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Market-Book Ratios of European Banks: What Does Explain the Structural Fall?

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MARKET-BOOK RATIOS OF EUROPEAN BANKS: WHAT DOES EXPLAIN THE STRUCTURAL FALL?

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Abstract

In the years since the outbreak of the crisis, financial markets have persistently reduced the market value of European banks, as consequence of macroeconomic, regulatory and structural factors. Even if these factors affected the whole European banking industry, differences characterized market evaluation of banks along country, size and business mix profiles.

Following the extant literature on bank market valuation, our paper tests for the difference between market to book ratios of the large European banks, using three blocks of indicators typically affecting the banks' market value.

To verify our research question, we first regress the market to book ratio over performance measures and risk indicators. Then, we verify whether bank business size and composition affect bank market valuation. Lastly we evaluate the relevance of country context variables, by considering both macroeconomic and banking structure indicators.

Our panel consists of all large publicly traded bank holding companies at European level. Large publicly traded banks are all listed banks with consolidated assets exceeding 50 billion euro in 2015.

The results highlight that the market considers the fundamental variables (current performance and volatility) as the main factors affecting the evaluation process. Furthermore a significant share of variability in banks' market-book values is explained by country context variables.

Keywords: market-to book value; country context; business mix; size; panel data; Shapley decomposition

EFM classification 510

JEL classification G20; G21

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1. Introduction

In the years since the outbreak of the crisis, financial markets have persistently reduced the market value of European banks, as result of macroeconomic, regulatory and structural factors.

According to recent banking literature the persistence of low growth following a financial crisis, along with a monetary policy stance addressed to maintain a low level on interest rate in the long run, are considered as the main factors impairing the prospects of bank intermediation[1].

The fall of market-to-book ratio (M/B) is interpreted as result of the decline of rents or quasi rents originated by the factors that make the banks special: the private information about borrowers, the intertemporal nature of bank relationship, the monetary characteristic of bank liabilities[2]. These are the main determinants of the charter value of traditional intermediation that lose importance in an unfavourable economic context leading both to less, higher-risk lending and to a squeeze of interest margins on deposits.

The erosion of bank charter value is partly related to the regulatory changes made in the wake of financial crisis. Sarin and Summers (2016) attribute the fall of the bank market value to the action of supervisory authorities that restricted some profitable albeit risky activities (as for example proprietary trading), required banks to hold more liquid assets and stable funding, increased the capital constraints on bank activity growth and, not less important, introduced uncertainty on likely future regulatory measures: a range of requirements that enhanced the competition from shadow banks.

The effect of the regulatory action on bank market value may have been more severe for larger banks, changing the relation between charter value and the implicit too-big-to-fail insurance. The widely-held view that big banks have a competitive hedge deriving from the safety net subsidy has been challenged by the overhaul of regulatory guidelines concerning the large and complex banks. The higher capital requirements along with greater regulatory scrutiny caused them higher risk management and compliance costs with the result of reducing their prospective rentability.

A further factor affecting the market value concerns the rigid bank cost structure facing the evolution of technological innovation. The banks have to deal with legacy issues such as branch networks in a market context in which an increasing share of financial products and services are delivered through online channels. The menace posed by new entrants that do not necessarily need a local presence to distribute their products is increasing the potential competition in retail financial markets and reducing the traditional franchise value of banks[3].

While it is widely believed that the above-mentioned macroeconomic, regulatory and banking structural factors impaired bank market value, whether and to what extent these factors affected

[1] A large recent literature supports the view that the persistence of a prolonged low interest rate environment lowers the banks' earnings prospects especially hurting the smaller deposit-funded and less diversified banks. See Borio et al. (2015), IMF (2017), Claessens et al. (2017).

2 In a recent study on the determinants of value creation within U.S. commercial banks, Egan et al. (2017) add evidence to the extant literature that the screening and monitoring of information-intensive loans is an important source of bank value while the ability to raise sticky short-term funding is a key source of bank synergies.

[3] With the words of Philippon (2017): "Fintech…innovations can disrupt existing industry structures and blur industry boundaries, facilitate strategic disintermediation, revolutionize how existing firms create and deliver products and services, provide new gateways for entrepreneurship, democratize access to financial services, but also create significant privacy, regulatory and law enforcement".

the national banking systems and bank business models in a different way is an open research question.

As for the European banking industry, many differences could persist in bank market evaluation along country and business model profiles.

The sovereign debt crisis that hit the euro area has changed the way in which markets evaluate national banks' prospects. Therefore, we expect that the banks' value reflects some indicators like GDP growth and interest rates but also a country risk on/off investment behaviour that emphasizes the impact of fundamental variables.

Country differences persist in the taxation and consumer protection rules as well as in the insolvency laws. Even the regulation and its effect on bank market value still reflect country situations. Changes in regulatory policies in the form of higher capital requirements, increases in bank liquidity and the limits posed to leverage regarded all the European banks but there is not yet a single jurisdiction for the purpose of calculating G-SIB (global systemically important bank) buffers as well as there is still national discretion in implementing the single rulebook (ECB 2017). Moreover, the banking union needs to be completed with a European deposit insurance scheme. The country effect reflects also the pre-emptive action of supervisory authority, which has been more pervasive in financial systems more exposed to credit and market risk.

A further country specificity concerns the banking system structure that shows a wide variation of efficiency across the European countries. For some European banks and systems there is considerable room to improve operational efficiency, especially through branch rationalization (IMF 2016) so that the different degree of overcapacity, along with the difficulties to reform the systems by removing the structural shortcomings, could affect the way in which the market evaluates the prospects of banks belonging to different countries.

The banking system structure is also characterized by the fragmentation of banking market and by its effects on competitive arena. In some countries, the large banks suffer the competition by a wide number of small savings and cooperative banks, which reduces the chance of improving the profitability by moving decisively into the retail market. Moreover, euro area countries differ substantially when it comes to the relative weight of foreign bank branches or subsidiaries (ECB 2016).

Country differences in terms of bank market evaluation may be due to the interventions of governments to stabilize and restructure the domestic financial system. The global financial crisis and the subsequent recession differently affected domestic banking systems along with the response of the authorities in a different way and measure. As outlined in Millaruelo and del Rio (2017) the mixed experiences of bail-out respond both to the differing intensity and duration of the economic crisis and to the vulnerability of their economies to the sovereign debt crisis.

Whereas regulation drives to implement homogeneous bank requirements, in industry dichotomous strategies emerged. To respond to the crisis some banks have restricted their size and scope of activities, others have grown and enhanced diversification. How the market does

evaluate the changing bank business models (and their effect on business mix) is a question that has important implications for bank managers and for the funding of their strategies[4].

The paper focuses on the large European banks with the objective of evaluating to what extent the financial markets set bank share prices in relation to banks' business fundamentals, business size and mix indicators along with country variables.

The novelty of our contribution consists of an empirical methodology for separating three different groups of determinants of banks' value. The first one concerns the business fundamentals that, according to traditional financial models, are the pillars of market evaluation: return and risk characteristics. Starting from the traditional Dividend Discount Model and accepting some simplifying assumptions, we expect that the bank market value positively reflects both the current return on equity, while negatively reacts to higher levels of market riskiness as result of an increasing cost of capital.

The second set of variables considered as determinants of market value concern the size and composition of bank activity. The research question can be expressed as follows: when setting banks' value does the market evaluate the way in which the return and risk originate? In other terms, do the business size and mix variables address information to the market about the prospects of bank profitability?

Lastly our study focuses on the importance that the country specificities take on when the market looks at both the macroeconomic context and the structural features of banking systems. The relevance of country variables in explaining the banks' value is estimated considering some macroeconomic national context indicators (national GDP growth and CDS spread) and two principal banking system structural indicators (concentration ratio and branch productivity), controlling also for the intensity by which the State made bail out interventions.

In order to evaluate how effective the above groups of determinants are in explaining the heterogeneity of banks' market/book ratios and how this explanatory power changed in the last decade we provide a Shapley decomposition of the explained variance measure (i.e. the total R2) (Shapley, 1953). As far as we know our paper represents the first attempt to use the Shapley decomposition to investigate the heterogeneity of banks' value.

Finally, we conclude our study with a forecasting exercise to test the capability of our model specification to correctly predict the dynamic of market-to-book ratio.

The paper proceeds as follows. In Section 2 we remind how the financial literature deals with the determinants of bank's value. In section 3 we focus on the fundamental variables which explain the M/B ratio and related bank's charter value. Section 4 illustrates the banks' sample, the data variables and some descriptive statistics concerning the European large banks' M/B ratio. Section 5 describes the results of both the econometric and Shapley decomposition analysis. Then we present the results of the forecasting exercise. Section 6 reports the robustness checks. Section 7 concludes and discusses possible policy implications.

[4] On the relation between bank performance and business models see the recent literature review in Cosma et al. (2017).

2. The literature review

As result of the dramatic and persistent fall of the banks' market value in the main financial systems, several recent studies have examined the evolution and the causes of this decline, calling into question the ability of the banks to recover the values reached before the crisis.

One of the main puzzling questions concerns the effects of the regulatory changes intervened in the wake of financial crisis. While the regulatory requirements have increased the capital and liquidity of banks making them safer when evaluated on the accounting evidence, it is not clear the effect of these rules on both the return for shareholders and economic capital. In fact the negative impact of regulatory requirements on the expected bank profitability may have more than offset the positive effect arising from the reduction in the financial riskiness related to leverage.

Sarin and Summer (2016) find that the measures of volatility and contribution to systemic risk for the sample of US and non US banks analysed appear to be higher in the post-crisis period compared to the pre-crisis one. Their explanation points to the decline of bank franchise as result of a persistent low interest rate context and a regulatory regime that in recent years has progressively restricted some profitable activities. Chousakos and Gordon (2017) explain the decline post-crisis of Q-ratio for a sample of US and European banks as due to regulation that would have made all banks essentially the same and inefficient.

The drastic fall of market value of bank equity compared to book capital has raised doubts about the reliability of banks' accounting information. Huizinga and Laeven (2012) show that since the onset of financial crisis the US bank holding companies banks have preserved book capital by understating the impairment of their real estate related assets and loan loss provisioning/charge-offs. Calomiris and Nissim (2014) assess the impact of the unrecognition of loan losses on the low level of US banks' M/B ratio. The relevance of this factor is related to the size of non performing loans in the banks' balance sheets and to the provisiong policies that banks adopt to recognise incurred and expected losses.

In addition to the common factors driving the market evaluation the bank literature examines how the different characteristics of banks impact on their value.

Several studies raise the question of whether the market price of banks increases with size. The popular view that large banks have a competitive hedge originates from the idea that the too big to fail (TBTF) status allows them to benefit from the implicit funding subsidy. The large banks' market value may benefit from market power or reflect scale and scope economies as well as the advatages of an increased diversification of revenues. Further advantages may be related to the easier access to market capital. Many studies support this conclusion. With reference to the bonds issued in the U.S. market by a large sample of banks, nonbanks, and nonfinancial corporations between 1985 and 2009, Santos (2014) finds evidence that the largest banks benefit from a bigger discount. Kolaric et al. (2017) study the effect of rating change announcements on the CDS spreads of a sample of 154 international financial institutions for the period 2004-15 and conclude that rating downgrades have a limited effect on the perceived creditworthiness of TBTF banks, rendering downgrades an ineffective channel through which market discipline can be exercised on large banks. Some authors contrast this view and point to the possibility that subsidies through the financial safety net to systemically large banks may be reduced by weak public finances. Demirguc-

Kunt and Huizinga (2013) find that the market to book ratio of an international sample of banks for the period 1991-2008 is positively related to the absolute size of its assets, but it becomes negative when related both to bank's total liabilities-to-GDP ratio and to government debt and deficits. Minton et al. (2017) find no evidence that valuation of large US banks increases with their size.

How the market evaluates the ability of banks to generate higher future profits is the research question of a large literature on diversification and business models. The effect of diversification on banks' market value depends on the trade-off between synergies and economies of scope from combining various activities and the costs arising from the complexity of the conglomerate organization. For Baele et al. (2007) stock market investors anticipate that the financial conglomerates have been able to generate higher current and future profits. In their study the sample of 255 European banks during the period 1989-2004 have benefited of the revenue-based diversification showing a significant positive relationship between the revenue diversity and the market value performance measures. With reference to a larger sample of banks from 43 countries over the period 1998–2002, Laeven and Levine (2007) reach different results finding that the Tobin's Q of financial conglomerates is lower than that shown by financial intermediaries that specialize in the individual activities. Calomiris and Nissim (2014) estimate the impact of US bank diversification by considering the contribution of the noninterest income variable to bank value. They conclude that since the financial crisis the intangible value associated to diversification has declined substantially.

In banking literature the relevance of country variables in explaining the banks' value is analyzed by considering the nexus between sovereign risk and the cost of capital. According to CGFS (2011) the underperformance of banks' share prices has been greatest for banks headquartered in the euro area countries affected by sovereign debt concerns. As outlined in Millaruelo and del Rio (2017) country differences also affected domestic banking systems and the banks' value through the response of the authorities to banks' crises. A further country effect on banks' values is related to banking system structure that shows both a wide variation of efficiency across the European countries and a fragmentation of banking markets and to its effects on competitive arena (IMF 2016; ECB 2016)

3. The bank's value

The market-to-book ratio (M/B) is a popular measure of banks' value (Chousakos and Gorton (2017); Egan et al. (2017); Minton et al. (2017); Sarin and Summers (2016); Calomiris and Nissim (2014)). It relates the market price (M) to the book value (B) of bank's equity and represents a measure of value creation, i.e. the capability to earn a rate of return higher than the cost of capital.

Starting from the traditional Dividend Discount Model and accepting the simplifying assumptions of perpetual flows, constant return on equity (ROE) and dividend growth (g), the M/B ratio can be traced to the business fundamentals: return, risk and growth. In formal terms

$$(M/B)_i = \frac{E(ROE_i) - E(g_i)}{E(k_i) - E(g_i)} \quad (1)$$

where

$E(ROE_i)$ = expected long-term return on equity of bank *i*;

$E(g_i)$ = expected dividend long-term growth rate of bank *i*;

$E(k_i)$ = expected bank *i*'s cost of equity (function of the risk borne by bank *i*'s shareholders).

As such, M/B proves to be a measure of value creation, i.e. the capability to earn a rate of return higher than the cost of capital: values greater (lower) than 1 reveal beliefs of ROE > k (ROE < k). By definition,

$M_i = B_i + MVA_i$

where MVA = market value added. Therefore

$$(M/B)_i = 1 + \frac{MVA_i}{B_i} \quad (2)$$

If g=0, equation (2) can be written as

$$(M/B)_i = 1 + \frac{E(ROE_i) - E(k_i)}{E(k_i)} \quad (3)$$

The second term of (2) and (3) is the "franchise value" defined «*as the present value of the future profits that a firm is expected to earn as a going concern. Profits are those gains beyond what is required to cover all costs, including the cost of capital*» (Demsetz et al. 1996, p. 2). The franchise value is also the difference between a firm's market value and the expense of rebuilding the firm today (replacement cost):

Franchise value (FV) = market value – replacement cost.

The replacement cost concept is central for the well-known "Tobin's *q*":

Q = (firm's market value) / (firm's replacement cost),

often adopted to represent the bank's value along with, or in alternative to, the M/B ratio (Minton et al. (2017); Brewer and Saidenberg (1996); Demsetz et al. (1996)). Unfortunately, the replacement cost is not observable and need to be replaced by a proxy. For example, Demsetz et al. (1996) approximate the replacement cost of a bank's assets using the book value of its assets minus goodwill; this substitution gives the following proxy for Tobin's *q*:

Q = (M+L) / (A-goodwill),

where M is the market value of equity, while L and A are the book value of liabilities and of assets, respectively.

In banking, the FV, sometimes called "charter value" (i.e. Chousakos and Gorton 2017), stems from various sources of rents or quasi-rents that Demsetz et al. (1996) group in market-related and bank-related. Market-related sources concern limits to competition created by regulation or innovation; i.e.: the evolution of banks' regulation and the increasing pace of product and ICT

innovations have raised the competition banks face from other banks and from nonbank financial institutions and new types of competitors, with negative effects on the FV. Bank-related sources are usually connected to competitive advantages granted by the branch network and what makes each bank "special", i.e. the production of private information about borrowers through long-term relationships that reduce the cost of loan origination with respect to other lenders. According to Chousakos and Gorton (2017, p. 3) «*In oligopolistic industries like banking, the Q's may normally be above one, and can stay that way if there are barriers to entry*».

4. Data, variables and descriptive statistics

4.1. Data and variables

The bank sample is made up of 47 banking groups belonging to thirteen European countries. The composition of the sample by country is provided in the Appendix (Table A.1). We have considered consolidated data of listed European banking groups with a total asset value greater than 50 billion euro at 2015. We collect financial information from SNL Financial database and market information from Thomson Reuters Datastream. We exclude banks with missing data on basic accounting variables, including assets, loans, deposits, equity, interest income, non-interest income and commissions. We use the last ten years of data, 2006–2015. The starting date is 2006 since we limit our analysis to a period in which banks report accounting data based on IAS/IFRS.

The final dataset includes 411 bank-year observations corresponding to 47 bank holding companies (BHCs) belonging to 13 countries. We select 34 banks from 9 countries in the Euro area, accounting for more than 70% of the EMU's total banking assets, plus 13 Non-EMU banking groups. Italy (8) and Spain (7) account for the majority of banks in the sample, given the fragmentation of their banking systems.

Differently from other studies (DeYoung and Roland 2001; Chiorazzo et al. 2008) in our analysis we use consolidated accounting data. This latter choice is of particular importance for several reasons: on the one hand banks tend to reserve the making of non traditional innovative activities to non-banking subsidiaries whose contribution can be more precisely evaluated if consolidated financial statements are available; on the other hand, diversification benefits may exist for the institution as a whole and not for the single subsidiary. Moreover, financial holding company represents the relevant unit of observation for regulators on extremly important topic such as the level of systemic risk (Stiroh and Rumble 2006).

We measure bank market value using the market-to-book ratio - M/B (market value of equity divided by the book value of equity). In our baseline specification, as the principal measure of profitability, we use an accounting-based measure of profitability - ROAE (Return on average equity), computed as net income divided by average equity over the prior year, while as a proxy for risk we employ the equity volatility – VOL, i.e. the annualized standard deviation of daily stock returns. In the robustness section we use several alternative measures of profitability and risk.

To these fundamental indicators, we add some variables that reflect bank specific characteristics in terms of size and business mix. To capture the degree of diversification of bank activities, or in other terms the results of choices concerning bank business mix, in line with the literature (Stiroh

2004a,b; Lepetit et al., 2008) we consider the ratio between net interest margin mainly generated by traditional activities over total operating income (INT). To proxy bank's credit quality we use the ratio of NPL over Gross loans (NPL). To catch the engagement in market-related activities we consider the variable trading assets as a fraction of total assets (TRAD). We use the natural logarithm of book total assets as our measure of bank size (TA).

Then, we control for specific country situations: the GDP growth, whose evolution also affects the expected return on bank activity; the sovereign CDS spread as proxy of sovereign risk; national banking system structural indicators expressed by the concentration index C5 and by a productivity measure - BRANCH - computed as the ratio between country total banking asset over country total number of bank branches. Finally, we control for the intensity by which the State made bail out interventions, measured as financial instruments subscribed by government in financial institutions as a fraction of GDP - GOVT.

4.2. The descriptive statistics

Table 1 shows descriptive statistics by year for our final sample of banks. All variables are winsorized at the 1% and 99% level. The statistics reported are obtained by averaging the variables each year. We show the results for median values. The number of banks in our sample varies by year and increases from 29 at the start of the sample period to 46 as of 2015. The median size of the banks increases from euro 158.53 billion as of 2006 to euro 253.17 billion as of 2015.

[Table 1 around here]

A detailed description of all variables used in the study is available in the Appendix (Table A.2).

In the following tables (Tabb. 2- 4) we report the mean, median, standard deviation and coefficient of variation indicators of M/B values over time, group of countries and banks' characteristics. The data confirm that since the crisis the decline in market evaluation has been drastic and that at the end of the period the median M/B ratio is still less than half the value of 2006.

If evaluated on the basis of average M/B values the sovereign debt crisis has been much more severe and prolonged: in the 2011-12 period the ratio averaged around 0.6 a quarter of the values registered in 2006.

The M/B variability across banks over the period shows a reduction at the start of the crisis (2008) and then it stabilises on the lower values. Since the reduction of the variability can be linked also to a reduction in mean values, we compute the coefficient of variation (CV). Also the CV shows that despite the improvement in banks' values the disparity between them remains wide suggesting the persistence of profitability challenges and differences in the progress made by institutions in loosening structural constraints. Moreover, if we consider that the European regulatory action has progressively developed during the period, we don't have evidence that the more severe and uniform capital and liquidity requirements have made bank performance prospects more homogeneous across banks.

[Table 2 around here]

In Table 3 we group banks by country and by group of countries and report country average, median, standard deviation and coeffient of variation. In general, during the ten years under analysis, we observe that there are wide differences in market values both inside the euro area and between banks belonging respectively to euro and non euro countries. German, Italian and French banks evidence the least M/B ratio values, a signal that the differences inside euro area do not run between core and mediterranean Europe. The M/B coefficient of variation across banks belonging to different areas shows that the variation in time within the country is much higher for EMU countries, and in particular for those of the non core EMU area. In fact, CV is higher for banks belonging to EMU non core area, while the least CV is for the banks belonging to NON-EMU with a CV which is the half of the CV of the banks belonging to EMU area non core.

[Table 3 around here]

The breakdown of M/B ratio by banks' total assets does not show evidence supporting the idea that the largest banks take advantage of safety net subsidy (Table 4). The banks more focused on the traditional intermediation, as evidenced by the the fourth quartile value of the ratio between net interest income and operating income, suffer a lower market valuation. This undervaluation is also related to credit riskiness, so that the banks with higher incidence of non performing loans pay a lower market value.

[Table 4 around here]

5. Empirical analysis

5.1. Econometric analysis

The econometric models employed to examine the link between market performance and banks' characteristics is expressed as follows:

$$y_{i,t} = \alpha_{i,t} + \beta_1 ROAE_{i,t} + \beta_2 VOL_{i,t} + \beta_3 ROAE_{i,t} \times VOL_{i,t} + \beta_4 SIZE_{i,t} + \sum_{i=1}^{3} \beta_i BM_{i,t} + \sum_{j=1}^{2} \beta_j MACRO_t + \sum_{r=1}^{2} \beta_r BK_t + \beta_{12} GOVT_t + \varepsilon_{i,t} \quad (4)$$

where *i* identifies the individual bank-observation belonging to the sample (*i = 1, 2, 3,...,47*); *t* expresses the time variable (*t = 2006,…, 2015*); βs are the parameters to be estimated. Both the constant and the error terms are also indicated in the model.

The approach is based on the panel relationship with year and bank fixed effects[5], between our dependent variable, the market-to-book ratio (M/B) and proxies for bank fundamentals: a performance measure (ROAE), a risk measure (VOL) and the interaction term among the former (ROAE x VOL).

To these covariates we add some variables that can convey information to the market in setting the banks' value:

- bank size (SIZE) to test the too-big-to-fail hypothesis;

- banks' business mix (BM) proxied by three different measures: the ratio of net interest margin over operating income - INT; the ratio of NPL over Gross loans - NPL; the ratio of trading assets over total assets - TRAD. In fact, in their assessment investors could rely not only on the level of business fundamentals but also on how risk and return are originated. In other terms, the pricing of banks' shares might also reflect the business model viability. Business mix informations could provide a long-term perspective that complements the short-term profile of our risk and return variables, bridging the gap between current and expected business fundamentals. For instance, the equity market can view a heavy exposure to the interest margin as a weakness for future profitability and consequently underprice traditional retail banks;

- macroeconomic country situations (MACRO) that are supposed to have direct consequences on banks' business fundamentals: the GDP growth, whose evolution also affects the long-term expected growth of banks' return; the CDS spread as proxy of sovereign risk which can have an implications on the cash flows discount rate;

- national banking system structural characteristics (BK): the concentration index C5 and a productivity measure - BRANCH - computed as the ratio between country total banking asset over country total number of bank branches;

-an indicator - GOVT – which measures the value of financial instruments subscribed by government in financial institutions as a fraction of GDP.

In all regressions, we cluster standard errors by bank. Including year fixed effects and clustering standard errors by firm is a common approach used to address two sources of correlation when panel data have more firms than years (Petersen 2009). Results are reported in Table 5.

[Table 5 around here]

The results of the model are in line with our expectations: profitabilty positively influences the bank's market value, while risk has a negative impact.

Among banks' characteristics, size shows a negative and statistical significant sign; hence, in line with Demirguc-Kunt and Huizinga (2013) and Minton et al. (2017), we find no evidence that larger

[5] We tested for our final regression specifications whether FE or RE was to be preferred, using the Hausman specification test. The test suggests that a fixed effect model is most appropriate. To see if time fixed effects are needed when running a FE model, we use the Stata command testparm; it is a joint test to see if the dummies for all years are equal to 0, if they are then no time fixed effects are needed. The Prob > F = 0.0000, so we reject the null that the coefficients for all years are jointly equal to zero, therefore time fixed-effects are needed in this case.

banks are valued more highly or that their valuations increase with size as result of implicit subsidies from the regulatory safety net. In other terms, we don't find evidence of a too big to fail effect; instead the restrictive stance of regulation applied to large banks could explain the discount set by the market on the bank book value.

Differently from Baele et al. (2007) and Calomiris and Nissim (2014), no statistical significant effect is evident with respect to business mix elements. This situation points out that market does not seem to assess how fundamentals are originated or in other words the business mix variables do not address information to the market about the prospects of bank profitability and therefore do not add information to the performance fundamental variables.

The positive value of GDP growth coefficient signals the importance of an economic context that fosters the banks' intermediation and their rentability. In line with CGFS (2011), the negative and statistical sign of the variable CDS signals that the sovereign CDS spread negatively affects the bank's value as result of the higher cost of capital required by the market in banking system where credit and sovereign risk are strictly related.

Among the variables that capture the national banking system structural characteristics only the productivity measure - BRANCH – is statistically significant. Its positive sign signals that an increase in the branch productivity fosters the market valuation.

The insignificancy of the variable GOVT signals that the government intervention cannot be interpreted either as a positive or negative signal on bank's future perspectives.

Particularly interesting is the time dimension of the analysis. The time dummies variables highlight that respect the year 2006, in the model without the variables controlling for country specificities both in terms of macroeconomic context and structural features of banking systems (columns 1-3), the impairment has been particularly severe in the two periods of financial and sovereign debt crisis, with the sovereign debt crisis hitting more than financial one. When controlling for country specificities (columns 4-6) the impairment appears severe during the whole period following the outbreak of the crisis; that means that the reduction in market valuation is linked to variables not directly included in our specification, as for instance the regulatory regime that has progressively restricted some profitable activities imposing higher capital and liquidity requirements. Also other studies (Chousakos and Gordon, 2017) connected the decline in post-crisis of market valuation to regulatory interventions.

5.2. Shapley Decomposition

The previous section reports estimates of the model described in the equation (4) emphasizing that most of the groups of regressor variables have a significant effect on the market-to-book ratio. Nonetheless, the previous analysis does not allow for establishing the relative importance of variables in explaining the heterogeneity of banks' value among European banks. For this purpose we use the Shapley decomposition method (Shapley, 1953; Chevan and Sutherland, 1991; Stufken, 1992) that is aimed at distributing the goodness-of-fit measure of our econometric model among the regressor variables. In this analysis, we adopt as goodness-of-fit measure the total R^2-value.

According to Shapley (1953), the Shapley Value represents for a player in a cooperative game the fair expected payoff or *marginal* contribution. Equivalently, for each variable *v (v = 1, 2, ..., k)*, the expected contribution C_v is defined as:

$$C_v = \sum_{|S| \leq k, v \in S} \frac{|S|!\,(k-|S|-1)!}{k!} \left[R^2(S \cup \{v\}) - R^2(S)\right] \qquad (5)$$

where *S* is a sub-model of the full one presented in the equation (4) (i.e. the regression model containing all indipendent variables), $|S|$ is the number of variables in the sub-model *S* and *k* is the number of regressor variables *v* of the full model. The efficiency axiom implies that $\sum_{v=1}^{k} C_v = R^2$, so C_v is interpreted as the marginal contribution (weighted by the number of possible permutations) of variable *v* to total R^2-value (Coleman, 2017).

Since some determinants of the market-to-book ratio belong to a group of variables, we use also a generalization of the Shapley value, the Owen value (Owen, 1977), which allows for decomposition in case of exogenously grouped regressors as suggested by Shorrocks (2013). The Owen value takes the implied restrictions on the set of possible sub-models into account (Huettner and Sunder, 2012). Specifically, the goodness-of-fit measure is distributed to each group of variables as a whole and then its members negotiate the group's contribution between themselves. If all regressor variables *k* belong to one group or if there are *k* one-variable groups, Shapley and Owen value decomposition coincide. Young (1985) and Khmelnitskaya and Yanovskaya (2007) showed that both the Shapley and Owen values are the solutions that satisfy three desirable properties: efficiency, monotonicity, and the equal treatment of players/variables property. In addition, the Owen value satisfies the equal treatment of groups' property.

To calculate the Shapley value decomposition of the R^2, we use the Stata module 'rego' (http://research.uni-leipzig.de/rego/) developed by Huettner and Sunder (2012). This Stata comand does not allow for panel regression models, but for OLS ones only. For this reason, we estimate here an OLS model with time fixed effects. In all regressions, we cluster standard errors by bank.

We decompose the R^2-value of the six models showed in Table 5 to assess the relative importance of the independent determinants in them. We add here a seventh model which includes also 'macro-area' fixed effects.[6] The latter help us to underline any difference among banks belonging to euro and non euro countries respectively, and within the euro area between the EMU core and the EMU non-core ones (see Table 3). Since we are interested in the influence of a whole determinants' cluster, we define the following 8 groups of variables:

1. BF – Bank fundamentals (ROAE, VOL, ROAE x VOL);
2. SIZE – Bank size;
3. BM – Bank business mix (INT, NPL, TRAD);
4. MACRO – Macroeconomic country situation (GDP_GROWTH, CDS);
5. BK – National banking system structural characteristics (C5, BRANCH);
6. GOVT – Governement intervention in financial institutions;
7. AREA – Macro-area fixed effects (i.e. EMU core, EMU non-core, and non-EMU);

[6] Including macro-area fixed effects was not possible in the previous analysis because of fixed-effect panel regression models drop all time-invariant variables, such as country or macro-area dummies.

8. YEAR – Time fixed effects.

Results of the Owen value decomposition are reported in Table 6, while Shapley values of the independent variables are provided in the Appendix (Table A.3). According to the values in Table 6, nearly the half of the overall R^2 of the first model (0.596) can be attributed to the BF group, whereas the other share must be jointly assigned to the time fixed effects which capture all shocks happened during the reference period (e.g. economic recession, sovereign debt crisis, regulation). Successive models (2-7) in Table 6 show a decreasing share of the R^2 attributed to BF and YEAR groups, but they always remain the most important ones in explaining the variance of the market-to-book ratio. Beyond these two groups of determinants, macroeconomic country situation turns out to be very relevant, accounting on average for the 21% of the overall explained variance. Bank business mix variables, national banking system structural characteristics, and macro-area dummies explain 5-6% of the variance of the market-to-book ratio, while the goodness-to-fit measure is barely distributed to the bank size and the governement intervention in financial institutions.

[Table 6 around here]

In order to credit greater reliability to the value decomposition, Figure 1 illustrates the same Owen values reported in Table 6 for the model (7) with 90% bootstrap confidence intervals, based on 200 bootstrap replications. Figure 1 overall confirms that BF, MACRO, and YEAR groups are the most important ones, while none of the other five groups never reach 10% of the variance of the dependent variable.

[Figure 1 around here]

Given the several shocks which have characterized the reference period, we are interested to replicate now the Shapley/Owen value decomposition through a between-period analysis. Indeed, it is likely that some shocks may have even affected the Owen values of some groups of determinants over time. We outline four specific time periods: I) 2006-2007, before the economic crisis; II) 2008-2010 period including the financial crisis; III) 2011-2012, the sovereign debt crisis; IV) 2013-2015, the gradual return to normal times. Table 7 reports between-period Owen values for the seven groups of determinants (for the sake of simplicity, time fixed effects are not included in this analysis).

Table 7 shows that MACRO and BK groups of variables (particularly thanks to GDP_GROWTH and BRANCH variables) were the most important ones in explaining the variance of the market-to-book ratio before the economic crisis, while only 19% of the overall R^2 were attributed to bank fundamentals. The latter receive the greatest share of the goodness-to-fit measure when the economic crisis started, due to a huge increase in the role of equity volatility and its interaction effect with the ROAE, and remain the most important group also in the 2011-2012 and 2013-2015 periods. During the econofinancial crisis period the SIZE, MACRO, and BK group shares of the overall explained variance drastically decline, whereas BM and AREA groups become more important. However, AREA dummies jointly keep their share of R^2 over time while the group share of bank business mix variables comes back to 8% in 2013-2015. Finally, Owen values of MACRO and BK groups return to rise over 20% in 2011-2012 and 2013-2015 periods respectively, but their trends are clearly instable.

[Table 7 around here]

5.3. Forecasting exercise

In this section we test the capability of our model specification, expressed in the equation (4), to correctly forecast the dynamics of dependent variable, i.e. the market-to-book ratio. To do that, we use the Gauss-Seidel forecasting technique which is a simple iterative technique commonly used in macroeconomic models and in most cases works remarkably well.

The adopted forecast model is the same presented in the equation (4), but *t* varies from 2006 to 2014, so that we can test the forecasting capability of our model comparing M/B value to the fitted one in 2015 (i.e. the last year of our panel sample). Our sample consists of a panel dataset, so the error term $\varepsilon_{i,t}$ can be decomposed as:

$$\varepsilon_{i,t} = u_i + \eta_{i,t} \qquad (6)$$

where u_i is the panel-level error term, and $\eta_{i,t}$ represents the idiosyncratic error term. By construction, u_i has a zero-mean across all panels, but it is non-zero for any individual bank. Therefore, also considering that the number of observations per year is modest, we should include it in our forecasts in order to prevent that the estimators of the panel-specific errors are inconsistent. To handle with this potential bias, we adjust the forecast model incorporating the average of estimates of the panel-level effects by bank into our predictions.

Figure 2 reports forecasts resulting from the forecast model estimation. Results show that our model specification largely overestimates the M/B value in 2015: the fitted M/B value is almost equal to 1.5, whereas the actual M/B value in 2015 is lower than 1. However, this prediction bias may be due to the fact that the panel sample used to estimate the forecast model contains a noteworthy time break within: the financial crisis. Indeed, before crisis waves (i.e. 2006 and 2007) values of the market-to-book ratio are very different with respect to the successive years. Figure 3 illustrates estimated forecasts resulting from the same forecast model than before, but excluding 2006 and 2007 waves in the estimation. As expected, in this case the predictive power of our model specification is considerably improved since the fitted M/B value in 2015 is 0.09 greater than the actual one (0.90). In conclusion, according to the results of this simple forecasting exercise, we can state that our model specification fits quite well the dynamics of the market-to-book ratio among European banks.

[Figure 2 and 3 around here]

6. Robustness check

In this section we investigate the likely impact of different measures of profitability and risk to assess banks' market performance during our sample period. In particular, we use two accounting-based measures of profitability: ROAE − net income divided by average equity over the prior year and ROAE_ADJ_SQ (Adjusted Return on average equity) computed scaling negative ROAE to zero

and then computing the squared in order to account for non linear relationship between market performance and ROAE.

We use different measures of risk: 1) equity volatility (VOL), the annualized standard deviation of daily stock returns; 2) beta as a measure of systemic risk. The beta of each bank was obtained by estimating, with the OLS method, the market model. More precisely, the beta of bank j for the year t was estimated using daily returns in local currency of the bank j in year t. The returns of the market portfolio are those of the S & P 100 E GLOBAL - PRICE INDEX (euro) and of the STOXX EUROPE 600 E - PRICE INDEX (euro) in order to obtain two betas: one referring to the world index (BETA_W) and one referring to the Euro market (BETA_E); 3) Tail risk (TAIL), the negative of the average return on a bank's stock over the 5% worst return days in the year as in Ellul and Yerramilli (2013).

As previuolsy, the econometric models employed to evaluate to what extent the financial markets set bank share prices in relation to banks' business fundamentals, business size and mix indicators along with country variables, is based on a panel relationship with year and bank fixed effects, clustering standard errors by bank, that takes the following form:

$$y_{i,t} = \alpha_{i,t} + \beta_1 PERF_{i,t} + \beta_2 RISK_{i,t} + \beta_3 PERF_{i,t} \times RISK_{i,t} + \beta_4 SIZE_{i,t} + \sum_{i=1}^{3} \beta_i BM_{i,t} + \sum_{j=1}^{2} \beta_j MACRO_t + \sum_{r=1}^{2} \beta_r BK_t + \beta_{12} GOVT_t + \varepsilon_{i,t}$$

Results in Table 8 show that our major empirical findings remain qualitatively unchanged when alternative performance and risk measures are used in the empirical analysis. In particular ROAE and ROAE_ADJ_SQ variables are significantly positive when combined with the measure of stock volatility and with the tail risk. The other variables confirm the signs and significancy of the baseline specification.

[Table 8 around here]

7. Conclusions

In the years since the outbreak of the crisis, financial markets have drastically reduced the market value of European banks. The impairment has been severe in the two periods of financial and sovereign debt crisis, respectively; but even in recent years the market went on evaluating banks with a substantial discount with respect to book values. At the end of the considered time span the median M/B value of the main European banks was still less than half the 2006 value.

This trend points out that the crisis has had long-term effects on the activity of European banking systems as result of macroeconomic, regulatory and structural factors.

The economic context, with a combination of slow economic growth and historically low levels of interest rates, reduced the prospects of banks in terms of intermediation volumes and interest margins. Even regulation contributed to make bank performance prospects uncertain. Supervisory authorities have progressively restricted capital and liquidity requirements constraining growth and diversification bank strategies and making the banking sector more vulnerable to shadow banking competition. Moreover, the legacy of costly and widespread bank branch network

weighted on the improvement of efficiency that represents the best way to recover a sustainable level of profitability.

Even if these factors affected the whole European banking industry, differences of market evaluations across countries still persist. These reflect macroeconomic variables like GDP growth CDS spreads that, even in a general deflationary context, pointed to a different path and riskiness of European economies. As for regulatory policies are concerned, it persists a national discretion in implementing homogeneous rules and the country effect reflects also the pre-emptive action of supervisory authority, which has been more pervasive in financial systems more vulnerable to credit and market risk. The banking system structure in some countries more than in others shows a considerable room to improve operational efficiency, especially through branch rationalization. So that the different degree of overcapacity could affect how the market evaluates the prospects of banks belonging to different countries.

This paper follows the market value literature methodology testing for the difference between book and market values of a significant sample of large European banks for the period 2006-2015.

With respect to the extant literature we have focused on different groups of determinants of banks' value: the business fundamentals expressed in terms of performance and risk measures; the size and business composition of bank activity; the country effect as result of macroeconomic and banking structure variables.

The results are in line with the expected effects. The market value reflects, with the right sign and in a statistically significant way, the different return and risk measures. The business mix indicators do not seem address information to market about the prospects of bank profitability.

The negative sign and statistically significant value of bank total asset points to a negative effect of size on market value. This result contradicts the too-big-to-fail hypothesis and probably reflects the higher costs that the large banks have to pay in terms of a more stringent regulation.

Lastly our study focused on the importance that the country specificities take on when the market looks at both the macroeconomic context and the structural features of banking systems. The GDP growth and the CDS spread as proxy of sovereign risk have the expected sign, positive and negative, respectively. Both the variables have a direct effect on the fundamental market evaluation model based on the bank earnings' growth and on the cost of capital. In terms of banking system structural indicators, the bank branch productivity positively contributes to explaining the difference in market values. The market seems to attribute a premium to banks belonging to national banking systems that have a higher branch network productivity.

A novelty of our work are the results obtained by applying the Shapley-Owen value decomposition method to explain the market-book ratio variance. According to these estimates the bank fundamentals variables along with the time effects figure as the most important ones. Beyond these two groups of determinants, macroeconomic country situation turns out to be very relevant, accounting for a significant share of the overall explained variance.
The sub-period analysis reveals that the role of equity volatility and its interaction effect with the ROAE became the most important in explaining the variance of the market-to-book ratio during and after the financial crisis. In the financial crisis period the bank size, the macroeconomic variables along with the structural profiles of national banking systems reduce their explanatory power, whereas the business mix and the country areas become more important. With the return

to a gradual normality the Owen values of banking structure variables rise over 20% and along with bank fundamental (30%) and country area (21%) variables explain a large share of M/B variance. These results highlight how and to what extent the European banks' performances and strategies are still dependent on national contexts.

Finally the forecasting exercise shows that when we exclude the pre-crisis years from the estimate our model specification fits quite well the dynamics of the market-to-book ratio among European banks.

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Table 1 – Descriptive statistics by year, median value

Year	ID	M/B	ROAE	VOL	BETA_W	BETA_E	TAIL	INT	NPL	TRAD	TA [euro billions]
2006	29	1.98	16.45	0.23	1.12	1.10	0.03	54.70	3.56	12.58	158.53
2007	39	1.56	17.36	0.26	1.19	1.06	0.04	55.84	3.15	12.41	200.52
2008	40	0.57	7.98	0.67	1.13	1.28	0.09	66.65	3.68	10.47	221.10
2009	44	0.84	5.04	0.60	1.76	1.64	0.08	61.04	5.61	11.67	230.46
2010	45	0.65	7.07	0.42	1.64	1.52	0.05	56.27	6.08	11.45	242.04
2011	44	0.49	5.38	0.52	1.59	1.47	0.07	59.96	6.73	10.71	270.37
2012	41	0.55	3.35	0.43	1.70	1.77	0.06	57.43	6.76	11.56	348.17
2013	43	0.80	4.72	0.34	1.37	1.47	0.04	55.70	7.72	9.57	280.44
2014	40	0.87	5.56	0.29	1.41	1.39	0.04	59.01	6.37	11.84	317.93
2015	46	0.75	6.13	0.31	0.90	0.94	0.04	58.45	5.31	8.65	253.17
Total	411	0.81	6.73	0.38	1.38	1.32	0.05	58.56	5.23	10.74	251.67

Table 2 – M/B values over time

Year	Mean	Median	SD	CV
2006	2.22	1.98	0.71	0.32
2007	1.71	1.56	0.68	0.40
2008	0.66	0.57	0.34	0.51
2009	0.90	0.84	0.43	0.48
2010	0.76	0.65	0.41	0.54
2011	0.57	0.49	0.46	0.82
2012	0.64	0.55	0.37	0.58
2013	0.93	0.80	0.41	0.44
2014	1.01	0.87	0.57	0.57
2015	0.87	0.75	0.44	0.51
Total	**0.98**	**0.81**	**0.66**	**0.68**

CV: coefficient of variation=SD/Mean

Table 3 – M/B values by country and group of countries

Country	Mean	Median	SD	CV
Austria	1.13	0.83	0.82	0.73
Belgium	0.92	0.66	0.65	0.71
France	0.69	0.61	0.35	0.50
Germany	0.62	0.51	0.32	0.51
Netherlands	0.94	0.76	0.62	0.67
Total EMU core	**0.80**	**0.63**	**0.54**	**0.68**
Greece	1.20	0.80	1.17	0.97
Ireland	1.05	1.03	1.01	0.96
Italy	0.73	0.58	0.46	0.64
Spain	1.17	0.93	0.70	0.60
Total EMU non core	**0.98**	**0.76**	**0.79**	**0.80**
Denmark	0.97	0.90	0.42	0.43
Sweden	1.34	1.34	0.41	0.30
Switzerland	1.37	1.33	0.41	0.30
United Kingdom	0.97	0.83	0.49	0.50
Total NON-EMU	**1.16**	**1.15**	**0.48**	**0.41**
Total	**0.98**	**0.81**	**0.66**	**0.68**

CV: coefficient of variation=SD/Mean

Table 4 – M/B values by quartile of banks' characteristics, median value

Quartile	TA	INT	NPL
1 Quartile [Lowest]	0.88	0.84	1.32
2 Quartile	0.69	0.92	0.81
3 Quartile	0.93	0.85	0.69
4 Quartile [Highest]	0.70	0.69	0.57

Table 5 – Results of the panel fixed effect estimation

VARIABLES	(1) M/B	(2) M/B	(3) M/B	(4) M/B	(5) M/B	(6) M/B
Constant	2.097***	14.144***	14.306***	13.553***	8.416**	8.015*
	(0.105)	(4.419)	(3.828)	(3.440)	(3.800)	(3.984)
ROAE	0.018***	0.017***	0.018***	0.015***	0.016***	0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
VOLATILITY	-0.483***	-0.462***	-0.546***	-0.341**	-0.329**	-0.318**
	(0.131)	(0.127)	(0.179)	(0.156)	(0.147)	(0.149)
ROAE x VOLATILITY	-0.012**	-0.011**	-0.011**	-0.010**	-0.010**	-0.010**
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
SIZE		-0.627***	-0.648***	-0.599***	-0.471**	-0.453**
		(0.230)	(0.202)	(0.178)	(0.182)	(0.189)
INT			0.002	0.002	0.004	0.004
			(0.003)	(0.003)	(0.003)	(0.002)
NPL			0.005	0.012	0.019	0.017
			(0.012)	(0.013)	(0.014)	(0.013)
TRAD			0.009	0.004	0.008	0.007
			(0.006)	(0.006)	(0.007)	(0.006)
GDP_GROWTH				0.020*	0.027**	0.026**
				(0.010)	(0.011)	(0.011)
CDS				-0.172**	-0.142**	-0.152**
				(0.064)	(0.059)	(0.057)
C5					-0.004	-0.004
					(0.008)	(0.008)
BRANCH					0.217***	0.225***
					(0.076)	(0.082)
GOVT						0.010
						(0.011)
2007	-0.475***	-0.371***	-0.356***	-0.166**	-0.264***	-0.257***
	(0.071)	(0.072)	(0.076)	(0.076)	(0.073)	(0.075)
2008	-1.174***	-1.034***	-1.013***	-0.450**	-0.609***	-0.602***
	(0.124)	(0.113)	(0.146)	(0.193)	(0.170)	(0.165)
2009	-0.927***	-0.791***	-0.759***	-0.312**	-0.445***	-0.462***
	(0.130)	(0.126)	(0.151)	(0.155)	(0.140)	(0.140)
2010	-1.193***	-1.005***	-0.994***	-0.475**	-0.656***	-0.669***
	(0.119)	(0.126)	(0.125)	(0.203)	(0.187)	(0.181)
2011	-1.222***	-1.027***	-1.016***	-0.393	-0.598***	-0.607***
	(0.123)	(0.150)	(0.146)	(0.248)	(0.214)	(0.207)
2012	-1.187***	-0.985***	-0.977***	-0.486***	-0.661***	-0.678***
	(0.118)	(0.136)	(0.132)	(0.165)	(0.145)	(0.144)
2013	-0.994***	-0.824***	-0.819***	-0.375***	-0.503***	-0.514***
	(0.116)	(0.119)	(0.127)	(0.128)	(0.110)	(0.108)
2014	-1.032***	-0.836***	-0.851***	-0.525***	-0.650***	-0.659***
	(0.138)	(0.159)	(0.118)	(0.145)	(0.129)	(0.127)
2015	-1.101***	-0.915***	-0.901***	-0.642***	-0.764***	-0.770***
	(0.123)	(0.122)	(0.127)	(0.130)	(0.119)	(0.115)
Observations	411	411	411	411	411	411
R-squared	0.710	0.737	0.740	0.771	0.778	0.780
Number of id	47	47	47	47	47	47
Adj. R-squared	0.575	0.301	0.319	0.359	0.440	0.446

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports the results of a panel data regression with year and bank fixed effects. In all regressions, we cluster standard errors by bank. Regression coefficients are reported with robust standard error in parenthesis. The dependent variable is the market-to-book ratio (**M/B**). We use proxies for bank fundamentals: **ROAE,** that measures the Return on average equity, is computed dividing Net income by average equity over the year; **VOL** (Equity volatility) is a measure of risk computed annualizing standard deviation of daily stock returns; **ROAE x VOL** is the interaction term among performance and risk measure. The following bank specific characteristics are included in the regression: **SIZE** is the natural logarithm of Total Asset in thousands of euro; **INT** is the ratio of net interest margin over operating income; **NPL** is the ratio of Non-Performing Loans over Gross loans; **TRAD** is the ratio of trading assets over total assets. Two macroeconomic variables are included as follows: **GDP_GROWTH** is the country annual growth rate of real GDP and **CDS** is the sovereign CDS spread. Two national banking system structural characteristics are included as follows: the concentration index **C5** computed dividing total asset of the largest 5 institutions over country total asset and a productivity measure - **BRANCH** - computed as the ratio between country total banking asset over country total number of bank branches. Finally, the variable **GOVT** controls for the intensity by which the State made bail out interventions and is measured by the value of financial instruments subscribed by government in financial institutions as a fraction of GDP. Time fixed effect are shown in the Table.
The observation period is 2006–2015.
For a definition of the variables, see Table A.2 in the Appendix.

Table 6 – Owen value decomposition of R^2 for groups of determinants

Group	Group share of the overall R-squared (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BF	49.56	48.53	44.50	33.80	30.23	29.91	27.18
SIZE		3.76	3.20	3.87	3.71	3.66	2.98
BM			6.99	5.79	5.66	5.40	4.89
MACRO				22.18	21.32	20.99	21.36
BK					5.82	5.83	5.51
GOVT						1.14	1.17
AREA							6.64
YEAR	50.44	47.71	45.30	34.36	33.25	33.07	30.27
R-squared	0.596	0.613	0.614	0.637	0.686	0.687	0.710

Notes: Standard errors are clustered by banks

Table 7 – Shapley and Owen value decomposition of R^2 for groups of determinants by period

Group	Variable	Individual share of the overall R-squared				Group share of the overall R-squared			
		2006-2007	2008-2010	2011-2012	2013-2015	2006-2007	2008-2010	2011-2012	2013-2015
BF	ROAE	12.2	13.4	15.8	20.4	19.2	37.4	31.5	30.7
	VOLATILITY	2.5	15.4	5.1	2.3				
	ROAE x VOLATILITY	4.5	8.6	10.6	8.0				
SIZE	SIZE	10.0	1.4	2.3	4.2	10.0	1.4	2.3	4.2
BM	INT	3.5	6.9	2.2	0.6	9.5	12.6	9.2	8.0
	NPL	0.9	4.3	5.3	3.5				
	TRAD	5.2	1.4	1.7	3.9				
MACRO	GDP_GROWTH	20.9	2.2	7.0	9.3	23.6	10.2	20.7	12.2
	CDS	2.7	8.0	13.7	2.9				
BK	C5	8.1	8.1	5.6	12.6	25.0	15.3	13.2	23.1
	BRANCH	16.9	7.2	7.7	10.5				
GOVT	GOVT	-	2.8	2.3	0.5	-	2.8	2.3	0.5
AREA	EMU NON-CORE	9.4	3.2	4.7	1.6	12.6	20.4	20.9	21.2
	NON-EMU	3.2	17.2	16.2	19.6				
Observations		68	129	85	129	68	129	85	129
R-squared		0.712	0.577	0.575	0.473	0.712	0.577	0.575	0.473

Notes: Standard errors are clustered by banks; GOVT is always 0 in 2006-2007 period.

Table 8 – Robustness check

VARIABLES	Baseline Model M/B	(1) M/B	(2) M/B	(3) M/B	(4) M/B
Constant	8.015*	9.113**	8.140*	8.226*	7.641*
	(3.984)	(3.663)	(4.201)	(4.226)	(4.010)
ROAE	0.016***		0.008***	0.008**	0.016***
	(0.004)		(0.003)	(0.004)	(0.004)
ROAE_ADJ_SQ		0.001*			
		(0.000)			
VOLATILITY	-0.318**	-0.319**			
	(0.149)	(0.152)			
BETA_W			-0.049		
			(0.063)		
BETA_E				-0.073	
				(0.067)	
TAIL					-2.215*
					(1.164)
ROAE x VOLATILITY	-0.010**				
	(0.004)				
ROAE_ADJ_SQ x VOLATILITY		0.014			
		(0.012)			
ROAE x BETA_W			-0.001		
			(0.001)		
ROAE x BETA_E				-0.000	
				(0.002)	
ROAE x TAIL					-0.071**
					(0.029)
SIZE	-0.453**	-0.432**	-0.447**	-0.454**	-0.432**
	(0.189)	(0.172)	(0.197)	(0.197)	(0.190)
INT	0.004	0.002	0.004	0.004	0.004
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
NPL	0.017	0.013	0.014	0.014	0.017
	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)
TRAD	0.007	0.003	0.005	0.005	0.006
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
GDP_GROWTH	0.026**	0.029**	0.029**	0.028**	0.027**
	(0.011)	(0.011)	(0.011)	(0.012)	(0.010)
CDS	-0.152**	-0.243***	-0.161***	-0.164***	-0.150***
	(0.057)	(0.072)	(0.056)	(0.057)	(0.056)
C5	-0.004	-0.003	-0.005	-0.004	-0.004
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
BRANCH	0.225***	0.115	0.219**	0.222**	0.221***
	(0.082)	(0.089)	(0.090)	(0.092)	(0.082)
GOVT	0.010	0.016	0.011	0.010	0.010
	(0.011)	(0.014)	(0.011)	(0.011)	(0.011)
2007	-0.257***	-0.128	-0.252***	-0.260***	-0.259***
	(0.075)	(0.101)	(0.079)	(0.078)	(0.075)
2008	-0.602***	-0.294	-0.766***	-0.751***	-0.599***
	(0.165)	(0.189)	(0.148)	(0.142)	(0.172)
2009	-0.462***	-0.173	-0.603***	-0.583***	-0.477***
	(0.140)	(0.152)	(0.123)	(0.118)	(0.140)
2010	-0.669***	-0.317	-0.721***	-0.706***	-0.685***
	(0.181)	(0.203)	(0.179)	(0.177)	(0.179)

2011	-0.607***	-0.254	-0.693***	-0.682***	-0.613***
	(0.207)	(0.250)	(0.191)	(0.188)	(0.206)
2012	-0.678***	-0.365**	-0.738***	-0.715***	-0.692***
	(0.144)	(0.170)	(0.140)	(0.136)	(0.142)
2013	-0.514***	-0.242*	-0.574***	-0.559***	-0.524***
	(0.108)	(0.127)	(0.103)	(0.099)	(0.108)
2014	-0.659***	-0.386**	-0.693***	-0.688***	-0.667***
	(0.127)	(0.151)	(0.127)	(0.122)	(0.124)
2015	-0.770***	-0.510***	-0.850***	-0.845***	-0.778***
	(0.115)	(0.133)	(0.128)	(0.120)	(0.116)
Observations	411	411	411	411	411
R-squared	0.780	0.779	0.772	0.773	0.780
Number of id	47	47	47	47	47
Adj. R-squared	0.446	0.469	0.412	0.419	0.448

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports the results of a panel data regression with year and bank fixed effects. In all regressions, we cluster standard errors by bank. Regression coefficients are reported with robust standard error in parenthesis. The dependent variable is the the market-to-book ratio (**M/B**). We use two different performance measure: **ROAE** that measures the Return on average equity revenue is computed dividing Net income by average equity over the year and **ROAE_ADJ_SQ** (Adjusted Return on average equity) computed scaling negative ROAE to zero and then computing the squared. We use different measures of risk: **VOL** (equity volatility) the annualized standard deviation of daily stock returns; Beta as a measure of systemic risk. Through Market model we compute two betas, one referring to the world index - **BETA_W** - and one referring to the Euro market - **BETA_E**; **TAIL** (Tail risk) the negative of the average return on a bank's stock over the 5% worst return days in the year. In each model we introduce the **interaction term** among performance and risk measure. The following bank specific characteristics are included in the regression: **SIZE** is the natural logarithm of Total Asset in thousands of euro, **INT** is the ratio of net interest margin over operating income, **NPL** is the ratio of Non-Performing Loans over Gross loans, **TRAD** is the ratio of trading assets over total assets. Two macroeconomic variables are included as follows: **GDP_GROWTH** is the country annual growth rate of real GDP and **CDS** is the sovereign CDS spread. Two national banking system structural characteristics are included as follows: the concentration index **C5** computed dividing total asset of the largest 5 institutions over country total asset and a productivity measure - **BRANCH** - computed as the ratio between country total banking asset over country total number of bank branches. Finally, the variable **GOVT** control for the intensity by which the State made bail out interventions and is measured by the value of financial instruments subscribed by government in financial institutions as a fraction of GDP. Time fixed effect shown in the Table.

The observation period is 2006–2015.

For a definition of the variables, see Table A.2 in the Appendix.

Figure 1 – Owen value decomposition results for groups (model (7) in Table 6), with 90% bootstrap confidence intervals, based on 200 bootstrap replications

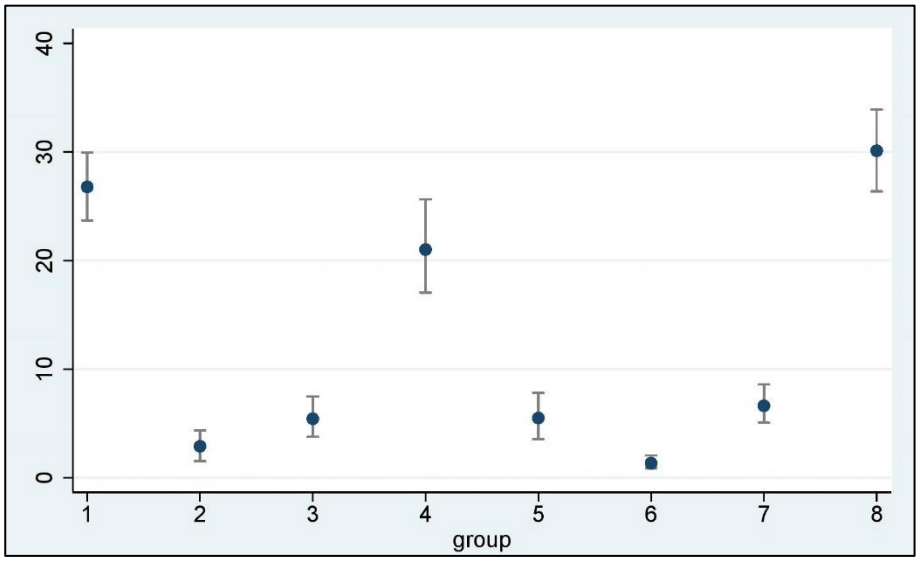


Figure 2 – M/B value forecast

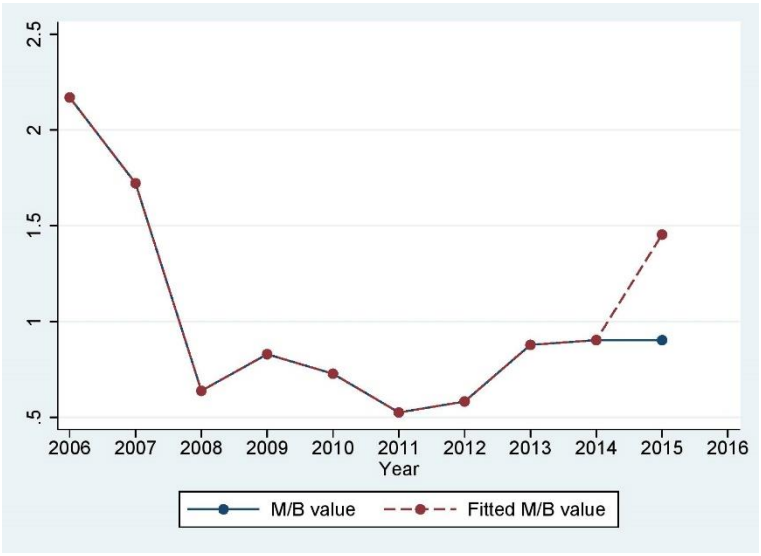
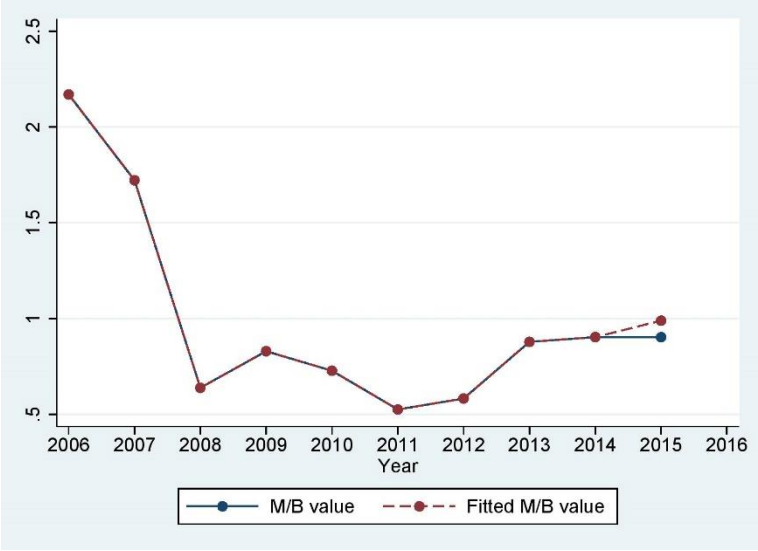


Figure 3 – M/B value forecast, excluding 2006 and 2007 waves from forecast model estimation



Appendix

Table A.1. – Composition of the sample by country

Country/Bank	TA 2015 (euro billions)
Austria (average)	**157.1**
Erste Group Bank AG	199.7
Raiffeisen Bank International AG	114.4
Belgium (average)	**241.3**
Dexia SA	230.3
KBC Group NV	252.4
Denmark (average)	**257.0**
Danske Bank A/S	441.2
France (average)	**1,122.4**
BNP Paribas SA	1,994.2
Crédit Agricole SA	1,529.3
Crédit Industriel et Commercial SA	254.0
Natixis	500.3
Société Générale SA	1,334.4
Germany (average)	**737.9**
Aareal Bank AG	51.9
Commerzbank AG	532.6
Deutsche Bank AG	1,629.1
Greece (average)	**85.4**
Alpha Bank AE	69.3
Eurobank Ergasias SA	73.6
National Bank of Greece SA	111.2
Piraeus Bank SA	87.5
Ireland (average)	**117.0**
Allied Irish Banks, Plc	103.1
Governor and Company of the Bank of Ireland	131.0
Italy (average)	**265.7**
Banca Monte dei Paschi di Siena SpA	169.0
Banca Popolare di Milano	50.2
BPER Banca SpA	61.3
Gruppo Banco Popolare	120.2
Intesa Sanpaolo SpA	676.5
Mediobanca - Banca di Credito Finanziario SpA	70.7
UniCredit SpA	860.4
Unione di Banche Italiane SpA	117.2
Netherlands (average)	**838.5**
ING Groep N.V.	838.5
Spain (average)	**438.2**
Banco Bilbao Vizcaya Argentaria, SA	750.1

Banco de Sabadell, SA	208.6
Banco Popular Español SA	158.6
Banco Santander, SA	1,340.3
Bankia, SA	207.0
Bankinter SA	58.7
CaixaBank, SA	344.3
Sweden (average)	**357.3**
Nordea Bank AB (publ)	646.9
Skandinaviska Enskilda Banken AB (publ.)	272.5
Svenska Handelsbanken AB (publ)	275.3
Swedbank AB (publ)	234.6
Switzerland (average)	**566.3**
Credit Suisse Group AG	754.7
Julius Bär Gruppe AG	77.3
UBS Group AG	866.9
United Kingdom (average)	**1,305.8**
Barclays Plc	1,519.8
HSBC Holdings Plc	2,218.6
Lloyds Banking Group Plc	1,094.6
Royal Bank of Scotland Group Plc	1,106.5
Standard Chartered Plc	589.7
Total (average)	**523.9**

Table A.2. – Variables definition and sources

Variable Name	Definition	Source
ROAE (Return on average equity)	Net income divided by average equity over the year	SNL Financial
ROAE_ADJ_SQ (Adjusted Return on average equity)	Squared of ROAE scaling negative value to zero	SNL Financial
VOL (Equity Volatility)	Annualized standard deviation of daily stock returns	Thomson Reuters Datastream
TAIL (Tail Risk)	The negative of the average return on a bank's stock over the 5% worst return days in the year	Thomson Reuters Datastream
BETA_W	Market model Beta with respect to the world index	Thomson Reuters Datastream
BETA_E	Market model Beta with respect to the Euro Stock index	Thomson Reuters Datastream
GDP_GROWTH	Real growth rate of GDP	Eurostat
CDS	Sovereign CDS spread	Thomson Reuters Datastream
C5	Total asset of largest 5 institutions over country total asset	ECB
BRANCH	Ratio between country banking system total asset over total number of bank branches	ECB
GOVT	Value of financial instruments subscribed by government in financial institutions as a fraction of GDP	Eurostat
SIZE	The natural logarithm of total assets (in euro $000)	SNL Financial
INT	Ratio between net interest margin over operating income	SNL Financial
NPL	Ratio of Non-Performing Loans over Gross loans	SNL Financial
TRAD	Trading assets as a fraction of total assets	SNL Financial

Table A.3 – Shapley value decomposition of R^2 for independent determinant

Group	Variable	Individual share of the overall R-squared (%)						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
BF	ROAE	24.66	23.76	22.14	16.94	14.97	14.80	13.67
	VOLATILITY	10.65	11.11	9.73	6.91	6.58	6.52	5.63
	ROAE x VOLATILITY	14.25	13.66	12.64	9.95	8.68	8.58	7.88
SIZE	SIZE		3.76	3.20	3.87	3.71	3.66	2.98
BM	INT			1.37	0.99	0.97	0.88	0.87
	NPL			3.96	2.90	2.86	2.71	2.50
	TRAD			1.67	1.90	1.84	1.81	1.52
MACRO	GDP_GROWTH				8.75	7.99	7.94	7.42
	CDS				13.43	13.34	13.06	13.94
BK	C5					5.02	5.04	3.50
	BRANCH					0.81	0.79	2.02
GOVT	GOVT						1.14	1.17
AREA	EMU NON-CORE							2.54
	NON-EMU							4.10
YEAR	2007	7.36	7.07	6.40	4.63	4.42	4.31	4.05
	2008	6.97	6.69	6.46	4.26	3.91	3.95	3.75
	2009	3.20	3.04	2.98	2.21	2.12	2.13	1.93
	2010	6.45	6.08	5.93	4.36	4.08	4.03	3.55
	2011	9.01	8.58	8.08	5.56	5.28	5.23	4.90
	2012	7.60	7.04	6.73	4.98	4.74	4.69	4.22
	2013	2.96	2.78	2.58	1.94	1.94	1.94	1.76
	2014	2.37	2.19	2.07	1.82	1.99	1.99	1.76
	2015	4.51	4.25	4.07	4.60	4.78	4.81	4.36
R-squared		0.596	0.613	0.614	0.637	0.686	0.687	0.710

Notes: Standard errors are clustered by banks

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