The Value Relevance of Regulatory Capital Components

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Abstract

We measure the value relevance of Tier 1 capital, regulatory adjustments, and Tier 2 capital of U.S. banks for the returns to common shareholders. Our research design relies on parsimonious log-linear regression models that mitigate shortcomings of conventional research designs. Results for the years 2001-2016 show that regulatory adjustments are weakly associated with market returns. The exceptions are positive adjustments, which are generally negatively correlated with market returns. More importantly, following the global financial crisis, the market response to changes in bank capital increases above its long-run norm of one. Departures from this norm are associated with excessive leverage. Response coefficients of measures of bank capitalization converge to one when the Tier 1 ratio increases to 12 percent.

JEL classification: E58, G21, G32, M41.

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1. Introduction

The global financial crisis prompted renewed attention to bank capital. In the wake of the crisis, rules on regulatory capital changed. New capital rules (Basel III) entered into force (BCBS, 2010, OCC, 2013). In anticipation of these rules, banks increased the level of regulatory capital, lowering their leverage (BCBS, 2018).

Attention to bank capital is focused predominantly on levels of capital, and views as to the benefits and costs of bank capital vary. Where Mehran and Thakor (2011), Admati, DeMarzo, Hellwig, and Pfleiderer (2016), Admati, DeMarzo, Hellwig, and Pfleiderer (2017), Berger and Bouwman (2013), Thakor (2014), Gambacorta and Shin (2016), and Firestone, Lorenc, and Ranish (2017) highlight the benefits of increased levels of bank capital, others express a more moderate position (e.g., Diamond and Rajan, 2001, Kashyap, Rajan, and Stein, 2008, DeAngelo and Stulz, 2013, Jordà, Richter, Schularick, and Taylor, 2017).

Surprisingly little has been written about the structure of regulatory bank capital or about the interaction between the structure and the level of capital. This is surprising for three reasons. First, regulation alters the structure of bank capital. Prudential bank regulation requires banks to apply adjustments to book equity to calculate regulatory capital, where book equity is the starting point of the calculation of solvency ratios (Federal Reserve, 2005, BCBS, 2010, FDIC, 2012, OCC, 2012). The adjustments are intended to exclude from capital items that do not contribute to the safety and soundness of the banking system, and include items that do. Examples of items that are deducted from book equity are goodwill, deferred tax assets (DTAs), mortgage servicing rights (MSRs), and unrealised gains on available-for-sale securities. Examples of items added to regulatory capital are specific perpetual securities, subordinated debt securities and unrealised losses on available-for-sale debt securities (Federal Reserve, 2005, 12 CFR 225, 2012). Consequently, regulatory capital differs from "accounting capital" or book equity. Non-common equity components can increase (decrease) Tier 1 capital up to 13.4 percent (24.4 percent) of risk-weighted assets. Tier 2 capital can increase regulatory capital by up to 14.9 percent of risk-weighted assets, see Table 2. These differences are economically significant. However, investors' responses to these differences are under-researched by academics.

Second, bank regulators consider the structure of regulatory capital to be important. For example, Basel III aims to raise both the *quantity* and the *quality* of regulatory capital (BCBS, 2010, paragraphs 8 and 9). Moreover, discussions regarding what items can or cannot count as regulatory capital, are often impassioned. A case in point is the controversy around mortgage servicing rights (MSRs, Harper (2010)). Under Basel III rules, these are now deducted from capital. Banks resisted this deduction, as shown by the response of Wells Fargo to the Basel III proposal:

> "[the proposal] ... would require that all intangibles be deducted from Common Equity. Although we believe there is sufficient uncertainty as to the realizable value of certain intangible assets to warrant their deduction, we do not believe that is the case for all intangible assets. Mortgage-servicing assets, nonmortgage-servicing assets and purchased credit-card relationships have shown themselves to have demonstrable realizable value over sustained periods."[1]

Third, non-common equity additions to regulatory capital have been criticised for lack of an ability to absorb losses (Ball, 2008, Collins, 2010). The alleged dysfunctional additions to regulatory capital were an important reason for the Basel Committee to amend the definition of capital after the onset of the global financial crisis.

[1] See www.bis.org/publ/bcbs165/wellsfargo.pdf

The reasons above prompt the question: what do we know about the relevance of the components that define regulatory capital? To answer that question, this paper examines the market value relevance of bank capital components, where we interpret value relevance in the same way as Barth, Beaver, and Landsman (2001) . However, unlike Barth et al. (2001) and many others, we use market elasticities of regulatory capital components to measure value relevance. These elasticities measure the effect of relative changes in bank capital components on market returns. They are derived from log-linear models, not the additive-linear models typically used in the literature to estimate response coefficients of market to changes in accounting values. Log-linear regression models mitigate important shortcomings of conventional research designs, which produce coefficient estimates that are hard to interpret, exhibit great volatility, and change from study to study (Lubberink and Willett, 2017).

Using data of U.S. bank holding companies covering the quarters from 2001 to 2016, we empirically examine the market elasticities of the following capital components: *i*) Tier 1 capital, *ii*) regulatory adjustments, and *iii*) Tier 2 capital. We compare the elasticities of these components to those of the book value of equity.

Components such as the book value of equity and Tier 1 explain well over 88 percent of the variation in bank market returns in regressions that pool observations over quarters. Coefficients of determination rise to 95 percent (93 percent) for bank book value of equity (Tier 1) when we rely on quarterly regressions. These R^2s are high compared to similar studies that use linear-additive regression models. For example, Brown, Lo, and Lys (1999) report R^2s that remain below 80 percent. Barth, Li, and McClure (2017), using Classification And Regression Tree (CART) analysis, model numerous variables to control for nonlinearities, reporting a maximum R^2 of 81.4 percent. This is close to the *minimum* R^2s we find: 82 percent for banks and 75 percent for non-financials. In contrast to these studies, our results rely on a parsimonious model. We use only the variables of interest (equity, Tier 1, capital components). Moreover, the elasticities associated with these variables are noticeably more stable than those reported by conventional research designs.

The market elasticity of book equity stays close to a value of one (1), with a pooled average of 1.02.[2] Values different from one show that changes in capital values fail to fully explain market returns. Following the global financial crisis, the market elasticities of equity and regulatory bank capital (i.e. Tier 1 and Total Capital) depart markedly from values of one, reverting back to unity once safer capital levels are restored. Elasticities of market returns above a long-run norm of unity are thus an indication of risky financial gearing.

The elasticities of regulatory adjustments are generally weaker than the elasticities on equity, Tier 1, or Total Capital, despite being the subject of (sometimes) intense debate. If we partition the regulatory adjustments into positive and negative, the former are associated with negative market elasticities, especially after the collapse of Lehman (2008Q3). In contrast, the market elasticities of negative regulatory adjustments (e.g. goodwill) are generally positive. This reveals a tension between prudential rules and the beliefs of equity investors, who appear to have a negative view on non-common equity items that increase regulatory capital, but a positive view on elements such as goodwill that the regulator deducts from capital.

Five particular regulatory adjustments are examined in detail: *i*) the deduction of goodwill and intangibles, *ii*) the deduction of deferred tax assets (DTAs), *iii*) the deduction of mortgage servicing rights (MSRs), *iv*) the prudential filter on unrealised gains and losses on available for

[2]See Section 3 and Lubberink and Willett (2017) for an explanation of the expected elasticity values.

sale (AFS) securities, and *v*) the inclusion of minority interests. These are the most significant adjustments on regulatory capital and were the subject of intensive discussion among regulators before the finalisation of Basel III (Simonian, 2010, BCBS, 2009, Enrich and Paletta, 2010).

The five regulatory adjustments have different market value relevance. The coefficient on the hotly debated MSRs and the prudential filter on unrealised gains and losses on AFS securities, for example, are largely insignificant and small. This last result is interesting given existing papers on this subject. Chircop and Novotny-Farkas (2016), for example, assert that the regulation on the recognition of unrealised gains and losses affects risk taking by banks. Another example is Barth, Gómez-Biscarri, Kasznik, and López-Espinosa (2017) who argue that "accounting for AFS securities gains and losses enables banks to manage regulatory capital and earnings in a variety of ways." However, from an investor's point of view, managing AFS securities appears to be inconsequential.

The market elasticity of Tier 2 capital is generally insignificant until the global financial crisis, when it becomes negative. This is likely the result of increases in banks' loan loss reserves, which predict future losses (Ng and Roychowdhury, 2014).

Lastly, an examination of the effect of leverage (or financial gearing) on the estimated elasticities shows that elasticity values that exceed the value of one are strongly correlated with excessive leverage. Once bank capitalization improves, the response coefficients on the main measures of bank capitalization (book equity, Tier 1, and Total Capital) converge to each other and to the value of one. These uniform coefficients correspond with a Tier 1 ratio of approximately 12 percent, close to results reported by Firestone et al. (2017), who document optimal bank capital levels of approximately 13 percent.

This paper contributes to the literature by documenting the value relevance of regulatory capital components for common shareholders. Using data of listed U.S. bank holding companies for all quarters of the years 2001–2016, we show that following the global financial crisis, the market response coefficients to changes in bank capital increase above their long run norm of one. The departures of the elasticities from their long run value disappear once bank capitalisation improves. Some capital components, however, appear to contradict the policy objectives of regulators. Positive adjustments to bank capital, which are meant to contribute to safety and soundness of the financial system, are negatively associated with market returns. In contrast, some negative adjustments, such as goodwill, are positively associated with market returns.

Our research design shows the benefits of log-linear regression models to assess value relevance. The elasticities estimated using these models show patterns over time that are easier to interpret than results produced by traditional research designs and correspond much more clearly to what we would expect, based upon events occurring in the wider economy.

2. Literature

To the best of our knowledge, no empirical studies thus far have comprehensively or collectively examined the relevance of separate components of regulatory capital for common equity investors. Many papers focus only on single items, in particular loan-losses (Moyer, 1990, Bushman and Williams, 2012), goodwill (Begley, Chamberlain, and Li, 2006), deferred tax assets of Japanese banks Skinner (2008), the allowance for loan and lease losses includible in Tier 2 capital (Kim and Kross, 1998, Ramesh and Revsine, 2000), prudential filters (Barth et al., 2017, Dong and Zhang, 2017, Kim, Kim, and Ryan, 2017). These papers predominantly examine levels of capital and the management thereof. For example, in a study of commercial banks, Beatty, Chamberlain, and Magliolo (1995) examine factors that banks may use to manage tax, regulatory capital, and earnings. Similarly, Kim et al. (2017) show that banks mitigate regulatory capital volatility by way of classifying an increased proportion of investment securities as held to maturity.

Regarding Tier 2 capital, Ng and Roychowdhury (2014) document a positive association between the allowance for loan and lease losses includible in Tier 2 capital, an "add-back" to capital, and the risk of bank failure. Their study confirms the results of Laeven and Majnoni (2003), who show that banks tend to postpone provisioning. Results of studies examining Tier 2 capital may not be generalizable for all capital components or banks, in particular for going-concern banks. Tier 2 capital is increasingly seen as "gone concern" capital. As opposed to Tier 1 capital, which absorbs losses in going concern by the deduction of losses from book equity, Tier 2 capital can be drawn down to limit "losses given default" or LGD. Tier 1, on the other hand, should reduce the probability of a bank defaulting (PD). Basel III formalizes the distinct roles of Tier 1 and Tier 2. The former has a going-concern role, and the latter has a gone-concern role (BCBS, 2010, 2011).

The literature on regulatory capital acknowledges that bank capital is expensive, with recent empirical findings shown by Plosser and Santos (2018). Two important factors that drive the high cost of bank capital are subsidised debt and the benefits forgone by less-intense creditor monitoring. Tax deductibility of debt increases firm value with leverage (Modigliani and Miller, 1963). In the presence of a regulatory safety net that mitigates the effects of bank failure on the financial system, banks may increase leverage beyond levels generally observed in corporate firms. Berger, Herring, and Szegö (1995) document that the leverage of banks has increased from about 1:1 in 1840 to about 14:1 at the end of the twentieth century. Moreover, the increases in leverage documented by Berger et al. coincide with regulatory initiatives that "widened" the safety net for banks Clair (1984).

The literature on creditor monitoring highlights the special role of banks in society as financial intermediaries. This literature acknowledges the limits of low leverage. More capital may "crowd out" creditors and depositors, which may lower managers' commitment to collect cash flows from debtors (Diamond and Rajan, 2001).

In contrast, Admati et al. (2016) argue that the global financial crisis has demonstrated the limits of creditor monitoring. Admati et al. therefore highlight the benefits of high levels of capital. Empirical papers supporting Admati et al. (2016) include Mehran and Thakor (2011), who show that bank value increases with capital. Berger and Bouwman (2013) show that banks' odds of surviving a crisis increase with capital. Firestone et al. (2017) show that the economic benefits of higher capital ratios outweigh the economic cost, with the net GDP benefit reaching a maximum when capital ratios are between 13 percent and 25 percent, depending on the assumptions made about the costs and benefits of financial crises. But the jury is still out: Jordà et al. (2017) show empirical evidence that contradicts studies that merit high capital ratios. Using data from 17 countries over the years 1870 to 2013, they demonstrate that the capital ratio is poor indicator of systemic financial crises.

Studies on bank capital ratios employ research designs that use ratios to adjust variables by a measure of scale. For example, Demirgüç-Kunt, Detragiache, and Merrouche (2013) look at the link between different solvency ratio definitions and stock market performance. Their explanatory variables are all deflated by a scale factor. Another paper is Yang (2016), Vallascas and Hagendorff (2013), who compare the leverage ratio with the risk-weighted capital ratio to examine which ratio is a better predictor of failure. The problems of statistical specification introduced by deflated variables are well-known and we avoid these in our research design.

Studies that use "un-scaled" variables can be found in the accounting literature, see for example Ali and Zarowin (1992) who show that earnings levels explain returns. Subsequent studies e.g. Barth (1994), Dhaliwal, Subramanyam, and Trezevant (1999), Barth and Clinch (2009) document the relevance of accounting information using variations of the following model:

$$M_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_j \cdot A_{n,i,t} + \varepsilon_{(i,t)} \qquad (1)$$

where $M_{i,t}$ is the market value and $A_{n,i,t}$ a list of n accounting variables for the i^{th} firm all at, or in the year (or quarter) to, time t. The intercept term, β_0, and the slope coefficients, β_n, are assumed constant in the simplest models, interpreted as averages across firms, with the error term, $\varepsilon_{(i,t)}$, assumed to be approximately normally distributed for inferential purposes. The explanatory variables in the most basic fundamental analysis are book equity and income.

These additive "un-scaled" models are also not free of problems, as documented by Easton (1998), who shows that the coefficients of these models too suffer from problems related to scale. Easton therefore recommends using scaled variables. Lubberink and Willett (2017) however show that the market-book relation actually takes the form of a power law and that distributions of market value and fundamental accounting variables such as earnings and dividends are close to being jointly lognormal. This makes log-linear models a natural choice for estimating response coefficients in the market-accounting relation as elasticities, and not as per-unit of change coefficients derived from the linear-additive models typically assumed in prior research. We therefore use the modelling approach suggested by Lubberink and Willett.

3. Hypotheses

We expect the market elasticity of measures of bank capital to be positive and close to 1. This indicates that these accounting-based measures of capital are sufficient by themselves to explain nearly all of market returns in the long-run. Formally, therefore our main hypothesis is:

Hypothesis 1 *The market elasticity of measures of bank capital are positive and close to 1.*

When we disaggregate book value into Tier 1 and net adjustments (where net adjustments equals Tier 1 minus the book value of equity), we expect the market elasticity of adjustments that decrease Tier 1 relative to equity to be positive given that banks need to replenish any deduction by new capital. This lowers a bank's probability of default.

Hypothesis 2 *Negative regulatory adjustments have positive elasticities of market value.*

We might expect increases in Tier 1 capital relative to equity would lower a bank's probability of default. However, these adjustments are often hybrid capital instruments that are equity in all but name, and because they dilute equity, they may not be valued by holders of common stock. For reasons of symmetry with hypothesis 2, therefore, our next hypothesis is framed as follows:

Hypothesis 3 *Positive regulatory adjustments have negative elasticities of market value.*

Finally, we expect the market elasticity of Tier 2 to be negative, given that this component of regulatory capital is gone concern capital, and that it is for a significant part determined by loan loss reserves or expected losses, as shown by Ng and Roychowdhury (2014).

Hypothesis 4 *The Tier 2 elasticity of market value is negative.*

4. Research design

Our choice of the research design departs from existing literature examining the relationship between stock price returns (or stock prices) and fundamental values. Lubberink and Willett (2017) show that the relation between market and fundamental accounting values is multiplicative rather than additive, of the following form:

$$M_t = \nu \prod_i |A_i|_t^{\beta_i} \tag{2}$$

where $A_i,\ i = 0, 1, \ldots$ are lognormally distributed accounting variables that reconcile opening book value of equity B_{t-1} with its closing book value B_t. $A_{0,t}$ denotes B_{t-1}. ν is a constant scale factor relating M to the product of the $|A_i|$, and κ is a constant scale factor relating M to $|B|$. To estimate this model with ordinary least squares, we convert it to a linear model where the lowercase variables are the logs of the absolute values of $A_{i,n}$:

$$m_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot a_{n,i,t} + \varepsilon_{i,t} \tag{3}$$

where $a_{n,i,t}$ comprises the following, end of quarter (N) variables: *i*) *BV*. This is book value excluding perpetual preferred stock [3210]–[3283][3]; *ii*) *Tier 1*. This is Tier 1 capital [8274] for pre-Basel III quarters and the Common Equity Tier 1 capital [P859] under Basel III; *iii*) *Tier 2*. This is Supplementary Capital [5311]; *iv*) *Net Adjustments*. These are net prudential adjustments,

[3]The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary

defined as Tier 1 minus BV, both as previously defined; *v*) *Pos Adjustments*. These are adjustments that increase Tier 1 relative to equity; and *vi*) *Neg Adjustments*. These are adjustments that decrease Tier 1 relative to equity.

We use logs of absolute values of the variables in the regression models, which produce estimates of elasticities that are matrix-weighted averages of the elasticities of the positive and negative values of these variables. Lubberink and Willett (2017) demonstrate that the concern that the use of absolute values restricts modelling to the use of variables with positive values only is not justified.

5. Sample selection and data

Our main sample uses quarterly data from U.S. bank holding companies submitted on report FR Y-9C to the Federal Reserve System.[4] The regulatory adjustments are taken from the report's Schedule HC-R–Regulatory Capital. Table 1 specifies the adjustments, as well as their average impact on regulatory capital. The table shows that non-common equity instruments (e.g. Trust Preferred Securities and Perpetual Stock) and minority interests dominate the positive adjustments.[5]

[Table 1 about here]

The negative adjustments are dominated by Goodwill and Intangibles, Unrealised gains on Available-For-Sale (AFS) securities, Deferred Tax Assets (DTAs), and Mortgage Servicing Rights (MSRs). We use market data for bank holding companies with a link to Center for Research in Security Prices (CRSP) data obtained via the New York Federal Reserve Banking Research Dataset web-

[4] To compare our results against data from non-financial companies, we also use data from Compustat where we exclude firms with SIC codes between 6000 and 6799 (financials) and between 4000 and 4999 (regulated industries), see Table 3 and Figure 1.

[5] See Lubberink (2015) for a comprehensive description of regulatory adjustments.

site.[6] The starting point of the sample is the first quarter of 2001. From that quarter onward, the reporting schedule for regulatory capital on FR Y-9C retained its current structure with only minor changes. The sample includes observations up to the last quarter of December 2016. All observations have December 31 year-ends.

[Table 2 about here]

The table shows that size variables, e.g. market value (M), book value of equity (BV), Total Assets are skewed, with the largest bank more than 40 times larger than the bank at percentile 95. This further justifies our reliance on elasticities, because these are scale free.

A comparison of Tier 1 values to BV shows that the former is generally smaller than the latter, which is the result of regulatory adjustments. Of the prudential adjustments, the deductions ($878M) are on average larger than positive adjustments ($371M), leading to an average net deduction from equity of $507M.

The Tier 1 ratio is 12.2 percent, which is comparable to existing studies. Under pre-Basel III rules, banks were allowed to report the same amount of Tier 2 capital as Tier 1 capital. In practice, however, the ratio of Tier 1 to Tier 2 capital is less symmetric: the average Tier 1 amount ($2,110M) is significantly larger than the average Tier 2 amount ($599M). The Tier 1 ratio is also higher than the Tier 2 ratio (1.65 percent).

The average regulatory adjustments are relatively small. The mean net adjustment is −92 basis points of RWA, with negative adjustments depressing the Tier 1 ratio by 2.74 percent of RWA.

[6] See: www.newyorkfed.org/research/banking_research/datasets.html

However, maximum and minimum values of the adjustments and values at the outer percentiles show that the regulatory adjustments can have a significant effect on regulatory capital.

Our sample contains 21,862 quarterly observations, with the number of observations varying from 1,580 in 2001 to 1,043 in 2016, with a peak of 1,692 in 2003. The primary cause of the drop in the number of banks after 2005 is a change in the filing requirements for bank holding companies: in 2006, the threshold for filing a FR Y-9C report changed from $150 million in total assets to $500 million in total assets (Federal Reserve, 2006).

During the sample period, the Tier 1 ratio ranged between 10.7 percent and 14.4 percent, with lows during crises. Financial gearing, i.e the ratio of Total Assets to Book Equity, reaches a value of 12.52 in 2009. It then drops to its minimum value of 9.05 in 2016. The two bottom rows of the lower panel of Table 2 show the effect of Basel III: deductions are significantly higher and positive adjustments are significantly lower than under pre-Basel III rules.

6. Results

6.1. Main Results

Table 3 highlights the main results of our analysis. The top panel shows results of pooled regressions, with t-values that rely on Petersen (2009) to control for two-way clustering of observations. To avoid econometric problems related to the use of time-series and panel data analyses, we perform quarterly cross-section regressions, the average response coefficients of which are shown in the bottom panel, with Fama and MacBeth (1973) t-values. These are calculated as the ratio of the sample mean to the standard error of the distribution of the estimated coefficients, divided by the square root of the number of quarterly cross-sections (64).[7]

[Table 3 about here]

Note that the coefficient values in the top panel are similar to those reported in the bottom panel. Given the similarities, we will concentrate on the top panel coefficients and discuss the bottom panel coefficients only when they diverge markedly from those reported in the top panel.

The summed coefficients in the column next to the column of intercepts should be closer to one than any of the single coefficients, which is the case for all regression models shown in the table. The $\overline{R}^2$ values show that, with respect to banks, our model explains at least 88 percent of the variation in market returns using the pooled data.

The first row of the top panel shows a highly significant coefficient value of 1.02 on book value of bank equity (BV). This indicates a one percent change in book value is associated with a 1.02 percent change in market value.

The second rows of both panels of Table 3 show book value elasticities for non-financial firms of which we sourced data from Compustat. The elasticities of the non-financial firms are also close to but lower than 1.

The third and fourth rows show results of regressions of market values on bank Tier 1 and Total capital (TC). The elasticity on Tier 1 is greater than that on the book value of equity. The

[7]For Tier 1, Total capital, and book value of equity (BV), we calculate t-values where the numerator is the difference between the sample mean and the theoretically expected value of 1.

coefficient on Total capital, is lower than Tier 1 but still higher than that on equity, although the difference in the latter case is small. These findings support rejecting hypothesis 1.

We find very high t-values throughout our analyses, therefore we use graphs to report the evolution of coefficients over our sample period without noting t-values. Figure 1 summarises estimates of the elasticities of market value for the book value of bank equity, the book value of non-financials equity, bank Tier 1 capital and bank Total capital, in quarterly cross sections for the period 2001–2016. The figure shows that in the years before the global financial crisis (the area between the two grey bands), the market elasticities of book values, Tier 1, and Total capital remained relatively stable, and above the value of one. We discuss the reasons for the higher elasticity on Tier 1 capital relative to equity in Section 7.

[Figure 1 about here]

During the global financial crisis, however, the elasticities temporarily drop to values closer to one. The elasticities then start rising from the second quarter of 2009. From mid-2010 through to the end of 2016, the elasticities converge to 1 and to each other. This is associated with improvements in the capitalisation of banks, a point we will address in Section 7. Regarding non-financial firms, the dotted line shows that the market elasticities of book values are more stable over all years, and slightly below one.

Rows V of Table 3 show results of a pooled regression where we split the book value of equity into Tier 1 capital and net regulatory adjustments. The market elasticity of net regulatory adjustments is negative and significant. A similar result is reflected in the quarterly cross-section elasticities shown in Figure 2.

[Figure 2 about here]

The figure shows that net regulatory adjustments were not associated with market returns in the lead up to the global financial crisis. Only during the fourth quarter of 2008, the market elasticities of net regulatory adjustments start to turn negative. The adjustments turn to positive values in 2015, which we see as a manifestation of Basel III's drive to curb positive regulatory capital additions.

Rows VI show negative coefficients on positive regulatory adjustments (–0.13) and a positive coefficients on negative regulatory adjustments (0.07). Consequently we cannot reject hypothesis 2 and hypothesis 3. The coefficients are significant and show that a relative increase of negative (positive) adjustments is associated with positive (negative) returns. A relative increase in items that augment Tier 1 capital is associated with negative market returns, which suggests that investors discount banks' efforts to increase Tier 1 by way of increasing non-common equity. An explanation for the negative coefficient on positive adjustments is that equity investors expect Tier 1 capital instruments to dilute cash flows at their expense and that Tier 1 instruments are incorrectly priced: coupons on Tier 1 instruments are high and may not reflect market perceptions of their true, possibly overstated, loss absorbing capabilities. The coefficients of positive adjustments more than offset those of the deductions, leading to a negative coefficient on net regulatory adjustments.

Figure 3 shows the values of the cross section estimates of elasticities on additions and deductions over time. The "gap" between the positive and negative adjustment elasticities widens during the global financial crisis, with a steep decline in the coefficient value for additions during the fourth quarter of 2008.

[Figure 3 about here]

However, from 2010 onward, the coefficient on positive regulatory adjustments converges to zero as bank capitalisation improves.

The seventh rows of both panels in Table 3 (Model VII) include Tier 2 as an explanatory variable. The coefficient on this variable is negative and significant. This result is as expected and we do not reject hypothesis 4. The Tier 2 elasticity is negative, which can be attributed to banks increasing Tier 2 to compensate for recognising loan losses in Tier 1 capital. This result confirms the findings reported by Ng and Roychowdhury (2014), who, for a sample of failed banks, show that Tier 2 behaves like a loan loss reserve. As our estimated coefficients are long-run elasticities, we infer from this that the recognition of loan losses is less transitory than the literature suggests. Our results therefore support Badertscher, Burks, and Easton (2014) who argue that losses recognised by banks are more permanent than losses recognised by corporates. Figure 4 shows the evolution of the relevant elasticities.

[Figure 4 about here]

Rows VIII include variables for additions, deductions, and Tier 2. The results for these variables are similar, in particular with respect to the elasticities of additions and deductions. The significance of the market elasticity of Tier 2 drops, which is explained by the drop in sample size and by the observation that the coefficient of Tier 2 is positive in some quarters, see Figure 4.[8] The bottom panel shows a significant *t*-value for the Tier 2 coefficient.

[8]The drop in sample size is because we use logged variables and some of the gross positive and negative adjustments are zero, where the net of both is non-zero.

Row IX repeats the regressions and control for the change in the filing requirements for bank holding companies in 2006 when the threshold for filing a FR Y-9C report changed from $150 million of total assets to $500 million of total assets (Federal Reserve, 2006). Note that the coefficients are not overly sensitive to size, row IX shows virtually the same coefficient values as those reported in rows VIII. These stable coefficient values contrast to those reported by, for example, Demirgüç-Kunt et al. (2013), who document coefficient values that are size-sensitive.

Table 4 and Table 5 examine the behaviour of the main coefficients of our analysis over time more formally. Table 4 reports coefficients of regressions ran on quarterly data, whereas averages of these coefficient values are shown in Table 5.

[Table 4 and Table 5 about here]

Table 4 shows that elasticities for Tier 1, Positive adjustments, and Negative adjustments are generally significant. The coefficient of determination for the cross section regressions is high, ranging between 0.82 and 0.97 with an average of 0.95. The sum of coefficients on average is 1.08, with a maximum (minimum) of 1.17 (0.97).

Table 5 displays average values of the cross-section coefficients shown in Table 4 for all quarters, for quarters affected by both the dot.com crisis and the global financial crisis, for quarters after the dot.com crisis and before the onset of the global financial crisis (or GFC), for quarters after the fall of Lehman, and for quarters after the Federal Reserve Board approved the final rule on the implementation of Basel III in July 2013.[9]

[9]See the press release "Federal Reserve Board approves final rule to help ensure banks maintain strong capital positions" of July 2, 2013 www.federalreserve.gov/newsevents/pressreleases/bcreg20130702a.htm

In defining these periods, we follow Berger and Bouwman (2013) and Demirgüç-Kunt et al. (2013) and designate non-crisis quarters as those from 2002Q4 to 2007Q2 and from 2009Q2 to the present. We designate crises quarters as those that were affected by the dot.com or market crisis ($t < 2002Q4$) and the global financial crisis: $t > 2007Q2$ and $t < 2009Q2$. We designate pre-crisis quarters as those between the dot.com crisis and the global financial crisis. Quarters after the fall of Lehman Brothers on September 15, 2008 are designated as post-Lehman quarters, which are characterised by heightened regulatory uncertainty. The announcement of the final rule on the implementation of Basel III marks an era of regulatory and financial calm. The bottom rows of Table 5 show the difference of average coefficient values for the post-Lehman period and the pre-crisis period.

The table confirms the main results reported above. Moreover, the results in the last row confirm significant differences in the coefficient values of regulatory adjustments before and after the fall of Lehman.

6.2. Results for goodwill, DTAs, MSRs, unrealised gains and losses, and for minority interests

Table 6 shows results for the regulatory adjustments that top the two panels of Table 1 or that attracted regulatory attention in the time before finalisation of Basel III. These are *i*) the deduction of goodwill and intangibles, *ii*) the deduction of deferred tax assets (DTAs), *iii*) the deduction of mortgage servicing rights (MSRs), *iv*) the prudential filter on unrealised gains and losses on available for sale (AFS) securities, and *v*) the inclusion of qualifying minority interests in consolidated subsidiaries. We refer to Figures 5 and 6 to illustrate our results.

[Table 6 and Figures 5 and 6 about here]

The first column of Table 6 shows that the market elasticity of goodwill based on pooled data is positive and significant (0.05, t-value of 9.14). Despite regulators excluding goodwill from equity without a great deal of discussion (the deduction has basically not changed since the first Basel accord (BCBS, 1998)), markets value this adjusted item positively. This is noteworthy. A large literature on accounting conservatism places low value on soft assets such as goodwill and intangibles on the basis that they cannot be used for contracting purposes and do not contribute to an orderly liquidation of a company (Holthausen and Watts, 2001).

The market elasticity of DTAs is negative (–0.05, t-value of –9.15). This indicates that investors do not have a positive view about the value of DTAs, a view reflected in prudential regulations.

The coefficient on mortgage servicing rights is insignificant, which is also noteworthy given that at the time of the Basel III negotiations, MSRs were controversial. One the one hand, mortgage servicing rights (MSRs) are believed to create value, for instance,[10]

> "It's just astonishing to me that you would give zero value to a fundamental element of the mortgage business." Harper (2010)

On the other hand, a study by the Federal Reserve Board presented a more critical view on MSRs, claiming that their valuations are inherently subjective and uncertain. According to this study, MSRs were a factor contributing to the failure of four insured depositories during the recent credit cycle, supporting the exclusion of MSRs from capital.

[10]This position was supported by the American Bankers Association, who opposed the deduction of MSRs in its comment on the Basel III consultative document BCBS (2009). See the ABA's comments on www.bis.org/publ/bcbs165/cacomments.htm

The coefficient on the prudential filter on AFS securities is only marginally significant for the add-back of unrealised losses, despite being controversial (Ball, 2008). The deduction of unrealised gains is economically and statistically insignificant in a pooled regression. However, in applying a Fama and MacBeth approach, as in Table 5, both coefficients are significant but small: 0.01 (t-value 9.57) for the deducted unrealised gains and 0.02 (t-value 2.76) for the addition to capital of unrealised losses (not tabulated). The fact that the market elasticities for unrealised losses on AFS securities is positive can be explained by the low incidence of impairments, as documented by Badertscher et al. (2014): banks will hold these securities until their values pull to par at maturity. Overall, these results reveal the limited economic significance of the prudential filter on AFS securities, contrary to existing papers (Barth et al., 2017, Chircop and Novotny-Farkas, 2016).

The results for minority interests are mixed. In the pooled regression, the coefficient is insignificantly different form zero. However, applying a Fama and MacBeth approach renders the coefficient negative and significant. This indicates that an increase in minority interests is associated with negative returns. This suggests that minority interests are viewed by investors as more debt-like than equity like, despite the Financial Accounting Standards Board (FASB) Statement No. 160, which classifies minority interests as equity (FASB, 2008, Frankel, Lee, and McLaughlin, 2010).

7. Additional tests

7.1. Results for Capitalisation Deciles and Gearing

Our results show that the elasticities on equity, Tier 1, and Total Capital often exceed the value of one, in particular when it concerns banks before and during the global financial crisis. This prompts the question as to why these elasticities are higher than one. To answer this question, we perform two tests. First, we sort our sample in deciles based on Tier 1 capital ratios for each sample quarter. Table 7 and Figure 7 show the results based on ordering the sample by Tier 1 decile. Figure 7 includes results from the same regressions, and additionally displays results examining the book value of equity and Total capital.

[Table 7 and Figure 7 about here]

It is evident that the elasticities of all three measures of capital monotonically decline until the fifth decile and then level out. This convergence of metrics for well-capitalised banks is confirmed by the BIS Annual Economic Report 2018, which shows that the differences between measures of bank solvency become smaller when bank resilience increases and PD values drop (BIS, 2018, Graph III.4).

Interestingly, the Tier 1 ratio that corresponds with the fifth decile is about 12 percent, which closely matches results of Firestone et al. (2017), who document optimal bank capital levels are at least slightly over 13 percent.

Second, we measure financial gearing for all quarters of the sample period, where we define gearing as $\frac{TA}{BV}$, the reciprocal of an accounting leverage ratio. Figure 8 superimposes the gearing variable over Figure 3. The black dotted line shows the evolution of gearing and reflects the values of the right-hand side vertical axis. The figure also shows the correlation coefficients between gearing and the elasticities of Tier 1, positive adjustments, and negative adjustments.

[Figure 8 about here]

The figure shows a strong correspondence between gearing and Tier 1 elasticity values. The correlation coefficient between gearing and the Tier 1 elasticity is 0.706 and the associated *p*-value is zero. We interpret this result as a manifestation of the risk-return relation, in line with Bhagat, Bolton, and Lu (2015). The correlation coefficient on positive regulatory adjustments is –0.568, again highly significant. We interpret that as positive adjustments conveying slightly less information about risk than Tier 1 does. The correlation coefficient on negative regulatory adjustments (0.300) is weakly related to gearing, indicating that these adjustments convey less information about risk than does Tier 1. Untabulated results show that the correlation between gearing and Tier 1 elasticitity and gearing and positive regulatory adjustments elasticities are the strongest. For example, the correlation coefficient between gearing and the elasticity on goodwill is 0.370, the correlation coefficient between gearing and the elasticity on MSRs is 0.079.

The results of this subsection confirm that poorly capitalised banks display higher Tier 1 elasticities of market value. These departures from the long run norm of one are a sign of risk or excessive leverage. Further, the market sees the long run minimum Tier 1 ratio as being close to 12 percent.[11]

7.2. The relevance of non-common equity financials versus non-financials

Our results show that the market elasticities of non-common equity items (e.g. preferred stock) are generally negative. To demonstrate that this relationship is not a statistical artefact of the models, we compute the market elasticities of preferred stock of non-financial firms. We use CRSP and Compustat data for the same period as the one that we use for our main analyses. Specifically, we

[11] Additional regressions that control for the inclusion of negative (positive) regulatory adjustments in book value (Tier 1), or regressions where book value replaces Tier 1as a regressor, lead to results that do not affect our inferences.

use quarterly market values from CRSP and Compustat items *ceqq* and *pstkq* for the book value of common equity and preferred stock, respectively. From the CRSP and Compustat data, we exclude firms with SIC codes between 6000 and 6799 (financials) and between 4000 and 4999 (regulated industries). Figure 9 shows the results of this examination.

[Figure 9 about here]

The figure shows positive market elasticities for preferred stock in all but three quarters (2007Q3–2008Q1). Results from an untabulated pooled regression shows that the coefficient of the book values of common equity is 0.81 with a t-value of 45.6, and the coefficient on preferred stock is 0.05 (t-value of 4.92). From this we conclude that the relation between positive adjustments to bank capital and negative market elasticities on those adjustments is not a statistical artefact.

8. Conclusion

We measure the value relevance of regulatory bank capital components. Specifically, we measure the value relevance of *i*) Tier 1 capital, *ii*) regulatory adjustments, and *iii*) Tier 2 capital of U.S. bank holding companies from 2001 to 2016.

We establish that our research design, which relies on parsimonious log-linear regression models, validly measures the market response to relative changes in regulatory bank capital components. Our research design thus overcomes problems of many conventional studies.

Our main results then show that following the global financial crisis, the market response coefficients to changes in measures of bank capital increase above their long run norm of one, with the elasticities on bank measures of capital generally greater than the elasticities on book value of equity. The departures of the elasticities from their long run value disappear once bank capitalisation improves.

The regulatory adjustments are generally weakly associated with market returns, despite being the subject of (sometimes) intense debate. The exceptions are the adjustments that increase bank capital relative to book equity. These positive adjustments (e.g. Tier 1 preferred securities and Tier 2 capital) are negatively correlated with market returns, especially after the onset of the global financial crisis.

A further examination shows that the departures from the norm of one of elasticities of measures on bank capital indicate excessive gearing. Banks that are highly geared account for most of the differences between the elasticities of measures on regulatory capital and the value of one. Moreover, the cause of the divergences between elasticities on bank capital and book equity are correlated with gearing in such a way that these differences disappear after the global financial crisis, coinciding with a long run Tier 1 ratio of 12 percent.

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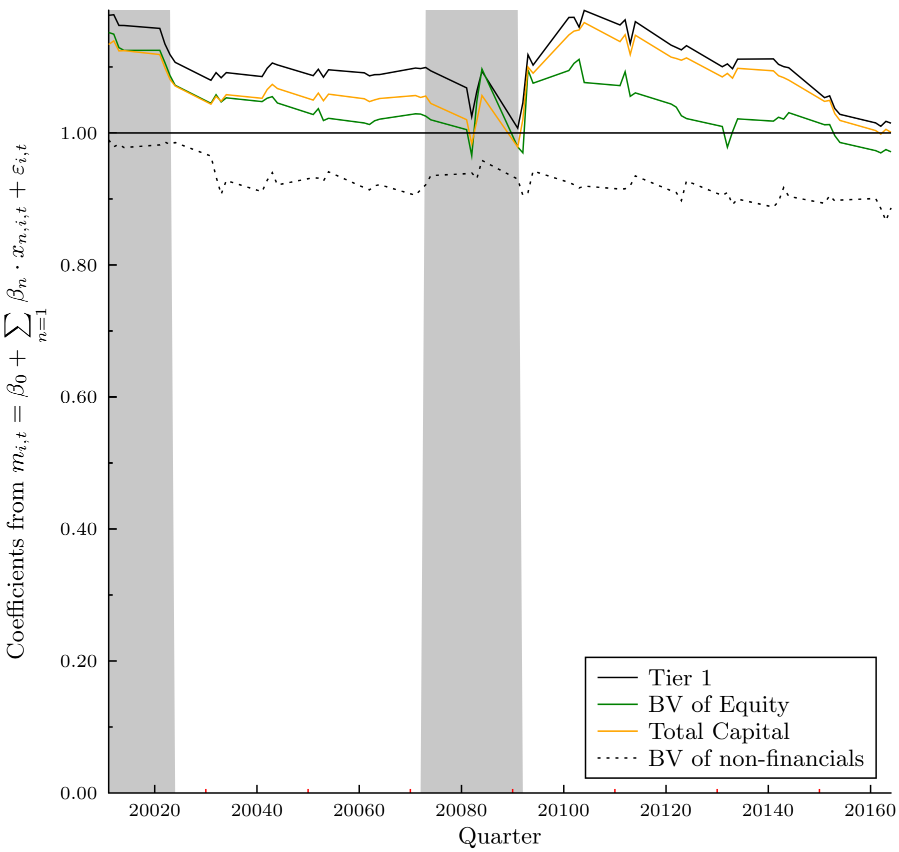


Figure 1: Comparison of market elasticities. $m = f(t1)$, $m = f(bv)$, $m = f(tc)$, where the variables are logged absolute values of the market value at the end the quarter (m); Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III *(t1)*; the book value excluding perpetual preferred stock at the end of the quarter (bv); and total regulatory capital (tc).

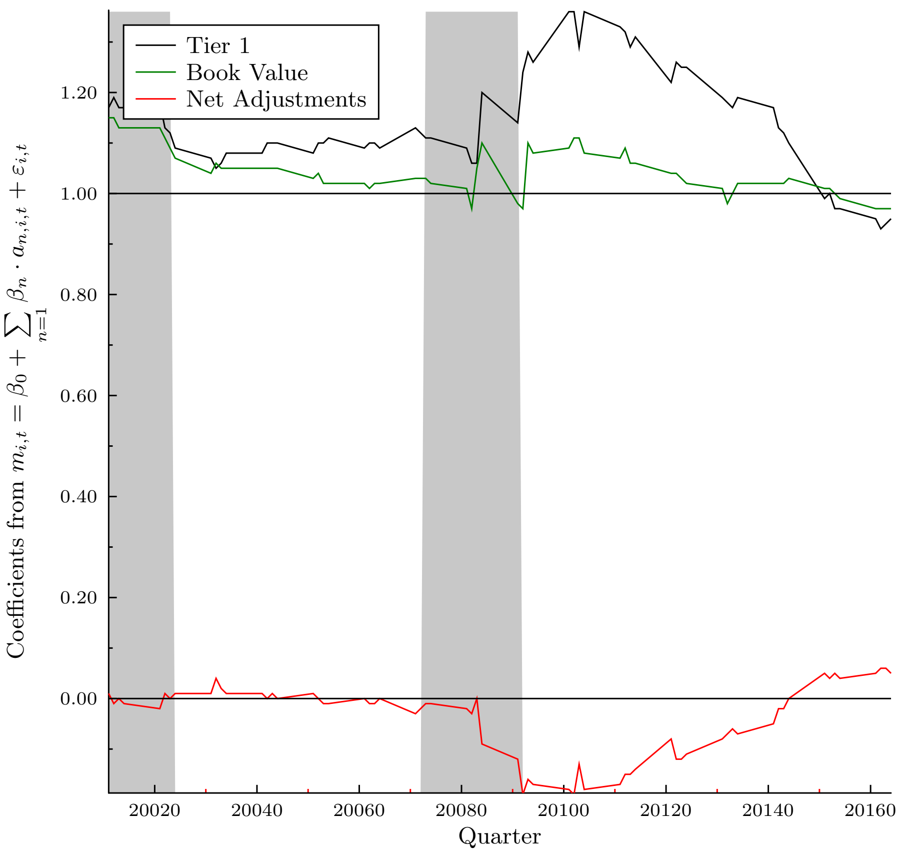


Figure 2: Comparison of market elasticities for $m = f(bv)$ and $m = f(t1, \Delta)$. Variables are logged absolute values of the market value at the end the quarter (m); Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III *(t1)*; the book value excluding perpetual preferred stock at the end of the quarter (bv); and the net value of regulatory adjustments (Δ).

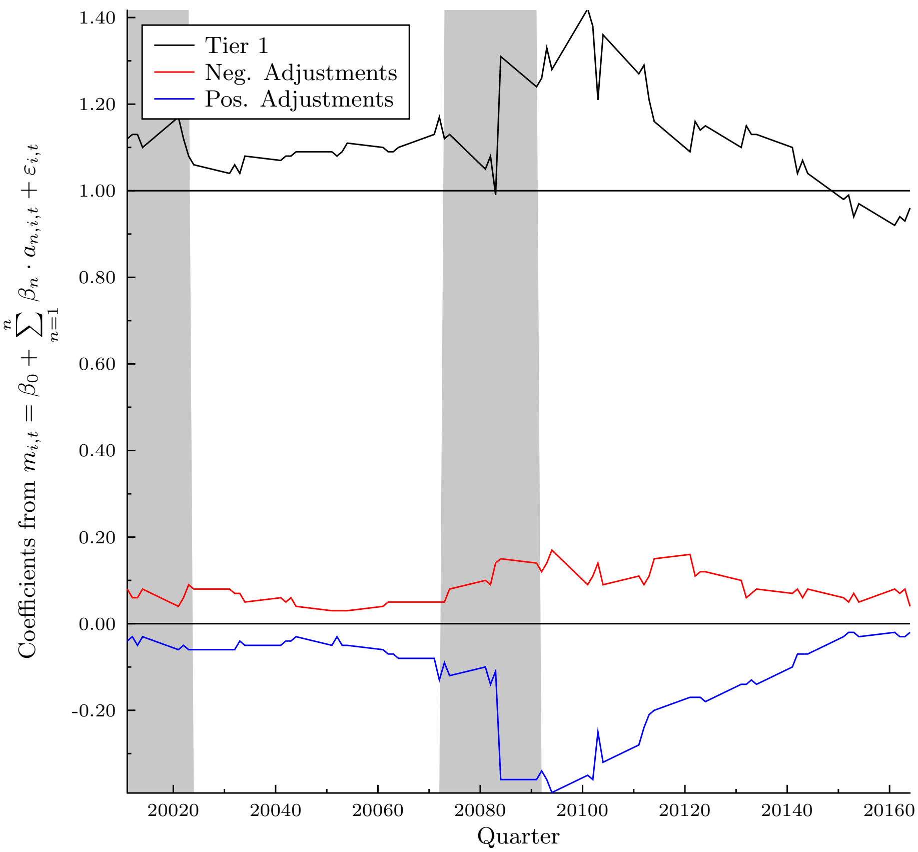


Figure 3: Comparison of market elasticities for $m = f(t1, \Delta^+, \Delta^-)$. Variables are logged absolute values of the market value at the end the quarter (m); Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III *(t1)*; adjustments that increase Tier 1 or CET1 relative to equity (Δ^+); and adjustments that decrease Tier 1 or CET1 relative to equity (Δ^-).

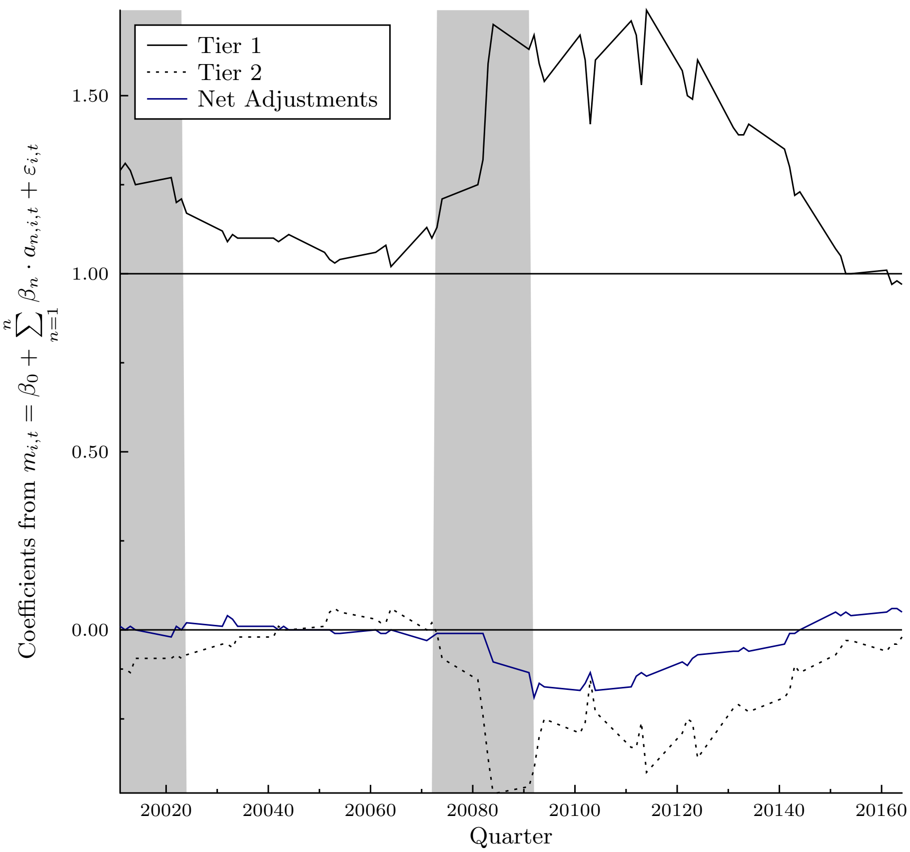
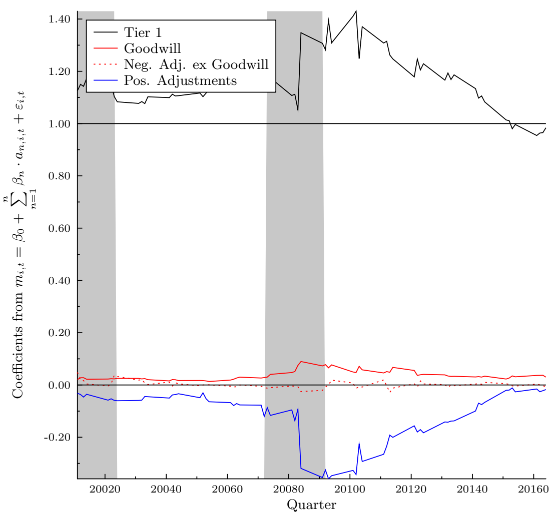
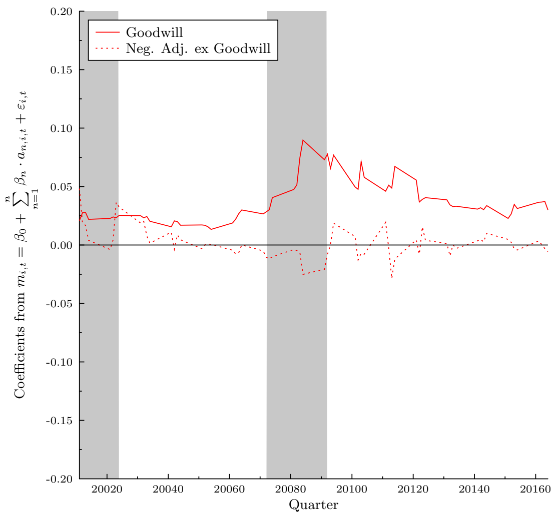


Figure 4: Comparison of market elasticities for $m = f(t1, t2, \Delta)$, where the variables are logged absolute values of the market value at the end the quarter; Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III *(t1)*; Tier 2 or Supplementary Capital *(t2)*; and the net value of regulatory adjustments (Δ).

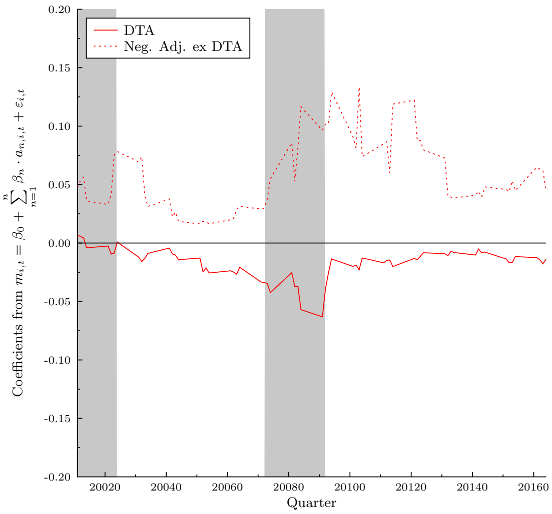


Panel 1: Comparison of market elasticities for deducted goodwill: $m = f(t1, gw, \Delta^{-'}, \Delta^{+})$, where variables are logged absolute values. $\Delta^{-'}$ is negative regulatory adjustments excluding the prudential adjustment for goodwill. Δ^{+} are adjustments that increase Tier 1 or CET1 relative to equity.

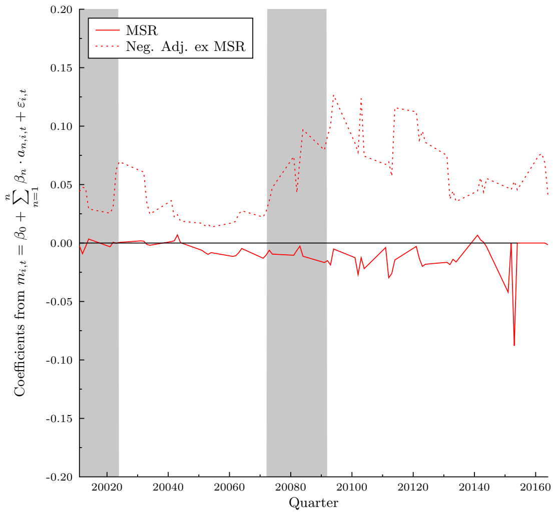


Panel 2: Comparison of market elasticities for deducted goodwill – enlarged. Unlike the graph to the left, the elasticities of Tier 1 and the positve regulatory adjustments are not shown.

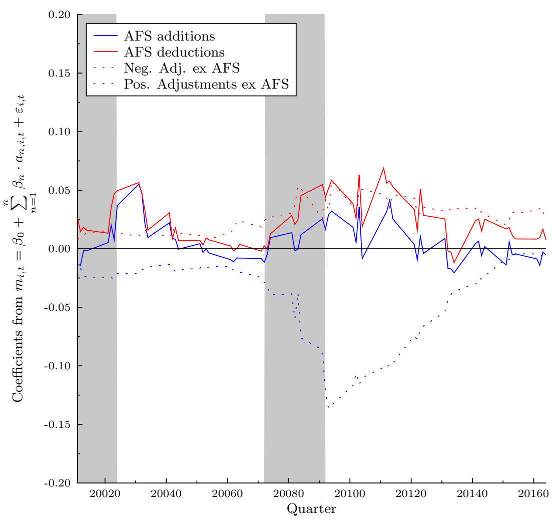
Figure 5: Market elasticities for the prudential filter on goodwill.



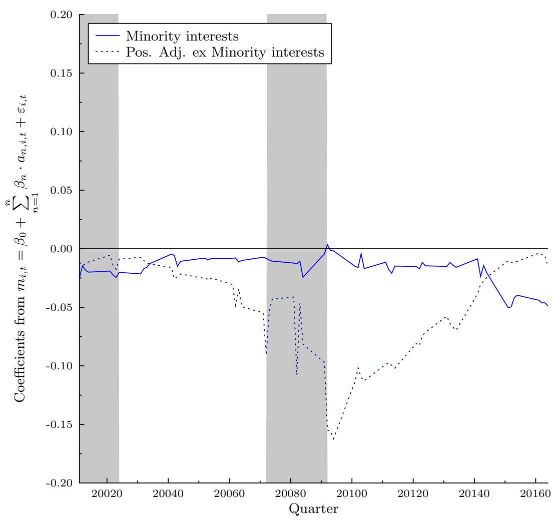
Panel 1: Deferred Tax Assets



Panel 2: Mortgage Servicing Rights



Panel 3: AFS



Panel 4: Minority interests

Figure 6: Market elasticities of the other main regulatory adjustments. $m = f(t1, x, \Delta^{-'}, \Delta^{+'})$, where the variables are logged absolute values of the market value and x, where $x \in \{DTA, MSR, AFS, Minority\}$. The regulatory adjustments , i.e Δ^{+} and Δ^{-} exclude x, hence the prime symbol in $\Delta^{+'}$ $\Delta^{-'}$.

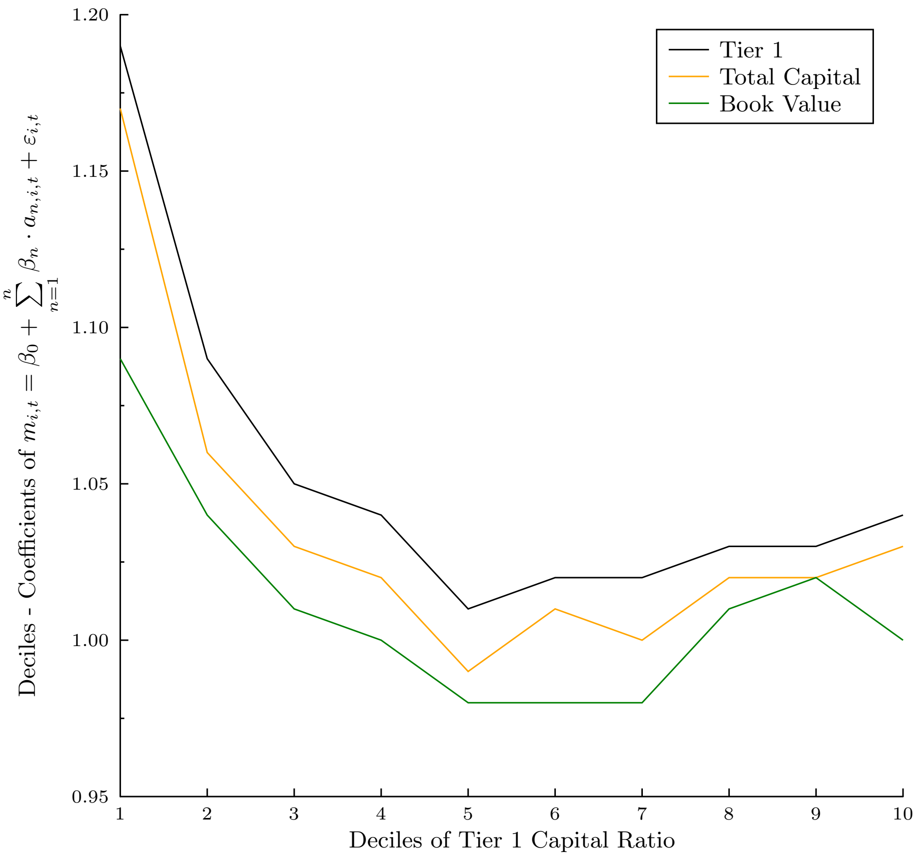


Figure 7: Comparison of market elasticities for $m = f(t1)$, $m = f(tc)$, $m = f(bv)$; variables are logged absolute values of the market value at the end the quarter (m); Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III *(t1)*; total regulatory capital (tc); and the book value excluding perpetual preferred stock at the end of the quarter (bv).

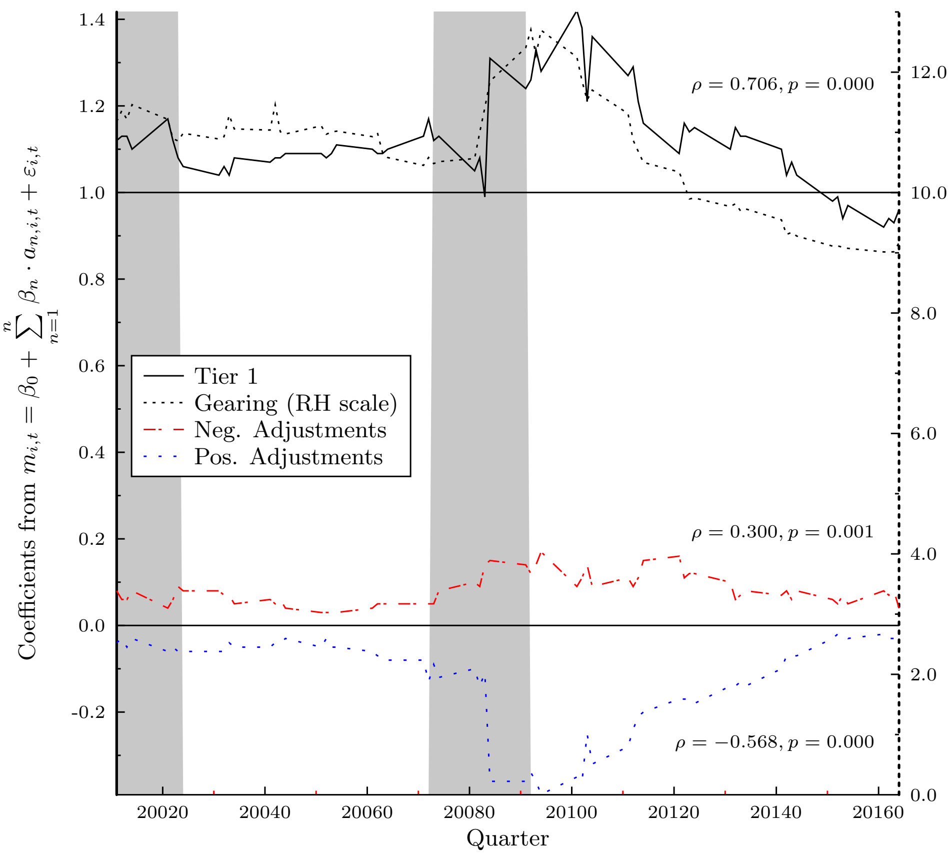


Figure 8: Comparison of market elasticities and correlation (ρ) with gearing, where, except for gearing, the variables are logged absolute values of the market value at the end the quarter; Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III; adjustments that increase Tier 1 or CET1 relative to equity; and adjustments that decrease Tier 1 or CET1 relative to equity. Gearing is defined as Total Assets over Book Value.

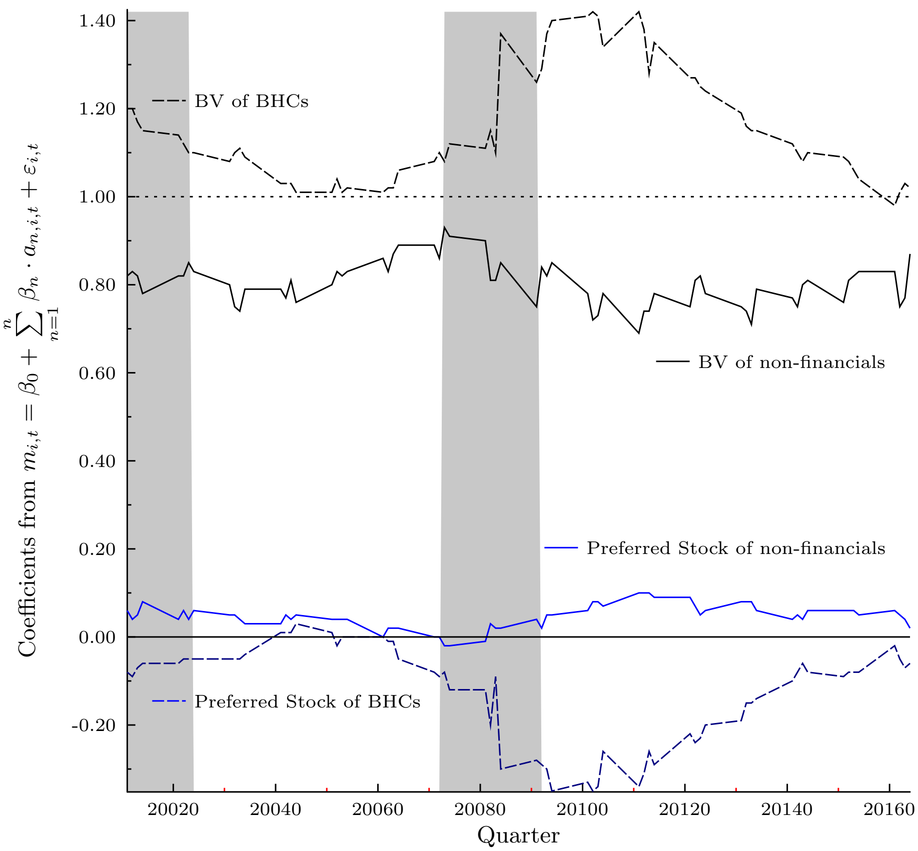


Figure 9: Comparison of market elasticities of book values and preferred stock for banks (BHCs) and non-financials. For non-financial firms, the relevant variables are Compustat items *book value of common equity* and *preferred stock*.

Table 1 Regulatory Adjustments.

Positive adjustments are:	Impact on Tier 1 in bp of RWA
Qualifying Trust Preferred Securities [C502], Qualifying restricted core capital elements [G215]	105.4
Minority interests in consolidated subsidiaries [G214], [B589], [P839], and [P862]	28.5
Additional Tier 1 capital instruments plus related surplus [P860]	10.3
Net unrealized holding losses on Available-For-Sale securities [8434]	9.87
Accumulated loss on cash-flow hedges and Defined benefit post-retirement plans [4336], [P846], [P847) and [P849]	7.42
Tier 1 Minority Interest Not Included In Common Equity Tier 1 Capital	3.89
Perpetual Preferred Stock including Related Surplus (pre-Basel III) [3283]	3.21
Non-qualifying capital instruments subject to phase out from Additional Tier 1 capital [P861]	0.07
Qualifying mandatory convertible preferred securities of internationally active bank holding companies [G216]	0.08
Net unrealized losses on held-to-maturity securities that are included in AOCI [P848]	0.13
Unrealized loss in fair valued financial liabilities attributable to changes in own creditworthiness [F264] and [Q258]	0.02
Other	2.17
Negative adjustments are:	**Impact on Tier 1 in bp of RWA**
Goodwill and Intangibles [B590], [P842], [P841]	202.0
Net unrealized holding gains on Available-For-Sale securities [8434], [A221], and [P845]	19.4
Additional Tier 1 capital deductions, [P864]	12.0
Deferred Tax Assets [5610], [P843], [P855]	12.0
Mortgage servicing rights and purchased credit card relationships [P854], [B591]	0.97
Non-qualifying Perpetual Preferred Stock [B588]	0.62
Accumulated gains on cash-flow hedges and Defined benefit post-retirement plans [4336], [P846], [P847) and [P849]	0.54
Unrealized gain in fair valued financial liabilities attributable to changes in own creditworthiness [F264] and [Q258]	0.08
Net unrealized gains on held-to-maturity securities that are included in AOCI [P848]	0.02
Significant investments in financial institutions, MSR, and DTAs over the 15 % CET1 deduction threshold [P856]	0.01
Investments in the capital of unconsolidated financial institutions that exceed the relevant 10 % threshold [P851] and [P853]	0.01
Other	0.96

Regulatory adjustments for U.S. bank holding companies covering the quarters 2001Q1–2016Q4. *Additions* increase, and *Deductions* decrease *Tier 1 capital [8274]* relative to the book value of common equity. The items are sorted on the mean values of these items over risk weighted assets (*RWA*, the rightmost column). *bp* is basis points. The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary.

Table 2 Descriptive Statistics.

$n = 21,862$	Mean	Min	p5	p25	p50	p75	p95	Max	StDev
M	3,436	1.00	27.8	83.1	226	820	9,976	307,295	18,471
BV	2,617	–510	28.1	68.7	150	531	6,470	244,863	16,037
Tier 1	2,110	–505	31.0	73.6	157	488	5,763	193,089	12,631
Tier 2	599	0.00	2.72	7.35	16.5	54.6	1,445	66,951	3,828
Net Adjustments	–507	–75,702	–925	–41.5	–1.89	11.68	91.6	52,237	3,880
Pos Adjustments	371	0.00	0.00	3.26	20.3	68.4	698	116,129	3,067
Neg Adjustments	878	0.00	0.08	3.72	19.1	110	1,499	106,128	5,826
Total Assets	28,793	141	366	827	1,761	5,504	64,189	2,577,148	180,719
Tier 1 over RWA (%)	12.2	0.03	8.23	10.2	11.7	13.6	17.9	51.0	3.26
Tier 2 over RWA (%)	1.65	0.00	0.83	1.16	1.26	1.87	3.69	14.9	0.94
Net Adj over RWA (%)	–0.92	–21.8	–5.77	–2.30	–0.47	0.99	2.69	13.3	2.90
Pos Adj over RWA (%)	1.82	–0.32	0.04	0.70	1.80	2.68	3.99	13.4	1.31
Neg Adj over RWA (%)	2.74	0.00	0.07	0.74	2.00	3.95	7.43	24.4	2.76

Year	M	BV	Tier 1	Tier 2	Net Adj	Pos Adj	Neg Adj	$\frac{\text{Tier 1}}{RWA}$ (%)	$\frac{\text{Tier 2}}{RWA}$ (%)	Gearing	$\frac{\text{NetAdj}}{RWA}$ (%)	$\frac{\text{Pos}}{RWA}$ (%)	$\frac{\text{Neg}}{RWA}$ (%)	# of obs.
2001	2,757	1,091	932	344	-152	130	279	10.8	1.91	11.31	-0.18	1.67	1.85	1,580
2002	2,570	1,159	977	353	-179	151	328	11.3	1.85	10.99	-0.31	1.82	2.12	1,661
2003	2,696	1,243	1,052	371	-191	164	355	11.4	1.85	11.04	-0.32	1.97	2.30	1,692
2004	3,171	1,447	1,132	388	-315	183	498	11.6	1.79	11.12	-0.39	2.11	2.50	1,659
2005	3,158	1,648	1,236	423	-412	212	624	11.6	1.62	11.03	-0.60	2.04	2.64	1,670
2006	3,951	2,055	1,540	533	-515	298	813	11.6	1.56	10.79	-0.73	2.17	2.90	1,484
2007	3,784	2,286	1,648	660	-639	373	1,011	11.2	1.54	10.51	-1.12	2.04	3.15	1,419
2008	2,578	2,319	1,995	795	-324	830	1,154	10.7	1.63	11.18	-0.95	2.11	3.06	1,344
2009	2,172	2,572	2,549	825	-23	1,126	1,149	11.7	1.75	12.52	-0.58	2.10	2.68	1,302
2010	2,978	3,093	2,592	797	-501	709	1,210	12.8	1.79	11.83	-0.65	2.06	2.71	1,277
2011	2,855	3,532	2,895	784	-637	649	1,286	14.1	1.69	10.84	-0.76	2.08	2.84	1,201
2012	3,315	3,871	3,105	698	-766	563	1,329	14.3	1.60	10.07	-1.00	1.97	2.97	1,175
2013	4,253	4,075	3,283	684	-792	490	1,282	14.4	1.50	9.75	-0.97	1.72	2.69	1,172
2014	5,025	4,335	3,401	684	-934	142	1,076	14.0	1.41	9.37	-1.33	1.40	2.73	1,176
2015	5,768	5,139	3,970	823	-1169	58	1,227	11.9	1.46	9.10	-2.79	0.27	3.06	1,047
2016	5,707	5,420	4,150	868	-1271	53	1,323	11.8	1.52	9.05	-2.84	0.25	3.10	1,043

The table presents descriptive statistics of variables from U.S. bank holding companies over the 2001Q1 to 2016Q4. The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary. *M* is market value at the end the quarter. *BV* is book value excluding perpetual preferred stock at the end of the quarter [3210] – [3283]. *Tier 1* is either Tier 1 [8274] or Common Equity Tier 1 [P859], the latter as defined by the U.S. implementation of Basel III. *Tier 2* is Tier 2 or Supplementary Capital [5311]. *Gearing* is Total Assets over Book Value (BV). *Net Adjustments* is the net of prudential adjustments, defined as *T1* minus *BV*, both as previously defined. *Pos Adjustments* is adjustments that increase *T1* relative to equity. *Neg Adjustments* is adjustments that decrease *T1* relative to equity. *Total assets* is item [2170]. *RWA* is Risk-Weighted Assets (net of allowances and other deductions) [A223]. Amounts are in millions of USD. The number of observations reported in a row is the sum of the quarterly observations.

Table 3 Log Model

Pooled		BV	Tier 1	TC	Net Adj	Pos Adj	Neg Adj	Tier 2	Intercept	$\Sigma\beta_{1..N}$	$\bar{R}^2$	# of obs.
I	β	1.02							0.04	1.02	0.91	21,862
	(*t*)	(99.9)							0.29			
II*	β	0.93							1.23	0.93	0.79	195,147
	(*t*)	(123)							20.6			
III	β		1.07						–0.56	1.07	0.88	21,896
	(*t*)		(96.9)						–3.68			
IV	β			1.04					–0.37	1.04	0.88	21,896
	(*t*)			(92.7)					–2.37			
V	β		1.15		–0.07				–0.85	1.08	0.88	21,896
	(*t*)		(48.0)		(–4.01)				–4.49			
VI	β		1.11			–0.13	0.07		–0.57	1.06	0.89	18,029
	(*t*)		(42.5)			(–5.97)	(6.68)		–3.04			
VII	β		1.24		–0.06			–0.08	–1.15	1.09	0.89	21,825
	(*t*)		(24.0)		(–4.0)			(–2.33)	–4.44			
VIII	β		1.17			–0.12	0.07	–0.06	–0.78	1.07	0.90	17,725
	(*t*)		(23.1)			(–6.10)	(6.61)	(–1.59)	–3.16			
IX**	β		1.18			–0.12	0.08	–0.06	–0.86	1.07	0.89	16,955
	(*t*)		(22.3)			(–6.00)	(7.13)	(–1.72)	–3.20			
Fama MacBeth		**BV**	**Tier 1**	**TC**	**Net Adj**	**Pos Adj**	**Neg Adj**	**Tier 2**	**Intercept**	$\Sigma\beta_{1..N}$	$\bar{R}^2$	**# of obs.**
I	β	1.04							–0.24	1.04	0.95	21,862
	(*t*)	(7.22)							(–15.1)		(207)	
II*	β	0.92							1.28	0.92	0.80	194,737
	(*t*)	(21.3)							6.87		(229)	
III	β		1.10						–0.98	1.10	0.93	21,896
	(*t*)		(17.8)						(–20.6)		(155)	
IV	β			1.07					–0.79	1.07	0.92	21,896
	(*t*)			(13.0)					(–18.0)		(142)	
V	β		1.14		–0.04				–1.05	1.10	0.93	21,859
	(*t*)		(10.5)		(–4.37)				(–8.92)		(166)	
VI	β		1.12			–0.12	0.08		–0.73	1.08	0.95	18,029
	(*t*)		(8.71)			(–8.96)	(18.5)		(–17.5)		(217)	
VII	β		1.28		–0.03			–0.13	–1.50	1.12	0.94	21,825
	(*t*)		(9.6)		(–3.98)			(–7.58)	(–9.09)		(194)	
VIII	β		1.23			–0.11	0.08	–0.11	–1.12	1.09	0.95	18,001
	(*t*)		(9.63)			(–9.12)	(19.5)	(–7.82)	(–8.34)		(251)	

The table reports results of regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2016Q4, where the dependent variable (m) is the log of the Market Value of the bank at the end the quarter:

$$m_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot a_{n,i,t} + \varepsilon_{i,t} \tag{4}$$

$a_{n,i,j}$ is from the following list of (N) regressors, which are all logged absolute values of the underlying values: *BV* is book value excluding perpetual preferred stock at the end of the quarter [3210]–[3283]. For non-financials, this is item common/ordinary equity $(ceqq)$ from the CRSP-Compustat merged quarterly database. *Tier 1* is either Tier 1 [8274] or Common Equity Tier 1 [P859], the latter as defined by the U.S. implementation of Basel III. *TC* is total qualifying capital allowable under the risk-based capital guidelines [3792]. *Net Adj* is the net of prudential adjustments, defined as *Tier 1* minus *BV*, both as previously defined. *Pos Adj* is adjustments that increase *Tier 1* relative to equity. *Neg Adj* is adjustments that decrease *Tier 1* relative to equity. *Tier 2* is Tier 2 or Supplementary Capital [5311]. $\Sigma\beta_{1..n}$ is the sum of the coefficients, excluding the intercept. The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary. The regression model used for the top panel relies on t-values that account for two-dimensional within-cluster correlation (Petersen, 2009). The t-values in the bottom panel are Fama and MacBeth (1973) t-values. For Tier 1, Total capital, and book value of equity (BV), we calculate t-values where the numerator is the difference between the sample mean and the theoretically expected value of 1.
Note *: Non-financial firms only: all Compustat firms excluding those with SIC codes between 6000 and 6799 (financials) and between 4000 and 4999 (regulated industries).
Note **: Only banks with Total Assets $> \$500M$.

Table 4 Log Model – Cross Section Regressions.

Qtr	Crisis	Tier 1	t	Pos	t	Neg	t	$\Sigma\beta_{1..n}$	β_0	t	$\bar{R}^2$	# of obs.
20011	dot.com	1.12	31.23	–0.04	–3.19	0.08	3.74	1.17	–1.54	–5.91	0.97	181
20012	dot.com	1.13	35.91	–0.03	–3.12	0.06	3.31	1.16	–1.33	–5.77	0.97	224
20013	dot.com	1.13	27.54	–0.05	–3.96	0.06	1.94	1.15	–1.25	–4.89	0.97	213
20014	dot.com	1.10	21.73	–0.03	–2.47	0.08	2.59	1.14	–1.12	–3.62	0.96	237
20021	dot.com	1.17	38.14	–0.06	–4.64	0.04	2.70	1.15	–1.30	–5.61	0.97	271
20022	dot.com	1.12	30.40	–0.05	–4.46	0.06	3.01	1.13	–0.91	–3.75	0.97	245
20023	dot.com	1.08	31.93	–0.06	–4.75	0.09	4.54	1.10	–0.69	–2.94	0.97	255
20024		1.06	37.81	–0.06	–5.56	0.08	5.44	1.08	–0.40	–2.05	0.97	273
20031		1.04	38.51	–0.06	–5.28	0.08	5.11	1.06	–0.16	–0.88	0.97	277
20032		1.06	43.77	–0.06	–5.30	0.07	5.52	1.07	–0.19	–1.12	0.97	288
20033		1.04	43.98	–0.04	–3.71	0.07	5.28	1.06	–0.05	–0.31	0.97	298
20034		1.08	50.12	–0.05	–4.46	0.05	3.72	1.08	–0.19	–1.22	0.97	317
20041		1.07	44.74	–0.05	–3.24	0.06	4.08	1.07	–0.12	–0.77	0.97	302
20042		1.08	52.59	–0.04	–3.20	0.05	5.26	1.09	–0.33	–2.25	0.97	350
20043		1.08	50.62	–0.04	–3.07	0.06	5.16	1.09	–0.41	–2.62	0.97	319
20044		1.09	53.66	–0.03	–2.35	0.04	3.72	1.09	–0.35	–2.26	0.97	328
20051		1.09	55.08	–0.05	–3.48	0.03	4.03	1.08	–0.27	–1.88	0.97	357
20052		1.08	59.57	–0.03	–2.46	0.03	3.98	1.09	–0.38	–2.57	0.97	347
20053		1.09	58.62	–0.05	–4.08	0.03	4.10	1.08	–0.30	–1.99	0.97	363
20054		1.11	55.11	–0.05	–3.59	0.03	3.54	1.09	–0.45	–2.96	0.97	367
20061		1.10	51.16	–0.06	–3.80	0.04	4.00	1.08	–0.34	–2.06	0.97	339
20062		1.09	47.49	–0.07	–3.74	0.05	4.81	1.07	–0.26	–1.55	0.96	347
20063		1.09	47.43	–0.07	–3.92	0.05	4.74	1.08	–0.29	–1.73	0.96	339
20064		1.10	31.97	–0.08	–4.52	0.05	4.09	1.08	–0.33	–1.41	0.96	337
20071		1.13	47.58	–0.08	–4.40	0.05	5.11	1.10	–0.65	–3.89	0.96	340
20072		1.17	44.06	–0.13	–6.03	0.05	4.44	1.09	–0.76	–4.50	0.96	335
20073	GFC	1.12	45.74	–0.09	–4.82	0.05	4.10	1.09	–0.74	–4.05	0.96	333
20074	GFC	1.13	38.56	–0.12	–5.46	0.08	4.71	1.08	–0.83	–3.80	0.95	317
20081	GFC	1.05	30.43	–0.10	–3.96	0.10	5.45	1.05	–0.38	–1.64	0.94	309
20082	GFC	1.08	25.97	–0.14	–5.32	0.09	4.20	1.02	–0.45	–1.53	0.89	317
20083	GFC Post-Lehman	0.99	6.95	–0.11	–1.62	0.14	3.54	1.03	–0.16	–0.19	0.86	304
20084	GFC Post-Lehman	1.31	18.06	–0.36	–6.04	0.15	4.86	1.10	–1.78	–4.36	0.86	309
20091	GFC Post-Lehman	1.24	14.18	–0.36	–4.79	0.14	4.13	1.01	–1.00	–2.28	0.82	309
20092	Post-Lehman	1.26	13.79	–0.34	–4.58	0.12	3.12	1.04	–1.24	–2.84	0.84	305
20093	Post-Lehman	1.33	17.50	–0.36	–5.39	0.14	4.51	1.11	–2.06	–6.16	0.90	303
20094	Post-Lehman	1.28	12.78	–0.39	–6.03	0.17	4.10	1.06	–1.33	–2.23	0.90	305
20101	Post-Lehman	1.42	20.43	–0.35	–5.74	0.09	2.91	1.15	–2.51	–7.78	0.93	299
20102	Post-Lehman	1.38	23.49	–0.36	–6.56	0.11	3.65	1.13	–2.31	–7.85	0.93	298
20103	Post-Lehman	1.21	17.99	–0.25	–5.37	0.14	4.27	1.10	–1.74	–4.98	0.91	302
20104	Post-Lehman	1.36	21.51	–0.32	–7.00	0.09	3.50	1.13	–2.17	–5.99	0.92	290
20111	Post-Lehman	1.27	10.60	–0.28	–5.56	0.11	2.71	1.10	–1.69	–2.25	0.91	285
20112	Post-Lehman	1.29	26.31	–0.24	–5.52	0.09	4.15	1.14	–2.24	–7.49	0.92	283
20113	Post-Lehman	1.21	24.30	–0.21	–6.67	0.11	3.81	1.11	–2.06	–5.60	0.91	281
20114	Post-Lehman	1.16	16.50	–0.20	–5.67	0.15	4.22	1.11	–1.84	–3.86	0.91	278
20121	Post-Lehman	1.09	11.97	–0.17	–4.99	0.16	3.81	1.08	–1.14	–1.98	0.93	277
20122	Post-Lehman	1.16	23.16	–0.17	–5.98	0.11	4.10	1.09	–1.45	–4.35	0.94	274
20123	Post-Lehman	1.14	22.89	–0.17	–5.68	0.12	4.09	1.09	–1.28	–3.98	0.94	272
20124	Post-Lehman	1.15	22.98	–0.18	–5.10	0.12	4.56	1.09	–1.32	–4.26	0.94	271
20131	Post-Lehman	1.10	26.54	–0.14	–5.76	0.10	4.44	1.06	–0.81	–2.91	0.96	268
20132	Post-Lehman	1.15	30.82	–0.14	–5.86	0.06	3.21	1.07	–0.97	–3.82	0.96	273
20133	Basel III	1.13	31.06	–0.13	–4.76	0.07	4.84	1.06	–0.72	–3.08	0.96	276
20134	Basel III	1.13	32.23	–0.14	–4.99	0.08	4.78	1.07	–0.78	–3.04	0.96	276
20141	Basel III	1.10	29.78	–0.10	–4.40	0.07	4.28	1.06	–0.62	–2.13	0.96	273
20142	Basel III	1.04	32.61	–0.07	–4.05	0.08	5.83	1.06	–0.46	–1.70	0.96	267
20143	Basel III	1.07	36.40	–0.07	–4.67	0.06	5.40	1.06	–0.61	–2.50	0.97	263
20144	Basel III	1.04	34.96	–0.07	–3.97	0.08	6.23	1.05	–0.41	–1.60	0.96	267
20151	Basel III	0.98	31.18	–0.03	–1.69	0.06	3.63	1.02	0.22	0.87	0.97	173
20152	Basel III	0.99	36.87	–0.02	–1.83	0.05	4.23	1.01	0.26	1.08	0.97	185
20153	Basel III	0.94	31.49	–0.02	–1.30	0.07	5.04	1.00	0.49	1.94	0.97	182
20154	Basel III	0.97	37.78	–0.03	–2.54	0.05	4.36	0.99	0.47	2.12	0.97	204
20161	Basel III	0.92	30.82	–0.02	–1.54	0.08	5.60	0.98	0.74	2.85	0.97	181
20162	Basel III	0.94	26.63	–0.03	–1.99	0.07	3.90	0.98	0.69	2.49	0.97	171
20163	Basel III	0.93	28.26	–0.03	–1.80	0.08	4.67	0.97	0.79	3.01	0.97	169
20164	Basel III	0.96	34.66	–0.02	–1.02	0.04	3.46	0.99	0.84	3.70	0.97	231

The table reports results of regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2016Q4, where the dependent variable (m) is the log of the Market Value of the bank at the end the quarter:

$$m_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot a_{n,i,t} + \varepsilon_{i,t} \tag{5}$$

$a_{n,i,j}$ is from the following list of (N) regressors, which are all logged absolute values of the underlying values: *Tier 1* is either Tier 1 [8274] or Common Equity Tier 1 [P859], the latter as defined by the U.S. implementation of Basel III. *Pos (Neg)* is adjustments that increase (decrease) *Tier 1* relative to equity. $\Sigma\beta_{1..n}$ is the sum of the coefficients, excluding the intercept. *Crisis* designates crises quarters as those that were affected by the dot.com crisis ($t < 2002Q4$) and the global financial crisis: $t > 2007Q2$ and $t < 2009Q2$. *Post-Lehman* is the period from 2008Q3 onward. *Basel III* marks quarters after the Federal Reserve Board approved the final rule on the implementation of Basel III in July 2013.

Table 5 Log Model – Summary Cross Section Regressions.

Averages	$\overline{Tier1}$	$\bar{t}$	$\overline{Pos}$	$\bar{t}$	$\overline{Neg}$	$\bar{t}$	$\overline{t\Sigma\beta_{1..n}}$	$\overline{\beta_0}$	$\bar{t}$	$\overline{R}^2$	# of obs.
All	1.12	33.0	–0.12	–4.26	0.08	4.22	1.08	–0.73	–2.54	0.95	18,029
t-value	8.71		–8.96		18.5		13.5	–17.5		217	
In both crises	1.13	28.3	–0.11	–4.19	0.09	3.77	1.10	–0.96	–3.60	0.93	3,824
t-value	6.27		–3.92		9.29		6.91			68.3	
Pre-Crisis	1.09	48.1	–0.06	–4.01	0.05	4.53	1.08	–0.33	–2.00	0.97	6,223
t-value	12.6		–11.0		14.6		33.9			909	
Post Lehman	1.23	19.1	–0.26	–5.50	0.12	3.89	1.09	–1.55	–4.26	0.91	5,786
t-value	9.30		–12.3		19.9		11.0			111	
Basel III	1.01	32.5	–0.06	–2.90	0.07	4.73	1.02	0.06	0.29	0.97	3,118
t-value	0.49		–4.99		20.5		2.16			676.5	
Post Lehman – pre-crisis	0.14		–0.20		0.07		0.01	–1.23		–0.06	
t-value	3.46		–5.76		6.83		0.75	–5.61		–4.48	
p-value	0.00		0.00		0.00		0.77	0.00		0.00	

The table reports averages of coefficient values of regressions shown in the Table 4. $\overline{\text{Tier 1}}$ is the average value of the coefficient on Tier 1. $\overline{Pos}$ ($\overline{Neg}$) is the average value of the coefficient adjustments that increase (decrease) Tier 1 relative to equity. $\Sigma\beta_{1..n}$ is the average of the sum of the coefficients, excluding the intercept (β_0). $\bar{t}$ is the average t-value. Crises quarters as those that were affected by the dot.com or market crisis ($t < 2002Q4$) and the global financial crisis: $t > 2007Q2$ and $t < 2009Q2$. *Pre-Crisis* is the period 2002Q4 to 2007Q2. *Post-Lehman* is the period from 2008Q3 onward. *Basel III* is the period from 2013Q3 onward. *Post Lehman – pre-crisis* is the difference in coefficient values between values for the pre-crisis period and the Post Lehman period. t-values are Fama and MacBeth (1973) t-values calculated as the ratio of the sample mean to the standard deviation of the distribution of the estimated coefficients, divided by the square root of the number of quarterly cross-sections. For $\overline{\text{Tier 1}}$, we calculate t-values where the numerator is the difference between the sample mean and the theoretically expected value of 1. For $\overline{\text{Tier 1}}$ and for $\Sigma\beta_{1..n}$ we use 1 (one) as a reference value to determine the t-values. The p-values assume unequal sample distributions.

Table 6 Log Model – Goodwill, DTA, MSR, Unrealised Gains and Losses, Minority Interests.

	Goodwill		DTA		MSR		UR Gain & Loss		Minors	
	β	*t*	β	*t*	β	*t*	β	*t*	β	*t*
Tier 1	1.17	44.7	1.15	51.5	1.15	42.8	1.09	62.4	1.06	53.9
Positive adjustments	–0.12	–6.31	–0.12	–6.79	–0.12	–6.11				
Negative adjustments (ex Goodwill, DTA, MSR)	–0.04	–4.70	0.05	6.30	0.03	4.48				
Goodwill	**0.05**	**9.14**								
Deferred Tax Assets			**–0.05**	**–9.15**						
Mortgage Servicing Rights					**0.00**	**0.72**				
Negative adjustments									0.06	6.18
Positive adjustments (ex unrealised losses, minors)							–0.05	–7.06	–0.05	–6.52
Unrealised losses							**0.02**	**2.37**		
Negative adjustments (ex unrealised gains)							0.03	5.15		
Unrealised gains							**0.01**	**0.95**		
Minority interests									**–0.01**	**–0.95**
Intercept	–0.73	–3.93	–0.72	–4.30	–0.70	–3.38	–0.68	–3.79	–0.64	–3.25
$\Sigma\beta_{1..n}$	1.06		1.03		1.07		1.09		1.07	
$\overline{R}^2$		0.90		0.90		0.89		0.89		0.89
# of obs.		18,698		18,698		18,698		18,698		18,698

The table reports results of regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2016Q4, where the dependent variable (m) is the log of the Market Value of the bank at the end the quarter:

$$m_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot a_{n,i,t} + \varepsilon_{i,t} \tag{6}$$

$a_{n,i,j}$ is from the following list of (N) regressors, which are all logged absolute values of the underlying values: *Tier 1* is either Tier 1 [8274] or Common Equity Tier 1 [P859], the latter as defined by the U.S. implementation of Basel III. *Positive Adjustments* is adjustments that increase *T1* relative to equity. *Negative Adjustments* is adjustments that decrease *T1* relative to equity. *Goodwill* is disallowed Goodwill and intangibles [B590], [P842], [P841]. *Deferred Tax Assets* is Deferred Tax Assets disallowed for regulatory capital purposes [5610, P843, P855]. *Mortgage Servicing Rights* (MSR) is disallowed mortgage servicing rights and purchased credit card relationships [P854], [B591]. *Unrealised Gains (Losses)* represent the prudential filter on net unrealised holding gains (losses) on Available-For-Sale securities [8434], [A221], and [P845]. *Minors* is qualifying minority interests in consolidated subsidiaries. The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary. The regression model relies on t-values that account for two-dimensional within-cluster correlation (Petersen, 2009).

Table 7 Log Model – Deciles

Decile	Tier 1 Ratio	Average Total Assets	Tier 1	t	Intercept	t	$\overline{R}^2$
1	8.05%	84,686	1.19	141	–2.23	–18.5	0.91
2	9.81%	42,637	1.09	140	–0.76	–7.40	0.87
3	10.51%	35,650	1.05	128	–0.30	–2.89	0.87
4	11.05%	32,383	1.04	127	–0.18	–1.70	0.88
5	11.59%	27,221	1.01	118	0.13	1.28	0.86
6	12.17%	20,281	1.02	109	0.05	0.45	0.88
7	12.85%	20,062	1.02	106	0.07	0.57	0.87
8	13.66%	7,459	1.03	110	–0.08	–0.74	0.85
9	15.08%	11,782	1.03	124	–0.13	–1.33	0.87
10	20.47%	4,718	1.04	128	–0.19	–2.00	0.89

The table reports results of regressions of data sorted on a bank's quarterly Tier 1 ratio: Tier 1 capital divided by risk-weighted assets. The regressions rely on data of U.S. bank holding companies over the 2001Q1 to 2016Q4, where the dependent variable (m) is the log of the Market Value of the bank at the end the quarter:

$$m_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot a_{n,i,t} + \varepsilon_{i,t} \tag{7}$$

$a_{n,i,j}$ is the logged absolute value of *Tier 1*, which is either Tier 1 [8274] or Common Equity Tier 1 [P859], the latter as defined by the U.S. implementation of Basel III. *Average Total Assets* is the average of Total Assets [2170], in millions of USD. The mnemonics in square brackets refer to the item codes from the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C); their definitions are from www.federalreserve.gov/apps/mdrm/data-dictionary. The regression model relies on t-values that account for two-dimensional within-cluster correlation (Petersen, 2009). The number of observations per decile is 2,189.