models, confirming how banks reliant to short term debt are more vulnerable to liquidity shocks and perceived riskier, instable and expressing a higher level of insolvency risk (Diamon and Dybvig, 1983; Bernanke, 2008; Brunnermeier and Oehmke, 2013; Du and Palia, 2018).
We also find that less efficient banks from an operational point of view show a higher level of equity volatility and insolvency risk as we expected. Moreover, looking at the macro variable we find that positive variations of the GDP are associated to a lower level of idiosyncratic risk, meaning that favorable economic conditions are possible related to a lower level of risk in the credit portfolio (Pasiouras, 2008). The sign of the relationship is negative even for the other risk dimensions but not statistically significative.
Additionally, our empirical analysis shows how the level of the Euribor which wants to capture the role of the monetary policy is negative related to bank risk. As a result, a lower level of short-term interest rates is associated to a higher level of risk, consistent with the idea that in a context of permanent low levels of interest rates banks, in search of yield, modify the behavior towards risk-appetite engaging in riskier activities (Altunbas et al., 2010).
Finally, we find the HHID which expresses the degree of market power has a negative impact on bank specific risk suggesting that banks with a higher level of market power tend to reduce the risk perceived by the market showing a higher level of financial stability (Agoraki et al., 2011).

4.1. Robustness checks

To further validate our baseline results we run several robustness checks.
First, we assess the cross-sectional heterogeneity concerning the relationship between capital, provisions and size with our banks risk dimensions (Demirguc-Kunt and Anginer, 2014). In other words, we evaluate if the association between our explanatory variables and risk variables diverges for small and large banks, high and low liquid banks and across the global financial crisis (Bitar et al., 2018). We focus only on bank specifics variables.
First, we subdivide our sample in relation with bank size. Table 5 presents the results.

(Please, insert table 5 about here)

We find surprisingly that the risk-based capital measure for small banks increases significantly equity betas and further the sign of the relationship is still positive in the case of total equity risk; the impact on the distance to the default is not significative. This result corroborates the idea that risk-based capital measures leave space to manipulation in the risk weights by bank managers, even considering that small banks are used to quantify their risk weights drawing on standardized or (IRB) approaches hence dealing with possible incentives in moral hazard practices (Cathcart et al., 2015). Moreover, we confirm the negative sign between the simple book leverage ratio and bank risk.
Looking at provisions and coverage levels we confirm our baseline results, in fact our results do not report significative asymmetries between small and large banks: loans loss provisions are confirmed to increase bank risk across different specifications, while Texas ratio spreads appears to have a more significative negative impact on risk in small banks, consistent with the idea that small banks are more focused on the traditional loan business hence facing an higher level of credit risk.
This idea is further supported by the results of our liquidity variable; indeed, we find significative mismatches between small and large banks. Small banks, that for a lower level of liquidity hence

deposits, have a higher loans portfolio are perceived less risky by the market, subtending a lower level of systematic, total and insolvency risks. For large banks the result is essentially the opposite, these appears riskier when maximize the loan portfolio when deposits are low.
To provide further insights regarding the role of the liquidity factor we split our sample considering as liquidity variable the ratio between liquid assets and short-term debt & deposits, the so-called maturity mismatch ratio (Beck et al., 2013), which aims to express the risk that the derives from dissimilar maturities of the funding.

(Please, insert table 6 about here)

Results reported in Table 6 show that while for high liquid banks capital ratios appears to reduce bank risk, while for banks with a lower level of liquidity, higher levels of risk-based capital ratio increase significantly bank systematic and total risks. At this regard it is necessary emphasize that the joint impact of capital and liquidity on banks fragility represented one of the "pillars" of the Basel III regulatory framework; our results provide therefore support to the Basel initiatives, supporting the idea that these two factors are complementary and the merely effect on capital is not sufficient in decreasing bank systematic and total risks (Vazquez and Federico, 2015).

In addition, we provide further empirical asymmetries across bank size in relation with liquidity; indeed, we find that when liquidity is high, larger banks exhibit a statistically significative (10% level) lower level of idiosyncratic and total risk, while for lower levels of liquidity size is statistically irrelevant.
Moreover, liquidity does not influence the results of the loan loss provisions ratio which increases all bank risk profiles; on the contrary Texas ratio spreads assume statistical significance increasing idiosyncratic, total and insolvency risks when the bank is facing an higher level of liquidity risk. These findings suggest that the market sensitivity towards this index is enhanced with a higher level of liquidity risk, consistent with the idea that the jointly effect of credit risk and liquidity risk has negative effects on bank stability (Imbierowich and Rauch, 2014).
Further we check for the crisis period considering as crisis period the 2008-2012 period which include the subprime crisis and the subsequent sovereign debt crisis in EU (Beck et al., 2013). Therefore, we create a dummy that takes on a value of 1 for the period 2008q1-2012q4 and 0 otherwise. We interact the dummy with our bank specific variables. Table 6 presents the results

(Please, insert table 7 about here)

Results show how during the crisis period the risk-based capital ratio did not assume statistical significance, resulting ineffective in reducing bank risk along several dimensions. On the contrary, the sign of the common book leverage ratio is negative and statistically significative, confirming the misalignments we found in the baseline results. In the post crisis period, we report a negative relationship between total capital ratio and idiosyncratic and insolvency risk, and the meaningful results of the book leverage ratio are confirmed. These findings therefore provide further support to the implementation of the Basel III capital regulatory framework with the leverage ratio, which appears to be more effective in containing bank risk (Dermine, 2015).
Regarding provisions, the loan loss provisions ratio and the Texas ratio spreads assume statistical significance increasing bank risk especially during the financial crisis as we expected; in the post-crisis period systematic risk and total risk are not affected by the two indicators.
Finally, taking into account the size factor, results show how size was a crucial factor increasing banks systematic risk, but even harming financial stability of institutions increasing Merton's Distance to Default during the crisis period.

These findings provide confirmation regarding the “too big to fail hypothesis”, as during the global financial crisis large banks had major incentives to take on higher risk activities as they enjoy a complete public safety net (Haq and Haeney, 2012; Haan and Poghosyan, 2012).
Further, we control for endogeneity issues. Capital, asset quality and size variables are potentially endogenous with risk variables in relation with simultaneity bias, as widely shown by literature (Altunbas et al., 2007; Tan and Floors, 2013; among others). In order to deal with endogeneity, we follow Carner and Hansen (2004) running an instrumental variable regression, and instrumented capital provisions and size variables, applying as instruments their own lagged values (Roberts and Whited, 2011; Wooldridge, 2015). Results are shown in Table (7).

(Please, insert table 8 about here)

Results remains equal; therefore, endogeneity issue appears limited and it does not impact on our variables of interests.

5. Conclusions and implications

Based on a sample of 62 listed banks located in the European Economic Area Region and spanning a period of 14 years, from 2005 to 2018 on a quarterly basis, this paper explores the determinants of bank risk in EU. We contribute at the extant literature by disentangling the complex concepts of risk in the banking sector, employing several definitions of risk (idiosyncratic risk, systematic risk, total risk, stability/insolvency risk). We put in the spotlight the role of capital, loan loss provisions and size, testing the connections with the profiles investigated, with the objective of assessing the existence of asymmetric behaviours across different dimensions of risk contours.
Our findings show that the simple book leverage ratio (equity-to-asset ratio) recently introduced in the Basel regulatory framework on capital is more effective, compared to the risk-based capital measure, in capturing bank risk, being negative related with all the dimension of risk included in the study. In addition, at light of the introduction of the Basel III capital framework, we provide new empirical evidence about the convex relationship between bank capital and risk corroborating the idea that the regulation on bank capital might be unintentional consequences. Indeed, it appears plausible suppose that banks with high levels of capital may increase the risk appetite if forced by regulators to further increase the capitalization level.
In addition, we find that during the crisis period the total risk-based capital ratio was ineffective in containing bank risk while the significance of the of the leverage ratio is confirmed and when we control for liquidity we find that when liquidity is low the total risk-based capital ratio has the unintended effect to increase bank systematic and total risks.
These results have fundamental implications for regulators and policymakers, highlighting that the regulation on capital has different limitation in containing bank risk and reducing the probability of default of institutions. Indeed, the risk-based capital measure appears ineffective in reducing bank systematic and total risks, casting several doubts regarding the risk weighting methodology used by bank regulators (Cathcart et al., 2015; Dermine, 2015; Bitar et al., 2018).
The other crucial factor significantly related to bank risk are loan loss provisions. We find a significantly positive relationship between the loan loss provisions ratio and all the bank risk variables, implying that provisions are still perceived by the market as a crucial factor impacting on bank risk along different dimensions. In addition, our panel analysis corroborates the role of the Texas ratio which represents the level of coverage on troubled loans mixing capital and loan loss reserves. The index assumes statistical significance in explaining bank idiosyncratic and insolvency risks (Jesswein, 2009). The implications of such results are several at light of the recent ECB *addendum* and the 2018 CRR reform proposal. Indeed, in March 2018, additionally to ECB *addendum* which sets the quantitative expectations regarding NPLs coverage, the European Commission within the comprehensive measures adopted to tackle NPL issue, included a common minimum loss coverage

levels for newly originated loans which turn into NPLs exposures. The aim of the proposal is to force banks to detain a coverage level up to common minimum levels. Whether the minimum level of coverage is not reached by institutions, the difference between the actual coverage and the minimum required coverage should be deducted from CET 1 capital. Therefore, the aim of the minimum loss coverage is to act as a "statuary prudential backstop" in order to better reflect the risks associated to NPLs in CET 1 capital ratios. However, our results clearly demonstrate that forcing banks to act on the provisions lever raise some concerns about the applicability of these reforms: forcing banks to extensive provision policies with possible cliff-edge effects, especially in a context already characterized by a weak level of profitability (*see* EBA risk dashboard, Q42018), might lead to increase financial instability.

Finally, from our analysis the role of size is not completely decipherable, indeed our baseline results report only a negative and statistically significative (10% level) relationship between size and idiosyncratic risk supporting the idea that larger banks are more diversified and subtend less risk (Konishi and Yasuda, 2004, Stiroh, 2006; Haq and Haeney, 2012). We also find that during the crisis period larger banks were more sensitive to market trend mirroring a higher level of systematic risk (Anderson and Fraser, 2000; Haq and Haeney, 2012).

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Table 1: The Sample (Millions of Euro)

Country	*Average Assets*
Austria	145,868.70
Belgium	359,753.50
Croazia	104,929.90
Cyprus	9,649.35
Czech Republic	782,552.00
Denmark	1,397,493.00
Finland	548,349.60
France	1,606,566.00
Germany	788,212.50
Greece	71,223.72
Hungary	9,744,507.00
Italy	220,083.70
Lithuania	1,094.47
Norway	123,249.30
Poland	90,535.36
Portugal	61,365.84
Slovenia	14,419.06
Spain	423,262.80
Sweden	1,809,116.00
Switzerland	1,245,532.00
Netherlands	877,833.60
UK	1,473,399.00
Total	***723,556.10***

Table 2: Pairwise correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Total Capital ratio% (1)	1.000										
Leverage (A/E) (2)	0.058	1.000									
Texas ratio% spread (3)	-0.055	-0.004	1.000								
Loan Loss Provisions ratio (4)	-0.156	-0.013	0.140	1.000							
Coverage ratio% (5)	-0.023	0.002	-0.119	-0.006	1.000						
Gross Loans/(Short term funding & Deposits)% (6)	0.057	-0.049	0.068	-0.072	-0.017	1.000					
(Short Term Debt/Total Liabilities) % (7)	-0.284	-0.026	0.158	0.151	-0.011	-0.234	1.000				
Efficiency ratio% (8)	0.043	0.085	0.043	-0.344	0.006	0.010	-0.029	1			
Size (9)	0.300	0.036	-0.052	-0.113	-0.063	0.005	0.003	0.0217	1		
Var% GDP (10)	-0.109	-0.003	0.019	0.022	0.014	-0.008	0.017	0.0159	-0.021	1	
3m-Euribor (11)	-0.514	0.050	-0.082	-0.104	0.020	-0.039	0.146	-0.0077	-0.0628	0.1332	1

This table shows the pairwise correlations among explanatory variables.

Table 3: Descriptive statistics of the variables

		N	sd	mean	p25	p50	p75
Dependent Variables	Idiosyncratic risk	3363	0.048	0.046	0.014	0.032	0.061
	Systematic risk (ß)	3363	3.018	1.281	0.086	1.261	2.480
	30d stock volatility	3111	0.176	0.396	0.282	0.360	0.474
	Distance to Default	3373	0.464	2.842	2.526	2.828	3.163
Explanatory Variables	Total Capital ratio	3232	0.039	0.148	0.118	0.142	0.170
	Leverage (E/A)	3336	0.032	0.070	0.047	0.064	0.087
	Texas ratio spread	3007	0.019	-0.001	-0.010	-0.001	0.004
	Loan Loss Provisions ratio	3196	0.002	0.002	0.001	0.001	0.003
	Coverage ratio	3022	0.714	0.797	0.485	0.622	0.781
	[Gross Loans/ (Short term funding & Deposits)]	3268	0.368	0.969	0.729	0.884	1.156
	(Short Term Debt/Total Liabilities)	3336	0.102	0.139	0.063	0.114	0.192
	Efficiency ratio	3315	0.239	0.631	0.509	0.587	0.686
	Ln (TA)	3336	1.682	12.309	11.059	12.045	13.724
	Var. GDP	3465	0.151	-0.008	-0.035	0.014	0.052
	3m-Euribor	3528	1.661	1.249	-0.027	0.677	2.162

The table shows the descriptive statistics of the variables selected in our study.

Table 4: OLS regression model

Variables	*Idiosyncratic risk*		*Systematic risk*		*Total Equity Risk*		*Bank stability*	
	Baseline model	*Squared capital*	*Baseline model*	*Squared capital*	*Baseline model*	*Squared capital*	*Baseline model*	*Squared capital*
Total Capital ratio	-0.123**	0.123	1.365	33.16***	0.0392	5.678***	1.717***	-2.354
	(0.0473)	(0.192)	(1.695)	(9.288)	(0.285)	(1.185)	(0.627)	(2.019)
Leverage ratio	-0.142**	-0.520***	-7.110**	-22.60*	-0.736	-1.187	4.185***	14.52***
	(0.0596)	(0.166)	(3.097)	(12.92)	(0.582)	(1.501)	(1.057)	(2.452)
Squared Total Capital ratio		-0.689		-90.85***		-16.31***		11.12*
		(0.477)		(26.76)		(3.384)		(5.593)
Squared Leverage ratio		2.021**		78.90		1.378		-55.89***
		(0.848)		(58.05)		(7.226)		(12.51)
Texas ratio spreads	0.268***	0.267***	3.064	2.856	0.0497	0.00507	-3.278***	-3.287***
	(0.0734)	(0.0709)	(2.951)	(2.777)	(0.974)	(0.913)	(1.027)	(1.033)
Loan Loss Provisions ratio	3.454***	3.400***	42.26*	43.98**	10.87***	11.36***	-54.55***	-52.51***
	(0.786)	(0.772)	(22.20)	(21.61)	(2.593)	(2.350)	(5.815)	(5.245)
Coverage ratio	0.00307***	0.00276**	0.0373	0.0172	0.00444	0.00190	-0.00248	0.00488
	(0.00115)	(0.00109)	(0.0505)	(0.0477)	(0.0110)	(0.0112)	(0.0194)	(0.0180)
Size	-0.00161*	-0.00225**	0.0134	-0.0407	-0.00637	-0.0134	-0.0141	0.000266
	(0.000917)	(0.00102)	(0.0431)	(0.0511)	(0.00912)	(0.00980)	(0.0210)	(0.0215)
Liquidity	0.00271	0.00276	0.189	0.265	0.0627	0.0807*	-0.192***	-0.184***
	(0.00335)	(0.00303)	(0.442)	(0.397)	(0.0500)	(0.0457)	(0.0686)	(0.0597)
Funding Structure	0.0383***	0.0339**	1.787*	1.666*	0.295***	0.299***	-1.256***	-1.134***
	(0.0125)	(0.0128)	(1.009)	(0.881)	(0.0992)	(0.0986)	(0.181)	(0.154)
Efficiency ratio	0.00508	0.00386	-0.203	-0.267	0.0962***	0.0904***	-0.303***	-0.273***
	(0.00649)	(0.00649)	(0.363)	(0.404)	(0.0228)	(0.0210)	(0.0418)	(0.0417)
GDP growth	-0.0419***	-0.0427***	0.0220	-0.0790	0.106**	0.0853*	0.0127	0.0193
	(0.0141)	(0.0141)	(0.353)	(0.349)	(0.0472)	(0.0441)	(0.0793)	(0.0779)
Euribor	-0.0136***	-0.0138***	-0.149	-0.118	-0.0160	-0.00529	0.222***	0.230***
	(0.00336)	(0.00341)	(0.114)	(0.107)	(0.0224)	(0.0220)	(0.0329)	(0.0312)
HH-Index	-0.0265**	-0.0265**	-1.109	-0.961	0.0349	0.0929	0.0923	0.118
	(0.0131)	(0.0122)	(1.185)	(1.101)	(0.0852)	(0.0791)	(0.196)	(0.177)
Observations	2562	2562	2519	2519	2423	2423	2567	2567
R-Squared	0.243	0.245	0.255	0.284	0.592	0.618	0.721	0.738
Mod-Wald (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Country Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

This table shows the OLS estimation result of equation (7). See table 2 for the definition of the explanatory and control variables included in the study. Modified Wald is the test of homoscedasticity. *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively. Huber-White standard errors are clustered at bank level and presented in parentheses.

Table 5: Size: small vs large banks

Variables	*Idiosyncratic risk*		*Systematic risk*		*Total Equity Risk*		*Stability*	
	Small banks	*Large banks*	*Small banks*	*Large banks*	*Small banks*	*Large banks*	*Small banks*	*Large banks*
Total Capital ratio	-0.200	-0.132***	4.270*	-0.722	0.115	-0.184	1.223	1.521**
	(0.150)	(0.0339)	(2.156)	(2.219)	(0.418)	(0.390)	(0.944)	(0.718)
Leverage ratio	-0.120	-0.206**	-3.322*	-19.57**	-0.575	-1.641*	2.821**	9.634***
	(0.0725)	(0.0925)	(1.780)	(7.920)	(0.605)	(0.845)	(1.032)	(1.931)
Texas ratio spreads	0.196*	0.226*	3.539	-0.123	-0.0138	-1.101	-2.323*	-4.287**
	(0.0983)	(0.127)	(2.743)	(5.783)	(0.943)	(0.764)	(1.155)	(1.721)
Loan Loss Provisions ratio	3.463***	3.949***	35.94	67.19**	9.676***	9.355***	-63.32***	-40.12***
	(0.969)	(0.929)	(21.27)	(25.16)	(2.862)	(3.012)	(7.675)	(5.360)
Coverage ratio	0.00233	0.00185	0.0319	0.0796	0.0135	-0.0102	-0.0162	-0.00599
	(0.00138)	(0.00145)	(0.0579)	(0.0712)	(0.0145)	(0.0130)	(0.0245)	(0.0211)
Liquidity	0.00226	0.00903**	-0.561***	0.892	-0.0105	0.150*	0.0152	-0.214***
	(0.00695)	(0.00340)	(0.170)	(0.668)	(0.0635)	(0.0751)	(0.101)	(0.0675)
Funding Structure	0.0422*	0.0228*	0.517*	3.033*	0.348**	0.0930	-0.938***	-1.264***
	(0.0212)	(0.0130)	(0.304)	(1.664)	(0.127)	(0.125)	(0.234)	(0.166)
Efficiency ratio	0.00248	0.00318	0.295**	-0.706	0.0980***	0.0734***	-0.417***	-0.202***
	(0.0120)	(0.00712)	(0.126)	(0.598)	(0.0325)	(0.0233)	(0.0802)	(0.0308)
Observations	1289	1491	1283	1453	1174	1458	1314	1490
R-Squared	0.218	0.307	0.243	0.352	0.653	0.657	0.747	0.781
Country Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

Small and large banks. The dependent variables are Idiosyncratic risk, Systematic risk, Total Equity risk and Bank stability. In the even and odd columns, we consider Small and Large banks respectively. Small banks and large bank based on their total asset size. Banks are classified as small banks when Total Asset < Q(50), large when Total Asset > Q(50). Estimations are based on OLS regression model. Robust standard errors are clustered at bank level and presented in the brackets. *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

Table 6: High vs Low Liquidity

Variables	*Idiosyncratic risk*		*Systematic risk*		*Total Equity Risk*		*Insolvency risk*	
	High Liq.	*Low Liq.*	*High Liq.*	*Low Liq.*	*High Liq.*	*Low Liq.*	*High Liq.*	*Low Liq.*
Total Capital ratio	-0.130***	-0.125	-0.835	5.840**	-0.132	0.724*	1.523**	1.128
	(0.0364)	(0.0840)	(1.486)	(2.601)	(0.333)	(0.377)	(0.598)	(0.851)
Leverage ratio	-0.161*	-0.172**	-9.995	-6.812***	-2.008**	-0.733*	8.069***	3.062***
	(0.0854)	(0.0732)	(8.076)	(2.196)	(0.997)	(0.222)	(1.564)	(1.009)
Texas ratio spreads	-0.0231	0.296***	6.832***	2.964	-0.244	0.0353	-3.080	-2.642***
	(0.0923)	(0.0894)	(1.951)	(3.326)	(0.384)	(1.033)	(1.956)	(0.971)
Loan Loss Provisions ratio	3.006***	3.330***	60.77**	34.76	8.963**	8.916***	-40.21***	-56.66***
	(0.798)	(0.899)	(28.17)	(22.94)	(3.474)	(3.295)	(7.805)	(6.686)
Coverage ratio	0.00323***	0.00224	0.105*	0.0136	0.000460	0.00570	-0.0224	-0.0324
	(0.00109)	(0.00197)	(0.0571)	(0.0722)	(0.00829)	(0.0150)	(0.0210)	(0.0216)
Size	-0.00199*	-0.00216	0.00160	-0.0263	-0.0267*	-0.0106	0.0259	-0.00318
	(0.00112)	(0.00176)	(0.0849)	(0.0661)	(0.0136)	(0.0166)	(0.0276)	(0.0291)
Funding Structure	-0.00259	0.0494**	2.091**	1.306**	-0.0610	0.337***	-0.849***	-1.107***
	(0.0154)	(0.0203)	(0.871)	(0.602)	(0.109)	(0.115)	(0.167)	(0.179)
Efficiency ratio	0.00482	0.000937	-0.285	-0.0788	0.120***	0.0502	-0.186***	-0.367***
	(0.00691)	(0.0107)	(0.349)	(0.330)	(0.0345)	(0.0319)	(0.0561)	(0.0510)
Observations	1395	1384	1360	1375	1332	1299	1407	1396
R-Squared	0.275	0.256	0.295	0.299	0.593	0.672	0.731	0.771
Country Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

In this table we test for liquidity, distinguishing high liquid banks from low liquid banks. The dependent variables are Idiosyncratic risk, Systematic risk, Total Equity risk and Bank stability. Banks are classified hig liquid when bank liquidity is higher thant the upper quantile of its liquidity ratio i.e. the ratio between liquid assets and short-term funding and deposits. Estimations are based on OLS regression model. Standard errors are robust and clustered at bank level. *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

Table 7: Crisis vs Post Crisis

Variables	*Idiosyncratic risk*		*Systematic risk*		*Total Equity Risk*		*Bank stability*	
	Crisis	*Post crisis*	*Crisis*	*Post crisis*	*Crisis*	*Post crisis*	*Crisis*	*Post crisis*
Total Capital ratio	-0.148	-0.151**	1.440	0.282	-0.127	0.270	1.178	1.362**
	(0.133)	(0.0617)	(2.847)	(2.610)	(0.436)	(0.387)	(0.897)	(0.603)
Leverage ratio	-0.0227**	-0.0171**	-0.509*	-0.581	-0.0822*	-0.116**	0.386***	0.421***
	(0.0111)	(0.00657)	(0.264)	(0.405)	(0.0464)	(0.0540)	(0.135)	(0.129)
Texas ratio spreads	0.414***	0.138	1.332	3.652	0.652	-0.799	-4.146*	-1.532
	(0.147)	(0.0829)	(3.220)	(3.312)	(0.787)	(0.701)	(2.177)	(1.185)
Loan Loss Provisions ratio	3.499**	2.288**	50.45**	6.676	9.086**	-0.230	-25.61***	-48.60***
	(1.432)	(1.001)	(24.03)	(22.64)	(3.512)	(3.623)	(9.129)	(6.210)
Coverage ratio	0.0187	0.0141	-0.0220	1.308	-0.0333	-0.103	-0.165	-0.564*
	(0.0186)	(0.0206)	(0.555)	(1.429)	(0.0576)	(0.155)	(0.175)	(0.319)
Size	0.000277	-0.00169	0.174***	0.00670	0.0127	-0.0103	-0.0573***	0.00612
	(0.00157)	(0.00124)	(0.0550)	(0.0481)	(0.00944)	(0.0111)	(0.0199)	(0.0256)
Liquidity	0.0162***	0.00220	-0.000550	0.308	0.0527*	0.0578	-0.194***	-0.286***
	(0.00558)	(0.00392)	(0.170)	(0.548)	(0.0292)	(0.0537)	(0.0638)	(0.0775)
Funding Structure	0.0483**	0.0216	0.325	3.556*	0.159*	0.194	-0.975***	-1.383***
	(0.0195)	(0.0194)	(0.533)	(2.125)	(0.0806)	(0.124)	(0.181)	(0.238)
Efficiency ratio	0.00874	-0.00226	0.0463	-0.376	0.0336**	0.0868***	-0.216***	-0.322***
	(0.0127)	(0.00755)	(0.123)	(0.605)	(0.0149)	(0.0270)	(0.0508)	(0.0484)
Observations	785	1639	749	1644	726	1593	785	1663
R-Squared	0.216	0.268	0.493	0.334	0.661	0.733	0.717	0.783
Country Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

In this table we test for crisis and post crisis period. The crisis dummy takes on a value of 1 for the years 2008q1-2012q4 and 0 otherwise including both the subprime crisis period as well as the sovereign debt crisis. Te post-crisis dummy variable take on a valye of 1 for the years 2013q1-2018q4 and 0 otherwise. Estimations are based on OLS regression model. Robust standard errors are clustered at bank level. *,** and *** indicate statistical significance at 10%, 5% and 1% respectively.

Table 8: IV-Regression with 2SLS Estimator

Variables	*Idiosyncratic risk*		*Systematic risk*		*Total Equity Risk*		*Bank stability*	
	Baseline model	*Squared capital*	*Baseline model*	*Squared capital*	*Baseline model*	*Squared capital*	*Baseline model*	*Squared capital*
Total Capital ratio *(Inst)*	-0.0781	0.456**	2.637	38.83***	-0.00383	6.372***	1.402**	-3.873
	(0.0505)	(0.225)	(1.791)	(10.24)	(0.315)	(1.361)	(0.638)	(2.364)
Leverage ratio *(Inst)*	-0.197***	-0.536***	-6.483***	-21.44*	-0.995*	-1.737	4.010***	14.64***
	(0.0726)	(0.193)	(2.422)	(13.03)	(0.584)	(1.550)	(1.023)	(2.601)
Squared Total Capital ratio *(Inst)*		-1.485***		-100.9***		-17.99***		13.94**
		(0.565)		(28.46)		(3.713)		(6.301)
Squared Leverage ratio *(Inst)*		1.587		67.60		2.370		-51.89***
		(0.982)		(58.77)		(7.103)		(12.92)
Texas ratio spreads *(Inst)*	0.134***	0.126	3.489	2.979	-0.359	-0.443	-2.159***	-2.105***
	(0.0046)	(0.123)	(2.882)	(2.732)	(1.036)	(0.948)	(0.0128)	(0.0167)
Loan Loss Provisions ratio *(Inst)*	7.347***	7.429***	88.14**	97.51**	26.73***	28.02***	-86.85***	-86.02***
	(1.504)	(1.565)	(44.96)	(43.64)	(5.361)	(4.989)	(12.71)	(12.33)
Coverage ratio *(Inst)*	0.00176	0.00124	0.0723	0.0450	0.00282	-0.000696	-0.000732	0.00969
	(0.00144)	(0.00137)	(0.0629)	(0.0585)	(0.0136)	(0.0137)	(0.0254)	(0.0245)
Size *(Inst)*	-0.00158*	-0.00264**	0.0126	-0.0523	-0.00681	-0.0155	-0.0138	0.00447
	(0.000202)	(0.00106)	(0.0395)	(0.0478)	(0.00909)	(0.00968)	(0.0208)	(0.0203)
Liquidity	0.00536	0.00635*	0.131	0.211	0.0692	0.0863**	-0.216***	-0.210***
	(0.00367)	(0.00328)	(0.411)	(0.365)	(0.0490)	(0.0437)	(0.0717)	(0.0615)
Funding Structure	0.0301**	0.0270**	1.535*	1.434*	0.241**	0.241**	-1.184***	-1.071***
	(0.0127)	(0.0125)	(0.924)	(0.813)	(0.0947)	(0.0946)	(0.177)	(0.160)
Efficiency ratio	0.00543	0.00406	-0.111	-0.172	0.0952***	0.0892***	-0.310***	-0.276***
	(0.00601)	(0.00606)	(0.297)	(0.344)	(0.0239)	(0.0219)	(0.0433)	(0.0429)
GDP growth	-0.0324**	-0.0343***	0.443**	0.332*	0.125***	0.103**	-0.00704	0.00888
	(0.0126)	(0.0127)	(0.216)	(0.202)	(0.0433)	(0.0405)	(0.0908)	(0.0872)
Euribor	-0.00329	-0.00262	0.0144	0.0629	-0.0219**	-0.0137	0.0275	0.0172
	(0.00210)	(0.00220)	(0.0492)	(0.0451)	(0.00855)	(0.00865)	(0.0181)	(0.0192)
HH-Index	-0.0265	-0.0210	-2.336	-2.035	0.0964	0.205*	0.368	0.372
	(0.0277)	(0.0267)	(1.625)	(1.491)	(0.134)	(0.123)	(0.393)	(0.358)
Observations	2717	2717	2676	2676	2577	2577	2740	2740
R-Squared	0.222	0.238	0.247	0.275	0.579	0.624	0.715	0.743
Hansen' J Statistic	14.68 [0.229]	15.32 [0.228]	17.34 [0.121]	18.32 [0.108]	19.389 [0.101]	20.312 [0.098]	14.976 [0.203]	18.543 [0.198]
Country Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

This table shows the estimation of equation (6) using an instrumental variable regression model with 2SLS estimator. We instrument capital, provisioning and size variables using as instruments their own lagged values. Robust standard errors are clustered at bank level and reported in parentheses. *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.