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This draft: November 21, 2016

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Abstract

We investigate how bank charter value affects risk for a sample of OECD banks by using standalone and systemic risk measures before, during, and after the global financial crisis of 2007-2008. Prior to the crisis, bank charter value is positively associated with risk-taking and systemic risk for very large "too-big-too-fail" banks and large U.S. and European banks but such a relationship is inverted during and after the crisis. A deeper investigation shows that such a behavior before the crisis is mostly relevant for very large banks and large banks with high growth strategies. Banks' business models also influence this relationship. In presence of strong diversification strategies, higher charter value increases standalone risk for very large banks. Conversely, for banks following a focus strategy, higher charter value amplifies systemic risk for very large banks and both standalone and systemic risk for large U.S. and European banks. Our findings have important policy implications and cast doubts on the relevance of the uniform more stringent capital requirements introduced by Basel III.

Keywords: Systemic risk, Standalone risk, Charter value, Bank strategies, Too-big-too-fail, Global financial crisis, Bank regulation

JEL codes: G21, G28, G32

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1. Introduction

This paper revisits the charter value hypothesis (CVH) and the effectiveness of its risk-disciplining impact in the light of the major transformations of the banking industry before and after the global financial crisis of 2007-2008 (GFC). Worldwide, in the years preceding the GFC, banks experienced tremendous changes. Specifically, value enhancing mergers and acquisitions (M&A) arrangements led banks to grow in size, become larger and more powerful by increasing their market shares, and yet, riskier (Anginer et al., 2014; Martinez-Miera and Repullo, 2010; De Jonghe and Vennet, 2008). Mechanically, banks gained competitive advantage and an increase in their charter value, backed by size, operational complexity and higher profit expectations driven by more aggressive risk-taking policies (Jones et al., 2011; Furlong and Kwan, 2006; Stiroh, 2004)[1]. Such operations had altered bank charter value but also the importance of large "too-big-to-fail" (TBTF) banks and institutions which were later recognized as "systemically important financial institutions" (SIFIs) or "too-complex-to-unwind" banks[2]. These banks were at the heart of the GFC. They were deeply involved in complex activities and tended to accumulate less capital and less stable funds before the crisis while regulators, by focusing on microprudential regulation, did little to prevent the resulting build-up of systemic risk (Bostandzic and Weiss, 2016; Laeven et al., 2015; Brunnermeier et al., 2012).

It is widely recognized that charter value (or franchise value, proxied by Tobin's q) self-disciplines bank risk-taking, the so-called charter value hypothesis (CVH), and provides banks with a valuable source of monopoly power (Jones et al., 2011; Ghosh, 2009; González, 2005; Gan, 2004; Demsetz et al., 1996; Keeley, 1990). Higher charter value is expected to lower risk-taking incentives and increase capital because of the higher bankruptcy costs that banks could endure if they fail. Nevertheless, banks have systematically looked for higher profitability, more returns and higher margins, by increasing their exposure to new market-based instruments and by extensively relying on short-term debt (Martynova et al., 2014). This shift towards new financial instruments at a large scale and riskier business models is puzzling for banks with high charter value.

[1] Jones et al. (2011) emphasize three factors to explain the increase in charter value during the 1988-2008 period: a rise in banks' noninterest income, a run-up in the stock market, potentially "irrational exuberance", and a strong economic growth.

[2] M&A operations have significantly reduced the degree of competition and have positively affected prices and margins. They were achieved for strategic reasons, such as improving market share, profitability, or efficiency (Jones et al., 2011; De Jonghe and Vennet, 2008).

Meanwhile, systemic risk has considerably increased in the banking industry with a higher threat posed by very large banks, including those with high charter values which pursued riskier policies prior the GFC. Market imperfections and system vulnerability to contagion have also enhanced systemic risk (Hartmann, 2009). Also, banks had benefited from implicit guarantees and deposit insurance, particularly for SIFIs, which allowed them to gain competitive advantages and to change their growth strategy and business model and therefore to take more risk. Another factor that has received less attention, before the GFC, is the increase in bank charter value. This leads us to adopt a different view on the disciplining role of charter value in such a risk-accumulating period (before the GFC).

The perception of bank risk has also changed, based not only on its individual dimension (idiosyncratic risk and individual default risk), but also more and more on the vulnerability of banks and their contribution to systemic risk. Hence, throughout this paper, we look at both risk dimensions and consider standalone alongside systemic risk measures. We go beyond the literature addressing the nexus between bank charter value and risk by considering systemic risk indicators (Anginer et al., 2014; Hovakimian et al., 2015; Jones et al., 2011; Soedarmono et al., 2015) along the traditional standalone proxies (Niu, 2012; Jones et al., 2011; González, 2005).

Large banks, TBTF banks and SIFIs, have a natural tendency to grow further, change their business model and hence follow high risk strategies presumably above the socially optimal levels (Acharya et al., 2012). Their failure propagates contagion across the system and could also trigger the default of other banks and degenerate into global financial distress[3]. Although there is no unique definition of systemic risk, wherein the entire financial system is distressed, it is commonly accepted that a bank's systemic risk exposure refers to the comovement of individual bank risk and sensitivity to an extreme shock (Haq and Heaney, 2012; Weiß et al., 2014; Laeven et al., 2015). Various measures have been proposed in the literature to capture bank systemic risk. Adrian and Brunnermeier (2011) have introduced a comovement measure (ΔCoVaR) of financial system value at risk (VaR) conditionally on banks' VaR; Acharya (2009) consider the sensitivity of bank equity losses to market crashes (MES); while, the tail-beta used among others by Campbell et al. (2008) and Anginer et al. (2014) captures the sensitivity of systematic risk to extreme events (tail risk). The inherent unstable nature of risk (pre and post GFC), suggests that the relationship between

[3] Laeven and Levine (2007) argue that SIFIs engaged in multiple activities (charter-gain-enhancing) suffer from increased agency problems and poor corporate governance that could be reflected in systemic risk. Demirgüç-Kunt and Huizinga (2010) find that banks that rely to a larger extent on non-deposit funding and non-interest income are more profitable but also riskier.

charter value and risk may possibly change depending on the opportunities and constraints that banks face in different environments pre and post crisis.

Although there is a broad literature looking at the impact of charter value on bank individual risk (Niu, 2012; Jones et al., 2011; González, 2005; Konishi and Yasuda, 2004; Demsetz et al., 1996; Keeley, 1990) there is no clear-cut consensus on the effect of bank charter value on banks' standalone risk and systemic risk in normal versus abnormal economic conditions (i.e. pre and post the GFC). Hence, this paper examines the stability of the relationship between charter value and risk to track possible changes before the crisis (2000-2006), during the crisis (2007-2009), and after (2010-2013). It also looks into possible differences for U.S. banks, European banks and the more conservative banks in the rest of OECD countries which rely on a more traditional banking model[4]. It also considers possibly different impacts of charter value on standalone and systemic bank risk measures. To the best of our knowledge, this is the first study that investigates the charter value hypothesis by considering both standalone and systemic risk measures of bank risk by further differentiating the exceptional risk-building period prior to the GFC from the acute crisis and post-crisis periods.

We use a sample, spanning from 2000 to 2013, of 859 banks established in OECD countries. The results show that prior to the GFC charter value positively impacts both standalone and systemic bank risk measures but such a relationship is inverted during and after the crisis. A deeper investigation shows that such a behavior before the crisis is mostly relevant for very large banks and large banks with high growth strategies. Banks' business models also influence this relationship. In presence of strong diversification strategies, higher charter value increases standalone risk for very large banks. Conversely, for banks following a focus strategy, higher charter value amplifies systemic risk for very large banks and both standalone and systemic risk for large U.S. and European banks.

The remainder of the paper is organized as follows. Section 2 presents the data and variables used in this paper. In section 3, we present the empirical specifications. In section 4, we present the results of the econometric investigation. Section 5 reports robustness checks and concludes.

[4] Banks in these three geographical areas have very different business models and operate in differently organized banking systems. U.S. and European banks are more market-oriented; whereas, Australian, Canadian and Japanese banks are more reliant on traditional intermediation activities. Haq et al. (2016) argue that Australian and Canadian banks appear to pursue safer policies, even before the GFC (1995-2006), hence preserving financial stability.

2. Data and variables

2.1. Sample selection

The sample comprises publicly traded OECD banks for which stock price information and accounting data are available in both the Bloomberg and Thomson-Reuters databases. To ensure that we use the most informative risk indicators, we delete banks with missing historical stock prices or infrequently traded stocks. We disregard stocks if daily returns are zero during at least 30% of the whole trading period. Hence, we only consider bank stocks that are very liquid, i.e. those that are most likely to reflect important extreme events in their movements. Subsequently, we retrieve accounting data and filter out bank year observations by dropping the top and bottom 1 percent level to eliminate the adverse effects of outliers and misreported data. Due to the delisting of many banks, mainly due to mergers and acquisitions, we end up with an unbalanced panel dataset of 859 commercial, cooperatives and savings banks, from the 28 major advanced OECD economies, among which 22 are European[5] (Table 1). Our sample period runs from January 03, 2000 to December 31, 2013 (Table 2). The sample is dominated by commercial banks and by U.S. banks. It consists of 506 U.S. banks and 353 non-U.S. banks (of which 245 are European and 84 are Japanese). Taken together, listed banks account for more than 55% of the total assets of the European banking industry and 77% in the U.S.. For the other OECD countries, the coverage varies between 9% for Mexico to 31% for Japan.

[Insert Tables 1 and 2]

Data on individual bank daily stock prices, stock market indexes, as well as generic government bond yields, implicit volatility indexes and three-month LIBOR and Overnight Indexed Swap (OIS) spreads were collected from Bloomberg. Annual income statement and balance sheet data are obtained from Thomson Reuters whereas the OECD Metadata statistics provide yearly macroeconomic data: inflation and gross domestic product growth rates.

[5] From 988 banks, we end up with 859 banks due to our data cleaning process as well as the data availability that varies depending on the combination of variables used in regressions. Our sample consists of 22 European countries, three Americas countries (U.S., Canada and Mexico) and three Asian-Pacific countries (Japan, South Korea, Australia). Iceland and New Zealand were dropped because of insufficient liquid stocks (see Table 1).

In line with previous research, we define very large "too-big-too-fail" banks institutions with total assets above \$20 billion, large banks as those with total assets ranging from \$1 billion to 20 billion and small banks as those with assets between \$500 million and \$1 billion (Köhler, 2015; Laeven et al., 2015; Barry et al., 2011; Lepetit et al., 2008). Because of their specific business models, we exclude banks with less than \$500 million of total assets (Distinguin et al., 2013).

2.2. Standalone risk variables

We consider four standalone risk indicators that are equity based risk measures: total risk, bank-specific risk, systematic risk and a market based z-score. Total risk is computed as a moving standard deviation of bank stock daily returns. This is calculated each day for each bank using a moving window of 252 daily return observations. Similarly, we estimate the rest of the standalone risk measures with the following single index rolling market model[6]:

$$R_{i,t} = \alpha_i + \beta_{i,M} R_{M,t} + \varepsilon_{i,t}, \tag{1}$$

Where $R_{i,t}$ is the daily (t) stock return of bank i, $R_{M,t}$ the daily return on the market index of the country where the bank is located and $\varepsilon_{i,t}$ is the residual term. With this, $\beta_{i,M}$, the equity market betas are used as a proxy of banks' systematic risk. From the residual term, we proxy the idiosyncratic risk. Hence, bank specific risk is estimated as the standard deviation of the residuals generated from the single index rolling regressions of a bank's daily stock returns on the market index.

Furthermore, we use the market z-score, a metric for insolvency risk and default which is calculated as follows: MZ-Score $= \left(\overline{R_{i,t}} + 1\right)/\sigma_{R_{i,t}}$, where $\overline{R_{i,t}}$ is the mean and $\sigma_{R_{i,t}}$ the standard deviation of the monthly returns for a given year. A higher value of MZ-Score indicates a lower probability of failure (Lepetit et al., 2008).

2.3. Systemic risk measures

Besides the above standalone risk measures, we also consider four systemic risk measures. First, we follow Acharya et al. (2012) and Brownlees and Engle (2012) and use the Marginal

[6] We use rolling regressions of a bank's daily stock returns on market returns, as a return generating process. We estimate risk measures for each bank using a moving window of 252 daily observations.

Expected Shortfall (MES) which corresponds to the marginal participation of bank i to the Expected Shortfall (ES) of the financial system[7]. Formally, it corresponds to the expected stock return for bank i, conditional on the market return when the latter performs poorly. Acharya et al. (2012) define the MES as the expectation of the bank's equity return per dollar in year t conditional on a market crash in that given period.

$$MES_{i,t}^{q} \equiv E\left(R_{i,t} | R_{M,t} \leq VaR_{R_{M,t}}^{q}\right), \tag{2}$$

where $R_{i,t}$ is the daily stock return for bank i, $R_{M,t}$ is the daily market return[8], q-percent is a pre-specified extreme quantile enabling us to look at systemic events. $VaR_{R_{M,t}}^{q}$ stands for Value-at-Risk, which is a critical threshold value that measures the worst expected market loss over a specific time period at a given confidence level. Herewith, we follow the common practice and set q at 5-percent, the term $R_{M,t} \leq \mathrm{VaR}_{\mathrm{R_{M,t}}}^{\mathrm{q}}$ reflects the set of days when the market return is at or below the 5-percent tail outcomes in that given year. Thus, under the nonparametric assumption, the MES is the average of bank stock returns during market crash times, that correspond to the 5-percent worst days of the stock market index. It is expressed as:

$$MES_{i,t}^{q=5\%} = \frac{\sum R_{i,t} \times I\left(R_{M,t} < VaR_{R_{M,t}}^{q}\right)}{\sum I\left(R_{M,t} < VaR_{R_{M,t}}^{q}\right)} = \frac{1}{N} \sum_{R_{M,t} < VaR_{R_{M,t}}^{q}} R_{i,t}. \tag{3}$$

In equation (3), I (.) is the indicator function defining the set of days where the market experienced 5-percent worst days (crash period) and N is the number of days where the aggregate equity return of the entire market (proxied by a market index) experienced its 5-percent worst outcomes (Weiß et al., 2014). The higher a bank's MES is (in absolute value), the higher is its contribution to aggregate systemic risk and so its probability to be undercapitalized in bad economic conditions.

Second, we use CoVaR introduced by Adrian and Brunnermeier (2011) as a similar concept as VaR. It corresponds to the VaR of the entire financial system (i.e. the market index with a return of R_M) conditional on an extreme event leading to the fall of a bank i's stock return

[7] Economically, the term "marginal" refers to the bank's capital shortfall stemming from each unit variation in the equity value $\mathrm{MES}_{\mathrm{i,t}}^{\mathrm{q}}$. The MES measures the increase in systemic risk induced by a marginal increase in the exposure of bank i to the system.

[8] To estimate risk measures, we either employ the financial sector index for the most developed financial market or the broad market index.

R_i beyond its critical threshold level ($\mathrm{VaR}^{q}_{\mathrm{R_i}}$). $CoVaR^{q}_{R_{M|i,t}}$is the q-percent quantile of this conditional probability distribution and can be written as [9]:

$$Prob_{t-1}\left(R_{M,t} \leq CoVaR^{q}_{R_{M|i,t}} \mid R_{i,t} = VaR^{q}_{R_{i,t}}\right) = q \tag{4}$$

Explicitly, Adrian and Brunnermeier (2011) define bank ΔCoVaR as the difference between the VaR of the financial system conditional on the firm being in distress and the VaR of the system conditional on the bank being in its median state. It catches the externality a bank causes to the entire financial system. Therefore, bank ΔCoVaR is the difference between the $\mathrm{CoVaR}^{\mathrm{q=distress\ state}}_{\mathrm{R_{M|i,t}}}$ of the financial system when bank i is in financial distress, i.e. the bank stock return is at its bottom q probability level, and the $\mathrm{CoVaR}^{\mathrm{q=median}}_{\mathrm{R_{M|i,t}}}$ of the financial system when this bank i is on its median return level, i.e. the inflection point at which bank performance starts becoming at risk. Hence, $\mathrm{CoVaR}^{\mathrm{q}}_{\mathrm{R_{M|i,t}}}$ measures the systemic risk contribution of bank i when its return is in its q-percent quantile (distress state). Here, we set q at 1-percent. Whereas, $\mathrm{CoVaR}^{\mathrm{q=50\%}}_{\mathrm{R_{M|i,t}}}$ measures the systemic risk contribution of bank i when bank i's is in a normal state. The $\Delta\mathrm{CoVaR}^{\mathrm{q}}_{\mathrm{R_{M|i,t}}}$of individual ban is defined as:

$$\Delta CoVaR^{q}_{R_{M|i,t}} = CoVaR^{q}_{R_{M|i,t}} - CoVaR^{median}_{R_{M|i,t}} \tag{5}$$

Therefore, the systemic risk contribution of an individual bank i at q=1% can be written as:

$$\Delta CoVaR^{q=1\%}_{R_M|R_i=VaR^{1\%}_{R_{i,t}},t} = \hat{\lambda}^{1\%}_{R_{M|i,t}}\left(VaR^{1\%}_{R_{i,t}} - VaR^{50\%}_{R_{i,t}}\right). \tag{6}$$

$\Delta\mathrm{CoVaR}^{\mathrm{q}}_{\mathrm{R_{M|i,t}}}$is estimated given the bank i's unconditional VaRs, defined in equation (7), and the conditional VaRs {$\mathrm{CoVaR}^{\mathrm{q}}_{\mathrm{R_{M|i,t}}}$=$\mathrm{VaR}^{\mathrm{q}}_{\mathrm{R_{M,t}}}$|$\mathrm{VaR}^{\mathrm{q}}_{\mathrm{R_{i,t}}}$}, defined in equation (8). For bank's unconditional VaRs we run separately 1-percent and 50-percent quantile regressions, using daily stock prices over the whole period (Adrian and Brunnermeier, 2011). Specifically, we run the following quantile regressions over the sample period to obtain:

$$VaR^{q}_{R_i} = \hat{R}_{i,t} = \hat{\alpha}_i + \widehat{\gamma_i^q} R_{M,t-1} + \hat{\varepsilon}_{i,t} \tag{7}$$

$$CoVaR^{q=1\%}_{R_{M|i,t}} = \hat{R}_{M,t} = \hat{\alpha}_{R_{M|i}} + \hat{\lambda}^{1\%}_{R_{M|i,t}} VaR^{1\%}_{R_{i,t}} + \hat{\varepsilon}_{M|i,t} \tag{8}$$

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[9] As MES, CoVaR is a conditional VaR computed at time t given information available at time t-1 based on the financial system Expected Shortfall.

Following regression model in equation (7), we estimate $VaR_{R_{i,t}}^{1\%}$ and $VaR_{R_{i,t}}^{50\%}$. Then, within the q-percent quantile regressions, we predict the systemic risk conditional on bank i in distress ($\mathrm{CoVaR}_{\mathrm{R}_{\mathrm{M|i,t}}}^{\mathrm{q=1\%}}$) and in median state ($\mathrm{CoVaR}_{\mathrm{R}_{\mathrm{M|i,t}}}^{\mathrm{q=50\%}}$), and estimate $\hat{\lambda}_{R_{M|i,t}}^{1\%}$, the slope coefficient of the 1-percent quantile regression (equation (8)) (Mayordomo et al., 2014; Adrian and Brunnermeier, 2011).

Third, as an extension of MES, Long Run Marginal Expected Shortfall (LRMES) has also been proposed by Acharya et al. (2012). It is an approximation of equity values fall in the crisis scenarios when the market goes down below a given threshold, 40 percent over 180 days (Laeven et al., 2015; Acharya et al., 2012). We use a similar approximation to compute a long-run MES based on a one-day MES (tail expectation of the bank's return conditional on a market decline) [10]:

$$LRMES_{\ i,t} \cong 1 - exp^{\left(-18 \times MES_{i,t}^{q=5\%}\right)}. \tag{9}$$

The fourth measure of systemic risk is Tail-beta (quantile-beta), based on De Jonghe (2010) and Engle and Manganelli (2004). It is obtained using a quantile regression model at the q pre-specified quantile and captures bank's sensitivity to extreme movements. We use the model presented in equation (8) and run a 1-percent quantile regression and tail betas of each bank i are estimated by regressing daily bank stock return $R_{i,t}$ on daily market return $R_{M,t}$. We predict tail-betas ($\beta_{i,\mathrm{M}}$) as the market index coefficients in the 1-percent quantile regression. Thus, the spillover coefficient ($\beta_{i,\mathrm{M}}$) measures the risk sensitivity of bank i at the 1% quantile. The larger is the spillover effect, the more vulnerable is bank i to a financial downturn.

2.4. Long-term performance: Bank charter value

Bank charter (franchise) value is our main explanatory variable and based on existing literature, we use Tobin's q as the proxy. Charter value equals the net present value of the expected stream of rents, which characterizes a bank's profit-generating potential beyond its merchantable assets (Marcus, 1984; Acharya, 1996; Demsetz et al., 1996). This value reveals more information

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[10] Our paper derives numerical results of systemic risk based on two standard risk measures of tail risk: value-at-risk (VaR) and expected shortfall (ES). Losses are expressed in positive terms. Risk measures: MES, ΔCovaR and LRMES are positive, given in absolute value. An increase in a bank's systemic risk measures is thus indicated by a positive change.

than bank size. It sums up intangible assets as goodwill, growth possibilities, economic rents, degree of market power, financial strength, etc. (Furlong and Kwan, 2006; Jones et al., 2011). It is often used for comparability among varying size banks and/or banks with different pricing power (in loan, deposit or other marketable securities) (Keeley, 1990). Furthermore, it has a cyclical feature and is also dependant on banks' earnings expectations (Saunders and Wilson, 2001). Hence, the advocates of the so-called CVH argue that when charter is built up, banks (i.e. shareholders) seek to preserve it from adverse shocks, otherwise it cannot be fully liquidated at the event of closure. Bankruptcy is costly when charter value is high, with regards also to the additional cost of failure (Jones et al., 2011; Hellmann et al., 2000; Demsetz et al., 1996).

For publicly traded banks, Tobin's q is calculated as the bank's future economic profits reflected in the market value of assets (i.e. debt and market value of equity) divided by the book value of total assets. We follow Soedarmono et al. (2015), Haq and Heaney (2012), Gropp and Vesala (2004) and Keeley (1990) and define it as:

$$q_{i,t} = \frac{MVE_{i,t} + BVL_{i,t}}{BVA_{i,t}}. \qquad (10)$$

where $\mathrm{MVE}_{\mathrm{i,t}}$, $\mathrm{BVL}_{\mathrm{i,t}}$ and $\mathrm{BVA}_{\mathrm{i,t}}$ represent respectively: market value of equity, book value of liabilities and book value of assets of bank i at time t. Market value of equity is the annual average of daily bank market capitalization at year t and the two accounting measures denote values at the end of year t. The numerator of Tobin's q is the market value of assets, i.e. $\mathrm{MVA}_{\mathrm{i,t}} \equiv \mathrm{MVE}_{\mathrm{i,t}} + \mathrm{BVL}_{\mathrm{i,t}}$. It refers partly to higher run-up in stocks price with regards to other investments. Whereas, the denominator reflects the accounting value of assets and is equal to: $\mathrm{BVA}_{\mathrm{i,t}} + \mathrm{BVE}_{\mathrm{i,t}}$ (book value of equity).

Moreover, the literature highlights various factors that affect bank charter value. Furlong and Kwan (2006) and Demsetz et al. (1996) emphasize two main determinants: market regulation which leads to higher market power through M&A operations, and bank-related aspects other than market power as the expansion of off-balance sheet activities and noninterest income[11]. In a similar vein, González (2005), Allen and Gale (2004) and Hellmann et al. (2000) argue that bank charter value stems from financial liberalization, regulatory restrictions, deposit insurance and

[11] According to the CVH, regulation promotes bank franchise value through more entry restrictions and more market concentration enhancing profit opportunities. By contrast, deregulatory efforts that increase financial service competition may erode charter value and thereby increase risk taking incentives (Anginer et al., Zhu 2014; Allen and Gale, 2004; Hellmann et al., 2000).

competition[12]. Again, Haq et al. (2016) argue that market discipline, bank capital, contingent liabilities, and non-interest income are factors that enhance bank charter value. In fact, bank charter value may have multiple roles. According to the CVH, it gives banks self-disciplining incentives and restrains excessive risk-taking appetite. Nevertheless, Gropp and Vesala (2004) found the CVH to be only effective for small banks, with lower charter values and that such a result could reflect lower moral hazard with the introduction of explicit deposit insurance in Europe. However, for large banks which are presumably "TBTF", charter value does not explain their risk-taking. Moreover, although many papers report a negative relationship between bank risk taking and bank charter value, consistent with the CVH (Park and Peristiani, 2007; Konishi and Yasuda, 2004; Anderson and Fraser, 2000; Hellmann et al., 2000; Demsetz et al., 1996; Keeley, 1990; Agusman et al., 2006), others find a positive or a non-linear relationship, i.e. a "U" shape relationship (Niu, 2012; Haq and Heaney, 2012; Jones et al., 2011; Martinez-Miera and Repullo, 2010; Saunders and Wilson, 2001; De Nicolo, 2001).

2.5. Control variables

We consider various control variables in our regressions. Specifically, two main types of controls are considered: bank-specific controls and country-level determinants. For bank-specific controls, we follow the literature and account for bank size, the capital ratio, profitability, the bank's involvement in market-based activities, operational efficiency, and the bank's business model. Bank size is measured by the natural logarithm of total bank assets in U.S. dollars), the capital ratio is defined as total assets over equity and the return on assets as the ratio of net income to total assets). Ratio of net loans to total assets proxies asset mix and the cost-to-income ratio, which is measured by the importance of non-interest expense relatively to total operating revenue, proxies bank efficiency. As a proxy of bank complexity and diversification we use the ratio of non-interest income to total income (Ghosh, 2009; De Jonghe and Vennet, 2008).

Regarding country-level factors that capture cross-country variations, we control for the gross domestic product growth rate and the annual inflation rate. We also introduce the overall capital stringency index to control for the extent to which regulatory requirements are strict and effective

[12] Anginer et al. (2014) and Allen and Gale (2004) argue that in highly competitive markets, banks earn lower rents, which also reduces their incentives for monitoring.

(Barth, et al., 2013). We also consider macro-financial controls. We use interbank market rates to control for differences in interest rates and access to overnight cash markets across OECD countries (Haq et al., 2016; Furlong and Kwan, 2006). We introduce the LIBOR-OIS spread (difference between London Interbank Offered Rate and Overnight Indexed Swap) as a proxy of the liquidity risk premium. Besides, we control for M&As by introducing a dummy variable that takes the value of 1 if total assets grow by more than 15% in one year and 0 otherwise (De Jonghe and Öztekin, 2015). Finally, we introduce year dummies to capture year-specific effects.

2.6. Summary statistics

Descriptive statistics of our variables are presented in Table 3. The average (median) charter value is 1.06 (1.02), indicating that, on average, the market value of bank assets exceeds their book value by 5.60%. Dispersion in Charter value is relatively low with a standard deviation of 0.17. The remaining controls are comparable to what is observed in previous studies (De Jonghe et al., 2015; Laeven et al., 2015; Black et al., 2016; Niu, 2012; González, 2005). With regard to risk measures, all the measures exhibit substantial variations over the 13 years covered by our study[13]. MES ranges between -1.13% and 9.63% with an average (standard deviation) of 1.56% (1.83). ΔCoVaR varies around a mean (standard deviation) of 1.39% (1.71). Regarding standalone risk measures the average (standard deviation) values are 2.18% (1.22), 0.52 (0.52), 2.36% (1.27), and 53.64 (23.41) for specific risk, systematic risk, total risk and MZ-score, respectively. All indicators of standalone and systemic risk exhibit substantial volatility as their standard deviations are high, indicating high bank risk-taking and high exposure to default risk.

We report the pair-wise correlation coefficients among the explanatory variables in Table 4. We perform the variance inflation factor (VIF) test which confirms the absence of major multicollinearity problems.

[Insert Tables 3 and 4]

[13] The differences in the number of observations is due to missing accounting and market data for some banks.

3. Empirical specification

We consider a simultaneous equations model with unbalanced panel data. The specification of the second stage is represented by the following reduced form model:

$$Risk_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_i + \varepsilon_{2i,t}. \qquad (11)$$

where, $Risk_{i,t}$ is a set of risk measures, subscripts i denotes individual banks and t denotes each fiscal year. $\widehat{Charter}_{i,t}$ represents the predicted value of bank charter value of the first stage regression. $X_{i,t-1}$ and $C_{i,t}$ are respectively vectors of bank-level explanatory variables for each bank i lagged by one year, to mitigate potential endogeneity concerns, and country-level explanatory variables to control for macroeconomic variations. The coefficient β_1 captures the effect of charter value on bank risk and the rest of the coefficients are those of the control variables. λ_t is a set of year dummies ($\sum_{t=2001}^{2013} year_t$) included to further account for time trend varying effects through the business cycle and for possible structural changes in the banking industry. μ_i captures bank-specific effects, and standard errors are clustered at the individual bank level.

Our empirical setup may suffer from reverse causality. High-chartered banks might be systemically important and/or involved in high risk activities, or vise-versa. We hence adopt an instrumental variable approach. In theory, bank charter value and risk taking may be simultaneously targeted (Martinez-Miera and Repullo, 2010; Ghosh, 2009; Boyd and De Nicoló, 2005; Gropp and Vesala, 2004; Keeley, 1990)[14]. Some papers also argue that higher charter value may derive from high risky strategies (Laeven and Levine, 2007; Konishi and Yasuda, 2004; Saunders and Wilson, 2001; Park, 1997).

To tackle possible endogeneity issues, we use the two-stage least squares (TSLS) instrumental variables method with fixed effects. In the first stage, we instrument and estimate charter value $\widehat{Charter}_{i,t}$. Previous literature has identified different determinants of charter value (Furlong and Kwan, 2006; Jones et al., 2011). Hereafter, we use three continuous and exogenous variables to instrument the charter value. First, we use the one year lagged value of charter value, assumed to be exogenous. Second, we follow González (2005) and include assets tangibility

[14] Bank with higher default risk could have a higher market-to-book asset ratio if deposit insurance were underpriced and its value were capitalized on the market (but not on the book). Riskier banks could be over valuated, because risk shifting increases the option value of equity (Keeley 1990).

measured as the ratio of tangible assets to total assets to account for possible differences due to the extent of tangible assets, differences in efficiency, branching policy, or country size. Third, we follow Laeven and Levine, (2009) and Keeley (1990) and use market share defined as total assets of bank i over the aggregate assets of the banking system in a given country (all banks included, listed and non-listed) as a proxy of market power[15]. Subsequently in the second stage, risk regressions incorporate the predicted values of charter value from the first stage with the rest of the explanatory variables[16].

To ensure the reliability of the subsequent empirical results at the second stage, we statistically test the validity and strength of the chosen instruments. Under heteroscedasticity and robust-clustering, we perform the Hansen j overidentifying restriction test to check the exogeneity of the instruments in the estimated models. The relevance of the three instruments is also assessed through Kleibergen–Paap (KP) rank-LM and KP-Cragg-Donald Wald versions of under-identification and weak identification tests. To reject the null hypothesis of weak instruments, the KP Cragg-Donald Wald F statistics are reported at 5% critical value along Stock and Yogo (2005)[17].

Statistics from these respective tests are reported in the results' tables. The Hansen's j test confirms the validity of instruments. The null hypotheses of weak correlation between the chosen instruments and the endogenous regressor and underidentification of the model are rejected.

4. Results

4.1. Impact of charter value on bank risk taking

Table 5 displays TSLS estimations regarding standalone risk (even columns) and systemic risk (odd columns) over the pre-crisis period (2000-2006) and later (2007-2013). We match

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[15] Although core deposits are regarded as important to explain charter value (Jones et al., 2011), we do not introduce them in the regressions because of insufficient observations for banks in countries other than the U.S.. Similarly, we do not use the entry denied index as an instrument of charter value, such as in (Laeven and Levine, 2009), because the index is not available for almost all the countries, including the U.S., during the 2008-2012 period. Instead, we use a proxy of market power.

[16] We follow Keeley (1990), Gropp and Vesala (2004) and González (2005) who use the same model specification.

[17] The Cragg-Donald Wald F statistics of the first stage show values greater than the Stock-Yogo's critical values for 5% maximal IV size (relative bias is 16.85). Stock and Yogo (2005) tabulate 95% critical values of the canonical correlation rank statistic for the first-stage F-statistic to test whether instruments are weak.

individual and systemic risk measures to investigate whether the impact of charter value may differ depending on the type of risk and economic conditions (pre-crisis period versus crisis and post-crisis). The coefficients estimates for bank charter value are positive and statistically significant at 1% in the pre-crisis period (columns 1-7), indicating that an increase in charter value is associated with an increase in bank individual risk and systemic risk over the pre GFC period. Similarly, the negative and significant relationship at the 1% level between charter value and the market-based z-score indicator (column 8) shows that higher charter value increases bank default. On the whole, table 5 shows that bank charter value and risk move together during the profitable, pre-crisis period (2000-2006). Therefore, the self-disciplining role induced by charter value is not effective during the years that preceded the GFC. However, during and after the crisis (2007-2013) the coefficients of charter value take the opposite sign consistent with the CVH. When we further split the 2007-2013 period into acute crisis (2007-2009) and post crisis (2010-2013) periods (Table 6), we find that the disciplining effect of charter value is only effective after the crisis and that charter value does not play any role during the crisis.

The impact of charter value on risk is also economically meaningful. For instance, before the crisis a one standard deviation increase in the charter value (0.17) leads to an increase in the MES of 1.4% (8.03*0.17) (column 1 of Table 5) and a decrease in the MES in the subsequent period 0.11% (-0.66*0.17) (column 1 of Table 6, period [2010-2013]).

Regarding the control variables, most of them enter significantly and the coefficients carry the signs obtained in previous studies. Bank size has a positive and statistically significant effect on systemic risk and systematic risk and a negative and statistically significant effect on the rest of standalone risk variables. The coefficient of the capital ratio variable is positive and statistically significant for systemic and systematic risk but significantly negative for the other standalone risk proxies. The coefficient of the return on assets is negative and significant in all periods for all risk measures, indicating that a higher ROA is associated with lower risk. The coefficient of the M&A dummy is significantly positive but only for systematic risk and systemic risk. With respect to macroeconomic factors, the inflation rate has a significantly positive impact on risk measures. Thus, in presence of bad economic conditions such as inflationary pressures or high interbank rates, banks become riskier and more vulnerable to systemic shocks. On the whole, as expected, the coefficients of economic growth are negative and significant but they are nevertheless positive and significant for systemic risk measures in the pre-crisis period. This suggests that although higher economic growth is good for individual bank stability it might have an adverse effect on the threat that banks might pose to the entire financial system. The coefficients of the capital stringency index are negative and significant, suggesting that regulation is effective in lowering risk.

[Insert Tables 5 and 6]

In what follows, we go deeper in the investigation of the positive relationship between charter value and bank risk during the pre-crisis period. Specifically, we test whether differences in risk-taking culture across countries, bank size, and growth and diversification strategies are possible drivers of such an unexpected impact of charter value on risk.

4.2. Charter value-bank risk relationship: the impact of cross-country heterogeneity, bank size, and growth and diversification strategies

The relationship between charter value and bank risk may depend on differences in risk taking cultures. For instance, Japanese banks are well known to be more conservative than their U.S. counterparts (Haq et al., 2016). We therefore take advantage of the heterogeneity of our OECD bank sample that comprises different countries and financial systems (market-based vs. bank-based financial systems). We define three geographical sub-groups: U.S., European countries and the rest of OECD countries (which is dominated by Japan). Table 7 displays the results. They show that the positive relationship between charter value and bank risk during the pre-crisis period only holds for banks in the U.S. (Panel A) and Europe (Panel B).

Through the crisis, charter value negatively affects individual risk measures for U.S. banks (Appendix A, Panel A and Appendix B, Table 1, Panel A) and all risk measures for the rest of OECD banks (Appendix B, Panel C). After the crisis, charter value is effective in reducing systemic risk and default risk of U.S. banks (Appendix B, Table 2, Panel A) and both systemic risk and individual risk of European banks (Appendix A, Panel B and Appendix B, Table 2, Panel B).

[Insert Table 7]

In the next step, we only keep U.S. and European banks, i.e. we eliminate from our sample banks from the rest of OECD countries for which the relationship between charter value and bank risk is not significant, and test whether the charter value-bank risk relationship may be influenced by bank size. Table 8 reports the results. We find that a high charter value increases both standalone and systemic risks for very large and large banks; whereas for small banks, such a relationship is not found for half of our specifications (columns 2, 3, 5 and 6 in Table 8).

[Insert Table 8]

Lastly, we consider the sample of very large and large banks for which the positive relationship between charter value and risk is confirmed and explore if differences in growth strategies and business models alter such a relationship. We define banks with high growth strategies as those in the top 75th percentile of bank total assets variation[18] during the pre GFC period, while banks with low growth strategies are those in the bottom 25th percentile. We use similar cutoffs for the business model and consider the variation of the non-traditional income ratio as an indicator of bank diversification[19]. Tables 9 and 10 display the results. While the positive impact of charter value on both standalone and systemic risks is confirmed for the sample of very large banks regardless of the growth strategies (Table 9, Panels A and B), we do find differences for the sample of large banks. In fact, for the latter sample, charter value has no impact on both standalone and systemic risks when banks are characterized by a low growth strategy (Table 9, Panel A). As regards to bank business model, a quasi-similar pattern is noticeable. Irrespective of the degree of diversification (activity-mix), the positive impact of charter value on bank risk is also confirmed for the sample of very large banks. Nevertheless, compared to the previous findings, the impact on standalone risk is weaker for less diversified banks (Table 10, Panel B, even columns), while it is non-existent when considering the systemic risk measures for highly diversified banks (Table 10, Panels A, odd columns). Considering the sample of large banks,

[18] Growth strategy (business model) variation is computed as the change over the pre-GFC period (between 2000 and 2006) in total assets (diversification ratio) over the average total assets (diversification ratio) (see descriptive statistics, Table 3).
[19] We use the ratio of non-interest income to total income as the diversification ratio. Alternately, we consider the ratio of non-interest income to operating income and obtain similar results.

charter value is positively associated with both standalone and systemic risks only when banks have a strong diversification strategy (Table 10, Panel B).

[Insert Tables 9 and 10]

5. Robustness checks and conclusion

5.1. Robustness checks

To check the robustness of the results, we proceed as follows. Firstly, the definition of TBTF banks we consider (banks with total assets above $20 billion) is presumably more accurate for banks operating in the most developed banking systems but less appropriate for the less developed OECD countries. Therefore, we keep the absolute size criterion of total assets above $20 billion for banks operating in the world's top 10 economies, and for the rest of the OECD countries in our sample, we use bank size relative to GDP. Very large banks with respect to the home country's GDP are defined as those with a ratio above 10 percent (De Jonghe et al., 2014). We re-estimate the regressions (Tables 8, 9 and 10) and find similar conclusions. We find that charter value has a positive and significant impact on bank risk-taking during the pre GFC period for large banks and very large (TBTF) banks (Tables 11 and 12). Considering growth and diversification strategies during the pre-crisis period (Tables 13 and 14), the results support our earlier findings although for very large banks, we note some minor differences: the relationship between charter value and standalone risk is no longer significant when banks pursue a high growth strategy and the relationship becomes significant when banks have a strong diversification strategy. Secondly, we consider an alternative proxy of charter value. We use the standardized market value added (MVA)[20] and market-to-book ratio and obtain similar conclusions (Table 15). Finally, in Tables 16 and 17, we use the median as a new cutoff to define high and low bank growth and diversification strategies during the pre-crisis period, instead of the top 75th and bottom 25th quartiles of total assets and non-traditional income ratio variations. Consistent with our results, we find that in the presence of an expansion strategy (above the median), a higher charter value leads to an increase of both individual and systemic risks, during the pre GFC period (Tables 16, Panels

[20] We calculate the standardized market value added MVA as (current market capitalization –total equity) divided by total equity.

A). Similarly, in presence of strong diversification strategies (above the median of the non-traditional income ratio variation), charter value increases both risk dimensions for very large and large banks (Tables 17, Panel A). Meanwhile, for banks following a low growth strategy (below the median increase in total assets), a positive relationship between charter value and both risk measures is found only for very large banks (Tables 16, Panel B). Our results are therefore robust to alternative definitions of TBTF banks, charter value and the choice of cutoffs.

[Insert Tables 11, 12 and 13]

5.2. Conclusion

Previous studies on the relationship between charter value and bank risk-taking have mainly focused on standalone risk measures and report mixed results. Although higher charter value is generally considered as beneficial in terms of bank stability, by reducing a bank's risk taking incentives, some studies find this relationship not be linear. This paper considers both standalone and systemic risk measures and shows that the relationship between charter value and risk is different during normal times and distress periods dependent on the state of the economy and the business cycle. Specifically, based on our investigation of 859 publicly-traded banks in 28 OECD countries over the 2000–2013 period, we find that before the global financial crisis charter value positively impacted both individual and systemic risks. Such a behavior is mostly effective for large "too-big-to-fail" banks with aggressive diversification strategies or other large banks with fast growth policies. Our findings highlight that instead of mitigating risk, charter value may have provided incentives to accumulate risk which in turn might have contributed to higher systemic risk. By contrast, the results show that during, and more specifically after, the global financial crisis, banks tend to protect their charter value and lessen their risk exposure thereby reducing their contribution to systemic risk.

Our findings have important policy implications. The one size fits all capital conservation buffers introduced by Basel III may not be enough to guarantee bank stability and should not only be based on the business cycle but also on the state of the financial system. Although banks are required to accumulate buffers during economic upturns, banks with a stronger position with higher charter value might be building up more aggressive expansion strategies during bullish financial markets. Regulators and supervisors should hence closely look into the behavior of very large "too-big-to fail banks" and large banks with high growth or strong diversification (business mix) strategies. For such banks the impact of charter value on bank stability can be a double-edged sword.

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Table 1. Sample composition

Table shows the sample country composition. It presents the distribution of 859 listed banks in 28 OECD countries: Australia, Austria, Belgium, Britain, Canada, Czech, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, Norway, Poland, Portugal, Slovakia, South Korea, Spain, Sweden, Switzerland, Turkey and United-States. Sample is dominated by U.S. banks with 506 banks; whereas, number of European banks stands at 245 banks.

Country	Num.	Obs.	Country	Num.	Obs.
Australia	6	84	Luxembourg	1	12
Austria	7	89	Mexico	3	39
Belgium	3	40	Netherlands	3	36
Canada	11	144	Norway	17	212
Czech	1	13	Poland	12	155
Denmark	40	476	Portugal	3	42
Finland	2	27	Slovakia	2	23
France	21	227	South Korea	7	80
Germany	18	219	Spain	15	162
Greece	12	141	Sweden	4	53
Hungary	1	14	Switzerland	24	306
Ireland	2	28	Turkey	16	188
Italy	25	301	United-Kingdom	13	150
Japan	84	1121	United-States	506	6255

Table 2. Sample distribution by calendar year

Table shows the sample distribution by calendar year. The sample spans 14 years, from 2000 to 2013. Bank-year observations vary between 528 and 855 observations.

Year	Freq.	Percent
2000	684	6.40
2001	711	6.66
2002	726	6.8
2003	744	6.96
2004	773	7.24
2005	812	7.60
2006	843	7.89
2007	855	8.00
2008	835	7.82
2009	822	7.70
2010	805	7.54
2011	768	7.19
2012	776	7.26
2013	528	4.94

Table 3. Descriptive statistics and variables definition

Table reports summary statistics for all variables: bank risks and explanatory variables, used in the regressions. Bank-level data consists of publicly traded OECD banks from 28 countries during the 2000-2013 period. The imbalanced sample explains why the number of observations are different. We report four basic summary statistics: number of observations, mean, standard deviation and median, for variables measured at time t. We document also data sources and definitions of variables. Detailed information on the construction of bank risk proxies are provided in section 3.

Variable	N	Mean	Standard deviation	Median	Source	Definition
Risk measures						
Specific Risk (%)	10321	2.181	1.223	1.831	Bloomberg	Equation 1.
Systematic Risk	10321	0.521	0.521	0.362	Bloomberg	Equation 1.
Total Risk (%)	10321	2.358	1.263	2.007	Bloomberg	Equation 1.
MZ-score	10321	53.640	23.410	50.724	Bloomberg	Market-based Z-score.
MES (%)	10321	1.560	1.832	1.155	Bloomberg	Equation 2.
ΔCoVaR (%)	10321	1.389	1.707	1.201	Bloomberg	Equation 4.
LRMES (%)	10321	19.393	21.925	17.655	Bloomberg	Equation 9.
Tail-beta	10321	0.644	0.855	0.668	Bloomberg	Quantile beta.
Charter	10417	1.056	0.171	1.018	Bloomberg, and Thomsen-Reuters Advanced Analytic (TRAA)	Charter value proxied by Tobin's q.
Size	10584	8.211	2.186	7.745	TRAA	Natural logarithm of bank total assets (in $billion).
CAPR					Bloomberg, and TRAA	Capital ratio, total equity over total assets.
Diversification	10238	0.210	0.127	0.186	TRAA	Income diversification, noninterest income over total income.
Loans	9608	0.693	0.160	0.700	TRAA	Loans to total assets, net loans over total assets.
Efficiency	9480	0.463	0.149	0.446	TRAA	Cost income ratio, non-interest expense over total income.
ROA	10321	0.006	0.012	0.007	TRAA	Return on assets, ratio of net income to total assets.
d(merger)	10682	0.37	0.48	0.000	SNL, and Bloomberg	Mergers and acquisitions dummy, takes value of 1, if bank had an M&A experience, the annul total assets variation exceeds 15%; 0, otherwise.
ΔTA	5293	0.646	0.534	0.604	TRAA	Change in total assets between 2000 and 2006 divided by the average total assets over the pre-GFC period.
ΔDiv.	5122	0.203	0.423	0.236	TRAA	Change in diversification ratio between 2000 and 2006 divided by the average diversification ratio over the pre-GFC period
LiborOis	10682	27.340	26.038	19.135	Bloomberg	Liquidity premium, defined as the spread between 3-month London Inter-Bank Offered Rate (LIBOR) and Overnight Indexed Swaps rate (OIS). It reflects soundness of the banking system.
InterbankRate	10509	2.500	2.121	1.802	Bloomberg	Short-term interbank lending interest rates, in each country.
GDP	10682	1.759	2.153	1.880	OECD stats Metadata, and IMF WEO	Gross domestic product growth, defined as annual real GDP growth rate.
Inflation	10682	2.332	3.127	2.300	OECD stats Metadata, and IMF WEO	Inflation, defined as annual inflation rate.
Market share	10467	0.016	0.053	0.001	Bankscope, and TRAA	Share of individual bank's total assets in domestic total assets of the country's banking system.
Tangibility	8803	0.011	0.005	0.009	TRAA	Tangible assets ratio, book value of tangible assets to total assets.

Table 4. Correlation matrix

Table presents the pairwise correlation matrix for bank-level characteristics and macroeconomics variables. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ denote statistical significance at the 10%, 5% and 1%, respectively. Definitions of all variables are listed in Table 3.

	Charter	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Size (1)	-0.125***	1								
ROA (2)	0.216***	-0.052***	1							
CAPR (3)	-0.239***	0.499***	-0.330***	1						
Diversification (4)	0.035***	0.400***	0.112***	0.120***	1					
Efficiency (5)	0.042***	-0.030**	-0.313***	0.084***	0.400***	1				
Loans (6)	0.254***	-0.189***	-0.0295**	-0.114***	-0.235***	-0.069***	1			
InterbankRate (7)	-0.044***	-0.035***	0.182***	-0.093***	-0.108***	-0.395***	-0.065***	1		
LiborOis (8)	-0.069***	0.037***	-0.170***	0.019	-0.076***	-0.042***	0.032**	0.034***	1	
GDP (9)	0.101***	-0.074***	0.275***	-0.103***	-0.020*	-0.118***	-0.023*	0.281***	-0.480***	1
Inflation (10)	0.078***	-0.082***	0.093***	-0.174***	-0.109***	-0.234***	-0.029**	0.811***	0.041***	0.210***

Table 5. Standalone and systemic risks: effect of bank charter value in two sub-periods, pre-crisis and abnormal periods

Regression results for various bank risk measures on bank charter value over the pre-crisis period (2000-2006), during and the post-crisis period (2007-2013). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering at the bank-level. Results of model $\mathrm{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter, proxied by Tobin's q) is modelled endogenously in all regressions. We instrument Charter by its one-year lagged value, Tangibility=tangible assets ratio and Market share = bank total assets over domestic total assets of the country banking system. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Year dummies are not reported. Definitions of control variables are: Size=natural log of total assets, Loans=Loans to total assets, Diversification=non-interest income over total income, Efficiency=cost income over total income, CAPR=capital ratio, equity to total assets, ROA= Return on assets, d(merger)= dummy takes one if the bank experienced a merger-acquisition event (annul total assets variation exceeds 15%), and zero otherwise, and zero otherwise, d(crisis)= dummy takes one during crisis time (2007-2009), and zero otherwise, GDP=gross domestic product growth, Inflation=annual inflation rate and Cap_String=capital stringency. Heteroscedasticity consistent and robust standard errors t statistics are in brackets below their coefficients estimates. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ denote statistically significant at 10%, 5% and 1% levels, respectively. Hansen j test reports p-value of overidentification test. Kleibergen-Paap rank LM statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor. Kleibergen-Paap rk Wald F-statistic testing for weak (Cragg-Donald Wald test, Stock and Yogo (2005) 5% critical value is 16.85). We do not face muticollinearity problems (if VIF test is less than 10 basis points, not reported).

	Pre-crisis period [2000-2006]								Crisis and post-crisis period [2007-2013]							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	8.029***	2.035***	2.342***	2.926***	5.073***	3.494***	97.45***	-79.91***	-1.086***	-0.359**	-0.305**	-0.202***	-0.125	-0.532***	-9.581***	7.681***
	(6.15)	(2.59)	(3.32)	(6.35)	(4.72)	(5.20)	(5.61)	(-5.57)	(-4.62)	(-2.07)	(-2.38)	(-3.41)	(-0.50)	(-3.02)	(-3.39)	(2.67)
Size	0.0593	-0.315***	0.115	0.0980**	0.232**	-0.238***	1.852	3.855*	0.394**	-0.647***	0.100	0.160***	0.348**	-0.516***	4.856**	10.37***
	(0.44)	(-3.76)	(1.19)	(2.02)	(2.14)	(-2.72)	(1.04)	(1.90)	(2.34)	(-6.31)	(1.16)	(3.18)	(2.33)	(-4.90)	(2.30)	(6.45)
CAPR	1.004	-1.576*	1.876*	1.215**	2.123*	-0.999	20.31	58.74***	-0.428	-5.082***	1.129*	0.763***	2.837**	-3.766***	0.746	53.75***
	(0.73)	(-1.73)	(1.68)	(2.24)	(1.77)	(-1.04)	(1.02)	(2.86)	(-0.39)	(-6.64)	(1.82)	(2.67)	(2.50)	(-5.06)	(0.06)	(4.13)
Diversification	-0.755*	0.125	0.0801	-0.00344	-0.538	0.0391	-6.817	10.34	-0.447	0.505	-0.500*	0.0220	0.497	0.594	-5.777	-1.782
	(-1.76)	(0.44)	(0.24)	(-0.02)	(-1.34)	(0.13)	(-1.16)	(1.39)	(-0.85)	(1.32)	(-1.65)	(0.20)	(0.92)	(1.52)	(-1.06)	(-0.34)
Loans	-0.0466	-0.467*	0.242	-0.149	0.350	-0.570**	2.598	5.738	0.883***	-0.0423	0.419**	0.0527	-0.0296	0.161	11.52***	-0.0533
	(-0.13)	(-1.79)	(0.78)	(-1.15)	(1.02)	(-2.03)	(0.53)	(0.88)	(2.88)	(-0.19)	(2.32)	(0.81)	(-0.09)	(0.71)	(3.06)	(-0.01)
Efficiency	0.260	0.101	0.148	0.0445	0.476	0.202	2.973	-5.376	-0.333	-0.581*	-0.140	-0.200**	-0.840**	-0.789**	-0.583	1.547
	(0.59)	(0.35)	(0.45)	(0.30)	(1.33)	(0.64)	(0.51)	(-0.78)	(-0.72)	(-1.92)	(-0.61)	(-2.09)	(-2.03)	(-2.52)	(-0.12)	(0.39)
ROA	-6.771	-13.71***	-0.590	-2.525*	-2.235	-14.99***	-42.31	131.9*	-7.811**	-37.68***	0.241	-1.344*	2.596	-39.02***	11.59	263.5***
	(-1.20)	(-2.91)	(-0.16)	(-1.72)	(-0.49)	(-3.11)	(-0.67)	(1.83)	(-2.13)	(-13.59)	(0.13)	(-1.86)	(0.76)	(-13.83)	(0.27)	(9.51)
d(merger)	0.0815**	-0.00496	0.00888	0.0311**	0.0738*	0.0122	1.163**	-0.314	-0.0412	-0.142***	-0.0483	-0.0209*	0.344***	-0.133***	-0.114	0.940*
	(2.16)	(-0.24)	(0.24)	(2.25)	(1.81)	(0.57)	(2.28)	(-0.49)	(-0.72)	(-4.53)	(-1.58)	(-1.70)	(5.30)	(-4.08)	(-0.19)	(1.68)
d(crisis)									-0.312	0.0787	-0.0139	-0.148*	0.529**	-0.137	1.639	6.419***
									(-0.69)	(0.54)	(-0.09)	(-1.88)	(2.05)	(-0.82)	(0.34)	(2.58)
LiborOis	-0.448***	-0.108***	-0.139***	-0.0265**	-0.465***	-0.133***	-5.579***	4.259***	0.0287**	0.0369***	-0.00723*	0.00155	0.0224***	0.0496***	0.0444	-0.965***
	(-11.27)	(-5.42)	(-3.33)	(-1.97)	(-10.77)	(-6.29)	(-10.54)	(6.70)	(2.14)	(8.56)	(-1.78)	(0.64)	(2.99)	(10.60)	(0.29)	(-11.14)
InterbankRate	-0.0989***	-0.0593***	-0.0200	0.00285	-0.110***	-0.0562***	-1.239***	2.281***	-0.199***	-0.173***	-0.0686***	-0.0421***	-0.170***	-0.211***	-2.188***	4.239***
	(-4.00)	(-4.84)	(-1.20)	(0.34)	(-4.02)	(-4.28)	(-3.67)	(5.75)	(-7.35)	(-11.61)	(-4.91)	(-6.20)	(-6.17)	(-13.33)	(-7.38)	(13.46)
GDP	0.0273	-0.106***	0.0388*	-0.00181	0.124***	-0.109***	0.912**	1.577***	-1.086***	-0.359**	-0.305**	-0.202***	-0.125	-0.532***	-9.581***	7.681***
	(0.93)	(-6.06)	(1.76)	(-0.20)	(3.46)	(-5.87)	(2.38)	(2.83)	(-4.62)	(-2.07)	(-2.38)	(-3.41)	(-0.50)	(-3.02)	(-3.39)	(2.67)
Inflation	0.283***	0.0752***	0.0741**	0.0670***	0.100**	0.0907***	3.411***	-3.997***	0.394**	-0.647***	0.100	0.160***	0.348**	-0.516***	4.856**	10.37***
	(6.32)	(3.35)	(2.06)	(5.02)	(1.97)	(3.54)	(6.01)	(-4.83)	(2.34)	(-6.31)	(1.16)	(3.18)	(2.33)	(-4.90)	(2.30)	(6.45)
Cap_String	-0.00658	-0.0396***	-0.0165	-0.000896	0.0443*	-0.0378***	0.146	0.975**								
	(-0.31)	(-3.18)	(-1.18)	(-0.15)	(1.75)	(-2.86)	(0.52)	(2.21)								
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	3319	3278	3265	3263	3319	3279	3320	3279	4010	4059	4052	4054	4001	4069	4000	4066
Banks	592	590	591	591	592	589	592	588	667	666	663	667	667	666	667	666
Hansen j test (p-value)	0.000	0.345	0.633	0.000	0.352	0.069	0.000	0.000	0.000	0.036	0.039	0.009	0.386	0.001	0.001	0.004
KP rk LM statistic	29.44***	29.50***	29.55***	29.46***	29.21***	29.58***	29.32***	29.54***	138.1***	135.2***	136.1***	133.9***	136.2***	137.8***	137.7***	137.9***
KP Wald rk F statistic	45.34	45.04	44.43	45.16	45.15	44.98	45.29	44.93	31.67	30.58	31.00	31.47	32.42	31.54	32.24	31.39

Table 6. Standalone and systemic risks: effect of bank charter value in the acute-crisis and the post crisis periods

Regression results for various bank risk measures on bank charter value over the acute-crisis period (2007-2009) and the post-crisis period (2007-2013). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter, proxied by Tobin's q) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Year dummies are not reported. Definitions of all variables are listed in Table 3. Heteroscedasticity consistent and robust standard errors t statistics are in brackets below their coefficients estimates. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ denote statistically significant at 10%, 5% and 1% levels, respectively. Hansen j test reports p-value of overidentification test. Kleibergen-Paap rank LM statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor. Kleibergen-Paap rk Wald F-statistic testing for weak (Cragg-Donald Wald test, Stock and Yogo (2005) 5% critical value is 16.85). We do not face muticollinearity problems (if VIF test is less than 10 basis points, not reported).

	Acute-crisis period [2007-2009]							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	-2.584	-3.216	-2.626	-1.626	5.896	-3.460	-29.53	28.24
	(-0.43)	(-0.91)	(-1.03)	(-1.00)	(0.91)	(-0.96)	(-0.68)	(0.63)
Size	1.002	-0.141	0.158	0.248*	-0.244	0.0972	14.47*	1.747
	(1.05)	(-0.27)	(0.45)	(1.84)	(-0.36)	(0.18)	(1.78)	(0.27)
CAPR	6.584	-0.883	-0.0132	-0.164	4.456	2.507	18.15	71.10**
	(1.62)	(-0.41)	(-0.01)	(-0.25)	(1.09)	(1.07)	(0.49)	(2.43)
Diversification	-3.601***	0.270	-1.193**	-0.68***	-1.124	-0.0880	-40.91***	26.3***
	(-3.46)	(0.34)	(-2.27)	(-3.41)	(-0.87)	(-0.11)	(-3.85)	(2.94)
Loans	1.360	-0.841	-0.471	0.0511	-0.479	-0.478	8.204	7.958
	(1.00)	(-1.07)	(-0.90)	(0.25)	(-0.35)	(-0.58)	(0.65)	(0.74)
Efficiency	0.518	-0.727	-0.133	-0.278	-0.265	-1.038	10.72	2.253
	(0.47)	(-0.94)	(-0.26)	(-1.43)	(-0.22)	(-1.35)	(0.99)	(0.28)
ROA	-13.97	-45.12***	-3.529	-1.944	-10.64	-49.01***	25.26	71.77
	(-1.46)	(-7.71)	(-1.06)	(-1.21)	(-1.23)	(-8.30)	(0.25)	(1.29)
d(merger)	-0.163	-0.123**	-0.0921**	-0.0312*	0.485***	-0.136**	-1.111	1.346
	(-1.62)	(-2.10)	(-2.18)	(-1.84)	(4.22)	(-2.30)	(-1.17)	(1.64)
LiborOis	0.001	0.003	0.006	-0.001	0.005	0.001	0.06	0.004
	(0.13)	(0.44)	(1.32)	(-0.29)	(0.45)	(0.17)	(0.70)	(0.05)
InterbankRate	-0.15***	-0.19***	-0.07***	-0.024**	-0.0541	-0.22***	-1.71***	4.01***
	(-3.22)	(-6.27)	(-3.15)	(-2.19)	(-0.88)	(-6.86)	(-3.80)	(10.18)
GDP	0.0166	0.0359	0.00286	0.0144	0.123	0.0389	-0.562	-0.164
	(0.20)	(0.75)	(0.09)	(1.19)	(1.55)	(0.74)	(-0.81)	(-0.27)
Inflation	-0.192**	-0.268***	-0.0568	0.025**	-0.211**	-0.30***	-0.288	1.92***
	(-2.17)	(-5.18)	(-1.49)	(2.03)	(-2.10)	(-5.36)	(-0.36)	(3.06)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1803	1864	1870	1872	1764	1858	1798	1852
Banks	640	640	638	642	630	638	641	637
Hansen j test (p-value)	0.638	0.169	0.039	0.903	0.964	0.367	0.206	0.167
KP rk LM statistic	9.378**	9.141**	9.979**	9.856**	9.791**	8.994**	9.281**	8.887**
KP Wald rk F statistic	3.818	4.200	4.229	4.674	3.997	4.031	3.319	4.010

	Post-Crisis period [2010-2013]							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	-0.657***	-0.385**	-0.102	-0.104**	-0.586**	-0.521***	-5.673*	7.498***
	(-2.83)	(-2.32)	(-0.63)	(-2.42)	(-1.98)	(-3.26)	(-1.87)	(3.74)
Size	0.458*	-0.537***	-0.0931	0.0924	-0.00466	-0.486***	6.992**	13.13***
	(1.72)	(-3.27)	(-0.50)	(1.12)	(-0.02)	(-2.82)	(2.14)	(5.60)
CAPR	0.948	-5.497***	-0.156	0.799**	0.557	-4.648***	8.023	55.13***
	(0.58)	(-5.24)	(-0.14)	(2.19)	(0.33)	(-4.48)	(0.38)	(3.50)
Diversification	-0.00475	-0.0337	0.279	0.286*	-0.891	-0.0496	-3.800	-2.013
	(-0.01)	(-0.07)	(0.61)	(1.68)	(-1.18)	(-0.10)	(-0.45)	(-0.30)
Loans	0.872**	0.783***	0.867**	-0.20***	0.632	0.821***	12.09**	-1.697
	(2.05)	(3.13)	(2.56)	(-2.67)	(1.55)	(3.28)	(2.20)	(-0.40)
Efficiency	-0.516	-1.135***	-0.0412	-0.269**	-0.798	-1.370***	-1.494	9.598**
	(-0.87)	(-3.08)	(-0.12)	(-2.07)	(-1.44)	(-3.65)	(-0.20)	(2.17)
ROA	-4.108	-27.83***	1.723	-1.342	3.561	-28.95***	60.78	207.0***
	(-0.97)	(-8.52)	(0.66)	(-1.57)	(0.83)	(-9.03)	(1.12)	(7.38)
d(merger)	0.253***	-0.188***	0.0113	0.0296*	0.173*	-0.131***	3.116***	0.129
	(3.33)	(-4.51)	(0.19)	(1.75)	(1.91)	(-3.06)	(3.40)	(0.16)
LiborOis	0.03***	0.023***	-0.01***	0.00**	0.001	0.034***	0.23***	-0.791***
	(4.25)	(5.42)	(-3.21)	(2.11)	(0.13)	(7.52)	(2.99)	(-9.18)
InterbankRate	-0.32***	-0.16***	-0.014	-0.01	-0.20**	-0.20***	-2.89***	4.633***
	(-4.46)	(-4.52)	(-0.35)	(-0.70)	(-2.20)	(-5.25)	(-4.29)	(7.26)
GDP	-0.145***	-0.064***	-0.06***	-0.010**	-0.198***	-0.0752**	-1.356***	1.520***
	(-4.50)	(-4.29)	(-3.98)	(-2.04)	(-5.61)	(-4.81)	(-3.69)	(7.25)
Inflation	0.150**	0.0411	0.0399	0.00231	0.196***	0.0679**	1.819***	-2.305***
	(2.53)	(1.26)	(1.14)	(0.23)	(3.27)	(1.97)	(2.99)	(-4.44)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	2167	2153	2143	2138	2189	2167	2162	2169
Banks	628	622	622	619	630	621	626	622
Hansen j test (p-value)	0.002	0.146	0.305	0.001	0.100	0.004	0.002	0.000
KP rk LM statistic	105.0***	101.0***	101.6***	99.32***	103.3***	104.3***	103.4***	104.4***
KP Wald rk F statistic	60.03	55.70	56.80	63.67	61.84	60.54	61.91	60.40

Tables 7. Geographical sub-panels analysis: effect of bank charter value on risk in the pre-crisis period [2000-2006]

Table shows regression results for various bank risk measures on bank charter value over the pre-crisis period (2000-2006). Panel A reports estimation results for U.S. Banks, Panel B reports estimation results of European Banks and in Panel C, we report results of the remaining banks from: Australia, Canada, Japan, South Korea and Turkey. In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported. Heteroscedasticity consistent and robust standard errors t statistics are in brackets below their coefficients estimates. * p < 0.1, ** p < 0.05, *** p < 0.01 denote statistically significant at 10%, 5% and 1% levels, respectively. Hansen j test reports p-value of overidentification test. Kleibergen-Paap rank LM statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor. Kleibergen-Paap rk Wald F-statistic testing for weak (Cragg-Donald Wald test, Stock and Yogo (2005) 5% critical value is 16.85). We do not face muticollinearity problems (if VIF test is less than 10 basis points, not reported).

Panel A: Charter value and risk for U.S. banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	14.75***	1.588	5.822***	6.767***	6.943***	4.983***	186.1***	-172.7***
	(6.61)	(1.45)	(3.68)	(7.14)	(4.42)	(3.95)	(6.51)	(-4.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1896	1872	1848	1862	1898	1886	1896	1885
Banks	340	339	339	339	340	339	340	338
Hansen j test (p-value)	0.174	0.799	0.243	0.280	0.680	0.389	0.177	0.182
KP rk LM statistic	29.50***	28.47***	28.74***	28.89***	29.34***	29.06***	29.35***	29.07***
KP Wald rk F statistic	53.92	52.47	55.34	53.08	53.55	52.27	53.38	52.33

Panel B: Charter value and risk for European banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	4.832***	4.302***	1.498**	0.947***	4.147**	4.627***	52.21***	-73.67***
	(3.38)	(4.88)	(2.07)	(2.82)	(2.49)	(5.23)	(2.88)	(-3.80)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	915	897	909	892	914	884	915	885
Banks	162	161	162	162	162	160	162	160
Hansen j test (p-value)	0.349	0.141	0.064	0.169	0.848	0.062	0.407	0.068
KP rk LM statistic	19.35***	18.74***	19.07***	19.19***	19.34***	18.50***	19.35***	18.47***
KP Wald rk F statistic	22.15	21.64	22.40	22.36	22.17	21.42	22.15	21.48

Panel C: Charter value and risk for the rest of OECD sample

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	9.763	6.072	-5.893	0.771	20.67***	5.315	175.5*	-60.30
	(1.29)	(1.44)	(-1.02)	(0.44)	(2.76)	(1.17)	(1.86)	(-0.59)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	508	509	508	509	507	509	509	509
Banks	90	90	90	90	90	90	90	90
Hansen j test (p-value)	0.014	0.361	0.509	0.205	0.516	0.341	0.006	0.035
KP rk LM statistic	18.47***	17.82***	17.64***	17.82***	18.47***	17.82***	17.82***	17.82***
KP Wald rk F statistic	1.643	1.781	1.788	1.781	1.591	1.781	1.781	1.781

Table 8. TBTF and size effects on the relation between charter value and risk in pre-crisis period for U.S. and European banks

Table shows regression results on the effect of TBTF (Very large banks) and size (Large and Small banks) on the relation between charter value and risk for U.S. and European banks over the pre-crisis period (2000-2006). Very large banks (TBTF) are defined as banks with total assets above \$20 billion, Large banks as those with total ranging \$1 and 20 billion and Small banks those with total assets between \$500 million and \$1 billion. In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\mathrm{Risk}_{\mathrm{i,t}} = \beta_1 \widehat{Charter}_{\mathrm{i,t}} + \beta_2 X_{\mathrm{i,t-1}} + \beta_3 C_{\mathrm{i,t}} + \lambda_{\mathrm{t}} + \mu_{\mathrm{i,t}} + \varepsilon_{2\mathrm{i,t}}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported. Heteroscedasticity consistent and robust standard errors t statistics are in brackets below their coefficients estimates. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ denote statistically significant at 10%, 5% and 1% levels, respectively. Hansen j test reports p-value of overidentification test. Kleibergen-Paap rank LM statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor. Kleibergen-Paap rk Wald F-statistic testing for weak (Cragg-Donald Wald test, Stock and Yogo (2005) 5% critical value is 16.85). We do not face muticollinearity problems (if VIF test is less than 10 basis points, not reported).

	Very large banks							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	14.36***	5.094***	4.772***	1.975**	9.106**	6.958***	148.9***	-188.9***
	(4.43)	(3.39)	(2.77)	(2.42)	(2.42)	(4.33)	(4.15)	(-3.22)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	610	597	605	602	610	603	610	605
Hansen j test (p-value)	0.149	0.597	0.535	0.126	0.999	0.380	0.085	0.086
KP rk LM statistic	22.82***	22.33***	22.70***	22.87***	22.82***	22.62***	22.82***	22.72***
KP Wald rk F statistic	25.20	22.54	25.46	24.13	25.20	23.01	25.20	23.11

	Large banks							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	5.479***	1.704*	1.751**	2.579***	3.052***	2.776***	68.77***	-39.83**
	(4.71)	(1.73)	(2.37)	(5.58)	(2.98)	(3.26)	(4.21)	(-2.27)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1614	1591	1594	1577	1614	1587	1614	1585
Hansen j test (p-value)	0.271	0.272	0.144	0.374	0.496	0.261	0.268	0.118
KP rk LM statistic	12.85***	12.71***	13.45***	12.62***	12.71***	12.76***	12.85***	12.74***
KP Wald rk F statistic	30.34	30.63	30.53	30.30	30.19	30.78	30.34	30.76

Table 8 (continued)

	Small banks							
	1	2	**3**	**4**	**5**	**6**	**7**	**8**
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	11.20**	5.688	0.933	6.114***	2.722	7.750	158.7**	-231.7**
	(2.49)	(1.26)	(0.16)	(4.29)	(1.01)	(1.59)	(2.46)	(-2.18)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	587	581	558	575	588	580	587	580
Hansen j test (p-value)	0.866	0.638	0.902	0.244	0.470	0.453	0.700	0.706
KP rk LM statistic	13.82***	13.28***	12.48***	12.72***	14.07***	13.31***	13.69***	13.31***
KP Wald rk F statistic	17.39	15.88	14.72	17.58	17.84	15.91	16.81	15.91

Tables 9. Charter value and risk: effects of growth strategies over the pre-crisis period for U.S. and European banks

Table shows regression results on the effect of bank growth strategies on the relation between charter value and risk for U.S. and European banks over the pre-crisis period (2000-2006). Panel A reports estimation results for banks group with a high growth strategies (Q75, top quartile of bank total assets variation during the pre-crisis period) and Panel B reports estimation results for banks group with a low growth strategies (Q25, bottom quartile of bank total assets variation during the pre-crisis period). Panels differentiate between Very large banks (with total assets above $20 billion) and Large banks (with total assets ranging $1 and 20 billion). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

Panel A. Effects of top quartile75 growth strategies

	Very Large banks							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	10.75**	4.882*	5.057**	0.801	4.134	5.594**	114.2**	-137.7*
	(2.22)	(1.72)	(2.24)	(0.63)	(0.74)	(2.22)	(2.12)	(-1.94)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	164	161	161	162	164	161	164	161
Hansen j test (p-value)	0.839	0.978	0.416	0.856	0.0482	0.563	0.697	0.231
KP rk LM statistic	6.697*	7.847**	6.507*	6.554*	6.697*	8.194**	6.697*	8.194**
KP Wald rk F statistic	18.45	8.873	15.57	15.99	18.45	9.343	18.45	9.343

	Large banks							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	5.457***	2.924***	1.312	2.031***	4.059**	3.417***	65.39***	-32.39*
	(3.19)	(2.98)	(1.39)	(3.98)	(2.43)	(3.28)	(2.85)	(-1.77)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	380	381	377	378	381	381	380	381
Hansen j test (p-value)	0.492	0.0403	0.231	0.823	0.443	0.0465	0.460	0.0742
KP rk LM statistic	10.47**	10.55**	9.913**	10.67**	10.55**	10.55**	10.47**	10.55**
KP Wald rk F statistic	23.71	23.70	24.49	24.36	23.70	23.70	23.71	23.70

Panel B. Effect of bottom quartile25 growth strategies

	Very Large banks							
	1	**2**	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	14.20***	6.119***	5.719	2.954**	9.618*	7.197***	127.0**	-165.9**
	(2.58)	(2.99)	(1.20)	(2.27)	(1.84)	(3.06)	(2.51)	(-2.21)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	149	147	148	148	149	149	149	149
Hansen j test (p-value)	0.0435	0.501	0.250	0.177	0.0912	0.367	0.0131	0.237
KP rk LM statistic	4.815	4.707	4.854	4.846	4.815	4.815	4.815	4.815
KP Wald rk F statistic	25.45	26.18	25.27	25.74	25.45	25.45	25.45	25.45

	Large banks							
	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	3.612	2.194	-1.537	-0.120	5.886**	2.227	45.69	-10.80
	(1.04)	(1.30)	(-0.66)	(-0.09)	(2.24)	(1.19)	(1.01)	(-0.22)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	399	396	393	382	397	398	399	398
Hansen j test (p-value)	0.140	0.133	0.481	0.820	0.882	0.156	0.134	0.142
KP rk LM statistic	12.41***	12.29***	12.98***	12.28***	12.47***	12.12***	12.41***	12.12***
KP Wald rk F statistic	14.31	14.48	15.73	13.85	14.53	13.99	14.31	13.99

Table 10. Charter value and risk: effects of business models over the pre-crisis period for U.S. and European banks

Table shows regression results on the effect of business models on the relation between charter value and risk for U.S. and European banks over the pre-crisis period (2000-2006). Panel A reports estimation results for banks group with a strong diversification strategies (Q75, top quartile of diversification ratio variation during the pre-crisis period) and Panel B reports estimation results for banks group with a focused growth strategies (Q25, bottom quartile of diversification ratio variation during the pre-crisis period). Panels differentiate between Very large banks (with total assets above $20 billion) and Large banks (with total assets ranging $1 and 20 billion). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

Panel A. Effect of top quartile75 diversification strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systemat c Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	13.53*	8.040***	-4.686	-0.411	15.87	9.688***	107.7	-276.6***	3.367	-0.133	0.0771	1.552*	2.367	0.581	60.63*	-8.317
	(1.80)	(3.32)	(-1.61)	(-0.27)	(1.63)	(2.98)	(1.31)	(-3.35)	(1.56)	(-0.10)	(0.05)	(1.79)	(1.06)	(0.50)	(1.66)	(-0.20)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	165	163	163	162	165	165	165	165	410	408	402	404	409	407	410	405
Hansen j test (p-value)	0.0575	0.233	0.206	0.127	0.250	0.187	0.0276	0.187	0.259	0.817	0.341	0.191	0.703	0.763	0.267	0.756
KP rk LM statistic	11.87***	11.90***	11.49***	11.90***	11.87***	11.87***	11.87***	11.87***	6.848*	6.852*	7.086*	6.828*	6.831*	6.784*	6.848*	6.725*
KP Wald rk F statistic	34.12	34.60	31.23	32.08	34.12	34.12	34.12	34.12	45.07	44.93	53.55	45.11	44.74	43.53	45.07	43.11

Panel B. Effect of bottom quartile25 diversification strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systemati Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	18.87***	4.795	6.589**	1.420	15.29***	6.565**	203.0***	-133.0	6.075***	2.088*	2.493**	2.644***	2.386*	3.413***	68.44***	-53.75**
	(3.99)	(1.39)	(2.20)	(0.94)	(2.88)	(2.23)	(3.38)	(-1.45)	(4.25)	(1.70)	(2.17)	(5.07)	(1.67)	(2.98)	(3.78)	(-2.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	154	152	152	152	154	152	154	152	394	384	389	386	395	378	394	378
Hansen j test (p-value	0.355	0.575	0.562	0.116	0.711	0.718	0.483	0.121	0.491	0.670	0.137	0.561	0.0230	0.265	0.506	0.148
KP rk LM statistic	7.876**	7.336*	7.892**	8.066*	7.876**	7.336*	7.876**	7.336**	12.80***	12.16***	11.47***	11.68***	11.82***	12.46***	12.80***	12.46***
KP Wald rk F statisti	45.47	13.35	33.91	35.17	45.47	13.35	45.47	13.35	67.58	60.56	62.43	66.02	65.01	57.16	67.58	57.16

Robustness checks. Analysis on U.S. and Europeans banks with total assets above $1 billion.

Tables (11-14) present regression results for an alternative definition of TBTF effects on the relation between charter value and risk for all OECD listed banks in pre-crisis period (2000-2006). TBTF is defined as: (i) bank with total assets above $20 billion for the world's top 10 economies and (ii) for the rest of OECD countries, bank that is very large with respect to the home GDP (i.e. more than 10%). Large banks are defined as banks with total assets between $1 and 20 billion. In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\mathrm{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

Table 11. Alternative TBTF definition. Size effects on the relation between charter value and risk in pre-crisis period for all OECD listed banks

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	14.99***	3.667***	3.406**	2.031***	12.14***	6.048***	163.7***	-141.9***	4.784***	1.747*	1.508**	2.319***	2.685***	2.580***	58.90***	-36.20**
	(4.83)	(2.78)	(2.09)	(2.60)	(3.02)	(4.08)	(4.70)	(-2.67)	(4.26)	(1.87)	(2.14)	(5.82)	(2.70)	(3.02)	(4.04)	(-2.22)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	927	915	922	922	927	924	928	925	1825	1801	1805	1786	1824	1794	1825	1793
Hansen j test (p-value)	0.0000739	0.0143	0.943	0.000974	0.238	0.000373	0.000140	0.0000243	0.00281	0.163	0.0933	0.0190	0.144	0.0400	0.00254	0.000785
KP rk LM statistic	19.87***	19.96***	20.07***	20.23***	19.87***	19.54***	19.88***	19.54***	19.38***	19.31***	20.59***	19.09***	19.14***	19.48***	19.38***	19.44***
KP Wald rk F statistic	24.07	21.41	24.29	23.47	24.07	21.60	24.04	21.63	40.85	40.59	42.37	40.79	40.54	40.34	40.85	40.35

Table 12. Alternative TBTF definition. Size effects on the relation between charter value and risk in pre-crisis period for U.S. and European banks

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	15.92***	4.557***	5.000***	2.480***	10.65***	7.071***	169.7***	-193.8***	5.379***	1.736*	1.835***	2.607***	2.521**	2.739***	65.91***	-40.90**
	(4.52)	(2.85)	(2.75)	(3.04)	(2.69)	(3.87)	(4.45)	(-2.86)	(4.93)	(1.86)	(2.62)	(5.75)	(2.56)	(3.34)	(4.37)	(-2.45)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	573	560	568	567	573	569	573	570	1671	1647	1651	1632	1671	1640	1671	1639
Hansen j test (p-value)	0.137	0.545	0.384	0.177	0.826	0.320	0.0878	0.0664	0.269	0.189	0.401	0.261	0.261	0.154	0.266	0.0440
KP rk LM statistic	18.45***	18.16***	18.12***	18.54***	18.45***	17.91***	18.45***	17.92***	15.18***	14.95***	15.82***	15.01***	15.03***	15.02***	15.18***	15.00***
KP Wald rk F statistic	19.68	17.47	19.84	19.22	19.68	17.46	19.68	17.47	32.13	31.85	32.76	32.41	31.96	31.64	32.13	31.63

Tables 13. Alternative TBTF definition. Charter value and risk: effects of growth strategies over the pre-crisis period for U.S. and European banks

Panel A. Effects of top quartile75 growth strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	14.31***	3.940	6.824***	1.979	3.815	6.021	148.6***	-81.31	5.181***	3.053***	1.286	2.002***	3.927**	3.544***	61.14***	-36.65*
	(2.64)	(1.00)	(2.58)	(1.47)	(0.60)	(1.60)	(2.60)	(-0.88)	(2.93)	(2.79)	(1.30)	(3.66)	(2.25)	(3.06)	(2.62)	(-1.70)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	152	149	149	150	152	149	152	149	348	348	345	346	349	348	348	348
Hansen j test (p-value)	0.488	0.862	0.245	0.835	0.0304	0.449	0.405	0.431	0.439	0.0319	0.417	0.945	0.477	0.0451	0.429	0.0544
KP rk LM statistic	5.903	6.316*	5.564	5.999	5.903	6.501*	5.903	6.501*	9.717**	9.739**	9.638**	9.660**	9.739**	9.739**	9.717**	9.739**
KP Wald rk F statistic	9.579	5.377	7.302	8.763	9.579	5.424	9.579	5.424	21.72	21.76	22.38	22.51	21.72	21.76	21.72	21.76

Panel B. Effect of bottom quartile25 growth strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	12.92*	3.753**	6.626	3.362**	10.89**	5.444**	114.2*	-138.9*	2.737	1.989	-1.235	0.595	3.966*	2.440	27.43	-44.67
	(1.83)	(2.28)	(1.25)	(2.04)	(1.98)	(2.40)	(1.74)	(-1.91)	(0.92)	(1.29)	(-0.64)	(0.47)	(1.81)	(1.43)	(0.70)	(-0.92)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	142	140	141	141	142	142	142	142	426	423	419	409	424	425	426	425
Hansen j test (p-value)	0.0795	0.774	0.259	0.125	0.0910	0.665	0.0208	0.283	0.0970	0.106	0.737	0.938	0.423	0.139	0.0891	0.0500
KP rk LM statistic	3.857	3.824	3.904	3.836	3.857	3.857	3.857	3.857	11.32***	11.18***	11.57***	11.67***	11.30***	11.14***	11.32***	11.14***
KP Wald rk F statistic	17.60	18.22	17.57	18.18	17.60	17.60	17.60	17.60	14.42	14.25	16.00	16.71	14.34	14.20	14.42	14.20

Table 14. Alternative TBTF definition. Charter value and risk: effects of business models over pre-crisis period for U.S. and European banks

Panel A. Effect of top quartile75 of diversification strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	23.05***	6.264**	-4.554	2.327	31.28***	12.35***	222.4**	-354.7***	3.537**	0.624	0.270	1.346	0.179	0.820	55.56**	-33.68
	(2.75)	(1.96)	(-1.36)	(1.53)	(3.52)	(3.41)	(2.38)	(-3.26)	(2.17)	(0.58)	(0.16)	(1.63)	(0.10)	(0.74)	(1.98)	(-0.86)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	148	146	146	145	148	148	148	148	400	397	393	394	399	396	400	394
Hansen j test (p-value)	0.0869	0.0767	0.560	0.423	0.278	0.0729	0.0556	0.176	0.644	0.709	0.767	0.192	0.433	0.606	0.558	0.339
KP rk LM statistic	12.11***	12.07***	11.30***	11.81***	12.11***	12.11***	12.11***	12.11***	9.321**	9.043**	9.417**	9.300**	9.280**	8.913**	9.321**	8.760**
KP Wald rk F statistic	25.98	25.40	24.60	22.94	25.98	25.98	25.98	25.98	71.95	70.80	83.30	72.14	72.37	69.96	71.95	69.50

Panel B. Effect of bottom quartile25 of diversification strategies

	Very Large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	18.23***	4.179	5.894**	1.257	15.55***	6.042**	196.1***	-117.9	6.309***	2.333*	2.747**	2.686***	2.437*	3.651***	71.58***	-58.24**
	(3.64)	(1.20)	(1.98)	(0.83)	(2.84)	(2.05)	(3.09)	(-1.30)	(4.40)	(1.93)	(2.40)	(5.29)	(1.68)	(3.26)	(3.94)	(-2.38)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	148	146	146	146	148	146	148	146	418	408	413	410	419	402	418	402
Hansen j test (p-value	0.333	0.565	0.654	0.130	0.637	0.775	0.455	0.168	0.439	0.618	0.148	0.579	0.0336	0.204	0.429	0.109
KP rk LM statistic	7.803*	7.385*	7.701*	7.883*	7.803*	7.385*	7.803*	7.385*	12.70***	12.04***	11.43***	11.62***	11.75***	12.35***	12.70***	12.35***
KP Wald rk F statisti	37.65	11.74	26.92	27.66	37.65	11.74	37.65	11.74	71.98	64.92	66.50	70.23	69.27	61.71	71.98	61.71

Tables 15. Alternative measure of bank charter value: standardized market value added and market-to-book ratio

Table displays the results on the baseline model for standardized market-value-added (SMVA) and market-to-book ratio, as an alternative definition of bank charter value (Charter_Alternative). SMVA is computed as the difference between the market value and capital contribution over book value of equity normalized by total equity. In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter\_Alternative}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). SMVA (and market-to-book ratio) is modelled endogenously in all regressions. We instrument SMVA (and market-to-book ratio) by one-year lagged Charter_Alternative, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

	Pre-crisis period [2000-2006]								Crisis periods [2007-2013]							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
SMVA	1.001***	0.0384	0.195**	0.329***	0.760***	0.218***	12.40***	-7.685***	-0.221	-0.254	0.0280	-0.0137	0.180	-0.319	3.005	1.006
	(7.13)	(0.58)	(2.31)	(6.19)	(5.91)	(2.97)	(7.24)	(-3.81)	(-0.70)	(-1.14)	(0.20)	(-0.22)	(0.68)	(-1.31)	(0.89)	(0.34)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	3304	3265	3250	3248	3304	3266	3305	3266	2475	2523	2524	2501	2476	2523	2468	2522
Hansen j test (p-value)	0.00000624	0.446	0.503	0.000308	0.164	0.110	0.0000134	0.0000207	0.0570	0.00413	0.0795	0.0309	0.464	0.00216	0.269	0.0112
KP rk LM statistic	71.22***	69.17***	70.48***	70.38***	71.22***	69.64***	71.10***	69.60**	41.64***	42.00***	38.53***	40.67***	40.71***	41.42***	40.98***	42.01***
KP Wald rk F statistic	97.48	94.97	97.68	96.24	97.43	95.94	97.21	95.90	14.04	14.19	13.50	13.85	14.02	14.10	13.57	14.25

	Pre-crisis period [2000-2006]								Crisis periods [2007-2013]							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Market-to-Book	8.838***	1.740**	3.071***	3.441***	5.105***	3.420***	107.3***	-84.48***	-1.627	-1.323*	-1.012**	-0.380*	1.453	-1.832**	-0.560	14.66
	(5.54)	(2.31)	(3.91)	(5.75)	(4.21)	(5.74)	(5.20)	(-4.95)	(-1.52)	(-1.89)	(-2.14)	(-1.65)	(1.31)	(-2.29)	(-0.05)	(1.18)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	2224	2188	2199	2179	2224	2190	2224	2190	2523	2569	2572	2545	2524	2576	2516	2575
Hansen j test (p-value)	0.179	0.253	0.288	0.407	0.848	0.0968	0.194	0.00628	0.128	0.00746	0.221	0.202	0.216	0.00310	0.404	0.00827
KP rk LM statistic	22.47***	21.75***	22.65***	22.46***	22.47***	21.89***	22.47***	21.90***	31.06***	29.97***	29.00***	29.76***	30.26***	30.48***	32.46***	30.32***
KP Wald rk F statistic	38.84	37.96	37.60	38.93	38.94	38.03	38.84	38.03	14.16	13.56	13.15	13.72	13.69	13.80	14.73	13.76

Table 16. Charter value and risk: effects of growth strategies over the pre-crisis period for U.S. and European banks

Table shows regression results on the effect of bank growth strategies on the relation between charter value and risk for U.S. and European banks over the pre-crisis period (2000-2006). Panel A reports estimation results for banks group with a high growth strategies (above Q50, median value of bank total assets variation during the pre-crisis period) and Panel B reports estimation results for banks group with a low growth strategies (below Q50, median value of bank total assets variation during the pre-crisis period). Panels differentiate between Very large banks (with total assets above $20 billion) and Large banks (with total assets ranging $1 and 20 billion). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

Panels A. Effects of above quartile 50 growth strategies

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	16.49***	6.316***	4.330*	3.009**	11.50*	9.015***	178.5***	-283.5***	5.887***	2.139**	2.373***	2.516***	3.256**	3.147***	72.70***	-42.96***
	(3.78)	(3.30)	(1.75)	(2.38)	(1.80)	(4.18)	(3.56)	(-3.24)	(4.29)	(2.07)	(2.86)	(5.41)	(2.52)	(3.34)	(3.84)	(-2.70)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	323	319	320	319	323	320	323	320	792	790	786	788	794	785	792	783
Hansen j test (p-value)	0.294	0.719	0.848	0.278	0.222	0.625	0.243	0.288	0.639	0.287	0.160	0.475	0.332	0.408	0.695	0.524
KP rk LM statistic	13.52***	13.85***	13.08***	13.18***	13.52***	13.67***	13.52***	13.67***	11.84	11.61	11.40	11.40	11.58	11.73	11.84	11.70
KP Wald rk F statistic	14.93	12.56	13.85	14.95	14.93	12.66	14.93	12.66	37.50	36.82	36.27	36.74	36.35	37.45	37.50	37.40

Panels B. Effects of bellow quartile 50 growth strategies

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	11.43***	3.341**	4.213*	1.276	9.424**	4.864***	109.2**	-94.77*	4.792*	-0.887	0.470	3.188**	2.352	0.511	70.93*	-4.340
	(2.72)	(2.14)	(1.87)	(1.62)	(2.26)	(2.75)	(2.54)	(-1.68)	(1.80)	(-0.57)	(0.27)	(2.42)	(1.17)	(0.33)	(1.94)	(-0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	287	278	285	283	287	283	287	285	822	801	808	789	820	802	822	802
Hansen j test (p-value)	0.208	0.517	0.486	0.0727	0.306	0.535	0.135	0.108	0.102	0.233	0.609	0.346	0.394	0.110	0.103	0.0864
KP rk LM statistic	9.827**	9.584**	9.982**	9.672**	9.827**	9.961**	9.827**	10.07*	17.71***	17.64***	18.17***	17.99***	17.67***	17.59***	17.71***	17.59***
KP Wald rk F statistic	22.95	21.54	25.06	21.76	22.95	24.82	22.95	25.35	40.58	31.93	42.70	44.36	40.35	29.61	40.58	29.61

Table 17. Charter value and risk: effects of business models over the pre-crisis period for U.S. and European banks

Table shows regression results on the effect of business models on the relation between charter value and risk for U.S. and European banks over the pre-crisis period (2000-2006). Panel A reports estimation results for banks group with a strong diversification strategies (above Q50, median value of diversification ratio variation during the pre-crisis period) and Panel B reports estimation results for banks group with a focused growth strategies (below Q50, median value of diversification ratio variation during the pre-crisis period). Panels differentiate between Very large banks (with total assets above $20 billion) and Large banks (with total assets ranging $1 and 20 billion). In all regressions, columns report second stage coefficients from a two-stage least squares (TSLS) IV estimator with bank-specific fixed effects, time dummies and a robust-clustering on the bank-level. Results of model $\text{Risk}_{i,t} = \beta_1 \widehat{Charter}_{i,t} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t} + \lambda_t + \mu_{i,t} + \varepsilon_{2i,t}$, where dependent variables are four systemic risk measures: MES, Tail-beta, CoVaR and LRMES (models in the odd columns: 1,3,5,7), matched with four standalone risk measures: specific risk, systematic risk, total risk and market z-score (models in the even columns: 2,4,6,8). Bank charter value (Charter) is modelled endogenously in all regressions. We instrument Charter by one-year lagged Charter, tangible assets ratio and market share. Regressions control for one-year lagged bank-level characteristics to mitigate endogeneity concerns and possible omitted variables. We control also for macro-financial variables and country-level variables. Control variables and year dummies are not reported.

Panel A. Effect of above quartile50 of diversification strategies

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	11.14**	5.193***	1.508	1.407	13.81**	6.851***	103.8*	-210.2***	4.650**	-0.490	1.212	2.551***	1.714	0.605	78.42**	-6.485
	(2.13)	(3.33)	(0.52)	(1.09)	(1.99)	(3.38)	(1.77)	(-2.95)	(2.28)	(-0.43)	(0.88)	(2.76)	(1.00)	(0.62)	(2.27)	(-0.19)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	304	298	302	301	304	303	304	303	827	818	815	807	825	815	827	813
Hansen j test (p-value)	0.0731	0.0933	0.298	0.0726	0.136	0.158	0.0387	0.215	0.249	0.955	0.308	0.359	0.784	0.636	0.260	0.459
KP rk LM statistic	10.11**	10.07**	9.940**	10.09**	10.11**	10.11**	10.11**	10.11**	9.003**	8.919**	9.980**	8.955**	8.974**	8.865**	9.003**	8.809**
KP Wald rk F statistic	30.37	28.88	28.80	29.03	30.37	30.39	30.37	30.39	48.85	48.94	55.80	48.58	49.12	48.45	48.85	48.14

Panel B. Effect of bellow quartile50 of diversification strategies

	Very large banks								Large banks							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	15.74***	3.609*	6.634***	2.187*	8.956*	6.012***	170.1***	-164.6**	5.646***	2.280**	2.060**	2.526***	3.065**	3.350***	63.29***	-55.88***
	(3.63)	(1.71)	(2.75)	(1.91)	(1.92)	(2.59)	(3.66)	(-1.98)	(4.17)	(2.21)	(2.31)	(4.77)	(2.35)	(3.71)	(3.70)	(-2.84)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Observations	306	299	303	301	306	300	306	302	787	773	779	770	789	772	787	772
Hansen j test (p-value)	0.398	0.781	0.767	0.338	0.486	0.967	0.509	0.122	0.710	0.273	0.254	0.735	0.104	0.0779	0.844	0.0680
KP rk LM statistic	10.47**	10.24**	11.08**	10.61**	10.47**	10.41**	10.47**	10.48**	11.63***	11.40***	11.13***	10.84***	11.25***	11.59***	11.63***	11.59***
KP Wald rk F statistic	9.821	7.741	9.882	9.055	9.821	7.762	9.821	7.780	54.37	52.78	51.16	53.63	52.83	52.81	54.37	52.81

Appendix A. Charter value and risk: effect of bank charter value on risk in the pre-crisis, acute-crisis and the post-crisis periods

Panel A. U.S. banks, with total assets above $1 billion

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	2.160*	2.599***	1.548**	2.234***	-0.780	2.052***	38.18**	-26.58*
	(1.65)	(2.94)	(2.45)	(5.57)	(-0.84)	(2.85)	(2.56)	(-1.87)
Charter*d.(acute-crisis) (α2)	5.221***	-6.112***	-0.278	-0.798**	4.887***	-3.707***	38.75**	-13.70
	(2.66)	(-7.05)	(-0.37)	(-2.11)	(2.72)	(-4.27)	(2.20)	(-0.93)
Charter* d.(post-crisis) (α3)	-2.994**	-2.810***	-1.518**	-2.373***	-0.397	-2.432***	-45.93***	36.62***
	(-2.36)	(-3.15)	(-2.46)	(-5.99)	(-0.43)	(-3.36)	(-3.22)	(2.71)
d.(acute-crisis)	356.7***	252.4***	6.411	-15.01	454.8***	381.9***	2978.4***	-8139.6***
	(7.72)	(7.65)	(0.23)	(-1.22)	(10.05)	(11.87)	(5.76)	(-13.84)
d.(post-crisis)	84.63***	58.26***	2.905	-1.071	104.4***	87.61***	730.3***	-1872.9***
	(7.94)	(7.57)	(0.46)	(-0.38)	(10.08)	(11.71)	(6.14)	(-13.96)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	2884	2906	2915	2923	2877	2932	2881	2930
Hansen j test (p-value)	0.182	0.068	0.702	0.057	0.281	0.006	0.067	0.022
KP rk LM statistic	39.85***	36.44***	38.79***	40.00***	38.86***	39.34***	39.76***	39.31***
KP Wald rk F statistic	8.491	7.840	7.920	7.514	7.527	7.999	8.320	8.001
Wald tests: $\alpha_1 + \alpha_2$	7.38***	-3.51***	1.27*	1.44***	4.11**	-1.66*	76.93***	-40.28***
$\alpha_1 + \alpha_3$	-0.83	-0.21	0.03	-0.14	-1.18**	-0.38	-7.75	10.04

Panel B. European banks, with total assets above $1 billion

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	4.135***	3.975***	1.453**	0.838***	2.181	4.023***	54.48***	-66.23***
	(3.31)	(4.46)	(2.36)	(2.64)	(1.55)	(4.37)	(3.75)	(-3.99)
Charter*d.(acute-crisis) (α2)	0.653	-0.434	0.742	-0.120	0.245	0.811	-7.116	2.274
	(0.39)	(-0.27)	(0.98)	(-0.29)	(0.14)	(0.45)	(-0.41)	(0.11)
Charter* d.(post-crisis) (α3)	-8.245***	-6.651***	-1.950**	-1.264***	-5.204***	-7.480***	-93.88***	117.4***
	(-4.38)	(-4.54)	(-2.39)	(-3.10)	(-2.78)	(-4.68)	(-4.69)	(4.81)
d.(acute-crisis)	-669.6	4.975	0.0456	0.476	-580.6	-103.4	-4975.4	-1744.4
	(-1.35)	(0.02)	(0.03)	(1.12)	(-1.54)	(-0.29)	(-1.00)	(-0.27)
d.(post-crisis)	-114.6	7.887	2.031**	1.624***	-101.8	-10.96	-814.9	-458.3
	(-1.24)	(0.14)	(2.21)	(4.07)	(-1.44)	(-0.16)	(-0.88)	(-0.38)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1874	1862	1865	1817	1888	1843	1870	1845
Hansen j test (p-value)	0.348	0.105	0.765	0.337	0.886	0.172	0.382	0.553
KP rk LM statistic	16.13***	15.14***	33.14***	24.03***	15.51***	15.03***	16.13***	15.03***
KP Wald rk F statistic	3.633	3.377	7.281	4.701	3.462	3.361	3.625	3.361
Wald tests: $\alpha_1 + \alpha_2$	4.79**	3.54*	2.20**	0.72	2.43	4.83**	47.36**	-63.96***
$\alpha_1 + \alpha_3$	-4.11**	-2.68**	-0.50	-0.43	-3.02**	-3.46**	-39.40**	51.17**

Appendix B. Geographical sub-panels analysis in the acute-crisis and the post-crisis periods.

Table 1. Effect of bank charter value on risk in the acute-crisis period [2007-2009]

Panel A: U.S. Banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	13.22*	-10.80***	3.449	0.809	-9.133	-9.845**	87.21	-9.186
	(1.79)	(-2.63)	(1.63)	(0.91)	(-1.34)	(-2.50)	(1.49)	(-0.21)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1053	1111	1119	1121	1008	1111	1050	1107
Hansen j test (p-value)	0.425	0.824	0.597	0.968	0.212	0.469	0.272	0.369
KP rk LM statistic	11.70***	14.32***	15.88***	15.80***	14.33***	14.40***	12.27***	14.61***
KP Wald rk F statistic	11.39	14.29	17.75	17.88	16.77	14.07	12.01	14.49

Panel B: European banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	0.325	-8.376	1.445	-0.174	-1.055	-7.086	-13.44	71.56
	(0.03)	(-1.24)	(0.33)	(-0.11)	(-0.16)	(-1.02)	(-0.21)	(1.26)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Non	Non	Non	Non	Non	Non	Non	Non
Observations	467	470	468	469	476	464	465	462
Hansen j test (p-value)	0.273	0.362	0.107	0.544	0.526	0.350	0.336	0.854
KP rk LM statistic	9.253**	11.96***	8.011**	10.08****	10.56**	12.21***	6.903*	12.02***
KP Wald rk F statistic	2.940	4.822	2.675	2.972	3.918	4.831	2.016	4.771

Panel C: Other Banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	-33.73***	-9.109***	-1.819	-3.260**	-1.685	-14.52***	-294.5***	128.4*
	(-3.17)	(-3.44)	(-0.46)	(-2.34)	(-0.22)	(-4.03)	(-2.61)	(1.77)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	283	283	283	282	280	283	283	283
Hansen j test (p-value)	0.103	0.005	0.315	0.201	0.928	0.010	0.184	0.455
KP rk LM statistic	7.278*	7.278*	7.278*	7.281*	7.284*	7.278*	7.278*	7.278*
KP Wald rk F statistic	9.029	9.029	9.029	8.931	9.197	9.029	9.029	9.029

Tables 2. Effect of bank charter value on risk in the post-crisis period [2010-2013]

Panel A: U.S. Banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	-1.225***	-0.173	0.166	-0.105*	-1.725***	-0.387*	-15.83***	8.972***
	(-3.60)	(-0.74)	(0.81)	(-1.66)	(-3.91)	(-1.70)	(-3.34)	(3.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1262	1253	1245	1276	1281	1266	1259	1267
Hansen j test (p-value)	0.069	0.108	0.783	0.002	0.777	0.004	0.408	0.001
KP rk LM statistic	54.83***	50.74***	51.88***	52.32***	52.67***	52.91***	52.77***	52.81***
KP Wald rk F statistic	55.27	52.10	54.12	56.63	56.41	57.11	53.14	56.82

Panel B: European banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	-2.310**	-0.961	-0.391	-0.104	-0.655	-1.505*	-11.84	14.66
	(-2.13)	(-1.49)	(-0.48)	(-0.53)	(-0.73)	(-1.90)	(-1.51)	(1.64)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	487	488	484	446	493	484	485	485
Hansen j test (p-value)	0.675	0.105	0.458	0.843	0.616	0.101	0.419	0.521
KP rk LM statistic	7.932**	7.570*	8.064**	7.047*	7.503*	7.538*	7.955**	7.476*
KP Wald rk F statistic	10.18	11.15	2.871	3.459	11.21	11.05	10.14	11.11

Panel C: Other Banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter	1.790	-0.302	1.820	0.147	-1.214	-0.349	14.79	35.06
	(1.00)	(-0.47)	(1.44)	(0.37)	(-0.54)	(-0.49)	(0.75)	(1.63)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	418	412	414	416	415	417	418	417
Hansen j test (p-value)	0.000	0.148	0.022	0.025	0.010	0.00	0.000	0.001
KP rk LM statistic	20.49***	19.96***	19.64***	20.06***	19.97***	20.73***	20.49***	20.73***
KP Wald rk F statistic	11.30	10.62	11.13	11.10	10.80	11.49	11.30	11.49

Tables 3. Effects of growth strategies and business models for U.S. and European banks

Panel A. Effects of top and bottom quartiles of growth strategies

Very Large banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	15.09***	4.152*	5.568*	2.201**	12.29**	7.044***	165.2***	-230.0**
	(2.98)	(1.71)	(1.86)	(2.08)	(2.14)	(2.62)	(2.90)	(-2.51)
Charter*d.Quartile75 (ΔTA) (α2)	-2.490	1.516	-1.882	-0.968	-6.461	-0.791	-40.11	74.18
	(-0.45)	(0.54)	(-0.60)	(-0.63)	(-1.01)	(-0.26)	(-0.64)	(0.69)
Charter*d.Quartile25 (ΔTA) (α3)	-4.616	-0.559	-1.765	-0.475	-5.452	-2.482	-62.24	115.4
	(-0.85)	(-0.24)	(-0.48)	(-0.36)	(-0.93)	(-0.95)	(-1.02)	(1.28)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	610	597	605	602	610	603	610	605
Hansen j test (p-value)	0.037	0.345	0.590	0.067	0.898	0.107	0.023	0.051
KP rk LM statistic	10.57**	9.444**	9.156**	10.73**	10.57**	8.763**	10.57**	8.753**
KP Wald rk F statistic	9.070	7.365	7.739	8.714	9.070	6.964	9.070	6.959
Wald tests: $\alpha_1+\alpha_2$	12.60****	5.67***	3.69*	1.23	5.83	6.25**	125.09***	-155.82*
$\alpha_1+\alpha_3$	10.09***	3.59***	3.80	1.73*	6.84*	4.56***	101.96***	-114.6**

Large banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	9.259***	0.639	2.997	5.604***	2.322	2.658*	125.0***	-55.01
	(3.86)	(0.46)	(1.38)	(5.77)	(1.31)	(1.71)	(3.79)	(-1.51)
Charter*d.Quartile75 (ΔTA) (α2)	-3.482	1.479	-1.019	-3.147***	1.064	0.483	-52.45	3.005
	(-1.35)	(1.00)	(-0.45)	(-3.06)	(0.54)	(0.31)	(-1.43)	(0.08)
Charter*d.Quartile25 (ΔTA) (α3)	-10.96***	0.537	-4.138*	-6.118***	-1.465	-1.618	-159.0***	110.3**
	(-3.67)	(0.27)	(-1.70)	(-4.29)	(-0.65)	(-0.79)	(-3.94)	(2.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1614	1591	1594	1577	1614	1587	1614	1585
Hansen j test (p-value)	0.038	0.595	0.040	0.045	0.287	0.367	0.042	0.090
KP rk LM statistic	41.61***	40.09***	41.14***	41.63***	41.01***	40.16***	41.61***	39.77***
KP Wald rk F statistic	41.00	40.90	42.46	41.94	40.97	40.99	41.00	40.57
Wald tests: $\alpha_1+\alpha_2$	5.78***	2.12**	1.98**	2.46***	3.39**	3.14***	75.55***	-52.00***
$\alpha_1+\alpha_3$	-1.70	1.18	-1.14	-0.51	0.86	1.04	-34.00	55.29

Panel B. Effects of top and bottom quartiles of diversification strategies

Very Large banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	16.39***	4.009*	7.917**	3.705***	8.728*	7.069***	178.4***	-247.1***
	(2.99)	(1.93)	(2.29)	(2.75)	(1.79)	(2.78)	(3.11)	(-2.64)
Charter*d.Quartile75 (ΔDiv.) (α2)	-6.160	2.830	-8.939**	-4.608***	2.556	0.00296	-87.43	74.87
	(-0.97)	(1.33)	(-2.48)	(-3.28)	(0.35)	(0.00)	(-1.24)	(0.77)
Charter*d.Quartile25 (ΔDiv.) (α3)	-1.624	1.146	-3.423	-1.858	-0.576	-0.398	-24.88	124.7
	(-0.31)	(0.47)	(-0.98)	(-1.14)	(-0.10)	(-0.15)	(-0.45)	(1.22)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	610	597	605	602	610	603	610	605
Hansen j test (p-value)	0.177	0.478	0.317	0.140	0.992	0.291	0.110	0.078
KP rk LM statistic	8.899**	8.934**	9.379**	8.789**	8.899**	9.099**	8.899**	9.142**
KP Wald rk F statistic	4.724	4.765	5.128	4.611	4.724	4.826	4.724	4.850
Wald tests: $\alpha_1+\alpha_2$	10.23*	6.84***	-0.51	-0.90	11.28	7.07***	90.97	-172.23**
$\alpha_1+\alpha_3$	14.77***	5.16***	4.49**	1.85	8.15*	6.67***	153.52***	-122.40*

Large banks

	1	2	3	4	5	6	7	8
	MES	Specific Risk	Tail-beta	Systematic Risk	ΔCoVaR	Total Risk	LRMES	MZ-score
Charter (α1)	5.633***	2.203	3.885**	3.592***	3.871**	3.369**	80.43***	-47.09
	(2.65)	(1.57)	(2.39)	(3.43)	(2.05)	(2.31)	(2.72)	(-1.19)
Charter*d.Quartile75 (ΔDiv.) (α2)	-1.094	-2.621	-3.737*	-1.135	-2.063	-2.459	-9.354	24.76
	(-0.38)	(-1.47)	(-1.85)	(-0.80)	(-0.92)	(-1.42)	(-0.22)	(0.53)
Charter*d.Quartile25 (ΔDiv.) (α3)	0.429	0.199	-2.049	-1.222	-0.382	0.0368	-8.631	1.715
	(0.18)	(0.13)	(-1.07)	(-1.07)	(-0.17)	(0.02)	(-0.26)	(0.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	No	No	No
Observations	1610	1587	1590	1573	1610	1583	1610	1581
Hansen j test (p-value)	0.216	0.262	0.102	0.438	0.485	0.310	0.236	0.126
KP rk LM statistic	26.12***	24.58***	27.66***	26.10***	25.61***	23.88***	26.12***	23.40***
KP Wald rk F statistic	50.73	49.12	54.71	50.35	50.42	48.33	50.73	47.71
Wald tests: $\alpha_1+\alpha_2$	4.54*	-0.42	0.15	2.46**	1.81	0.91	71.08*	-22.33
$\alpha_1+\alpha_3$	6.06***	2.40**	1.84**	2.37***	3.49***	3.41***	71.80***	-45.38***