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Valuation of diversified banks: New evidence

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ABSTRACT

This paper reconsiders the effect of diversification on bank valuation. Our objective is to provide new evidence based on a unified estimation framework that places particular emphasis on separating the effects of diversification (specialised banks vs. diversified banks) from those of bank type (investment banks vs. commercial banks). Consistent with prior studies, we find a significant diversification discount at the end of the 1990s. Our main finding is that it decreases over time and practically vanishes after the financial crisis. We do not find support for the hypothesis that the diversification effect is influenced by geographical or regulatory factors. The valuation impact of bank characteristics varies over time, particularly in the financial crisis, but this structural break does not explain the observed decrease of the diversification discount. We show that the pre-crisis discount is considerably smaller in a robust regression, which in part is driven by banks with a large share of non-interest income.

1. Introduction

Previous theoretical and empirical literature suggests that the diversification of banks has important implications for bank valuation. On the one hand, diversification may allow economies of scope and synergies between different business units, for example, by providing financial consulting services to firms that are also loan clients. On the other hand, diversification can give rise to conflicts of interest and agency costs, and it may result in a more complex organisational structure and a less focused customer orientation (see Walter (2004) for a detailed review of these arguments). In a comprehensive study of banks in 43 countries from 1998 to 2002, Laeven and Levine (2007) find a substantial diversification discount, which is consistent with the view "that economies of scope in financial intermediation are not sufficiently large to compensate for countervailing forces", such as intensified agency problems (Laeven and Levine, 2007, p. 364). The discount is sufficiently large to be highly relevant for shareholders. It is also relevant for bank governance because it raises the question of whether the past trend of diversifying into non-lending activities was, overall, value destroying. In addition, while bank regulators are mainly interested in risk and, particularly systemic risk (Caprio et al., 2007), the valuation effects in question are relevant for bank regulation insofar as diversification is related to risk (Stiroh, 2004).

The main objective of this paper is to present evidence of time variation in the diversification discount during the global financial crisis and the following years. The early studies provide strong evidence of a valuation premium for banks relying predominantly on investment activities (Baele et al., 2007; Laeven and Levine, 2007). However, during times of financial distress, commercial activities have been shown to be more stable and recession-proof than non-lending business activities (DeYoung and Roland, 2001), which suggests that the premium associated with investment banking may have diminished or even reversed in the aftermath of the global financial crisis. As highlighted by Elsas et al. (2010), it is also plausible to assume that the crisis has led to a re-evaluation of the costs and benefits of diversification: on the one hand, diversified banks could be better able to absorb shocks; on the other hand, they might suffer disproportionately from the negative outlook for the investment banking branch. Moreover, the financial crisis revealed weaknesses of individual banks going beyond their classification as commercial or investment banks. Thus, it is possible that

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a shift in valuation from activity-related criteria towards more individual criteria has taken place.

Our second objective is to provide a unified estimation framework that allows us to elucidate the inconclusive results of previous studies. In the recent literature, Laeven and Levine (2007) document a significant diversification discount, Baele et al. (2007) report a significant diversification premium, and Elsas et al. (2010) find no direct effect of diversification but an indirect effect from a positive association of diversification with profitability. The underlying factor behind these results could be the regulatory environment. Specifically, Baele et al. (2007) argue that the relation between diversification and bank value is different in Europe than in the US because the European banking sector had already been deregulated by the Second Banking Coordination Directive in 1989, while in the US, the Glass-Steagall Act was still in force. Thus, European banks were allowed to diversify earlier and more broadly. As a consequence, the potential advantages of diversification might have been exploited more thoroughly in Europe relative to the US. However, other explanations cannot be ruled out because studies differ in several aspects, such as the sample period and the estimation method. Even more importantly, they follow different approaches to separating the effect of diversification (specialised banks vs. diversified banks) from the effect of bank type (investment banks vs. commercial banks), which is critically important to identifying diversification effects. We hypothesise that the different results of previous studies might be partly caused by these settings, so the remaining role of geographical and regulatory factors is smaller than suggested. This is in line with the view that the Glass-Steagall Act had already been substantially weakened by the end of the 1990s and that banks operating internationally had become relatively similar.

A third contribution is that we propose robust regressions in order to better understand the time variation of the diversification discount. This extension of a "regular" regression framework is motivated by the fact that the number of investment banks is small compared to the number of commercial banks, and there is concern that extreme observations for some investment banks might strongly affect the estimation results.

Our main results can be summarised as follows. Before the financial crisis, we find a significant premium for investment banks and a significant diversification discount. However, this result is partly driven by a small number of observations for investment banks, so the effects are considerably smaller in a robust regression. The diversification discount decreases over time and practically vanishes after the financial crisis. We do not find support for the hypothesis that the diversification effect is systematically influenced by geographical or regulatory factors. The valuation impact of bank characteristics varies over time, particularly during the financial crisis, but this structural break does not explain the observed decrease in the diversification discount.

The remainder of this paper is structured as follows. The next section presents prior research in more detail and discusses measures of bank type and diversification. In Section 3, we describe the data and the methodology used in the empirical analysis. In Section 4, we present the main results, followed by robustness tests in Section 5. Section 6 concludes.

2. The diversification discount in prior literature

Since Lang and Stulz (1994) and Berger and Ofek (1995), an extensive literature on the valuation effects of diversification for non-financial conglomerates has developed. The results, however, are mixed. For the financial sector, interest in this topic was aroused by the passage of the Gramm-Leach-Bliley Act in 1999. Laeven and Levine (2007), Elsas et al. (2010) and Baele et al. (2007) study the association between bank valuation and bank diversification using similar approaches based on data for listed banks from the Bankscope database compiled by Bureau van Dijk. Laeven and Levine (2007) include banks with more than US$100 million in total assets from a global sample of 43 countries for the period 1998–2002 (3,415 bank-year observations). Baele et al. (2007) focus on 143 banks from 17 European countries (the EU15, as well as Norway and Switzerland) over the period 1989–2004 (1,200 bank-year observations), while Elsas et al. (2010) include 380 large banks with total assets exceeding US$1 billion from nine developed countries (Australia, Canada, France, Germany, Italy, the UK, the US, Spain and Switzerland) from 1996 to 2008 (3,348 bank-year observations). While Laeven and Levine (2007) find evidence of a diversification discount, Baele et al. (2007) report a significant diversification premium, and Elsas et al. (2010) confirm only an indirect effect via profitability.

Important differences among these studies include that Elsas et al. (2010) focus on variation in individual bank value over time (estimating a model with bank fixed effects), whereas Laeven and Levine (2007) and Baele et al. (2007) are primarily interested in cross-sectional valuation differences (country fixed effects). Even more importantly, only Laeven and Levine (2007) include a bank type variable in addition to the bank diversification measure, which is critically important for the results.[1] A bank is considered fully specialised (i.e., not diversified at all) if the interest-income share is zero or one. In contrast, a bank is more or less diversified if it earns interest income from lending as well as non-interest income from commissions or trading. Bank type is also typically proxied by the interest-income share. A fully specialised investment bank will be assigned a value of zero because it does not engage in interest-earning activities, while a fully specialised commercial bank only earns interest income and is thus assigned a value of one. Banks combining investment and commercial banking activities are assigned in-between values. As both "type" and "diversification" are measured on the basis of the share of interest income, they are closely related and have to be considered jointly (Laeven and Levine, 2007, p. 337). The estimation of the diversification effect will likely be distorted if the type effect is not simultaneously taken into account, and vice versa. This affirms the finding of a diversification discount in Laeven and Levine (2007) rather than those of Elsas et al. (2010) and Baele et al. (2007).

The main result of Laeven and Levine (2007) is confirmed by Schmid and Walter (2009) for US financial services firms, broadly defined, from 1985 to 2004 (4,060 firm-year observations). The study is not limited to the banking sector and therefore captures broader, segment-based dimensions of diversification. The number of segments reported by Compustat (commercial banking; investment banking; insurance) serves as a measure of diversification. Schmid and Walter (2009) find a "substantial and persistent conglomerate discount" (p. 195), with the exception of firms operating primarily in investment banking.

For 45 of the largest European conglomerates active in both banking and insurance, van Lelyveld and Knot (2009) reach a different conclusion. They do not find a universal discount but substantial variability and some evidence of a positive time trend in the valuation of conglomerates. A study of acquisitions by US bank holding companies by Filson and Olfati (2014) even suggests "that diversification into investment banking, securities brokerage and insurance under the Gramm–Leach–Bliley Act of 1999 creates value" (p. 209).

Empirical evidence on the potential determinants of the size and variability of the diversification discount is very limited.

[1] In Baele et al. (2007), the main regression in Table 3, column 5 does not include a type variable. In Elsas et al. (2010), the relevant regression in Table 3, column 3 also does not control for type.

Liang et al. (2016) argue that corporate governance mechanisms mitigate the diversification discount, while Klein and Saidenberg (2010) emphasise the role of organisational structure as a moderator variable.

A related stream of literature studies the impact of diversification on profitability and risk rather than on bank value.[2] Stiroh (2004) presents early evidence that the growing importance of non-interest income tends to increase the volatility of bank profitability and to worsen the risk-return tradeoff (similarly, see Li and Zhang (2013) for China). Recent literature, stimulated by the financial crisis of 2007–2009, has mostly confirmed this finding for systemic risk. In theoretical work, Wagner (2010) shows that diversification may reduce the failure risk of individual institutions while simultaneously increasing systemic risk. Van Oordt (2014) extends this model to the case of securitised loan portfolios and finds that securitisation allows to reduce individual bank risk without affecting systemic risk. Empirically, De Jonghe (2010) and Brunnermeier et al. (2012) document that banks' contributions to systemic risk tend to increase with their share of non-interest income. De Jonghe (2010, p. 387) concludes, "Overall, diversifying financial activities under one umbrella institution does not improve banking system stability, which may explain why financial conglomerates trade at a discount." In contrast, Saunders et al. (2016) find no evidence that the share of non-interest income is associated with lower profitability or with higher systemic risk. Engle et al. (2014) confirm an overall positive association of non-interest income and systemic risk but find that the relation depends on market structure: the positive association is only found when the level of concentration in a country's banking sector is low.

3. Data and methodology

3.1. Sample of banks

We obtain bank-level data for listed banks from the Bureau van Dijk Bankscope database. The data on market capitalisation come from Thomson Reuters Datastream. We use regulatory data from Barth et al. (2013) and a financial freedom index from the Heritage Foundation. Our sample covers the 16-year period from 1998 to 2013. This period includes different business cycles and stock market conditions (e.g., the dot-com bubble, the economic expansion of the early 2000s, the sub-prime crisis, the sovereign debt crisis). Our sample is free from survivorship bias, since we also consider banks that were delisted during the sample period. We exclude banks with missing data on accounting variables and small banks with less than US$ 100 million in total assets to enhance comparability across countries. Following Laeven and Levine (2007), we select the following Bankscope categories: Commercial Banks, Bank Holdings & Holding Companies, Investment Banks, Cooperative Banks, Savings Banks, and Real Estate & Mortgage Banks. Our final sample includes 18221 firm-year observations, with a strong share of bank holding companies (8708) and commercial banks (7946). Table 1 shows the descriptive statistics by country for all countries with more than 100 firm-year observations. US banks are by far the largest group, representing approximately 48% of the sample. In parts of the empirical analysis, following Baele et al. (2007), we form a European subset that consists of banks from 17 European countries (the EU 15 + Norway and Switzerland). This subsample includes 2410 firm-year observations.

[2] For the effect of geographical rather than functional diversification on bank profitability, see Fang and van Lelyveld (2014) and Brighi and Venturelli (2016).

3.2. Methodology

We adopt the methodology used by Beck et al. (2013) in their study of bank competition and systemic fragility. In order to examine how diversification affects bank valuation while controlling for other determinants, we estimate the following panel regression as our baseline empirical specification:

$$Q_{i,t} = \alpha_0 + \alpha_1 Type_{i,t} + \alpha_2 Diversification_{i,t} + \boldsymbol{\alpha_3 X}_{i,t} + \gamma_{j(i),t}(+\theta_i) + \epsilon_{i,t}, \quad (1)$$

where $Q_{i,t}$ is Tobin's Q of bank i at time t, *Type* and *Diversification* are the main variables of interest, and $\boldsymbol{X}$ is a vector of bank-level control variables. The regression includes time-varying country fixed effects, $\gamma_{j(i),t}$ (i.e. fixed effects for country-year pairs), where $j(i)$ denotes the country of origin of bank i. We estimate the regression with and without additional bank fixed effects, θ_i. Without bank fixed effects, the regression model uses two sources of variation in the data to estimate the diversification effect: first, the cross-sectional variation in a given year and country; second, the time variation for a given bank that is not explained by the country's time trend. Considering only country-year fixed effects may lead to biased coefficients due to omitted variables because it is hardly possible to perfectly control for time-invariant characteristics such as managerial experience and board composition.[3] Including bank fixed effects solves this issue but at the cost of reducing the variation available for estimating the diversification effect. We apply both approaches to allow comparison with the prior literature and to evaluate the robustness of our results.[4]

To gain insight into the determinants of the diversification discount or premium, in further analyses, we generalise regression model (1) to include conditional type and diversification effects:

$$Q_{i,t} = \alpha_0 + \alpha_{1,j,t} Type_{i,t} + \alpha_{2,j,t} Diversification_{i,t} + \boldsymbol{\alpha_3 X}_{i,t} + \gamma_{j(i),t}(+\theta_i) + \epsilon_{i,t}, \quad (2)$$

where

$$\alpha_{*,j,t} = \beta_{*,0} + \boldsymbol{\beta_{*,1} Z}_{j,t} \quad (3)$$

with * as a marker for type (1) or diversification (2). Thus, the type and diversification effects are allowed to vary across countries and over time, depending on the vector of determinants $\boldsymbol{Z}_{j,t}$. For theses determinants, we consider time, regional and regulatory variables. Technically, the conditional structure of regression model (2) is captured by interaction effects. All t-statistics and p-values are based on standard errors adjusted for clustering at the country-year level.

The financial crisis marks a break in the data because income from investment banking activities collapsed and banks began to dispose of a part of their assets in an attempt to deleverage. As a result, the diversification measures might decrease even though a bank has maintained the same degree of activity diversification. To account for this potential measurement problem, we use pre-crisis measures of diversification throughout the sample period.[5] This is consistent with the view that diversification is chosen strategically so that it should not fluctuate significantly from year to year. More specifically, in the pre-crisis subperiod (1998 to 2006), we update the type and diversification measures on a yearly basis, while during the crisis and in the post-crisis period (2007 to 2013), we use the 2006 levels of both measures. We conduct several robustness tests in Section 5, for example by keeping the measures constant only during the immediate crisis from 2007 to 2009.

[3] We thank one of the anonymous referees for noting this.

[4] Engle et al. (2014) show that the estimated diversification effects may change upon excluding bank fixed effects.

[5] We thank one of the anonymous referees for this argument and proposition.

Table 1
Descriptive statistics.

	Obs.	Tobin's Q	Type (assets)	Div. (assets)	Type (income)	Div. (income)	Log assets	Equity ratio
US	8804	1.020	0.751	0.489	0.794	0.405	13.612	0.088
JAPAN	1569	0.982	0.684	0.622	0.847	0.283	17.001	0.042
INDIA	465	0.998	0.649	0.698	0.688	0.597	15.810	0.059
DENMARK	437	0.989	0.699	0.589	0.696	0.601	13.276	0.112
FRANCE	334	0.974	0.789	0.381	0.565	0.815	16.272	0.096
INDONESIA	315	1.054	0.651	0.600	0.790	0.396	14.753	0.094
ITALY	280	1.009	0.733	0.475	0.629	0.693	16.739	0.072
THAILAND	255	1.011	0.704	0.552	0.662	0.541	15.699	0.090
GERMANY	244	0.997	0.520	0.740	0.684	0.530	17.818	0.028
BRAZIL	213	0.953	0.459	0.696	0.780	0.428	15.348	0.107
NORWAY	197	0.953	0.859	0.281	0.752	0.496	15.116	0.067
SWITZERLAND	190	1.017	0.601	0.286	0.512	0.474	15.724	0.075
VENEZUELA	168	0.960	0.675	0.641	0.720	0.545	15.075	0.091
CROATIA	149	0.988	0.710	0.580	0.659	0.681	13.182	0.113
UK	142	1.003	0.629	0.645	0.557	0.754	19.229	0.045
POLAND	141	1.058	0.711	0.572	0.572	0.838	16.330	0.093
ISRAEL	136	0.987	0.769	0.453	0.616	0.762	16.708	0.055
RUSSIA	128	1.000	0.771	0.447	0.678	0.595	15.928	0.106
UN. ARAB EM.	127	1.114	0.726	0.531	0.653	0.616	15.541	0.143
AUSTRIA	125	0.968	0.627	0.743	0.658	0.659	16.851	0.057
TURKEY	123	1.031	0.678	0.642	0.733	0.534	16.797	0.107
KENYA	120	1.125	0.711	0.571	0.633	0.730	13.752	0.126
SOUTH AFRICA	119	1.048	0.733	0.464	0.476	0.823	15.720	0.095
PHILIPPINES	118	1.036	0.474	0.837	0.608	0.759	15.297	0.109
EGYPT	112	1.034	0.484	0.810	0.646	0.623	14.677	0.098
JORDAN	108	1.030	0.546	0.861	0.711	0.572	14.398	0.140
MEXICO	108	1.030	0.547	0.772	0.653	0.656	16.754	0.113
REP. OF KOREA	107	0.956	0.758	0.424	0.785	0.390	16.703	0.077
CHINA	106	0.996	0.504	0.905	0.854	0.291	19.592	0.061
TUNISIA	105	1.002	0.812	0.376	0.572	0.806	14.727	0.086
COLOMBIA	104	1.028	0.761	0.470	0.553	0.741	15.777	0.089
HONG KONG	103	1.037	0.573	0.825	0.690	0.616	16.700	0.085
KUWAIT	102	1.153	0.525	0.533	0.528	0.516	15.845	0.143
SAUDI ARABIA	102	1.157	0.614	0.763	0.675	0.629	16.714	0.121
SPAIN	101	1.014	0.751	0.480	0.661	0.672	18.378	0.058

Median values of selected variables by country, sorted by the number of observations available. Only countries with more than 100 bank-year observations are included. "Div." stands for Diversification.

3.3. Variables

In the following, we describe the included variables in more detail. Table 2 gives an overview and specifies the data sources.

3.3.1. Tobin's Q

We define Tobin's Q as follows:

$$Q = \frac{Market\ value\ of\ equity + Book\ value\ of\ debt}{Book\ value\ of\ equity + Book\ value\ of\ debt} \tag{4}$$

We use the market value of equity three months after the fiscal year end to account for the typical delay in releasing accounting information. Following Bolt et al. (2012), we winsorise Tobin's Q at 1% and 99% to mitigate the impact of outliers on regression estimates.

3.3.2. Bank type and diversification

We use the same income-based and asset-based measures of bank type and diversification as Laeven and Levine (2007). The income-based measures are *Income-based* $Type = x$ and *Income-based* $Diversification = 1 - |2x - 1|$, with x as the interest-income share. The asset-based measures are *Asset-based* $Type = y$ and *Asset-based* $Diversification = 1 - |2y - 1|$, with y as ratio of loans to total earning assets, where total earning assets includes loans, securities, and investments. Large values of x and y indicate that banks specialise in commercial activities, lower values indicate a higher degree of investment activities.

The definition of our diversification measure presupposes that the turning point in the relationship of diversification and value is 50%. However, the 50/50 benchmark is not necessarily optimal in terms of low volatility or high Sharpe ratio. The optimal weights depend on the correlations among the different income streams, as well as their volatilities and expected returns. The optimal value could, of course, be bank specific. There is some evidence that non-interest income is more volatile than interest income without adequate compensation in excess returns (see Stiroh 2006). This would mean that the optimal combination will give more weight to interest income. However, the 50/50 benchmark is a natural choice if uncertainty about the relative risk and return parameters is high. In later robustness tests, we estimate unconstrained LOWESS regressions to empirically substantiate the position of the turning point.

It is an open question whether the income-based measures or the asset-based measures are more appropriate. Laeven and Levine (2007) favour the asset-based definition due to potential measurement problems faced by income-based measures. A particular concern is that loans granted by commercial banks can yield fee income that is attributed to investment activities. However, the asset-based measure may also be problematic because of the increased presence of off-balance sheet activities over the past decades (Kane and Unal, 1990; Cooper et al., 2003). Since these items are not formally booked, an asset-based measure may underestimate diversification. As there is no clear preference, we show all results for asset-based and income-based measures of bank type and diversification.

Table 3 shows the correlations between bank type and diversification for the whole sample. Asset-based measures and income-based measures are significantly but not strongly correlated (0.39 for bank type, 0.12 for diversification), suggesting that they measure different aspects of bank activities.

Table 2
Variables and data sources.

Variable	Description and source
Tobin's *Q*	Ratio of the market value of equity plus the book value of liabilities to the book value of assets. Bankscope, Datastream
Type (assets)	Ratio of loans to total earning assets. Bankscope
Diversification (assets)	Diversification measure based on the ratio of loans to total earning assets. Bankscope
Type (income)	Ratio of net interest income to total operating income. Bankscope
Diversification (income)	Diversification measure based on the share of interest income in total operating income. Bankscope
Deposits share	Ratio of customer deposits to total liabilities. Bankscope
Wholesale share	Ratio of wholesale funding, defined as total short-term funding minus customer deposits, to total liabilities. Bankscope
Operating profit	Ratio of operating profit to total assets. Bankscope
Cost-to-income	Ratio of overheads divided by the sum of net interest revenue plus other operating income. Bankscope
Loan loss provisions	Ratio of loan loss provisions to net loans. Bankscope
Z-score	Return on assets plus capital ratio divided by the standard deviation of return on assets. Bankscope
Growth of total assets	Current year's growth in total assets as a percentage of the previous year's total assets. Bankscope
Log assets	Natural logarithm of total assets. Bankscope
Equity ratio	Ratio of common equity to total assets. Bankscope
Capital regulation	Index of capital regulatory oversight of bank, with higher values indicating greater stringency. Barth et al. (2013)
Diversification guidelines	Index of asset diversification guidelines imposed on banks, ranging from zero to two, with higher values indicating more diversification. Barth et al. (2013)
Regulatory restrictions	Index of regulatory restrictions on bank activities, with higher values indicating a more restrictive environment. Barth et al. (2013)
Conglomerates restrictiveness	Index of overall financial conglomerates restrictiveness, with higher values indicating a more restrictive environment. Barth et al. (2013)
Statement transparency	Index of the transparency of bank financial statement practices, with higher values indicating better transparency. Barth et al. (2013)
Deposit insurance	(0–1) variable indicating whether an explicit deposit insurance scheme exists. Barth et al. (2013)
Supervisory power	Index of power of commercial bank supervisory agency, measuring the power of the supervisory authorities to take specific actions to prevent and correct problems, with higher values indicating greater power. Barth et al. (2013)
Financial freedom	Index of financial freedom, scaled from zero to one hundred, with higher values indicating greater freedom. Heritage Foundation

Table 3
Correlation matrix.

	Diversification (assets)	Type (income)	Diversification (income)
Type (assets)	−0.526 ***	0.385 ***	−0.028 ***
Diversification (assets)	1.000	−0.032 ***	0.119 ***
Type (income)		1.000	−0.511 ***
Diversification (income)			1.000

Pearson correlation coefficients. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Fig. 1 shows box plots for each year to illustrate the evolution of the type and diversification measures over time (upper graphs: type; lower graphs: diversification). The median of type is near 0.75, and the 25% quantile is still clearly above 0.5. This indicates that the vast majority of banks is oriented more towards commercial banking than towards investment banking. Banks with an interest-income share or net loans share below 0.25 are rare and typically identified as outliers in the box plots. The upper graphs show a noticeable spike in the share of interest income during the crisis year of 2008. This echoes findings from DeYoung and Roland (2001) for prior episodes of financial distress and confirms that commercial activities seem more stable and recession-proof than investment activities. Further evidence is found in the lower graphs of Fig. 1, which show a decrease in the overall level of diversification in 2008. The median of net loans share tends to increase in the five years before the financial crisis and to slightly decrease again after 2009. However, the distributions of the type and diversification measures do not seem to be strongly or systematically different in the years before and after 2008.

3.3.3. Bank-level control variables

We control for variables that are known from theory and empirical banking research to be related to bank value. The following are our proxies for a bank's earnings potential: (1) The ratio of operating profit to total assets.[6] (2) The cost-to-income ratio as a standard bank-efficiency measure (Elsas et al., 2010). (3) The ratio of loan loss provisions to net loans. (4) The Z-score as a measure of bank-level risk and the distance to default.[7] (5) The change in total assets as a proxy for growth opportunities (Laeven and Levine, 2007).

Further control variables are two measures of banks' funding structures: the deposit share, defined as the share of customer deposits in total liabilities, and the wholesale share, defined as the share of wholesale funding (total short-term funding minus customer deposits) of total liabilities. We also include the natural log of total assets as a measure of bank size and the ratio of common equity to total assets. Because equity represents a buffer against losses but is commonly regarded as expensive, a higher equity ratio is expected to be associated with higher valuations during times of financial distress but with lower valuation during good times.

3.3.4. Regulatory variables

To capture the regulatory environment in different countries, we include indexes provided by Barth et al. (2013). These indexes reflect country-specific capital stringency, diversification guidelines, restrictions on bank activities, restrictiveness with respect to financial conglomerates, financial statement transparency, deposit

[6] We use operating profit rather than net income because it is commonly argued that gross or operating profit, reflecting a firm's core activity, is a better proxy for profitability (see Novy-Marx (2013); Yao and Liang (2005); and Trueman et al. (2000)).

[7] We update the Z-score following the recommendation of Lepetit and Strobel (2013).

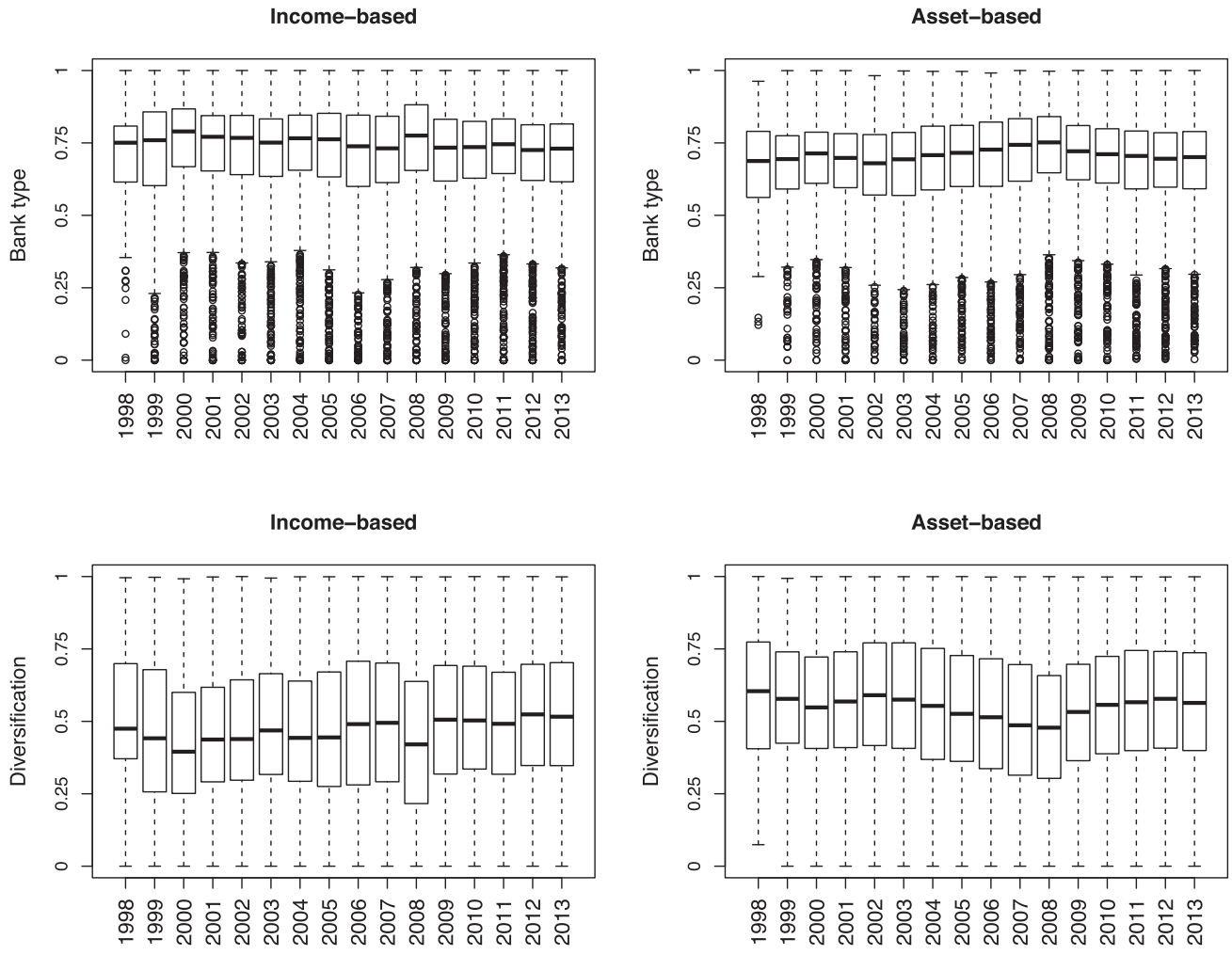

Fig. 1. Evolution of distributional characteristics of bank type and diversification over time. The boxplots illustrate the evolution of bank type (upper graphs) and diversification (lower graphs) over time for income- and asset-based measures within the whole sample.

insurance scheme, and supervisory power. Finally, we use the financial freedom index produced by the Heritage Foundation, which is a measure of banking independence from government control.

4. Empirical results

The regression results are shown in Table 4 for income-based measures and Table 5 for asset-based measures. Columns (1) and (2) include time-varying country fixed effects; columns (3) and (4) include bank fixed effects. Columns (1) and (3) show the baseline estimation for the whole sample period, while columns (2) and (4) differentiate between the pre-crisis and post-crisis subperiods.

Over the whole period, we find a significant diversification discount for income-based measures, while the diversification effect for asset-based measures is insignificant. The type coefficients are mostly negative but only significant (at the 1% level) in specifications with time-varying country fixed effects (without bank fixed effects). The direction of the estimated effects is as in Laeven and Levine (2007), but the size is much smaller.

The differentiation by subperiods in columns (2) and (4) provides evidence of time variation in the diversification discount. Consistent with the prior literature, we confirm strongly negative type and diversification effects in the first subperiod from 1998 to 2006. The estimates of the diversification discount are −0.058 and −0.034 for income-based measures and −0.026 and −0.037 for asset-based measures. These values are statistically and economically significant; the valuation discount of diversified banks corresponds to a range of 20% to 50% of the cross-sectional standard deviation of Tobin's *Q*. In the second subperiod from 2007 to 2013, the diversification discount drops significantly, which is apparent from the positive interaction terms. The total diversification effect for this subperiod (base effect plus interaction term) is in no case significantly different from zero.

The most important control variable is operating profit. Its positive effect on Tobin's *Q* is almost mechanical because the market-to-book ratio is a proxy for the discounted value of expected profits. The coefficients of the control variables are similar across the four specifications in Tables 4 and 5, with the exception of log assets, which has a positive coefficient in regressions without bank fixed effects and a negative coefficient with bank fixed effects. Thus, there is a positive size effect on Tobin's *Q* in the cross-section of banks but not in the size changes of individual banks.

The main conclusion, that is, the diversification discount has decreased significantly over time and is no longer apparent in the post-crisis years, can also be seen in Figs. 2 and 3. Fig. 2 illustrates the combined effect of type and diversification for the income-based and asset-based definitions. As emphasised earlier, type and diversification are strongly related because they are defined as functions of the same base variable (interest-income share or net loans share). To capture the combined effect, we plot the predicted partial response of Tobin's *Q* to type and diversification in a graph with the interest-income share or the net loans share

Table 4
Diversification effect based on income-based measures.

	Country-Year fixed effects		Bank fixed effects	
	(1)	(2)	(3)	(4)
Type	−0.0386 *	−0.0741 ***	−0.0265	−0.0406
	(−1.87)	(−3.49)	(−0.69)	(−1.10)
Diversification	−0.0399 ***	−0.0580 ***	−0.0239	−0.0335 **
	(−3.24)	(−4.86)	(−1.46)	(−2.13)
Type x Post crisis		0.0939 ***		0.1192 ***
		(2.91)		(2.89)
Diversification x Post crisis		0.0486 ***		0.0808 ***
		(2.63)		(3.19)
Deposits Share	0.0287 *	0.0272 *	−0.0362 *	−0.0400 **
	(1.94)	(1.81)	(−1.91)	(−2.13)
Wholesale Share	0.0071	0.0016	0.0251	0.0172
	(0.40)	(0.09)	(0.80)	(0.59)
Operating profit	2.7622 ***	2.6754 ***	1.8352 ***	1.5887 ***
	(6.75)	(6.36)	(4.63)	(4.07)
Cost-to-income	0.3928 ***	0.3598 ***	0.3469 ***	0.2849 ***
	(2.87)	(2.59)	(3.39)	(2.65)
Loan loss provisions	0.9505 ***	0.9006 ***	0.6762 **	0.5248 **
	(3.14)	(2.98)	(2.56)	(2.22)
log Z-score	−0.0019	−0.0019	−0.0051	−0.0042
	(−0.70)	(−0.72)	(−1.47)	(−1.34)
Growth in assets	0.1128	0.0937	0.1325	0.0994
	(1.06)	(0.92)	(1.55)	(1.28)
Log assets	0.0047 **	0.0046 **	−0.0183 **	−0.0190 **
	(2.36)	(2.28)	(−1.97)	(−1.97)
Equity ratio	−0.0297	−0.0227	−0.2298 **	−0.2276 **
	(−0.46)	(−0.37)	(−2.26)	(−2.44)
Observations	15349	15349	15349	15349
N Banks	1834	1834	1834	1834
R-squared (within)	0.1181	0.1244	0.0575	0.0791
Country-Year FE	Yes	Yes	Yes	Yes
Bank FE	No	No	Yes	Yes

The dependent variable is Tobin's *Q*. The regression model is given in Eqs. (2) and (3). Type and Diversification are income-based measures. "Post crisis" is a dummy variable with value one for the years 2007 to 2013. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$. *t*-values in parentheses.

Table 5
Diversification effect based on asset-based measures.

	Country-Year fixed effects		Bank fixed effects	
	(1)	(2)	(3)	(4)
Type	−0.0408 **	−0.0666 ***	0.0235 **	−0.0281 **
	(−2.42)	(−4.06)	(2.43)	(−2.18)
Diversification	0.0088	−0.0261 **	0.0127	−0.0368 ***
	(0.90)	(−2.25)	(1.18)	(−3.01)
Type x Post crisis		0.0718 **		0.1031 **
		(2.47)		(2.51)
Diversification x Post crisis		0.0427 ***		0.0539 **
		(2.91)		(2.20)
Deposits Share	0.0272 *	0.0254	−0.0407 **	−0.0401 **
	(1.73)	(1.60)	(−1.97)	(−2.00)
Wholesale Share	0.0155	0.0126	0.0252	0.0234
	(0.83)	(0.63)	(0.81)	(0.79)
Operating profit	2.8644 ***	2.8402 ***	1.8536 ***	1.7562 ***
	(6.75)	(6.76)	(4.88)	(4.65)
Cost-to-income	0.4242 ***	0.4105 ***	0.3782 ***	0.3385 ***
	(3.23)	(3.17)	(3.48)	(3.01)
Loan loss provisions	1.0487 ***	1.0352 ***	0.6816 **	0.6192 **
	(3.34)	(3.33)	(2.55)	(2.39)
log Z-score	−0.0029	−0.0032	−0.0052	−0.0065
	(−1.12)	(−1.26)	(−1.50)	(−1.63)
Growth in assets	0.1523	0.1465	0.1386	0.1333
	(1.56)	(1.53)	(1.54)	(1.57)
Log assets	0.0040 **	0.0040 **	−0.0180 *	−0.0176 *
	(2.06)	(2.10)	(−1.91)	(−1.74)
Equity ratio	−0.0187	−0.0184	−0.2240 **	−0.2109 **
	(−0.30)	(−0.29)	(−2.23)	(−2.06)
Observations	15349	15349	15349	15349
N Banks	1834	1834	1834	1834
R-squared (within)	0.1177	0.1207	0.0605	0.0710
Country-Year FE	Yes	Yes	Yes	Yes
Bank FE	No	No	Yes	Yes

The dependent variable is Tobin's *Q*. The regression model is given in Eqs. (2) and (3). Type and Diversification are asset-based measures. "Post crisis" is a dummy variable with value one for the years 2007 to 2013. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$. *t*-values in parentheses.

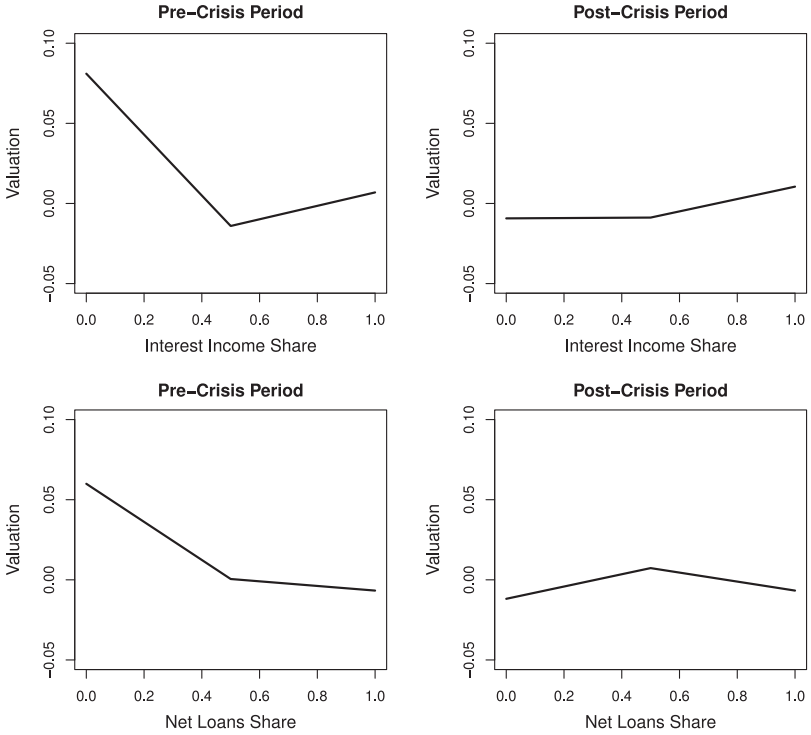

Fig. 2. Type and diversification effect. The graphs show the partial response of Tobin's *Q* to interest-income share (upper graphs) and net loans share (lower graphs) as implied in the regression coefficients of bank type and diversification presented in Tables 4 and 5, column 2. The other independent variables included in the model are bank-level. Pre-crisis period: 1998–2006, post-crisis period: 2007–2013.

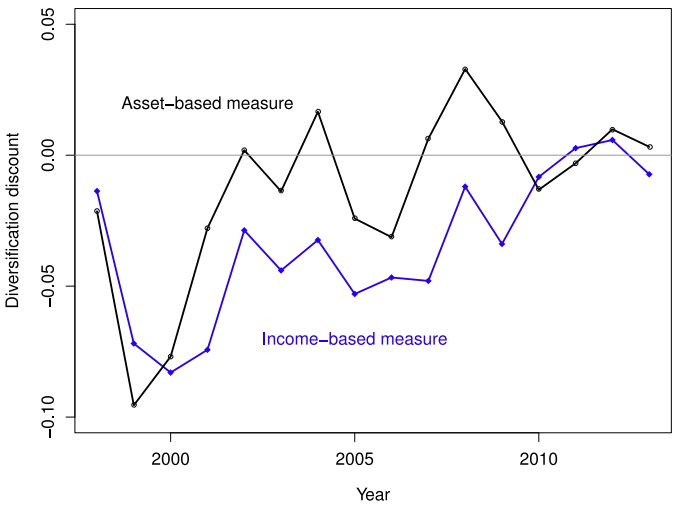

Fig. 3. Diversification discount by year. The graph shows the diversification discount estimates over time from 1998 to 2013. The estimates are the slopes of interaction terms of year and diversification in regression model (2) and (3).

on the horizontal axis.[8] An effect of type can be seen from the difference of Tobin's *Q* at the left and right edges, and an effect of diversification is reflected in the kink of the profile in the middle. The graphs on the left of Fig. 2 show pronounced type and diversification effects in the first subperiod, while the graphs on the right show almost flat lines, which indicates that the effects have disappeared in the second subperiod.

Fig. 3 illustrates the evolution of the diversification discount estimates over time, based on regression model (2) and (3) including interactions of type and diversification with years instead of subperiods. The diversification effect is negative in the first years and increases gradually to zero at the end of the sample period, which supports our analysis so far.

Table 6 reports the results for regional differences, namely, among the US, Europe (EUR: EU15 + Norway + Switzerland) and Japan (JAP). As the regressions include interaction terms with these three regions, the base effect captured by the Type and Diversification variables is related to the group of remaining countries. The total diversification effect for the US, Europe and Japan (base effect plus interaction term) is documented below the regression results. We also report *F*-statistics of Chow tests for differences in the diversification effects between the regions.

We find a significant income-based diversification discount in all three regions (total diversification effect). The discount tends to be higher in Europe compared to the US (e.g., −0.097 vs. −0.047 in column 1), but the results are mixed across specifications and are therefore inconclusive. In the US and Europe, the asset-based discount is smaller than the income-based discount, while the relation is not clear in Japan. The change of the diversification in the second subperiod is always significantly positive. For asset-based measures, the discount is particularly strong for Japanese banks and significantly higher than in Europe and the US.

A segment of the literature hypothesises that heterogeneity in the diversification discount across countries and regions might be driven by differences in the regulatory environment. We use eight indicators of bank regulation proposed in the literature (see Table 2) and test whether these indices interact with the type and diversification effects. The results in Table 7 in the Appendix do not confirm that regulation is an important driver of differences in

[8] All other explanatory variables are fixed at their mean level. One possible issue with the partial analysis is the presence of high correlations with other independent variables. In our case, however, all pairwise correlations are lower than 0.4.

Table 6
Interaction effects: geographical regions.

	Income-based measures				Asset-based measures			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Type	0.0167	−0.0222	−0.0328	−0.0324	0.0238	−0.0047	−0.0103	−0.0146
	(0.47)	(−0.62)	(−0.82)	(−1.16)	(0.79)	(−0.17)	(−1.20)	(−0.95)
Diversification	−0.0179	−0.0395	−0.0194	−0.0228	0.0084	−0.0108	−0.0370	−0.0308
	(−0.58)	(−1.34)	(−0.70)	(−0.80)	(0.49)	(−0.76)	(−1.46)	(−1.23)
Type x Post crisis		0.0960 ***		0.0577 ***		0.0754 ***		0.0996 **
		(2.85)		(2.83)		(2.62)		(2.46)
Div. x Post crisis		0.0545 ***		0.0792 ***		0.0497 ***		0.0530 **
		(2.77)		(3.07)		(3.30)		(2.15)
Type x EUR	−0.0680	−0.0761 *	0.0626	0.0184	−0.0848 ***	−0.0955 ***	0.0499	0.0362
	(−1.58)	(−1.70)	(0.99)	(0.69)	(−2.93)	(−3.11)	(0.62)	(0.24)
Type x US	−0.0906 ***	−0.0767 **	0.0460	0.0339 *	−0.0856 ***	−0.0715 ***	−0.0462	−0.0318
	(−2.95)	(−2.46)	(1.20)	(1.83)	(−3.12)	(−2.93)	(−0.69)	(−0.48)
Type x JAP	−0.0559	−0.0405	−0.1463	−0.0911	−0.0562**	−0.0617***	0.0345	0.0374
	(−1.51)	(−0.99)	(−1.42)	(−1.04)	(−2.31)	(−3.43)	(0.47)	(0.52)
Div. x EUR	−0.0790 **	−0.0853 **	0.0492	0.0132	−0.0135	−0.0200	0.0223	0.0065
	(−2.19)	(−2.36)	(0.70)	(0.17)	(−0.53)	(−0.76)	(1.66)	(0.99)
Div. x US	−0.0288	−0.0211	0.0284	0.0186	0.0063	0.0154	−0.0234	−0.0159
	(−1.04)	(−0.77)	(0.95)	(0.57)	(0.45)	(1.49)	(−0.71)	(−0.48)
Div. x JAP	−0.0104	0.0013	−0.1144 ***	−0.0956 ***	−0.0490 ***	−0.0496 ***	−0.0628 **	−0.0700 **
	(−0.38)	(0.05)	(−4.67)	(−4.45)	(−4.63)	(−5.56)	(−2.01)	(−2.12)
R-squared (within)	0.1252	0.1318	0.0612	0.0819	0.1245	0.1279	0.0633	0.0731
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	Yes	Yes	No	No	Yes	Yes
Total diversification effect (coefficient, *t*-test)								
EUR	−0.0969 ***	−0.1248 ***	0.0298	−0.0096	−0.0051	−0.0308	−0.0147	−0.0243
US	−0.0467 ***	−0.0605 ***	0.0089 **	−0.0042	0.0147 ***	0.0046	−0.0604 **	−0.0467 *
JAP	−0.0283 ***	−0.0382 ***	−0.1338 ***	−0.1184 ***	−0.0405 ***	−0.0603 ***	−0.0998 ***	−0.1008 ***
Chow test for regional differences of the diversification effect (F-stat)								
EUR-US	17.1985 ***	21.0696 ***	0.3255	0.0544	2.0843	5.2451 ***	3.2194 *	1.5773
EUR-JAP	11.3320 ***	17.6728 ***	6.9860 ***	3.1962 **	13.5335 ***	13.6114 ***	4.1769 **	3.7788 **
US-JAP	2.8372 *	3.2124 *	6.6054 ***	4.1238 **	27.6430 ***	28.4492 ***	3.0539 *	3.7281 **

The dependent variable is Tobin's *Q*. The regression model is given in Eq. (2) and (3) with interaction terms for countries and regions. "Div." stands for Diversification. "Post crisis" is a dummy variable with value one for the years 2007 to 2013. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$. *t*-values in parentheses.

the discount. After controlling for the time variation across subperiods, none of the regulatory variables significantly interacts with the diversification effect. We have to be cautious, however, in interpreting this result because regulation may still play an important role. As some of the regulatory variables follow a time trend themselves (e.g., capital regulation becomes stricter over time), these trends might have contributed to the observed time trend in the diversification discount.[9]

5. Robustness tests and endogeneity

In our baseline specification, Tobin's *Q* was winsorised at 1% and 99%. We obtain essentially the same results when trimming (instead of winsorising) the observations below 1% and above 99%. The results are also very similar when Tobin's *Q* is replaced with the market-to-book ratio of equity. Moreover, the specific set of control variables does not seem to be crucial. Estimations for a reduced set of explanatory variables, including only operating profit and log assets, yield the same main results for type and diversification.

As explained in Section 3.2, we use pre-crisis measures of type and diversification throughout the sample period in order to avoid a measurement problem related to a potential structural break in banks' income streams in the financial crisis. We obtain very similar results when keeping the measures constant only during the immediate crisis from 2007 to 2009. The results also appear to be robust with respect to the definition of the pre-crisis measures of type and diversification. In particular, the same time pattern of the diversification discount is observed when using the mean of the 2005 and 2006 values instead of the 2006 levels of type and diversification in the second subperiod. In our base regressions, we drop observations for which 2006 values are not available, which could introduce a selection bias.[10] However, we obtain very similar results when using the current, post-crisis levels of the type and diversification measures if the values from 2006 are not available.

The financial crisis clearly had an effect on the distribution of profitability and risk characteristics in our sample of banks. Therefore, a structural break in the valuation effects attributed to these control variables is plausible. To capture this structural break, we allow the coefficients to change in 2007 (i.e., in Eq. (1), we include an additional term $+D\boldsymbol{\alpha_4}\boldsymbol{X}_{i,t}$, where D is a dummy variable equal to one for the years 2007–2013). Table 8 in the Appendix shows that the coefficients of the deposits share, log assets, equity ratio and log Z-score change significantly during the financial crisis. The estimated diversification discount tends to be smaller, but the main results are unaffected.

Sample selection in the sense of Heckman (1979) should not be an issue because we use the entire sample of listed banks.[11] However, there is some concern that type and diversification might

[9] Further attempts to disentangle the effects by exploiting differences in the regulatory trends across countries did not provide conclusive results.

[10] We lose 2872 observations for 677 banks.

[11] A remaining problem is that the decision to list a firm is not random. For example, some bank managers could face particular incentives to avoid the stricter disclosure requirements of listed banks. To address this concern, the decision to be listed would have to be modelled separately in a first stage regression.

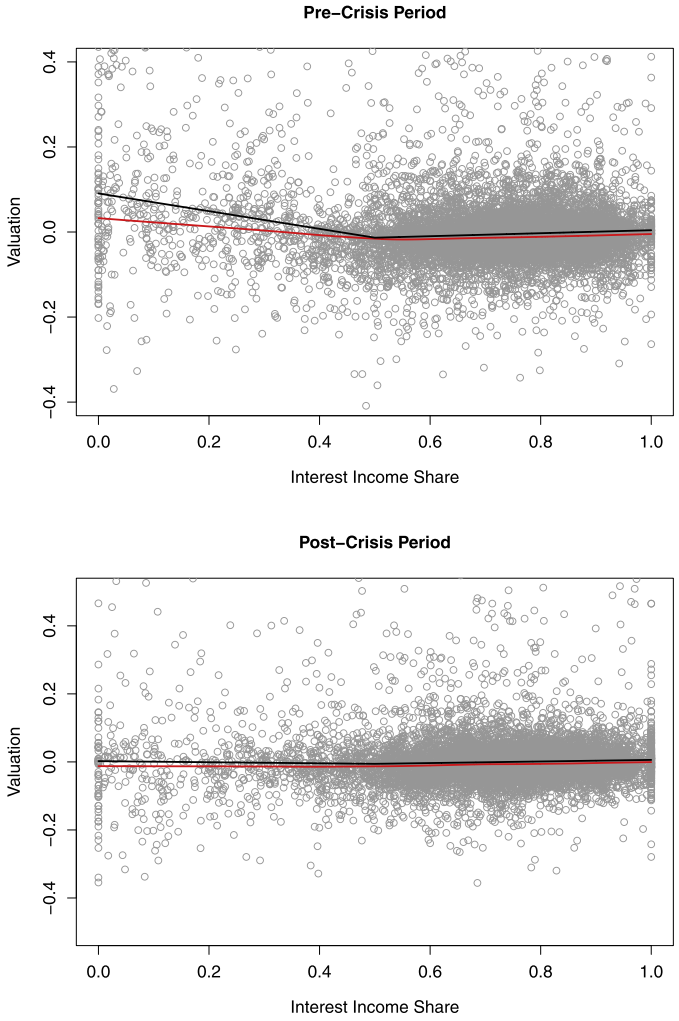

Fig. 4. Partial residual plots. The graphs show the partial response of Tobin's *Q* to interest-income share from 1998 to 2006 (upper graph) and 2007 to 2013 (lower graph) together with the residuals of regression (2) and (3). The red lines show a nonparametric regression based on a locally-weighted polynomial regression model (LOWESS). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

be choice variables that are correlated with unobservables contained in the error term. Such self-selection will produce endogeneity bias that should be avoided by using instruments for the endogenous variables. However, it is almost impossible to find appropriate instrumental variables. While the variables proposed in the literature, such as lagged diversification, are correlated with diversification as required, they might also be correlated with the error term in the explanatory equation and thus suffer from the same problem as the diversification variable itself. Nevertheless, as a robustness check, we estimate the type and diversification effects using two instrumental variables proposed by Laeven and Levine (2007) (activity restriction in the country of origin, and diversification of other banks in the same country) and one proposed by Elsas et al. (2010) (lagged diversification). The main conclusions remain valid. Specifically, we are able to replicate the results of Laeven and Levine (2007) for their study period. For the other periods, we confirm a weakening of the type and diversification effects over time.

Another concern is that the results might be driven by a small number of highly valued investment banks. To examine this issue, Fig. 4 shows partial residual plots for the effects of interest-income share on Tobin's *Q*. The graphs are similar to Fig. 2 (upper panel) but include the residuals.[12] We also include an additional smooth nonparametric regression line based on a locally-weighted polynomial regression (LOWESS). This method does not make assumptions about the form of the regression and is less sensitive to outliers than linear OLS regression. A further advantage of LOWESS regression is that the position of a possible kink in the profile is extracted from the data rather than fixed in advance at a level of 0.5 as in the estimation approach used so far.

A first interesting finding is that the LOWESS line can actually be approximated by a linear profile with a kink at 0.5. This is consistent with the view that the relevant transition point is indeed 0.5, where the highest degree of diversification is achieved. The second important observation is that the magnitudes of the type and diversification effects are substantially smaller in the first subperiod compared to the standard regression. The strong type and diversification effects apparent in the standard regressions for income-based measures diminish considerably (to approximately one-third of the effect). This finding is consistent with the hypothesis that the diversification discount found in the first period is partly due to a small number of large observations for investment banks.

6. Conclusion

Our main finding is that the diversification discount in bank valuation documented in previous work declined during the years before the financial crisis and essentially vanished afterwards. We do not confirm strong roles of geographical or regulatory factors in bank valuation. Rather, our results suggest that the market valuation of banks with respect to type and diversification is internationally well aligned. We show that the discount before the financial crisis is considerably smaller in a robust regression, which in part is driven by banks with a large share of non-interest income.

Our results call into question the policy implications of prior findings of a substantial diversification discount. The prior findings suggest that shareholders and bank managers tend to overestimate diversification synergies and underestimate agency costs, which will lead to inefficient business combinations in banking. They also suggest that the attempt to reduce bank-specific risk by diversifying income streams might generally be costly. However, it is important to note that the previously observed discount reflected a split picture: an almost flat level of Tobin's *Q* as a function of interest-income share for the vast majority of banks whose share of interest income ranges from 50% to 100% and a decreasing function only for the few banks whose share of interest income is between 0% and 50%. As this decrease has flattened with the re-evaluation of banks since the financial crisis, the new empirical evidence supports a neutral position according to which diversification per se is neither value destroying nor value enhancing.

A limitation of this paper is shared with most of the previous work in that we only estimate the *net* effect of diversification and do not measure its components, e.g., economies of scope and agency problems. While appropriate proxies for these components are difficult to find for a large-scale sample,[13] a step in this direction would be important to better understand the substantial variability in the values of diversified banks.

[12] While our base regressions use pre-crisis levels of type and diversification in the post-crisis period, this graph is based on the current level of interest-income share.

[13] See, e.g., Laeven and Levine (2007, p. 332), "Empirically, it is extraordinarily difficult to measure economies of scope in the provision of financial services or to measure agency problems in financial conglomerates". Similarly Brighi and Venturelli (2016, p. 2), "this could be linked to the fact that it is extraordinarily difficult to unequivocally measure economies of scope or agency problems empirically".

Table 7
Interaction effects with indicators of bank regulation.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Type	−0.0981	−0.0303	−0.0162	−0.1343	−0.1264 **	−0.0838 ***	−0.2096 *	−0.0314
	(−1.35)	(−0.35)	(−0.22)	(−1.69)	(−2.25)	(−4.10)	(−1.76)	(−0.75)
Diversification	−0.0399	−0.1015 ***	−0.1188 **	−0.1478 ***	−0.0797 ***	−0.0577 ***	−0.1470 **	−0.0418
	(−0.68)	(−2.76)	(−2.20)	(−2.79)	(−3.82)	(−5.06)	(−2.05)	(−1.20)
Type x Post crisis	0.0882 ***	0.0940 ***	0.0983 ***	0.0969 ***	0.0928 ***	0.0914 ***	0.0781 **	0.0949 ***
	(2.72)	(2.86)	(3.17)	(3.11)	(2.92)	(2.89)	(2.19)	(2.87)
Diversification x Post crisis	0.0531 ***	0.0478 **	0.0445 **	0.0507 ***	0.0467 **	0.0478 ***	0.0386 *	0.0505 **
	(2.69)	(2.45)	(2.34)	(2.87)	(2.41)	(2.64)	(1.76)	(2.57)
Div. x Capital Regulation	−0.0032							
	(−0.33)							
Div. x Regulatory restrictions		0.0056						
		(1.34)						
Div. x Conglomerates restrictiveness			0.0081					
			(1.17)					
Div. x Supervisory power				0.0067				
				(1.53)				
Div. x Diversification guidelines					0.0138			
					(0.94)			
Div. x Deposit insurance						−0.0323		
						(−0.76)		
Div. x Statement transparency							0.0177	
							(1.19)	
Div. x Financial freedom								−0.0003
								(−0.61)
R-squared (within)	0.1246	0.1251	0.1261	0.1257	0.1254	0.1269	0.1255	0.1249

The dependent variable is Tobin's *Q*. Type and Diversification are income-based measures. Regulatory control variables used are capital stringency, diversification guidelines, restrictions on bank activities, financial conglomerates restrictiveness, financial statement transparency, presence of explicit deposit insurance scheme, supervisory power, and an index of financial freedom (see Table 3). Interaction terms of the regulatory indicators with type are included but not tabulated. The number of observations is 15349. Bank-specific control variables and time-varying country fixed effects are included. "Div." stands for Diversification. "Post crisis" is a dummy variable with value one for the years 2007 to 2013. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$. *p*-values in parentheses.

Table 8
Control for a structural break in the valuation effects of control variables in the wake of the financial crisis.

	Income-based measures		Asset-based measures	
	(1)	(2)	(3)	(4)
Type	−0.0593 **	−0.0304 *	−0.0786 **	−0.0533 ***
	(−2.51)	(−1.88)	(−2.39)	(−3.28)
Diversification	−0.0501 ***	−0.0475 ***	−0.0397 ***	−0.0319 *
	(−3.94)	(−2.73)	(−3.25)	(−1.82)
Type x Post crisis	0.0540 **	0.0758 ***	0.0541 ***	0.0361 **
	(2.30)	(3.06)	(2.88)	(2.53)
Diversification x Post crisis	0.0395 ***	0.0530 ***	0.0352 **	0.0275 **
	(2.84)	(2.73)	(2.15)	(2.28)
Deposits Share x Post crisis	−0.0390 **	−0.0599 ***	−0.0539 ***	−0.0330 **
	(−2.43)	(−3.23)	(−3.20)	(−1.97)
Wholesale Share x Post crisis	−0.0161	−0.0079	−0.0176	−0.0301
	(−0.69)	(−0.36)	(−0.71)	(−1.28)
Operating profit x Post crisis	−1.1021	−1.2897 ***	−1.4853 ***	−1.4883
	(−1.05)	(−2.68)	(−3.37)	(−1.37)
Cost-to-income x Post crisis	−0.2373	−0.2818 **	−0.4132 ***	−0.4263 ***
	(−1.37)	(−2.02)	(−2.84)	(−2.68)
Loan loss provisions x Post crisis	0.1119	−0.4348	−0.5581 *	−0.0671
	(0.21)	(−1.35)	(−1.71)	(−0.12)
log Z-score x Post crisis	0.0042 ***	0.0121 ***	0.0119 ***	0.0039 **
	(3.16)	(3.02)	(2.93)	(2.31)
Growth in assets x Post crisis	−0.1320	−0.0971	−0.1197	−0.1763
	(−0.62)	(−0.60)	(−0.72)	(−0.84)
Log assets x Post crisis	−0.0052 ***	−0.0123 ***	−0.0113 ***	−0.0048 ***
	(−3.62)	(−3.00)	(−2.78)	(−2.99)
Equity ratio x Post crisis	−0.1993 ***	−0.3748 ***	−0.3863 ***	−0.1977 ***
	(−2.88)	(−3.32)	(−3.57)	(−2.79)
Observations	15349	15349	15349	15349
N Banks	1834	1834	1834	1834
R-squared (within)	0.1334	0.1140	0.1154	0.1335
Controls	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes

The dependent variable is Tobin's *Q*. The regressions in Tables 4 and 5, columns 2 and 4, are extended to allow a structural break in the valuation effects of the bank-specific control variables in the wake of the financial crisis. "Post crisis" is a dummy variable equal to one for the years 2007 to 2013. The control variables are included but the coefficients not tabulated.

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