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Asset diversification and banks' market value

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Overview

In this note we study the effect of asset diversification on the market value of banks, measured by the price-to-book ratio (PTB). An empirical analysis on a sample of 92 listed European banks over the period 2011-17 shows that the costs of diversification outweigh its benefits. In particular, there exists a negative relationship between asset diversification and the PTB of European banks. This negative relationship is stronger for large financial intermediaries, including global systemically important banks (G-SIBs).

1. Introduction and conclusions

Since the beginning of the global financial crisis banks' price-to-book ratios (PTBs) have persistently declined across banks and countries. The PTB – defined as the ratio of the market value of capital to the accounting value for a listed firm – quantifies the expectations of how much value is created from a specific composition of assets and liabilities (the 'franchise value'). Differences between market and accounting values, i.e. values of the PTB other than one, can derive from investors' assessment of banks' risks and expectations of future profits.

Despite improvements in banking sector prospects in recent years, due to a more favorable financial environment and regulatory changes aimed at adjusting the sector, the PTBs are lower than one for a large number of banks in Europe. Moreover, market values exhibit a high variance across intermediaries, even those within the same country (Figure 1).

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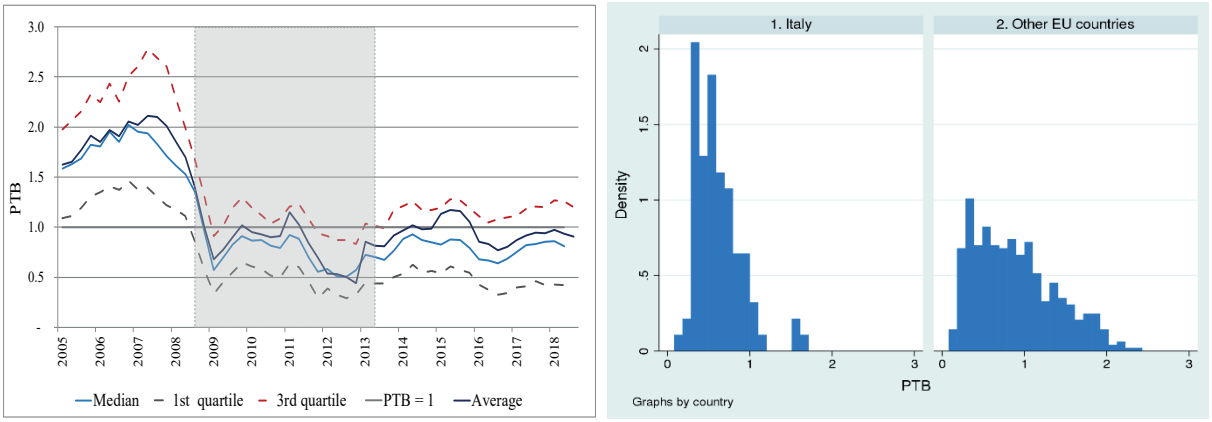
Figure 1: PTB – distribution over time and across countries

a) Distribution over time (1) b) Italy and other countries



Source: Refinitiv Datastream. (1) The grey area indicates the period of the financial crisis.

The level of asset diversification is one of the determinants that can explain the recent trends of market values.[1] A high degree of diversification can have both a positive and a negative effect on valuations, depending on whether the benefits due to operational synergies and the reduction of costs outweigh drawbacks associated with greater organizational complexity, the agency costs and investments in more risky activities than lending.

In order to investigate the relation between asset diversification and PTBs, we conducted an empirical analysis on a sample of listed banks in Europe over the period 2011-17. The evidence supports the existence of a relationship between asset diversification and market values for European banks. The relationship is negative and stronger for large banks, including those identified as global systemically important banks (G-SIBs). Overall, our findings are consistent with the view presented in the literature that the net effect of diversification on a firm's value is negative due, for instance, to higher costs and structure complexity.[2] The relationship between asset diversification and market value also holds for the subsample of Italian banks.

In Section 2 we discuss the benefits and costs of diversification as presented in the theoretical and empirical literature. In Section 3 we describe the data and the empirical setting, while in Section 4 we present the main findings.

2. Benefits and costs of diversification

Banks can engage in a variety of activities: on the one hand, there are specialized banks mainly involved in lending or investments; on the other hand diversified intermediaries combine commercial banking, securities investment, insurance with other financial activities.

1 See, for instance, Laeven, L. and R. Levine (2007), 'Is there a diversification discount in financial conglomerates?', Journal of Financial Economics, Vol. 85: 331-367; Guerry, N. and M. Wallmeier (2017), 'Valuation of diversified banks: New evidence', Journal of Banking and Finance Vol. 80: 203-214; Borroni M. and S. Rossi (2017), 'Does revenue diversification still matter in banking? Evidence from some European countries', DISCE - Quaderni del Dipartimento di Scienze Economiche e Sociali n. 123, March 2017, Università Cattolica del Sacro Cuore, Dipartimenti e Istituti di Scienze Economiche (DISCE).

2 Berger, A.N. and E. Ofek (1995), 'Diversification's effect on firm value', Journal of Financial Economics, Vol. 37: 39-65. Servaes, H. (1996), 'The value of diversification during the conglomerate merger wave', Journal of Finance, n. 51: 1201-1225; Laeven and Levine 2007.

The effects of diversification on risk, resilience to financial shocks and profitability are the subject of a number of studies, sometimes producing conflicting results.[3] Demirgüç-Kunt and Huizinga 2010 find that diversification is beneficial for profitability, but increases bank risk. Altunbas *et al.* 2011 show that the most diversified banks are generally less susceptible to shocks. For Mergaerts and Vennet 2016 banks with a high degree of income diversification tend to perform better than other banks in the long term, since they enjoy higher ROE and ROA without becoming more susceptible to economic shocks. Köhler 2014 and 2015 show that diversification has different effects depending on the main business of the financial institution: stability increases with diversification for retail banks, but this is not true for investment banks.

In the case of market valuation, the theoretical and the empirical literatures suggest that the overall effect of diversification can be either positive or negative, depending on whether the benefits outweigh the costs. Diversified banks can exploit operational synergies between different business units.[4] In particular, the sharing of inputs such as staff or technology between multiple outputs can be a source of substantial cost savings. Furthermore, the process of making loans can give some important information that may facilitate the provision of other financial services and vice versa. On the contrary, the organizational complexity of large banking conglomerates may increase costs because diversification can intensify conflicts of interest and agency problems between managers and shareholders.[5]

Evidence from a number of empirical studies supports the existence of a negative relationship. Laeven and Levine 2007 carry out an analysis over the years 1998-2002 for a sample of banks from 42 countries documenting a diversification discount on market values expressed by Tobin's q. They find that the market values of banks performing multiple activities are much lower than those of specialized banks, suggesting that diversification exacerbates agency problems and destroys value. Similar results are found by Armstrong and Fin 2014 on a sample of 800 banks in 31 OECD countries over the period 1998-2012;[6] they show that the impact of diversification on market value is either insignificant or negative. Furthermore, they also show that diversification may add value for small banks but destroys it for large banks. Finally, Guerry and Wallmeier 2017, who analyze a large sample of international banks (including in the EU, Japan and the US) over the period 1998-2013, show that there is a significant diversification discount in the pre-crisis period, but this effect decreases over time and becomes less relevant after the financial crisis.

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3 See for instance Demirgüç-Kunt, A. and H. Huizinga (2010), 'Bank activity and funding strategies: The impact on risk and returns', Journal of Financial Economics, Vol. 98(3): 626–650, Köhler, M. (2014), 'Does non-interest income make banks more risky? Retail- versus investment-oriented banks', Review of Financial Economics, Vol. 23: 182-193, Köhler, M. (2015), 'Which banks are more risky? The impact of business models on bank stability', Journal of Financial Stability, Vol. 16: 195-212, Mergaerts, F. and R.V. Vennet (2016), 'Business models and bank performance: A long-term perspective', Journal of Financial Stability, Vol. 22: 57-75, Altunbas, Y., S. Manganelli, D. Marques-Ibanez (2011), 'Bank during the financial crisis, do business models matter?', ECB working paper n. 1394, November 2011.

4 Diamond, D. (1991), 'Monitoring and reputation: the choice between bank loans and directly placed debt', Journal of Political Economy, Vol. 99: 689-721. Saunders, A. and I. Walter (1994), 'Universal Banking in the United States: What Could We Gain? What Could We Lose?' Oxford University Press, New York. Guerry, N. and M. Wallmeier (2017), 'Valuation of diversified banks: New evidence', Journal of Banking and Finance, Vol. 80: 203-214.

5 Stulz, R. (1990), 'Managerial discretion and optimal financial policies', Journal of Financial Economics, Vol. 26: 3-27. Berger, A.N. and E. Ofek (1995), 'Diversification's effect on firm value', Journal of Financial Economics, Vol. 37: 39-65.

6 Armstrong, A. and T. Fin (2014), 'Bank diversification and valuation: international evidence', Discussion Paper N. 438, National Institute of Economic and Social Research.

Baele, De Jonghe and Vennet 2007, on the contrary, show that a higher share of non-interest income over total income affects banks' franchise value positively while asset-based diversification does not affect long-run bank performance.[7] In particular, investors appear to base their valuations on income from non-traditional revenue sources. As the authors explain, the differences with respect to similar studies arise mainly due to the setting and scope of the analysis. Indeed, they only focus on European countries and on revenue diversification instead of asset-based measures.

3. Empirical analysis

3.1 Data

We focus on a sample of 92 listed European banks over the period 2011-17. These institutions belong to the following BankFocus specialization categories: commercial, savings, cooperative, investment, bank holdings and holding companies. Most of them are commercial (57) or saving and cooperative banks (20); only 15 are investment and holding companies. Furthermore, there are 9 institutions classified as global systemically important banks (G-SIBs).[8]

Data include PTBs, measures of diversification, macroeconomic variables and other indicators selected as the main drivers of PTB trends from the literature.[9] The list of all the variables, with their definitions and sources are in Table A.1 whereas their distributions are reported in Table A.2 (in the Annex).

In this note we focus on the diversification of banks' assets. As observed in the literature, income-based measures could overestimate the degree to which some credit institutions are engaged in non-credit activities since loans can generate both interest and non-interest income in terms of fees; therefore asset-based measures are more useful for distinguishing between activity categories and are more appropriate for our analysis.[10]

We consider two asset-based measures that take into account different asset categories: loans, other assets or a more granular classification.[11] The former is an asset diversity index (div-asset) introduced by Laeven and Levine. It is calculated as 1- |(net loans - other assets)/total assets| where 'other assets' are securities and investments and 'total assets' is the sum of net loans and other assets. Low values are obtained

7 Baele, L., O. De Jonghe, and R.V. Vennet (2007), 'Does the stock market value bank diversification?', Journal of Banking and Finance, n. 31: 1999-2023.

8 As a regulatory response to the revealed vulnerability of the banking sector during the financial crisis, the Financial Stability Board (FSB), in consultation with BCBS and national authorities, developed a method to identify the most significant banks (named G-SIBs), in terms of the scale and the degree of influence they hold in the global and the domestic financial markets. The list of G-SIBs is updated annually, based on a common methodology. G-SIBs are required to apply a set of stricter requirements: they have a higher capital buffer, a higher standard for Total Loss-Absorbing Capacity (TLAC), mandatory resolution planning and regular resolvability assessments.

9 Xu, T.T, K. Hu and U.S. Das (2019), 'Bank profitability and financial stability', IMF working paper WP/19/05. Bogdanova, B., I. Fender and E. Takats (2018), 'The ABCs of Bank PBRs', BIS Quarterly Review, March 2018. Elsas, R., A. Hackethal and M. Holzhäuser (2010), 'The anatomy of bank diversification'. Journal Bank Finance, Vol. 34 (6); Guerry, N. and M. Wallmeier (2017), 'Valuation of diversified banks: New evidence', Journal of Banking and Finance, Vol. 80: 203-214.

10 See for instance Guerry, N. and M. Wallmeier (2017), 'Valuation of diversified banks: New evidence', J. of Banking and Finance Vol. 80: 203-214; Laeven, L. and R. Levine (2007), 'Is there a diversification discount in financial conglomerates?', Journal of Financial Economics, Vol. 85: 331-367.

11 In the note we report the results for the asset diversity index, but similar results are obtained for the other indicator.

when the ratio of net loans to assets is either very large, indicating that the bank specializes in commercial activities, or very small, indicating that the bank specializes in investments. Alternatively, we consider an indicator of asset diversification based on concentration (div-HHI), defined as (1-HHI*), where HHI* = (HHI-1/N)/(1-1/N), HHI is the Herfindahl-Hirschman index, calculated on the shares of each asset category over total assets, with N the number of categories.[12] Both measures take values between 0 and 1 indicating an increasing degree of diversification: lower values imply greater specialization, while higher values indicate diversification of activities.

On top of asset diversity we consider the loan to asset ratio (LTA), a standard measure for capturing the business focus of a bank.[13] Figure 2 reports the relation between asset diversity and LTA, distinguishing between large-to-medium and small-to-medium-sized banks (i.e. banks whose size is more or less than the median value). The maximum degree of diversification is achieved when LTA is 50%, whereas either a low or a high share of loans describes low diversification. In our sample, highly diversified banks include intermediaries of different sizes and specialized banks are mostly retail banks (those involved in lending). For robustness purposes we extend the asset concentration measure to take into account off-balance sheets activities (div-HHI-ex), not considered in our main definitions. [14]

Figure 2: Relation between asset diversity and LTA

Source: Moody's Analytics BankFocus. Note: Banks are divided into two size classes, identified by the median value (of size) over the whole sample.

[12] N is equal to 2 or 3, if we further divide loans into two classes according to the counterparty, households or firms.

[13] Mergaerts, F. and R.V. Vennet (2016), 'Business models and bank performance: A long-term perspective', Journal of Financial Stability, Vol. 22: 57-75. Bonaccorsi di Patti E. and F. Palazzo (2018), 'Bank profitability and macroeconomic conditions: are business models different?,' forthcoming in Economic Notes, https://onlinelibrary.wiley.com/doi/full/10.1111/ecno.12155.

[14] This extended definition of the index is highly correlate with the standard one (about 94%).

The diversification measures exhibit some variability across banks but the average sample values are stable over the period (Figure A.1 in the Annex). The average asset diversity is 0.59 while the average concentration measure is 0.56; the mean of LTA is 62.6% (Table A.2 in the Annex). This indicates that banks, on average, attempt to keep their portfolios relatively balanced. Asset diversity exhibits a strong positive correlation with the concentration measure (0.84, Table A.3 in the Annex).

The other drivers of the PTB included in the analysis are a profitability measure (ROA), an index of cost efficiency (cost-to-income), a credit quality indicator (ratio of non-performing loans to total loans or NPL ratio), a measure of leverage (the ratio of equity to assets) and a control for bank size.[15] In addition to these, we consider some measures of asset opacity.[16]

Table 1: Banks' characteristics, asset diversity and size

Panel A: Asset diversity
(median value; per cent)

Asset diversity	CTI	NPL ratio	ROA	Provisions to assets	Size
Low	59.2	5.1	0.53	0.36	11.0
High	59.6	5.2	0.48	0.22	12.5

Asset diversity	Share of assets other than loans	Opacity	Share of levels 2 and 3	Share of level 3
Low	27.9	18.0	44.9	0.65
High	50.7	28.0	48.6	1.61

Panel B: Asset diversity and size
(median value; per cent)

Asset diversity	Size	CTI	NPL ratio	ROA	Provisions to assets
Low	**Medium**	59.2	4.3	*0.61*	0.35
Low	**Large**	59.5	5.7	*0.37*	0.42
High	**Medium**	56.8	6.4	*0.86*	0.34
High	**Large**	61.5	5.0	*0.38*	0.21

Asset diversity	Size	Share of assets other than loans	Opacity	Share of levels 2 and 3	Share of level 3
Low	**Medium**	22.8	13.1	*42.0*	0.7
Low	**Large**	29.4	25.2	*46.3*	1.4
High	**Medium**	47.1	6.9	*18.9*	0.8
High	**Large**	47.3	31.8	*55.9*	2.1

Source: Moody's Analytics BankFocus. Low and high asset diversity and medium- and large-sized banks are identified by values lower or higher than the third quartile of the distribution of the corresponding variable, respectively.

[15] See Laeven, L. and R. Levine (2007), 'Is there a diversification discount in financial conglomerates?', Journal of Financial Economics, Vol. 85: 331-367 and Lang and Stulz 1994, 'Tobin's Q, corporate diversification and firm performance', Journal of Political Economy Vol: 102, 1248-1280.

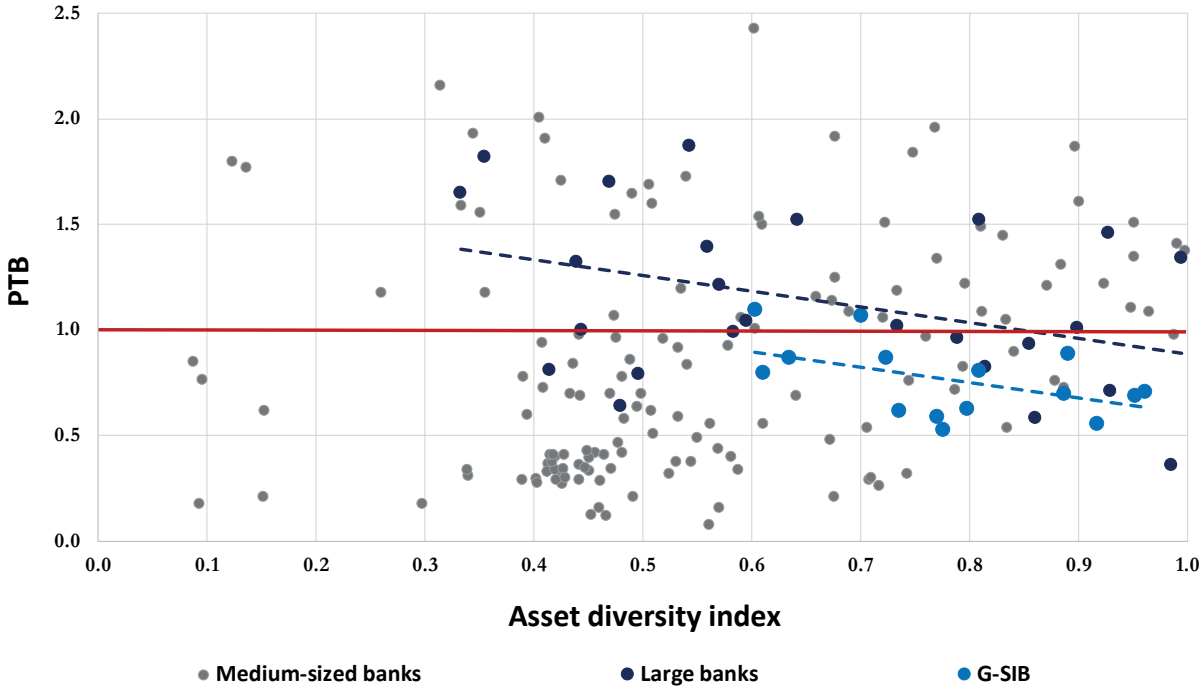
[16] To assess the riskiness and opacity of the assets we consider the share of hard-to-value securities (defined by level 2 and 3 assets in the fair value hierarchy) in relation to total fair value assets or to assets other than loans. Levels 2 and 3 consist of instruments other than those evaluated in an active market and classified as level 1. The relevance of these assets for the PTB ratio is discussed in Adam and Mikkonen, 'Gauging systemic risks from hard-to-value assets in euro-area banks' balance sheets' (see Box 7 in the ECB's *Financial Stability Review*, May 2019. The authors explain how the uncertainty associated with hard-to-value securities on bank balance sheets can affect market perceptions of banks, especially during period of stress.

Since the PTB is available on a daily frequency, we consider the average over the twelve months to the end of February to take into account the date at which the accounting data are known to the market.[17] Balance sheet indicators have an annual frequency and the reference date is 31 December.

Table 1 reports a description of banks, distinguishing them according to asset diversity and size, in terms of their main characteristics. More diversified banks (i.e. banks with asset diversity greater than the third quartile of the distribution) are characterized by a higher level of assets other than loans, a higher share of opaque assets and a larger size (Table 1, panel A). If we consider both asset diversification and size, larger and more diversified banks – identified by the third quartile of the distribution of the indicators – are characterized by high operating costs in relation to income, low ROA and a large share of opaque assets (Table 1, panel B).

Figure 3 shows graphical evidence of a negative relationship between asset diversity and market values, especially for large banks and G-SIBs. We investigate this relationship analytically in the next section.

Figure 3: PTB and asset diversity



Source: Moody's Analytics BankFocus. Medium- and large-size banks are identified by size values lower or higher than the 3rd quartile of the distribution, respectively. The figure refers to the two years 2016-2017, similar results are obtained for previous years.

[17] We assume a two-month lag between the accounting date and the publication of financial statements. Therefore, for the year 20XX we calculate the average PTB over the period 1 March 20XX – 28 February 20X(X+1). Similar results are obtained if the PTB is calculated as the average of values in the last month (from 1 February 20X(X+1) to 28 February 20X(X+1)). For a discussion of this issue see Calomiris, C.W. and D. Nissim, 'Crisis related shifts in the market valuation of banking activities', Journal Financial Intermediation, Vol. 23 (2014): 400-435.

3.2 *Empirical model*

The reference regression model for the empirical analysis is:

$$PTB_{i(t+2m)} = div_{it} + CTI_{it} + ROA_{it} + NPL\_ratio_{it} + Lev_{it} + Size_{it} + d4\_GDP + A_i + B_t + \varepsilon_{it} \quad (1)$$

where the dependent variable is the PTB and the regressors include a measure of asset diversification (div) as the main variable of interest (div-asset or div-HHI) and other determinants of market value identified in the related literature and discussed in Section 3.1 as control variables.[18] In additions to these regressors, we include in the equation bank fixed effects (A_i), year fixed effects (B_t) and the GDP annual growth rate (d4-GDP), in order to control for country heterogeneity in macroeconomic cycles. The sub-fix *i* stands for banks and *t* for time (year). The PTB refers to the end of February to take into account the delay in the disclosure of end-of-the-year accounting information. The estimation approach is based on a fixed-effect strategy with robust errors clustered at the bank level in order to deal with heteroscedasticity and group correlation.

We consider some variants of equation (1) with the addition of other factors such as opacity of assets or LTA. In order to investigate how banks' size class can affect the relationship between asset diversification and market values, we estimate equation (1) on the subsamples of small, intermediate and large banks (see the note to Table 3).

Finally, we analyze in more details the two sub-samples of: 1) Italian banks and 2) G-SIBs. Both groups have lower market values than other banks and it can be useful to investigate the possible determinants of these trends. In order to do this, we compare Italian banks with other European banks and G-SIBs with non-G-SIBs by looking at their main balance sheet characteristics and indicators. Operationally, in both cases, for each variable of interest, we implement a two-sample t-test to verify if the two sub-population means are equal or not.

4. Findings

Table 2 reports the results of the estimation of equation (1) and some alternative specifications. Overall, our findings support the evidence of a negative association between asset diversification and the PTB, while also controlling for other factors. The negative relationship holds for both asset diversity and asset concentration (columns 2-4), whereas the relation is not significant when the extended definition of asset concentration is taken into account (column 5). If LTA is added to equation (1) in order to control for the composition of assets (column 6), the coefficient of the asset diversity remains negative and significant, whereas that for LTA is not significant. Whereas diversification has a negative effect on market valuation, the different kinds of specialization (lending versus other activities) are not relevant when asset diversity is taken into account. The findings in Table 2 are consistent with the view in the literature that the intensification of agency problems and opaqueness related

[18] See Xu, T.T, K. Hu and U.S. Das (2019), 'Bank profitability and financial stability', IMF working paper WP/19/05. Elsas, R., A. Hackethal and M. Holzhäuser (2010), 'The anatomy of bank diversification'. Journal Bank Finance Vol. 34 (6), 1274-1287. Guerry, N. and M. Wallmeier (2017), 'Valuation of diversified banks: New evidence', Journal of Banking and Finance Vol. 80: 203-214.

to structure complexity for banks engaged in multiple activities may outweigh any benefits accruing from economy of scope and operational synergies.

Starting from equation (1), we can derive that a reduction of asset diversification of one standard deviation (0.20) would increase the PTB by 0.06, keeping the other factors constant, corresponding to 7 per cent of the average PTB in the whole sample.

In the case of the other factors included in equation (1) as control variables, banks which show good profitability indexes (as a measure of positive expectation of future earnings), the ability to deal effectively with the high level of non-performing loans and low operating costs are valued positively by the market.[19] The results hold across different specifications and for alternative measures of asset diversification (columns 4, 5 and 6 in Table 2).

Table 2: Effect of diversification

Dependent variable: PTB	**Asset diversity**	**Asset diversity and main drivers**	**Asset concentration and main drivers**	**Asset concentration extended and main drivers**	**Asset diversity and main drivers with LTA**
Variable/columns	(2)	(3)	(4)	(5)	(6)
Div-asset	**-0.358***	**-0.302***			**-0.319+**
	(0.15)	(0.14)			(0.18)
HHI-asset			**-0.347+**		
			(0.20)		
HHI-asset-ex				-0.072	
				(0.18)	
Div-inc					
LTA					-0.001
					(0.00)
ROA		**0.091***	**0.096***	**0.092***	**0.090***
		(0.04)	(0.04)	(0.04)	(0.04)
NPL ratio		**-0.009***	**-0.009***	**-0.009***	**-0.009***
		(0.00)	(0.00)	(0.00)	(0.00)
CTI		**-0.003+**	**-0.003+**	-0.003	**-0.003+**
		(0.00)	(0.00)	(0.00)	(0.00)
Lev		0.001	0.001	0.004	0.001
		(0.02)	(0.02)	(0.02)	(0.02)
Opac		-0.000	-0.000		-0.000
		(0.00)	(0.00)		(0.00)
Size		0.013	0.015	0.017	0.009
		(0.10)	(0.10)	(0.10)	(0.11)
D4 GDP	-0.008	-0.007	-0.009	-0.009	-0.007
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	**0.947****	0.970	1.067	0.800	1.052
	(0.09)	(1.27)	(1.26)	(1.26)	(1.45)
N	566	556	556	556	556
adj. R^2	0.14	0.24	0.23	0.22	0.24

Note: Standard errors in parentheses, + p<0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

[19] These findings are consistent with the literature, see for instance Xu, T.T, K. Hu and U.S. Das (2019), 'Bank profitability and financial stability', IMF working paper WP/19/05. Bogdanova, B., I. Fender and E. Takats (2018), 'The ABCs of Bank PBRs', BIS Quarterly Review, March 2018.

Another important factor to take into account is size, as it can influence market value through economies of scale.[20] The coefficient is not significant (Table 2), which suggests that there is no relationship between PTB and size once asset diversity is considered. In order to investigate if the negative relationship between PTB and diversification holds for banks of different sizes, we estimate the regression (1) for three subsamples: small-medium banks defined as those whose size is below the median, intermediate-size banks, whose size is between the median and the third quartile, and large banks, whose size is greater than the third quartile. All G-SIBs belong to the last category. The results, reported in Table 3 (columns 2, 3 and 4, respectively), show that the coefficient for asset diversity is negative for all three subsamples even though it is not significant for intermediate-size banks. The most interesting finding is that the effect of diversification is stronger for larger banks, consistent with the intuition that diseconomies due to complexity increase with the overall size of the organization.

Table 3: Asset diversification and size

	Small-medium banks	**Intermediate banks**	**Large banks**
Variable/columns	(2)	(3)	(4)
Div-asset	**-0.353+**	-0.466	**-0.616****
	(0.19)	(0.35)	(0.22)
ROA	0.042	0.044	0.303
	(0.03)	(0.06)	(0.17)
NPL ratio	**-0.007***	-0.002	-0.016
	(0.00)	(0.01)	(0.01)
CTI	-0.002	-0.004	-0.003
	(0.00)	(0.00)	(0.00)
Equity_asset	0.001	-0.002	-0.076
	(0.02)	(0.04)	(0.07)
D4_GDP	-0.008	0.056	0.000
	(0.01)	(0.04)	(0.02)
Constant	**1.117*****	**1.293***	**1.643*****
	(0.27)	(0.55)	(0.37)
N	319	101	140
adj. R^2	0.16	0.19	0.50

Note: Standard errors in parentheses, + p<0.10, * p < 0.05, ** p < 0.01, *** p < 0.001. Small-medium banks are those whose size is below the median, intermediate-sized banks are between the median and the third quartile and large banks those whose size is greater than the third quartile.

In order to test if the results are influenced by the inclusion in the sample of some specific categories of intermediaries, such as G-SIBs and investment banks, we evaluate our model by taking into account only commercial and retail banks, or by excluding G-SIBs or outliers for the diversification variable. The negative relation is robust (Table A.3 in the Annex).

[20] This point is investigate in Armstrong et al. 2014 and Bogdanova et al. 2018.

Further analyses were carried out to investigate in greater detail the subsample of G-SIBs. The estimates on G-SIBs show that asset diversity (and the other main drivers of PTB) have the same effect on market values for these conglomerates and other banks (Table A.5 in the annex). The only exception is leverage: in the case of G-SIBs the effect is negative and significant.[21] G-SIBs are generally highly diversified banks and have low PTBs (Table 4). Descriptive statistics suggest that the low PTBs of G-SIBs are the result of a combination of high asset diversity, low ROA, high leverage and cost-to-income, and a larger share of opaque assets in comparison with the other banks in the sample.

Table 4: G-SIBs versus other banks: main characteristics

	PTB	CTI	NPL ratio	ROA	Asset-div	Loan-asset	Equity-asset	Size
G-SIBs	0.76	68.4	5.8	0.23	0.77	43.8	6.1	14.0
Other banks	0.85	61.3	7.7	0.52	0.57	64.9	9.0	13.3
t-statistics	-1.48	+3.30	-1.78	-2.84	+7.78	-10.36	-6.20	+16.11
p-value	0.14(0.07 if H0 diff <0)	0.00	0.08(0.05 if H0 diff <0)	0.00	0.00	0.00	0.00	0.00

	Share level 3	Share levels 2 or 3	Opaque assets
G-SIBs	2.9	65.4	43.7
Other banks	6.5	43.5	28.1
t- statistics	-1.67	5.36	+3.86
p-value	0.09	0.00	0.00

Note: We implement a t-test on the equality of the mean for the two sub-samples (G-SIBs versus non- G-SIBs). We report the t-statistics and the p-value associated with the alternative hypothesis that means for the two groups are different, if not otherwise stated.

The negative relation between PTB and asset diversification holds also in the subsample of Italian banks (Table A.6).[22] It is worth noting that the PTB of Italian banks is below the average of banks in other EU countries (Table 5). The level of asset diversity cannot fully explain this gap because, on average, Italian banks are similar to banks in other countries in this regard. The difference in PTBs may be due to other factors, such as lower current profitability, higher incidence of impaired loans and higher operating costs that characterize Italian intermediaries with respect to banks in other countries. Our regressions show that these characteristics have a negative impact on market valuations.

[21] Xu, T.T, K. Hu and U.S. Das (2019), 'Bank profitability and financial stability', IMF working paper WP/19/05. Bogdanova, B., I. Fender and E. Takats (2018), 'The ABCs of Bank PBRs', BIS Quarterly Review, March 2018.

[22] As is the case for G-SIBs, Italian banks regression results can also be affected by the small number of banks in the subsample.

Table 5: Italian versus other countries banks: main characteristics

	PTB	Asset-div	ROA	NPL ratio	CTI	Loan-asset	Equity-asset	Size
Italian banks	0.61	0.57	0.005	13.6	66.4	66.6	7.9	10.9
Other EU banks	0.89	0.60	0.58	6.3	61.2	61.8	8.9	10.6
t-statistics	5.12	0.97	7.09	-8.26	-2.75	-2.48	2.39	-0.99
p-value	0.00	0.33	0.00	0.00	0.01	0.01	0.02	0.32

	Share level 3	Share levels 2 or 3	Opaque assets
Italian banks	3.2	16.8	13.6
Other EU	6.6	50.7	31.6
t- statistics	1.83	10.38	3.23
p-value	0.06	0.00	0.00

Note: We implement a t-test on the equality of the mean for the two sub-samples (G-SIBs versus non- G-SIBs). We report the t-statistics and the p-value associated with the alternative hypothesis that means for the two groups are different, if not otherwise stated.

5 Annex

Table A.1: List of variables

Variable	Description	Source
PTB	It is calculated as the ratio of the market value of a bank's equity to its latest accounting (book) value.	Refinitiv Datastream
Asset diversity (Div-asset)	Asset diversity index is a measure of asset diversification by Laeven and Levine 2007, defined as 1- |(net loans - other earning assets)/ total earning assets|. Index between 0 and 1.	Moody's Analytics Bankfocus
Asset concentration index (Div-HHI)	Normalized Herfindahl-Hirschman index, defined in terms of the asset categories: Loan to households (Hhloan), loans to firms (NFCloan) and other assets. The index is calculated as (HH_asset-1/3)/(1-1/3), where HH_asset is defined as (Hhloan_asset/100)^2+ (1-Hhloan_asset/100-NFCloan_asset/100)^2+ (NFCloan_asset/100)^2. Index varies between 0 and 1.	Moody's Analytics Bankfocus
Asset concentration index – extended (Div-HHI-ex)	Similar to the asset concentration index, but with the addition of off-balance sheet assets.	Moody's Analytics Bankfocus
Loan-to-asset (LTA)	The ratio of loans over assets. it is a standard measure used for describing business models in particular the retail based activities. Percentage values.	Moody's Analytics Bankfocus
Return on assets (ROA)	Ratio of net income and total assets. It is an indicator of the profitability of a firm assets. Percentage values.	Moody's Analytics Bankfocus
Cost-to-income (CTI)	Ratio of total operating expenses over total operating income. It represents the efficiency of company's operations. A lower ratio means that the bank is more efficient. Percentage values.	Moody's Analytics Bankfocus
NPL ratio	This is a measure of the amount of total loans which are impaired or doubtful (non-performing loans or NPLs). The lower this figure is the better the asset quality is. Percentage values.	Moody's Analytics Bankfocus
Leverage or equity-to-asset (Lev)	Ratio of equity over assets. As equity is a cushion against asset issues, this ratio measures the amount of protection afforded to the bank by the equity they invested in. It is a possible way to construct a leverage ratio. Percentage values.	Moody's Analytics Bankfocus
Share of level 2 FV assets (s_level2)	Share of level 2 assets over total assets valuated at fair value on the basis of FV hierarchy. Percentage value.	Moody's Analytics Bankfocus
Share of level 3 FV assets (s_level3)	Share of level 3 assets over total assets valuated at fair value on the basis of FV hierarchy. Percentage value.	Moody's Analytics Bankfocus
Share of levels 2 or 3 FV (s_level23)	Sum of Share of FV assets of levels 2 and 3.	Moody's Analytics Bankfocus
Opacity (opac)	Ratio of level 2 and 3 FV assets and assets other than loans. Percentage value.	Moody's Analytics Bankfocus
Size	Log of assets.	Moody's Analytics Bankfocus

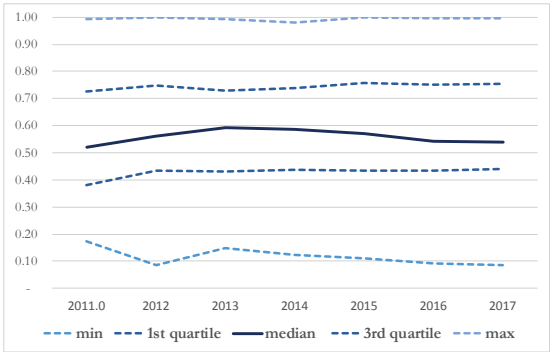
Table A.2: List of variables and distribution

Variable	mean	p10	p25	p50	p75	p90	min	max	sd
PTB	0.86	0.31	0.48	0.76	1.16	1.59	0.08	2.43	0.49
Diversification measures									
Asset diversity (Div-asset)	0.59	0.37	0.43	0.57	0.75	0.9	0.11	1	0.2
Asset Concentration index (Div-HHI)	0.56	0.03	0.13	0.50	1.00	1.00	0.00	1.00	0.42
Loan-to-asset (LTA)	62.6	36.4	53.9	66.6	75.7	79.6	10.6	86.3	16.7
Other factors									
ROA	0.49	-0.21	0.18	0.5	0.82	1.27	-5.07	5.15	0.79
CTI	61.62	46.14	52.64	59.58	68.61	81.71	30.98	112.52	14.33
NPL ratio	6.56	1.77	3.01	5.35	8.95	15.78	0.36	15.78	4.56
Leverage (Lev)	8.74	4.62	6.13	7.96	11.57	13.25	1.91	26.44	3.47
Share of FV assets of level 2 (s_level2)	39.6	0.9	11.5	39.2	61.6	84.5	0	98.9	29.9
Share of FV assets of level 3 (s_level3)	6.1	0.1	0.04	1.4	3.7	10.5	0.00	79.8	15.1
Opacity (opac)	29.8	1.3	7.2	21.5	39.7	90.5	0.00	100	29.8
Size (log assets)	10.71	8.42	9.25	10.35	12.36	13.91	5.95	14.63	2.04

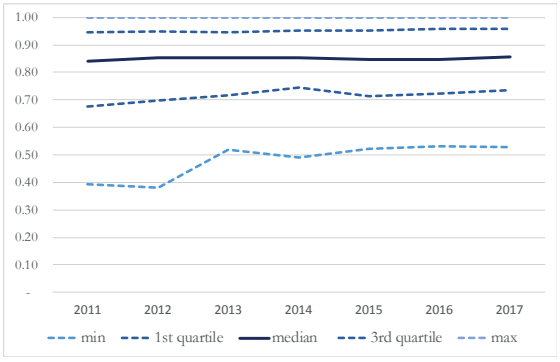
Source: Refinitiv Datastream, Moody's Analytics BankFocus. Note: Values outside the interval between the 1st and the 99th percentiles have been excluded.

Figure A.1: Diversification measures – distribution over time

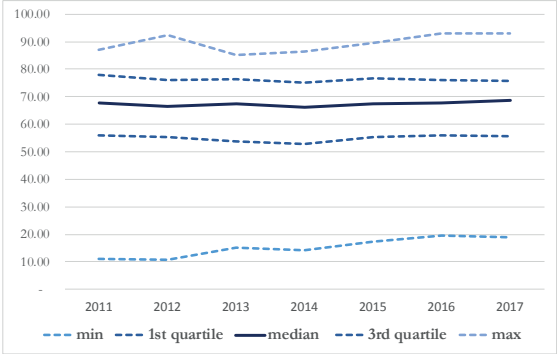
(a) Asset diversity



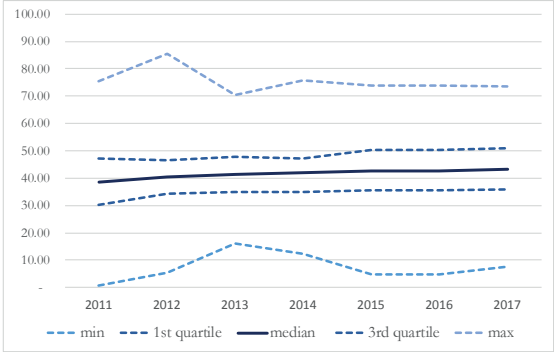
(b) Asset concentration



(c) Loan-to-asset



(d) Income diversification index



Source: Moody's Analytics Bankfocus.

Table A.3: Correlation between diversification measures

	Div-asset	Div-HHI	LTA
Div-asset	1.00		
Div-HHI	0.84	1.00	
LTA	-0.53	-0.41	1.00

Source: Moody's Analytics Bankfocus.

Table A.4: Robustness checks

	G-SIBs excluded	Investment banks excluded	Outliers for asset diversity excluded (1st and 99th percentiles excluded)	Outliers for asset diversity excluded (1st and 95th percentile excluded)
Variable/ column	(2)	(3)	(4)	(5)
Div-asset	**-0.379+**	**-0.325+**	**-0.360***	**-0.335+**
	(0.20)	(0.19)	(0.18)	(0.19)
ROA	**0.079***	**0.068+**	**0.094***	**0.085***
	(0.04)	(0.03)	(0.04)	(0.04)
NPL ratio	**-0.009***	**-0.009***	**-0.008***	**-0.009***
	(0.00)	(0.00)	(0.00)	(0.00)
CTI	**-0.003+**	**-0.002+**	**-0.003+**	**-0.002+**
	(0.00)	(0.00)	(0.00)	(0.00)
Lev	0.003	0.006	0.002	0.003
	(0.02)	(0.02)	(0.02)	(0.02)
d4_GDP	-0.010	-0.014	-0.010	-0.011
	(0.01)	(0.01)	(0.01)	(0.01)
Opac	-0.000	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
LTA	-0.002	-0.003	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
Size	0.020	0.072	0.047	0.067
	(0.12)	(0.13)	(0.11)	(0.12)
Constant	1.069	0.501	0.584	0.359
	(1.48)	(1.56)	(1.51)	(1.55)
Bank FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
N	500	479	542	526
adj. R^2	0.24	0.21	0.24	0.24

Note: Standard errors in parentheses, + p<0.10, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A.5: G-SIBs

Variable/columns	G-SIB and asset diversification (2)	G-SIB, asset diversification and main drivers (3)	G-SIB, asset diversification and extended drivers (3)
Asset_div_L	**-0.361***	**-0.291+**	**-0.374+**
	(0.16)	(0.15)	(0.20)
id_GSIB = 0	0.000	0.000	0.000
	(.)	(.)	(.)
id_GSIB = 1	0.000	0.000	0.000
	(.)	(.)	(.)
id_GSIB = 0 x Asset_div_L	0.000	0.000	0.000
	(.)	(.)	(.)
id_GSIB = 1 x Asset_div_L	0.066	0.234	0.047
	(0.35)	(0.54)	(0.87)
d4_GDP	-0.007	-0.007	-0.008
	(0.01)	(0.01)	(0.01)
ROA		**0.081***	**0.080***
		(0.04)	(0.04)
id_GSIB = 0 x.ROA		0.000	0.000
		(.)	(.)
id_GSIB = 1 x ROA		0.369	0.360
		(0.23)	(0.23)
NPL ratio		**-0.009***	**-0.009***
		(0.00)	(0.00)
id_GSIB = 0 x NPL ratio		0.000	0.000
		(.)	(.)
id_GSIB = 1 x NPL ratio		0.010	0.021
		(0.02)	(0.03)
CTI		-0.002	-0.003
		(0.00)	(0.00)
id_GSIB = 0 x CTI		0.000	0.000
		(.)	(.)
id_GSIB = 1 x CTI		0.006	0.006
		(0.00)	(0.00)
Size		0.029	0.021
		(0.12)	(0.12)
id_GSIB = 0 x Size		0.000	0.000
		(.)	(.)
id_GSIB = 1 x Size		-0.230	-0.094
		(0.25)	(0.21)
Equity_asset		0.004	0.003
		(0.02)	(0.02)
id_GSIB = 0 x Equity_asset		0.000	0.000
		(.)	(.)
id_GSIB = 1 x Equity_asset		**-0.128*****	**-0.128*****
		(0.03)	(0.03)
Opac			-0.000
			(0.00)
id_GSIB = 0 x Opac			0.000
id_GSIB = 1 x Opac			-0.001
			(0.00)
constant	0.943***	1.085	1.084
	(0.08)	(1.32)	(1.42)
N	566	556	556
adj. R^2	0.14	0.24	0.24

Note: Standard errors in parentheses, + p<0.10, * p < 0.05, ** p < 0.01, *** p < 0.001. The dummy id_GSIB is equal to 1 in case of G-SIB, 0 otherwise.

Table A.6: Italy versus other countries

	IT versus other IT	IT – medium banks	IT – large banks
Variable/columns	(2)	(3)	(4)
Div-asset	-0.278+	**0.109**	**-2.913*****
	(0.16)	(0.44)	(0.00)
0.IT	0.000		
	(.)		
1.IT	0.000		
	(.)		
0. IT x Div-asset	0.000		
	(.)		
1. IT x Div-asset	-0.024		
	(0.35)		
ROA	0.102+	0.021	-0.106
	(0.05)	(0.05)	(.)
0. IT x ROA	0.000		
	(.)		
1. IT x ROA	-0.064		
	(0.06)		
NPL ratio	-0.007	-0.002	**-0.136*****
	(0.01)	(0.01)	(0.00)
0. IT x NPL ratio	0.000		
	(.)		
1. IT x NPL ratio	-0.005		
	(0.01)		
CTI	-0.002	-0.002	-0.004
	(0.00)	(0.00)	(.)
0. IT x CTI	0.000		
	(.)		
1. IT x CTI	-0.001		
	(0.00)		
d4_GDP	-0.007	0.023	**-0.043****
	(0.01)	(0.02)	(0.00)
constant	**1.051*****	**0.804***	**1.367*****
	(0.14)	(0.26)	(0.02)
Bank FE	YES	YES	YES
Time FE	YES	YES	YES
N	566	76	15
adj. R^2	0.23	0.14	0.95

Note: Standard errors in parentheses, + p<0.10, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The dummy IT is equal to 1 in case of Italy, 0 otherwise. For Italy, the definition of medium and large banks is based on the third quartile of size distribution for Italian banks.