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THE RISK WEIGHTED OWNERSHIP INDEX:
AN EX-ANTE MEASURE OF BANKS RISK AND PERFORMANCE

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The Risk Weighted Ownership Index: an ex-ante measure of banks' risk and performance

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PRELIMINARY VERSION. PLEASE DO NOT QUOTE

Abstract

Attributing ratings to the top-20 owners, we construct a Risk-Weighted Ownership index (RWO) to measure the profitability and risk-taking behaviour of the ownership structure at banks. Collecting data from 19 European countries plus the UK over the 2008-2017 period, preliminary results show strong evidence that RWO measures are significant in explaining bank performance and risk, at both an accounting and a market-based level. Overall, these results suggest that not only markets and regulators should look at bank's owners: instead, it is far more relevant to assess the contribution carried by top-owners to bank risk, both individually and collectively.

Keywords: *bank, ownership, risk, corporate governance*

JEL Classification: G21, G32

1. Introduction

Over the last forty years, the world has witnessed repeated banking crises at both a domestic and a cross-country level. Among the most recent ones, the Global Financial Crisis (GFC), the European sovereign debt crisis, the non-performing loans crisis. All these hard times of our recent financial history demonstrate, first, the intrinsically risky nature of bank business, as well as its vulnerability to exogenous shocks (Barry et al., 2011); second, that banks substantially differ from other firms, for distress has systemic effects (Stulz, 2015). Researches investigating the origin of these crises show that corporate governance and ownership structure are at the root of banks' excessive risk-taking

(Berger et al., 2016; Gorton and Rosen, 1995; Kirkpatrick, 2009). In this paper, we focus on the risk of the ownership structure as a driver of a credit institution's performance and risk-taking.

As widely acknowledged, banks' corporate governance is a unique setting where agency theory can be studied (Macey and O'Hara, 2003, Mehran et al., 2011). Shareholders can collude with managers against depositors to undertake high-risk investments (Boyd et al. 1998; Shehzad et al., 2010), whereas regulators – acting for the sake of depositors – target the effort towards curbing excessive risk-taking behaviours (De Andres and Vallelado, 2008; Laeven and Levine, 2009). The empirical evidence supports that regulators cannot always prevent banks' financial instability (Berger et al. 2016; Beltratti and Stulz, 2012; Fahlenbrach and Stulz, 2011), however tight regulation may be. Thus, credit institutions remain a relevant source of risk for their stakeholders and the financial system as a whole.

In this paper, we investigate whether banks' risk appetite may be captured “originally” – that is, before corporate decisions be taken – by looking, first, at whom owns the bank (*owners' identity*); second, at the risk that shareholders collectively carry to corporate strategy (*owners' quality*).

The extant literature looking at the relationship between ownership structure and bank performance is broad. Empirical evidence is sometimes contrasting yet supports that ownership does matter. Mainstream research on bank ownership structure is focused on analysing specific forms of ownership (i.e. State vs. private, foreign vs. domestic, listed vs. unlisted, etc.); however, to the best of our knowledge, there is still a limited understanding of the implications of investors' heterogeneity on bank risk, as well as on corporate mechanisms linking owners' risk-appetite to credit institutions' performance and risk. Only recently, research seems to show interest in differentiating risk-taking incentives by the nature of owners: in particular, by investigating the role of institutional investors, who seemingly play a detrimental role in prompting managers to take risks (Barry et al., 2011; Erkens et al., 2012; Garel and Petit-Romec, 2017; Switzer et al., 2018). Moreover, the lack of detailed data on banks' ownership represents a structural limitation for researchers (Shaban and James, 2018), then making such area of research under-investigated.

With this paper, by hand-collecting data and matching several data sources, we contribute to this new emerging stream of literature by providing an in-depth analysis of the role of owners' risk-return profile in shaping bank performance and risk at different levels. In particular, our main contribution stands in testing an *ex-ante* measure of risk-appetite at banks, that we define the Risk-Weighted Ownership (hereafter RWO), which is aimed at capturing the owners' intrinsic risk. Besides, we discuss the corporate governance mechanisms by which the risk of the ownership structure shifts onto the credit institution's performance and risk.

In order to measure the risk-return profile of a bank's shareholding base, we collect data on top-20 owners of 83 listed banks, located in the 19 Euro Area countries plus the UK, over the 2008-2017

period. First of all, we aggregate data of owner identity and percentages of ownership. Second, we gather the ratings released by Credit Rating Agencies (CRAs) – when available – or calculate it by referencing to either the Bank Z-Score or the Altman Z-Score (depending upon the owner’s identity, whether financial or non-financial), based on the hypothesis that credit risk is correlated with equity risk (recently: Bai et al. 2017; Bekaert and Hoerova, 2016; Han et al., 2017). Where it was not possible to assign an idiosyncratic rating, we opted to attribute the rating of the country (systematic rating).

On this dataset, we measure the RWO by assigning weighting coefficients pursuant to the Basel 1 framework, in relation to each owner’s identity only, or Basel 2, by considering each owner’s rating too. Then, we account for the effect of the single owner on the ownership structure by multiplying Basel coefficients by the percentage stake in the bank’s capital. Hence, we can build two types of RWO index: one encompassing the sole identity of top-20 owners, another considering their “quality” too.

Controlling for other corporate governance characteristics and regulatory environment, our preliminary results show strong evidence that RWO measures are relevant in explaining bank performance and risk, at both an accounting and a market-based level.

The relevance of our findings is twofold. First, the RWO might be used as an early-warning indicator to signal when increasing the level of risk in bank decision-making is expected. This yields many remarkable implications in terms of stock market performance and volatility: also, considering the cross-correlation between financial markets. To policymakers, our results suggest that regulators, who already supervise banks’ ownership structure, should not only look at whom owns the bank but, also, devote particular attention to analysing the risk appetite of potential owners, still within the context of the already-existing shareholding base.

Our paper contributes to the emerging body of research by investigating the ways in which the ownership structure and specific categories of owners affect a bank’s risk-taking. Compared to the extant literature, our paper is the first to propose a methodology to measure the risk-return profile of a bank’s shareholding base as a driver of ex-ante risk-taking. In addition, we discuss how owners’ risk appetite affects both accounting and stock market performance. We do this by taking into account several measures of risk. In addition, our paper provides new empirical evidence on European banks’ ownership and governance mechanisms in a prolonged post-GFC period. Finally, our paper complements the wide literature on bank corporate governance.

Our paper excludes privately-held banks mainly for problems related to data availability. Actually, Barry et al. (2011) found no structural differences in being listed or not, whereas Akhigbe et al. (2017) underlined that, during periods of financial turmoil, differences in agency costs are irrelevant. However, listed banks are on average characterised by more dispersed ownership (Jensen and Meckling, 1976). In this sense, including in our sample listed banks only underestimates the

effect of the RWO index: as for private banks – due to the diverse identity of owners, as well as their concentration – the latter might result in a stronger effect on bank risk and performance. Further, although our study includes just data on the first level of ownership (circumscribed to the top-20 shareholders), such level often coincides with the ultimate one; also, when this is not the case, the risk appetite associated with the first level of ownership is driven by the ultimate owner's risk propensity. Finally, in this preliminary version of the paper, we still do not discuss endogeneity issues.

The paper is structured as follows. Section 2 reviews the previous literature. Section 3 discusses the RWO Index and the tested hypotheses. Methodology and variables are described in Section 4. Section 5 shows our results. Conclusions are reported in Section 6.

2. Related literature

Information asymmetries and conflicts of interest arising with the separation of ownership and control can lead managers to act in their own self-interest rather than the owners'. Corporate governance mechanisms should reduce agency costs, with the ultimate objective of controlling managers and aligning the interests of principals and agents (Jensen and Meckling, 1976). With specific regard to banks, which represent a unique context wherein agency theory faces special issues (Macey and O'Hara, 2003, Mehran et al., 2011), shareholders may consider it optimal to ask managers for excessive risk-taking, for they do not internalise the social costs of bankruptcy; still, the presence of public insurance on deposits reduces the debtors' control (Erkens et al. 2012). Pressure towards excessive risk-taking is mitigated by the presence of endogenous and exogenous governance mechanisms (that is, the supervision exerted by the board of directors and regulators respectively), as well as by executives showing a lower propensity to risk vis-à-vis shareholders, as the former ones put the value of their human capital on the labour market and, thus, their private benefits at risk (Laeven and Levine, 2009). Shareholders tend to mitigate such misalignment by means of compensation policy, often linked to stock market performance (De Young et al. 2013), or dividend policy (Onali et al. 2016). Moreover, agency costs and asymmetric information are reduced in the presence of efficient capital markets. In fact, managers of firms with negative stock performance are often replaced (Fama, 1980). Besides, dispersed ownership reduces agency cost (Jensen and Meckling, 1976).

Based on this theoretical framework, our research is devoted to investigating the relationship between ownership structure and profitability and risk at banks.

First, the type of ownership affects bank performance. On the alternative ownership structures – namely, government-owned, privately-owned and mutual banks –, Iannotta et al. (2007) find privately-owned ones to be more profitable, whereas those Government-owned are generally less capitalised, take lower retail deposits and extend less credit. The same authors (Iannotta et al., 2013) focus their attention on default risk too. Findings show that the risk of publicly-owned banks is artificially higher vis-à-vis the one faced by privately-owned institutions, due to the governmental backing which enables lower funding costs. Such inefficiencies of State ownership of banks are also confirmed in several domestic contexts (among others: Pennathur et al., 2012; Zhu and Yang, 2016). Further empirical evidence highlights that different ownership types may affect bank risk-taking (Balla and Rose, 2019; Martín-Oliver et al., 2017), while no structural and persistent difference is found between publicly and privately-held banks (Akihge et al., 2017; Barry et al., 2011).

Ownership concentration is an additional driver of bank performance and risk-taking. This occurs because, when large shareholders own banks, they tend to be more involved in corporate decisions, having agents' interest more aligned to principals'. However, lower agency costs make the conflict of interest shift from managers vs. controlling shareholders to managers vs. minority shareholders, raising an entrenchment issue due to the exploitation of private benefits (Jensen and Meckling, 1976; Shleifer and Vishny, 1986). By analysing a sample of 500 commercial banks from more than 50 countries, Shehzad et al. (2010) highlighted how the effect of ownership concentration onto the riskiness of banks is significantly positive in terms of both credit quality (lower proportion of non-performing loans) and capital adequacy. Such evidence, though limited to the pre-GFC period (2005-2007), supports the hypothesis that more concentrated ownership improves the performance of banks. With regard to risk, by investigating whether ownership concentration explains earnings management on a European sample across the GFC, Bouvatier et al. (2014) found that banks with larger shareholders use a greater level of discretionary component of provisioning.

Another risk driver in bank ownership structure is the presence of insiders, i.e. managers and directors (Saunders et al., 1990). With specific regard to the GFC, recent literature has found that managers' ownership has a positive impact on stock prices (Beltratti and Stulz, 2012); nevertheless, the literature agrees in underlining the positive association with default risk, consistently with Berger et al. (2016) on high shareholdings of (non-CEO) top and low-level management. On the opposite, outside directors and executives are found not to exert any significant effect upon excessive bank risk-taking.

Recent but still few contributions are devoted to studying the effect of risk-taking incentives – associated with the nature of owners – on bank risk-taking behaviour. Those existing are mainly focussed on the role of institutional investors.

A first attempt is the one by Barry et al. (2011), who, using a European sample of commercial banks both publicly-listed and privately-held across 1999-2005, analysed the link between ownership structure and risk. They discerned five categories of owners (managers/directors, institutional investors, non-financial firms, individuals/families and banks). The authors highlighted that a shift in equity from institutional investors to individuals/families or banks is associated with the lowest asset and default risk; whereas, when shifting onto non-financial firms, no significant difference arises. Moreover, they showed that, as for publicly-held banks, ownership changes do not influence bank risk-taking, underlining how market discipline is supposed to align risk-taking strategies, so that ownership structure is not a determinant for explaining differences in risk. On the opposite, Erkens et al. (2012) find that financial firms with higher institutional ownership (and independent boards) experienced worse stock returns during the GFC. More in detail, the greater presence of institutional investors in the ownership structure had exposed financial firms to greater risks prior to the crisis which, in turn, led to greater losses in the aftermath of the financial crisis. Recently Garel and Petit-Romec (2017) confirmed these results using 419 publicly listed U.S. banks and investigating the owners' investment time-horizon. In particular, they claim that not all investors are the same; hence, it is not only an issue of how much capital is provided but also who provides it. According to the authors, short-term institutional investors had a positive impact on bank performance during the GFC, whereas short-term investors do not ensure long-term resistance to shocks.

Further post-crisis evidence on the role of institutional investors is provided by Switzer et al. (2018). By analysing the corporate governance characteristics of 117 financial firms outside North America in the post-GFC period, they showed that institutional ownership reduces the probability of default, whereas insider ownership is positively related to credit risk.

The literature has also investigated the effect of specific categories of owners (i.e. States and families) on diversification (Saghi-Zedek, 2016). Evidence shows that when large owners are banks, institutional investors or industrial companies, banks benefit from product diversification. According to the authors, this is connected to professional investors' greater skills and expertise.

3. The RWO index and tested hypotheses

3.1 *The Risk Weighted Ownership index*

The paper's most important contribution to the extant literature is to propose a measure of the risk of bank's ownership structure and test it on several profitability and risk indicators.

Accordingly, our main assumption is that banks' corporate decisions mirror the ownership structure's risk appetite. In detail, in order to construct our RWO index, we combine each owner's risk-return profile – that is, a proxy of its individual default risk – with the stake held in the bank's capital. Then, our measure of RWO is strongly connected to the owners' credit risk, assuming that the latter can explain their equity risk too (that is, their risk appetite). This assumption is based on empirical evidence showing that firms with higher default risk report higher returns (Vassolou and Xing, 2004). In addition, using bond ratings as a measure of the deterioration of companies' economic and financial condition, several studies find that a bond downgrade is usually followed by a negative stock return (Holthausen and Leftwich 1986; Hand et al. 1992; Dichev and Piotroski 2001), highlighting a strong relationship between default risk perception and expected equity returns. Further recent evidence in the asset pricing literature supports the assumption that stock prices reflect credit risk (among the most recent papers: Bai et al. 2017; Bekaert and Hoerova, 2016; Han et al., 2017).

In order to construct the RWO index, we collected from Bloomberg and Moody's BankFocus data on 83 banks incorporated in the 19-country Euro Area plus the United Kingdom (see Table 1). For each bank, we collected data on the name and the total number of shares held by each owner at the end of each year's fourth quarter between 2008 and 2017, in a way capturing almost the entirety of a bank's shareholding base. We expressed stakes as both a percentage of the total number of shares outstanding (TOTAL criterion) and of the capital held by top-20 owners altogether (TOP20 criterion). We define the relevant ownership structure as the one made up by the top-20 shareholders (Demsetz and Lehn, 1985; Kang et al., 2007; Zhang et al., 2013).

In case of different types of shares, we used data associated with the ticker that refers to ordinary shares, for these are most representative of a bank's capital. In case of the same stock being listed on different markets, we consider the ticker that refers to the market located in the country wherein the company is incorporated. We set the following selection criteria, where reported stakes are those made of a number of shares greater than zero:

- the sum of reported stakes exceeds 100% of capital;
- reported stakes amount to less than 5% of capital;
- a bank is withdrawn from the sample if we are left with just 1 yearly observation after applying the criteria above.

RWO is defined as

$$RWO_{it} = 100 \cdot \sum_{j \in i}^{20} (q_{jt} \cdot w_{jt})$$

where $j \in i$ indexes the subjects j constituting the shareholding base of bank i , that we consider only with regard to the top-20; q_{jt} is the percentage stake – pursuant to either the TOTAL or the TOP20 criterion – held by subject j at time t ; w is the weight – pursuant to a Basel 1 or Basel 2 framework – attached to it. Under the former, the weights reflect the risk attributed to shareholders' identity, whereas under the latter, they stem from shareholders' ratings. The sum of each stake multiplied by the corresponding risk-weight yields the RWO figure. Notice that q may be expressed as either a percentage of total equity capital or of the capital held by the top twenty owners¹. In Appendix 1 and 2, we show how shareholders' stakes are risk-weighted under Basel 1 and 2 respectively².

In attributing weights, we discretionally matched shareholders' identity with Basel-compliant categories (Appendix 3)³. In addition, under Basel 2, we associated a rating to each top-20 shareholder, through the following stepwise procedure:

- the first source of ratings are the synthetic judgements released by the 'Big Three' CRAs (namely, S&P, Moody's, Fitch)⁴;
- ratings are divided into five classes (*plus* the 'unrated' category); and we keep such classification by associating each rating (for each company-year entry) with a number from 1 (most creditworthy) to 5 (less creditworthy);
- in case of an "unrated" shareholder, we attributed ratings by exploiting the alternativeness between two measures: namely, the Bank Z-Score (Laeven and Levine, 2009) and the Altman

¹ Once collected ownership data, we deleted all duplicates relative to the subjects holding stakes in more than one bank-year ownership structure.

² The Basel Committee on Banking Supervision groups entities with regard not (or not entirely) to a subjective criterion, but rather by the weighting coefficient attached to them, attributed in a way that, also, considers whether a subject is incorporated inside or outside the OECD area. For instance, pursuant to Basel 1, a bank will be weighted significantly more if it is incorporated outside it (100% compared to 20%), whereas its weight would change along with the rating pursuant to Basel 2.

³ It is important to notice that, unlike Basel 1 (under which all exposures to residual subjects, different from the first four categories, were weighted by 100%), supervised financial intermediaries different from banks – e.g., insurance companies and investment managers – are regarded as if they were banks, and weighted accordingly.

⁴ Since S&P displays by far the largest number of ratings, followed by Moody's (which actually shows very poor coverage) and Fitch (which is almost completely missing), we prefer reporting the S&P rating; in absence of it, the Moody's one; and, if both the former were absent, the Fitch one.

Z-Score (Altman, 1968), depending upon whether the shareholder be of financial or non-financial nature. We determined this by looking at the entity's primary business line;

- to move from Z-Scores to the corresponding ratings, we take the distribution of those values – year by year – and divide it into quintiles, given the 5 classes of ratings envisaged in the Basel 2 framework. Hence, we identify the first quintile as the fifth class of rating (that is, the worst), the second quintile as the fourth class, and so on. This holds for both types of Z-Scores;
- in the case even the Z-Score be absent, we resort to a “systematic” measure such as the external rating of the country of incorporation;
- along with natural persons, certain entities have turned out being eventually unrated: just to them – as a residual choice – we attributed the ‘unrated’ label.

Table 1

Sample composition

Country	Proportion of the sample in terms of Total Assets (% , 2017)	Number of domestic banks within the sample	Average proportion of a domestic bank	Adjusted average proportion of a domestic bank
	A	B	C = A / B	D = $\frac{C}{\sum C}$
United Kingdom	30.06%	16	1.88%	12.80%
France	19.43%	5	3.89%	26.48%
Spain	15.76%	7	2.25%	15.34%
Italy	11.12%	16	0.69%	4.73%
Germany	10.30%	5	2.06%	14.04%
Estonia	0.01%	1	0.01%	0.06%
Netherlands	6.48%	4	1.62%	11.04%
Belgium	2.44%	2	1.22%	8.31%
Austria	2.04%	6	0.34%	2.31%
Greece	1.34%	6	0.22%	1.52%
Portugal	0.52%	3	0.17%	1.19%
Slovakia	0.14%	2	0.07%	0.48%
Ireland	0.12%	1	0.12%	0.80%
Malta	0.10%	3	0.03%	0.23%
Finland	0.08%	2	0.04%	0.26%
Cyprus	0.04%	1	0.04%	0.24%
Slovenia	0.03%	2	0.01%	0.09%
Lithuania	0.01%	1	0.01%	0.07%

3.2 An example of RWO computation

In order to provide an example of RWO construction, in this paragraph we show the computational procedure with regard to Banco Santander. The largest 2017 shareholder - namely, State Street Corporation - held 1,903,708,929 shares out of 16,132,240,242 outstanding. This represents a 11.80% stake, if we consider the whole of the ownership structure by applying the TOTAL criterion; or 29.85%, if we circumscribe the shareholding base to the top-20 owners by applying the TOP20 criterion. State Street Corporation, which is a US-incorporated investment manager, gets attached of a weight equal to 100% under Basel 1 and 30% under Basel 2, as long as the former treats it as a company of residual type with respect to the categories explicitly given a lower weight; the latter acknowledges its idiosyncratic 'A' rating, associated with a 30% weight for regulated intermediaries. By repeating the same procedure for each shareholder at end-2017, and summing all risk-weighted stakes, we get the overall RWO figure as shown in Table 2.

Table 2

Example of RWO computation as for Banco Santander in 2017

Rank	Identity	Total stake	B1 weight	B2 weight	Top20 stake	B1 Total	B1 Top20	B2 Total	B2 Top20
1	Investment Manager	11.80%	100%	30%	29.85%	11.80%	29.85%	3.54%	8.95%
2	Investment Manager	6.73%	100%	20%	17.03%	6.73%	17.03%	1.35%	3.41%
3	Investment Manager	3.34%	100%	20%	8.45%	3.34%	8.45%	0.67%	1.69%
4	Investment Manager	3.02%	100%	20%	7.65%	3.02%	7.65%	0.60%	1.53%
5	Investment Manager	2.50%	100%	20%	6.32%	2.50%	6.32%	0.50%	1.26%
6	Bank (OECD)	2.11%	20%	20%	5.34%	0.42%	1.07%	0.42%	1.07%
7	Investment Manager	1.49%	100%	20%	3.77%	1.49%	3.77%	0.30%	0.75%
8	Bank (OECD)	1.23%	20%	30%	3.11%	0.25%	0.62%	0.37%	0.93%
9	Investment Manager	1.22%	100%	20%	3.08%	1.22%	3.08%	0.24%	0.62%
10	Open-End Fund	0.90%	100%	20%	2.27%	0.90%	2.27%	0.18%	0.45%
11	Pension Fund	0.78%	100%	30%	1.96%	0.78%	1.96%	0.23%	0.59%
12	Bank (OECD)	0.68%	20%	30%	1.72%	0.14%	0.34%	0.20%	0.52%
13	Investment Manager	0.67%	100%	30%	1.71%	0.67%	1.71%	0.20%	0.51%
14	Bank (OECD)	0.57%	20%	100%	1.44%	0.11%	0.29%	0.57%	1.44%
15	Natural Person	0.49%	100%	75%	1.24%	0.49%	1.24%	0.37%	0.93%
16	Natural Person	0.46%	100%	75%	1.16%	0.46%	1.16%	0.34%	0.87%
17	Investment Bank (OECD)	0.43%	20%	30%	1.09%	0.09%	0.22%	0.13%	0.33%
18	Investment Manager	0.41%	100%	30%	1.05%	0.41%	1.05%	0.12%	0.31%
19	Investment Manager	0.36%	100%	150%	0.91%	0.36%	0.91%	0.54%	1.36%
20	Non-Profit Organization	0.34%	10%	20%	0.86%	0.03%	0.09%	0.07%	0.17%

B1 Total	B1 Top20	B2 Total	B2 Top20
35.21	89.07	10.95	27.70

3.2 Tested hypotheses

According to the extant literature showing the effect of different ownership structures on bank performance, our first objective is to assess whether the identity and risk of the owners significantly explain differences in profitability and risk between banks. We use the RWO index as explained in par 3.1 to test our main hypothesis:

Hypothesis 1. *Different identity and risk of owners imply different bank levels of profitability and risk.*

To test our HP 1, We use the RWO index using respectively Basel 1 and Basel 2 approach as discussed in par. 3.1.

Among the categories of investors, institutional owners seem to play a significant role in explaining risk-taking behaviour. Institutional investors act in reducing agents' opportunistic behaviour with benefits for both bondholders and stockholders, thus increasing performance and lowering credit risk. Recent empirical evidence shows different results depending on the period of analysis, whether pre- or post-GFC. In more detail, Switzer et al. (2018), Erkens et al. (2012) and Aebi et al. (2012) findings suggest that, before the GFC, institutional investors used to push managers to take excessive risk exposures asking for performance, whereas, in the aftermath of the crisis, the strategy of investment on survived banks changed toward a more prudent risk attitude, in order to gain stock performance from losses recovery. According to the literature, since the period under investigation is post-GFC, we expect that a greater presence of institutional investors increases profitability and reduces banks' default risk.

Hypothesis 2. *Institutional investors increase profitability and reduce credit risk.*

Insiders' ownership can play an important role in risk-taking. According to agency theory, corporate insiders may find beneficial to take excessive risks by seeking short-term returns (Jensen and Meckling, 1976). From Saunders et al. (1990) onwards, research has confirmed that the larger the proportion of capital held by managers, the greater the bank's risk-taking, for the interests of agents and principals become aligned through compensation. Barry et al. (2011) found that, over a pre-crisis period, insider ownership significantly affects bank profitability measures, whereas not clear evidence is provided as for risk measures. Fahlenbrach and Stulz (2011) found that banks experiencing stock price drops had CEO with incentives in better alignment with shareholders' interest. With regard to bank failures during the GFC, Berger et al. (2016) found that both top and low-level management shareholding increase the probability of default, behaving in accordance with the moral hazard incentives as they do not face bankruptcy costs. Such risk-taking incentive might be lower for CEOs who hold more human capital at risk, thus showing a more risk-averse behaviour. Recently, Switzer et al. (2018) found that, in the post-crisis period (2010-2012), the insider ownership increases fundamental default probability, whereas no significant result is recorded as for the CDS market. Based on previous theoretical and empirical evidence, we assume that insider ownership has a significant impact on profitability and risk.

Hypothesis 3. Insider ownership increases profitability and risk.

Although we do not formulate specific hypotheses, we also tested corporate governance variables which are assumed to exert some influence on profitability and risk.

4. Methods, variables and descriptive statistics

4.1 Methods and variables

Using a panel regression, we test the effect of RWO on profitability and risk measures, from both an accounting and a market standpoint (see Table 3). We specify the panel data model, with individual-fixed effects, as follows:

- (1) $ROA_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$
- (2) $ROE_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$
- (3) $Z\text{-SCORE}_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$
- (4) $CDS_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$
- (5) $MTB_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$
- (6) $BETA_{it} = \alpha + \beta RWO_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}$

where dependent variables are $[4 \times 1]$ vectors made of the same entry repeated four times; and RWO is a $[4 \times 1]$ vector, defined as

$$\mathbf{RWO} := \begin{pmatrix} B1_TOTAL \\ B1_TOP20 \\ B2_TOTAL \\ B2_TOP20 \end{pmatrix}$$

and \mathbf{X} is a $[1 \times 6]$ vector, defined as

$$\mathbf{X} := (\text{INSTIT_OWN} \quad \text{INS_OWN} \quad \text{IND_DIR} \quad \text{BOARD_SIZE} \quad \text{CEO_DUALITY})$$

α is the individual-fixed effect; β is scalar denoting the coefficient of either element of \mathbf{RWO} ; $\boldsymbol{\gamma}$ is a $[6 \times 1]$ vector, encompassing the coefficients of each corresponding variable of \mathbf{X} . ε_{it} is the idiosyncratic error term.

Table 3
Dependent variables

Variable	Description	Label
Return on Asset	Defined as the ratio between <i>Trailing 12M Net Income</i> and <i>Average Total Assets</i> . <i>Trailing 12M Net Income</i> is the end-of-year figure of net income recorded in the income statement. <i>Average Total Assets</i> is the average of the beginning and ending annual figure of total assets.	ROA
Return on Equity	Defined as the ratio between <i>Net Income Available to Common Shareholders</i> and <i>Average Total Common Equity</i> . <i>Net Income Available to Common Shareholders</i> is the end-of-year figure of net income recorded in the income statement, net of the monetary amount paid as dividend to preferred shareholders and of other adjustments. <i>Average Total Common Equity</i> is the average of the beginning and ending annual figure of Total Common Equity. This value is empty if either the beginning or ending total common equity is negative.	ROE
Bank Z-Score	Defined as the sum of <i>Return on Assets</i> and the <i>Capital-to-Assets Ratio</i> , at the numerator, divided by the 5-year-backward standard deviation of the latter component. <i>Return on Assets</i> is defined as above. <i>Capital-to-Assets Ratio</i> is the ratio between Total Common Equity and Total Assets, both end-of-year figures as recorded in the balance sheet.	Z-SCORE
CDS Mean	Defined as the simple mean, computed over a 1-year window, of daily observations of <i>5-Year CDS spread</i> . <i>5-Year CDS spread</i> is the spread charged on credit default swaps as implied by the Bloomberg Issuer Default Risk Model Likelihood of Default.	CDS
Market to Book ratio	Defined as the ratio between <i>Market Capitalisation</i> and <i>Total Common Equity</i> . <i>Market Capitalisation</i> is the end-of-year marked-to-market value of all outstanding shares. <i>Total Common Equity</i> is the end-of-year figure recorded in the balance sheet.	MTB
Beta	Defined as the simple mean, computed over 2-year window of weekly observations.	BETA

In addition to RWO measures, we control for other corporate variables as described in Table 4.

Table 4
Other corporate governance variables

Variable	Description	Label
Institutional Ownership	Defined as a dichotomic variable which takes value 1 if the figure of <i>Institutional Ownership</i> is higher than the median in that given year, and 0 otherwise. <i>Institutional Ownership</i> is the end-of-year percentage of outstanding shares held by institutional investors. These include 13Fs, US and International Mutual Funds, Schedule Ds (US Insurance Companies) and Institutional stake holdings that appear on the aggregate level.	instit_own
Insider Ownership	Defined as the end-of-year percentage of outstanding shares held by insiders.	ins_own
Independent Directors	Defined as the end-of-year percentage of independent directors seating on the board of directors	ind_dir
Board Size	Defined as the latest available end-of-year number of directors on the board. In case of a two-tier governance structure, it is defined as the number of directors on the supervisory board.	board_size
CEO Duality	Defined as a dichotomic variable which takes value 1 if, at the end of that year, the CEO is the same person as the chairman of the board of directors, and 0 otherwise.	ceo_duality

4.1 Descriptive statistics

In Figures 1 to 4, we report the synthesis of the descriptive statistics relative to RWO measures. As one may notice, under B1 version, RWO tends to be more stable. Under B2, which is sensitive to time-varying ratings, ownership structures are more heterogeneous as of their distribution. However, the fundamentals – namely, the mean, the median and the standard deviation – tend to remain quite constant over time. Also, applying the TOP20 criterion yields to greater heterogeneity vis-à-vis the TOTAL one, as it works in a way which can theoretically the distance between different credit institutions' RWO.

In order to gauge what drives changes in RWO, we may consider those years showing the widest interquartile range for each RWO variable: this occurs in 2012 for B1_TOTAL, 2013 for B1_TOP20, and 2014 for both B2_TOTAL and B2_TOP20. Hence, we may have a deeper insight on the shareholding base of those banks corresponding to each year's first and third quartile of that variable's distribution.

In 2012, the first quartile of the B1_TOTAL distribution corresponds to BNP Paribas, whereas the third quartile of the same variable is represented by Caixabank (see Figure 5). There are two major differences between their ownership structures: while the former is much more fragmented, with the largest stake slightly above 10%, the latter is dominated by a relevant shareholder with nearly 70%; besides, the former has an OECD sovereign State (weighted by 0%) as the top owner, whereas the latter is controlled by a holding company (weighted by 100%). In 2013, the first quartile of the B1 TOP20 distribution corresponds to BNP Paribas, whereas the third quartile of the same variable is represented by Brewin Dolphin (see Figure 6). The two ownership structures are not remarkably different in terms of concentration: once valorised the notion of control by applying the TOP20 criterion, the largest stake turns out being 14 points higher in the former vis-à-vis the latter; yet, if we look at the first five owners in both entities, such combined stakes differ by just 7 points. Conversely, the actual composition of shareholding bases is the main driver of the divergence in RWO figures: similarly to the B1_TOTAL case, the largest shareholder is an OECD sovereign State as for the bank corresponding to the first quartile and a 100%-weighted entity – namely, an investment manager – for that corresponding to the third quartile. Within the top five owners, BNP Paribas encompasses a bank (weighted by 20%) and three 100%-weighted entities: namely, one financial advisor and two investment managers. Brewin Dolphin has just subjects endowed with the maximum B1 weight: namely, one insurance company, one open-end fund and two investment managers. Notice that this explains not only an RWO divergence under the same set of rules but, also, provides an insight on the effects of shifting from Basel 1 to Basel 2: as a matter of fact, under Basel 2, the distance between the RWO of the two banks would drop by more than 40 point, given

that Basel 1 – unlike Basel 2 – recognised neither insurance companies nor open-end funds or investment managers as akin to banks, from a risk-based perspective.

In 2014, the first quartile of the B2 TOTAL distribution corresponds to the average between Banco de Sabadell and Autobank, whereas the third quartile of the same variable is represented by the average between Banca Ifis and Orey Antunes (see Figure 7). Comparing Banco de Sabadell and Banca Ifis, without stakes being re-proportioned by means of the TOP20 criterion, the difference in the ownership structure is the major driver in RWO divergence: in fact, Banco de Sabadell's largest shareholder has less than 7%, whereas the largest owner of Banca Ifis holds an outright majority stake. Such remarkable gap faces just little squeeze by considering that the former subject – which is a natural person – is weighted by 75%, whereas the latter – which is an investment manager – is weighted 50%. Hence, the subject controlling Banca Ifis actually benefits from the ratings-based system under Basel 2, for both subjects would be weighted 100% under Basel 1: if that were the reference framework, still pursuant to the TOTAL criterion, the two RWO figures would differ by ~57 points rather than ~31.

Comparing Autobank and Orey Antunes, the pattern is utterly similar: in fact, considering all the top owners (which are less than 20, in both banks), their combined stake is just above 40% for the former, and just below 90% for the latter. In addition to this, the RWO figure of Orey Antunes is propped up by the higher number of top owners (6, compared to Autobank's 4) and their larger stakes, because many of these are natural persons. Even if we considered the top four owners in both institutions, the RWO divergence would not change much.

In 2014, the first quartile of the B2 TOP20 distribution corresponds to the average between BBVA and Banco BPM, whereas the third quartile of the same variable is represented by the average between KBC Groep and Mediolanum (see Figure 8). Comparing BBVA and KBC Groep, the divergence is not particularly related to ownership structures: in fact, the gap is very low – namely, ~4 points as for the largest shareholder, ~5 points if we look at the combined stake of the top five owners – and in favour of BBVA, which is close to the first quartile. Actually, BBVA is characterised by a shareholding base in which no owner holds a stake comparable to the largest one (more than three times higher), such that some form of 'dominant influence' may actually be exerted; upon KBC Groep, conversely, control is far less stringent, as long as the relative distance between the first two owners is much smaller. This leads the single largest stakes in the two banks to be very close under the TOP20 criterion, despite a remarkable difference in nominal terms (*i.e.* pursuant to the TOTAL criterion): in fact, KBC Groep's top owner holds a percentage of capital which is more than double vis-à-vis the one of BBVA's top owner. What actually drives the divergence between RWO figures is the weight attributed to the top owner of each bank: while both entities would be weighted by

100% under Basel 1, they fundamentally differ under the ratings-based framework of Basel 2, as BBVA's largest shareholder gets weighted by 20% and KBC Groep's one by 150%.

Comparing Banco BPM and Mediolanum – which, coincidentally, are both incorporated in Italy and even headquartered in the same city –, we may identify the same reason behind RWO divergence as above: in fact, the top five shareholders of the former are weighted by coefficients ranging between 20% and 50%, whereas the top five of the latter are all weighted by 75%. This would have no match under Basel 1: by shifting from an identity-based system to a ratings-based one, and applying the same TOP20 criterion, the RWO significantly decreases for both entities, thanks to the extremely relevant presence of institutional investors within the top-20 owners of each. As for Banco BPM, however, such improvement faces non-neglectable exceptions: weights are steadily lower in case of investment companies or vehicles, whereas banks tend to be slightly penalised. Conversely, Mediolanum's shareholders systematically benefit from the framework change, with one single exception circumscribed to a very little stake. Although its magnitude is generally greater for Banco BPM, such downward shift in weights does not help fully explaining the divide with Mediolanum. Instead, this is the effect of different ownership concentration: while Banco BPM has a very fragmented one, with the top two owners reaching just above 40% under the TOP20 criterion, Mediolanum shows two extremely relevant shareholders, whose combined stake is slightly lower than 80%. Since the top two owners of Mediolanum are both weighted by 75%, whereas those of Banco BPM are weighted by 20% and 50% respectively, this explains much of the RWO divergence.

In conclusion, as for RWO figures computed under the TOTAL criterion, divergence between banks corresponding to the first and the third quartile of the widest range is mainly driven by the degree of ownership concentration: since stakes are taken as they are, without any re-proportioning, higher (lower) stakes – signalling a higher (lower) degree of concentration – usually determine higher (lower) RWO figures. This is plainly in agreement with the literature suggesting that ownership concentration be positively associated with risk-taking (Shehzad et al., 2010).

Conversely, as for RWO figures computed under the TOP20 criterion, divergence is mainly driven by the weights attached to owners, as long as re-proportioning tends to squeeze the gaps between stakes of different size, provided that there is a shareholder with a significantly higher stake than others (however tiny in absolute terms). Nevertheless, divergence in terms of ownership structure still plays a relevant role under Basel 1, for weights are not time-varying and, also, a vast majority of subjects gets weighted by 100%, given the far narrower span of Basel 1 categories vis-à-vis Basel 2 ones (e.g., under the old framework, non-bank regulated financial intermediaries were not endowed with the same weight as banks). Under Basel 2, conversely, the TOP20 criterion allows subjects with higher (lower) creditworthiness – thus, in our theoretical framework, more prudent

(aggressive) risk-return attitude - to actually show a lower (higher) RWO, as long as the quality of the shareholding base actually drives that figure.

Figure 1

RWO computed under Basel 1 and without re-proportioning stakes

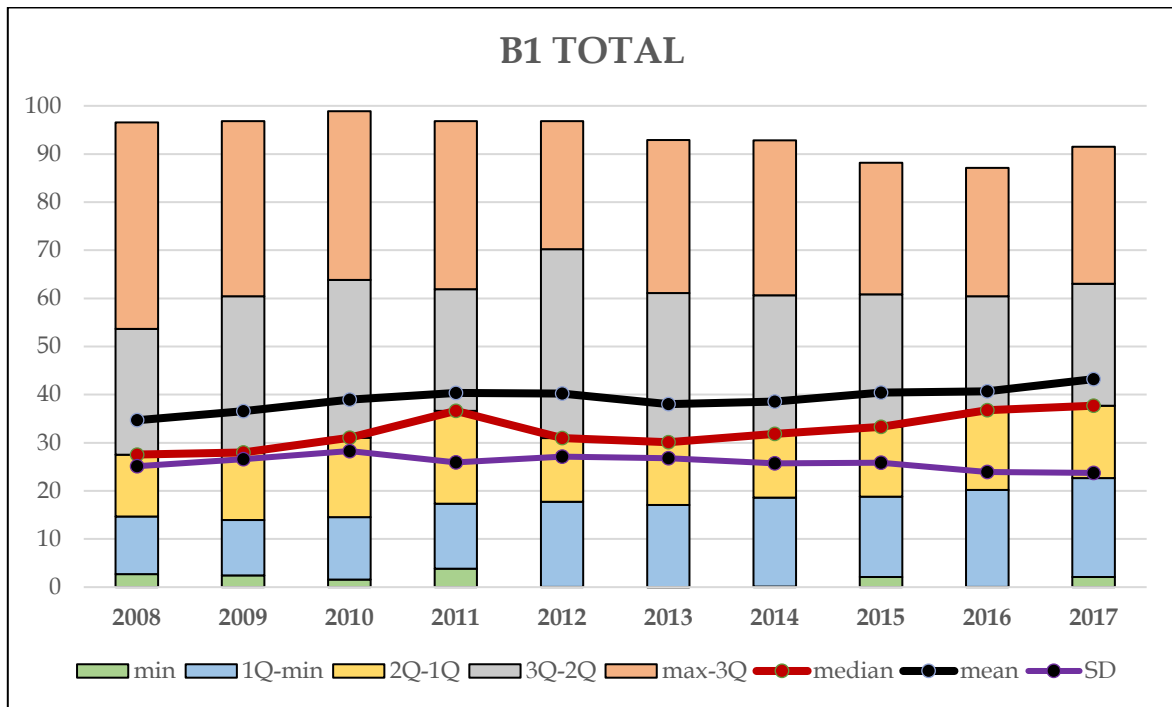


Figure 2

RWO computed under Basel 1 and by re-proportioning stakes

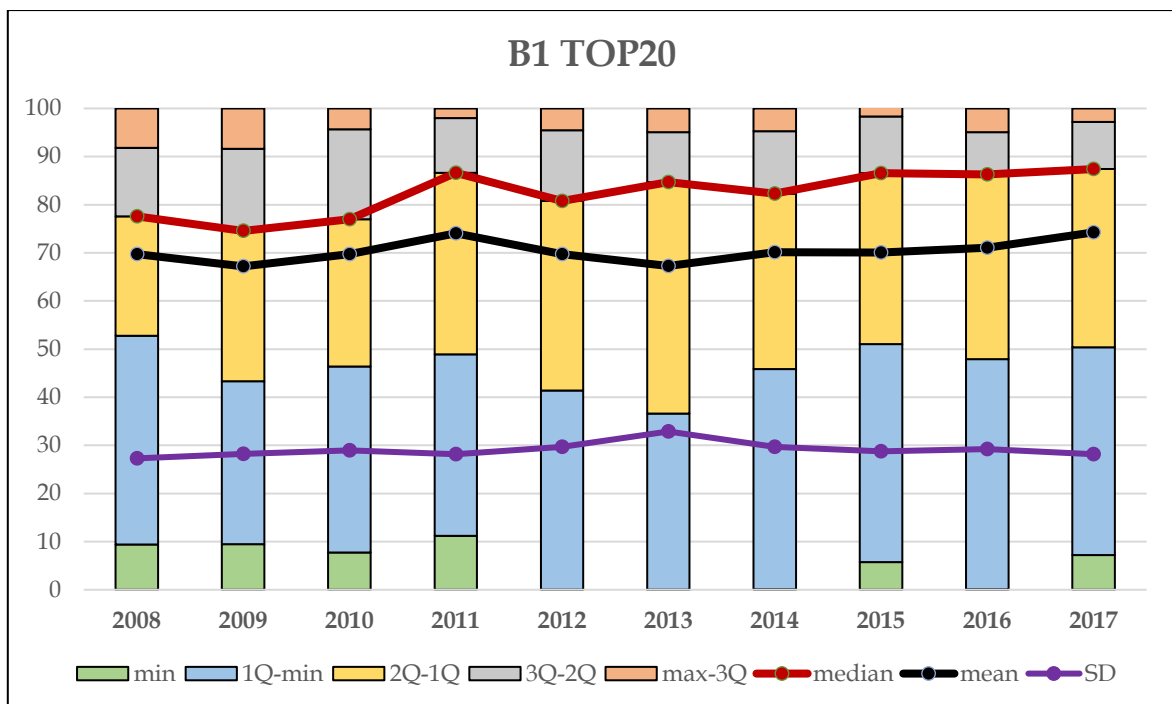


Figure 3

RWO computed under Basel 2 and without re-proportioning stakes

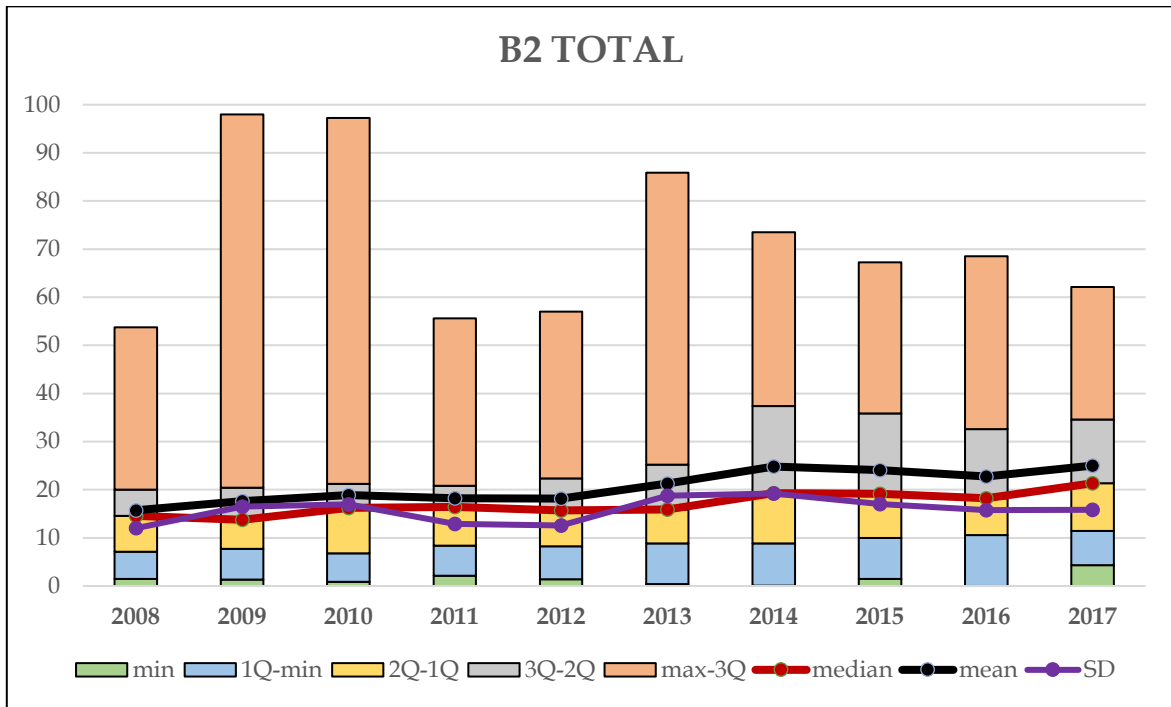


Figure 4

RWO computed under Basel 2 and by re-proportioning stakes

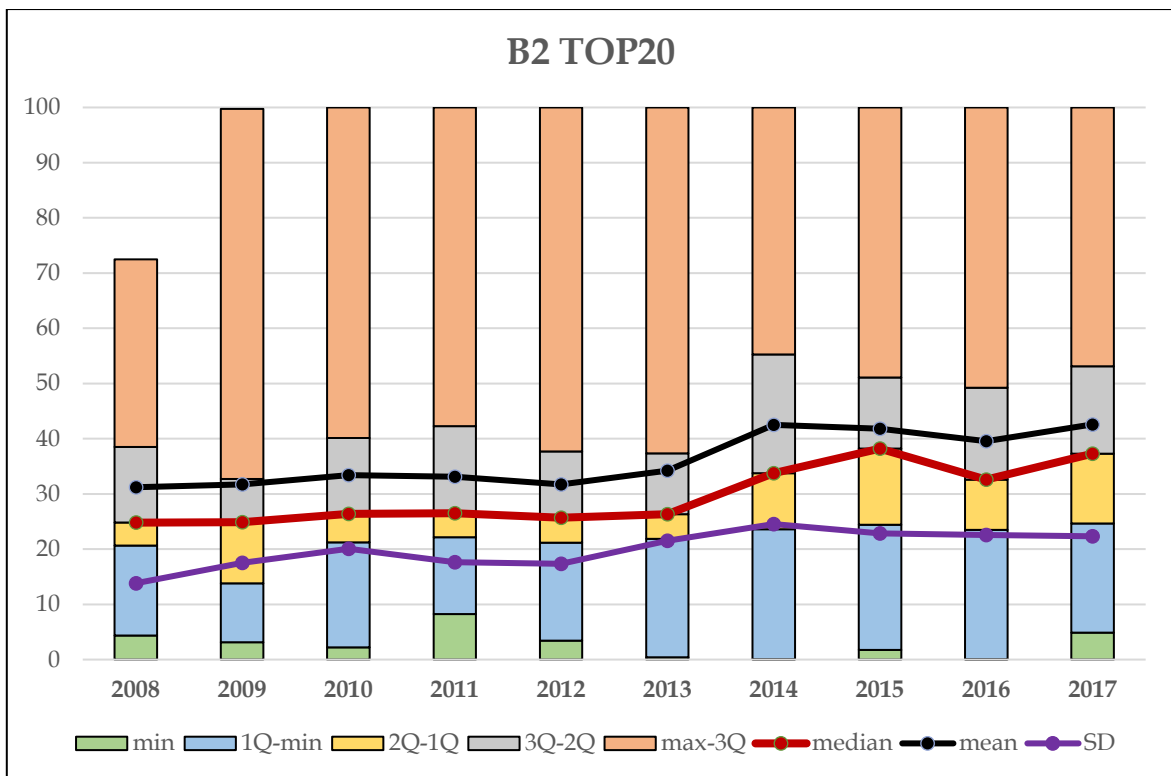


Figure 5

B1_TOTAL's widest interquartile range across time

BNP Paribas (2012)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	14.90	49.03	5.01	16.50

Caixabank (2012)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	70.21	96.21	14.87	20.37

TOTAL
stake

B1
weight

TOTAL
stake

B1
weight

	TOTAL stake	B1 weight		
Sovereign State (OECD)	10.30%	0%	0%	33.89%
Insurance Company	5.37%	100%	30%	17.66%
Bank (OECD)	2.07%	20%	20%	6.80%
Financial Advisor	1.69%	100%	20%	5.58%
Investment Manager	1.32%	100%	20%	4.36%
Investment Manager	1.05%	100%	30%	3.46%
Investment Bank (OECD)	1.03%	20%	20%	3.39%
Sovereign State (OECD)	1.01%	0%	0%	3.33%
Investment Manager	0.93%	100%	30%	3.05%
Bank (OECD)	0.82%	20%	50%	2.71%
Investment Manager	0.82%	100%	20%	2.69%
Investment Bank (OECD)	0.81%	20%	30%	2.66%
Bank (OECD)	0.50%	20%	20%	1.64%
Investment Manager	0.45%	100%	20%	1.47%
Investment Manager	0.45%	100%	30%	1.47%
Open-End Fund	0.42%	100%	20%	1.38%
Investment Manager	0.40%	100%	20%	1.32%
Open-End Fund	0.35%	100%	20%	1.17%
Investment Manager	0.30%	100%	50%	1.00%
Insurance Company	0.30%	100%	20%	0.99%

	TOTAL stake	B1 weight		
Holding Company	69.14%	100%	20%	94.75%
Bank (OECD)	1.06%	20%	30%	1.46%
Banking Foundation	1.06%	10%	20%	1.45%
Bank (OECD)	0.82%	20%	30%	1.13%
Bank (OECD)	0.31%	20%	20%	0.42%
Financial Advisor	0.16%	100%	50%	0.23%
Investment Manager	0.15%	100%	20%	0.20%
Investment Manager	0.04%	100%	20%	0.05%
Natural Person	0.03%	100%	75%	0.04%
Bank (OECD)	0.03%	20%	20%	0.04%
Investment Manager	0.02%	100%	20%	0.03%
Investment Bank	0.02%	20%	30%	0.03%
Investment Manager	0.02%	100%	20%	0.03%
Investment Manager	0.02%	100%	30%	0.02%
Investment Manager	0.02%	100%	30%	0.02%
Investment Manager	0.01%	100%	30%	0.02%
Natural Person	0.01%	100%	75%	0.02%
Investment Manager	0.01%	100%	30%	0.02%
Bank (OECD)	0.01%	20%	30%	0.02%
Investment Manager	0.01%	100%	20%	0.01%

Figure 6

B1_TOP20's widest interquartile range across time

BNP Paribas (2013)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	11.86	42.97	3.87	14.02

Brewin Dolphin (2013)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	74.62	95.18	20.00	25.51

B1
weight

TOP20
stake

B1
weight

TOP20
stake

	B1 weight		TOP20 stake
Sovereign State (OECD)	10.32%	0%	37.40%
Bank (OECD)	2.80%	20%	10.16%
Financial Advisor	1.80%	100%	6.51%
Investment Manager	1.68%	100%	6.09%
Investment Manager	1.24%	100%	4.50%
Sovereign State (OECD)	1.00%	0%	3.63%
Investment Manager	1.00%	100%	3.61%
Investment Manager	0.91%	100%	3.29%
Bank (OECD)	0.90%	20%	3.28%
Investment Bank (OECD)	0.90%	20%	3.27%
Investment Manager	0.86%	100%	3.10%
Investment Bank (OECD)	0.59%	20%	2.14%
Open-End Fund	0.56%	100%	2.04%
Investment Manager	0.55%	100%	2.01%
Open-End Fund	0.52%	100%	1.87%
Open-End Fund	0.48%	100%	1.73%
Investment Manager	0.42%	100%	1.54%
Investment Manager	0.38%	100%	1.36%
Insurance Company	0.36%	100%	1.31%
Bank (OECD)	0.32%	20%	1.15%

	B1 weight		TOP20 stake
Investment Manager	18.32%	100%	23.36%
Open-End Fund	11.71%	100%	14.94%
Insurance Company	6.12%	100%	7.81%
Investment Manager	4.97%	100%	6.34%
Investment Manager	4.01%	100%	5.11%
Bank (OECD)	3.78%	20%	4.82%
Investment Manager	3.49%	100%	4.45%
Investment Manager	3.43%	100%	4.37%
Investment Manager	3.16%	100%	4.03%
Investment Manager	2.67%	100%	3.41%
Investment Manager	2.46%	100%	3.14%
Investment Manager	2.28%	100%	2.91%
Open-End Fund	2.15%	100%	2.74%
Open-End Fund	1.99%	100%	2.54%
Insurance Company	1.97%	100%	2.51%
Investment Manager	1.44%	100%	1.84%
Investment Manager	1.38%	100%	1.76%
Natural Person	1.24%	100%	1.58%
Investment Bank (OECD)	0.94%	20%	1.20%
Investment Manager	0.89%	100%	1.13%

Figure 7

B2_TOTAL's widest interquartile range across time

Banco de Sabadell (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	15.98	85.09	8.74	46.55

	TOTAL stake		B2 weight	
Natural Person	6.91%	100%	75%	36.82%
Real-Estate Company	4.53%	100%	30%	24.14%
Bank (OECD)	2.09%	20%	20%	11.15%
Investment Manager	1.29%	100%	20%	6.86%
Open-End Fund	0.52%	100%	20%	2.79%
Natural Person	0.47%	100%	75%	2.52%
Investment Manager	0.40%	100%	20%	2.13%
Investment Manager	0.30%	100%	20%	1.57%
Local Government (OECD)	0.29%	10%	20%	1.52%
Bank (OECD)	0.28%	20%	50%	1.51%
Investment Manager	0.27%	100%	50%	1.45%
Natural Person	0.22%	100%	75%	1.18%
Investment Bank (OECD)	0.18%	20%	30%	0.98%
Investment Bank (OECD)	0.16%	20%	30%	0.87%
Investment Manager	0.16%	100%	30%	0.84%
Bank (OECD)	0.16%	20%	20%	0.83%
Bank (OECD)	0.15%	20%	50%	0.81%
Bank (OECD)	0.14%	20%	30%	0.77%
Investment Manager	0.12%	100%	50%	0.64%
Investment Manager	0.11%	100%	50%	0.61%

Banca Ifis (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	72.78	89.29	39.88	48.93

	TOTAL stake		B2 weight	
Investment Manager	56.67%	100%	50%	69.53%
Bank (OECD)	3.91%	20%	30%	4.79%
Investment Manager	3.67%	100%	30%	4.50%
Natural Person	2.53%	100%	75%	3.10%
Construction Company	2.01%	100%	75%	2.47%
Bank (OECD)	2.00%	20%	30%	2.46%
Manufacturing Company	2.00%	100%	75%	2.46%
Bank (OECD)	1.98%	20%	50%	2.43%
Investment Manager	1.06%	100%	20%	1.30%
Investment Manager	0.93%	100%	20%	1.14%
Investment Bank (OECD)	0.87%	20%	20%	1.07%
Bank (OECD)	0.72%	20%	50%	0.88%
Investment Manager	0.64%	100%	100%	0.78%
Bank (OECD)	0.58%	20%	100%	0.72%
Investment Manager	0.42%	100%	30%	0.51%
Investment Manager	0.35%	100%	50%	0.43%
Investment Manager	0.32%	100%	20%	0.39%
Bank (OECD)	0.29%	20%	30%	0.36%
Investment Bank (OECD)	0.28%	20%	30%	0.34%
Bank (OECD)	0.27%	20%	30%	0.33%

Autobank (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	41.98	98.98	8.48	20.00

	TOTAL stake		B2 weight	
Private Equity Firm	16.33%	100%	20%	38.50%
Non-Bank Lender	14.03%	100%	20%	33.08%
Investment Manager	11.51%	100%	20%	27.14%
Investment Bank (OECD)	0.54%	20%	20%	1.28%

Orey Antunes (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	88.54	100.00	45.77	51.69

	TOTAL stake		B2 weight	
Investment Manager	78.05%	100%	50%	88.16%
Natural Person	3.58%	100%	75%	4.04%
Natural Person	2.37%	100%	75%	2.67%
Service Company	2.04%	100%	20%	2.31%
Natural Person	1.35%	100%	75%	1.53%
Natural Person	1.14%	100%	75%	1.29%

Figure 8

B2_TOP20's widest interquartile range across time

BBVA (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	16.29	73.65	5.72	25.87
			B2 weight	TOP20 stake
Investment Manager	9.21%	100%	20%	41.61%
Bank (OECD)	2.87%	20%	30%	12.98%
Investment Manager	1.91%	100%	20%	8.64%
Investment Manager	1.74%	100%	20%	7.85%
Bank (OECD)	1.39%	20%	20%	6.29%
Bank (OECD)	0.61%	20%	50%	2.76%
Bank (OECD)	0.52%	20%	50%	2.37%
Holding Company	0.44%	100%	20%	1.99%
Investment Manager	0.43%	100%	100%	1.92%
Bank (OECD)	0.39%	20%	30%	1.77%
Investment Manager	0.38%	100%	50%	1.74%
Investment Manager	0.30%	100%	20%	1.35%
Local Government (OECD)	0.29%	10%	20%	1.33%
Bank (OECD)	0.29%	20%	50%	1.33%
Investment Manager	0.25%	100%	20%	1.11%
Investment Bank (OECD)	0.24%	20%	30%	1.09%
Investment Manager	0.22%	100%	30%	1.01%
Investment Bank	0.22%	20%	20%	1.00%
Investment Bank (OECD)	0.22%	20%	30%	0.98%
Bank (OECD)	0.19%	20%	30%	0.88%

KBC Groep (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	46.41	93.76	34.74	70.18
			B2 weight	TOP20 stake
Holding Company	18.55%	100%	150%	37.48%
Holding Company	11.46%	100%	20%	23.16%
Investment Manager	5.01%	100%	20%	10.12%
Investment Manager	2.92%	100%	30%	5.90%
Investment Manager	2.66%	100%	20%	5.38%
Bank (OECD)	1.71%	20%	20%	3.46%
Open-End Fund	1.14%	100%	20%	2.29%
Investment Manager	1.04%	100%	20%	2.11%
Investment Manager	0.86%	100%	30%	1.74%
Bank (OECD)	0.75%	20%	30%	1.52%
Investment Manager	0.63%	100%	30%	1.26%
Bank (OECD)	0.56%	20%	30%	1.13%
Investment Manager	0.44%	100%	20%	0.88%
Bank (OECD)	0.35%	20%	50%	0.70%
Investment Manager	0.31%	100%	20%	0.62%
Local Government (OECD)	0.24%	10%	20%	0.48%
Investment Bank (OECD)	0.23%	20%	30%	0.46%
Financial Advisor	0.22%	100%	20%	0.44%
Investment Manager	0.21%	100%	20%	0.43%
Investment Manager	0.21%	100%	30%	0.43%

Banco BPM (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	11.55	65.19	4.63	26.13
			B2 weight	TOP20 stake
Investment Manager	5.06%	100%	20%	28.54%
Bank (OECD)	2.15%	20%	50%	12.11%
Investment Manager	2.01%	100%	20%	11.32%
Investment Bank (OECD)	1.79%	20%	30%	10.10%
Bank (OECD)	1.58%	20%	20%	8.94%
Investment Manager	1.19%	100%	20%	6.73%
Investment Bank (OECD)	0.76%	20%	30%	4.32%
Open-End Fund	0.48%	100%	20%	2.73%
Insurance Company	0.40%	100%	20%	2.26%
Local Government (OECD)	0.39%	10%	20%	2.22%
Investment Manager	0.35%	100%	30%	1.96%
Bank (OECD)	0.25%	20%	20%	1.40%
Insurance Company	0.23%	100%	30%	1.31%
Bank (OECD)	0.20%	20%	50%	1.11%
Open-End Fund	0.17%	100%	20%	0.98%
Investment Manager	0.17%	100%	30%	0.93%
Bank (OECD)	0.15%	20%	30%	0.85%
Investment Bank (OECD)	0.14%	20%	30%	0.80%
Bank (OECD)	0.12%	20%	30%	0.70%
Investment Bank	0.12%	20%	30%	0.68%

Mediolanum (2014)	B1 TOTAL	B1 TOP20	B2 TOTAL	B2 TOP20
	76.59	97.51	55.36	70.48
			B2 weight	TOP20 stake
Holding Company	35.08%	100%	75%	44.67%
Holding Company	26.50%	100%	75%	33.74%
Investment Trust	3.33%	100%	75%	4.24%
Natural Person	3.32%	100%	75%	4.23%
Natural Person	3.20%	100%	75%	4.07%
Bank (OECD)	1.35%	20%	20%	1.71%
Investment Manager	1.14%	100%	20%	1.46%
Investment Bank (OECD)	0.79%	20%	30%	1.00%
Open-End Fund	0.61%	100%	20%	0.77%
Investment Manager	0.61%	100%	30%	0.77%
Investment Manager	0.46%	100%	30%	0.58%
Insurance Company	0.32%	100%	30%	0.41%
Investment Bank (OECD)	0.31%	20%	20%	0.40%
Investment Manager	0.29%	100%	20%	0.37%
Insurance Company	0.27%	100%	50%	0.34%
Investment Manager	0.26%	100%	20%	0.33%
Investment Manager	0.20%	100%	20%	0.25%
Financial Advisor	0.18%	100%	20%	0.23%
Holding Company	0.17%	100%	50%	0.22%
Investment Manager	0.16%	100%	30%	0.20%

5. Results

In Table 5 and 6, we report our model's result. Across its different measures, RWO – which, thereafter, will denote either of its four versions – performs well in explaining banks' profitability, combined with certain corporate governance characteristics. When trying to explain ROA, B2_TOTAL shows strong statistical significance (even at a 99% confidence level), followed by B1_TOP20 and B2_TOP20, whereas the coefficient of B1_TOTAL is not different from zero at any of the confidence levels considered (i.e. 90%, 95% and 99%). In particular, the sign of such association varies along with the criteria applied to construct the index: while B1_TOP20 has a negative association with ROA, B2_TOTAL and B2_TOP20 show a positive one. These last results are plainly consistent with the extant literature, which posits a positive association between banks' risk-taking and their performance: our findings suggest that more aggressive (prudent) shareholding bases yield better (worse) results as for the profitability of assets. The negative association with ROA shown by B1_TOP20 is ostensibly controversial yet may well be intended as reflecting the difference between alternative RWO versions. In fact, B1_TOP20 measures the risk-return profile implied by the identity of owners, while valorising the notion of control too. This means that, by raising the importance of a bank's top-20 owners and, also, ignoring their creditworthiness, performance turns out being lower. The underlying reason is that shareholders' "aggressiveness" is often overstated under Basel 1 and, also, the stakes held by non-bank institutional investors turn out being particularly high among the top-20 owners.

However, this idea seems to be contrasted by the B2_TOTAL coefficient being larger than the B2_TOP20 one. This may reflect the shift from a Basel 1 to a Basel 2 framework, for the latter tends to reduce the RWO gap between two banks in case the largest stakes had a very different size in one bank and were relatively similar in the other. Moreover, the acknowledgement of institutional investors' creditworthiness allows us to effectively disentangle the effect of shareholders' risk-return profile on bank's performance and risk. Hence, the association is stronger (weaker) in magnitude if we use B2_TOTAL (B2_TOP20) as focus explanatory variable. Results are very similar when we try to explain ROE, albeit the statistical significance of estimated coefficients decreases. Looking at market performance, MTB is very dimly affected by shareholders' risk-return profile, as only B2_TOTAL shows a statistically significant association with it, though very low in magnitude and just at a 90% confidence level. Results drawn by using risk measures as dependent variable show a significant negative association between B2_TOTAL and Z-SCORE. Banks with a more aggressive (prudent) shareholding base tend to be more distant (closer) to default. The statistical significance of RWO coefficients is lower if we look at market-based risk measures. In fact, while the effect on CDS is positive for B1_TOP20 (though very low in terms of magnitude), it is negative (and, still, very

small) for B2_TOTAL and B2_TOP20. This might mean that a more aggressive shareholders' risk-return profile determines a decrease of the mean CDS spread, computed over a 1-year window of daily observations. Yet, the variable's market origin might explain such evidence. In fact, while accounting risk – measured by Z-SCORE – behaves in the predicted way, *i.e.* by taking higher (lower) values in banks whose shareholding base has greater (lower) risk appetite, CDS does in the opposite way. One reason behind the divergence is that, moving from a Basel 1 to a Basel 2 framework, the lower weights attached to many institutional shareholders are not fully captured in balance sheets, for policies steered by these subjects tend to be particularly bold (that is, increase leverage and ROA volatility); at the same time, they are generally appreciated by markets for insurance against the bank's default (Erkens et al., 2012; Aebi et al., 2012), which actually require lower premia on banks showing greater RWO computed under Basel 2. This finding echoes the literature positing that the presence of long-term investors actually succeeds in reducing the risk associated with the investments they undertake (Switzer et al., 2018). Results on BETA do not show anything different from B2_TOT to affect such measure of systematic risk, computed with the same criterion as CDS. Actually, the estimated coefficient is very low: there is a very little increase – statistically significant at a 95% confidence level – of the return on bank stocks to the return on a broader market index, reflecting the bolder policy steered by a more aggressive shareholding base. On the whole, we accept Hypothesis 1, as it is strongly supported by empirical evidence: in fact, the association between RWO and various dependent variables is often statistically significant, though with remarkable differences in terms of sign, magnitude and the confidence level at which such conclusion is valid.

With regard to institutional ownership, INSTIT_OWN turns out being significant, as a variable useful to explain ROE only in the specification entailing B1_TOP20 (whose coefficient, however, does not statistically differ from zero). The same occurs to B1_TOTAL in the specification with ROA as dependent variable. We can infer that whenever RWO does not show any statistically significant association with a measure of profitability, the overly presence of institutional investors may be taken as a good replacement for it and, thus, play a very similar role. Notice that this seems to be circumscribed at a Basel 1 framework, which intrinsically fails in discerning institutional investors from categories which are risk-weighted by 100% without having “institutional” nature. Within the same specification, INSTIT_OWN exerts a positive effect on Z-SCORE, consistently with Basel 2 acknowledging the good creditworthiness – and, thus, prudent orientation – of several institutional investors, as generally agreed by the literature. Thus, we can claim that Hypothesis 2 is verified, for the presence of institutional investors is associated with better performance and lower default risk. Actually, relevant differences rise along with the discernment between accounting-based risk, on the one hand, versus market-based risk, on the other. While the former – measured

by the Bank Z-Score – seems to grow (fall) along with an increase (decrease) in RWO, the latter – measured by the mean of CDS spreads or betas – behaves in the opposite way. Hence, we may state that markets seemingly appreciate the presence of institutional investors, yet this last fails in determining “safe” financial conditions from an accounting standpoint, because of the higher leverage and more volatile profits they yield. Since RWO is strongly related to the presence of institutional investors within a bank’s top-20 owners (which is often predominant), the association between RWO and default risk is closely dependent upon computing that index under either a Basel 1 or a Basel 2 framework. By acknowledging shareholders’ creditworthiness, the latter is better suited to capture the actual quality of a subject, whereas the former takes only into account its identity: therefore, in terms of weighting coefficients, non-bank institutional investors are penalised (favoured) under Basel 1 (Basel 2). By affecting RWO levels, the use of one framework instead of another – as well as the choice about whether or not to re-proportion stakes, as if the top-20 owners held the whole of a bank’s equity or – has an impact on the sign, the magnitude and, once run the econometric tests, the statistical significance of estimated coefficients.

With regard to Hypothesis 3, INS_OWN is persistently significant toward MTB only supporting the literature which finds that greater level of insider ownership align the interests of principals and agents (Jensen and Meckling, 1976). We do not find any evidence of a strong significant relationship of INS_OWN with other performance measures.

Table 5

Panel regression – profitability and accounting-based default risk

Variables	ROA				ROE				Z-SCORE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
B1_TOTAL	-0.018 (0.016)				-0.176 ** (0.073)				-0.018 (0.017)			
B1_TOP20		-0.048 ** (0.022)				-0.123 (0.165)				0.007 (0.006)		
B2_TOTAL			0.056 *** (0.019)				0.399 ** (0.199)				-0.037 *** (0.012)	
B2_TOP20				0.033 ** (0.016)				0.186 * (0.112)				-0.012 (0.012)
instit_own	0.674 * (0.384)	0.104 (0.324)	0.002 (0.266)	0.414 (0.282)	6.640 (4.161)	4.909 * (2.617)	1.541 (1.979)	4.853 (3.028)	0.798 (0.656)	0.903 (0.680)	1.328 * (0.746)	0.929 (0.687)
ins_own	-0.063 (0.079)	-0.045 (0.088)	-0.078 (0.074)	-0.071 (0.070)	-0.289 (0.418)	-0.143 (0.388)	-0.259 (0.429)	-0.208 (0.366)	-0.597 (0.447)	-0.591 (0.457)	-0.611 (0.449)	-0.596 (0.459)
ind_dir	0.024 (0.020)	0.019 (0.019)	0.026 (0.020)	0.025 (0.020)	0.033 (0.065)	0.017 (0.070)	-0.004 (0.056)	-0.008 (0.056)	-0.005 (0.024)	-0.001 (0.024)	-0.001 (0.023)	-0.001 (0.024)
board_size	-0.239 ** (0.098)	-0.191 ** (0.091)	-0.278 *** (0.107)	-0.269 ** (0.106)	-0.160 (0.510)	-0.110 (0.619)	-0.240 (0.651)	-0.148 (0.611)	0.267 *** (0.089)	0.243 ** (0.098)	0.270 *** (0.088)	0.258 *** (0.094)
ceo_duality	0.612 (0.638)	0.345 (0.613)	0.469 (0.649)	0.731 (0.655)	2.339 (1.942)	2.000 (1.863)	1.806 (1.158)	3.447 * (2.029)	-0.135 (0.597)	-0.021 (0.632)	-0.025 (0.622)	-0.126 (0.591)
const	2.302 ** (1.078)	4.917 ** (2.144)	1.406 * (0.816)	0.969 (0.891)	5.939 (9.671)	8.346 (16.519)	2.042 (9.510)	4.093 (9.921)	-0.563 (1.970)	-1.607 (1.900)	-0.945 (1.678)	-0.875 (1.675)
Observations	319	319	319	319	319	319	319	319	296	296	296	296
R-squared	0.530	0.561	0.553	0.539	0.539	0.537	0.570	0.542	0.663	0.661	0.671	0.662
Number of bank_id	52	52	52	52	52	52	52	52	49	49	49	49

Robust standard errors in parentheses

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

Table 6

Panel regression – profitability and market-based default risk

Variables	MTB				BETA				CDS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
B1_TOTAL	0.001 (0.002)				-0.001 (0.002)				0.0116 (0.014)			
B1_TOP20		0.000 (0.001)				-0.001 (0.001)				0.030 ** (0.012)		
B2_TOTAL			0.003 * (0.002)				0.003 ** (0.001)				-0.065 ** (0.011)	
B2_TOP20				0.002 (0.002)				0.003 (0.002)				-0.052 *** (0.011)
instit_own	0.009 (0.082)	0.014 (0.085)	0.032 (0.079)	0.007 (0.080)	0.035 (0.048)	0.025 (0.055)	-0.004 (0.058)	0.014 (0.053)	-0.935 (0.567)	-0.575 (0.453)	-0.124 (0.349)	-0.481 (0.407)
ins_own	0.049 (0.030)	0.050 * (0.030)	0.050 * (0.028)	0.050 * (0.029)	0.002 (0.016)	0.002 (0.016)	0.001 (0.014)	0.001 (0.016)	0.037 (0.087)	0.026 (0.092)	0.051 (0.053)	0.042 (0.062)
ind_dir	0.005 (0.003)	0.005 (0.003)	0.005 (0.003)	0.005 (0.003)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.011 (0.010)	0.015 (0.010)	0.011 (0.007)	0.013 (0.008)
board_size	0.006 (0.022)	0.007 (0.021)	0.008 (0.021)	0.007 (0.021)	0.009 (0.018)	0.009 (0.018)	0.007 (0.018)	0.007 (0.017)	0.026 (0.060)	-0.004 (0.074)	0.064 (0.062)	0.062 (0.063)
ceo_duality	0.099 * (0.059)	0.099 * (0.058)	0.055 * (0.055)	0.092 (0.056)	0.081 (0.114)	0.074 (0.118)	0.072 (0.117)	0.091 (0.115)	0.234 (0.596)	0.402 (0.559)	0.394 (0.899)	0.029 (0.528)
const	0.966 *** (0.323)	0.905 *** (0.317)	0.915 *** (0.316)	0.889 (0.328)	1.071 *** (0.323)	1.097 *** (0.353)	1.013 *** (0.284)	0.972 *** (0.293)	1.744 ** (0.857)	0.079 (1.219)	2.423 ** (1.072)	3.269 ** (1.312)
Observations	320	320	320	320	320	320	320	320	317	317	317	317
R-squared	0.915	0.915	0.915	0.915	0.723	0.723	0.728	0.727	0.776	0.788	0.809	0.805
Number of bank_id	52	52	52	52	52	52	52	52	52	52	52	52

Robust standard errors in parentheses

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

6. Conclusions

This paper is the first to propose a methodology to measure the intrinsic risk of bank ownership as a driver of ex-ante risk-taking. We construct a Risk-Weighted Ownership index (RWO) to measure the profitability and risk-taking behaviour of a bank's ownership structure, providing evidence that shareholders' risk-appetite affects accounting and stock market performance. We also find that RWO is significant in explaining several measures of risk.

Our empirical evidence supports that RWO might be used as an early-warning indicator to signal when increasing the level of risk in bank decision-making is expected. Besides, to policy-makers, our results suggest that regulators should look at owners' risk appetite as a driver of bank risk-taking.

Excluding privately-held banks, our results underestimate the effect of the RWO index, which for private banks, due to the diverse identity of owners so as its concentration, might result in a stronger effect on bank risk and performance.

Future versions of this paper will include controls for institutional characteristics and will discuss endogeneity issues related to corporate governance studies.

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Appendix 1 – Basel 1 risk weights

Basel 1

1. 0% weight

- (a) Cash
- (b) Claims on central governments and central banks denominated in national currency and funded in that currency
- (c) Other claims on OECD central governments and central banks
- (d) Claims collateralised by cash of OECD central-government securities or guaranteed by the OECD central governments

2. 10% weight [0%, 10% or 20% at national discretion]

- (a) Claims on domestic public-sector entities, excluding central government, and loans guaranteed by such entities

3. 20% weight

- (a) Claims on multilateral development banks (IBRD, IADB, AsDB, AfDB, EIB) and claims guaranteed by, or collateralised by securities issued by such banks
- (b) Claims on banks incorporated in the OECD and loans guaranteed⁴ by OECD incorporated banks
- (c) Claims on banks incorporated in countries outside the OECD with a residual maturity of up to one year and loans with a residual maturity of up to one year guaranteed by banks incorporated in countries outside the OECD
- (d) Claims on non-domestic OECD public-sector entities, excluding central governments, and loans guaranteed by such entities
- (e) Cash items in process of collection

4. 50% weight

- (a) Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented

5. 100% weight

- (a) Claims on the private sector
- (b) Claims on banks incorporated outside the OECD with a residual maturity of over one year
- (c) Claims on central governments outside the OECD (unless denominated in national currency - and funded in that currency - see above)
- (d) Claims on commercial companies owned by the public sector
- (e) Premises, plant and equipment and other fixed assets
- (f) Real-estate and other investments (including non-consolidate investment participations in other companies)
- (g) Capital instruments issued by other banks (unless deducted from capital)
- (h) All other assets

Appendix 2 – Basel 2 risk weights

1 Exposures to sovereigns and their central banks

<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	0%	20%	50%	100%	150%	100%

2 Exposures to non-central government public sector entities (PSEs), based on external ratings

<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	20%	50%	50%	100%	150%	50%

3 Exposures to multilateral development banks (MDBs)

<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	20%	30%	50%	100%	150%	50%

4 Bank exposures (“base” risk weight)

<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	20%	30%	50%	100%	150%	100%

5 Unrated covered bond exposures (“base” risk weight)

<i>Risk weight of the issuing bank</i>	20%	30%	40%	50%	75%	100%	150%
<i>Risk weight</i>	10%	15%	20%	25%	35%	50%	100%

6 Corporate exposures

<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	20%	30%	50%	100%	150%	100%

7 Residential real-estate exposures

<i>External rating</i>	LTV ≤ 50%	50% < LTV ≤ 60%	60% < LTV ≤ 80%	80% < LTV ≤ 90%	90% < LTV ≤ 100%	LTV > 100%
<i>External rating</i>	AAA to AA-	A+ to A-	BBB+ to BB-	BB+ to B-	Below B-	Unrated
<i>Risk weight</i>	0.2	0.3	0.5	1	1.5	1

8 Retail exposures: 75% for all

We have not used Category 5 to match any of the shareholders’ identities, as it refers to securities rather than firms.

We have acknowledged the possibility of having unrated banks, something which has no match in reality (such that the BCBS had not envisaged it) but may theoretically occur in our database.

We have converted loan-to-value (LTV) figures into external ratings, keeping the standard Basel II subdivision (in a decreasing order: from AAA to AA-; from A+ to A-; from BBB+ to BBB-; from B+ to B-; below B-; and unrated).

Appendix 3 – Reconciliation of shareholders’ identity with Basel categories

Shareholders' identity	BASEL 1 Category	BASEL 2 Category
Agricultural Company	5	6
Bank (non-OECD)	5	4
Bank (OECD)	3	4
Banking Foundation	2	2
Central Bank (non-OECD)	5	1
Central Bank (OECD)	1	1
Closed-End Fund	5	4
Construction Company	5	6
Development Bank	3	3
Financial Advisor	5	6
Government Agency (non-OECD)	5	2
Government Agency (OECD)	1	2
Hedge Fund	5	6
Holding Company	5	6
Insurance Company	5	4
Investment Bank (non-OECD)	5	4
Investment Bank (OECD)	3	4
Investment Manager	5	4
Investment Trust	5	6
Local Government (non-OECD)	5	2
Local Government (OECD)	2	2
Local Investment Manager (non-OECD)	5	1
Local Investment Manager (OECD)	1	1
Manufacturing Company	5	6
Market Infrastructure	5	6
Natural Person	5	8
Non-Bank Lender	5	4
Non-Profit Organization	2	2
Open-End Fund	5	4
Pension Fund	5	4
Private Equity Firm	5	6
Real-Estate Company	5	7
Religious Institution	2	2
Service Company	5	6
Sovereign Investment Manager (non-OECD)	5	1
Sovereign Investment Manager (OECD)	1	1
Sovereign State (non-OECD)	5	1
Sovereign State (OECD)	1	1
Special Purpose Vehicle	5	6
Trade Company	5	6

‘Construction Companies’ are those committed to develop buildings and material infrastructures, whereas the business of ‘Real-Estate Companies’ is a financial one and consists in the sale and purchase of properties.

For the purpose of obtaining a categorisation compatible with Basel 1, we have discerned certain categories into OECD *vs.* non-OECD. Such discernment is irrelevant in the light of Basel 2.