

Does the stock market value bank diversification?

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Abstract

This paper investigates whether or not diversified banks have a comparative advantage in terms of long-term performance/risk profile compared to their specialized competitors. To that end, this study uses market-based measures of return potential and bank risk. We calculate the franchise value over time of European banks as a measure of their long-run performance potential. In addition, we measure risk as both the systematic and the idiosyncratic risk sensitivities derived from a bank stock return model. Finally, we analyze the return/risk trade-off implied in different diversification strategies using a panel data analysis over the period 1989-2004. Diversification affects banks' franchise values positively. Diversification increases the systematic risk of banks while the effect on the idiosyncratic risk component is non-linear and predominantly downward-sloping. These findings have conflicting implications for different stakeholders, such as investors, bank shareholders, bank managers and bank supervisors.

Keywords: Second Banking Directive, diversification, bank stock returns, charter value, risk factors

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1 Introduction

The Second Banking Directive of 1989 has allowed European banks to pursue functional diversification across activities such as commercial banking, investment banking, insurance and other financial services. This has resulted in a large degree of cross-sectional variation in the diversification strategies pursued by European banks. Some banks have elected to remain focused on intermediation in the retail market. Others have become full-blown financial conglomerates combining banking, insurance, investment banking, and asset management. The research question we address in this paper is: Do financial conglomerates possess a comparative advantage in terms of return/risk profile?

In order to answer this question, we analyze the long-term performance and riskiness of banks with different degrees of diversification using stock market data. We prefer capital market data to accounting data because equity prices are forward-looking and hence better identifiers of prospective performance and risks associated with different strategic choices. As a measure of long-term potential value, we use a modified version of Tobin's Q . This measure captures the market's expectation of future profits, but we control for valuation inefficiencies. At the risk side, we estimate an extended version of the market model to decompose total bank risk into a systematic and an idiosyncratic component. While well diversified investors are mainly interested in the systematic risk incorporated in the bank equity returns, regulators, bank managers, large stakeholders, and clients also care about idiosyncratic and total volatility. Finally, we quantify the effect of diversification on both risk and return in a panel study for a large set of European banks over the period 1989-2004.

In this paper, we focus on the European banking sector. Previous evidence on this matter is predominantly US oriented (see e.g. Demsetz and Strahan (1997) and Stiroh (2005, 2006)). In our opinion, however, Europe offers a more fertile ground for investigating the effect of diversification on the risk/return trade-off of banks. First, European banks have been less restricted in terms of the range of activities they are allowed to undertake. Historically, US banks have been confronted with legal restrictions prohibiting their entry in non-banking activities (the Glass-Steagall Act). Over the 1990's the ceiling on admissible investment banking revenues was gradually raised for certain banks. But it is only in 1999 that the Gramm-Leach-Bliley Act came into force, permitting banks to pursue

broader diversification in Financial Holding Companies. In Europe, the scope for functional diversification has been deregulated more completely. The landmark piece of legislation was the Second Banking Coordination Directive, enacted in 1989. The Directive was intended to create a level playing field for bank competition by introducing a single banking license, by allowing free cross-border servicing and establishment, and by introducing common regulatory and supervisory standards. But the Directive also laid the groundwork for functional diversification of European banks. Since then, banks are allowed to operate broad franchises, combining commercial banking, securities, insurance and other financial activities in a conglomerate organizational form¹. In subsequent years, this regulatory framework was extended with regulation aimed at the harmonization of areas such as investment services, insurance, capital adequacy and the prudential supervision of financial conglomerates. Second, in Europe, the scope for functional diversification has been deregulated earlier. Hence, not only can European banks engage in a wider range of activities than their US counterparts, they have also been able to do this for a longer period of time. This should enable us to distinguish banks that have pursued different diversification strategies for a sufficiently long time span. Consequently, our empirical analysis covers the 15-year period since the Second Banking Directive of 1989.

The findings in this paper suggest that the relationship between diversification and bank risk and return is different in Europe relative to other developed markets, notably the US. First, we find a positive relationship between franchise value and the degree of functional diversification. Apparently, the stock market anticipates that functional diversification can improve future bank profits. This observation differs from the one reported by Stiroh (2006) for the US and Laeven and Levine (2006)

¹Some European banks have opted to remain active in traditional financial intermediation, basically focusing on lending and deposit-taking, often through a branch network. A number of banks have diversified into investment banking, comparable to the situation in the US where some of the large banks have set up Section 20 subsidiaries. Some European banks have even pursued a pan-European strategy in investment banking (a typical example is ABN-AMRO) or have global ambitions, often through acquisitions (e.g. Deutsche Bank acquired Bankers Trust in the US). But the range of diversified financial conglomerates in Europe extends well beyond investment banking. Since the early nineties a number of banks have opted for the so-called bancassurance model, combining commercial banking and insurance activities, both underwriting and distribution (ING and Fortis are classical examples) (see Genetay and Molyneux, 1998). Moreover, a large number of banks are also active in brokerage activities, asset management (private banking, distribution of mutual funds), advisory activities for corporate clients and even venture capital.

for a set of 43 developed markets, although the results cannot be compared directly because we use an alternative methodology². Second, we find a non-linear relationship between diversification and bank-specific risk. For many banks diversification can actually decrease idiosyncratic risk and make them safer. This finding differs from that reported for US banks by Stiroh (2005, 2006). He concludes that diversified banks are more risky, measured as return volatility. We do confirm the finding of Stiroh (2006) that more diversified banks have systematically higher market betas and hence higher systematic risk. These results have a number of implications for different bank stakeholders. Bank supervisors care about bank sector stability, hence they are interested in both the systematic and idiosyncratic risk of banks. Diversified investors are primarily interested in systematic risk exposures, but large shareholders should also consider idiosyncratic risk, similar to borrowers and customers.

The rest of the paper is structured as follows. Section 2 briefly reviews the economics of financial conglomeration. Section 3 describes the sample of listed banks. In section 4 we outline the set-up of the empirical analysis and we document the calculation of the modified Tobin's Q measure as well as the risk decomposition. Section 5 presents the results of the empirical investigation. A number of robustness checks are discussed in Section 6. Section 7 concludes and draws a number of implications.

2 The impact of diversification on return and risk

What are the potential advantages of diversified banks over their specialized peers in terms of return and risk? From the profit dimension, the question is whether the benefits of conglomeration exceed the costs. Potential benefits of diversification include cost economies, revenue synergies, information economies and efficiency effects due to corporate governance. On the costs side, agency costs arising from the complexity of the conglomerate organization and regulatory costs associated with multiple supervision can be invoked. Useful surveys can be found in De Young and Roland (2001), Stiroh

²In a panel of Tobin's Q's of banks from 43 countries over the period 1998-2002, Laeven and Levine (2006) find that the market value of financial conglomerates that have engaged in multiple activities is lower than if those institutions were broken into financial intermediaries that specialize in the individual activities. Stiroh (2006) finds for a panel of US bank holding companies over the period 1997-2004 that banks most reliant on activities that generate non-interest income do not earn higher average equity returns.

(2004) or Laeven and Levine (2006).

First, the formation of financial conglomerates would be beneficial if there are positive cost and/or revenue effects from combining various financial service activities. Consolidated revenues would be improved if the income-generating capacity of the combined institutions is enhanced. Similarly, the operating costs of financial conglomerates would be lower relative to specialized banks if integration allows the realization of operational synergies, e.g. through economies of scope. The sharing of inputs such as labour, technology and information across multiple outputs constitutes the major source of such potential cost savings. Second, banks possess information from their lending relations that may facilitate the efficient provision of other financial services, including securities underwriting or insurance. Similarly, information acquired through securities or insurance underwriting can improve loan origination and credit risk management. Thus, financial conglomerates could enjoy economies of information that boost performance and market valuations. Third, the potential for functional diversification may improve corporate governance through the working of the takeover market. If specialized financial firms (banking, insurance, securities business) are sheltered from acquisition, e.g., due to legal barriers to takeover, inefficient managers are protected and agency costs are high. When cross-activity mergers are allowed, managers of financial firms incur stronger monitoring by the takeover market (Saunders, 1994). In an event study of European financial mergers, Cybo-Ottone and Murgia (2000) report that the abnormal returns are higher in cross-product deals than in horizontal bank mergers.

Alternatively, diversification of activities in a conglomerate structure could intensify agency problems, between insiders and outsiders, but also between the divisions of the conglomerate and between the conglomerate firm and its customers in the form of conflicts of interest. Managers may pursue diversification to enhance their ability to extract private benefits, even when diversification would lower the market value (Jensen and Meckling, 1976). The question is whether or not internal mechanisms can be designed to align interests or whether external discipline can alleviate some of the agency problems. Moreover, it is argued that the supervision of financial conglomerates may entail additional costs. However, since most European financial supervisors have themselves adapted their organizational structure to the conglomeration trend, the supervisory burden should probably be

alleviated, although considerations with respect to complex cross-border supervision remain valid.

Theoretically it is unclear whether or not the potential benefits are larger than the costs. Empirically, it has proven to be very difficult to assess the actual impact of these alternative hypotheses in banking. Especially, given the econometric difficulties and data limitations, economies of scope or agency costs are very difficult to identify empirically. Similar disagreement exists in the literature on conglomeration in non-financial corporations. Berger and Ofek (1995) find a diversification discount using a Tobin's Q measure, while Villalonga (2004) finds a diversification premium using data at the establishment level. However, Berger and Ofek (1995) also report that, although industry diversification reduces value on average, relatedness mitigates the value loss. Arguably, the activities undertaken in financial conglomerates have a higher degree of similarity than in most other industries. On the efficiency side, Vander Venet (2002) finds that financial conglomerates in Europe are more cost efficient than specialized banks. However, the cost advantage does not translate into a significant advantage in terms of profit efficiency. Using Tobin's Q, Laeven and Levine (2006) find a diversification discount in financial conglomerates across 43 countries. Their results are consistent with the argument that diversification intensifies agency problems in financial conglomerates with adverse implication for market values. Apparently, these diversification costs outweigh any benefits accruing from economies of scope.

From the risk dimension, standard portfolio theory predicts that the combined cash flows from non-correlated revenue sources should be more stable than the constituent parts. The combination of banking, insurance and securities activities may lead to a more stable profit stream, since the revenues stemming from different products in a conglomerate organization are usually imperfectly correlated. Saunders and Walter (1994) find that expanding banks' activities reduces risk, with the main risk-reduction gains arising from insurance rather than securities activities. In a survey article, Kwan and Laderman (1999) conclude that securities and insurance activities have the potential to decrease conglomerate risk, but the effect largely depends on the type of diversifying activities that bank holding companies undertake. Studies using accounting data suggest that an increased reliance on non-interest income raises the volatility of accounting profits without raising average profits. DeYoung and Roland (2001) and Stiroh (2004) find little gains from the shift towards more diversified banks

in the US. Stiroh and Rumble (2005) conclude that diversification benefits exist in Financial Holding Companies, but the gains are offset by the increased exposure to non-interest activities, which are much more volatile while not more profitable than interest-generating activities. The US results based on equity data arrive at a similar conclusion. For a sample of US banks over the period 1997-2004, Stiroh (2006) finds no link between non-interest income exposure and average returns across banks, but a significant positive link between non-interest income and the volatility of market returns. He concludes that some banks may have over-extended in diversifying activities.

3 Data

This study uses data on listed banks from 17 European countries (the countries of the EU15, Norway and Switzerland) over the period 1989-2004. The sample period starts in 1989, the year in which the Second Banking Coordination Directive was enacted. This directive laid the groundwork for functional diversification of European banks. The sample covers the 15-year period following the deregulation and should allow us to detect long-term effects of diversification on bank performance and risk. The time frame of the sample also ensures that it contains periods with different business cycle and stock market conditions. The sample consists of large and medium-sized banks and considers all types of banks, ranging from commercial and savings banks to financial conglomerates. Since listed banks are usually relatively large, the banks in the sample account for the majority of total assets of the European banking industry. In some countries the coverage is more than 90% of domestic bank assets. The dataset contains 255 banks. The panel dataset is unbalanced due to delistings (e.g., caused by mergers and acquisitions). We account for a potential survivorship bias by also including stocks of banks that have been delisted.

Annual data from bank balance sheets and income statements are obtained from the Bankscope database maintained by Fitch/Bureau Van Dijk. End-of-year market capitalization data and daily stock market returns are obtained from Datastream. For the estimation of bank risk we employ daily stock returns³, hence it is important to account for liquidity considerations. Since stocks that are

³We use daily instead of weekly data because Merton (1980) and Nelson (1992) showed that sufficiently high-frequency data is necessary to accurately measure historical volatilities. Problems of asynchronous trading are relatively

traded infrequently may yield uninformative returns, we disregard a year of stock market data for a particular bank if more than 15% of the bank's daily stock returns in that year are zero. As a result, we eliminated 112 banks, all of them are relatively small⁴ local savings banks (predominantly from Denmark, France and Norway). In the bank stock return model, we use market returns, interest rates, and exchange rates; they are taken from Datastream. The final panel dataset contains 143 banks and covers over 1200 bank-year observations.

4 Bank franchise value and bank risks

The objective of the paper is to assess the impact of diversification on the long-run performance and riskiness of European banks. For that purpose we need to define our performance concept and the relevant bank risk categories. Since we are interested in the return/risk trade-off over the longer term, we work with stock market-based measures because they are forward-looking. We use the bank's franchise value, measured as the adjusted Tobin's Q, as the proxy for its performance potential. We decompose the total variance of each bank's stock returns into a systematic and an idiosyncratic component. In the next two subsections, we describe the measurement of both the performance and the risk indicators.

4.1 Long-run performance measure: bank franchise value

If a bank possessed comparative advantages that have a positive impact on its long-term performance, this should be reflected in its stock market valuation. A number of studies, following Keeley (1990), have used Tobin's Q as a proxy for bank franchise value. The franchise value of a bank is equal to the present value of the current and future profits that a bank is expected to earn. Tobin's Q is the ratio of the market value of a bank divided by the replacement costs of the bank's assets. It has the advantage of permitting comparability across banks of all sizes. However, the Q ratio has limited given our exclusive focus on Europe. By only selecting sufficiently liquid bank stocks, we alleviate potential biases in our beta estimates due to autocorrelated returns. Nevertheless, we also estimated all models using weekly instead of daily returns, and found very similar results.

⁴These 112 small, local savings banks contribute even less than 5% to the total market capitalization of the initial sample of 255 listed banks.

two potential shortcomings. Bank managers may not maximize the value of the firm if there is a separation between ownership and control, although economic theory assumes the maximization of shareholder value. That is, bank managers may not achieve the highest potential market value of their assets given their operating and investment decisions. They may, e.g., pursue a suboptimal degree of diversification. Hence the measured Tobin's Q is an inadequate measure of effective performance because it fails to account for the difference between the highest potential value and the achieved value. Furthermore, measurement error and (bad) luck may have an effect on the market-to-book ratio of bank assets.

To obtain a long-run performance measure that overcomes these drawbacks, we follow Hughes et al. (1999) and estimate the following stochastic frontier model:

$$\ln(MVA_{i,t}) = \beta_0 + \beta_1 \ln(BVA_{i,t}) + \beta_2 (\ln(BVA_{i,t}))^2 + \varepsilon_{i,t} \quad (1)$$

$$\varepsilon_{i,t} = v_{i,t} - u_i \exp(-\eta(t - T)) \quad (2)$$

We opt for a translog specification when fitting a stochastic upper envelope to the market values (MVA) of the bank's assets (BVA). The composite error term (2) consists of statistical noise, $v_{i,t} \sim iid N(0, \sigma_v^2)$, and systematic time-varying departures (shortfalls), $u_{i,t} = u_i * \exp(-\eta(t - T))$, from the translog production frontier (Battese and Coelli, 1995)⁵. The u_i 's are assumed to be independently and identically distributed and are obtained by truncation at zero (to capture non-negativity) of the $N(\mu, \sigma_u^2)$ distribution. We also include time dummies in Equation (1). All listed banks operating in the European Union are considered to have access to virtually the same technology, operate in a common regulatory environment and produce relatively homogeneous products. Therefore, we estimate one frontier for the full sample of European banks.

From our estimates (see Appendix) we compute a noise-adjusted Q ratio, $Q_{i,t}^{NA}$, which can be written as:

⁵T is the last period of the panel and $t=1, \dots, T$; thus the random variable u_i can be considered as the inefficiency effect for the i -th bank at the last period of the panel. If the parameter η is positive, then $-\eta(t - T)$ is non-negative, which implies that $u_{i,t} \geq u_i$. In the case of a positive value for η , the inefficiencies systematically decline over time.

$$Q_{i,t}^{NA} = \frac{\exp(\ln(MVA_{i,t}) - v_{i,t})}{BVA_{i,t}} = \frac{MVA_{i,t}}{BVA_{i,t} * \exp(v_{i,t})} = \frac{\widehat{MVA}_{i,t}}{BVA_{i,t} * \exp(u_{i,t})} \quad (3)$$

We use this measure of long-run profitability as a proxy for the franchise value. \widehat{MVA} is the market value that banks would obtain if they were on the frontier. Hence, the noise-adjusted Tobin's Q is a function of market value inefficiency and the potential Tobin's Q ratio. As a result, the correlation (in absolute value) between $Q_{i,t}^{NA}$ and $u_{i,t}$ is very high, exceeding 0.90 on average, as can be seen in the lower part of Table 1.

Table 1 presents some summary statistics of our franchise value measure for each year of the sample period. There is considerable variation in the Q^{NA} ratio, both across banks and over time⁶. Average Q^{NA} increases gradually from 0.96 in the beginning of the nineties to its highest value of 1.058 in 1999. From 2000 onwards, average market-to-book ratios decrease for three consecutive years and recover afterwards. The evolution of the long-run performance measure mimics the overall macroeconomic conditions in the European Union during the sample period and the associated broad stock market trends. However, we control for the evolution of the overall stock market by using time dummies in the Q regressions and time-varying risk exposures in a market model. The maximum values of Q^{NA} exhibit a similar time pattern, with a maximum of 1.212 in 1999. The traditional (unadjusted) Tobin's Q ratio shows a comparable behaviour over time, but reaches some unreasonably high maximum values (exceeding 2) and has a larger standard deviation in all time periods compared to the Q^{NA} ratio. Hence, we consider the adjusted Q ratio to be a more reliable indicator of long-term bank performance potential. The correlation between both performance measures (see bottom row of the Table 1) fluctuates, and is on average 75% over the sample period.

The level of market value efficiency gradually decreases over time, but at a very low speed. This is due to the η coefficient, which is small but statistically significant (see Appendix). On average, a bank

⁶To illustrate the economic importance of the variation, consider an average-sized bank with an average equity over total assets ratio. Starting from a long-run equilibrium, a market value of equity of 4, a book value of liabilities 56 and a book value of total assets of 60 implies that the Tobin's Q equals 1. Another bank with equal size and liabilities should have a market value of equity of 5.2 in order to achieve a Tobin's Q of 1.02. This corresponds to a 30% increase in the market capitalization of the bank.

in the sample reaches about 89% of the market value at the frontier. Potential Q (i.e. the charter value or the value of the bank assets in a competitive auction) is also mentioned in the table. This ratio measures the market value that a bank would obtain if it were on the frontier as a proportion of its book value, and fluctuates between 1.1 (in 1992) and 1.21 (in 1999).

In Section 5 we use the Q^{NA} ratio to investigate the effect of functional diversification on banks' franchise values. Based on the US empirical evidence we would expect that financial conglomerates are unable to systematically outperform their more specialized competitors. However, we argue that the European banking landscape differs markedly from that in the US. European banks have been able to operate broad franchises for a longer time period and some banks have expanded into activities that have long been forbidden territory for US banks, e.g. insurance. Moreover, a number of European banks have integrated insurance activities or mutual fund distribution in their retail networks. This may have increased the acceptance of customers for one-stop shopping and may have enabled banks to extract reputational rents from these activities. Another potential difference is that European financial supervisors have a longer tradition of cooperation across functional areas and this may have alleviated agency costs both within conglomerates and vis-à-vis customers. As a result, we hypothesize that functional diversification may enable banks to realize long-term comparative performance advantages. If the stock markets make a similar assessment, this may translate into higher valuations, i.e. a higher Tobin's Q. Our hypothesis is that diversified banks will exhibit a higher long-term performance, measured with the adjusted Tobin's Q, than more specialized banks.

4.2 Decomposing Bank Risks

The second step in our empirical set-up is to identify and measure the relevant bank risks that should be linked to diversification. According to the Capital Asset Pricing Model (CAPM), total firm risk can be decomposed in a systematic and a firm-specific component by estimating the following relationship:

$$R_{i,t} = \beta_{i,t}R_{m,t} + e_{i,t} \tag{4}$$

where $R_{i,t}$ and $R_{m,t}$ represent the returns on the individual firm and the market. $\beta_{i,t}$ is a measure of the firm's systematic risk (its market beta), and $e_{i,t}$ is a firm-specific shock (idiosyncratic risk). Given that $R_{m,t}$ and $e_{i,t}$ are orthogonal by construction, the total variance $\sigma_{i,t}^2$ is given by

$$\sigma_{i,t}^2 = \beta_{i,t}^2 \sigma_{m,t}^2 + \sigma_{e,t}^2 \quad (5)$$

where $\sigma_{m,t}^2$ and $\sigma_{e,t}^2$ represent market and firm-specific volatility, respectively.

A number of papers, both in the asset pricing and banking literature, have argued that the CAPM should be extended to include other (systematic) risk factors. Flannery and James (1984) show that bank stock returns are not only exposed to market but also to interest rate shocks. In a theoretical model, they show that this exposure follows from the typical maturity mismatch between bank assets and liabilities. Apart from a market and interest rate factor, other studies have related bank stock returns to unexpected inflation shocks (Dermine and Lajeri, 1999), exchange rate risk (Choi et al. 1992), or changes in the yield spread and the default spread (Demsetz and Strahan, 1997 and Stiroh, 2006). In this paper, we estimate the following specification:

$$R_{i,t} = \beta_{i,t} R_{m,t} + X_t' \gamma_{i,t} + Y_{i,t}' \lambda_{i,t} + e_{i,t} \quad (6)$$

where $R_{m,t}$ is the return on a broad European stock market index, X_t is a $(k \times 1)$ vector of factor innovations common to all banks and countries, $Y_{i,t}$ a $(z \times 1)$ vector of country-specific factor innovations, and $\gamma_{i,t}$ and $\lambda_{i,t}$ respectively $(k \times 1)$ and $(z \times 1)$ bank-specific parameter vectors. X_t includes the return on a German 10 year government bond index, the German Term Spread⁷, and the US default spread⁸. $Y_{i,t}$ contains instruments that are specific to the country in which the bank is headquartered; they include the return on the local stock market index, changes in the local exchange rate vis-à-vis the German Mark (euro after 1999) and local interest rate changes.

Notice that in equation (6), all coefficients have a time subscript, i.e. they vary through time.

⁷The German Terms spread is defined as the difference between the 10-year and 1 year German government bond yield.

⁸The European corporate bond market has only recently developed into a broad market, hence sufficiently long time series for the default spread are absent. As an alternative we use the US default spread, defined as the difference between the yield on Moody's BAA and AAA rated corporate bonds.

The time variation in the coefficients may be caused by changes in the state of the economy⁹ or by changes in the characteristics of the bank, such as changes in their leverage or in their degree of international or functional diversification (Vander Venet, 2002), or more generally, with changes in bank regulation. The exposure of banks with respect to common market shocks may also increase with the degree to which the local equity market is financially integrated with world equity markets (see e.g. Bekaert and Harvey, 1997 and Baele, 2005). One possibility to allow for time variation in the market betas and bank-specific volatilities is to provide a fully parametric model. An obvious disadvantage of such an approach is that the true specification for both market betas and volatilities is unobserved, and hence that any specification may be inherently misspecified. Following Bekaert, Hodrick, and Zhang (2005) and Stiroh (2005, 2006), we estimate both factor exposures and bank-specific volatility on a year-by-year basis using daily bank stock returns. The main advantage of this approach is that we can treat both the exposures and residual volatilities as observable and hence use standard econometric methods to describe both their cross-sectional and time-series variation (see e.g. Campbell et al., 2001).

Equation (6) describes a general bank stock return model. Next to the return on a European stock market index, it contains also a number of other potentially important risk factors. For a number of reasons, our preferred return-generating model is the market model augmented with a European interest rate factor. First, Flannery and James (1984) showed that including an interest rate factor is economically meaningful for bank stocks and our results confirm that conjecture. Second, the (adjusted) R -squared is on average higher when including an interest rate factor. Third, adding the other (theoretically plausible) drivers of bank stock returns does not improve the fit of the return model (as measured by the adjusted R^2). This is confirmed using the absolute correlation error test developed in Bekaert, Hodrick, and Zhang (2005)¹⁰.

⁹See e.g. Ferson and Harvey (1991, 1993), Ferson and Korajczyk (1995), Jagannathan and Wang (1996), and more recently Santos and Veronesi (2004)

¹⁰Bekaert, Harvey, and Zhang (2005) compare competing factor models by their capacity to model to sample correlation between stock returns. We do find some added value from including exchange rate fluctuations in the early 1990s. However, the estimated values for the market betas and the idiosyncratic volatilities of the banks are largely unaffected.

Table 2 presents yearly averages for the market betas and for the total and idiosyncratic volatilities¹¹. The average market beta over the 15-year period and across banks amounts to 0.61. Over time, average betas fluctuate mostly in the range from 0.5 to 0.7, except in 1998 and 2000, when betas are, respectively, relatively high (0.82) and low (0.39). We observe substantial cross-sectional variation in the bank betas. Even though the total range for the betas as implied by the minimum and maximum values is large, the vast majority of bank betas are situated between -0.15 and 1.75 . The average yearly idiosyncratic volatility is about 24%. Volatility is especially high in the period 1998-2000 (up to 34% in 1998), but drops substantially afterwards (down to 16% in 2004). A similar pattern is found for the average annualized total volatility. Idiosyncratic volatility accounts on average for 91% of total risk, even though its importance has decreased slightly over time (from about 95% in 1989 to about 89% in 2004). Similar to previous studies, we find that, on average, larger banks have higher market betas and a higher proportion of their variance is explained by market volatility.

When investigating the effect of diversification, we make a difference between various types of bank risk. Different stakeholders such as shareholders, managers or supervisors are interested in different types of risk. Total risk captures the volatility of bank stock returns and will be influenced by anticipated changes in the underlying cash flows, i.e. bank profits, and discount rate shocks. Since diversified banks are more exposed to market-wide volatility, we expect their exposure to market risk (the market beta) to be higher than for specialized banks. Moreover, a potential benefit for financial conglomerates is their ability for cross-selling, whereby multiple financial products are sold to similar customers. However, while this may increase revenues, they are also more likely to be exposed to the same type of shocks. Idiosyncratic volatility, on the other hand, should be lower since the effect of diversification is expected to operate primarily through the channel of bank-specific profits. Hence, our hypothesis is that the market risk of financial conglomerates will exceed that of specialized banks. Idiosyncratic risk is expected to be lower.

¹¹ Although the interest rate factor is included in the market model, we disregard it the remainder of the paper since the market beta contributes by far the most to the explained variation in bank stock returns.

5 Does diversification pay?

5.1 Specification

The estimated risk exposures and performance measures vary over the cross-section of banks as well as over time. To examine the impact of functional diversification on bank risk and potential return measures, we exploit the panel structure of the data. We estimate the following specification:

$$y_{i,j,t} = \mathbf{X}_{i,j,t-1}^1 \boldsymbol{\beta}_1 + \mathbf{X}_{i,j,t-1}^2 \boldsymbol{\beta}_2 + \sum_t \delta_t \text{Year}_t + \sum_j \delta_j \text{Country}_j + \varepsilon_{i,j,t} \quad (7)$$

The dependent variable $y_{i,j,t}$ is either the market-based measure of potential return (Q^{NA}) or each of the bank risks (systematic risk, measured by the market beta, β_M , idiosyncratic volatility, σ_e^2 , or total bank risk, σ_i^2). The vector X^1 contains the explanatory variables of interest, i.e. different indicators of functional diversification of bank activities. The construction of the diversification measures is described in Section 5.2. The vector X^2 combines a set of bank-specific balance sheet and income statement variables that operate as control variables. All explanatory variables are lagged one year to alleviate endogeneity¹². We also include time fixed effects, Year_t , and country dummies, Country_j to capture unobserved time and country heterogeneity¹³. Standard errors are adjusted for heteroscedasticity by clustering at the bank-level.

As control variables, X^2 , we include bank capital, bank efficiency, loan loss provisions and bank size. We present summary statistics for the control variables in the lower panel of Table 3. Since higher capital serves as a buffer against unexpected revenue shocks, the equity-to-total asset ratio is expected to be associated with lower (market-based) risk. The degree of capital adequacy is also related to Q because banks may hold excess capital to protect their franchise value (Berger, 1995). We also include the squared capital ratio (as in Demsetz and Strahan, 1997) to capture the trade-off between risk and leverage. Second, the cost-to-income ratio (i.e., the ratio of all operating expenses as a fraction of the sum of net interest and non-interest revenues) measures the operational efficiency of each bank.

¹²Using contemporaneous matching between the dependent and independent variables does not change the results.

¹³For a given dependent variable, the magnitude and the dispersion of the country fixed effects are very robust over the different specifications. Thus, the behaviour of the listed banks operating in the 17 European countries in our sample is still not perfectly integrated, neither from a return nor a risk perspective.

Efficient banks are expected to have a higher franchise value, while we expect no particular effect on bank risk. Third, bank stock investors and analysts are confronted with asymmetric information when they want to assess the quality of a bank's loan portfolio. One of the few observable signals about loan quality is the amount of loan loss provisions that management reserves to cover unexpected losses from bad loans. Hence, the ratio of loan loss provisions to net interest revenues is used as a signal of the riskiness of the loan portfolio. We expect that loan loss provisions will primarily have an impact on bank-specific risk. Finally, we include (the log of) bank size as a control variable to account for any remaining size-induced valuation effect. However, bank size is highly correlated with the other control variables, and, more important, also with the measures of functional diversification. Therefore we orthogonalize bank size with respect to the other control variables and the diversification variables so that the residual of that regression can be interpreted as a pure size effect. It is expected that large banks will have higher market betas. The idiosyncratic risk could be lower, e.g. when the bank is considered to be too big to fail (Penas and Unal, 2004).

5.2 Measures of functional diversification

The definition of a financial conglomerate is not straightforward. From a regulatory perspective, a financial institution is considered to be a conglomerate (and is treated as such for supervisory purposes) when it combines at least two of three financial activities: banking, securities-related activities, or insurance. However, the construction of bank diversification measures is restricted by data availability. Disclosure requirements in Europe are such that only very few banks provide information on the types of loans in their portfolios or the different types of non-interest income generated by different business units. For our empirical analysis we adopt a pragmatic definition for the degree of functional diversification. We rely on broad revenue or asset-based measures of relative diversification. However, we do not think this will bias our results, since non-interest income captures all income from non-traditional intermediation and this publicly available information is the basis for analysts and investors to assess the long-term potential and risk of a bank.

We construct one revenue-based and one asset-based measure of diversification. Our preferred measure is the ratio of non-interest income to total operating income. The higher the ratio the

more a bank focuses on non-traditional bank activities. We prefer this measure because it effectively captures all the sources of non-interest income that diversified banks generate by providing a broad array of financial services, ranging from underwriting and distributing securities, underwriting and distributing insurance policies, over securitizing assets, selling mutual funds to providing payments and cash-related services. The asset-based measure is the loan-to-asset ratio, which captures the proportion of loans relative to total assets. One should be careful not to interpret the loans-to-asset ratio as an alternative indicator of the reliance of a bank on interest income, since other types of assets such as securities also generate interest revenues.

Our objective is to assess the impact of bank diversification on bank return potential and risk. However, the diversification indicators only capture the relative importance of non-traditional activities across banks, caused by a shift away from traditional intermediation. Hence, diversification is measured along a continuum from full specialization in traditional banking to full specialization in non-traditional banking. Yet, from a return and risk perspective, there may be an optimal degree of functional diversification. Diversified banks may only benefit from increasing their reliance on non-interest generating activities up to a certain threshold. Otherwise, when the proportion of non-interest income becomes too large, the bank will end up being too exposed to non-traditional banking activities. Therefore, we also include squared revenue -and asset-based measures of bank activities in our performance and risk regressions. This approach should allow us to identify the degree of diversification that the stock market perceives to be optimal in terms of risk and potential return.

Another way to accommodate this concern is to follow Laeven and Levine (2006) and construct measures of asset and revenue diversity¹⁴. The asset diversity is based on stock variables and revenue diversity is based on flow variables. They are defined as follows: $Diversity = 1 - |2x - 1|$, where x is either the loan-to-asset ratio or the ratio of non-interest income to total operating income. The diversity variables take values between 0 and 1 and are increasing in the degree of diversification. However, this relies on the assumption that an equal division between lending and non-lending activities constitutes the optimal diversification mix. We use these diversity measures to check the stability

¹⁴Asset and revenue diversity (or concentration) can also be measured with a Hirschmann-Herfindahl index of concentration of asset activities or income types (see Stiroh and Rumble, 2005, Hirtle and Stiroh, 2005 and Stiroh, 2005).

of the results.

Summary statistics of the measures of functional diversification are presented in panel A of Table 3. The share of non-interest income in total operating income has increased from 10% in the beginning of the sample period to 25% in 2004¹⁵. The dispersion in the non-interest revenue share across banks is large and has also increased substantially. This provides an indication of the extent to which different banks exhibit a diverging degree of functional diversification. The evolution towards other banking activities is also reflected in the evolution of the mean and the standard deviation of the revenue diversity measure.

5.3 Results

Table 4 contains the results of the franchise value regressions. Banks with a higher share of non-interest income have, all else equal, a higher value of Q^{NA} . The coefficient on the non-interest income share measure is positive and significant at the 1% level (see Column 1 of Table 4) indicating that the market judges more diversified banks to have a higher return potential¹⁶. An increase of this ratio with 0.13, which is the difference when a bank moves from the 25th to the 75th percentile, implies an economically meaningful increase in Q^{NA} with 0.012. The relationship is non-linear, since the coefficients of the non-interest income ratio and its squared value are both positive and jointly significant at the 1% level¹⁷. Hence, stock market investors anticipate that financial conglomerates are able to generate higher current and future profits. The finding of a revenue-based diversification benefit is confirmed by the significant positive relationship between the revenue diversity measure

¹⁵We use the ratio of gross non-interest income to gross total operating income. The ratio of net non-interest income to net total operating income is larger, but shows a similar picture over time. The level of the 'net' ratio increases from 25% in 1989 to a maximum of 40% in 2000. The evolution is similar to the one in the US. Stiroh (2004) reports that the share of non-interest income in net operating revenues represented 19% in the eighties and increased gradually to 43% in 2001.

¹⁶Using annualized returns, Stiroh (2006) does not find that US Financial Holding Companies with the largest share of non-interest income earn higher average equity returns.

¹⁷Since a variable is, in general, highly correlated with its squared term, the standard errors of the corresponding coefficients will be high due to multicollinearity. Therefore, we also present joint significance tests of the concerned variables.

and the long-run performance measure (Column 5 of Table 4). This is consistent with the findings of De Jonghe and Vander Vennet (2005) for a similar sample (over a shorter time period). The result is, however, in contrast to the conclusions of Laeven and Levine (2006) who obtain a diversification discount in financial conglomerates (for a worldwide sample). Since we use a similar measure of revenue diversification, the most probable explanation for the difference is the scope of the sample. The fact that diversified European banks have a longer track record and have committed sufficient operating and managerial resources to all these activities may explain the conviction that they will generate adequate profits. We find that asset-based diversification does not affect the long-run performance of European banks. None of the specifications yields significant coefficients for the loan-to-asset ratio. Hence, stock markets do not focus on the relative specialization of banks in lending; investors appear to base their valuations on the income potential of non-traditional revenue sources.

Concerning the control variables, we discover that well capitalized banks have higher franchise values. In addition, the relationship between the cost-to-income ratio and Q^{NA} is both statistically and economically significant. Firms with superior management or technology have lower costs and subsequently reap higher profits. Larger banks perform worse, everything else equal, than smaller ones.

The conclusion of the franchise value regressions is that more diversified banks are closer to (or constitute) the estimated potential performance frontier. A diversified bank will, all else equal, be perceived as less market value inefficient than a specialized one.

Next, we turn to the interpretation of the regressions with market risk, idiosyncratic risk and total bank risk as the dependent variables, in that order. Table 5 presents the results for the determinants of market betas. All specifications reveal a positive relationship between diversification and market betas. A bank that is more oriented towards non-traditional banking activities (a lower loan-to-asset ratio or a higher non-interest revenue share) has a higher market beta. Moreover, a bank's market beta increases even exponentially with the share of non-interest income in total income (see Column 3 of Table 5). The results are both statistically and economically significant. For example, if the share of non-interest income in total operating income increases with 0.10¹⁸ (starting from the

¹⁸An increase of the non-interest income share with 0.10 is less than the observed increase in the average non-

sample mean of 0.17), a bank's market beta increases with 0.106. The findings are robust to different diversification measures. The revenue and asset diversity measures confirm that diversified banks have higher systematic risk (as can be inferred from Columns 5 and 6 of Table 5). Consider the same example. An increase in the share of non-interest income with 0.10 (starting from the sample mean of 0.17) induces an increase in the revenue diversity measure from 0.34 to 0.54. As a result the market beta increases with $0.20 \times 0.62 = 0.124$. Stiroh (2006) also discovers a significantly positive relationship between the non-interest share and market betas for a sample of US Financial Holding Companies. These results are in line with expectations; more diversified banks have a higher exposure to changes in market sentiment (e.g., because of their reliance on investment banking) or economy-wide shocks.

The relationship between the capital-to-asset ratio and β_{market} is non-linear in all specifications. The relationship reaches a minimum at a capital ratio of at least -depending on the specification- 16.3%. In other words, for the majority of banks in our sample (> 95% of the banks), a higher degree of capital adequacy lowers the systematic risk of the bank. This result is expected; a higher capital buffer offers protection against adverse market shocks and this is appreciated by the stock market. This underscores the function and the importance of capital adequacy regulation. Larger banks are also more exposed to systematic risk. Stiroh (2006) finds no effect for capital, but also discovers a positive effect of size on market betas. He argues that smaller banks are more likely to be influenced by local economic conditions, especially when they rely on local intermediation business (Stiroh, 2005 and Stiroh, 2006).

The corresponding results for idiosyncratic risk are presented in Table 6. The coefficient on the non-interest income share reveals that an increasing reliance on non-interest income decreases a bank's idiosyncratic volatility (see Column 2 of Table 6). However, this relationship is non-linear. Once a bank becomes too exposed to non-traditional banking activities, its bank-specific risk increases. This shift in the relationship occurs once the share of non-interest income exceeds 36% (as can be derived from the results in Column 3 of Table 6). Stock market investors believe that banks can reduce their idiosyncratic risk by diversifying their income sources, but only to a certain extent. Once banks interest income share over the period 1989-2004 and is approximately the magnitude of the standard deviation of the cross-section of non-interest income shares.

become overly dependent on non-interest income, their bank-specific riskiness is judged to become larger. Stiroh (2006) finds a similar non-linear relationship for the US. He obtains that US Financial Holding Companies can reduce their idiosyncratic volatility by increasing their share of non-interest income as long as the ratio is below 16%. In his sample, this implies that for the majority of banks, albeit the smaller ones, the relationship is downward sloping. From the results, we can also compute the relative volatility of (non-) interest income. Returns from non-interest income generating activities are almost twice as volatile as returns from activities that generate interest income. This difference is economically and statistically significant. This corroborates the findings of Stiroh (2005) for the US. The implied correlation between the two sources of income is 0.16, which is smaller than in the US. The low correlation is indicative for the large potential of diversification benefits. On the other hand, we find that the share of loans in total assets is not an important driver of idiosyncratic risk (Column 2 of Table 6). The revenue diversity measure confirms that a more equal reliance on lending versus non-lending activities reduces idiosyncratic banking risk. Note however that the diversity measure implies that an equal division of income sources is considered to constitute the optimal degree of diversification. Our estimates suggest that this may not be optimal from a bank-specific risk point of view. To illustrate the economic impact of revenue diversification on bank-specific risk, we use the same example again. Assume an increase in the share of non-interest income with 0.10 (starting from the sample mean of 0.17). As a result the idiosyncratic volatility decreases with 0.015. Hence, while the relationship is statistically significant, the economic impact seems rather small compared to the effect of revenue diversity on systematic risk.

For the control variables we find that X-inefficiency, measured by the cost-income ratio, is positively related to bank-specific risk. This effect is not predicted; it implies that banks with superior management skills or better technologies are perceived to be less risky. Presumably, investors are convinced that a higher efficiency will shelter banks from unexpected profit shocks. Banks with relatively high loan loss provisions exhibit higher bank-specific risk. This is fully in accordance with expectations since the loan loss provisioning ratio provides an indication about the quality and riskiness of the loan portfolio. When a bank has to announce higher loan loss provisions, this is consistently interpreted as bad news by the stock market (Docking et al., 1997). Idiosyncratic risk tends to

fall with size. Recall that we construct a size measure that is orthogonal to all other bank-specific variables. Hence, being big lowers idiosyncratic risk, irrespective of the level of diversification. The negative relationship between size and a market-based measure of bank-specific risk is corroborated by the findings of Demsetz and Strahan (1997) and Stiroh (2006) for samples of US bank holding companies. We find that an increase in the capital ratio only reduces idiosyncratic bank risk if the capital-to-asset ratio is below 0.075 (approximately, depending on the specification). At very low capital levels, an increase in leverage may increase expected distress costs. This result is in line with the findings of Stiroh (2006). However, we notice that an increase in capital raises bank risk for already well capitalized banks (capital ratio above 7.5%).

Table 7 shows the results when total return variance is treated as the dependent variable. From Equation 5 we know that the total return volatility can be decomposed into systematic risk and idiosyncratic volatility. Hence, the results for total bank risk will be driven by both underlying components. Since we report that these components are to a large extent caused by different bank-specific variables, the impact of, e.g., revenue diversity on total risk cannot be directly inferred from a bank's exposure to systematic and idiosyncratic risk. Table 7 shows that the non-interest income revenue share is significantly related to total risk. The relationship inherits its non-linear form from the idiosyncratic component. However, the non-interest income share at which total risk is minimized drops to 22% (it is 36% for idiosyncratic risk). This is due to the positive effect of the share of non-interest income on the market beta of a bank. Looking at the revenue diversity measure, we find the unexpected result that the effects on the underlying risk components cancel out at the aggregate level. Since the loan-to-asset ratio is insignificantly related to idiosyncratic risk, total bank risk exhibits the same negative relationship as in the case of market betas. Banks that rely less heavily on traditional lending activities have higher total risk. The regression of total risk on asset diversity confirms this finding (see Column 6 of Table 7).

For bank size we obtain a diverging impact on systematic and bank-specific risk. Overall, bank size is positively related to total risk. Hence, the effect of the pure size measure on market beta dominates the size-idiosyncratic volatility relationship. The effects of the other variables are as expected since they work either in the same direction or are not significant in one of the components of total risk.

Finally, we consider the trade-off between risk and performance. Recall that the franchise value of a bank is equal to the discounted value of the current and future profits that a bank is expected to earn. Since the discount rate contains the exposure to systematic risk (and the risk-free rate), there is no need to adjust the Q^{NA} for systematic risk, measured by β_{market} ¹⁹. Therefore, we analyze the effect of diversification on the ratio $\frac{Q^{NA}}{Idiosyncratic\ Risk}$. From the previous discussion, we know that an increasing reliance on non-interest income affects a bank's franchise value positively (see Table 4). Moreover, it also reduces idiosyncratic volatility as long as the non-interest income share is below 36% (see Table 6). The same kind of non-linear relationship is discovered for the effect of revenue diversification on the trade-off measure $\frac{Q^{NA}}{Idiosyncratic\ Risk}$ (see Table 8). Revenue diversification improves the risk-adjusted return potential of an individual bank as long as the non-interest income share is below 40%. The turning point is higher compared to the results of the idiosyncratic volatility regressions, since diversification also boosts a bank's franchise value.

6 Robustness

The first set of robustness checks is motivated from an economic point of view. The relationship between the diversification variables and return or risk could reflect a reverse causality story²⁰ (Stiroh and Rumble, 2005). Banks with a low franchise value may want to boost their performance by expanding into riskier or more volatile activities. We redo the entire analysis for the sample of banks with a return on assets above the 10th percentile (0.18%) as well as for banks with a capital ratio above 3.33% (also the 10th percentile). Hence, we eliminate the most risky banks (from a profitability or capitalization perspective). For both subsamples, the results of the long-run performance measure and the market betas are very stable. Banks that diversify either on a revenue basis or an asset basis have higher systematic risk, whereas revenue diversity boosts a bank's franchise value. Moreover, the relationship with the share of non-interest income is still non-linear and jointly significant. In the

¹⁹We find that $\frac{Q^{NA}}{\beta_{market}}$ is not related to any of the diversification measures. Hence, from a stock market investor point of view, diversified banks do not offer a higher long-term return adjusted for systematic risk relative to specialized banks.

²⁰Note that our right-hand side variables are lagged one period. However, if bank-specific data are somewhat rigid, lagging the variables will not be sufficient.

subsample of profitable banks, however, this is no longer reflected in the revenue diversity measure of Laeven and Levine (2006) (in the subsample of well capitalized banks it is significant at the 15% level). The least profitable banks have significantly lower diversity levels and higher idiosyncratic volatility. Leaving them out reduces the significance of the negative relationship between diversification and bank-specific risk. Overall, the vast majority of conclusions remain valid in both subsamples.

In our analysis, we focus on listed banks that are frequently traded, which are in general the biggest banks in Europe. Nevertheless, there still is large variation in banks' total assets. We check whether there are differential effects for large banks. When leaving out the 10% smallest banks, all conclusions remain unchanged. We also consider the subset of the 50% largest banks. Again, all effects of diversification on return potential and risk as described in the previous sections hold. In addition, we discover some additional effects for the asset diversity measure. Large banks with a more balanced asset composition have a lower idiosyncratic volatility. Surprisingly, they also have somewhat lower franchise values. Hence, while the first effect corroborates the effect of revenue diversity, the second works in the opposite direction. We conclude that the advantages or costs of diversification are not notably different for large and small banks.

We try to control for the effect of important mergers in the following fashion. We only include a bank-year observation if the growth in assets is moderate both in the current and previous year (as in e.g., Laeven and Levine, 2006). We define moderate changes in assets as all percentage changes between -5% and 30% . While large changes in assets may reflect other phenomena, it will also eliminate the effect of large mergers. We now have reduced the sample to approximately 800 bank-year observations. Overall, we obtain the same results. The conclusions with respect to the market betas and the franchise value are qualitatively unaffected. As for the 'profitable' subsample, we obtain that higher values of revenue diversity no longer imply lower idiosyncratic volatility. Banks that experienced a large asset growth in the previous or current year, exhibit a low level of revenue diversity and high idiosyncratic volatility. Hence, the corresponding growth in assets may be inspired by an incentive to increase diversification through non-related mergers or acquisitions. Finally, we redo the analysis for the banks belonging to the countries of the euro area. The conclusions are the same as for the set of 17 European countries.

In addition, we also perform a number of robustness checks that are more data -and specification-related. First, in the panel analysis the independent variables are from the previous year relative to the dependent variable. Point estimates and significance are largely unaffected when performing the analysis with contemporaneous variables. Second, extreme outliers may drive the results. We redo the entire analysis using a winsorized sample. For each variable, we replace the values below (above) the 1st percentile (99th percentile) with the values from that percentile. Hence, we mitigate the effects of extreme outliers without deleting potentially informative data. All conclusions concerning the variables of interest and the control variables remain unchanged. Third, throughout the entire paper the revenue-based measures are based on the gross non-interest income share in gross total operating income. While the level of the net non-interest income ratio to net total operating income is higher, the evolution and the cross-sectional dispersion is very similar. Changing the definition of the revenue-based diversification measures obviously affects the magnitude of the corresponding coefficients. However, it does not alter the significance of the estimated coefficients nor the conclusions. Finally, we investigate the effect of diversification on long-run performance using the traditional Tobin's Q measure. Using Tobin's Q rather than Q^{NA} , we still obtain that stock market investors anticipate that banks with a diversified revenue stream will be able to gain higher current and future profits. Hence, the differences between our findings and those of Laeven and Levine (2006) are not driven by the use of a different long-run performance measure.

7 Conclusions

Should a bank maintain a narrow focus on lending or can banks be broader and offer an array of financial services? This long-standing debate has received renewed interest over the last decade. Both in the US (Gramm-Leach-Bliley Act 1999) and in Europe (Second Banking Directive 1989), important regulatory steps have been taken to expand the functional scope of banking institutions. In this paper we analyze whether diversified banks in Europe possess a systematic comparable advantage over specialized banks in terms of return potential and risk. Europe is an appropriate place to investigate this issue because deregulation has provided ample scope for functional deregulation in banking since at least 1989 onwards. As a result banks have pursued different strategies, from narrow intermediaries

to broad financial services firms. We use capital market data to assess the effect of diversification on performance and risk because equity prices are forward-looking and, hence, better capture prospective returns and risk.

We find a strongly positive relationship between franchise value and the degree of functional diversification. Apparently, the stock market anticipates that diversification of income sources has the potential to improve future bank profits. This means that, on average, the revenue and cost benefits of functional diversification are judged to exceed the costs of increased complexity and the associated agency costs. Obviously, the fact that we detect this effect in our European bank sample does not necessarily mean that unlimited diversification is optimal. Nevertheless, most of the banks in our sample are apparently situated below any ‘optimal’ degree of diversity, hence there is still further scope for diversification. Comparisons have to be made carefully because of differences in samples and methodologies, but our European evidence seems to conflict with results found in other developed economies, and notably the US. We argue that diversified European banks have been able to operate broader franchises and establish longer track records. Whether the anticipated gains from diversification can be transposed to other economies and regulatory jurisdictions remains a topic of further scrutiny.

On the risk side, we find a non-linear relationship between diversification and bank-specific risk. Hence, for some banks diversification can actually decrease idiosyncratic risk and make them safer. In our sample the relationship is predominantly downward-sloping, implying that most banks can reduce their risk by diversifying their revenues, although taking care that they do not exceed the optimal threshold. We argue that this feature could again be specific for the European case, since banks engage in a wider variety of activities, the returns of which are only moderately correlated in most periods. In the case of systematic risk, or the market beta, we confirm existing evidence that larger and more diversified banks have systematically higher market betas and hence higher systematic risk. This is not unexpected, the broader the exposure of banks to market or business cycle shocks, the higher the covariance with the market will be.

These results have a number of implications for different stakeholders. Investors that are able to

diversify themselves, such as pension funds, are primarily interested in systematic risk exposures. In the case of listed European banks, they face a trade-off: expected returns (proxied by the Q ratio) may be higher, but they are associated with higher systematic risk (market beta). This reflects the classical return/risk trade-off. On the other hand, bank shareholders with large stakes and bank-dependent parties such as borrowers, customers or managers, should mainly care about idiosyncratic risk. For these parties, diversification seems to have a payoff in terms of reduced bank-specific risk, at least in the European case that we consider. However, too much reliance on non-interest types of revenues may make banks less safe, since the relationship is non-linear. Presumably, it will matter what types of diversifying activities the bank undertakes and how they interact with economy-wide shocks, but this is beyond the scope of this paper. Finally, regulators and bank supervisors care about bank sector stability, hence they are interested in both the systematic and the idiosyncratic risk of banks. Concerning the systematic part of risk, since large diversified banks tend to have higher market betas, these financial conglomerates need to be monitored carefully. The current European practice of combining different types of functional supervision in one financial sector supervisor seems more than appropriate.

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Table 1: Measurement of Q^{NA} : Summary statistics

This table presents summary statistics on the noise-adjusted franchise value, Tobin's Q, market value inefficiency and potential Tobin's Q of European banks. We consider a sample of 143 listed banks active in the European Union (15 member states) and Norway and Switzerland in the period 1989-2004. We present the mean, the standard deviation, the minimum and maximum in each sample year. In the lower part of the table, we show two correlation coefficients. In the last column, we present, if available, for comparison the results for a sample of US Bank Holding Companies in 1994 reported by Hughes et al. (2003).

	Europe (17 countries): 1989-2004																US
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1994
Tobin's Q^{NA}																	
mean	0.9740	0.968	0.959	0.955	0.979	0.972	0.978	0.985	1.014	1.035	1.058	1.037	1.014	1.010	1.015	1.022	1.032
standard deviation	0.059	0.057	0.056	0.053	0.053	0.052	0.056	0.056	0.054	0.055	0.057	0.053	0.048	0.049	0.050	0.051	0.020
minimum	0.863	0.859	0.852	0.847	0.869	0.864	0.868	0.877	0.903	0.923	0.944	0.928	0.911	0.906	0.911	0.917	
maximum	1.167	1.164	1.150	1.144	1.171	1.163	1.197	1.211	1.225	1.245	1.261	1.227	1.204	1.200	1.197	1.207	
Tobin's Q																	
mean	1.027	1.013	1.001	0.992	1.013	1.004	1.007	1.013	1.038	1.057	1.081	1.052	1.025	1.012	1.019	1.022	1.036
standard deviation	0.104	0.081	0.052	0.034	0.050	0.041	0.047	0.062	0.080	0.108	0.160	0.101	0.051	0.046	0.051	0.054	0.033
minimum	0.937	0.866	0.881	0.909	0.928	0.923	0.922	0.920	0.920	0.905	0.925	0.921	0.915	0.913	0.907	0.900	
maximum	1.799	1.631	1.304	1.159	1.283	1.195	1.298	1.374	1.528	1.655	2.049	1.865	1.296	1.269	1.264	1.239	
Market Value Efficiency																	
mean	0.914	0.911	0.909	0.906	0.903	0.899	0.897	0.895	0.892	0.889	0.887	0.884	0.880	0.876	0.874	0.870	
standard deviation	0.032	0.032	0.033	0.033	0.033	0.033	0.035	0.037	0.037	0.038	0.040	0.040	0.039	0.040	0.042	0.044	
Potential Tobin's Q																	
mean	1.113	1.107	1.098	1.094	1.122	1.115	1.122	1.129	1.161	1.186	1.212	1.189	1.165	1.161	1.166	1.174	1.360
standard deviation	0.027	0.026	0.027	0.026	0.027	0.027	0.028	0.028	0.028	0.027	0.027	0.025	0.022	0.022	0.021	0.021	0.366
Correlation(Tobin's Q^{NA} , market value inefficiency)																	
	-0.905	-0.903	-0.896	-0.894	-0.882	-0.885	-0.887	-0.886	-0.884	-0.889	-0.902	-0.908	-0.911	-0.917	-0.924	-0.929	
Correlation(Tobin's Q^{NA} , Tobin's Q)																	
	0.593	0.613	0.710	0.684	0.753	0.813	0.781	0.792	0.807	0.816	0.809	0.744	0.890	0.782	0.740	0.745	

Table 2: Decomposing banking risk: Summary statistics

This table presents summary statistics on the decomposition of bank stock returns of European banks. We consider 143 listed banks active in the European Union (15 member states) and Norway and Switzerland in the period 1989-2004. The table contains information on the annualized average return, the market beta (β_{market}), and annualized idiosyncratic (σ_e^2) and total volatility (σ_i^2). The return-generating model is based on the traditional CAPM augmented with an interest rate factor. Factor exposures and bank-specific volatility are estimated on a year-by-year basis using daily bank stock returns. For each variable of interest, we present the mean, the standard deviation, the minimum and maximum in each sample year.

	Europe (17 countries): 1989-2004															
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Average Returns																
mean	0.288	0.000	0.040	-0.058	0.547	-0.065	0.108	0.271	0.615	0.317	0.259	0.098	-0.046	-0.083	0.328	0.198
standard deviation	0.345	0.428	0.202	0.282	0.847	0.141	0.222	0.275	0.443	0.690	0.494	0.326	0.227	0.267	0.263	0.177
minimum	-0.226	-0.445	-0.745	-0.775	-0.316	-0.407	-0.704	-0.208	-0.016	-0.332	-0.245	-0.642	-0.714	-0.704	-0.092	-0.079
maximum	1.809	1.795	0.675	0.877	6.136	0.374	0.853	1.494	3.537	5.128	3.842	2.059	0.539	0.993	1.207	0.692
Market Beta (β_{market})																
mean	0.5091	0.6720	0.7135	0.5311	0.6391	0.5792	0.7059	0.6020	0.6439	0.8160	0.6126	0.3854	0.5689	0.5863	0.6168	0.6440
standard deviation	0.399	0.481	0.522	0.516	0.511	0.512	0.562	0.541	0.442	0.494	0.488	0.276	0.496	0.610	0.621	0.493
minimum	-0.545	-0.049	-0.233	-0.339	-0.226	-0.248	-0.181	-0.292	-0.139	-0.079	-0.209	-0.052	-0.096	-0.088	-0.174	-0.136
maximum	1.375	1.683	1.803	2.053	2.032	1.961	2.227	1.930	1.643	1.787	2.217	1.155	1.571	2.201	2.494	1.614
Idiosyncratic Volatility (σ_e^2)																
mean	0.213	0.258	0.220	0.257	0.252	0.225	0.197	0.195	0.256	0.336	0.276	0.288	0.246	0.246	0.220	0.161
standard deviation	0.088	0.149	0.109	0.151	0.139	0.094	0.084	0.093	0.102	0.116	0.105	0.103	0.085	0.091	0.091	0.058
minimum	0.071	0.073	0.037	0.071	0.085	0.057	0.045	0.038	0.057	0.073	0.063	0.056	0.057	0.044	0.054	0.044
maximum	0.513	0.847	0.701	0.915	0.845	0.455	0.439	0.605	0.671	0.709	0.631	0.569	0.588	0.543	0.636	0.354
Total Volatility (σ_i^2)																
mean	0.225	0.280	0.244	0.273	0.262	0.243	0.217	0.208	0.283	0.387	0.297	0.298	0.283	0.303	0.262	0.180
standard deviation	0.089	0.152	0.110	0.153	0.139	0.096	0.089	0.095	0.107	0.128	0.112	0.109	0.106	0.137	0.112	0.061
minimum	0.073	0.075	0.038	0.072	0.090	0.057	0.045	0.039	0.059	0.075	0.064	0.057	0.059	0.044	0.054	0.045
maximum	0.517	0.909	0.747	1.002	1.005	0.473	0.450	0.617	0.679	0.735	0.632	0.587	0.597	0.608	0.660	0.369

Table 3: Measures of functional diversification and other bank-characteristics: Summary statistics

Panel A of this table presents summary statistics on the measures of functional diversification. The table contains information on the non-interest revenue share (ratio of non-interest income to total operating income), the loans-to-assets ratio, revenue diversity and asset diversity. The diversity measures are defined as follows: $Diversity = 1 - |2x - 1|$, where x is either the loan-to-asset ratio or the ratio of interest income to total operating income. The diversity variables take values between 0 and 1 and are increasing in the degree of diversification. For each variable of interest, we present the mean, the standard deviation, the minimum and maximum in each sample year. The lower panel, Panel B, shows the mean and the standard deviation of the bank-specific control variables. As control variables, we include bank capital (equity-to-assets), bank efficiency (cost-to-income), loan loss provisions (loan loss provisioning to the sum of net interest and non-interest revenues) and (the natural logarithm of) bank size.

Europe (17 countries): 1989-2004																	
Panel A: Measures of functional diversification																	
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Non-interest revenue share																	
mean	0.101	0.092	0.107	0.112	0.140	0.135	0.134	0.144	0.168	0.185	0.230	0.215	0.205	0.205	0.234	0.248	
std dev.	0.057	0.067	0.072	0.072	0.089	0.097	0.101	0.096	0.100	0.103	0.126	0.118	0.109	0.107	0.112	0.109	
minimum	0.010	0.024	0.026	0.001	0.005	0.000	0.004	0.000	0.003	0.002	0.010	0.004	0.000	0.000	0.005	0.007	
maximum	0.294	0.391	0.405	0.503	0.612	0.635	0.705	0.780	0.760	0.717	0.766	0.759	0.651	0.617	0.664	0.669	
Loans-to-Total Assets																	
mean	0.585	0.617	0.621	0.613	0.575	0.576	0.571	0.580	0.588	0.613	0.608	0.623	0.637	0.652	0.655	0.661	
std dev.	0.137	0.149	0.148	0.145	0.167	0.182	0.173	0.173	0.175	0.171	0.171	0.169	0.158	0.171	0.176	0.178	
minimum	0.375	0.330	0.322	0.313	0.208	0.155	0.149	0.152	0.064	0.160	0.167	0.225	0.181	0.137	0.137	0.134	
maximum	0.829	0.903	0.914	0.887	0.852	0.890	0.894	0.908	0.912	0.911	0.921	0.933	0.926	0.936	0.937	0.948	
Revenue Diversity																	
mean	0.202	0.185	0.214	0.224	0.272	0.262	0.256	0.273	0.322	0.356	0.432	0.410	0.399	0.405	0.458	0.485	
std dev.	0.114	0.134	0.143	0.143	0.142	0.160	0.153	0.126	0.144	0.159	0.182	0.178	0.188	0.197	0.197	0.192	
minimum	0.020	0.048	0.052	0.002	0.010	0.000	0.008	0.000	0.005	0.004	0.020	0.009	0.000	0.000	0.010	0.013	
maximum	0.588	0.783	0.810	0.995	0.777	0.794	0.984	0.879	0.882	0.806	0.996	0.895	0.983	0.922	0.973	0.913	
Asset diversity																	
mean	0.752	0.712	0.697	0.706	0.702	0.689	0.720	0.713	0.703	0.681	0.678	0.660	0.658	0.619	0.605	0.591	
std dev.	0.205	0.244	0.230	0.220	0.211	0.239	0.246	0.249	0.255	0.254	0.243	0.240	0.240	0.252	0.253	0.250	
minimum	0.342	0.195	0.172	0.226	0.296	0.220	0.212	0.185	0.128	0.178	0.159	0.135	0.148	0.127	0.127	0.105	
maximum	0.997	0.998	0.999	0.993	0.990	0.993	0.998	0.992	0.995	0.994	1.000	0.993	0.990	0.991	0.999	0.998	
Panel B: Bank-specific control variables																	
									Mean	Standard deviation							
									Equity-to-Assets	0.064	0.032						
									Cost-Income	0.620	0.129						
									Loan Loss Provisions	0.198	0.232						
									ln(Size)	10.540	1.918						

Table 4: Franchise value regressions

This table presents OLS regressions of the franchise value, Q^{NA} , on measures of revenue and asset diversification. The first specification describes the effect of the non-interest revenue share on the dependent variable, Q^{NA} . The second column shows the results when that relationship is allowed to be non-linear. The third and fourth column present the relationship between Q^{NA} and the loans-to-assets ratio in a linear and quadratic way, respectively. Columns 5 (and 6) contain the regressions in which revenue diversity (asset diversity) is linked to long-run performance. In all regressions, we control for a number of bank-specific characteristics. Country and year dummy variables are included, but not reported, in all specifications. All balance sheet and income statement variables are lagged with one year. *, **, *** denote statistical significance at the 10%, 5% and 1%, respectively. Standard errors are adjusted for clustering at the bank-level. z statistics, i.e. estimated coefficients divided by their robust-estimated standard errors, are reported in brackets. The line containing 'joint significance of linear and quadratic term' reports p-values from the Wald test of the joint significance of the included linear and squared term of the revenue-based (or asset-based) measure of functional diversification.

	Q^{NA}	Q^{NA}	Q^{NA}	Q^{NA}	Q^{NA}	Q^{NA}
Non-Interest Revenue Share	0.0949***	0.0593				
	[4.635]	[1.357]				
(Non-Interest Revenue Share) ²		0.0645				
		[0.662]				
Loans-to-Total Assets			-0.0012	0.0085		
			[0.109]	[0.124]		
(Loans-to-Total Assets) ²				-0.0086		
				[0.153]		
Revenue Diversity					0.0449***	
					[4.914]	
Asset Diversity						-0.003
						[0.434]
Equity-to-Assets	-0.1696	-0.1285	-0.1786	-0.1803	-0.2499	-0.183
	[0.742]	[0.522]	[0.761]	[0.766]	[1.034]	[0.785]
(Equity-to-Assets) ²	2.8295**	2.5706*	3.5076***	3.5225***	3.5317***	3.5192***
	[2.198]	[1.812]	[2.680]	[2.672]	[2.603]	[2.679]
X-Inefficiency	-0.0517***	-0.0497***	-0.0398***	-0.0401***	-0.0518***	-0.0383***
	[4.962]	[4.666]	[3.716]	[3.735]	[4.968]	[3.622]
Loan Loss Provisions	0.001	0.0014	0.002	0.0019	0.001	0.0019
	[0.246]	[0.347]	[0.517]	[0.502]	[0.266]	[0.479]
ln(Size)	-0.0015	-0.0013	-0.0033**	-0.0033***	-0.0024*	-0.0032**
	[1.299]	[1.109]	[2.513]	[2.700]	[1.827]	[2.401]
Constant	0.9759***	0.9761***	0.9749***	0.9724***	0.9779***	0.9759***
	[67.656]	[68.634]	[61.199]	[40.193]	[66.051]	[64.994]
Joint Significance of linear and quadratic term		0.000***		0.9708		
Number of observations	1220	1220	1220	1220	1220	1220
Number of crosssections	136	136	136	136	136	136
R-squared	0.71	0.71	0.70	0.70	0.71	0.70

Table 5: Market beta regressions

This table presents OLS regressions of the market beta, β_{market} , on measures of revenue and asset diversification. The first specification describes the effect of the non-interest revenue share on the dependent variable, β_{market} . The second column shows the results when that relationship is allowed to be non-linear. The third and fourth column present the relationship between β_{market} and the loans-to-assets ratio in a linear and quadratic way, respectively. Columns 5 (and 6) contain the regressions in which revenue diversity (asset diversity) is linked to systematic risk. In all regressions, we control for a number of bank-specific characteristics. Country and year dummy variables are included, but not reported, in all specifications. All balance sheet and income statement variables are lagged with one year. *, **, *** denote statistical significance at the 10%, 5% and 1%, respectively. Standard errors are adjusted for clustering at the bank-level. z statistics, i.e. estimated coefficients divided by their robust-estimated standard errors, are reported in brackets. The line containing 'joint significance of linear and quadratic term' reports p-values from the Wald test of the joint significance of the included linear and squared term of the revenue-based (or asset-based) measure of functional diversification.

	β_{market}	β_{market}	β_{market}	β_{market}	β_{market}	β_{market}
Non-Interest Revenue Share	1.3295***	0.6422**				
(Non-Interest Revenue Share) ²	[9.753]	[2.207]				
Loans-to-Total Assets			-1.0087***	-1.0965**		
(Loans-to-Total Assets) ²			[11.350]	[2.290]		
Revenue Diversity				0.0779	0.6167***	
Asset Diversity				[0.195]	[7.568]	0.3816***
						[6.145]
Equity-to-Assets	-9.3177***	-8.5998***	-6.6607***	-6.6460***	-10.1468***	-8.8465***
(Equity-to-Assets) ²	[8.502]	[7.564]	[5.946]	[5.898]	[8.776]	[7.242]
X-Inefficiency	19.6705***	15.1279***	13.9151***	13.7872***	27.8354***	27.0097***
Loan Loss Provisions	[4.036]	[2.935]	[2.690]	[2.628]	[5.104]	[4.641]
ln(Size)	0.0681	0.1049	-0.1084	-0.1056	0.0709	0.0906
Constant	[0.803]	[1.221]	[1.222]	[1.185]	[0.815]	[0.964]
	-0.0135	-0.006	0.062	0.0627	-0.0106	0.0095
	[0.295]	[0.131]	[1.371]	[1.382]	[0.229]	[0.195]
	0.1950***	0.2004***	0.1849***	0.1853***	0.1819***	0.1618***
	[23.398]	[23.587]	[22.059]	[21.236]	[20.487]	[17.700]
	0.6827***	0.6907***	1.3492***	1.3715***	0.7005***	0.4015***
	[4.541]	[4.636]	[8.349]	[6.611]	[4.654]	[2.601]
Joint Significance of linear and quadratic term		0.000***		0.000***		
Number of observations	1208	1208	1208	1208	1208	1208
Number of crosssections	135	135	135	135	135	135
R-squared	0.65	0.65	0.66	0.66	0.63	0.62

Table 6: Idiosyncratic volatility regressions

This table presents OLS regressions of the idiosyncratic volatility, σ_e^2 , on measures of revenue and asset diversification. The first specification describes the effect of the non-interest revenue share on the dependent variable, σ_e^2 . The second column shows the results when that relationship is allowed to be non-linear. The third and fourth column present the relationship between σ_e^2 and the loans-to-assets ratio in a linear and quadratic way, respectively. Columns 5 (and 6) contain the regressions in which revenue diversity (asset diversity) is linked to firm-specific risk. In all regressions, we control for a number of bank-specific characteristics. Country and year dummy variables are included, but not reported, in all specifications. All balance sheet and income statement variables are lagged with one year. *, **, *** denote statistical significance at the 10%, 5% and 1%, respectively. Standard errors are adjusted for clustering at the bank-level. z statistics, i.e. estimated coefficients divided by their robust-estimated standard errors, are reported in brackets. The line containing 'joint significance of linear and quadratic term' reports p-values from the Wald test of the joint significance of the included linear and squared term of the revenue-based (or asset-based) measure of functional diversification.

	σ_e^2	σ_e^2	σ_e^2	σ_e^2	σ_e^2	σ_e^2
Non-Interest Revenue Share	-0.0670**	-0.2930***				
(Non-Interest Revenue Share) ²	[2.105]	[4.009]				
		0.4092***				
		[3.332]				
Loans-to-Total Assets			0.0047	0.1044		
(Loans-to-Total Assets) ²			[0.235]	[0.839]		
				-0.0885		
				[0.830]		
Revenue Diversity					-0.0511***	
					[2.929]	
Asset Diversity						0.004
						[0.272]
Equity-to-Assets	-0.7154**	-0.4794	-0.7409**	-0.7576**	-0.6375*	-0.7279**
(Equity-to-Assets) ²	[1.994]	[1.345]	[2.060]	[2.110]	[1.796]	[2.062]
	4.8538***	3.3606*	4.5655**	4.7108***	4.4008**	4.5112**
	[2.618]	[1.809]	[2.500]	[2.583]	[2.439]	[2.512]
X-Inefficiency	0.1086***	0.1207***	0.1017***	0.0985***	0.1139***	0.0985***
	[5.175]	[5.679]	[4.631]	[4.502]	[5.390]	[4.685]
Loan Loss Provisions	0.0765***	0.0790***	0.0754***	0.0746***	0.0768***	0.0758***
	[5.476]	[5.747]	[5.332]	[5.273]	[5.515]	[5.396]
ln(Size)	-0.0048**	-0.003	-0.0036*	-0.0040*	-0.0045**	-0.0036*
	[2.285]	[1.346]	[1.755]	[1.894]	[2.220]	[1.726]
Constant	0.1818***	0.1844***	0.1803***	0.1549***	0.1791***	0.1810***
	[4.003]	[4.102]	[3.748]	[2.692]	[3.963]	[3.886]
Joint Significance of linear and quadratic term		0.0002***		0.7034		
Number of observations	1208	1208	1208	1208	1208	1208
Number of crosssections	135	135	135	135	135	135
R-squared	0.48	0.49	0.48	0.48	0.49	0.48

Table 7: Total volatility regressions

This table presents OLS regressions of the total risk of a bank, σ_i^2 , on measures of revenue and asset diversification. The first specification describes the effect of the non-interest revenue share on the dependent variable, σ_i^2 . The second column shows the results when that relationship is allowed to be non-linear. The third and fourth column present the relationship between σ_i^2 and the loans-to-assets ratio in a linear and quadratic way, respectively. Columns 5 (and 6) contain the regressions in which revenue diversity (asset diversity) is linked to total bank risk. In all regressions, we control for a number of bank-specific characteristics. Country and year dummy variables are included, but not reported, in all specifications. All balance sheet and income statement variables are lagged with one year. *, **, *** denote statistical significance at the 10%, 5% and 1%, respectively. Standard errors are adjusted for clustering at the bank-level. z statistics, i.e. estimated coefficients divided by their robust-estimated standard errors, are reported in brackets. The line containing 'joint significance of linear and quadratic term' reports p-values from the Wald test of the joint significance of the included linear and squared term of the revenue-based (or asset-based) measure of functional diversification.

	σ_i^2	σ_i^2	σ_i^2	σ_i^2	σ_i^2	σ_i^2
Non-Interest Revenue Share	0.046	-0.1743**				
(Non-Interest Revenue Share) ²	[1.291]	[2.179]				
		0.3991***				
		[2.955]				
Loans-to-Total Assets			-0.0802***	-0.0163		
(Loans-to-Total Assets) ²			[3.532]	[0.120]		
				-0.0567		
				[0.489]		
Revenue Diversity					0.009	
					[0.455]	
Asset Diversity						0.0332**
						[2.064]
Equity-to-Assets	-1.3107***	-1.0805***	-1.1122***	-1.1229***	-1.3170***	-1.2847***
(Equity-to-Assets) ²	[3.493]	[2.857]	[2.945]	[2.973]	[3.450]	[3.451]
	5.7291***	4.2726**	4.9619***	5.0550***	5.9864***	6.0068***
	[2.994]	[2.190]	[2.583]	[2.628]	[3.084]	[3.164]
X-Inefficiency	0.1071***	0.1189***	0.0854***	0.0834***	0.1106***	0.1002***
	[4.776]	[5.232]	[3.677]	[3.597]	[4.887]	[4.504]
Loan Loss Provisions	0.0667***	0.0691***	0.0720***	0.0715***	0.0671***	0.0678***
	[4.658]	[4.896]	[4.983]	[4.944]	[4.688]	[4.741]
ln(Size)	0.0084***	0.0102***	0.0088***	0.0085***	0.0077***	0.0069***
	[3.607]	[4.109]	[3.816]	[3.574]	[3.343]	[2.960]
Constant	0.2168***	0.2194***	0.2715***	0.2552***	0.2164***	0.1943***
	[4.619]	[4.716]	[5.415]	[4.152]	[4.625]	[4.093]
Joint Significance of linear and quadratic term		0.0067***		0.0011***		
Number of observations	1208	1208	1208	1208	1208	1208
Number of crosssections	135	135	135	135	135	135
R-squared	0.51	0.52	0.52	0.52	0.51	0.51

Appendix: Estimation of the Stochastic Frontier

This table presents maximum likelihood estimates of the following regression equation:

$$\ln(MVA_{i,t}) = \beta_0 + \beta_1 \cdot \ln(BVA_{i,t}) + \beta_2 \cdot \ln(BVA_{i,t})^2 + \varepsilon_{i,t}.$$

We specify a translog function when fitting a stochastic upper envelope to the natural logarithm of market values (MVA) of the natural logarithm of bank's assets (BVA). The composite error term, $\varepsilon_{i,t} = v_{i,t} - u_i \cdot \exp(-\eta(t-T))$, consists of statistical noise, $v_{i,t} \sim \text{iid } N(0, \sigma_v^2)$, and systematic time-varying departures (shortfalls), $u_i \sim N^+(\mu, \sigma_u^2)$. We also include time dummies, with 1989 as the reference period. Column 2 reports the estimated parameters. Columns 3 and 4 show respectively the corresponding standard errors and t statistics. In the lower part of the table, we present some additional information. A likelihood ratio test allows us to conclude that the stochastic frontier specification, which includes an additional one-sided error term, offers a significant improvement in the value of the log likelihood over a model with a single-component error term. We

can confidently reject the hypothesis that $u_i = 0$. Further evidence in favour of our model is that gamma, $\gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$, is

significantly different from zero as well as from one, pointing respectively to the existence of inefficiency (hence, not all bank managers maximize their franchise value or, in other words, for most banks the difference between the charter value and the franchise value is statistically significant) and the stochastic nature of the frontier. Hence, a parametric method, such as stochastic frontier analysis, is preferred to a deterministic approach, such as data envelopment analysis. Both μ and η are statistically significantly different from zero. The shortfalls from the frontier become slightly larger over time, albeit at a very slow pace.

Dependent variable: ln(Market value of assets)	coefficient	standard error	t-statistic
Constant	0.2973	0.0454	6.54
ln(Book value of assets)	0.9718	0.0093	104.40
(ln(Book value of assets)) ²	0.0008	0.0005	1.73
Dummy 1990	-0.0033	0.0078	-0.42
Dummy 1991	-0.0109	0.0077	-1.41
Dummy 1992	-0.0153	0.0077	-1.97
Dummy 1993	0.0106	0.0078	1.36
Dummy 1994	0.0062	0.0076	0.82
Dummy 1995	0.0128	0.0077	1.65
Dummy 1996	0.0217	0.0079	2.76
Dummy 1997	0.0526	0.0080	6.56
Dummy 1998	0.0745	0.0083	8.94
Dummy 1999	0.0984	0.0087	11.33
Dummy 2000	0.0823	0.0089	9.21
Dummy 2001	0.0644	0.0093	6.92
Dummy 2002	0.0620	0.0099	6.24
Dummy 2003	0.0686	0.0104	6.60
Dummy 2004	0.0764	0.0108	7.07
$\sigma^2 (= \sigma_v^2 + \sigma_u^2)$	0.0062	0.0004	13.87
$\gamma (= \sigma_u^2 / \sigma^2)$	0.6351	0.0235	27.07
μ	0.1257	0.0106	11.89
η	-0.0288	0.0058	-4.92
Value of the Loglikelihood function			2580
Likelihood ratio test of the one-sided error (3 restrictions)			629
Number of iterations			27
Number of cross-sections			143
Number of time periods			16
Total number of observations			1676
Observations not in panel			612