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Is bank diversification a linking channel between regulatory capital and bank value?

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ABSTRACT

This study investigates the interrelationship between bank regulatory capital and bank diversification. We argue that regulatory capital might act as a substitutive mechanism of diversification to alleviate a bank's default risk. As a result, regulatory capital is likely to discourage firms from excessive diversification, which might in turn indirectly improve bank value. Using a sample of listed banks in developed countries from 2011 to 2017, we find that total regulatory capital is inversely associated with bank diversification. Narrower regulatory capital ratios only have a significant association with income-based but not with asset-based diversification. Our results also reveal an indirect effect of regulatory capital on bank value mediated by bank diversification (i.e. indirect-only mediation). Overall, our study provides novel insights into the complementarity of the institutional and strategic domains so as to understand the far-reaching implications of regulation reforms for the strategic behaviour of banking companies.

1. Introduction

This study brings together the institutional and strategic settings of banking companies. Ongoing regulatory reforms in banking urge a joint analysis of such complementary domains in order to make better sense of banks' environment and their strategic behaviour. We address the interrelationship between regulatory capital and bank diversification. Both play a part in alleviating default risk (Chiaramonte & Casu, 2017; Mehran & Thakor, 2011; Shim, 2013), which is paramount in the banking sector. In spite of this close connection between diversification strategy and the regulatory domain, the issue remains underexplored. Although much research has unveiled a number of factors which might shape this strategy's implementation and its performance (e.g. Andrés et al., 2017; Fuente & Velasco, 2020; Rudolph & Schwetzler, 2013; Santaló & Becerra, 2008), diversification in the financial industry calls for further attention (Meslier et al., 2014; Mirzaei & Kutan, 2016; Schmid & Walter, 2009).

One noticeable limitation of diversification literature stems from its focusing mainly on nonfinancial companies and the U.S. context. Several measurement complexities might have hindered a deeper analysis of diversification in the financial industry. One difficulty is that conventional valuation measures such as the 'excess value', widely used to assess the value impact of diversification, are not directly applicable to financial companies (Berger & Ofek, 1995). Another complexity is that bank diversification cannot be measured through SIC codes (the Standard Industrial Classification) due to information inconsistencies across banks and time (Elsas et al., 2010). In contrast, nonfinancial firms benefit from the use of the SIC codes and the application of the Statement of Financial Accounting Standards No. 121 that foster informativeness of segment disclosure in U.S. data.

The importance of expanding current knowledge of bank diversification has increased in recent decades. Financial liberalization

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and growing competition in the banking sector have fostered firms' expansion from traditional lending to other fee/trading-based activities (Boot & Marinc, 2007; Stiroh, 2004). Schmid and Walter (2009) report that around 39% of the value of mergers and acquisitions worldwide from 1985 to 2007 involved the financial industry. In addition, the recent financial crisis was a major shock to the banking sector and has affected banking strategies and their market valuation (Guerry & Wallmeier, 2017). Overall, this growing relevance of bank diversification contrasts with the still limited research on this strategy in the particular case of banking companies, with the exception of works such as Laeven and Levine (2007), Elsas et al. (2010), Liang et al. (2016), or Guerry and Wallmeier (2017).

Our study goes a step further by jointly analysing a bank's diversification strategy and its regulatory capital base. Earlier evidence suggests that banking capital regulation permeates the strategic field. For instance, Boot and Marinc (2007) conclude that higher capital requirements deteriorate the competitive position of weak banks, which encourages entry into the banking sector. However, although the association between a bank's capital and its corporate value has been a central concern (e.g. Berger et al., 1995), little research has explored the strategic nature of the implications of capital regulations (e.g. Boot & Marinc, 2007).

In order to narrow this gap, this research examines how a bank's regulatory capital might be associated with a bank's diversification and whether this latter strategy might be a mediating channel between regulatory capital and a bank's value.[1] Our focus on a bank's regulatory capital base is motivated by the (even greater) primary importance attached to its quality and quantity by the recent Basel III framework, which has become a core concern for policymakers and banking companies alike. Recent research has shown an interest in assessing the consequences of the Basel Accords to bank efficiency and performance (Ayadi et al., 2016; Berger & Bouwman, 2013; Chiaramonte & Casu, 2017; Fraisse et al., 2021; Le et al., 2020; Yan et al., 2012). However, to the best of our knowledge, no previous studies have dealt with the implications of this bank capital regulation for diversification and the indirect effects of regulatory capital for bank performance via the strategic sphere. Specifically, we investigate two questions: (i) Is a bank's regulatory capital base associated with a bank's level of diversification? (ii) Does a bank's diversification strategy mediate an indirect effect of regulatory capital on bank value? The answer to these questions might shed further light on the value driver mechanisms in a regulated industry such as banking by taking into account its particular idiosyncrasy.

One of our empirical findings is that higher regulatory capital is inversely associated with a bank's diversification. This is consistent with the idea that regulatory capital might serve as a substitutive mechanism of diversification to alleviate a bank's default risk. Interestingly, narrower regulatory capital ratios are only significantly associated with income-based diversification but not with asset-based diversification. As a consequence, our evidence suggests the relevance of distinguishing between different dimensions of diversification. Our results also reveal that regulatory capital does not influence bank value directly, but rather indirectly through diversification, acting as a mediator in such a relationship. As our evidence supports the existence of a diversification discount, insofar as regulatory capital restricts the level of diversification, this improves bank value.

This paper makes several contributions. First, our study adds to previous research aimed at gaining a better understanding of the far-reaching consequences of regulatory capital (Berger et al., 1995) by focusing on its association with a bank's strategy (Boot & Marinc, 2007). Capital regulations enable firms to achieve certain objectives (e.g. to reduce default risk), and a bank's greater compliance with such regulations may also be related to the implementation of strategies that serve the same purpose.

Second, we identify an alternative channel through which regulatory capital can indirectly affect bank value; namely diversification strategy. We help reconcile the mixed evidence on how a bank's capital affects its corporate value (Caprio et al., 2007; Mehran & Thakor, 2011), and make better sense of research such as Caprio et al. (2007), who support the notion that banking regulations do not enhance a bank's value but are rather primarily aimed at strengthening its governance and stability. Our work reveals that the absence of any straightforward effect of regulatory capital on bank value should not lead us to underestimate the impact which it might indirectly carry. We thus provide a better understanding of the consequences of the Basel Accords capital regulation at the strategic-level, which may prove important vis-à-vis clarifying the different performance of strategies in banks compared to those in nonfinancial companies.

The remainder of this paper proceeds as follows. Section 2 sets out our theory and hypotheses. Section 3 describes our sample, variables, models and estimation methodology. Section 4 contains our empirical findings. Section 5 describes robustness analyses. Finally, section 6 concludes.

2. Theory and hypotheses

2.1. An outline of Basel III

Banks' regulatory capital is a crucial issue as regards limiting government exposure and protecting the financial system and the real economy from bank failures (Berger et al., 1995). For this reason, bank capital has become a particular target for regulation. One of the most influential recent reforms of international capital standards for banks is the Basel III Accord, which is a comprehensive set of reform measures proposed by the Basel Committee on Banking Supervision (BCBS) to strengthen the regulation, supervision and risk management of the banking sector. The Basel III capital provisions, which will be fully effective by 2022, aim to raise not only levels of capital but also its quality (Schoenmaker, 2015) in order to strengthen the capacity to absorb potential losses and ensure financial stability (BCBS, 2017).

In broad terms, the Basel III Accord seeks to improve the resilience of the financial system by reducing bank risk-taking *ex ante* as

[1] In contrast, previous studies such as Rossi et al. (2009) address banks' economic capital (the ratio of equity to total assets) rather than regulatory capital requirement.

well as the likelihood of bank default *ex post* (Fidrmuc & Lind, 2020). The underlying logic of Basel III is that the higher the level of regulatory capital, the more resilient and safer banks will become (Le et al., 2020). The transition towards higher regulatory capital requirements is by no means free from difficulties. It imposes a number of changes on banking companies such as transitional shortfall in bank capital as a result of a gap between actual capital and the target capital ratio (Fidrmuc & Lind, 2020).

Among the requirements concerning banks' capital base, Basel III establishes that Tier 1 capital must be at least 6% of risk-weighted assets at all times, consisting of a minimum of 4.5% of common equity capital ratio and 1.5% of additional Tier 1 capital. Total capital buffer (Tier 1 capital plus Tier 2 capital) must represent at least 8% of risk-weighted assets at all times. Moreover, a minimum of 2.5% of risk-weighted assets is also required as a common equity Tier 1 capital conservation buffer (BCBS, 2017). Complementarily, Basel III includes minimum requirements for the liquidity coverage ratio and the net stable funding ratio in order to improve banks' liquidity position.

2.2. Bank capital and diversification

Default risk is a matter of paramount importance in the banking sector since banks are highly leveraged and more exposed to the risk of insolvency (Macey & O'Hara, 2003). Moreover, bank interconnectedness in the global banking system can lead the default of one bank to create contagion in the network of interbank obligations and trigger a cascading failure in the financial system as a whole (Gauthier et al., 2012). Overall, implementing adequate mechanisms to manage bank default risk proves to be crucial not only at the individual bank level but also vis-à-vis reducing the likelihood of a financial crisis.

This prominent importance of precluding bank failure has shifted attention towards different mechanisms which might curb risk-taking and alleviate bank default risk. Among them, substantial empirical evidence supports the usefulness of adequate capital endowment. A larger capital base strengthens banks' ability to absorb potential losses (Abou-El-Sood, 2016; Berger & Bouwman, 2013; Schoenmaker, 2015), thereby decreasing their default risk exposure arising from either direct losses or contagion (Gauthier et al., 2012). The need to comply with a certain level of capital adequacy ratio prompts banks to issue new equity or to decrease high-risk assets (Hyun & Rhee, 2011). Another side-effect of this bank capital regulation can arise from a bank's decision to collect outstanding loans or to become reluctant to approve new lending (Hyun & Rhee, 2011).

Earlier literature suggests that regulatory capital helps to mitigate bank exposure to default risk (Chiaramonte & Casu, 2017; Mehran & Thakor, 2011). For example, Berger and Bouwman (2013) confirm that higher capital increases the survival probability of small banks, and also does so in medium and large banks during banking crises. Chiaramonte and Casu (2017) conclude that Basel III capital standards play a significant part in curbing bank probability of default in large banks. Abou-El-Sood (2016) supports an inverse association between the capital adequacy ratios required by regulators (Tier 1 capital ratio) and the probability of distress of undercapitalized banks.

Another related stream of literature links capital management and bank risk-taking. Some works reveal that banks are motivated to undertake lower risks under more stringent capital regulation (Ding & Sickles, 2019, chap. 13; Jokivuolle & Vesala, 2007; Santos, 1998). Compliance with the Basel risk-based capital regime might discourage high-risk investments given the need to hold enough capital to absorb potential losses. Jokivuolle and Vesala (2007) confirm this idea empirically under the Basel II framework and show that risk-based capital requirements result in more efficient resource allocation. In this regard, Basel III goes a step further in reflecting risk and raising a bank's capital quality. Nevertheless, it should also be acknowledged that recent articles, such as Bitar et al. (2018), for a sample of OECD country banks, cast doubt on how effective risk-based capital ratios are when it comes to decreasing bank risk.

Moving from the regulatory level to a strategic sphere, extant literature emphasizes the usefulness of some strategies such as diversification, which firms might undertake as a means of corporate hedging. Bank diversification mitigates default risk through the coinsurance effect (Lewellen, 1971). This effect emerges as a result of combining businesses whose streams of earnings are imperfectly correlated, thereby reducing a firm's cash flow volatility. In support of this idea, Borghesi et al. (2007) report that diversification diminishes the mortality rate of industrial firms and their likelihood of bankruptcy. Similarly, Kuppuswamy and Villalonga (2016) regard the greater debt capacity of conglomerates to be the result of this strategy's ability to mitigate default risk. Additional studies confirm the default risk-reducing role of diversification in financial companies. For instance, Barth et al. (2004) report that corporate diversification is positively associated with bank stability. Shim (2013) shows that there is less risk of bankruptcy in diversified banks as a result of lower earnings volatility, and that diversification results in a need for less bank capital buffer.[2]

Based on the above discussion, we argue that a larger capital base is likely to be inversely associated with diversification for two main reasons. First, regulatory capital might act as a substitutive mechanism of diversification to alleviate bank default risk, since both serve the same purpose. As a more solid capital base enhances bank survival probability, such a lower exposure to default risk reduces the attractiveness of implementing diversification additionally, since redundancies and costs from a greater complexity of the organization might intensify (Baele et al., 2007; Liang et al., 2016). Second, since regulatory capital is felt to reduce bank risk-taking propensity (Ding & Sickles, 2019), this cut downs the need to engage in further risk-reducing practices such as diversification. Hence, we hypothesize:

[2] It is worth noting that Shim (2013) analyzes the effect of revenue diversification on bank capital buffer, defined as the difference between actual total risk-weighted capital (Tier1 plus Tier2) ratio and the minimum total required capital ratio of 8%. Both the direction of the relationship and the bank capital measure differ from our research purposes. Moreover, Shim (2013) draws on a partial adjustment framework to examine the dynamic nature of bank capital adjustment over the business cycle, which also differs from our research aim. He builds a sample of U.S. banks during 1992–2011, whereas we use an international sample during 2011–2017.

Hypothesis 1. A bank's regulatory capital base is negatively associated with the degree of bank diversification.

2.3. Diversification as a mediating channel in the relationship between regulatory capital on bank value

The impact of diversification on bank value offers fertile ground for research. The seminal article by Laeven and Levine (2007) adapts the diversification and excess value measures of nonfinancial conglomerates to financial firms. Much empirical evidence shows a diversification discount in financial conglomerates (Bressan & Weissensteiner, 2021; Elsas et al., 2010; Guerry & Wallmeier, 2017; Laeven & Levine, 2007; Schmid & Walter, 2009; Vo, 2017). Laeven and Levine (2007) attribute this finding to the severe agency problems, which might outweigh the potential benefits of diversification such as economies of scope. Schmid and Walter (2009) confirm this evidence in all types of financial intermediaries, except investment banking.

Most recent works provide an alternative standpoint for interpreting the diversification discount evidence. Using quarterly U.S. data from 2005 to 2017, Bressan and Weissensteiner (2021) document a discount in financial conglomerates, which they attribute not to inefficiencies in this strategy but rather to investor demand for higher returns to conglomerates because diversification reduces the upside potential of corporations. Recent evidence, such as Kim and Kim (2020), reveals that banks face some adjustment costs when engaging in this strategy, which leads to a diversification discount that disappears after the costly early stage of adjustment.

Another stream of works reports a diversification premium (Baele et al., 2007; Meslier et al., 2014) or a non-significant relation (Elsas et al., 2010).[3] Baele et al.'s (2007) sample only comprises European banks, and the authors explain their diversification premium as a result of the stock market's anticipation of this strategy's potential to enhance a bank's profits. Compared to their U.S. diversified counterparts, European banks enjoy a more advantageous position when implementing this strategy. They have been operating large franchises for longer and have expanded into related activities earlier (e.g. insurance). Divisional managers have also traditionally been more predisposed to cooperate with one another.

Bringing together the arguments from Hypothesis 1, which posits that regulatory capital is negatively associated with bank diversification, and previous evidence that diversification impacts bank value, it seems reasonable to explore whether diversification might be a channel through which regulatory capital requirements influence bank value. Addressing this channel might help to reconcile the mixed evidence concerning the direct impact of regulatory capital on bank value. While Berger and Bouwman (2013) conclude that greater capital increases the performance of medium and large banks, Caprio et al. (2007) find no significant direct impact of regulatory capital on bank value. They claim that the purpose of banking regulations is not to increase a bank's value but rather to strengthen its governance and stability.

Institutional factors have been subject to extensive analysis in bank diversification, and report a dissimilar performance of this strategy between developed and emerging countries (Li & Zhang, 2013; Meslier et al., 2014; Stiroh, 2004; Stiroh & Rumble, 2006). In view of this institutional relevance and the idiosyncrasy of the banking industry, regulatory frameworks such as the Basel Accords are cornerstone. Prior evidence suggests the influence of industry regulation on diversification and on a firm's performance in other regulated sectors such as electric utility (Jandik & Makhija, 2005). Again, there is little empirical evidence on the banking industry (Barth et al., 2004).

We argue that the impact of regulatory capital on bank value might be partly mediated by diversification. As Hypothesis 1 proposed, regulatory capital is likely to be negatively associated with diversification, which might reduce redundancies and coordination costs from excessive diversification (Chen et al., 2019) and trigger its more efficient implementation. Greater pursuit of Basel capital provisions is thus likely to alleviate certain inefficient managerial practices such as overinvestment, deemed to be one cause of this strategy's failure (Berger & Ofek, 1995). Overinvestment worsens in banking companies as a result of their lower cost of debt over equity finance due to deposit insurance protection, which limits depositor exposure to bank risk (Mehran et al., 2011). In addition, greater regulatory capital compliance strengthens banks' transparency and disclosure (BCBS, 2011), thereby making monitoring of managerial decisions easier (Andrés & Vallelado, 2008; Mehran & Thakor, 2011).

Altogether, we expect regulatory capital to exert an indirect positive effect on bank value by deterring inefficient diversification strategies and the overinvestment derived therefrom (Fuente & Velasco, 2020; Hoechle et al., 2012). Hence, the following hypothesis is proposed:

Hypothesis 2. Bank diversification mediates the relationship between regulatory capital and bank value.

3. Empirical analysis: data and methodology

3.1. Data sources and sample selection

We use an international sample of listed banks from 2011 to 2017, after the publication of the Basel III Accord (December 2010). Following prior works such as Elsas et al. (2010), we restrict our focus to developed countries in order to have a more homogeneous sample. Similar to their study, we consider banks from nine different countries: Australia, Canada, France, Germany, Italy, Spain, the United Kingdom, the United States, and Switzerland. We collect bank-level data from the Orbis Bank Focus database by Bureau van Dijk. Macroeconomic data are taken from the International Financial Statistics by the International Monetary Fund.

[3] The insignificant relation documented by Elsas et al. (2010) is explained on the grounds that diversification has a positive influence on a bank's value but indirectly via a bank's profitability.

In order to alleviate potential survivorship bias, we include banks delisted during the sample period (Baele et al., 2007; Guerry & Wallmeier, 2017). Following Laeven and Levine (2007), we exclude small banks with less than US$100 million of total assets (130 firm-year observations) so as to foster comparability across countries. We eliminate bank-year observations with missing values in the basic accounting variables used to compute diversification and bank value measures. To minimize the influence of outliers, all variables are winsorized at the 1% level. The final sample comprises 2881 bank-year observations corresponding to 466 different banks.[4]

Table 1 presents the distribution of sample observations across countries and years. Observations are distributed relatively uniformly across years. The representativeness of the different countries in our sample is similar to prior studies (Elsas et al., 2010). The main presence corresponds to U.S. banks and European banks, which represent about 62% and 31% of observations respectively.

3.2. Variables construction

Table 2 summarizes the main variables of our study.

3.2.1. Measures of bank value

We apply the modified version of the 'chop-shop' approach by Laeven and Levine's (2007) to compute excess value in financial companies. They draw on Tobin's Q (q) as a measure of bank valuation and define a bank i's excess value (*EXCESSVALUE*) as the difference between the actual q and the activity-adjusted q:

$$EXCESSVALUE_i = q_i - activity\ adjusted\ q_i \quad [1]$$

The activity-adjusted q estimates the q as if a bank i were split into separate single-activity financial entities. Following Laeven and Levine (2007), we consider two different activities: commercial banking (lending operations) versus investment banking. Accordingly, the activity-adjusted q is defined as follows:

$$activity\ adjusted\ q_i = \alpha_{i1} \times q^1 + \alpha_{i2} \times q^2 = \alpha_{i1} \times q^1 + (1 - \alpha_{i1}) \times q^2 \quad [2]$$

where. $\alpha_{i1} + \alpha_{i2} = 1$

α_{i1} and α_{i2} represent the percentage of bank i's total activity from commercial banking and investment banking, respectively. α_{i1} is the ratio of net loans to earning assets. q^1 and q^2 are computed based on the subsample of specialized banks within our full sample, and represent the (median) market valuation (Tobin's Q) of pure-activity banks. A bank is classified as focused on commercial banking (investment banking) if the ratio of net loans to total assets is greater than 0.90 (less than 0.10). Therefore, q^1 is calculated as the median q of all pure-activity banks in our full sample that specialize in commercial banking. Similarly, q^2 is obtained as the median q of specialized banks on investment banking within our full sample.[5]

3.2.2. Measures of bank diversification

The level of product diversification is approximated by using a continuous measure such as the Herfindahl-Hirschman index (Elsas et al., 2010; Saghi-Zedek, 2016). First, we define the Herfindahl-Hirschman index based on bank income structure (*HERFincome*), which ranges between 0 and 0.5 (Elsas et al., 2010; Kim & Kim, 2020; Saghi-Zedek, 2016; Simoens & Vennet, 2021, p. 102093). The closer this measure is to 0.5, the greater the level of diversification. It is obtained as follows:

$$HERFincome = 1 - \left[\left(\frac{\text{Interest income}}{\text{Operating income}}\right)^2 + \left(\frac{\text{Noninterest income}}{\text{Operating income}}\right)^2\right] \quad [3]$$

where operating income is calculated as the sum of interest income and non-interest income.

Second, by using loans versus other assets, we compute an asset-based Herfindahl-Hirschman index (*HERFassets*), which also ranges between 0 and 0.5 (Elsas et al., 2010):

$$HERFassets = 1 - \left(\left(\frac{\text{net loans}}{\text{total assets}}\right)^2 + \left(\frac{\text{other assets}}{\text{total assets}}\right)^2\right). \quad [4]$$

3.2.3. Measures of bank capital

As the Basel III capital provisions are still in the implementation phase, our study considers a bank's risk-based capital ratios rather

[4] Some robustness checks exclude observations with negative values in the capital variables (Stolz & Wedow, 2011) or equity (Houston et al., 1997). These comprise a total of 26 bank-year observations.

[5] As do Laeven and Levine (2007), we consider all specialized banks within our full sample to calculate median q. In their seminal article, they recommend proceeding in this way because of the limited number of observations for pure-activity banks at the country level. Our q^1 and q^2 estimates equal 0.123 and 0.240, respectively. Similar to Laeven and Levine (2007), we alleviate the limitation of this procedure by considering country and time effects to account for differences in q across country and years.

Table 1
Distribution of the sample by year and country.

PANEL A:Distribution of observations by YEAR		
	No. of observations	**% of observations**
2011	344	11.94
2012	379	13.16
2013	426	14.79
2014	435	15.10
2015	441	15.31
2016	444	15.41
2017	412	14.30
Total	**2881**	**100**
PANEL B:Distribution of observations by COUNTRY		
	No. of observations	**% of observations**
Australia	96	3.33
Canada	110	3.82
France	172	5.97
Germany	117	4.06
Italy	161	5.59
Spain	59	2.05
Switzerland	221	7.67
The UK	159	5.52
The US	1786	61.99
Total	**2881**	**100%**

This table presents the distribution of bank-year observations in our sample. The final sample consists of 2881 bank-year observations corresponding to 466 banks. Panel A shows the distribution of observations by year. Panel B contains the distribution of observations by country.

Table 2
Definition of variables.

VARIABLE	DEFINITION	SOURCE
Measures of bank value		
EXCESSVALUE	Excess value measured by Laeven and Levine (2007), calculated as the difference between the actual *q* and the activity-adjusted *q*. This latter component is the weighted average of (**median**) *q* of pure-activity banks, weighted by the relative participation of the bank in commercial banking and investment banking activities.	Orbis Bank Focus
Measures of bank diversification		
HERFincome	The income-based Herfindahl-Hirschman index based on interest versus non-interest income (Elsas et al., 2010; Saghi-Zedek, 2016).	Orbis Bank Focus
HERFassets	The asset-based Herfindahl-Hirschman index based on loans versus other assets (Elsas et al., 2010).	Orbis Bank Focus
Measures of bank regulatory capital		
CAPITAL_RWA	The ratio of total capital to risk-weighted assets of the Basel III regulatory framework.	Orbis Bank Focus
TIER1_RWA	Tier 1 capital divided by risk-weighted assets of the Basel III regulatory framework.	Orbis Bank Focus
CET1_RWA	Common Equity Tier 1 divided by risk-weighted assets of the Basel III regulatory framework.	Orbis Bank Focus
Bank-level control variables		
ASSETS	A bank's size, measured as the natural logarithm of total assets.	Orbis Bank Focus
ZSCORE	A bank's default risk, approximated by the natural logarithm of the Z-score. This latter measure is calculated as the return on assets plus the capital asset ratio, all divided by the standard deviation of the rate of return on assets (Khan et al., 2017).	Orbis Bank Focus
DEPOSITS_LIAB	A bank's funding structure calculated as deposits divided by total liabilities	Orbis Bank Focus
ASSETSgrowth	A bank's growth opportunities measured by the annual growth rate in total assets.	Orbis Bank Focus
INCOMEgrowth	A bank's past performance measured by the annual growth rate in net income.	Orbis Bank Focus
DEPOSITshare	A bank's competitive position and market power calculated as a bank's market share in total bank deposits in the country.	Orbis Bank Focus
ROA	A bank's profitability, proxied by the return on assets.	Orbis Bank Focus
dumNYSE	A dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise.	Orbis Bank Focus
Country-level control variables		
SHAREDIVERSIF	The share of diversified banks in the country.	
GDPgrowth	The annual growth rate in real Gross Domestic Product (GDP).	International Financial Statistics by the IMF
INFLATION	Inflation calculated as the annual rate of change in the Consumer Price Index (CPI).	International Financial Statistics by the IMF

Table 3
Summary descriptive statistics.

	N	Mean	Median	Std. dev.	Minimum	Maximum
EXCESSVALUE	2539	−0.0214	−0.0330	0.1102	−0.1865	0.5680
Bank diversification						
HERFincome	2517	0.3753	0.4242	0.1299	0.0000	0.4999
HERFassets	2749	0.3851	0.4135	0.1105	0.0002	0.5000
Regulatory capital						
CAPITAL_RWA	1419	0.1658	0.1494	0.0631	0.0005	0.8860
TIER1_RWA	1396	0.1471	0.1297	0.0602	0.0005	0.8860
CET1_RWA	1343	0.1388	0.1217	0.0604	0.0571	0.8860
Bank-level control variables						
ASSETS	2881	9.3422	8.9097	2.0156	4.8754	14.614
ZSCORE	2881	3.7891	3.9580	1.1184	−4.6162	7.0830
DEPOSITS_LIAB	2588	0.8378	0.8979	0.1686	0.1333	0.9954
ASSETSgrowth	2617	0.0905	0.0553	0.1790	−0.2491	0.9440
INCOMEgrowth	2616	0.0774	0.0710	1.4015	−7.6387	7.3923
DEPOSITshare	2588	0.0234	0.0008	0.0655	0.0000	0.3577
ROA	2881	0.0108	0.0086	0.0176	−0.0387	0.1700
Country-level control variables						
SHAREDIVERSIF	2881	0.3495	0.2791	0.1267	0.2084	0.6637
GDPgrowth	2881	0.0165	0.0168	0.0099	−0.0170	0.0314
INFLATION	2881	0.0141	0.0146	0.0097	−0.0050	0.0330

This table summarizes the descriptive statistics of our final sample of 2881 bank-year observations corresponding to 466 banks from 2011 to 2017. Some variables display a lower number of observations due to the existence of missing values. *EXCESSVALUE* (Laeven and Levine's excess value measure) approximates a bank's value. *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index) are two continuous measures of a bank's degree of diversification. Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), *DEPOSITshare* (a bank's competitive position measured as a bank's market share in total bank deposits in the country), and *ROA* (profitability approximated by the return on assets). Country-level control variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy), *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP), and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index).

than each bank's compliance with the Basel III capital requirements.[6] Such measures of capital in relative terms also represent a good proxy for the degree of compliance with the Basel standards. Our analyses focus on Tier 1 capital and total capital (Tier 1 plus Tier 2) since the risk-based capital requirements established by Basel III are primarily based on these. Accordingly, we consider several proxies for robustness: the ratio of total capital to risk-weighted assets (*CAPITAL_RWA*), Tier 1 capital divided by risk-weighted assets (*TIER1_RWA*), and the Common Equity Tier 1 divided by risk-weighted assets (*CET1_RWA*).

3.2.4. Control variables in the decision to diversify

We model a firm's diversification with a group of variables commonly used in earlier works (e.g. Laeven & Levine, 2007)[7]: a bank's size, measured as the natural logarithm of total assets (*ASSETS*); bank default risk, measured by the natural logarithm of the Z-score[8] (*ZSCORE*); profitability, proxied by the return on assets (*ROA*); the share of diversified banks in the economy (*SHAREDIVERSIF*), calculated as the fraction of banks classified as diversified (those with a ratio of net loans to total assets of between 0.10 and 0.90); and an indicator variable of whether the bank is listed on the NYSE (*dumNYSE*). Less profitable banks are more likely to diversify in search of new growth opportunities (Lang & Stulz, 1994). Larger banks can better exploit the economies of scope of diversification (Meslier et al., 2014). The relevance of diversified banks in the economy and belonging to a major exchange are also likely to encourage a bank's diversification. A higher proportion of diversified banks in a country might be indicative that diversification is likely to offer some competitive advantages in such an institutional setting (Campa & Kedia, 2002; Santaló & Becerra, 2008). Being listed on a major exchange such as the NYSE also favours embarking on this strategy by facilitating acquisitions/divestitures and by alleviating asymmetries of information (Campa & Kedia, 2002).

[6] In support of this, it should be pointed out that most of the banks in our sample surpass the minimum capital standards required by Basel III. Therefore, an indicator variable to capture whether a bank-year observation complies or not with the Basel capital requirements has little discriminating power.

[7] We do not control for the book value capitalization of each bank (the ratio of the book value of equity to the book value of assets) because it shows a correlation with regulatory capital measures above 0.30 and might drive multicollinearity problems. This variable displayed no statistical significance in Laeven and Levine (2007).

[8] Z-score is computed as the return of assets plus the capital asset ratio, all divided by the standard deviation of the rate of return on assets. Given the skewness of this measure, we use its natural logarithm (Khan et al., 2017). It is an inverse proxy for bank default risk.

Table 4
Spearman's correlation matrix.

	1.	2.	3.	4.	5.	6.
1. EXCESSVALUE	1.0000					
2. HERFincome	−0.1890***	1.0000				
3. HERFassets	−0.1767***	0.3969***	1.0000			
4. CAPITAL_RWA	0.1152***	−0.2587***	−0.2816 ***	1.0000		
5. TIER1_RWA	0.1380***	−0.2780***	−0.2681***	0.9499***	1.0000	
6. CET1_RWA	0.1880***	−0.3060***	−0.2352***	0.9144***	0.9815***	1.0000
7. ASSETS	−0.3662***	0.2992***	0.1472***	−0.1376***	−0.1989***	−0.1989***
8. ZSCORE	0.0060	0.1612***	0.0261	−0.0303	0.0379	0.0564**
9. DEPOSITS_LIAB	0.0883***	0.0545***	0.1958***	−0.1167***	−0.0241	−0.0288
10. ASSETSgrowth	0.1698***	−0.1221***	−0.0430**	0.0337	0.0183	0.0246
11. INCOMEgrowth	0.0292	−0.0520**	−0.0215	0.0547**	0.0712**	0.0608**
12. DEPOSITSshare	−0.3212***	0.1986***	0.1482***	−0.0933***	−0.1489***	−0.1818***
13. ROA	0.6069***	−0.2070***	−0.2157***	0.2264***	0.2624***	0.2874***
14. SHAREDIVERSIF	−0.2314***	0.1314***	−0.1561***	−0.0080	−0.0152	0.0141
15. GDPgrowth	0.0164	−0.0724***	0.0616***	0.0437*	0.0536**	0.0353
16. INFLATION	0.0199	0.0076	0.1922***	−0.1162***	−0.1564***	−0.1508***

3.2.5. *Control variables in the diversification-value relationship*

Similar to prior studies (e.g. Laeven & Levine, 2007), we control for a number of bank-level characteristics which might also affect a bank's market valuation. One control variable is a bank's size (*ASSETS*) due to its potential to provide access to economies of scope. Second, we add the Z-score (*ZSCORE*) to control for bank default risk. Third, a bank's funding structure (*DEPOSITS_LIAB*) controls for the relative weight of deposits over total liabilities. In addition, we include the annual growth rate of total assets (*ASSETSgrowth*) to control for growth opportunities and the annual growth rate of net income (*INCOMEgrowth*) to account for past performance. Finally, we control for a bank's competitive position and market power through its market share in the country's total bank deposits (*DEPOSITshare*).

As far as country-level control variables are concerned, we consider economic growth and inflation to control for the business cycle and economic conditions. They are measured by the annual growth rate in real Gross Domestic Product (*GDPgrowth*) and annual rate of change in the Consumer Price Index (*INFLATION*), respectively.

3.3. *Descriptive statistics*

Table 3 summarizes the descriptive statistics. On average, our sample displays a diversification discount (−0.02), which is also present in each country in our sample except for the UK. Our sample banks evidence a moderate degree of diversification as indicated by either the *HERFincome* (0.37) and *HERFassets* (0.38). Almost all banks meet the minimum capital thresholds set by Basel III, except for two bank-year observations (from the same bank) with the *CAPITAL_RWA* below the required 8%, and four bank-year observations (corresponding to two different banks in years between 2011 and 2013) with the *TIER1_RWA* below the required 6%. The average *CAPITAL_RWA* reaches 16.58% for the full sample.

Tables A.1. and A.2. in the Appendix provide supplementary descriptive statistics by country and year, respectively. On average, the countries showing the most negative *EXCESSVALUE* are France (−0.10) and Spain (−0.09). The UK is the only country which exhibits an average diversification premium (0.04). As far as regulatory capital is concerned, it is worth noting the cases of Germany (20.32%), Switzerland (19.32%), the UK (18.86%), and Italy (16.66%), which display above-mean values for *CAPITAL_RWA*. These countries also show above-mean values for *TIER1_RWA* and *CET1_RWA*. Table A.2. shows evidence that the performance of diversification has improved over time.

Table 4 provides the Spearman correlation coefficients. The diversification measures are negatively associated with bank value, beyond a 1% level of statistical significance. The proxies for a bank's regulatory capital base exhibit negative correlations with the diversification measures. The correlations between bank capital measures and excess value are positive and statistically significant.

3.4. *Empirical strategy*

To examine the influence of a bank's regulatory capital on the degree of diversification (Hypothesis 1), we specify this Tobit model:

$$DIVERSIFICATION^{*}_{it} = \gamma_0 + \gamma_1 \times BANKCAPITAL_{it} + \gamma_2 \times ASSETS_{it} + \gamma_3 \times ZSCORE_{it} + \gamma_4 \times ROA_{it} + \gamma_5 \times SHAREDIVERSIF_{it} + \gamma_6 \times dumNYSE_{it} + \mu_t + \varepsilon_{it} \quad [5]$$

7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1.0000									
−0.0165	1.0000								
−0.4910***	0.0829***	1.0000							
−0.1767***	−0.0335*	0.1650***	1.0000						
−0.0690***	0.0606***	0.0427**	0.0976***	1.0000					
0.7080***	−0.0982***	−0.3961***	−0.1728***	−0.0585***	1.0000				
−0.1649***	0.0215	−0.0233	0.1114***	0.1264***	−0.1367***	1.0000			
0.2168***	−0.0683***	−0.3125***	−0.1432***	−0.0387**	0.2916***	−0.0642***	1.0000		
−0.0836***	0.0795***	0.1002***	−0.0041	0.0312	−0.0524***	0.0305	−0.3257***	1.0000	
−0.0496***	−0.0656***	0.0906***	0.1126***	−0.0061	−0.0398**	−0.0280	−0.2930***	−0.2169***	1.0000

This table provides the pair-wise Spearman correlation coefficients for the main variables of our research for our final sample from 2011 to 2017. *EXCESSVALUE* (Laeven and Levine's excess value measure) approximates bank value. *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index) are two continuous measures of a bank's degree of diversification. Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), *DEPOSITshare* (a bank's competitive position measured as its market share in total bank deposits in the country), and *ROA* (profitability approximated by the return on assets). Country-level control variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy), *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP) and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index). ***, ** and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

where *DIVERSIFICATION** is a latent variable observed as $DIVERSIFICATION_{it}^* = DIVERSIFICATION_{it}$ if $DIVERSIFICATION_{it}^*>0$, and zero otherwise. Subscripts *i* and *t* indicate firm and year, respectively. ε_{it} is the random disturbance and μ_t captures year fixed effects. Standard errors are clustered by country in all regressions.[9] The dependent variable is bank diversification (either *HERFincome* or *HERFassets*). Bank capital refers to the alternative measures of regulatory capital (*CAPITAL_RWA*, *TIER1_RWA* and *CEtier1_RWA*). In accordance with Hypothesis 1, we expect to obtain $\gamma_1 < 0$, such that bank regulatory capital is inversely associated with a bank's level of diversification. Control variables include a bank's size (*ASSETS*), bank default risk (*ZSCORE*), profitability (*ROA*), the share of diversified banks in the country (*SHAREDIVERSIF*) and an indicator variable of whether the bank is listed on the NYSE (*dumNYSE*). We estimate equation [5] by using a censored regression approach such as Tobit because the dependent variable of diversification is bounded below zero (Amemiya, 1984; Chen et al., 2016). As zeros in the diversification variables are true zeros in a corner solution setting (and not assigned values to missing data), Amore and Murtinu (2021) note that Tobit models are better suited than OLS.

To test the mediating effect posited by Hypothesis 2, equation [5] is one of the conditions to be fulfilled, as given by a significant relationship between the independent variable (regulatory bank capital) and the mediator (bank diversification) (condition (i)). Moreover, Baron and Kenny (1986) established three additional conditions when testing for mediating effects: (ii) a direct effect, given by a significant relationship between the independent variable and the dependent variable (excess value) (equation [6]); (iii) the mediator is significantly related to the dependent variable (equation [7]); and finally, (iv) the impact of the independent variable on the dependent variable lessens (partial mediation) or becomes no longer significant (full mediation) after the inclusion of the mediator (equation [8]). Subsequent studies such as Zhao et al. (2010) have raised concerns about the potential misapplication of Baron and Kenny's (1986) approach. They point out that the only requirement for mediation should be that the indirect effect must be significant. There can still be mediation without any need for a significant direct effect between the independent variable (regulatory capital) and the dependent variable (excess value) (therefore, condition (ii) is not indispensable). In cases such as indirect-only mediation, the direct effect might not exist, but an indirect effect may still occur. The reason could be that the impact of the independent variable on the dependent variable captures the "total effect" given by the sum of the indirect path and the direct path, which could be of the opposite sign and therefore, offset each other. Therefore, to find support for our Hypothesis 2, bank capital does not necessarily have to display a statistically significant coefficient in equation [6] and [8], although we do expect bank diversification to have a negative and statistically significant effect on excess value (i.e. $\beta_1 < 0$ and $\delta_1 < 0$ in equations [7] and [8], respectively), thereby suggesting its

[9] In addition to clustering standard errors by country, we include year fixed effects to account for the time effect. This econometric solution (Thompson, 2011) simultaneously handles, in our case, country and time effects. Two of the main advantages of cluster-adjusted standard errors by country are that they allow us to deal with correlation among residuals over time and that they offset the loss of degree of freedom by reducing the number of dummy variables included in the model.

mediating role in the association between a bank's regulatory capital and excess value.

$$EXCESSVALUE_{it} = \lambda_0 + \lambda_1 \times BANKCAPITAL_{it} + \lambda_2 \times Bank - level\ controls_{it} + \lambda_3 \times Country - level\ controls_{jt} + \mu_t + \varepsilon_{it} \quad [6]$$

$$EXCESSVALUE_{it} = \beta_0 + \beta_1 \times DIVERSIFICATION_{it} + \beta_2 \times Bank - level\ controls_{it} + \beta_3 \times Country - level\ controls_{jt} + \mu_t + \varepsilon_{it} \quad [7]$$

$$EXCESSVALUE_{it} = \delta_0 + \delta_1 \times DIVERSIFICATION_{it} + \delta_2 \times BANKCAPITAL_{it} + \delta_3 \times Bank - level\ controls_{it} + \delta_4 \times Country - level\ controls_{jt} + \mu_t + \varepsilon_{it} \quad [8]$$

where ε_{ijt} is random disturbance, and μ_t indicates year fixed effects. Standard errors are clustered by country in all regressions. The dependent variable is Laeven and Levine's (2007) excess value. *BANKCAPITAL* refers to the alternative regulatory capital measures. As proxies for diversification, we apply the income-based Herfindahl-Hirschman index (*HERFincome*) and the asset-based Herfindahl--Hirschman index (*HERFassets*), alternatively. The set of bank-level control variables comprises a bank's size (*ASSETS*), bank default risk (*ZSCORE*), funding structure (*DEPOSITS_LIAB*), growth opportunities (*ASSETSgrowth*), past performance (*INCOMEgrowth*), and competitive position (*DEPOSITshare*). The group of country-level variables includes the economic cycle (*GDPgrowth*) and inflation (*INFLATION*). Models [6] to [8] are estimated by ordinary least squares (OLS) with fixed effects to control for unobservable heterogeneity.

4. Empirical results

4.1. Univariate analyses

A set of mean-comparison analyses based on t-tests are conducted to identify the differences in both the degree of diversification and bank valuation across banks depending on their relative regulatory capital (above or below the sample median). Table 5 provides the difference-of-means tests. Panel A explores whether above-sample median and below-sample median capital observations differ in their average levels of diversification. Panel B assesses whether above-sample median and below-sample median capital observations differ in their average excess values.

As Panel A shows, banks whose regulatory risk-based capital ratios are above the sample median exhibit lower diversification. All differences of means prove statistically significant (above the 1% level), suggesting that higher capitalized banks engage in diversification to a lesser extent, which is consistent with Hypothesis 1. Panel B displays the difference-of-means tests in terms of bank valuation between above-median and below-median capitalized banks. These differences attribute a higher valuation of diversification to higher capitalized banks. For example, *EXCESSVALUE* is 1.08 percentage points higher in higher capitalized banks (in terms of *CAPITAL_RWA*) compared to lower capitalized ones. This difference becomes most pronounced (about 3.63 percentage points) when we consider the Common Equity Tier 1 capital ratio. These results provide some preliminary insights into the importance of the relative amount of regulatory capital when valuing a bank's diversification strategy.

4.2. Regulatory capital base and the diversification strategy

Table 6 contains the Tobit regressions of equation [5] of bank diversification. Columns (1) to (4) show the estimates using

Table 5
Mean-comparison tests.

PANEL A: MEAN-COMPARISON TESTS FOR THE LEVEL OF DIVERSIFICATION			
Mean values	**Below sample median *CAPITAL_RWA***	**Above sample median *CAPITAL_RWA***	**Difference-of-means test**
HERFincome	0.3953	0.3655	0.0298***
HERFassets	0.3927	0.3696	0.0231***
	Below sample median *TIER1_RWA*	**Above sample median *TIER1_RWA***	**Difference-of-means test**
HERFincome	0.3974	0.3655	0.0319***
HERFassets	0.3966	0.3715	0.0251***
	Below sample median *CET1_RWA*	**Above sample median *CET1_RWA***	**Difference-of-means test**
HERFincome	0.4036	0.3625	0.0411***
HERFassets	0.3982	0.3730	0.0252***
PANEL B: MEAN-COMPARISON TESTS FOR BANK VALUATION			
Mean values	**Below sample median *CAPITAL_RWA***	**Above sample median *CAPITAL_RWA***	**Difference-of-means test**
EXCESSVALUE	−0.0278	−0.0170	−0.0108**
	Below sample median *TIER1_RWA*	**Above sample median *TIER1_RWA***	**Difference-of-means test**
EXCESSVALUE	−0.0354	−0.0097	−0.0257***
	Below sample median *CET1_RWA*	**Above sample median *CET1_RWA***	**Difference-of-means test**
EXCESSVALUE	−0.0391	−0.0028	−0.0363***

This table presents univariate tests (mean comparison t-tests) on the difference in diversification (*HERFincome* and *HERFassets*) and bank valuation (*EXCESSVALUE*) between banks with regulatory capital ratios below and above the sample median. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

HERFincome. When statistically significant, control variables present the expected signs. A larger size and lower profitability are positively associated with bank income diversification. Also, a lower default risk (i.e. a higher *ZSCORE*) is positively related to income diversification. A higher *SHAREDIVERSIF* is also found to be positively related to the level of income diversification. Our findings support Hypothesis 1, suggesting a significant negative association between a bank's capital and its diversification. Results are consistent with the idea that this corporate strategy and a bank's capital might serve as substitutive mechanisms to mitigate a bank's default risk. For instance, a one standard deviation increase in *CAPITAL_RWA* is associated with a reduction in *HERFincome* of 3.27 percentage points.

Columns (5) to (8) display the robustness estimations by using asset-based diversification (*HERFassets*). Here, only *CAPITAL_RWA* retains statistical significance and supports Hypothesis 1. If *CAPITAL_RWA* increases by one standard deviation, *HERFassets* falls by 2.67 percentage points. The remaining capital variables (*TIER1_RWA* and *CEtier1_RWA*) have a negative association with diversification, but are not statistically significant. This finding suggests that banking companies are unwilling to restrict their asset-based diversification strategy, in spite of having a stronger regulatory capital base.

These results yield interesting implications. First, they reveal the importance of a two-fold analysis of diversification (income-based versus asset-based diversification). Second, our results support Hypothesis 1 concerning total regulatory capital: a higher *CAPITAL_RWA* has an inverse association with both income-based and asset-based diversification. Narrower capital ratios (i.e. Tier 1 capital and Common Equity Tier 1) only have a significant impact on diversification undertaken at the income but not the asset dimension. These findings can be explained by some additional benefits granted by asset-based diversification to banking companies, which make them reluctant to forego this strategy. In this regard, previous research considers asset diversification to have the greatest effect on market power (Lin et al., 2021), and leads banks to avoid excessive concentration towards loans, thereby leading them to suffer less if loans start non-performing or defaulting (Ghosg, 2018).

4.3. Bank regulatory capital base, diversification and excess value

We depart from the baseline equation [6] to estimate the direct path between bank regulatory capital and excess value. Columns (1) to (3) of Table 7 provide the OLS estimates with fixed effects. We find that the direct effect exhibits no statistical significance. However, this should not mislead us into concluding the absence of any mediating effect. As Zhao et al. (2010) note, mediation can still occur in the form of indirect-only mediation. We therefore proceed by estimating the effect of diversification on a bank's value (equation [7])

Table 6
Banks' regulatory capital and diversification.

	Dependent variable: *HERFincome*				Dependent variable: *HERFassets*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.1018	0.2137***	0.2248***	0.2405***	0.3549***	0.3409***	0.3503***	0.3326***
	(0.0663)	(0.0680)	(0.0564)	(0.0502)	(0.0787)	(0.3409)	(0.0416)	(0.0466)
ASSETS	0.0184***	0.0172***	0.0149***	.0130***	0.0097	0.0149**	0.0127**	0.0125**
	(0.0036)	(0.0038)	(0.0033)	(0.0031)	(0.0077)	(0.0064)	(0.0054)	(0.0050)
ZSCORE	0.0239***	0.0141*	0.0143*	0.0150**	0.0031	−0.0026	−0.0027	−0.0021
	(0.0070)	(0.0087)	(0.0084)	(0.0078)	(0.0074)	(0.0060)	(0.0063)	(0.0058)
ROA	−2.0082***	−2.0663***	−2.1533***	−2.0610***	−1.8164***	−0.6883	−0.8208	−1.1902**
	(0.3537)	(0.3952)	(0.4067)	(0.5340)	(0.5566)	(0.6565)	(0.6420)	(0.5684)
SHAREDIVERSIF	0.0503	0.1123***	0.1295***	0.1507***	−0.1918**	−0.0438	−0.0372	−0.0364
	(0.0673)	(0.0416)	(0.0373)	(0.0348)	(0.0943)	(0.0742)	(0.0665)	(0.0643)
dumNYSE	−0.0180	−0.0088	−0.0050	−0.0053	−0.0085	−0.0042	−0.0012	−0.0008
	(0.0121)	(0.0125)	(0.0122)	(0.0121)	(0.0079)	(0.0092)	(0.0083)	(0.0092)
Regulatory capital								
CAPITAL_RWA		−0.5176**				−0.4240*		
		(0.2186)				(0.2356)		
TIER1_RWA			−0.5457***				−0.3875	
			(0.1862)				(0.2778)	
CEtier1_RWA				−0.6433***				−0.2595
				(0.1380)				(0.2180)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2522	1301	1288	1247	2749	1392	1371	1320

This table provides the Tobit estimation results of equation [5]. The dependent variable is a bank's degree of diversification, which is approximated by *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets) and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level explanatory variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *ROA* (profitability approximated by the return on assets) and *dumNYSE* (a dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise). Country-level explanatory variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7
Diversification, regulatory capital and bank valuation.

	Dependent variable: *EXCESSVALUE*										
	Regulatory capital			Diversification		Diversification & Regulatory capital					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Intercept	0.0142	0.0203	−0.0298	0.0161	0.1128	−0.0095	−0.0397	−0.0757	0.0192	0.0259	−0.0273
	(0.0912)	(0.0953)	(0.0963)	(0.0462)	(0.0770)	(0.0842)	(0.0728)	(0.0791)	(0.0882)	(0.0952)	(0.0967)
HERFincome				−0.1238***		−0.1141*	−0.1059*	−0.0986*			
				(0.0328)		(0.0541)	(0.0549)	(0.0541)			
HERFassets					−0.0663				−0.0531	−0.0550	−0.0855***
					(0.0530)				(0.0415)	(0.0360)	(0.0231)
Regulatory capital											
CAPITAL_RWA	0.0760					−0.0897			0.0559		
	(0.0813)					(0.0947)			(0.0788)		
TIER1_RWA		−0.0075					−0.0944			−0.0276	
		(0.0790)					(0.1142)			(0.0939)	
CEtier1_RWA			0.1137					0.0172 (0.1485)			0.1020
			(0.1296)								(0.1391)
Control variables											
ASSETS	−0.0136	−0.0128	−0.0113	−0.0066	−0.0127	−0.0089	−0.0076	−0.0070	−0.0126	−0.0119	−0.0097
	(0.0080)	(0.0077)	(0.0072)	(0.0038)	(0.0076)	(0.0056)	(0.0047)	(0.0048)	(0.0078)	(0.0074)	(0.0066)
ZSCORE	0.0038	0.00443	0.0035	0.0073***	0.0026	0.0073**	0.0084***	0.0074**	0.0037	0.0043	0.0032
	(0.0030)	(0.0026)	(0.0027)	(0.0021)	(0.0036)	(0.0025)	(0.0024)	(0.0024)	(0.0030)	(0.0027)	(0.0027)
DEPOSITS_LIAB	0.0291*	0.0237	0.0429	−0.0224	−0.0777**	0.0759***	0.0825**	0.0928***	0.0381**	0.0336	0.0608*
	(0.0154)	(0.0219)	(0.0306)	(0.0428)	(0.0274)	(0.0211)	(0.0824)	(0.0234)	(0.01740)	(0.0196)	(0.0283)
ASSETSgrowth	0.0475**	0.0537**	0.0514**	0.0277**	0.0460**	0.0299**	0.0360**	0.0330**	0.0480**	0.0537**	0.0507**
	(0.0165)	(0.0181)	(0.0162)	(0.0118)	(0.0193)	(0.0124)	(0.0120)	(0.0109)	(0.0167)	(0.0188)	(0.0168)
INCOMEgrowth	0.0002	0.0005	0.0001	−0.0002	0.0004	−0.0007	−0.0006	−0.0009	0.0002	0.0005	−0.0001
	(0.0002)	(0.0030)	(0.0033)	(0.0017)	(0.0015)	(0.0031)	(0.0030)	(0.0030)	(0.0031)	(0.0030)	(0.0033)
DEPOSITshare	−0.0899	−0.1036	−0.1166	−0.2151	−0.1837	−0.0906	−0.1044	−0.1158	−0.0830	−0.0959	−0.1060
	(0.1548)	(0.1463)	(0.1393)	(0.1609)	(0.1825)	(0.1358)	(0.1236)	(0.1203)	(0.1448)	(0.1379)	(0.1264)
GDPgrowth	0.4542	0.4556	0.5758	0.7201*	0.6210*	0.2785	0.2412	0.3809	0.4392	0.4473	0.5700
	(0.5013)	(0.4749)	(0.4736)	(0.3315)	(0.3192)	(0.4048)	(0.4075)	(0.4189)	(0.4936)	(0.4725)	(0.4756)
INFLATION	3.1082***	3.2052***	3.5764***	3.9991***	4.2999***	2.9447***	3.0507***	3.4403***	3.1926***	3.2773***	3.6969***
	(0.7125)	(0.7434)	(0.6802)	(1.1656)	(1.1913)	(0.6643)	(0.7918)	(0.7644)	(0.7240)	(0.7629)	(0.7013)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1200	1188	1164	2112	2215	1147	1137	1116	1200	1188	1164
F-statistic	-	-	-	-	-	-	-	-	-	-	-
R^2	0.3406	0.3458	0.3496	0.3049	0.2689	0.4006	0.4074	0.4105	0.3433	0.3486	0.3561

This table presents the fixed-effects OLS estimation results of equation [6] (columns (1) to (3)), equation [7] (columns (4) and (5)), and equation [8] (columns (6) to (11)). The dependent variable is *EXCESSVALUE* (Laeven and Levine's excess value measure). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Measures of bank diversification are: *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), and *DEPOSITshare* (a bank's competitive position measured as its market share in total bank deposits in the country). Country-level control variables include: *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP) and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 8
Sobel test results of mediation.

Independent variable	Mediator	Dependent variable	Sobel test (z)
CAPITAL_RWA	HERFincome	EXCESSVALUE	7.0390***
CAPITAL_RWA	HERFassets	EXCESSVALUE	5.2220***
TIER1_RWA	HERFincome	EXCESSVALUE	7.1500***
TIER1_RWA	HERFassets	EXCESSVALUE	4.9790***
CEtier1_RWA	HERFincome	EXCESSVALUE	7.6180***
CEtier1_RWA	HERFassets	EXCESSVALUE	5.3440***

This table displays the Sobel test results of the statistical significance of the indirect effect of different regulatory capital variables on a bank's value through the mediating variable of bank diversification. The dependent variable is *EXCESSVALUE* (Laeven and Levine's excess value measure). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). The measures of bank diversification are: *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 9
Changes in regulatory capital and diversification: influence on a bank's default risk.

	Dependent variable: *ZSCORE*					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	3.8004***	3.8124***	3.8008***	3.7678***	3.7803***	3.7763***
	(0.0044)	(0.0045)	(0.0045)	(0.0043)	(0.0043)	(0.0044)
Diversification						
ΔHERFincome	−0.0010	−0.0009	−0.0022			
	(0.0082)	(0.0082)	(0.0084)			
ΔHERFassets				−0.0047	−0.0326	−0.0427
				(0.0355)	(0.0449)	(0.0569)
Regulatory Capital						
ΔCAPITAL_RWA	0.1103***			0.1237***		
	(0.0266)			(0.0264)		
ΔTIER1_RWA		0.1494***			0.1599***	
		(0.0257)			(0.0255)	
ΔCEtier1_RWA			0.1426***			0.1493***
			(0.0257)			(0.0256)
N	927	915	876	995	977	929
F-statistic	8.58***	16.90***	15.49***	11.00***	19.87***	17.19***

This table presents the fixed-effects OLS estimation results of the influence of changes in diversification and regulatory capital on a bank's default risk. Measures of yearly changes in bank diversification are: Δ*HERFincome* (the yearly percentage change in the income-based Herfindahl-Hirschman index) and *HERFassets* (the yearly percentage change in the asset-based Herfindahl-Hirschman index). Measures of yearly changes in regulatory capital are: Δ*CAPITAL_RWA* (the yearly percentage change in the ratio of total capital to risk-weighted assets), Δ*TIER1_RWA* (the yearly percentage change in the ratio of Tier 1 capital to risk-weighted assets), and Δ*CET1_RWA* (the yearly percentage change in the ratio of Common Equity Tier 1 to risk-weighted assets). Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

and compare our sample results with previous literature. Columns (4) and (5) of the same table report the results. Our evidence supports a diversification discount in banks, which is statistically significant in income-based diversification ($\beta = -0.1238$, $p = 0.005$). Asset-based diversification has a negative effect on *EXCESSVALUE*, but displays no statistical significance. As regards economic significance, if *HERFincome* increases by one standard deviation, *EXCESSVALUE* decreases by about 1.61 percentage points.

Next, we expand our baseline model by including regulatory capital (equation [8]). Columns (6) to (11) of Table 7 display these estimations. Results remain similar. The diversification discount persists and is statistically significant for *HERFincome* (and gains statistical significance for *HERFassets* when we control for *CEtier1_RWA*)[10]. The economic significance of the diversification discount decreases when controlling for regulatory capital. Bank regulatory capital fails to be statistically significant across all regressions. This finding agrees with prior evidence, such as Caprio et al. (2007) who find no significant direct effect of regulatory capital on bank value. However, we should not discard the possibility that regulatory capital might carry an indirect effect through another variable (e.g. in our study, bank diversification) and that indirect-only mediation might exist.

[10] It is worth noting that, whereas *HERFincome* drops in magnitude and statistical significance the narrower the regulatory capital variables, the opposite is observed for *HERFassets*. This may be due to the different correlations displayed between diversification and regulatory capital variables. For *HERFincome*, the highest correlation is reached with *CET1_RWA*. As a consequence, this might lead to the coefficient size of *HERFincome* weakening when the two variables enter simultaneously. In contrast, the opposite pattern occurs with *HERFassets*: the correlation of this diversification proxy is weaker for narrower bank capital measures. In all cases, the variance inflation factors (all below 2) rule out multicollinearity problems.

To this end, we draw on the Sobel approach (Sobel, 1982) to test the significance of the mediating (indirect) effect of regulatory capital through bank diversification.[11] This econometric procedure tests the null hypothesis of no difference between the direct effect of regulatory capital and the indirect effect through bank diversification. The Sobel test has been applied in earlier accounting literature (Abdel-Maksoud et al., 2016).

Table 8 summarizes the results of the Sobel test. The coefficient of the z-statistic is statistically significant at the 1% level in all cases and leads to the null hypothesis of no difference between the direct and indirect effects being rejected. This test supports Hypothesis 2 that bank diversification mediates the relationship between regulatory capital and bank value. Therefore, given the lack of significance of the direct association between bank regulatory capital and excess value, our findings support the existence of an indirect relationship in the form of indirect-only mediation. Regulatory capital impacts bank value indirectly, and this indirect effect is channelled via diversification. Insofar as regulatory capital is inversely related to diversification (statistically significantly for asset-based diversification), this in turn translates into higher excess values indirectly, since diversification is associated with a value discount in our sample.

5. Robustness analyses[12]

5.1. *Regulatory capital and diversification: additional tests*

This section explores further the underlying mechanisms which might drive the negative association between regulatory capital and bank diversification. Specifically, we analyse how yearly changes in regulatory capital and diversification impact a bank's default risk. In light of our previous findings that a bank's capital is negatively associated with diversification, we expect regulatory capital to have a more prominent role in reducing a bank's default risk, which might restrict a bank's need to draw on further costly risk-reducing strategies such as diversification. Table 9 reports these estimations. Changes in bank diversification have no significant impact on a bank's default risk (*ZSCORE*). In contrast, yearly increases in regulatory capital lead to an increase in the *ZSCORE*, which means lower bank default risk. These results agree with the idea that diversification and a bank's capital serve as substitutive mechanisms to mitigate a bank's default risk. Since we find that regulatory capital has the largest and most significant effect, this might be one of the underlying mechanisms which motivate banks with a strong regulatory capital base to be reluctant to engage in diversification.

5.2. *Supplementary robustness checks*

First, were diversification strategy and bank capital strategy simultaneously determined by bank managers, reverse causality would be likely to play a role in our empirical setting. To mitigate potential endogeneity concerns, we re-estimate equation [5] to test Hypothesis 1 by applying the instrumental variable Tobit, similar to earlier works (Machokoto et al., 2021). We instrument bank regulatory capital by taking the yearly median ratio of total capital to risk-weighted assets by country (*countryCAPITAL*). Table A.3. in the Appendix contains these robustness checks. In columns (1) to (3) using *HERFincome*, the Wald test of exogeneity does not lead to the null hypothesis of exogeneity being rejected. Overall, our main evidence remains supportive of a negative association between regulatory capital and bank diversification. Moreover, it is worth noting that all regulatory capital variables display statistical significance in all regressions (both for income-based and asset-based diversification).

Second, we evaluate the robustness of our results when observations with negative equity and/or negative regulatory capital are excluded from the sample. Tables A.4. and A.5. in the Appendix show these robustness estimations. Table A.4. shows that our results remain robust. Total regulatory capital is negatively and significantly related to both income-based diversification and asset-based diversification, although the other regulatory capital ratios only have a significant negative association with income-based diversification. Table A.5. confirms that the diversification discount is statistically significant for *HERFincome* in most cases. Again, individual regulatory capital variables exhibit no statistically significant effect on excess value directly.

Third, we perform additional robustness analyses in a subsample corresponding to the time window 2013–2017. This is because although the Basel III Accord was issued in 2010, regulatory adaptation by many countries commenced in 2013.[13] Results confirm our earlier findings of a bank's diversification discount and that higher risk-based regulatory capital ratios palliate the negative impact of diversification. Similarly, banks with greater capital ratios are negatively associated with diversification. Therefore, a bank's regulatory capital appears to have a substitutive effect with diversification.

Finally, we report further robustness results about the negative association of regulatory capital with bank diversification by considering additional bank buffers. We define *TIER1ADD_RWA* as the sum of Tier 1 capital plus additional Tier 1 divided by risk-weighted assets of the Basel III regulatory framework. This variable has more missing values and for this reason we restrict its use

[11] The *sgmediation* command in STATA is applied to compute the Sobel test.

[12] In order to consider business practice, we interviewed seven managers from European banks by email during July–August 2021. We thank an anonymous referee for this suggestion. The survey is available upon request. It is worth noting that three of the seven managers agreed that they make decisions in line with the direction explored in this study. Based on a 5-point Likert scale, these three managers selected an agreement rate of four regarding this statement: "Since regulatory capital reduces bank risk-taking propensity, there is less need to engage in further risk-reducing practices (i.e. diversification)"

[13] For example, in the European Union through Directive 2013/36/EU and Regulation (EU) no. 575/2013). These robustness analyses are available upon request.

Table 10
Banks' regulatory capital and diversification: Robustness analyses by considering additional capital.

	Panel A:Full sample	
	Dependent variable: *HERFincome*	Dependent variable: *HERFassets*
Intercept	0.2714***	0.3855***
	(0.0237)	(0.0236)
ASSETS	0.0126***	0.0061*
	(0.0018)	(0.0035)
ZSCORE	0.0046	−0.0050
	(0.0036)	(0.0034)
ROA	−1.5997***	−0.9678*
	(0.5574)	(0.5396)
SHAREDIVERSIF	0.0915***	−0.0425**
	(0.0915)	(0.0209)
dumNYSE	−0.0109	−0.0020
	(0.0068)	(0.0057)
Regulatory capital		
TIER1ADD_RWA	−0.3212**	−0.0219
	(0.1284)	(0.1746)
Year fixed effects	Yes	Yes
Cluster country	Yes	Yes
N	1030	1052
	Panel B:Excluding observations with negative equity and/or negative capital	
	Dependent variable: *HERFincome*	**Dependent variable: *HERFassets***
Intercept	0.2693***	0.3841***
	(0.0234)	(0.0227)
ASSETS	0.0129***	0.0062*
	(0.0017)	(0.0034)
ZSCORE	0.0044	−0.0050
	(0.0036)	(0.0035)
ROA	−1.7556***	−1.1118**
	(0.4728)	(0.4875)
SHAREDIVERSIF	0.0961***	−0.0371
	(0.0134)	(0.0229)
dumNYSE	−0.0106	−0.0016
	(0.0071)	(0.0053)
Regulatory capital		
TIER1ADD_RWA	−0.3235**	−0.0198
	(0.1275)	(0.1717)
Year fixed effects	Yes	Yes
Cluster country	Yes	Yes
N	1022	1043

This table provides the Tobit estimation results of equation [5] by considering additional regulatory capital. The dependent variable is a bank's degree of diversification, which is approximated by *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measure is *TIER1ADD_RWA* (the sum of Tier 1 capital plus additional Tier 1 divided by risk-weighted assets). Bank-level explanatory variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *ROA* (profitability approximated by the return on assets) and *dumNYSE* (a dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise). Country-level explanatory variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

to this robustness section. Table 10 illustrates these results. Our main result also holds: *TIER1ADD_RWA* is significantly and negatively related to income-based diversification, yet displays no statistically significant association with asset-based diversification.

5.3. Endogeneity

One widespread concern in this area of research involves the potential endogeneity affecting the relation between diversification and a firm's value. Such endogeneity could be rooted in two sources. One is the non-random nature of a bank's diversification decision (self-selection bias) since the same bank-level characteristics which stimulate the decision to engage in this strategy might also affect a bank's value (Campa & Kedia, 2002; Laeven & Levine, 2007). The other source of endogeneity concerns the reverse causality resulting from a bank's past performance influencing subsequent strategic decisions such as diversification.

To mitigate potential endogeneity, we perform robustness estimations for equation [7] to test Hypothesis 2 by using two-stage least squares (2SLS) with instrumental variables (IV) (Larcker & Rusticus, 2010). In the presence of endogeneity, 2SLS estimates are more efficient and consistent than OLS ones. However, finding relevant and strong instruments proves to be a challenging task since there

Table 11
Diversification, regulatory capital and bank valuation: 2SLS robustness estimations.

	PANEL A:First-stage estimation results					
	Dependent variable: *HERFincome*			Dependent variable: *HERFassets*		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.4248***	−0.3859***	−0.2680**	0.0481	0.0362	−0.0522
	(0.1067)	(0.1081)	(0.1140)	(0.0790)	(0.0801)	(0.0831)
countryDIV	0.7745***	0.6671***	0.6672**	0.3230*	0.3261*	0.3719**
	(0.2509)	(0.2513)	(0.2634)	(0.1852)	(0.1866)	(0.1912)
dumNYSE	−0.0425***	−0.0390***	−0.0369***	−0.0289***	−0.0253***	−0.0298***
	(0.0109)	(0.0109)	(0.0108)	(0.0086)	(0.0086)	(0.0083)
Regulatory capital						
CAPITAL_RWA	−0.3586***			−0.3357***		
	(0.0737)			(0.0535)		
TIER1_RWA		−0.3786***			−0.2899***	
		(0.0734)			(0.0568)	
CEtier1_RWA			−0.5724***			−0.0847
			(0.0791)			(0.0596)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
N	1147	1137	1116	1200	1188	1164
Cragg-Donald Wald F statistic	12.67***	10.11***	9.17***	7.48***	6.08***	8.45***

	PANEL B: Second-stage estimation results Dependent variable: *EXCESSVALUE*					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0716**	0.0536	0.0512	0.2281***	0.2228***	0.1398***
	(0.0330)	(0.0336)	(0.0318)	(0.0586)	(0.0589)	(0.0415)
HERFincome	−0.2612**	−0.2182*	−0.1960			
	(0.1234)	(0.1362)	(0.1436)			
HERFassets				−0.5679**	−0.5061**	−0.3578*
				(0.2483)	(0.2668)	(0.2156)
Regulatory capital						
CAPITAL_RWA	−0.0373			−0.0323		
	(0.0651)			(0.0989)		
TIER1_RWA		−0.0482			−0.0818	
		(0.0709)			(0.0962)	
CEtier1_RWA			0.0280			0.1368**
			(0.0987)			(0.0571)
Control variables						
ASSETS	−0.0056	−0.0053	−0.0059*	−0.0060	−0.0067	−0.0066
	(0.0038)	(0.0040)	(0.0035)	(0.0044)	(0.0045)	(0.0042)
ZSCORE	0.0066**	0.0073***	0.0061**	0.0037	0.0038	0.0013
	(0.0026)	(0.0027)	(0.0027)	(0.0025)	(0.0024)	(0.0021)
DEPOSITS_LIAB	0.0711**	0.0706**	0.0652**	0.0625*	0.0583	0.0633*
	(0.0329)	(0.0369)	(0.0314)	(0.0336)	(0.0386)	(0.0380)
ASSETSgrowth	0.0074	0.0139	0.0117	0.0236	0.0289*	0.0291**
	(0.0136)	(0.0137)	(0.0142)	(0.0160)	(0.0162)	(0.0152)
INCOMEgrowth	−0.0007	−0.0004	−0.0008	0.0012	0.0012	0.0001
	(0.0015)	(0.0015)	(0.0015)	(0.0018)	(0.0018)	(0.0016)
DEPOSITshare	0.0211	0.0081	−0.0050	0.1562**	0.1257	0.0595
	(0.0412)	(0.0419)	(0.0440)	(0.0808)	(0.0857)	(0.0678)
GDPgrowth	−0.5250*	−0.5206*	−0.5028	−0.2128	−0.2547	−0.3391
	(0.3188)	(0.3146)	(0.3163)	(0.4140)	(0.4133)	(0.3684)
INFLATION	0.8580	0.6906	0.6501	0.3745	0.1987	0.2472
	(0.6480)	(0.6483)	(0.6599)	(0.7645)	(0.7561)	(0.7182)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
N	1147	1137	1116	1200	1188	1164
F-statistic	37.76***	39.21***	37.92***	25.99***	27.31***	30.38***
Sargan overidentification test p-value	0.3640	0.3886	0.3278	0.3790	0.1884	0.1064
Durbin-Wu-Hausman statistic	1.74	0.79	0.55	5.10**	3.08*	1.35

This table presents the two-step least squares (2SLS) estimation results of equation [8]. Panel A reports the results of the first-stage estimation, in which the dependent variable is bank diversification. The exclusion restrictions are: *dumNYSE* (a dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise) and the yearly median value of diversification by country (*countryDIV*). Panel B reports the results of the second-stage estimation, in which the dependent variable is *EXCESSVALUE* (Laeven and Levine's excess value measure). The measures of bank diversification are: *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), and *DEPOSITshare* (a bank's competitive position measured as its market share in total bank deposits in the country). Country-level control variables include: *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP) and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. The Cragg-Donald Wald F-statistic tests for weak instruments. The Sargan test of overidentifying restrictions evaluates instrument validity. The Durbin-Wu-Hausman statistic tests for endogeneity in our analyses. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

are no perfect instruments. We use two instrumental variables for bank diversification: *dumNYSE* and yearly median diversification by country (*countryDIV*).[14] These variables are considered by prior literature to affect the diversification decision as a result of their connection to firm size, firm visibility in capital markets, and industry competition strategy (Guerry & Wallmeier, 2017; Laeven & Levine, 2007; Schmid & Walter, 2009). Choosing *countryDIV* as the instrument is grounded on the idea that there might be country-specific factors which shape the attractiveness of diversification (Laeven & Levine, 2007; Santaló & Becerra, 2008). *dumNYSE* might carry mixed effects: on the one hand, firms traded in major exchanges such as the NYSE may find it easier to engage in growth strategies such as diversification (Laeven & Levine, 2007); on the other hand, firms listed on the NYSE might be discouraged from diversifying to a greater extent since their larger size and greater visibility might impose coordination costs and complexities on them (Chen et al., 2019). As explained below, both instruments satisfy the conditions of instrument relevance (i.e. non-zero correlation with the endogenous variable of bank diversification) and instrument validity (i.e. not correlated with the error term).

In the first stage model, the potentially endogenous variable (bank diversification) is regressed on all explanatory variables and on our two chosen instruments for diversification (these latter ones playing the role of exclusion restrictions). Table 11 (Panel A) reports the first-stage results. The Cragg-Donald Wald F-statistic (Cragg & Donald, 1993) tests the null hypothesis that the instruments are weakly identified. This test leads to the null hypothesis of weak instruments being rejected, thereby supporting the notion that our instruments fulfil the relevance condition. Being listed in the NYSE deters additional diversification, while firms operating in countries with higher levels of diversification are encouraged to diversify further. In the second stage, the fitted diversification variables obtained from the previous stage are entered as independent variables together with the standard control variables in order to explain excess value. Panel B of Table 11 shows the second-stage results. The adequacy of our instrumental variables is further examined by the Sargan test of overidentifying restrictions (Sargan, 1958), which does not reject the null hypothesis of instrument validity. The Durbin-Wu-Hausman statistic evaluates the null hypothesis that bank diversification is exogenous. When this statistic does not lead to the null hypothesis of exogeneity being rejected, we can assume that our earlier OLS estimates are consistent. Anyway, both OLS and 2SLS provide similar evidence for our hypothesis.

Additionally, we conduct robustness 2SLS regressions by applying alternative instruments for bank diversification, other than dummy variables (*dumNYSE*).[15] To do so, we combine our previous instrumental variable *countryDIV* with another continuous variable (*RENEWABLE*). *RENEWABLE* is the percentage of electricity production which comes from renewable sources in each country. Data about this variable are publicly available from the World Bank's World Development Indicators database. The number of total observations drop since data for *RENEWABLE* are currently available until 2015.[16] The literature suggests that environmentally-friendly practices alleviate a firm's risk (Cai et al., 2016). A greater commitment to renewable energy sources in the country might promote stronger environmental commitment in companies, which in turn might lead them to rely on alternative risk-reducing strategies such as diversification to a lesser extent. These robustness results appear in Table A.6. of the Appendix. Overall, results remain similar and bank capital displays no statistical significance in most regressions when bank diversification is considered. In this case, the Durban-Hu-Hausman statistic supports the existence of endogeneity to a greater extent. The remaining tests confirm the adequacy of these alternative instrumental variables.

6. Conclusions

Regulatory capital is cornerstone in banking activity since it serves as a buffer to absorb potential losses and preserve financial stability. This research explores the interrelationship between two mitigating mechanisms of default risk: regulatory capital and bank diversification. This is of interest because the banking industry is subject to a number of regulatory constraints which affect strategic decision-making. Moreover, linking a bank's regulatory capital and the diversification strategy proves particularly important given the focus of the Basel provisions on raising the levels and quality of banks' capital and because of previous literature, which suggests that the Basel reforms impact bank efficiency and performance (Ayadi et al., 2016; Berger & Bouwman, 2013; Yan et al., 2012). Interestingly, our analyses are conducted during a time window after the publication of the most recent Basel Accord, the Basel III.

Using an international sample of developed countries from 2011 to 2017, we find empirical evidence that a stronger total regulatory capital base is inversely associated with bank diversification. This finding can be explained by a risk-reducing substitution effect of banks' capital on the diversification strategy. Narrower regulatory capital ratios only have a significant influence on income-based

[14] We base this median on *HERFincome*. Our main results remain robust when using *HERFassets* to compute the instrumental variable of the yearly median diversification by country.

[15] We thank the Editors for this suggestion.

[16] See the World Bank official website: https://data.worldbank.org/indicator/EG.ELC.RNWX.ZS?view=chart.

diversification but not on asset-based diversification. In addition, our study identifies a mediating variable (bank diversification) which channels an indirect effect of regulatory capital on bank value. Similar to much of the earlier literature, our results evidence a diversification discount. As a consequence, since regulatory capital is negatively related to the level of diversification, this is likely to indirectly lead to better bank performance. More specifically, our evidence supports the existence of indirect-only mediation. Overall, evidence suggests the close connection between diversification and regulatory capital in shaping banking companies' performance.

This study's results have important implications for policy makers. Regulations in matters of bank capital not only encourage banks to increase their capital levels in an effort to ensure financial stability but can also trigger further consequences for each bank's corporate strategy. This study provides interesting insights into how regulatory capital can model a bank's strategic behaviour and indirectly affect its value through corporate strategies such as bank diversification.

Our work opens up a number of important avenues for future research. First, future investigation should broaden the spectrum of the implications of the latest Basel III framework by adopting a cross-disciplinary approach. Such a wider perspective emerges as promising in terms of making better sense of the effectiveness of banking regulations accounting for the idiosyncrasy of this industry in numerous domains (e.g. strategic behaviour, competition, corporate governance, …). Second, further work could shed light on the consequences of Basel III by distinguishing between different diversification profiles (e.g. related/unrelated diversification) and by exploring other widely used strategies in the banking industry such as internationalization. Likewise, it would be insightful to decompose bank diversification into a finer level of detail (Kimball, 1997; Simoens & Vennet, 2021, p. 102093) and consider product diversification across customer groups (e.g. individuals, SMEs, large corporations).[17] For instance, it might be of interest to explore the type of customers in which a bank's loan-based activity is diversified and the length of the relationship the bank has with each of them. This could lead to address the role of relationship banking (i.e. which can affect the costs of engaging in diversification (Meslier et al., 2014)) in the association between bank capital and bank diversification.

Third, another interesting avenue to expand our work could be aimed at considering the phased implementation and release of revised documents of Basel III for banks operating in different jurisdictions (BIS, 2020) in order to conduct exogenous tests of changes in capital. Moreover, it could be insightful to exploit exogenous shocks such as the current COVID-19 crisis as a natural experiment to assess the interplay of bank capital and bank diversification as insurance mechanisms (Simoens & Vennet, 2021, p. 102093). This might also help delve into the causality between the two. Additionally, another central issue that still remains is to investigate additional principles established by Basel III, such as leverage ratio and liquidity requirements, in order to build a more comprehensive picture of the implications of this regulatory framework. Given that the Basel Committee decisions have no legal power, it still remains a challenge for future research to elucidate whether the mandatory or voluntary nature of banking regulation influences the intensity of its strategic consequences. Finally, similar to Graham and Harvey (2001) who assess the math between the corporate finance theory and business practice by CFOs, it would prove insightful to adopt a survey approach and conduct interviews with a large sample of bank managers. This could help to reach a more comprehensive understanding about how they see the interplay between regulatory capital and bank diversification strategies when making their business practice decisions.

Declaration of competing interest

None.

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APPENDIX

Table A.1
Mean values by country

	Descriptive statistics of variables by country								
	AUSTRALIA	CANADA	FRANCE	GERMANY	ITALY	SPAIN	SWITZERLAND	The UK	The US
EXCESSVALUE	−0.0069	−0.0084	−0.1018	−0.0549	−0.0692	−0.0885	−0.0551	0.0429	−0.0073
Bank diversification									
HERFincome	0.3335	0.4136	0.4152	0.3208	0.4272	0.4476	0.3580	0.3627	0.3705
HERFassets	0.3575	0.3862	0.3162	0.3177	0.3847	0.4243	0.2881	0.3678	0.4093
Regulatory capital									
CAPITAL_RWA	0.1524	0.1563	0.1549	0.2032	0.1666	0.1366	0.1932	0.1886	0.1563

(*continued on next page*)

[17] We thank an anonymous reviewer for this suggestion.

Table A.1 (*continued*)

	Descriptive statistics of variables by country								
	AUSTRALIA	CANADA	FRANCE	GERMANY	ITALY	SPAIN	SWITZERLAND	The UK	The US
TIER1_RWA	0.1339	0.1276	0.1356	0.1723	0.1434	0.1223	0.1835	0.1600	0.1404
CET1_RWA	0.1168	0.1212	0.1280	0.1547	0.1410	0.1203	0.1793	0.1572	0.1316
TIER1ADD_RWA	0.1262	0.1407	0.1284	0.1599	0.1455	0.1313	0.2011	0.1657	0.1473
Bank-level control variables									
ASSETS	9.8668	10.479	9.8144	9.3819	9.9447	11.772	9.6500	9.7942	8.9829
ZSCORE	3.8612	3.7226	4.2337	3.8226	2.6928	3.2961	4.3726	2.9219	3.8644
DEPOSITS_LIAB	0.6344	0.7256	0.7877	0.7358	0.7188	0.7758	0.7550	0.7405	0.8917
ASSETSgrowth	0.0181	0.0422	0.0332	0.0219	0.0607	0.0496	0.0464	0.1086	0.1120
INCOMEgrowth	0.1827	0.0222	0.2320	0.2146	−0.3520	0.1451	−0.0011	0.1062	0.0924
DEPOSITshare	0.1111	0.0833	0.0495	0.0542	0.0427	0.1095	0.0327	0.0652	0.0041
ROA	0.0120	0.0115	0.0153	0.0086	0.0069	0.0043	0.0077	0.0208	0.0105
Country-level control variables									
SHAREDIVERSIF	0.4210	0.5384	0.5252	0.3225	0.6637	0.6637	0.4602	0.2084	0.2791
GDPgrowth	0.0252	0.0168	0.0119	0.0181	0.0013	0.0106	0.0793	0.0172	0.0179
INFLATION	0.0252	0.0156	0.0088	0.0120	0.0112	0.0106	−0.0013	0.0178	0.0164

This table summarizes the mean values of the variables by country.

Table A.2
Mean values by year

	Descriptive statistics of variables by year						
	2011	2012	2013	2014	2015	2016	2017
EXCESSVALUE	−0.0665	−0.0565	−0.0118	−0.0167	−0.0183	0.0004	0.0037
Bank diversification							
HERFincome	0.3803	0.3783	0.3821	0.3746	0.3723	0.3698	0.3704
HERFassets	0.4017	0.3985	0.3877	0.3817	0.3821	0.3745	0.3737
Regulatory capital							
CAPITAL_RWA	0.1522	0.1628	0.1667	0.1768	0.1619	0.1755	0.1590
TIER1_RWA	0.1246	0.1359	0.1452	0.1548	0.1456	0.1569	0.1435
CET1_RWA	0.1182	0.1304	0.1382	0.1457	0.1369	0.1479	0.1340
TIER1ADD_RWA	0.1287	0.1404	0.1405	0.1539	0.1464	0.1590	0.1417
Bank-level control variables							
ASSETS	9.2874	9.2552	9.2927	9.2809	9.3452	9.3682	9.5521
ZSCORE	3.7563	3.8231	3.7591	3.7617	3.7792	3.7941	3.8501
DEPOSITS_LIAB	0.8316	0.8449	0.8443	0.8375	0.8332	0.8384	0.8339
ASSETSgrowth	0.0894	0.0926	0.0713	0.0821	0.0651	0.0891	0.1433
INCOMEgrowth	0.0160	0.0319	0.0338	0.0864	0.1460	0.0517	0.1323
DEPOSITshare	0.0258	0.0236	0.0231	0.2047	0.0226	0.0225	0.0234
ROA	0.0065	0.0089	0.0114	0.0114	0.0113	0.0123	0.0127
Country-level control variables							
SHAREDIVERSIF	0.3526	0.3430	0.3491	0.3496	0.3514	0.3504	0.3504
GDPgrowth	0.0165	0.0166	0.0137	0.0232	0.0235	0.0155	0.0053
INFLATION	0.0278	0.0191	0.0133	0.0133	0.0016	0.0092	0.0088

This table summarizes the mean values of the variables by year.

Table A.3
Banks' regulatory capital and diversification: Instrumental variable Tobit estimations

	Dependent variable: *HERFincome*			Dependent variable: *HERFassets*		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.3001***	0.2812***	0.2639***	0.5389***	0.5191***	0.5061***
	(0.0731)	(0.0686)	(0.0687)	(0.1009)	(0.0676)	(0.0594)
ASSETS	0.0159***	0.0134***	0.0121***	0.0109*	0.0075	0.0054
	(0.0033)	(0.0030)	(0.0024)	(0.0058)	(0.0053)	(0.0048)
ZSCORE	0.0137*	0.0152*	0.0158**	−0.0047	−0.0015	0.0009
	(0.0082)	(0.0085)	(0.0077)	(0.0067)	(0.0047)	(0.0044)
ROA	−1.7441**	−1.8923**	−1.9353**	0.6614	0.3539	0.2860
	(0.8219)	(0.8012)	(0.8446)	(1.0801)	(0.8459)	(0.7774)
SHAREDIVERSIF	0.1125***	0.1399***	0.1601***	−0.0134	0.0050	0.0324
	(0.0425)	(0.0353)	(0.0353)	(0.0653)	(0.0512)	(0.0554)
dumNYSE	−0.0120	−0.0059	−0.0055	−0.0102	−0.0032	−0.0031
	(0.0130)	(0.0118)	(0.0122)	(0.0121)	(0.0094)	(0.0088)
Regulatory capital						
CAPITAL_RWA	−0.9978**			−1.5141***		
	(0.4935)			(0.5905)		

(*continued on next page*)

Table A.3 (*continued*)

	Dependent variable: *HERFincome*			Dependent variable: *HERFassets*		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
TIER1_RWA		−0.9108**			−1.4216***	
		(0.4336)			(0.4269)	
CEtier1_RWA			−0.8094*			−1.4043***
			(0.4495)			(0.3784)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
Wald Chi2	1878.17***	5277.74***	1645.00***	26.45***	26.71***	513.41***
P-value of Wald test of exogeneity	0.2168	0.3503	0.6795	0.0641	0.0199	0.0024
N	1301	1288	1247	1392	1371	1320

This table provides the instrumental variable Tobit estimation results of equation [5]. The dependent variable is a bank's degree of diversification, which is approximated by *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets) and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). We instrument each bank's regulatory capital variable by taking the yearly median ratio of total capital to risk-weighted assets by country (*countryCAPITAL*). Bank-level explanatory variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *ROA* (profitability approximated by the return on assets) and *dumNYSE* (a dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise). Country-level explanatory variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table A.4
Banks' regulatory capital and diversification: Robustness regressions excluding observations with negative equity and/or negative regulatory capital

	Dependent variable: *HERFincome*				Dependent variable: *HERFassets*			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Intercept	0.1007	0.2132***	0.2237***	0.2399***	0.3547***	0.3408***	0.3500***	0.3329***
	(0.0669)	(0.0683)	(0.0569)	(0.0505)	(0.0789)	(0.0459)	(0.0422)	(0.0462)
ASSETS	0.0185***	0.0174***	0.0151***	0.0131***	0.0097	0.0149**	0.0127**	0.0124**
	(0.0036)	(0.0038)	(0.0034)	(0.0031)	(0.0077)	(0.0064)	(0.0054)	(0.0049)
ZSCORE	0.0238***	0.0139	0.0140*	0.0147*	0.0033	−0.0029	−0.0030	−0.0023
	(0.0069)	(0.0087)	(0.0084)	(0.0078)	(0.0033)	(0.0059)	(0.0062)	(0.0057)
ROA	−2.0208***	−2.1263***	−2.2136***	−2.1225***	−1.9308***	−0.7537	−0.8876	−1.256**
	(0.3527)	(0.3908)	(0.4026)	(0.5329)	(0.5181)	(0.6542)	(0.6298)	(0.5583)
SHAREDIVERSIF	0.0532	0.1168***	0.1338***	0.1553***	−0.1892**	−0.0402	−0.8876	−0.0322
	(0.0674)	(0.0422)	(0.0378)	(0.0359)	(0.0951)	(0.0749)	(0.0673)	(0.0655)
dumNYSE	−0.0180	−0.0085	−0.0047	−0.0049	−0.0078	−0.0038	−0.0009	−0.0004
	(0.0122)	(0.0127)	(0.0124)	(0.0124)	(0.0084)	(0.0093)	(0.0084)	(0.0093)
Regulatory capital								
CAPITAL_RWA		−0.5252**				−0.4235*		
		(0.2223)				(0.2333)		
TIER1_RWA			−0.5482***				−0.3835	
			(0.1883)				(0.2720)	
CEtier1_RWA				−0.6484***				−0.2631
				(0.1409)				(0.2158)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2508	1293	1280	1239	2737	1383	1362	1311

This table provides the Tobit estimation results of equation [5] excluding bank-year observations with negative equity and/or negative regulatory capital from the sample. The dependent variable is a bank's degree of diversification, which is approximated by *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets) and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level explanatory variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *ROA* (profitability approximated by the return on assets) and *dumNYSE* (a dummy variable which equals 1 if the bank is listed on the NYSE, and 0 otherwise). Country-level explanatory variables include: *SHAREDIVERSIF* (the share of diversified banks in the economy). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients.***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table A.5
Banks' regulatory capital and diversification: Robustness regressions excluding observations with negative equity and/or negative regulatory capital

	Dependent variable: *EXCESSVALUE*					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.0094	−0.0407	−0.0753	0.0195	0.0257	−0.0272
	(0.0843)	(0.0722)	(0.0794)	(0.0883)	(0.0952)	(0.0967)
HERFincome	−0.1181*	−0.1099*	−0.1025			
	(0.0572)	(0.0581)	(0.0573)			
HERFassets				−0.0589	−0.0609	−0.0916***
				(0.0404)	(0.0359)	(0.0234)
Regulatory capital						
CAPITAL_RWA	−0.0951			0.0527		
	(0.0961)			(0.0825)		
TIER1_RWA		−0.0977			−0.0294	
		(0.1156)			(0.0929)	
CEtier1_RWA			0.0125			0.0984
			(0.1484)			(0.1334)
Bank-level control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country-level control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
N	1143	1133	1112	1195	1183	1159
Adjusted-R^2	0.4015	0.4083	0.4109	0.3430	0.3485	0.3559

This table presents the fixed-effects OLS estimation results of equation [8] excluding bank-year observations with negative equity and/or negative regulatory capital from the sample. The dependent variable is *EXCESSVALUE* (Laeven and Levine's excess value measure). The measures of bank diversification are: *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), and *DEPOSITshare* (a bank's competitive position measured as its market share in total bank deposits in the country). Country-level control variables include: *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP) and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table A.6
Diversification, regulatory capital and bank valuation: 2SLS robustness estimations using alternative instruments

	PANEL A: First-stage estimation results					
	Dependent variable: *HERFincome*			Dependent variable: *HERFassets*		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.2882	−0.2393	−0.1052	0.1403	0.1509	0.0155
	(0.2463)	(0.2455)	(0.2559)	(0.1975)	(0.1981)	(0.2038)
countryDIV	0.7864	0.7438	0.8147	0.4056	0.3397	0.4894
	(0.5557)	(0.5492)	(0.5755)	(0.4509)	(0.4497)	(0.4637)
RENEWABLE	−1.2197**	−1.1309**	−1.0555*	−0.7198*	−0.6901	−1.0074**
	(0.5579)	(0.5534)	(0.5661)	(0.4384)	(0.4394)	(0.4444)
Regulatory capital						
CAPITAL_RWA	−0.2980***			−0.4913***		
	(0.1034)			(0.0758)		
TIER1_RWA		0.5534***			−0.4247**	
		(0.1032)			(0.0856)	
CEtier1_RWA			−0.6239***			−0.1327
			(0.1164)			(0.0942)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
N	525	517	499	552	544	524
Cragg-Donald Wald F statistic	5.41***	4.80***	4.55***	2.81*	2.39*	4.92***
	PANEL B: Second-stage estimation results Dependent variable: *EXCESSVALUE*					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0501	0.0162	0.0506	0.3248***	0.3464***	0.1839***
	(0.0475)	(0.0469)	(0.0535)	(0.1192)	(0.1272)	(0.0651)
HERFincome	−0.3944**	−0.4020**	−0.4277**			
	(0.1909)	(0.2040)	(0.2184)			

(*continued on next page*)

Table A.6 (*continued*)

HERFassets				−0.8740*	−0.9416*	−0.6581**
				(0.4665)	(0.5230)	(0.3095)
Regulatory capital						
CAPITAL_RWA	−0.1370			−0.2850		
	(0.0881)			(0.2446)		
TIER1_RWA		−0.1976**			−0.4340*	
		(0.0974)			(0.2461)	
CEtier1_RWA			−0.2622			−0.0882
			(0.1620)			(0.1035)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster country	Yes	Yes	Yes	Yes	Yes	Yes
N	525	517	499	552	544	524
F-statistic	15.28***	15.07***	13.70***	8.31***	7.46***	10.26***
Sargan overidentification test p-value	0.4484	0.3346	0.4141	0.5609	0.5160	0.5588
Durbin-Wu-Hausman statistic	2.4423	2.5689*	2.8815*	6.3890***	6.2633***	5.3018**

This table presents the two-step least squares (2SLS) estimation results of equation [8]. Panel A reports the results of the first-stage estimation, in which the dependent variable is bank diversification. The exclusion restrictions are: the yearly median value of diversification by country (*countryDIV*) and the percentage of country-level electricity production which comes from renewable sources (*RENEWABLE*). Panel B reports the results of the second-stage estimation, in which the dependent variable is *EXCESSVALUE* (Laeven and Levine's excess value measure). The measures of bank diversification are: *HERFincome* (the income-based Herfindahl-Hirschman index) and *HERFassets* (the asset-based Herfindahl-Hirschman index). Regulatory capital measures are *CAPITAL_RWA* (the ratio of total capital to risk-weighted assets), *TIER1_RWA* (the ratio of Tier 1 capital to risk-weighted assets), and *CET1_RWA* (the ratio of Common Equity Tier 1 to risk-weighted assets). Bank-level control variables comprise: *ASSETS* (a bank's size as measured by the logarithm of total assets), *ZSCORE* (a bank's default risk, proxied by the natural logarithm of the Z-score), *DEPOSITS_LIAB* (a bank's funding structure captured by the ratio of total deposits to total liabilities), *ASSETSgrowth* (growth opportunities measured by the annual growth rate in total assets), *INCOMEgrowth* (past performance approximated by the annual growth rate in net income), and *DEPOSITshare* (a bank's competitive position measured as its market share in total bank deposits in the country). Country-level control variables include: *GDPgrowth* (the economic cycle given by the annual growth rate in real GDP) and *INFLATION* (inflation measured by the annual rate of change in the Consumer Price Index). Year fixed effects and clustered standard errors by country are included in all regressions. Standard errors are reported in parentheses under coefficients. The Cragg-Donald Wald F-statistic tests for weak instruments. The Sargan test of overidentifying restrictions evaluates instrument validity. The Durbin-Wu-Hausman statistic tests for endogeneity in our analyses. ***, ** and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

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