When are pre-crisis winners post-crisis losers?

Kees Cools[1], Arthur van Soest[2], and Joris van Toor[*1]

[1] *TIAS School for Business and Society, Tilburg University, Tilburg, The Netherlands*

[2] *Netspar, Tilburg University, Tilburg, The Netherlands*

July 18, 2016

Abstract

Which banks did not recover from the financial crisis, and why? We document that pre-crisis high performing U.S. banks were not able to recover and to restore their performance up to eight years after the onset of the crisis. We demonstrate that their (risky) business models which allowed them to outperform their peers in the run up to the crisis were not viable anymore afterwards, leading to lagging post-crisis stock returns. Their risk culture and business model were based on low Tier 1 Ratios, high leverage and other risk factors, which were not allowed or profitable anymore after the crisis, hence their low post-crisis returns. For Europe, we find no significant correlation between pre- and post crisis bank returns. Risky business models and risk culture were less prominent at European banks, leading to a lower necessity for a fundamental post-crisis transformation.

[*]Electronic addresses: Kees@duvelhok.com, A.H.O.vanSoest@uvt.nl, J.A.C.vanToor@tias.edu (Corresponding author)

Keywords: Banking, Financial Crisis

1 Introduction

How did pre-crisis high performing banks perform after the (onset of the) crisis, and why? The answer very much depends on the question whether banks were able to fundamentally adjust their (risky) business models and risk culture when the circumstances forced them to do so. In the aftermath of the 2007 to 2008 financial crisis we have seen more clearly what some of the building blocks of the banking sector economics were prior to 2007. On the assets side banks sold mortgages with harsh conditions through aggressive sales tactics to unsophisticated clients with dubious credit quality (Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff, 2014). Through the securitization process these assets were off-loaded from the balance sheet by either selling them to investors or putting them in conduits. During the selling process underwriters and credit agencies misrepresented the quality of mortgages to investors (Griffin and Tang, 2012; Piskorski, Seru, and Witkin, 2015). And according to Acharya, Schnabl, and Suarez (2013) the rationale to use conduits was to circumvent capital requirements and earn additional profits, since the credit risk was born by the bank off-loading the assets. Securitization of mortgages was no exception but rather the rule before the crisis: in 2006 around 56% of all outstanding residential mortgages and more than two-thirds of the subprime mortgages were securitized (The Economist, September 20, 2007).

A related and fundamental problem in the run up to the crisis were high leverage ratios. Berger, Herring, and Szegö (1995) show that the equity to assets ratio for U.S. commercial banks consistently decreased from around 20% in 1900 to between 6% and 8% at the end of the century. As convincingly argued by Admati and Hellwig (2013) low levels of equity on the liabilities side benefited U.S. banks with an implicit government guarantee, of which

the value was equal to over $100bn for shareholders alone at the height of the crisis (Kelly, Lustig, and Van Nieuwerburgh, 2011).

In addition to gains earned through the securitization process and increased leverage, Zingales (2015) documents fines for bank's malpractices in libor and euribor rate setting and discrimination in the provision of loans. Moreover, Demirgüç-Kunt and Huizinga (2010) point to the higher risk associated with relying more on non-deposit short term funding.

One would expect that banks engaging in relatively high volumes of risky activities funded by little high quality capital, but supported by implicit government guarantees, would generate high stock returns. Conversely, when collateral values suddenly drop, risk premiums surge, interest rates of short term funding rise, counterparties default or cannot meet their obligations and a financial crisis is immanent, these same institutions will suffer the most and their stock returns will be amongst the poorest.

But after the crisis has reached its lowest point and stock prices start recovering, how do banks with the more risky business models and risk culture then perform? Do they then again start reaping the benefits of their high risk-high return profile and once more show superior stock returns? We refer to this as the 'high risk high reward' hypothesis. Or do they encounter sustained difficulties to recuperate and to restore trust amongst their (former) clients and counterparts and consequently show persistently low returns? We call this the 'boom and bust' hypothesis. The rationale for this scenario would be that many of the highly profitable pre-crisis financial instruments and practices are no longer allowed or possible post-crisis. Subsequently, the pre-crisis high risk–high return banks, that were forced to fundamentally change their business model and risk culture to satisfy regulators, investors, clients and taxpayers, might have been willing but just not able to do so. Consequently, the loss of significant pre-crisis profit pools could not be compensated by alternative business

models, with lagging stock returns as a consequence.

We empirically test these two hypotheses against each other and find evidence for the U.S. that is strongly supportive of the boom and bust hypothesis. Using a sample of 411 U.S. banks we show that superior pre-crisis (2000-2006; henceforth this period is referred to as pre-peak because it is the period before the bank's stock price attains its highest pre-crisis level) stock performance is a strong predictor of poor stock performance since the onset of the crisis (this period we refer to as post-peak). This correlation is mainly driven by the quintile of pre-peak best performing banks. These results hold, regardless of whether we include investement banks in our sample or not. Our key result is that on average each percentage point of positive stock return before the financial crisis is associated with a negative return of 0.07% in the post-peak period. We subsequently document that pre-peak risk indicators of banks are negatively correlated to post-peak stock returns, indicating that banks with high levels of business risk or risk culture generated low post-peak stock returns. The main risk characteristics that predict poor post 2006 performance are leverage, market beta, low propotions of assets held as securities and conversely high proportions of assets held as loans. Also 2006 bank size negatively predicts post-crisis stock returns, suggesting that larger banks entail higher levels of risk possibly due to increased complexity, intransparancy, bureaucracy and inherently higher levels of internal conflicts of interest.

In order to better understand the characteristics of pre-crisis high performing banks we regress 2000-2006 stock returns on pre-peak attributes of banks. We find that pre-peak high performing banks show strong signs of a high risk business model or culture. They have high (market value of) leverage, high funding fragility, low book-to-market ratios and low levels of securities as percentage of total assets.

Earlier studies (e.g., Beltratti and Stulz, 2012; Fahlenbrach, Prilmeier, and Stulz, 2012) have found that high pre-crisis returns of banks are predictive of poor stock performance during the crisis. We equally find that U.S. banks with a high pre-crisis risk profile that generate high stock returns in the run up to the crisis are the worst performers during the crisis (2007-2009). None of these studies, however, have analysed subsequent bank performance during the years after the crisis.

In sum, U.S. banks that generated high stock returns before the crisis had a high risk profile. Not surprisingly these banks showed the highest drop in stock prices during the crisis, but subsequently these banks were not able to recover after the crisis and showed poor stock performance all the way to 2015. Apparently these pre-2007 risky banks were unable to change their risk culture and business model into a safer and more profitable organisation and client service model.

Our findings for U.S. banks raise the question: Why are pre-crisis winners post-crisis losers? We argue that the pre-crisis business models, in particular shadow banking in many of its forms, was restricted or made impossible through various legal measures and regulations in the aftermath of the crisis, such as Basel III, the Dodd-Frank act in the U.S. and the ringfencing of investment and commercial banking in the U.K.

Therefore we argue that risk is appreciated differently by investors after the crisis than before. When we regress post-peak stock returns on bank attributes at 2014 we find that leverage is negatively correlated with performance. While risk was highly appreciated by investors before the crisis, after the start of the crisis, banks with lower levels of (financial) risk showed the highest stock returns. One explanation is that several of the risk elements and parts of the pre-crisis business model were no longer viable or not allowed anymore, e.g., banks were forced to increase their capital ratios and thereby significantly reducing the distortive effect

of moral hazard stemming from the implicit government guarantee. In addition, during the crisis it became clear that the visible risks of banks were associated with too high levels of hidden risks (Griffin and Tang, 2012; Piskorski et al., 2015), which after the crisis were not appreciated by investors.

Similar to our findings for the U.S., for the 247 banks in our European sample we find a negative relation between the pre-peak return and the return during the crisis. However, no statistically significant relation is found between the pre-peak return and the post-peak return of banks. This suggests that, in contrast to their U.S. peers, European pre-crisis high performing banks were able to adjust their business model after the crisis, to the extent necessary.

Also in Europe, pre-crisis stock returns of banks are associated with higher levels of risk, such as high risk weights, high fragility in funding, much variation in stock returns and large exposure to the real estate market. Interestingly, leverage is not one of those factors, indicating that leverage was not rewarded by investors before the crisis, in contrast to U.S. banks. Also after the crisis leverage remains unrelated to stock performance.

Our study is related to Fahlenbrach et al. (2012), who investigate persistence in bank performance across crises. They show that U.S. banks performing badly in the 1998 Russian financial crisis performed badly again in the 2007 - 2008 financial crisis. They conclude that the risk culture of banks does not change easily and refute the alternative learning hypothesis, which states that banks performing badly during a crisis will learn and will thus improve their performance during the next crisis. We likewise claim that the business model of banks that performed badly in the recent financial crisis has not changed after the crisis. This time, however, the reasons are quite different. In spite of the magnitude and impact

of the 1998 crisis – Robert Rubin, then Secretary of the Treasury, stated "that it was the worst financial crisis in the last 50 years" – that crisis did not lead to stricter bank regulations, on the contrary. One year after the crisis the 1999 Gramm-Leach-Bliley Act (the culmination of a $300 million lobbying effort by the banking and financial services industries, according to Stiglitz (2009)) repealed the two provisions in the Glass-Steagall Act of 1932 that restricted affiliations between commercial banks and investment banks. Five years later, in April 2004, the SEC allowed investment banks to increase their debt-to-equity ratio from 12:1 to 30:1 (Shefrin, 2009). Since bank regulation was loosened rather than tightened in the years after the Russian financial crisis and old regulations were stripped back, the pre-crisis business model remained viable and the risk culture of banks flourished as never before, generating above-average stock returns until 2007. Because regulation changed considerably in the aftermath of the 2007/2009 financial crisis, thereby turning the pre-crisis business models largely obsolete, pre-crisis winners were not able to adjust their business model and risk-culture to the new (regulatory) reality and consequently generated lagging stock returns. More specifically, while Fahlenbrach et al. (2012) find a negative correlation between stock performance during the crisis and short-term post-crisis performance, for the U.S. we find that poor performers during the crisis also had lagging stock returns after the crisis. In addition, Fahlenbrach et al. (2012) did not find that bottom performers during the 1998 financial crisis showed longer term underperformance (January 1999 until June 2007), while we do find such negative correlation (from 2007 until 2015).

Our paper is also related to recent studies that try to explain bank's performance during the financial crisis, such as Beltratti and Stulz (2012) and Berger and Bouwman (2013). Beltratti and Stulz (2012) show that more risky banks before the crisis had worse stock performance during the crisis, while Berger and Bouwman (2013) document that capital enhances performance, as measured by the probability of survival and market share, during crises.

In section 2 we discuss the sample, introduce the main dependent and independent variables and show summary statistics. Section 3 presents the relation between returns before the crisis and after the pre-crisis peak. In sections 4 and 5 we try to explain the relation we find. In section 6 we perform some robustness tests. Section 7 concludes.

2 Data

In this section we describe the sample selection, dependent and independent variables and summary statistics.

2.1 Sample construction

We focus on U.S. and European banks since the U.S. was the region where the financial crisis started and Europe the region it spread to easily as a consequence of integrated financial markets. Furthermore, at the start of 2016 the U.S. and European banking sectors together comprise more than 50% of the banking assets worldwide (see `http://www.eiu.com/industry/Financial-services#`). Only banks that were listed at December 31, 2006 are included in our sample since we want to analyse stock returns. Finally, we only consider banks with assets over $500 million at December 31, 2006.

These restrictions result in the sample presented in the top line of Figure 1.

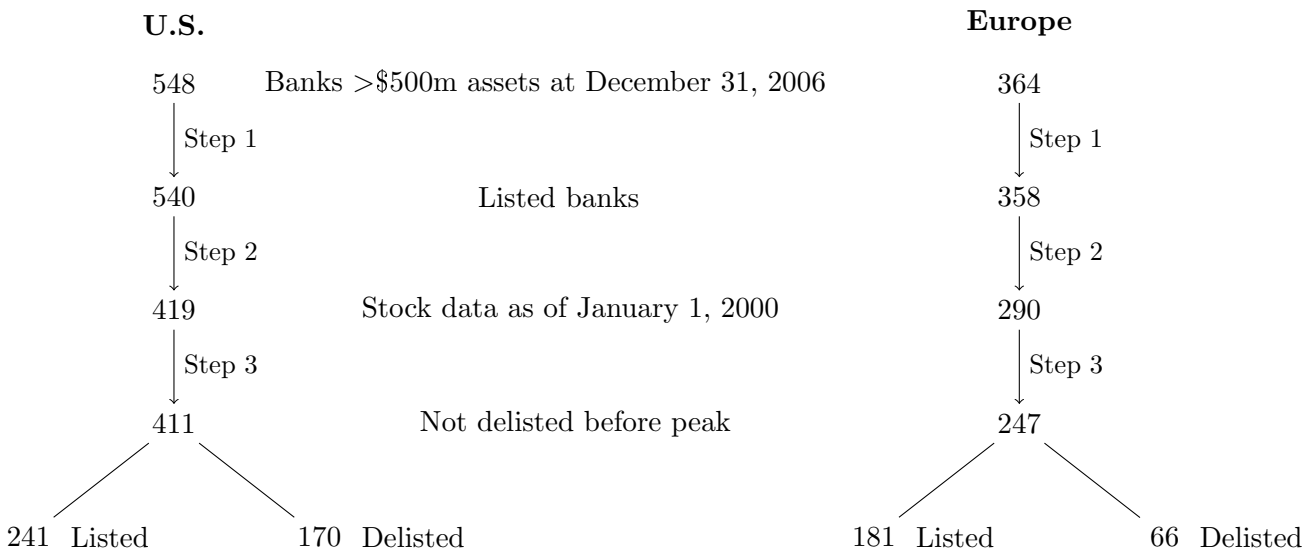

Figure 1. Listed and delisted U.S. and European banks with assets over $500m at December 31, 2006. In the first step banks drop out because there is no stock data available in Datastream. In the second step banks that have not yet been listed on January 1, 2000 are deleted. The third step excludes banks that had already been delisted before the pre-crisis peak.

These banks are linked to banks in Datastream by using the International Securities Identification Number (ISIN). Banks for which there is no stock data available in Datastream are deleted in the first step. In the second step banks for which no stock price was available at the start of the pre-crisis period (January 1, 2000) are dropped. In the third step we delete banks that were delisted before the pre-crisis peak was reached. This leaves us with a sample of 411 U.S. and 247 European banks. 170 of the 411 U.S. banks were delisted between the 2006 peak and the end of the sample period (May 22, 2015), while the rest was listed during the entire time period. In Europe 181 banks were listed continuously and 66 banks were delisted. In general companies delist for three different reasons: bankruptcy, merger or acquisition and a going private transaction. We do not distinguish between these three different causes of delisting.

Table 1 gives an overview of the sample banks per country and shows the division between the listed and delisted categories.

Table 1. Sample banks per country and categorized as either listed or delisted. Banks for which buy-and-hold stock returns are available from January 1, 2000 until May 22, 2015 are categorized as listed. Banks for which stock returns are available from January 1, 2000 to the moment of delisting (after the pre-crisis peak) are categorized as delisted.

Country	Total	Listed	Delisted
United States	411	241	170
United Kingdom	38	31	7
France	26	20	6
Switzerland	24	22	2
Italy	23	16	7
Denmark	23	12	11
Norway	16	15	1
Germany	14	8	6
Spain	13	4	9
Turkey	12	10	2
Greece	11	7	4
Austria	8	7	1
The Netherlands	7	5	2
Sweden	6	6	0
Belgium	5	5	0
Ireland	5	3	2
Cyprus	4	2	2
Portugal	4	2	2
Finland	3	2	1
Liechtenstein	2	2	0
Luxembourg	2	1	1
Monaco	1	1	0
Europe	247	181	66

The totals for the U.S. and Europe correspond to the totals of the last lines in Figure 1. Although the overall banking market in Europe is much larger than in the U.S. (currently three times larger in terms of assets, see `http://www.eiu.com/industry/Financial-services#`) our sample contains more U.S. banks. This has two reasons: European banks are less often listed and the listed banks in Europe are in general smaller than in the U.S.

2.2 Dependent and independent variables

We empirically test the boom and bust hypothesis and high risk-high reward hypothesis against each other. Our main explanatory variable is the buy-and-hold stock return between January 1, 2000 and the pre-crisis peak, i.e., *Return2000peak*. We admit that the starting point is a bit arbitrary. The peak is defined as the highest level of the unweighted average stock return of all banks in our sample. Since we consider the U.S. and Europe separately, we use different dates for the peak: December 28, 2006 for U.S. sample banks and June 1, 2007 for the European sample banks.

We consider two dependent variables to capture the bank's performance after the pre-crisis peak. We focus primarily on the period after the pre-crisis peak until May 22, 2015, *Returnpeak2015*.

Secondly, we use the stock returns between the peak date and the trough of the crisis, *Returnpeak2009*, as dependent variable. The trough is defined as the lowest level of the unweighted average return for the sample banks. Incidently the dates of the trough of the U.S. and the European sample banks coincide: March 9, 2009.

The aforementioned discussion is graphically summarized in Figure 2.

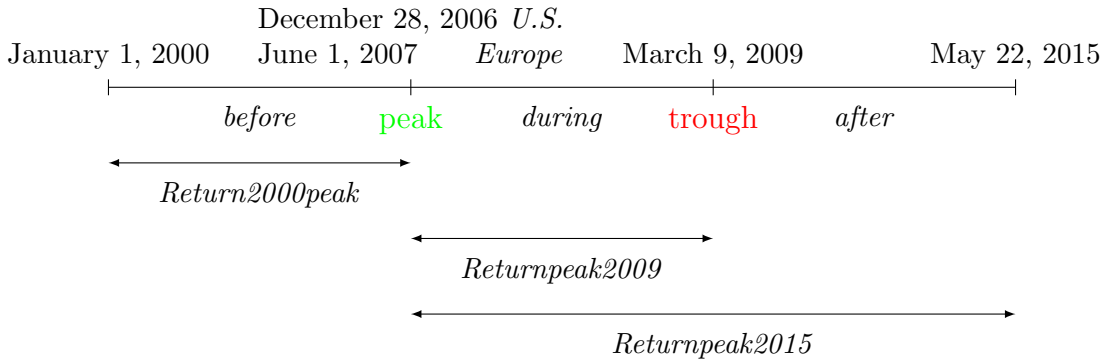

Figure 2. The time periods *before*, *during* and *after* the crisis and return variables.

For delisted banks *Returnpeak2009* and *Returnpeak2015* are set equal to the return until delisting. In other words, the return is set equal to zero after delisting. Delistings take place for different reasons, but we expect financial distress to have been the main one during the financial crisis. In that case, the delisted bank does not 'perform' anymore after delisting, which motivates the choice to set the return equal to zero. However, for banks that have been acquired or were taken privately this reasoning is less applicable. Therefore, to alleviate these concerns we perform robustness tests in section 6, where the return of delisted banks as of delisting is extended with a financial index return or delisted banks are deleted from the sample altogether.

We control for Fama-French factors, i.e., we include market beta, size and book-to-market of equity, and market value of leverage (Barber and Lyon, 1997; Fahlenbrach et al., 2012; Fama and French, 1993). We estimate market *Beta* from a weekly CAPM regression model from 2003 to 2006. Consistent with (Fama and French, 1993), size is measured by *Market Capitalization* of equity and we apply a logtransformation to adjust for the positive skewness of the distribution and to limit the impact of very large banks. *Book-to-market* is the book value of common equity to the market value of common equity. Finally, we use the market value of leverage, *MVLeverage*, as defined in Acharya, Pedersen, Philippon, and Richardson (2010).

Furthermore, we include three other variables: *Funding fragiliy*, *Securities* and *Illiquidity*. The first is used in Demirgüç-Kunt and Huizinga (2010) and measures the proportion of nondeposit short-term funding to total short term funding (including deposits). Inspired by Beltratti and Stulz (2012) we also want to include the proportion of assets used for holding securities (and consequently not for loans). The third variable measures the difficulty a bank might experience to repay short term liabilities in case of distress. A high value of *Illiquidity* indicates a high level of non-deposit short term liabilities in relation to liquid assets.

In some regressions leverage is replaced by the *Tier 1 Ratio*, which then automatically excludes investment banks, government sponsored entities (e.g., Fannie Mae and Freddie Mac for the U.S. and Nationale Bank van België and Schweizerische Nationalbank for Europe) from the sample. If not stated otherwise all variables are measured at December 31, 2006.

A description of all variables can be found in Appendix A.

We obtain data from Bankscope, except for market capitalisation and stock returns for which we use Datastream. For stock returns we use the Total Return datatype of Datastream, which takes the reinvestment of dividends and stock splits into account. The International Securities Identification Number (ISIN) links Bankscope data to Datastream data. In some cases the Bankscope ISIN did not match the Datastream ISIN. To ensure correspondence between data from both databases we verified the asset size of the bank found in Datastream with the one provided by Bankscope.

2.3 Summary Statistics

Before we present summary statistics for U.S. and European banks we show the trajectory of stock prices over the period studied. Figure 3 is the unweighted average for U.S. and European banks in our sample from 2000 to 2015.

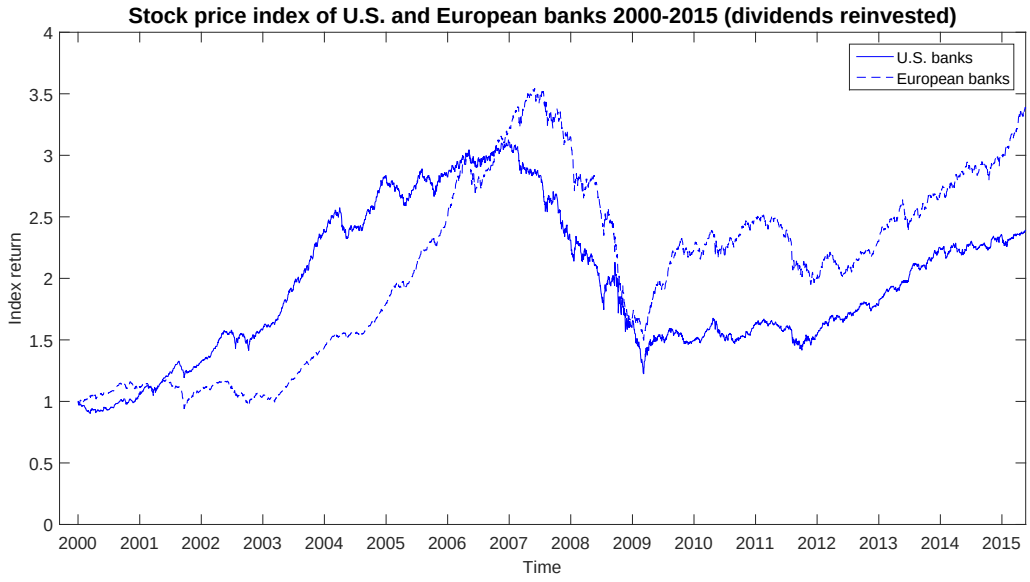

Figure 3. Stock prices, accounted for reinvestment of dividends and stock splits, for the unweighted index of U.S. (solid line) and European (dashed line) banks in our sample from 2000 to 2015. The return of delisted banks is set to zero as of the moment Datastream does not provide data anymore.

Although the phases of the trajectories are similar there are some striking differences between U.S. and European banks. First, while U.S. bank stock returns are increasing continuously as of the start of the sample period until the peak at the end of 2006, the sustained increase of stock returns at European banks starts three years later, in the first quarter of 2003. Second, European banks attain their peak half a year later than the U.S. banks. Third, European banks' stock returns have recovered significantly better from the crisis than their U.S. counterparts. Since the start of the crisis until May 2015, U.S. banks have lost on average 14%, while European banks lost 5% between the peak and May 2015. The 2011-2012 eurozone crisis is clearly visible and has hit European banks harder than U.S. banks. In spite of these losses European banks have come out of the financial crisis more strongly, viewed over the entire sample period, compared to their transatlantic colleagues.

When looking more closely at the stock returns of U.S. and European banks we see interesting

differences and similarities. We define five quintiles based on pre-crisis stock performance, whereby *Quintile 1* contains the 20% banks performing worst pre-crisis and *Quintile 5* the 20% banks performing best. Figures 4 and 5 depict the average stock returns for banks in these 5 quintiles for the U.S. and Europe, respectively, and Tables 2 and 3 show the corresponding numbers.

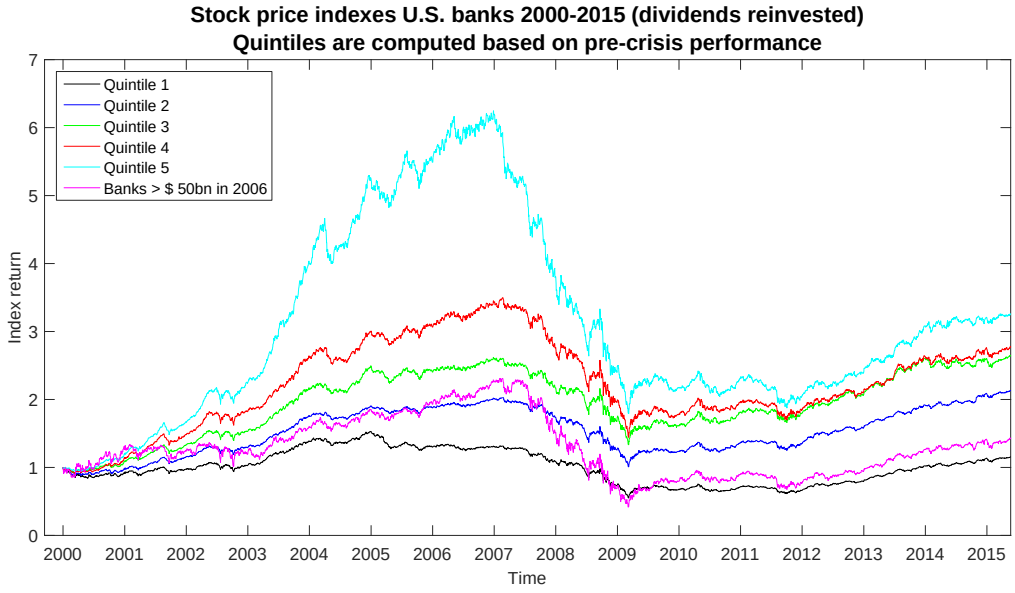

Figure 4. U.S. banks' unweighted average stock prices (accounted for reinvestment of dividends and stock splits) per quintile. The first quintile contains the 20% worst performers before the crisis and the fifth quintile contains the 20% best performers. The purple line is the average stock price development of banks with more than $50bn assets at December 31, 2006.

Table 2. U.S. banks' average stock returns per quintile for different time periods. Quintiles are constructed based on pre-crisis stock performance. The first quintile contains the 20% worst performers before the crisis and the fifth quintile contains the 20% best performers.

U.S.	Q1	Q2	Q3	Q4	Q5
2000-peak	32%	102%	162%	245%	466%
peak-2009	-58%	-51%	-49%	-59%	-67%
2009-2015	185%	149%	139%	128%	113%
peak-2015	-11%	4%	-1%	-19%	-41%
2000-2015	15%	113%	164%	177%	210%

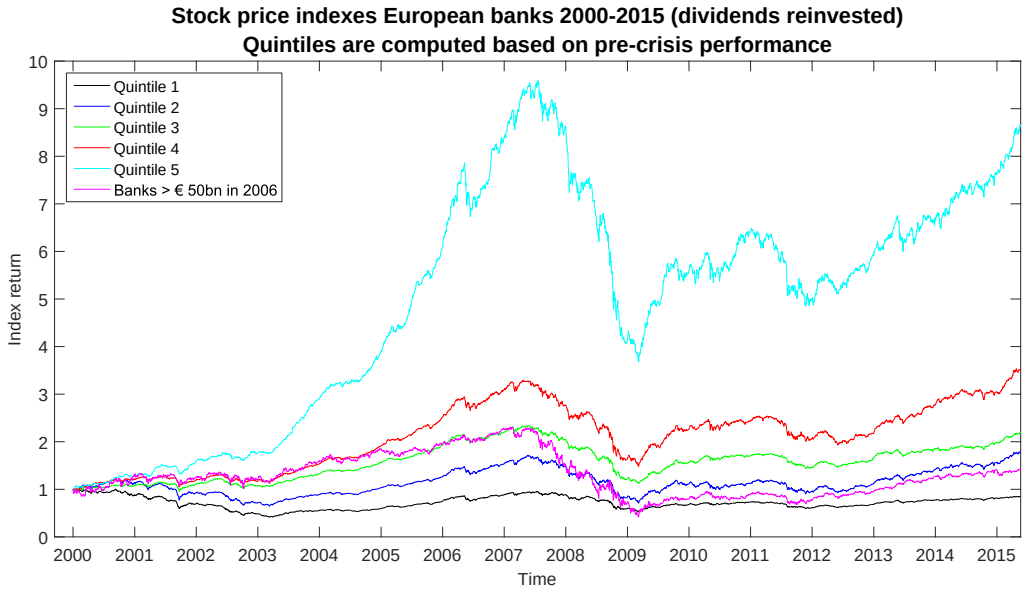

Figure 5. European banks' unweighted average stock prices (accounted for reinvestment of dividends and stock splits) per quintile. The first quintile contains the 20% worst performers before the crisis and the fifth quintile contains the 20% best performers. The purple line is the average stock price development of banks with more than €50bn assets at December 31, 2006.

Table 3. European banks' average stock returns per quintile for different time periods. Quintiles are constructed based on pre-crisis stock performance. The first quintile contains the 20% worst performers before the crisis and the fifth quintile contains the 20% best performers.

Europe	Q1	Q2	Q3	Q4	Q5
2000-peak	-5%	70%	133%	228%	795%
peak-2009	-48%	-58%	-51%	-54%	-65%
2009-2015	62%	147%	131%	230%	170%
peak-2015	-20%	5%	-7%	6%	-9%
2000-2015	-15%	80%	119%	253%	678%

For both regions the fifth quintile stands out. For the U.S., pre-peak returns of the fifth quintile are almost twice the returns of the fourth quintile and for Europe the fifth quintile pre-peak returns exceed over three times the fourth quintile returns. Clearly the pre-crisis outperforming banks stand out as a group per se. Regarding post-peak bank returns the U.S. and Europe show quite different pictures. In the U.S. pre-crisis top performing (fifth quintile) banks generated an average -41% peak-2015 return, compared to only a -9% return for European banks.

Figure 4 also shows that in the U.S. the largest banks (with total assets over $50bn) perform badly. On average their returns over the entire sample period deviate not much from the average return of the lowest quintile, while their pre-crisis returns equal the average of the second and third quintile.

For Europe the image is not much different. Over the entire sample period the returns of the largest banks lie in between the returns of the first and second quintile, while their pre-crisis returns coincide with the third quintile. Apparently, large banks in both areas were not able to recover and restore their (stock) performance after the crisis.

In Table 4 summary statistics of U.S. banks are presented for the main variables used throughout the paper.

Table 4. Sample summary statistics of U.S. banks. All variables are winsorized at the 1% and 99% level. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Number	Min	25% Quantile	Median	75% Quantile	Max	Mean	SD
Returnpeak2015	411	-1.00	-0.71	-0.12	0.30	1.85	-0.14	0.66
Returnpeak2009	411	-1.00	-0.86	-0.65	-0.34	0.33	-0.57	0.35
Return2000peak	411	-0.16	0.88	1.59	2.72	9.31	2.01	1.71
Return20002015	411	-1.00	-0.41	1.06	2.49	11.03	1.35	2.18
Book-to-market	408	0.19	0.44	0.56	0.70	1.62	0.60	0.24
log(Market cap)	408	3.84	4.73	5.43	6.98	11.41	6.05	1.83
Market cap (in $m)	408	46.61	113.09	228.26	1,078.88	90,048.81	4,298.84	14,396.09
Beta	411	-0.16	0.12	0.46	0.89	1.73	0.53	0.46
MES	411	-0.02	-0.01	-0.01	-0.00	0.00	-0.01	0.01
MVLeverage	408	2.80	6.64	8.36	10.71	38.34	9.43	4.82
BVLeverage	411	3.66	9.52	11.28	13.20	26.24	11.64	3.47
TCE ratio	411	0.00	0.06	0.07	0.09	0.20	0.08	0.03
Tier 1 ratio	354	0.08	0.10	0.11	0.13	0.24	0.12	0.03
Assets (in $m)	411	509.42	761.98	1,275.97	6,237.96	843,936.00	31,466.27	128,492.79
Loans	411	0.00	0.61	0.71	0.77	0.90	0.66	0.19
Securities	411	0.00	0.12	0.17	0.26	0.82	0.20	0.14
Real estate beta	411	-0.21	0.00	0.09	0.19	0.61	0.11	0.15
Risk weights	349	0.42	0.68	0.77	0.83	1.02	0.76	0.12
Customer deposits	411	0.00	0.67	0.74	0.81	0.90	0.69	0.20
Funding fragility	409	0.00	0.03	0.07	0.12	1.00	0.13	0.22
Illiquidity	411	0.00	0.41	1.20	2.99	16.59	2.18	2.87
IV	411	0.02	0.04	0.05	0.07	2.04	0.11	0.25

The median book-to-market ratio of the banks in our sample is 0.56. The market capitalization equals $228m for the median bank. Median market beta equals 0.46, which is considerably lower than 1. An alternative measure for systemic risk is the Marginal Expected Shortfall of Acharya et al. (2010), which measures banks' performance during the 5% worst days of market performance from 2003 to 2006. The median bank had a return of -0.56% during these days.

To gauge the financial robustness of banks we use four capital ratios. Following Acharya et al. (2010) we define the market value of leverage as total assets minus the book value of equity plus the market value of equity, divided by the market value of equity. Alternatively,

we consider the book value of leverage, which is the proportion of assets to the book value of equity. The median bank has a lower market value of leverage (8.36) than book value of leverage (11.28), which is consistent with a median book-to-market ratio of 0.56. The third capital ratio is the amount of tangible common equity to tangible assets, TCE ratio, which equals 7.3% for the median bank. The fourth ratio is the amount of regulatory Tier 1 capital to risk weighted assets, Tier 1 ratio. For the U.S. the median Tier 1 Ratio equals 11%, which is nearly three times the minimum requirements of Basel I and II, while the lowest value of the Tier 1 ratio of 8% still exceeds these regulatory requirements considerably (the minimum Tier 1 Capital Ratio in the Basel I and II Accords was 4%). The median bank has $1.3bn assets, but there is a large dispersion in size: the smallest bank in our sample has $508**m** assets and the largest bank $847**bn**.

The banks in our sample hold much more loans (median of 71%) on their balance sheet than securities (median of 17%). The exposure to the real estate market as proxied for by the real estate beta is limited on average. The risk weights of assets for the median bank is 77%, i.e., every dollar of assets counts for 0.77 dollar in the computation of the risk-adjusted assets. These risk-adjusted assets are the denominator in the Tier 1 ratio.

74% of the median balance sheet is funded with customer deposits. Furthermore, only a small portion of total short term funding (i.e., including deposits) is funded with non-deposit funds, such as money-market funds. Hence the funding fragility at our median bank is only 7%.

A large dispersion exists in the proportion of liquid assets to honour short term obligations. The illiquidity variable ranges from 0 (no short term liabilities) to 16.59 (16.59 dollars of short term liabilities to every dollar of liquid assets).

Finally an alternative measure of bank risk is the idiosyncratic volatility of bank returns, which is large when the variability in stock returns, that cannot be explained by market variability, is high.

Table 5 contains the summary statistics for European banks.

Table 5. Sample summary statistics of European banks. All variables are winsorized at the 1% and 99% level. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Number	Min	25% Quantile	Median	75% Quantile	Max	Mean	SD
Returnpeak2015	247	-1.00	-0.66	-0.15	0.37	3.30	-0.05	0.81
Returnpeak2009	247	-0.99	-0.77	-0.61	-0.39	0.19	-0.55	0.29
Return2000peak	247	-0.70	0.52	1.32	2.59	17.21	2.43	3.36
Return20002015	247	-1.00	-0.35	0.86	2.81	25.45	2.21	4.61
Book-to-market	242	0.14	0.39	0.51	0.86	17.13	1.18	2.45
log(Market cap)	242	3.05	5.93	7.03	8.57	11.44	7.23	1.97
Market cap (in €m)	242	27.95	494.69	1,493.33	6,938.23	122,826.69	10,669.28	23,597.30
Beta	247	-0.15	0.13	0.42	0.80	1.73	0.50	0.43
MES	247	-0.03	-0.02	-0.01	-0.00	0.01	-0.01	0.01
MVLeverage	242	1.07	5.45	10.51	18.41	501.00	21.83	57.41
BVLeverage	247	1.05	7.40	12.36	18.28	68.69	14.80	11.50
TCE ratio	247	0.01	0.04	0.07	0.11	0.95	0.15	0.22
Tier 1 ratio	137	0.06	0.07	0.09	0.11	0.27	0.10	0.04
log(assets)	247	6.05	7.64	8.94	10.71	14.19	9.27	2.14
Assets (in €m)	247	425.10	2,089.70	7,617.89	44,742.48	1,459,962.90	106,331.24	278,343.76
Loans	247	0.00	0.33	0.62	0.75	0.93	0.53	0.29
Securities	247	0.00	0.07	0.15	0.30	0.99	0.24	0.25
Real estate beta	247	-0.18	-0.00	0.06	0.14	0.42	0.07	0.12
Risk weights	130	0.15	0.48	0.64	0.77	1.17	0.62	0.22
Customer deposits	247	0.00	0.19	0.42	0.55	0.84	0.38	0.24
Funding fragility	234	0.00	0.11	0.27	0.50	1.00	0.36	0.30
Illiquidity	245	0.00	0.33	0.77	1.91	25.57	2.15	4.26
IV	247	0.01	0.03	0.04	0.05	0.12	0.04	0.02

In discussing the characteristics of European banks we focus on differences with U.S. banks. Firstly, European banks are much larger: the median market capitalization five times and the median asset size six times. Secondly, the median European bank is funded with only 42% customer deposits compared to 74% for the median American bank. Consequently, the funding fragility of European banks is higher.

Thirdly, also in terms of capital ratios European banks seem more fragile than their American counterparts. However, when comparing the summary statistics of capital ratios between the U.S. and Europe, one should be cautious of the differences in accounting standards. In the U.S. the generally accepted accounting principles (GAAP) are used, while in Europe the International Financial Reporting Standards (IFRS) prevail. Admati and Hellwig (2013, pp.

83-85) indicate that, in the case of JP Morgan Chase for example, total assets on December 31, 2006 were 79% higher based on IFRS compared to US GAAP. The main reasons for those large differences is that in the U.S. more assets can be removed from the balance sheet and derivatives of the same counterparty on the assets and liabilities side of the balance sheet can be cancelled (so called netting) to one another. Whithin the IFRS framework there are more restrictions in these respects.

Suppose the U.S. GAAP vs IFRS differences of JP Morgan Chase could be extended to our sample of banks, the IFRS consistent value of assets would increase with 79% as well. Correspondingly, the median Tier 1 Ratio of 11% of U.S. banks would decrease to (11%/1.79=) 6.1%, which is 2.9% points lower than the 9.0% for European banks.[1] Although it can be expected that JP Morgan Chase holds relatively more derivatives on its balance sheet and more assets off-balance than an average U.S. bank it seems reasonable to assume that the median Tier 1 ratio is lower in the U.S. than in Europe. The same holds, mutatis mutandis, for the other capital ratios.

3 Results

The high risk - high reward hypothesis implies a positive correlation between pre-crisis stock returns and returns eight years after the (onset of the) crisis. The boom and bust hypothesis predicts a negative relation between pre-peak and post-peak returns. For U.S. banks, the results presented in Table 6 show strong support for the boom and bust hypothesis.

[1] We apply the same risk weights used to obtain the US GAAP Tier 1 ratio to compute the IFRS consistent Tier 1 ratio.

Table 6. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2015* – on pre-peak returns and other bank characteristics for U.S. banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)
Return2000peak	-0.0848***	-0.0738***	-0.0771***	-0.0879***	-0.0819***
	(-4.52)	(-3.93)	(-4.19)	(-4.36)	(-4.40)
Book-to-market		0.0199	-0.5759***	-0.4251***	-0.4202***
		(0.10)	(-4.14)	(-2.84)	(-3.00)
log(Market cap)		-0.0483*	-0.0453*	0.0150	-0.0190
		(-1.89)	(-1.81)	(0.52)	(-0.73)
Beta		-0.2250**	-0.2795***	-0.3951***	-0.2389**
		(-2.34)	(-2.94)	(-3.70)	(-2.49)
MVLeverage		-0.0342***			
		(-3.60)			
Securities		1.1528***	1.3088***	1.6285***	1.0149***
		(4.86)	(5.53)	(5.02)	(4.38)
Funding fragility		0.1983	0.2118	-0.5522	0.0582
		(1.16)	(1.26)	(-0.98)	(0.34)
Illiquidity		0.0073	0.0082	0.0152	0.0069
		(0.67)	(0.76)	(1.05)	(0.63)
BVLeverage			-0.0481***		
			(-5.21)		
Tier 1 ratio				0.4457	
				(0.33)	
TCE ratio					4.3544***
					(3.87)
constant	0.0337	0.4514**	1.0256***	0.0314	-0.0445
	(0.68)	(2.44)	(4.77)	(0.13)	(-0.20)
N	411	406	406	351	406
R^2	0.0476	0.1615	0.1896	0.2028	0.1656
F	20.4263	9.5612	11.6118	10.8720	9.8519
pvalue	0.0000	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first column shows a strongly negative and statistically highly signifant correlation between pre-peak and post-peak stock returns. A one standard deviation increase in *Return2000peak* implies a 14.5% (-0.0848 $\times$ 1.71) decline in stock returns from the peak to 2015. Controlling for the Fama and French (1993) factors, market value of leverage, securities to assets, funding fragility and illiquidity of assets only slightly decreases the size and

significance of this correlation. The Fama and French (1993) factors have the expected sign, but the book-to-market ratio is not significant. Furthermore, the coefficient for MVLeverage is significantly negative implying that banks which were highly leveraged pre-crisis show weak stock performance in the post-peak period. Banks that hold a larger proportion of their assets as securities ceteris paribus performed significantly better after the peak. Given that banks with much loans have less securities and combined they comprise 88% of assets for the median bank, the finding of Beltratti and Stulz (2012) that the amount of loans is negatively related to bank performance during the crisis seems to extend to performance after the crisis.[2]

In columns 3 to 5 MVLeverage is replaced by three alternative capital ratios. Replacing it with BVLeverage – assets divided by the book value of equity – yields similar results as in column 3, except for book-to-market which becomes significantly negative. By including the Tier 1 ratio in column 4 we can exclude the possibility that results are driven by non-depository institutions, since only depository institutions are required to report Tier 1 ratios. Except for size which changes signs the main result still holds. The Tier 1 ratio has the expected sign, but is not significant. Finally, following Beltratti and Stulz (2012) and Fahlenbrach et al. (2012), we include the tangible common equity ratio (column 5), which is strongly positively related to post-peak performance. This does not alter the main result.

When controlling for Fama and French (1993) factors and including bank characteristics, we consistently find support for the boom-and-bust hypothesis.

In Table 7 we will focus exclusively on the returns during the financial crisis, i.e., the dependent variable will be *Returnpeak2009*.

[2]We refer to column 2 in panels A and B of Table 4 in Beltratti and Stulz (2012) as in these regressions the category of banks is closest to our definition: they consider banks with a minimum of $10bn in assets while we consider banks with a minimum of $500m. However, we have to note that they consider 32 different countries from all over the world, while in Table 6 we only consider U.S. banks.

Table 7. Regressions of buy-and-hold stock returns during the crisis – *Returnpeak2009* – on pre-peak returns and other bank characteristics for U.S. banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)
Return2000peak	-0.0310***	-0.0262***	-0.0288***	-0.0347***	-0.0317***
	(-3.09)	(-2.67)	(-3.00)	(-3.17)	(-3.20)
Book-to-market		0.0209	-0.3897***	-0.3213***	-0.2972***
		(0.21)	(-5.37)	(-3.96)	(-4.00)
log(Market cap)		-0.0458***	-0.0432***	-0.0133	-0.0294**
		(-3.42)	(-3.31)	(-0.85)	(-2.14)
Beta		-0.0422	-0.0772	-0.0942	-0.0500
		(-0.84)	(-1.55)	(-1.63)	(-0.98)
MVLeverage		-0.0240***			
		(-4.83)			
Securities		0.7051***	0.7931***	0.6664***	0.6006***
		(5.68)	(6.41)	(3.79)	(4.87)
Funding fragility		0.0064	0.0108	-0.1596	-0.0754
		(0.07)	(0.12)	(-0.52)	(-0.83)
Illiquidity		0.0027	0.0030	0.0004	0.0018
		(0.47)	(0.54)	(0.05)	(0.31)
BVLeverage			-0.0306***		
			(-6.36)		
Tier 1 ratio				1.7820**	
				(2.45)	
TCE ratio					2.1173***
					(3.54)
constant	-0.5047***	-0.1547	0.2091*	-0.5027***	-0.4009***
	(-19.10)	(-1.60)	(1.86)	(-3.70)	(-3.41)
N	411	406	406	351	406
R^2	0.0229	0.1783	0.2105	0.1787	0.1568
F	9.5721	10.7689	13.2278	9.3022	9.2254
pvalue	0.0021	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Comparing the first line of this table with the first line of Table 6 we conclude that for all regressions the size and significance level of the pre-peak return is lower. Hence, the pre-peak return is more informative in explaining the post-peak return than in explaining only the return during the crisis. This is not only statistically but also economically relevant: a one standard deviation higher return before the crisis is associated with a decrease of 5.3%

(-0.031 × 1.71) during the crisis, which is considerably lower than the 14.5% decrease during the whole post-peak period found in regression 1 of Table 6.

Since the period we consider as dependent variable in these regressions for a large part overlaps with the period used in Table 2 of Fahlenbrach et al. (2012) and Table 4 of Beltratti and Stulz (2012) (both papers use the period July 2007 to December 2008) we compare their results with ours. The pre-peak stock return, book-to-market, log(Market cap) and MVLeverage are similar to the findings of Fahlenbrach et al. (2012). However, the coefficient of market beta has the opposite sign. Except for the difference in dependent variable, Fahlenbrach et al. (2012) use 2004 to 2006 to compute the CAPM beta while we start at 2003. In addition, they consider banks with a minimum of $50m assets and we have a minimum of $500m.

Consistent with Beltratti and Stulz (2012) we find that banks with relatively more securities and lower pre-crisis returns performed better during the crisis. However, a difference is the insignificance of funding fragility we report. Apparently the importance of funding fragility for the banks around the world (Beltratti and Stulz, 2012) does not apply to our sample of U.S. banks.

The results for the U.S. are supportive of the boom and bust hypothesis. We confirm findings of earlier studies that U.S. banks performing well before the crisis performed worse during the crisis. These analyses are repeated for the European sample. In Table 8 we report results where the post-peak period is the dependent variable. In contrast to the U.S. we do not find support for the boom and bust hypothesis in Europe.

Table 8. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2015* – on pre-peak returns and other bank characteristics for European banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)
Return2000peak	0.0010	0.0103	0.0079	-0.0259	0.0090
	(0.07)	(0.67)	(0.51)	(-1.29)	(0.58)
Book-to-market		0.0761*	0.0069	-0.0246	0.0095
		(1.89)	(0.29)	(-0.61)	(0.40)
log(Market cap)		-0.1202***	-0.1038***	-0.0186	-0.1066***
		(-3.59)	(-3.01)	(-0.40)	(-3.13)
Beta		0.3778**	0.3728**	-0.1516	0.3677**
		(2.34)	(2.30)	(-0.67)	(2.28)
MVLeverage		-0.0039**			
		(-2.17)			
Securities		0.4114	0.3220	-0.4344	0.1327
		(1.53)	(1.20)	(-0.85)	(0.46)
Funding fragility		0.1427	0.1834	0.6380*	0.0741
		(0.71)	(0.91)	(1.85)	(0.36)
Illiquidity		0.0111	0.0120	-0.0216	0.0129
		(0.82)	(0.88)	(-0.55)	(0.95)
BVLeverage			-0.0087*		
			(-1.84)		
Tier 1 ratio				5.5900***	
				(3.34)	
TCE ratio					0.7438**
					(2.05)
constant	-0.0538	0.4190*	0.4440*	-0.5792	0.3186
	(-0.85)	(1.83)	(1.93)	(-1.43)	(1.37)
N	247	228	228	132	228
R^2	0.0000	0.1042	0.0990	0.1278	0.1022
F	0.0044	3.1851	3.0065	2.2523	3.1151
pvalue	0.9474	0.0019	0.0032	0.0279	0.0024

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The pre-peak stock return is not significantly correlated to the post-peak return in any of the specifications. In unreported regressions we included country dummies, which did not change this result. Allowing for different correlations between pre-peak and post-peak returns for different countries, i.e., by including interactions of the pre-peak return with country dummies, yields insignificant results for 14 countries representing 131 of the 228

banks. For the remaining seven countries the relation between pre- and post-peak returns is *positively* significant for six countries (74 banks) and negatively for one country (23 banks). The coefficient on market beta has a positive sign, which is the opposite of what we find for U.S. banks. Surprisingly, European banks with a larger exposure to the market performed better after the pre-crisis peak. Securities to assets which was positively related to both *Returnpeak2009* and *Returnpeak2015* in the U.S. is not statistically significant for the European sample.

Therefore we conclude that the evidence for U.S. banks for the boom and bust hypothesis is not confirmed for European banks. Moreover, for six countries we find support for the high risk - high reward hypothesis.

When analysing returns during the crisis the relation with pre-crisis returns is similar for Europe and the U.S., as shown in Table 9.

Table 9. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2009* – on pre-peak returns and other bank characteristics for European banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)
Return2000peak	-0.0133**	-0.0201***	-0.0192***	-0.0301***	-0.0194***
	(-2.41)	(-3.69)	(-3.53)	(-4.17)	(-3.54)
Book-to-market		-0.0296**	-0.0049	-0.0051	-0.0039
		(-2.08)	(-0.58)	(-0.35)	(-0.46)
log(Market cap)		-0.0269**	-0.0323***	-0.0082	-0.0263**
		(-2.27)	(-2.64)	(-0.50)	(-2.17)
Beta		-0.2475***	-0.2452***	-0.2499***	-0.2389***
		(-4.34)	(-4.28)	(-3.05)	(-4.15)
MVLeverage		0.0014**			
		(2.20)			
Securities		0.0777	0.1085	-0.1644	0.0737
		(0.82)	(1.14)	(-0.89)	(0.72)
Funding fragility		0.0141	-0.0005	0.2776**	-0.0129
		(0.20)	(-0.01)	(2.23)	(-0.17)
Illiquidity		-0.0040	-0.0045	-0.0130	-0.0060
		(-0.84)	(-0.93)	(-0.92)	(-1.24)
BVLeverage			0.0028*		
			(1.68)		
Tier 1 ratio				0.3646	
				(0.60)	
TCE ratio					0.0832
					(0.64)
constant	-0.5199***	-0.2025**	-0.2100**	-0.4154***	-0.2071**
	(-22.69)	(-2.50)	(-2.58)	(-2.84)	(-2.49)
N	247	228	228	132	228
R^2	0.0231	0.2278	0.2209	0.2089	0.2123
F	5.7924	8.0776	7.7602	4.0610	7.3798
pvalue	0.0168	0.0000	0.0000	0.0003	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Pre-crisis returns are significantly negatively related to bank returns during the crisis as can be concluded from the first line of Table 9. Banks with higher pre-crisis market sensitivity (measured by beta) performed worse during the market downturn, which is in line with expectation. Moreover, small banks (measured by market capitalization) performed better during the crisis than large banks. These three findings are consistent with the signs found

for 32 countries around the world in Beltratti and Stulz (2012, Table 4). For other variables which are significant in Beltratti and Stulz (2012) such as funding fragility, loans to assets and Tier 1 ratio, we do not find supportive evidence.

In sum, European banks with high stock returns from January 2000 to June 2007 performed poorly during the crisis, but unlike U.S. banks, did not show lagging stock returns in the years after the crisis. Banks in six countries even showed a positive relation between the pre-peak and post-peak returns.

Until now we showed that for the U.S. the pre-peak stock returns show a strong negative correlation with both the post-peak return and the crisis return. For Europe we only document this relation for returns during the crisis. In order to better understand which banks drive these results we follow Fahlenbrach et al. (2012) and divide the sample into quintiles based on pre-crisis return, i.e., the first quintile contains the 20% worst pre-crisis performers and the fifth the 20% best. Since we do not find a relation between the pre- and post-peak returns for Europe (see Table 8) we do not perform the quintile analysis in that case. Table 10 contains the results.

Table 10. Regressions of buy-and-hold post-peak – *Returnpeak2015* – and during crisis – *Returnpeak2009* – stock returns on pre-peak stock returns quintile dummies and other bank characteristics. Quintile 2 / Quintile 3, ... is a dummy equal to one if a bank is in the second, third, ... quintile of *Return2000peak*. The first quintile is the base case. The first four columns contain results for the U.S. and the last two for Europe. Market capitalization is measured in $ in columns 1 to 4 and in € in columns 5 and 6. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	U.S. *Returnpeak2015*		**U.S.** *Returnpeak2009*		**Europe** *Returnpeak2009*	
	(1)	(2)	(3)	(4)	(5)	(6)
Quintile 2	0.1518	0.1242	0.0771	0.0555	-0.1028*	-0.0793
	(1.51)	(1.27)	(1.43)	(1.08)	(-1.76)	(-1.33)
Quintile 3	0.0999	0.0935	0.0951*	0.0689	-0.0385	-0.1116*
	(0.99)	(0.95)	(1.77)	(1.34)	(-0.66)	(-1.95)
Quintile 4	-0.0834	-0.0775	-0.0067	-0.0223	-0.0660	-0.1064*
	(-0.83)	(-0.77)	(-0.12)	(-0.42)	(-1.13)	(-1.85)
Quintile 5	-0.2992***	-0.2470**	-0.0828	-0.0662	-0.1752***	-0.2669***
	(-2.97)	(-2.44)	(-1.54)	(-1.25)	(-3.00)	(-4.52)
Book-to-market		0.0812		0.0496		-0.0320**
		(0.41)		(0.48)		(-2.20)
log(Market cap)		-0.0480*		-0.0447***		-0.0262**
		(-1.86)		(-3.31)		(-2.21)
Beta		-0.2115**		-0.0401		-0.2706***
		(-2.17)		(-0.78)		(-4.68)
MVLeverage		-0.0344***		-0.0240***		0.0014**
		(-3.61)		(-4.82)		(2.19)
Securities		1.1512***		0.7095***		0.0853
		(4.84)		(5.70)		(0.91)
Funding fragility		0.1984		0.0018		0.0099
		(1.16)		(0.02)		(0.14)
Illiquidity		0.0060		0.0022		-0.0029
		(0.55)		(0.39)		(-0.60)
constant	-0.1106	0.2832	-0.5836***	-0.2380**	-0.4763***	-0.1309
	(-1.56)	(1.42)	(-15.39)	(-2.28)	(-11.58)	(-1.53)
N	411	406	411	406	247	228
R^2	0.0574	0.1670	0.0336	0.1831	0.0413	0.2543
F	6.1784	7.1829	3.5246	8.0294	2.6060	6.6977
pvalue	0.0001	0.0000	0.0076	0.0000	0.0365	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the first, third and fifth column of Table 10 we do not control for other variables to be

better able to illustrate the interpretation of the coefficients. The constant in these columns is the average post-peak performance of banks in quintile 1. The interpretation of the other coefficients is relative to this constant term.

We conclude that the constant term in column 1 is not significant, which implies that the return from the end of 2006 to 2015 for banks in the first quintile is indistinguishable from zero. Moreoever, the coefficients for the second, third and fourth quintile dummies are not significantly different from the coefficient of the first quintile (the base case), thereby implying that the correlation reported in the first column of Table 6 is not driven by the first four quintiles. However, the coefficient for banks in the fifth quintile does differ significantly from the coefficient of quintile 1 (and thus from zero) and the average decline of banks in quintile 5 in the post-peak period equals –0.1106+–0.2992=–0.4098 = –41%. Hence the effect observed in the first column of Table 6 is driven by the 20% pre-crisis top performing banks, which is in line with the findings of Figure 4 and Table 2 that banks in quintile 5 showed by far the best performance pre-peak and the worst post-peak.

In column 2 we assess the robustness of this result by including the factors we have used before. The significance of the coefficient of quintile 5 in column 2 decreases compared to column 1, but is still strongly significant.

In columns 3 to 6 we repeat the analysis for the return during the crisis, *Returnpeak2009*, for the U.S. and Europe. First, focusing on columns 3 and 5 we see that the average return of the worst-performing U.S. and European banks pre-crisis shows a return significantly below zero during the crisis.

Second, except for quintile 3, the performance of the other U.S. banks' quintiles during the crisis does not differ significantly from the first quintile. In column 4 the difference of banks in quintile 3 and quintile 1 disappears when we control for other variables. So, the significant negative relation between pre-crisis and crisis return is not driven by a particular quintile, but homogeneously observed across all U.S. banks.

Third, from columns 5 and 6 we conclude that European banks in quintile 5 perform worse than banks in the other quintiles. Although we see that all European banks have a significantly negative return during the crisis, quintile 5 banks perform much worse compared to the others.

4 What are the characteristics of pre-crisis high performing banks?

For the U.S. we have presented strong evidence that high pre-crisis stock returns of banks predict low stock performance after the pre-crisis peak. Controling for beta, size, market-to-book ratio and leverage or another capital ratio only marginally attenuates the results. Moreover, results are not driven by investment banks. In all regressions the coefficient of the primary explanatory variable, *Return2000peak*, remains highly statistically and economically significant. For Europe on the other hand the 'high risk high reward' hypothesis is not supported. For the crisis period, however, also when controling for various bank characteristics, high pre-crisis returns do predict low crisis returns.

The relation we find for U.S. banks can be explained by a risky business model and corporate culture that generated the high pre-crisis stock returns for these banks but post-crisis also prevented them from a fundamental restructuring and from adjusting themselves to the harsh reality of more stringent rules and regulation and critical clients. In order to test this conjecture we relate pre-crisis stock returns to (risk) characteristics of the bank. We measure the characteristics at the end of 2006, i.e., at the end of the period over which we want to explain the stock returns, since this gives the best reflection of the state with which banks entered the financial crisis.

Table 11. Regressions of buy-and-hold pre-peak stock returns – *Return2000peak* – on bank characteristics for U.S. banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Book-to-market	-2.3362***	-1.5370***	-1.6894***	-2.5770***	-2.2914***	-2.1446***	-2.5690***
	(-4.63)	(-4.14)	(-4.34)	(-4.51)	(-4.56)	(-4.39)	(-5.24)
log(Market cap)	-0.1104	-0.1239*	-0.0900	-0.0595	-0.1479**	-0.0311	0.0055
	(-1.62)	(-1.82)	(-1.17)	(-0.74)	(-2.13)	(-0.45)	(0.08)
Beta	0.2221	0.2537	0.2205	0.1095	0.1506		-0.4681*
	(0.87)	(0.98)	(0.77)	(0.37)	(0.58)		(-1.66)
MVLeverage	0.0541**			0.0702**	0.0457*	0.0290	0.0648***
	(2.15)			(2.16)	(1.81)	(1.17)	(2.65)
Securities	-2.4204***	-2.3099***	-2.9848***		-2.3801***	-1.8816***	-2.3871***
	(-3.90)	(-3.63)	(-3.50)		(-3.92)	(-3.09)	(-3.97)
Funding fragility	0.6953	0.7705*	0.2299	-1.1113		0.7950*	0.7445*
	(1.53)	(1.69)	(0.15)	(-0.74)		(1.82)	(1.69)
Illiquidity	-0.0004	0.0029	-0.0042	0.0014	-0.0051	0.0121	-0.0144
	(-0.01)	(0.10)	(-0.11)	(0.04)	(-0.17)	(0.43)	(-0.50)
BVLeverage		0.0210					
		(0.83)					
Tier 1 ratio			4.1648				
			(1.16)				
Risk weights				1.8374**			
				(2.38)			
Customer deposits					-1.3349***		
					(-2.61)		
MES						14.7951	
						(0.89)	
IV						1.7129***	
						(5.34)	
Real estate beta							3.0614***
							(5.22)
constant	3.8456***	3.6605***	3.4380***	1.7916**	5.1827***	3.3707***	3.2374***
	(8.47)	(6.58)	(5.34)	(2.29)	(7.19)	(7.38)	(7.11)
N	406	406	351	346	408	406	406
R^2	0.0926	0.0837	0.0975	0.0972	0.0973	0.1534	0.1509
F	5.8016	5.1916	5.2917	5.2002	6.1600	8.9904	8.8185
pvalue	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11 shows cross-sectional regressions for the U.S. of the pre-crisis return on the three

Fama-French factors and various other bank characteristics. Column 1 contains the same variables as we have considered in previous tables. In columns 2 to 7 one of the variables in specification 1 is replaced by alternative or related variables. Finally, in column 8 we include the exposure of a bank to the real estate market as defined in Beltratti and Stulz (2012). We measure this exposure by first estimating a CAPM with the Fama French Real Estate index added as additional factor. We then use the estimated coefficient of the Fama French Real Estate index as proxy for the exposure to the real estate market.

The results presented in Table 11 support the hypothesis that in the U.S. a risky business model has been rewarded by investors before the crisis. Banks with risky practices, such as high leverage, few securities and consequently high risk weights, few customer deposits and consequently high fragility in funding, high stock return variability measued by IV, and large exposure to the real estate market, showed significantly higher stock returns before the crisis.

In addition, market capitalization is negatively related to performance, indicating that smaller banks performed better before the crisis. Finally, 'growth stocks' with a low book to market value of equity show significantly higher stock returns pre-crisis. This is an interesesting finding since it differs from the results presented by Barber and Lyon (1997) who document a significantly positive book-to-market premium for financial firms for the period 1973 - 1994. Apparently, contrary to the last decades of the previous century, in the run op to the financial crisis, growth stocks in the U.S. banking industry were rewarded by relatively high stock returns.

The proportion of assets held in securities (and thus not in loans) is negatively related to pre-crisis returns. Although it might be surprising that banks performing worse before the crisis had relatively more securities on their balance sheet, they were also regarded as less

risky by regulatros as their risk weights[3] were lower. The correlation between securities to assets and risk weights equals -0.7036. On the other hand, banks with more loans on the balance sheet had higher risk weights (correlation of 0.6724) and were thus viewed as more risky. The results of regression 5 are consistent with this reasoning as higher risk weights are associated with positive pre-crisis returns.

Funding fragility is in most regressions significanlty positively related to pre-peak performance, indicating that banks with a larger portion of short term debt funded with other sources than customer deposits performed better before the crisis. This finding is substantiated by column 6, which shows that more customer deposits is positively associated with lower returns. This is in line with the finding of Demirgüç-Kunt and Huizinga (2010) that banks that "rely prominently on attracting non-deposit funding are very risky."

As an alternative for beta we follow Fahlenbrach et al. (2012) and simultaneously consider the MES defined in Acharya et al. (2010) and the idiosyncratic volatility (IV) of Beltratti and Stulz (2012). A higher value for IV implies greater variability after correctiong for market variability. From the significantly positive relation between IV and pre-crisis return, we again conclude that more risky banks, i.e., with a more volatile trajectory, performed better before the crisis.

Finally, exposure to the real estate market was rewarded pre-crisis as can be concluded from the last column. This is not surprising considering the banks' practices before the crisis. Banks sold mortgages through aggressive sales tactics to unsophisticated clients (Agarwal et al., 2014). In addition, credit agencies misrepresented the quality of securitized mortgages

[3]A measure to gauge the overall riskiness of a bank's assets. These risk weights are used to multiply the assets to obtain the denominator of regulaotry capital ratios, such as the Tier 1 ratio. The higher the risk weights the riskier the assets of a bank.

which were subsequently sold to investors and banks (Griffin and Tang, 2012; Piskorski et al., 2015). This securitization of mortgages was no exception but rather the rule before the crisis: in 2006 around 56% of all outstanding residential mortgages and more than two-thirds of the subprime mortgages were securitized (The Economist, September 20, 2007).

Only during and after the crisis the consequences of these practices became clear. Erkens, Hung, and Matos (2012) report write-downs on mortgage-backed securities of $330bn from the second quarter of 2007 to the fourth quarter of 2008 for banks available in Bloomberg. Furthermore, the Financial Crisis Inquiry Commission documents in its Financial Crisis Inquiry Report (page *xxii*) losses of $112bn relating to fraud with mortgages sold between 2005 and 2007.

In Table 12 the same analyses are reported for European banks.

Table 12. Regressions of buy-and-hold pre-peak stock returns – *Return2000peak* – on bank characteristics for European banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Book-to-market	-0.4224**	-0.3111***	-0.2985*	-0.5374	-0.4135**	-0.3407**	-0.3707**
	(-2.42)	(-3.04)	(-1.66)	(-1.19)	(-2.46)	(-1.98)	(-2.21)
log(Market cap)	0.0773	0.0861	0.0818	0.0015	0.0795	0.0621	0.1479
	(0.53)	(0.57)	(0.40)	(0.01)	(0.57)	(0.42)	(1.04)
Beta	-1.9836***	-1.9426***	-2.8722***	-1.0805	-2.1486***		-2.3501***
	(-2.86)	(-2.79)	(-2.92)	(-1.07)	(-3.16)		(-3.51)
MVLeverage	0.0061			0.0119	0.0052	0.0028	0.0058
	(0.78)			(0.71)	(0.70)	(0.37)	(0.78)
Securities	-2.1889*	-2.1288*	-2.4627		-1.9204**	-1.6390	-1.7136
	(-1.88)	(-1.83)	(-1.08)		(-2.03)	(-1.39)	(-1.53)
Funding fragility	1.0028	0.9402	3.8455**	4.3641***		0.7168	0.1992
	(1.14)	(1.07)	(2.55)	(2.93)		(0.83)	(0.23)
Illiquidity	0.0678	0.0577	0.3226*	0.0611	0.0804	0.0855	0.0916
	(1.14)	(0.97)	(1.86)	(0.35)	(1.48)	(1.46)	(1.60)
BVLeverage		-0.0071					
		(-0.34)					
Tier 1 ratio			8.7818				
			(1.17)				
Risk weights				7.1575***			
				(4.16)			
Customer deposits					-1.0449		
					(-1.01)		
MES						102.9739***	
						(2.96)	
IV						39.7283***	
						(3.65)	
Real estate beta							8.3793***
							(4.51)
constant	3.2547***	3.3159***	1.8512	-2.3636	3.9898***	1.5967	2.4113**
	(3.33)	(3.37)	(1.02)	(-1.26)	(3.46)	(1.46)	(2.52)
N	228	228	132	125	240	228	228
R^2	0.1150	0.1130	0.2275	0.3161	0.1263	0.1507	0.1901
F	4.0833	4.0053	5.2179	7.7265	4.7922	4.8572	6.4245
pvalue	0.0003	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

First we see that in Europe riskiness has been rewarded before the crisis. Similar to the U.S.,

banks with little securities to assets and high risk weights, high fragility in funding, much variation in stock returns and large exposure to the real estate market performed better. Second, European banks with a low book-to-market ratio performed better, which is the same result as we found for U.S. banks.

Third, and in contrast to the U.S., a high market value of leverage is not associated with high stock returns for European banks before the crisis. It seems as if investors in Europe did not think higher leverage was in their best interest. This might be because they did not think the additional profits (with the same level of equity banks can have more earning assets) were enough to offset the additional risk (distance to default becomes smaller). This reasoning only holds if investors thought the additional risk was not covered by an implicit government guarantee.

Finally, European banks with a large exposure to the market index performed significanlty worse pre-crisis. This can be inferred from the negative sign of beta and the positive sign of MES.

5 What changed since the crisis?

For both the U.S. and Europe we have presented evidence that banks taking more risk before the crisis generated higher pre-crisis stock returns. However, an important difference between the U.S. and Europe is that leverage was rewarded before the crisis in the former and not in the latter.

In this section we are interested in the impact on stock performance of leverage as the primary risk factor of banks. We argue that the pre-crisis high risk business models and some unlawful practices were restricted or made impossible through various legal measures and regulations in the aftermath of the crisis. Measures taken by the Bank of Internationl Set-

tlements with Basel III and the Financial Stability Board are examples. In addition to these coordinated supra-national actions, individual countries also increased new laws and stricter regulation, e.g., the Dodd-Frank act in the U.S. in 2010 and the ringfencing of investment banking activities within commercial banks in the U.K. Most of these measures directly or indirectly affect the leverage or capital ratios of (commercial) banks.

Baily and Elliott (2014) point to five ways in which capital regulation have become more stringent after the crisis: more and higher quality of capital, increase in risk weights to compute regulatory capital ratios, more capital for trading positions and the introduction of a crude leverage ratio where assets are unweighted. Not only regulators require higher capital ratios, capital markets and society at large put similar pressure on banks. In the U.S. banks have increased their common equity tier 1 capital, the most stringent form of capital, from 4.6 percent of risk-weighted assets in the fourth quarter of 2007 to 11.6 percent in the third quarter of 2013.

We therefore want to test whether risk, in particular leverage, after the crisis was still being rewarded by the stock market. In Table 13 we present the results of regressing post-peak stock returns on bank characteristics at December 31, 2014.

Table 13. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2015* – on bank characteristics measured at December 31, 2014. Variable definitions can be found in Appendix A. Beta is the market coefficient in the CAPM from January 1, 2011 to December 31, 2014. The first three columns contain results for the U.S. and the last three for Europe. Market capitalization is measured in $ in columns 1 to 3 and in € in columns 4 to 6.

	U.S.			**Europe**		
	(1)	(2)	(3)	(4)	(5)	(6)
Book-to-market	-1.0646***	-0.9213***	-0.9786***	-0.0016	-0.0053**	-0.0031
	(-8.43)	(-6.77)	(-6.97)	(-0.18)	(-2.11)	(-1.04)
log(Market cap)	0.0452*	0.0645**	0.1478***	0.1156***	0.1176***	0.1188**
	(1.92)	(2.59)	(4.91)	(2.64)	(2.69)	(2.26)
Beta	-0.4341***	-0.4875***	-0.6886***	-0.6914***	-0.7180***	-0.5675***
	(-5.68)	(-5.92)	(-6.14)	(-4.43)	(-4.53)	(-2.79)
MVLeverage	-0.0091***			-0.0001		
	(-7.68)			(-0.39)		
Securities	0.8116***	0.9809***	0.4816	-0.2904	-0.2909	-0.9980*
	(2.98)	(3.37)	(1.31)	(-0.96)	(-0.96)	(-1.98)
Funding fragility	0.0928	-0.4053*	-0.6483	0.5720**	0.5997**	0.4344
	(0.42)	(-1.83)	(-0.98)	(2.49)	(2.55)	(0.92)
Illiquidity	0.0295**	0.0417***	0.0553***	-0.0169	-0.0150	0.0942**
	(2.37)	(3.17)	(3.43)	(-0.68)	(-0.61)	(2.14)
BVLeverage		-0.0857***			0.0032	
		(-5.23)			(0.52)	
Tier 1 ratio			1.9106			3.0050
			(1.38)			(1.37)
constant	0.8963***	1.3845***	0.0699	-0.2863	-0.3305	-0.7824*
	(4.43)	(4.31)	(0.26)	(-1.09)	(-1.19)	(-1.74)
N	217	217	195	159	159	104
R^2	0.3837	0.3014	0.3149	0.1721	0.1728	0.2375
F	18.5890	12.8792	12.2783	4.4839	4.5049	4.2710
pvalue	0.0000	0.0000	0.0000	0.0001	0.0001	0.0004

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For the U.S. the most striking difference with findings presented in section 4 is the opposite and statistically significant sign for leverage. Post-peak high leverage is associated with low stock returns, in contrast to the pre-peak period. In unreported regressions we focused on the recovery period, i.e., from March 9, 2009 to May 22, 2015, and found a similar negative sign, albeit not statistically significant.

These results are consistent with either a change in apprecation of leverage post-crisis or with banks surviving the crisis showing a negative relation between leverage and stock returns both pre- and post-peak. It seems to be a combination of both. When restricting the regression from the previous section of pre-crisis returns on 2006 bank characteristics to the sample of banks that survived the crisis, the significant relation between leverage and return disappears. This differs both from the significant positive relation we found for the full sample in the pre-crisis period (see Table 11) and from the significant negative relation found in the post-peak period for surviving banks (see Table 13).

For the U.S. we therefore conclude that, first, the returns of banks that survived the crisis were not associated with high leverage before the crisis. Second, in the post-peak period these banks showed a negative relation between leverage and stock performance. For U.S. banks, low levels of leverage were appreciated after the crisis, while pre-crisis high leverage, i.e., high risk, was rewarded by the stock market. The latter relation was driven by banks that ultimately did not survive the financial crisis. The fact that stock markets do not seem to appreciate risk, in particular leverage, anymore after the financial crisis is supportive of the boom and bust hypothesis.

Unlike for the U.S., for Europe we do not find evidence that leverage is associated with stock returns after the crisis, which is consistent with the pre-crisis results we presented in Section 4. In Europe high leverage of banks did not generate high stock returns before the crisis, which was neither the case after the crisis.

6 Robustness

In this section we investigate the robustness of the results for the way we treated delisted banks and for different size categories.

6.1 Delisted banks

After the moment the stock price of a listed bank is not recorded anymore in Datastream we have assumed that the bank is delisted (because of takover, merger, bankruptcy or taken private) as of that day. In all analyses we have set the return equal to zero after the day of delisting. In this subsection we explore other ways to deal with (the returns of) delisted banks.

6.1.1 Drop delisted banks

First we drop delisted banks from the sample altogether. This results in a sample of 241 U.S. and 181 European banks.

Table 14. Regressions of buy-and-hold post-peak – *Returnpeak2015* – and during crisis – *Returnpeak2009* – stock returns on pre-peak returns and other bank characteristics, where we exclude delisted banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Returnpeak2015				*Returnpeak2009*			
	U.S.		Europe		U.S.		Europe	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Return2000peak	-0.0711***	-0.0591**	0.0280	0.0271	-0.0165	-0.0097	-0.0069	-0.0149**
	(-2.71)	(-2.21)	(1.32)	(1.30)	(-1.64)	(-1.04)	(-1.02)	(-2.42)
Book-to-market		-0.0931		0.0632		-0.0465		-0.0201
		(-0.36)		(1.40)		(-0.52)		(-1.51)
log(Market cap $)		-0.0524				-0.0342***		
		(-1.53)				(-2.87)		
Beta		-0.0895		0.6125***		-0.0828*		-0.2751***
		(-0.65)		(3.09)		(-1.73)		(-4.69)
MVLeverage		-0.0229*		-0.0055**		-0.0158***		0.0002
		(-1.71)		(-2.46)		(-3.39)		(0.28)
Securities		0.9899***		0.0680		0.6760***		0.0677
		(2.88)		(0.22)		(5.65)		(0.75)
Funding fragility		0.1526		0.0067		-0.0475		-0.0639
		(0.69)		(0.03)		(-0.61)		(-0.92)
Illiquidity		0.0076		0.0288*		0.0043		-0.0023
		(0.49)		(1.71)		(0.81)		(-0.46)
log(Market cap €)				-0.1762***				-0.0335***
				(-4.46)				(-2.86)
constant	0.1622**	0.5143**	0.0370	0.9627***	-0.5668***	-0.3057***	-0.5493***	-0.1176
	(2.45)	(2.02)	(0.47)	(3.53)	(-22.37)	(-3.45)	(-21.98)	(-1.45)
N	241	239	181	163	241	239	181	163
R^2	0.0297	0.0985	0.0096	0.1842	0.0111	0.2529	0.0058	0.3519
F	7.3172	3.1418	1.7316	4.3462	2.6929	9.7321	1.0455	10.4508
pvalue	0.0073	0.0022	0.1899	0.0001	0.1021	0.0000	0.3079	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The main result of the paper, i.e., a significant negative relation between pre-peak and post-peak returns for U.S. banks still holds. However, the relation between pre-crisis and during the crisis return is no longer significant for the U.S. and only negatively significant for Europe when we correct for other bank characteristics (see last column). After delisted banks are excluded the relation between pre-peak and post-peak returns is positive in Europe with

a p-value around 19%. Based on the results in the first four columns we conclude that for constantly listed banks the relation between returns before and after the peak differs between the U.S. and Europe.

6.1.2 Extend with bank index

As a second alternative we extend the stock return of delisted banks with a financial index as of the moment no stock data is available. This method is also used by Fahlenbrach et al. (2012). For the U.S. we take the S&P 500 Financials index and for Europe the EURO STOXX 600 Banks index. Table 15 shows that the results remain unchanged.
So our results are robust for two alternative ways of dealing with delisted banks.

Table 15. Regressions of buy-and-hold post-peak – *Returnpeak2015* – and during crisis – *Returnpeak2009* – stock returns on pre-peak crisis returns and other bank characteristics. The return of delisted banks is set equal to the return of the S&P 500 Financials index as of the moment of delisting for American banks and to the return of the EURO STOXX 600 Banks index for European banks. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Returnpeak2015				*Returnpeak2009*			
	U.S.		**Europe**		**U.S.**		**Europe**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Return2000peak	-0.0951***	-0.0823***	0.0085	0.0157	-0.0283***	-0.0220***	-0.0090*	-0.0152***
	(-4.77)	(-4.11)	(0.54)	(0.99)	(-3.99)	(-3.32)	(-1.83)	(-3.28)
Booktomarket		0.0736		0.0620		0.0163		-0.0077
		(0.36)		(1.49)		(0.24)		(-0.63)
log(Market cap $)		-0.0602**				-0.0297***		
		(-2.21)				(-3.30)		
Beta		-0.2698***		0.3426**		-0.1255***		-0.2433***
		(-2.63)		(2.05)		(-3.69)		(-5.01)
MVLeverage		-0.0328***		-0.0031*		-0.0161***		-0.0000
		(-3.25)		(-1.67)		(-4.82)		(-0.09)
Securities		1.2022***		0.3758		0.5648***		0.1321
		(4.76)		(1.35)		(6.75)		(1.64)
Funding fragility		0.2289		0.0711		0.0350		-0.0829
		(1.26)		(0.34)		(0.58)		(-1.36)
Illiquidity		0.0095		0.0123		0.0042		-0.0039
		(0.81)		(0.87)		(1.09)		(-0.95)
log(Market cap €)				-0.1255***				-0.0280***
				(-3.62)				(-2.78)
constant	0.1172**	0.5619***	-0.0355	0.5305**	-0.6140***	-0.3690***	-0.5783***	-0.2291***
	(2.23)	(2.85)	(-0.55)	(2.24)	(-32.91)	(-5.65)	(-28.53)	(-3.32)
N	411	406	247	228	411	406	247	228
R^2	0.0526	0.1684	0.0012	0.0923	0.0375	0.2586	0.0135	0.2717
F	22.7152	10.0481	0.2960	2.7844	15.9303	17.3114	3.3629	10.2120
pvalue	0.0000	0.0000	0.5869	0.0059	0.0001	0.0000	0.0679	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.2 Does size matter?

One aspect of banks that has been much disputed since the financial crisis is their size. Do large banks have specific characteristics that make them more vulnerable for various kinds of

risk, for example because of increased levels of complexity, intransparency, agency conflicts, multi-layering or bureaucracy? We, therefore, split the sample by median total assets at the end of 2006 and by banks with more (or less) than $50bn of assets (the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank) uses the threshold of $50bn assets for systemic importance).

We consider U.S. banks in Table 16 and European banks in Table 17.

Table 16. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2015* – on pre-peak returns and other bank characteristics for U.S. banks and different size categories. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Largest 50% (1)	Smallest 50% (2)	>$50bn (3)	<$50bn (4)
Return2000peak	-0.0660***	-0.0523*	-0.1196	-0.0710***
	(-2.78)	(-1.76)	(-1.34)	(-3.72)
Book-to-market	-0.1819	-0.1201	-0.8241	-0.2627
	(-0.74)	(-0.39)	(-1.01)	(-1.27)
log(Market cap)	-0.0083	-0.2592*	0.0260	-0.0347
	(-0.30)	(-1.91)	(0.18)	(-0.89)
Beta	0.0263	-0.2257	0.1288	-0.3151***
	(0.20)	(-1.00)	(0.30)	(-2.92)
MVLeverage	-0.0401***	-0.0164	-0.0428	-0.0139
	(-3.43)	(-0.96)	(-0.87)	(-1.29)
Securities	0.7229**	1.6497***	0.5133	1.5755***
	(2.39)	(4.46)	(0.68)	(6.13)
Funding fragility	-0.0762	1.8006***	-0.4187	0.6390***
	(-0.43)	(3.66)	(-0.67)	(3.32)
Illiquidity	0.0027	-0.0119	-0.1307**	-0.0000
	(0.22)	(-0.56)	(-2.15)	(-0.00)
constant	0.2203	1.1805	0.5352	0.2768
	(0.82)	(1.58)	(0.34)	(1.15)
N	204	202	33	373
R^2	0.1892	0.2224	0.5010	0.2039
F	5.6861	6.9010	3.0121	11.6503
pvalue	0.0000	0.0000	0.0172	0.0000

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

From the first two columns we conclude that banks above and below the median both show

a negative relation between pre- and post-peak returns. The relation is strongest for the largest 50% banks. Furthermore, market value of leverage is significantly negatively related to post-peak returns only for the largest half of the sample, whereas market capitalization is significantly negatively and funding fragility significantly positively related only for the smallest half.

For banks with assets over $50bn no negative relation is reported between pre- and post-peak returns. However, considering the sample size of only 33 banks in this regression, this is not surprising. What is more surprising is that the illiquidity variable, that has not been of much importance in many of the regressions in previous sections, is significantly negatively related to post-peak returns for very large banks. For banks with less than $50bn in assets the fragility of funding is positvely related to returns after the peak.

In sum, we conclude that the relation we have documented between pre- and post-peak stock returns is not driven by a particular size category, but is in any case not driven by the largest banks.

Results for Europe are presented in Table 17.

Table 17. Regressions of buy-and-hold post-peak stock returns – *Returnpeak2015* – on pre-peak returns and other bank characteristics for European banks and different size categories. Variable definitions can be found in Appendix A. Accounting variables are measured at December 31, 2006.

	Largest 50% (1)	Smallest 50% (2)	>€50bn (3)	<€50bn (4)
Return2000peak	0.0394*	-0.0054	0.0108	0.0093
	(1.93)	(-0.23)	(0.33)	(0.52)
Book-to-market	0.0422	0.1218	-0.1563	0.0687
	(0.92)	(1.34)	(-0.63)	(1.57)
log(Market cap)	-0.0918	-0.1151	0.0711	-0.0812*
	(-1.53)	(-1.27)	(0.48)	(-1.69)
Beta	0.0569	0.6778**	-0.0962	0.5149***
	(0.28)	(2.56)	(-0.29)	(2.69)
MVLeverage	-0.0025	-0.0065	0.0050	-0.0021
	(-1.41)	(-0.80)	(0.53)	(-0.90)
Securities	0.6315	0.3501	-0.8316	0.4660
	(1.43)	(0.95)	(-0.98)	(1.57)
Funding fragility	-0.1542	0.2170	0.6369	0.1130
	(-0.58)	(0.70)	(0.90)	(0.50)
Illiquidity	0.0241	0.0129	-0.1873	0.0143
	(1.01)	(0.70)	(-0.96)	(0.99)
constant	0.3346	0.3102	-0.8484	0.1143
	(0.72)	(0.57)	(-0.65)	(0.37)
N	116	112	52	176
R^2	0.1034	0.1214	0.0604	0.0996
F	1.5429	1.7791	0.3455	2.3090
pvalue	0.1510	0.0896	0.9428	0.0225

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We document no difference in relation between pre- and post-peak returns for banks with more than €50bn and banks with less than €50bn in assets. However, we find a positve relation between pre- and post-peak stock returns for the 50% largest European banks, while no relation is found for the 50% smallest. This indicates that, unlike in the U.S., large European banks were able to recover post-crisis. In Section 3 we also reported a positive relation between pre- and post-peak returns for six countries representing 74 banks. These 74 banks are not overrepresented in the category containing the 50% largest banks: only 32

are in this category.

7 Summary and conclusion

We find strong evidence that pre-crisis high performing banks were bottom performers during the crisis. Moreover, we report new evidence that high performing U.S. banks were not able to recover after the crisis since they remained bottom performers in the aftermath of the crisis, at least until 2015; high pre-crisis stock returns of U.S. banks predict low stock returns since the onset of the crisis. These results are not driven by size, investment banks, delistings or other factors. For European banks these results do not apply.

High pre-crisis stock returns of U.S. banks were associated with some important pre-crisis risk characteristics, notably high leverage, fragility in funding, more risky assets, a higher variability in stock returns and more exposure to the real estate market. This result also holds for European banks except for leverage, which shows no relation with pre-crisis stock returns.
Interestingly, for U.S. banks, the relation between leverage and returns changes after the crisis: high leverage is related to lower stock returns.

For the U.S. we argue that high pre-crisis stock returns were caused by the (risky) business model characteristics and associated risk culture of these outperforming banks. Their low stock returns during the crisis were the flip side of that same risky business model. We suggest that the subsequent underperformance of these banks during the six years after the crisis was due to the massive tightening of bank regulation, which turned the pre-crisis high performing business model largely obsolete. Apparently the risky business model was so deeply engrained in their culture and behavioral and organisational DNA that these banks

were not able to embrace a new, more trust based and client centric business model. European high performing pre-crisis banks did not systematically underperform post-peak, suggesting that they had a lower risk-profile pre-crisis and were consequently better able to recover post-crisis.

References

Acharya, V. V., Pedersen, L. H., Philippon, T., Richardson, M. P., 2010. Measuring systemic risk. Paper presented at the AFA 2011 Denver Meetings PaperRetrieved from http://ssrn.com/abstract=1573171.

Acharya, V. V., Schnabl, P., Suarez, G., 2013. Securitization without risk transfer. Journal of Financial Economics 107 (3), 515–536.

Admati, A. R., Hellwig, M. F., 2013. The Bankers' New Clothes: What's Wrong with Banking and What to Do about It. Princeton, NJ: Princeton University Press.

Agarwal, S., Amromin, G., Ben-David, I., Chomsisengphet, S., Evanoff, D. D., 2014. Predatory lending and the subprime crisis. Journal of Financial Economics 113 (1), 29–52.

Baily, M. N., Elliott, D. J., 2014. How Is the System Safer? What More Is Needed? Hoover Institution Press, Stanford, CA, Ch. 9, pp. 165–195.

Barber, B. M., Lyon, J. D., 1997. Firm size, book-to-market ratio, and security returns: A holdout sample of financial firms. The Journal of Finance 52 (2), 875–883.

Beltratti, A., Stulz, R. M., 2012. The credit crisis around the globe: Why did some banks perform better? Journal of Financial Economics 105 (1), 1–17.

Berger, A. N., Bouwman, C. H., 2013. How does capital affect bank performance during financial crises? Journal of Financial Economics 109 (1), 146–176.

Berger, A. N., Herring, R. J., Szegö, G. P., 1995. The role of capital in financial institutions. Journal of Banking & Finance 19 (3), 393–430.

Demirgüç-Kunt, A., Huizinga, H., 2010. Bank activity and funding strategies: The impact on risk and returns. Journal of Financial Economics 98 (3), 626–650.

Erkens, D. H., Hung, M., Matos, P., 2012. Corporate governance in the 2007–2008 financial crisis: Evidence from financial institutions worldwide. Journal of Corporate Finance 18 (2), 389–411.

Fahlenbrach, R., Prilmeier, R., Stulz, R. M., 2012. This time is the same: Using bank performance in 1998 to explain bank performance during the recent financial crisis. The Journal of Finance 67 (6), 2139–2185.

Fama, E. F., French, K. R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33 (1), 3–56.

Griffin, J. M., Tang, D. Y., 2012. Did subjectivity play a role in CDO credit ratings? The Journal of Finance 67 (4), 1293–1328.

Kelly, B. T., Lustig, H., Van Nieuwerburgh, S., 2011. Too-systemic-to-fail: What option markets imply about sector-wide government guarantees. Tech. rep., National Bureau of Economic Research.

Piskorski, T., Seru, A., Witkin, J., 2015. Asset quality misrepresentation by financial intermediaries: evidence from the rmbs market. The Journal of Finance 70 (6), 2635–2678.

Shefrin, H., 2009. How psychological pitfalls generated the global financial crisis. The Research Foundation of CFA Institute, Ch. 13, pp. 224–256.

Stiglitz, J. E., January 2009. Capitalist fools. Vanity Fair, Retrieved from http://www.vanityfair.com/news/2009/01/stiglitz200901.

The Economist, September September 20, 2007. When it goes wrong... The Economist.

Zingales, L., 2015. Does finance benefit society? The Journal of Finance 70 (4), 1327–1363.

A Variable definitions

- *Assets* - We use the $ book value of assets for US banks and € book value for European banks (in millions).

- *Beta* - Beta of CAPM is used to proxy for systemic risk. For American companies we estimate a CAPM of weekly returns in excess of the three-month T-bill from January 1, 2003 to December 31, 2006. The market is represented by the S&P 500 index. For European banks we use three months Euribor as short rate and the STOXX 600 as index.

  We estimate the following time-series regression:

$$R_{i,t} - r_{0,t} = \alpha_i + \beta_i \left(R_{M,t} - r_{0,t}\right) + \varepsilon_{i,t}, \tag{1}$$

  where $R_{i,t}$ is the return of company i, $r_{0,t}$ the short rate and $R_{M,t}$ the market return. β_i is the exposure to systemic risk of company i and the variable we use.

- *Book to market* - Book value of common equity to market value of common equity.

- *Customer deposits to assets* - Customer deposits to total assets.

- *Funding fragility* - Deposits from other banks, other deposits and short-term borrowings, and repos and cash collateral normalized by total deposits (customers and companies), money market and short term funding.

- *IV* - Idiosyncratic volatility defined as

$$IV_i = \sqrt{\text{Var}\left(e_{i,t}\right)} \tag{2}$$

  where $e_{i,t}$ is the residual for company i at time t from the CAPM regression (see regression equation (1)).

- *BVLeverage* - The book value of assets to book value of equity. The book value of equity is the sum of equity, and preferred shares and hybrid capital accounted for as equity.

- *MVLeverage* - The book value of assets minus the book value of equity (see *BVLeverage* for definition) plus the *Market capitalization* divided by *Market capitalization*.

- *Illiquidity* - Deposits from other banks, other deposits and short-term borrowings, and repos and cash collateral normalized by liquid assets.

- *Loans* - Net loans to assets. Net loans equals gross loans minus the reserves for impaired loans.

- *Market capitalization* - The market value of equity in $ millions for U.S. banks and € for European banks. The maximum of Datastream's Market Value (MV) and Market Value for Company (MVC) variables is used. For companies with a single listed equity security these numbers are equal. For companies with more than one listed or unlisted equity securities the latter is the sum of these while the former ignores them.

- *MES* - Marginal Expected Shortfall from Acharya et al. (2010). The average return of company i during the 5% worst daily market returns between January 1, 2003 and December 31, 2006:

$$MES_{i,5\%} = \frac{1}{\#days} \sum_{\text{t: market return is in 5\% tail}} R_{i,t}, \tag{3}$$

  where $R_{i,t}$ is the return of company i during period t.

- *Net interest income to operating income* - Interest revenues minus interest expenses to total operating income.

- *Non-performing loans to gross loans* - Proportion of impaired loans to gross loans.

- *Real estate beta* - The coefficient of the Fama-French real estate industry excess return in a regression of the bank's excess stock return on the excess market return and the Fama-French real estate industry excess return. In formulas:

$$R_{i,t} - r_{0,t} = \alpha_i + \beta_i \left(R_{M,t} - r_{0,t}\right) + \beta_i^{RE} \left(R_{FFRE,t} - r_{0,t}\right) + \varepsilon_{i,t}, \tag{4}$$

  where $R_{FFRE,t}$ is the return of the Fama French real estate index and the remaining variables are as before. β_i^{RE} is the variable we use.

- *Return20002015* - Buy-and-hold stock return with reinvested dividends and accounted for stock splits from January 1, 2000 to May 22, 2015. The return of delisted banks is set equal to zero as of the moment the stock price is no longer available in Datastream.

- *Return2000peak* - Buy-and-hold stock return with reinvested dividends and accounted for stock splits from January 1, 2000 to the pre-crisis peak. This peak is defined as the highest level of the unweighted average buy-and-hold stock returns of the banks before the start of the crisis. In the U.S. the peak is reached at December 28, 2006 and in Europe at June 1, 2007.

- *Returnpeak2009* - Buy-and-hold stock return with reinvested dividends and accounted for stock splits from the peak to the lowest level of the unweighted average buy-and-hold stock returns of the banks after the start of the crisis. This date, March 9, 2009, coincides for U.S. and European banks. The return of delisted banks is set equal to zero as of the moment the stock price is no longer available in Datastream.

- *Returnpeak2015* - Buy-and-hold stock return with reinvested dividends and accounted for stock splits from the peak to May 22, 2015. The return of delisted banks is set equal to zero as of the moment the stock price is no longer available in Datastream.

- *ROAA* - Return On Average Assets: net income to average assets in a year. The

average is the arithmetic average between the start and end values of the year.

- *Risk weight* - The bank's risk weight according to the Basel rules and computed as the risk weighted assets to assets. For banks for which risk weighted assets are not available we can sometimes use:

$$\frac{\frac{\text{Tier 1 capital}}{\text{Tier 1 ratio}}}{\text{Assets}} = \frac{\text{Risk weighted assets}}{\text{Assets}}$$

- *Securities* - Securities held on the balance sheet to total assets. The securities category is comprised of reverse repos, cash collateral, trading securities, derivatives, available for sale securities, held to maturity securities, at-equity investments and other securities.

- *TCE ratio* - Tangible common equity to tangible assets. Goodwill and other intangibles are subtracted from common equity to obtain the numerator and from assets to obtain the denominator.

- *Tier 1 ratio* - The ratio of Tier 1 capital to risk weighted assets.

B Manual data adjustments

Certain firms had a price (Return Index in datastream) equal to zero. However, in some cases the stock price becomes larger than zero afterwards. Since it would impossible to compute stock returns if the stock recovers to values larger than zero, the zeros have been replaced with the first non-zero stock price after the zeros. So if prices are non-zero at $t = 0$ and $t = 2$ and equal zero at $t = 1$ the price of $t = 2$ is used as price at $t = 1$. This occured in ten cases in our dataset.