The Value Relevance of Regulatory Capital Components

MARTIEN LUBBERINK[a1] and ROGER WILLETT[1]

[1]Victoria University of Wellington

1st February 2021

The Value Relevance of Regulatory Capital Components

ABSTRACT

We measure the relevance of regulatory capital and regulatory adjustments of U.S. banks for shareholders. We use parsimonious log-linear regression models that mitigate shortcomings of conventional research designs. Results for the years 2001-2020 show that banks' share price sensitivity to various measures of bank capital e.g. book equity, Tier 1, and Total Capital, converges to one when market uncertainty is low and when banks' Tier 1 ratios reach 12 percent of RWAs. Share prices are particularly sensitive to changes in capital of highly geared banks during times of elevated market uncertainty. We attribute the excess sensitivity to adjustments that increase regulatory capital, supporting theories of risk shifting by bank owners: they stand to gain when systemic risks are high.

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, 2010a). In anticipation of these rules, banks increased the level of regulatory capital significantly (BCBS, 2020, EBA, 2020b).

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), Berger and Bouwman (2013), Thakor (2014), and Gambacorta and Shin (2018) 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 four reasons.

First, 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, 2010a, paragraphs 8 and 9). Consequently, regulation significantly alters the structure of bank capital. Basel rules require 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, 2010a, FDIC, 2012, OCC, 2012). As a result, regulatory capital differs from "accounting capital" or book equity. Non-common equity components can increase (decrease) Tier 1 capital up to 26.1 percent (97.1 percent) of risk-weighted assets. Tier 2 capital can increase regulatory capital by up to 24.4 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, banks and investors do focus on capital ratios that are based on adjusted book equity. For example, JPMorgan Chase's 2020Q3 earnings announcement features the CET1 capital ratio at the top of the first page. Jamie Dimon's comments on the announcement discuss Common Equity Tier 1 jointly with the bank's profitability and revenues (JPMorgan Chase, 2020).

Research, however, appears to favour simple, accounting-based measures of capitalization over adjusted ratios. Demirgüç-Kunt, Detragiache and Merrouche (2013), for example, find that higher quality forms of capital, such tangible common equity, are more relevant than other forms of capital. Martynova and Perotti (2018) argue that non-equity capital is inferior to pure equity. Haldane (2012) asserts that simpler measures of accounting capital based on equity capital outperform broader, more complex, measures.

Third, additions to regulatory capital have been criticized 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.

Lastly, recent research examines the effectiveness of capital requirements once banks achieve a certain level capitalisation (BCBS, 2018, 2019, Arnould, Pancaro and Żochowski, 2020). BCBS (2018), for example, shows that once banks are well capitalised, the mitigating effects on the probability of default of various measures of bank solvency (Tier 1 ratio, leverage ratio) converge. BCBS (2019) demonstrates that increasing Tier 1 capital ratios beyond 12 percent of risk-weighted assets has limited benefits.

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 relevance of bank capital components, where we interpret relevance in the same way as Barth, Beaver and Landsman (2001) and refer to it using the term "value relevance." However, unlike Barth et al. (2001) and others, to measure value relevance we use the sensitivity of banks' market capitalization to relative changes in regulatory capital components. We thus rely on elasticities that measure the effect of relative changes in bank capital components on mar-

ket values. The elasticities are derived from log-linear models, which 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, Appendix A and Lubberink and Willett (2020).

Using data of U.S. bank holding companies covering 78 quarters from 2001 to 2020Q2, we empirically examine the market elasticities of book equity, Tier 1, Tier 2, Total Capital, and regulatory adjustments. Our results show that the book equity elasticity of market values stays close to a value of one (1), with an average of 1.04. This result dovetails with the *dollar-for-dollar* relation between market and book values (Miller and Modigliani, 1961).[1]

The Tier 1 and Total Capital elasticities of market values are also generally close to one. However, we document significant excess elasticities when levels of market uncertainty are high and when banks are poorly capitalized. The Total Capital elasticity during the global financial crisis reaches a value of 2, while the Tier 1 capital elasticity reaches a value of 1.3: a one percent change in Total Capital (Tier 1) is associated with a two (1.3) percent change in market value. We attribute the excess sensitivities largely to regulatory adjustments that increase regulatory capital.

As bank capitalizations improved in the aftermath of the global financial crisis, the coefficients on Tier 1 and Total Capital converge to each other, to the elasticity of book value, i.e. to the value of one. These uniform coefficients correspond with a Tier 1 ratio of approximately 12-13 percent, reflecting results reported by Firestone, Lorenc and Ranish (2017), BCBS (2019), who document optimal bank capital levels of close to this percentage.

From these results we infer that shareholders benefit from increases in Tier 1 and Total Capital when banks are highly leveraged, during times of market uncertainty, i.e. when bank capital is needed most.

---

[1] The *dollar-for-dollar* relationship we refer to here is measured taking into account the market-to-book ratio, see Appendix A.

Regarding regulatory adjustments, when we partition them into positive and negative, the former are generally associated with excess elasticities of in particular Tier 1 and Total Capital, less so with book equity. The elasticities of regulatory adjustments are generally much smaller than the elasticities on equity, Tier 1, or Total Capital, despite being the subject of (sometimes intense) debate.

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

The market sensitivity to each of the five adjustments varies, and is low. The elasticities of the hotly debated MSRs and the prudential filter on unrealized gains and losses on AFS securities are less than 0.01. This last result is interesting given existing papers on this subject; e.g. Chircop and Novotny-Farkas (2016) assert that the regulation on the recognition of unrealized gains and losses affects risk taking by banks.

The market elasticity of Tier 2 capital is generally insignificant until the global financial crisis, when it becomes temporarily significantly negative. This is predominantly the result of increases in banks' loan loss reserves, which predict future losses (Ng and Roychowdhury, 2014). More importantly, the downward surge of the Tier 2 capital elasticity of market values coincides with a significant increase in the market elasticity of Total Capital. From this we infer that shareholders gain from increases in Total Capital of poorly capitalized banks during times of heightened marked uncertainty.

Lastly, our results show that the models we use are well-specified. Components such as the book value of equity and Tier 1 explain well over 90 percent of the variation in bank market values. Such R^2s are high compared to similar studies that use linear-additive regression models (Aledo Martínez, García Lara,

González Pérez and Grambovas, 2020). Moreover, the elasticities associated with these variables are noticeably more stable and easier to interpret than those reported by conventional research designs: just compare Figure 1 to Figure B1 in Appendix B.

This paper contributes to the literature by documenting the value relevance of regulatory capital and its components, for common shareholders. Using quarterly data of listed U.S. bank holding companies from 2001 to 2020Q2, we show that market values of banks are particularly sensitive to changes in regulatory capital of highly geared banks, during times of elevated market uncertainty. In more sanguine economic conditions, the sensitivity of market values to measures of bank capital converges to one.

Excess sensitivities of market values to regulatory capital, in particular Tier 1 and Total Capital are largely attributable to adjustments that increase regulatory capital. At the same time, the market elasticity of (unadjusted) book equity stays close to one, while the market elasticity of capital deductions remains close to zero.

We also show that elasticities of measures on bank capital that exceed one (1) are associated with excessive gearing. The post-GFC convergence of capital coefficients to the value of one coincides with a Tier 1 ratio of 12 percent. As such, our results contribute to studies that demonstrate the limited effectiveness of capital requirements once capital ratios reach a certain level.

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.

From a policy perspective, our paper shows that shareholders appear to benefit from regulatory adjustments that increase capital when banks are highly levered and when market uncertainty is high: increases

in non-equity Tier 1 and Tier 2 increase market values more strongly than increases in book equity capital. This result appears to confirm theories of risk shifting by shareholders (Chan and van Wijnbergen, 2014, Martynova and Perotti, 2018), whereas we cannot confirm the superiority of capital components that are deemed "pure" or "simple", especially when Tier 1 exceeds 12 percent. Regarding regulatory adjustments, regulators keep introducing new adjustments. For example, European supervisors introduced an adjustment for the treatment of software that requires banks to deducted from CET1 capital the positive difference between the prudential and the accounting accumulated amortization (EBA, 2020a). Our research shows such adjustments have limited (value) relevance.

2. Literature and hypotheses

2.1. 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, Gómez-Biscarri, Kasznik and López-Espinosa, 2017, Dong and Zhang, 2017, Kim, Kim and Ryan, 2019). 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. (2019) show that banks mitigate regulatory capital volatility by way of classifying an increased proportion of investment securities as held to maturity.

Studies on the quality of capital generally favour common equity over non-equity capital. Analytical papers by Koziol and Lawrenz (2012) and Chan and van Wijnbergen (2014) argue that non-equity capital

6

distort risk taking incentives that destabilize financial stability while benefiting equity holders. Empirical studies supporting these are Demirgüç-Kunt et al. (2013), Conlon, Cotter and Molyneux (2020). However, these studies rely on additive linear models, which, according to Appendix B produce coefficients that are volatile and sensitive to sample choice, time-period, and outlier treatment. Consequently, the results of these studies cannot easily be reproduced, and thus may not necessarily be generalizable.

Regarding the quantity of capital, the literature on regulatory capital acknowledges that bank capital is expensive (Plosser and Santos, 2018). The higher cost of capital is attributed to subsidized debt, tax deductibility of debt, and benefits forgone by less-intense creditor monitoring (Diamond and Rajan, 2001). 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 observed in corporate firms Berger, Herring and Szegö (1995).

Admati et al. (2016), however argue against high leverage. Empirical papers supporting Admati et al. 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. BCBS (2019) replicate Jordà et al. and confirm their findings. Moreover, the literature review in BCBS (2019) shows that the marginal benefits of higher capital level off once risk-weighted capital ratios reach a level of 12 percent and the unweighted (leverage) ratio reaches a commensurately lower level of approximately 6 percent. Arnould et al. (2020), studying the relationship between bank funding costs and solvency for European banks find that this relationship

is convex for senior bond yields and term deposit rates. For senior bonds, the inflexion point occurs at a 12 percent CET1 ratio, beyond which funding costs increase.

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 to limite the probability of default (PD), Tier 2 capital can be drawn down to limit "losses given default" or LGD (BCBS, 2010a, 2011).

2.2. Measuring value relevance

Studies on bank capital ratios generally employ research designs that use ratios to adjust variables by a measure of scale. Demirgüç-Kunt et al. (2013), for example, study the link between different solvency ratio definitions and stock market performance. Their explanatory variables are all deflated by a scale factor. Other papers are Vallascas and Hagendorff (2013), Yang (2016), Conlon et al. (2020), who examine which capital ratios predict failure better. 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:

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

where $M_{i,t}$ is the market value and $A_{n,i,t}$ a list of n accounting variables for the ith 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 (2020) 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. We therefore use the modelling approach suggested by Lubberink and Willett.

2.3. Hypotheses

Based on Lubberink and Willett (2020) and the (proportionate) *dollar-for-dollar* relation between market and book values (Miller and Modigliani, 1961), we expect the market elasticity of book values to be positive and close to 1. As Tier 1 and Total Capital are derived from book equity, and given BCBS (2018), we expect the elasticities on Tier 1 and Total Capital to be positive and close to 1 too.[2]

For now, we do not rule out elasticities that exceed a value of one (1), but this warrants further examination. Formally, therefore our main hypothesis is:

Hypothesis 1 *The market elasticity of measures of bank capital, i.e. book equity, Tier 1, Total Capital, are positive and close to 1.*

---

[2]In the hypothetical case of adjustments that sum up to zero, Tier 1: and Total Capital would be equal to book equity. In that hypothetical case the elasticities on Tier 1 and Total Capital are expected to be one.

From Lubberink and Willett and Appendix A we know that market elasticities on accounting items that aggregate into ending book equity sum up to 1. Given hypothesis 1, applying this logic to regulatory adjustments would lead us to expect that their elasticity values be closer to zero. Our second hypothesis, therefore is:

Hypothesis 2 *The market elasticities of regulatory adjustments are close to zero, not necessarily positive.*

3. Research design

3.1. The regression model

Our choice of the research design departs from existing literature examining the relationship between stock prices (or stock returns) and fundamental values. Lubberink and Willett (2020) show that for estimating the relationship a multiplicative model returns more valid results than additive linear model.

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

where A_i, $i = 0, 1, \ldots$ are lognormally distributed accounting variables that aggregate into closing book value of equity. ν is a constant scale factor relating M to the product of the $|A_i|$, and See Appendix A for a brief explanation of Lubberink and Willett (2020).

To estimate the models, we convert Equation (2) to a linear model where the lowercase variables are the logs of the absolute values of $A_{i,n}$:

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

10

where *m* is the log of market value two months after the end of the quarter; $a_{n,i,t}$ 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]. *iii*) *Tier 2*. This is Supplementary Capital [5311]; *iv*) *Net Adjustments*. These are net prudential adjustments, 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.

The use of logs in finance and economics is common. Our approach closely resembles that of Cobb and Douglas (1928), whose production function estimates the regression $Q_t = A \cdot L_t^{\beta_1} K_t^{\beta_2}$ in logarithms: $ln(Q_t) = \beta_0 + \beta_1 \cdot ln(L_t) + \beta_2 \cdot ln(K_t)$, where Q is total production, A is total factor productivity, L is labour input, and K is capital input. β_1 and β_2 are the output elasticities of capital and labour, respectively. Felipe and Adams (2005) show that data on output and inputs used at the aggregate level are linked through an accounting identity, i.e., capital and labour can be expressed in additive form, yet the production function is estimated by a log-linear model.

3.2. The choice of market values as the dependent variable

The research design measures the value relevance of capital components, where the coefficient estimates are the components' elasticities with respect to market values. We are aware that market values reflect are primarily relevant for shareholders. As Laux (2016) notices, what is relevant for shareholders may not necessarily be relevant for prudential regulators, financial stability, taxpayers, or society.

Nevertheless, we justify our choice to focus on market values for four reasons. Firstly is that the aim of the post-GFC regulation was to reduce procyclical amplification of financial shocks throughout the banking system, financial markets and the broader economy (BCBS, 2010a). The regulatory adjustments introduced

---

[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

by Basel III contribute to the reduction of procyclicality. This is important, because, as we show, some variation of market values can be attributed to regulatory adjustments.

Secondly, prudential supervisors have become increasingly aware of the risks of low bank valuations. Luis de Guindos, Vice-President of the ECB, for example drew attention to the poor profitability outlook of European banks, which "is reflected in rock-bottom bank valuations, with the stock prices of euro area banks recovering less than the overall market over the summer" ECB (2020).

Thirdly, banks are worried about the effects of regulatory adjustments on equity and share prises. Many of the submissions from banks on the initial Basel III proposal express worries about increased earnings volatility (presumably associated with book and market volatility) caused by the proposed adjustments. Credit Suisse, for example mentions: "Pension assets often stem from the off-balance sheet treatment of estimated future pension liabilities (actuarial losses). We understand regulators' preference for an on-balance sheet treatment of such losses, as this would provide a snapshot of a bank's capital base. However, such a treatment would lead to significant volatility in banks' capital bases. We believe this to be undesirable both from capital planning and pro-cyclicality perspectives." Other submitters worried that dilution of ordinary equity may interfere with recapitalisation or refinancing. Standard Chartered Bank, for example, fears that the "inclination towards Core Tier 1 capital assumes that there is a very significant appetite for new equity capital during the transition to the new capital framework. Any new capital raised will dilute earnings and lead to lower returns on equity which will compound the difficulty of raising new capital." (BCBS, 2010b).

Moreover, in communications with investors, banks highlight the adjusted measures of bank capitalization, see the reference to JPMorgan Chase in the introduction. But other banks do so too. Citibank and Barclays bank mention their Common Equity Tier 1 capital ratios, i.e. ratios based on adjusted equity, prominently in their earnings announcement.[4]

---

[4]For the Citibank 2020Q3 announcement see https://www.citigroup.com/citi/investor/data/p201013a.pdf and for Barclays 2020Q3 see https://home.barclays/investor-relations/reports-and-events/results/q3-2020-results/.

Lastly, shareholders do not operate in a vacuum. Going back at least to seminal works such as Myers (1977) and Jensen (1986), there is a literature on capital structure choice that focuses on the trade-offs between holders of equity and debt.

4. 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.[5,6] The regulatory adjustments are from the report's Schedule HC-R–Regulatory Capital. 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 period ends at 2020Q. We include only banks with December 31 year-ends. We match market data for bank holding companies using the link to CRSP data from the New York Federal Reserve Banking Research Dataset website.[7] 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, Additional Tier 1, Perpetual Stock) and minority interests dominate the positive adjustments.

[Table 1 about here]

The negative adjustments are dominated by Goodwill and Intangibles, unrealized gains on Available-For-Sale (AFS) securities, and Deferred Tax Assets (DTAs).

[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 45 times larger than the bank at percentile 95. Although this

---

[5]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.

[6]CRSP-Compustat data that support the findings of this study are available via WRDS. Restrictions apply to the availability of these data, which were used under license for this study. The bank holding companies data is publicly available.

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

justifies our reliance on elasticities because these are scale free, we further examine the effects of size in Section 6.3.

A comparison of Tier 1 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 ($1,053M) are on average larger than positive adjustments ($561M), leading to an average net deduction from equity of $492M.

The Tier 1 ratio is 13.0 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, average Tier 2 capital ($612M) is visibly less than Tier 1 ($2,444M).

The average regulatory adjustments are relatively small. The mean net adjustment is 0.98 basis points of RWA, with negative adjustments depressing the Tier 1 ratio by 2.54 percent of RWA. 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 26,476 quarterly observations, with the number of observations varying from 1,747 in 2001 to 380 in 2020, with a peak of 1,865 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 11.3 percent and 14.9 percent, with lows during crises. Financial gearing, i.e the ratio of Total Assets to Book Equity, reaches a value of 15.04 in 2009. It then drops to its minimum value of 8.66 in 2019. The lower panel of Table 2 show the effect of Basel III: from 2015 on, deductions are higher and positive adjustments are lower than before.

14

5. Results

5.1. Main Results

Table 3 highlights the main results of our analysis. It shows results of panel data regressions, with time fixed effects and t-values that control for two-way clustering of observations.[8] 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.[9] The $\overline{R}^2$ values show that, with respect to banks, our model explains at least 89 percent of the variation in market values. The underlined entries are t-values that test if a coefficient differs from 1.

[Table 3 about here]

The first row shows a significant coefficient value of 1.04 on book value of bank equity (BV). And although the associated t-value in the indicates a significant difference from 1, the difference is relatively small and the t-value is the lowest of all underlined t-values. We infer from this that a one percent change in book value is associated with an approximately one percent change in market value, thus confirming our expected dollar-for-dollar relationship for market and book equity values.

Row II shows book value elasticities for non-financial firms of which we used Compustat data. The elasticities of non-financial firms are also close to but lower than 1. From this we infer that our results are can be generalized to all industries.

Rows III and IV show results of regressions of market values on bank Tier 1 and Total capital (TC). The elasticity on Tier 1 is larger than the one on book value of equity and the coefficient on Total Capital is larger than the one on Tier 1. These findings offer support for hypothesis 1. However, the coefficients

---

[8]We also performed quarterly cross-section regressions with Fama and MacBeth (1973) t-values, 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 (78). These quarterly regressions show virtually the same results and hence do not alter our inferences.

[9]See Appendix A for an explanation as to why the coefficients should sum to one.

on Book Equity, Tier 1 and Total Capital exceed the value of 1, albeit modestly. We further examine this in Section 5.2 and Section 6.1.

Row IV of Table 3 reports negative elasticities for Tier 2. This result is expected: an increase in Tier 2 capital can be attributed to the issuance of subordinated debt or the recognition of loan losses. Table 2 confirms that Tier 2 capital increased during the global financial crisis and the first half of 2020, untabulated results then confirm that the recognition of loan losses drives this increase of Tier 2 capital.

Regarding the coefficients on regulatory adjustments, Row III shows that the elasticity of net regulatory adjustments is negative. Similarly, row V shows negative coefficients on positive regulatory adjustments and positive coefficients on negative regulatory adjustments. The coefficients of positive adjustments more than offset those of the deductions, which explains the negative coefficients on net regulatory adjustments.[10]

Row VI 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). The coefficients are not overly sensitive to this change: row VI shows virtually the same coefficient values as those reported in row III.

5.2. *The evolution of elasticities over the sample period*

Table 4 and Figure 1 show the evolution of market value elasticities of book equity, Tier 1, and Total Capital over our sample period. Figure 1 shows results from quarterly regressions and it adds coefficient estimates for non-banks (in blue) and a dashed line for the S&P/TSX Composite Index for Banks (TXBA.TS).

[Table 4 and Figure 1 about here]

---

[10]The drop in sample size to 22,370 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.

Table 4 shows coefficient estimates for distinct sub-periods. 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 2013Q3 to the present. We designate as "DotCom Crisis" the period from 2001Q1 (the start of the sample period) to 2002Q3, as "Pre-Crisis" the period from 2002Q4 to 2007Q2, and as "GFC onset" the period 2007Q3 to 2009Q1. This period includes the fall of Lehman Brothers on 15 September 2008. "Post-Lehman" is the period starting from the London G20 (G20, 2009) and the 2009 Supervisory Capital Assessment Program (Federal Reserve, 2009) and ending after the Federal Reserve Board approved the final rule on the implementation of Basel III in July 2013 (Federal Reserve, 2013). "Basel III" is the period from 2013Q3 to 2020Q2, marking an era of regulatory and financial calm.

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. During the global financial crisis, the elasticities of Tier 1 and Total Capital start rising and from mid-2010 through to the end of 2019 the elasticities converge to 1 and to each other. We will show that the convergence is associated with improvements in the capitalization of banks and lower market uncertainty, see Section 6.1. The dashed red line shows that elasticities respond to significant drops in the (sectoral) market index, but less so to increases in the index. Regarding non-financial firms, the blue line shows that the book value elasticities are more stable over all years, and slightly below one.

The table confirms the observations from Figure 1. Market elasticities of book values are close to one. More importantly, after the entry into force of Basel III, the slope coefficient on book values is indistinguishable from 1. The market elasticities of Tier 1 are all higher than those of book values; the coefficients for Total Capital exceed those of Tier 1. We see a significant uptick of the Tier 1 and Total Capital slope coefficients during the onset of the global financial crisis and subsequent years. After the entry into force of Basel III, these coefficients start converging to one. We attribute the increased sensitivity of market values

to Tier 1 and Total Capital to the associated positive non-equity regulatory adjustments. These findings offer further support for hypothesis 1.

Figure 2 shows the evolution of regulatory adjustments. Panel 1 of the figure shows that market values are generally insensitive to net regulatory adjustments in the lead up to the global financial crisis.

Only from the onset of the global financial crisis, the elasticities of net regulatory adjustments start to turn negative. The adjustment elasticity turns positive in 2015, which coincides with the drop in positive regulatory capital additions shown in Table 2. Note that the book value elasticity remains relatively close to the value of one, whereas the elasticity of Tier 1 increases after the onset of the global financial crisis.

[Figure 2 about here]

Panel 2 of Figure 2 shows a sharp decline in the coefficient value for additions during the fourth quarter of 2008. Figure 2 Panel 3 shows the evolution of the relevant elasticities: while the Tier 2 elasticity of market values become more negative, the elasticity of Total Capital increases. Again, we attribute the increased sensitivity of market values to Total Capital shown in Panel 3 of Figure 2 to Tier 2.

5.3. Results for goodwill, DTAs, MSRs, unrealized gains and losses, and for minority interests

Table 5 shows results for the regulatory adjustments that top the two panels of Table 1 or that attracted regulatory attention during the 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 unrealized gains and losses on available for sale (AFS) securities, and *v*) the inclusion of qualifying minority interests in consolidated subsidiaries. We refer to Figure 3 to illustrate our results.

[Table 5 and Figure 3 about here]

18

The first column of Table 5 shows that the market elasticity of goodwill positive and significant, albeit small (0.04, t-value of 6.57). Over our sample period, the coefficient on goodwill remains below 0.10, see Figure 3, Panel 1. 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 (-0.02, t-value of -3.20), indicating that market values decrease with an increase in DTAs. The coefficient on mortgage servicing rights is insignificant. This is 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:[11]

> "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, supporting the exclusion of MSRs from capital (Federal Reserve Board, 2016).

The coefficient on the prudential filter on AFS securities is insignificant for the add-back of unrealized losses, despite being controversial (Ball, 2008). The deduction of unrealized gains is statistically significant, but small: 0.02 (t-value 4.62). Overall, these results reveal the limited economic significance of the prudential filter on AFS securities, contrary to existing studies (Becker, 2013, Chircop and Novotny-Farkas, 2016).

---

[11]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), (BCBS, 2010b).

The negative sign coefficient for minority interests suggests that these 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). Again, the coefficient is small (-0.01).

In all, the results of this subsection confirm hypothesis 2: when compared to the elasticities of book equity, Tier 1, and Total Capital, the market elasticities of regulatory adjustments are close to zero, and not necessarily positive, see Figure 3 Panel 2.

Our interpretation of the overall results thus far is that the book equity elasticity of market values dovetails with the dollar-for-dollar relation between market and book values. Moreover, elasticities of the two other measures of bank solvency, e.g. Tier 1 and Total Capital, appear to converge to the elasticity of book equity when market uncertainty is low. Lastly, positive regulatory adjustments and their associated negative elasticities are generally associated with elevated Tier 1 and Total Capital elasticities, while elasticities on negative adjustments tend to be small and less significant.

6. Additional tests

6.1. Results for Capitalisation Deciles and Gearing: Twelve percent is the magic number

Our results show that the elasticities on equity, Tier 1, and Total Capital often exceed the value of one, in particular after the onset of the global financial crisis. This prompts the question as to why these elasticities are higher than one. To answer this question, we perform three empirical tests and refer to results from simulated data in Appendix A. Firstly, we partition our sample in deciles based on Tier 1 capital ratios for each sample quarter. Table 6 and Panel 1 of Figure 4 show the results based on ordering the sample by Tier 1-ratio decile.

[Table 6 and Figure 4 about here]

20

The elasticities of book value decline until the third 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 (BCBS, 2018, Graph III.4).

Moreover, the Tier 1 ratio that corresponds with the levelled-out elasticities is about 12-13 percent, which closely matches results of Firestone et al. (2017), who document optimal Tier 1 ratios are just over 13 percent. In line with this result, BCBS (2019) shows that the marginal benefits of augmenting capital requirements diminish once banks research a Tier 1 ratio of 12 percent. Lastly, the convexity shown in Panel 1 of Figure 4 aligns with results of Arnould et al. (2020), who show that the cost of bank funding increases once a bank reaches a Common Equity Tier 1 ratio of 12 percent.

Secondly, we compare financial gearing to the Tier 1 elasticity of market values, where we define financial gearing as the mean of $\frac{TA}{BV}$ for all sample bank-quarters. Panel 1 of Figure 4 superimposes the gearing variable over Figure 2, Panel 2. The green line shows the evolution of gearing and reflects the values of the right-hand side vertical axis.

[Figure 4 about here]

The figure in Panel 1 shows a strong correspondence between gearing and Tier 1 elasticity values, confirming prior research by Bhagat, Bolton and Lu (2015). The correlation coefficient between gearing and the Tier 1 elasticity is 0.77 (p-value = 0.00). Results from simulated data confirm this result: high elasticities are associated with banks that are highly geared, during times of high market volatility (See Appendix A and Panel 2 of Figure A2). Exponentiated intercept values (e^{β_0}) are concave over the range of deciles, confirming the banks with the lowest Tier 1 ratios have the lowest market-to-book ratios, indicating the market deems these banks risky.

21

Thirdly, Panel 2 of Figure 4 superimposes a measure of market volatility, the CBOE-VIX, over Figure 2, Panel 2. The green line shows the evolution of the VIX, where we use its logged values for the right-hand side vertical axis. The figure shows a fair correspondence between the VIX and Tier 1 elasticity values ($\rho = 0.32$, p-value = 0.00). Again, the results from simulated data confirm this result: high elasticities are associated with high market volatility (See Appendix A and Panel 1 of Figure A2).

The results of this subsection confirm that poorly capitalised banks display higher Tier 1 elasticities of market value, in particular when the banking sector is excessively leveraged, i.e. when systemic risks are elevated. Further, it appears as if Tier 1 ratios of about 12-13 percent are associated with regulatory adjustments that contribute the least to excess sensitivity of market values.

6.2. The relevance of non-common equity of financials and non-financials

Our results show that the market elasticities of non-common equity items (e.g. preferred stock) are generally negative, which is characteristic for debt instruments. In this subsection we examine if the market elasticities of preferred stock of non-financial firms show the same characteristic. We 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 5 shows the results.

[Figure 5 about here]

The figure shows positive market elasticities for preferred stock of corporate stock in general. The coefficient on preferred stock is 0.03, t-value of 3.80 (untabulated). From this result we infer that non-common equity items for banks are different, the main difference being that they contribute to regulatory capital, and in doing so help prevent a bank from losing its banking licence. This inference is consistent with our main

results. Part of the stronger sensitivity of market values when gearing and market uncertainty are high can be attributed to non-equity bank capital, be it Tier 1 or Tier 2 capital.

6.3. Does bank size matter?

The size of banks varies considerable. Table 2 shows that bank size, measured by total assets, ranges from $141 million to $3.2 trillion. This subsection examines the effects of size on our results. We sorted our bank sample in annual size deciles, then re-ran our log linear models for each decile. Table 7 shows the results of this examination.

[Table 7 about here]

The table shows that the elasticities are fairly close to 1 over the entire size range. Again, the book value elasticity is generally closest to 1 for the full size range. Given the extraordinary size range that characterizes the banking industry, we infer from this examination that size does not unduly affect our inferences.

6.4. European data

Using data from the EBA transparency exercises over the periods 2015Q2–2020Q2 we find similar results as our main study. The market elasticity of book-equity (Tier 1) is 1.02 (1.05), with t-values that indicate these values are insignificantly different from 1. Net adjustment are just positive, as in Panel 1 of Figure 2 for the same period. We also find a negative and significant coefficient on positive adjustment (-0.09, t-value of -2.01). The coefficient on negative adjustments is positive but insignificant. One handicap with European regulatory bank data is that that it is not as standardized as the U.S. bank holding company data that we use for our main analysis. Moreover, the number of listed European banks we could use for our examination is limited to 63. Nevertheless, it is encouraging to see the important coefficients dovetail with the results of our main study.

7. Conclusion

We measure the value relevance of regulatory capital and regulatory adjustments of U.S. banks for shareholders. Our research design relies on parsimonious log-linear regression models that mitigate shortcomings of conventional research designs. Results for the years 2001-2020 show that banks' share price sensitivity to various measures of bank capital, e.g. book equity, Tier 1, Total Capital, converges to one when market uncertainty is low and when banks' Tier 1 ratios reach 12 percent of RWAs. Market values are particularly sensitive to changes in Tier 1 and Total Capital of highly geared banks during times of elevated market uncertainty. We attribute the excess sensitivity largely to capital components that increase regulatory capital, e.g. non-common equity and Tier 2 capital. The Total Capital elasticity during the global financial crisis reaches a value of 2, while the Tier 1 elasticity reaches a value of 1.3: a one percent change in Total Capital (Tier 1) is associated with a two (1.3) percent change in market value. We thus show that shareholders stand to gain from increases in non-common equity regulatory bank capital when the continuation of banks as a going concern is at stake. Supporting this result is our examination of preferred stock for corporates, to which market values are less sensitive than preferred bank stock when market uncertainty is high. An investigation of five significant or controversial regulatory adjustments shows that market values are not overly sensitive to these prudential filters.

We performed many robustness checks. For example, we ran simulations to show that excess elasticity values are associated with gearing and market volatility. Our results are also generally insensitive to the size of banks. Main coefficients are comparable to those estimated using European banks and non-banks. We ran regressions with alternative model specifications, following the research design of Aledo Martínez et al. (2020). None of the alternative regression designs offer insights that are more consistent or easier to map to economic events than the research design we employ; see for an example our replication of an existing study in Appendix B. We are thus confident about the validity of our research method.

Regarding policy relevance, regulators do spend considerable time tweaking regulatory adjustments. Only recently the European Banking Authority approved a new adjustment for the treatment of capitalized software (EBA, 2020a). Our results indicate that such an adjustment has limited effect on the market values of banks. More importantly, despite studies supporting "simple" and "pure" measures of bank capital, our results show no superiority of a single measure, especially during sanguine economic conditions and when banks are well-capitalized. On the other hand, when markets are volatile and when banks are poorly-capitalized, our results show that shareholders stand to gain from increases in non-equity capital. This may contribute to a lower probability of default, perhaps at the expense of the ability of absorb losses. Whether that is desirable is a matter for policymakers to decide.

References

Admati, A. R., DeMarzo, P. M., Hellwig, M. F. and Pfleiderer, P. C. (2016). 'Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is not Expensive'. *SSRN eLibrary*, , no. ID 1669704, pp. 1–77.

Aledo Martínez, J., García Lara, J. M., González Pérez, M. T. and Grambovas, C. A. (2020). 'An empirical assessment of proposed solutions for resolving scale problems in value relevance accounting research'. *Accounting & Finance*, vol. 60, no. 4, pp. 3905–3933.

Ali, A. and Zarowin, P. (1992). 'The Role of Earnings Levels in annual Earnings-Returns Studies'. *Journal of Accounting Research*, vol. 30, no. 2, pp. 286–296.

Arnould, G., Pancaro, C. and Żochowski, D. (2020). *Bank funding costs and solvency* (ECB, Frankfurt). *https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2356~4a9ccc29af.en.pdf*.

Ball, R. (2008). 'Don't Blame the Messenger ... or Ignore the Message'. Chicago Booth working paper; *http://faculty.chicagobooth.edu/brian.barry/igm/ShootingtheMessenger2008-10-12.pdf*.

Barth, M. E. (1994). 'Fair value accounting: Evidence from investment securities and the market valuation of banks'. *The Accounting Review*, vol. 69, pp. 1–25.

Barth, M. E., Beaver, W. H. and Landsman, W. R. (2001). 'The relevance of the value relevance literature for financial accounting standard setting: Another view'. *Journal of Accounting and Economics*, vol. 31, pp. 77–104.

Barth, M. E. and Clinch, G. (2009). 'Scale effects in capital markets-based accounting research'. *Journal of Business Finance & Accounting*, vol. 36, no. 3-4, pp. 253–288.

Barth, M. E., Gómez-Biscarri, J., Kasznik, R. and López-Espinosa, G. (2017). 'Bank earnings and regulatory capital management using available for sale securities'. *Review of Accounting Studies*, vol. 22, no. 4, pp. 1761–1792.

BCBS (1998). *International convergence of capital measurement and capital standards - (July 1988, UPDATED TO April 1998)* (Bank for International Settlements, Basel). *http://www.bis.org/publ/bcbsc111.pdf*.

——— (2009). *Strengthening the resilience of the banking sector* (Bank for International Settlements, Basel). *www.bis.org/publ/bcbs164.pdf*.

——— (2010a). *Basel III: A global regulatory framework for more resilient banks and banking systems* (Bank for International Settlements, Basel). *www.bis.org/publ/bcbs189.htm*.

——— (2010b). *Comments received on the consultative documents "Strengthening the resilience of the banking sector"* (Bank for International Settlements, Basel). *https://www.bis.org/publ/bcbs165/cacomments.htm*.

——— (2011). *Final elements of the reforms to raise the quality of regulatory capital issued by the Basel Committee* (Bank for International Settlements, Basel). *www.bis.org/press/p110113.htm*.

——— (2018). *Annual Economic Report 2018* (Bank for International Settlements, Basel). *https://www.bis.org/publ/arpdf/ar2018e.pdf*.

——— (2019). *The costs and benefits of bank capital - a review of the literature* (Bank for International Settlements, Basel). *https://www.bis.org/bcbs/publ/wp37.htm*.

——— (2020). *Basel III Monitoring Report* (Bank for International Settlements, Basel). *https://www.bis.org/bcbs/publ/d512.pdf*.

Beatty, A., Chamberlain, S. L. and Magliolo, J. (1995). 'Managing Financial Reports of Commercial Banks: The Influence of Taxes, Regulatory Capital, and Earnings'. *Journal of Accounting Research*, vol. 33, no. 2, pp. 231–261.

Becker, L. (2013). 'Banks fear capital swings if Basel III kills bond filter'. *Risk Magazine*, pp. 33–42.

Begley, J., Chamberlain, S. L. and Li, Y. (2006). 'Modeling Goodwill for Banks : A Residual Income Approach with Empirical Tests'. *Contemporary Accounting Research*, vol. 23, pp. 31–68.

Berger, A. N. and Bouwman, C. H. (2013). 'How does capital affect bank performance during financial crises?' *Journal of Financial Economics*, vol. 109, no. 1, pp. 146–176.

Berger, A. N., Herring, R. J. and Szegö, G. P. (1995). 'The role of capital in financial institutions'. *Journal of Banking & Finance*, vol. 19, no. 3–4, pp. 393–430.

Bhagat, S., Bolton, B. J. and Lu, J. (2015). 'Size, Leverage, and Risk-Taking of Financial Institutions'. *Journal of Banking & Finance*, , no. 59, pp. 520–537.

Bushman, R. M. and Williams, C. D. (2012). 'Accounting discretion, loan loss provisioning, and discipline of Banks' risk-taking'. *Journal of Accounting and Economics*, vol. 54, no. 1, pp. 1–18.

Chan, S. and van Wijnbergen, S. (2014). 'Cocos, Contagion and Systemic Risk'. Tinbergen Institute Discussion Papers 14-110/VI/DSF79, Tinbergen Institute.

Chircop, J. and Novotny-Farkas, Z. (2016). 'The economic consequences of extending the use of fair value accounting in regulatory capital calculations'. *Journal of Accounting and Economics*, vol. 62, no. 2-3, pp. 183–203.

Cobb, C. W. and Douglas, P. H. (1928). 'A Theory of Production'. *American Economic Review*, vol. 18, no. 1, pp. 139–165.

Collins, S. M. (2010). *Amendment SA 3879 Restoring American Financial Stability Act of 2010.* Congress.gov. *http://beta.congress.gov/amendment/111/senate-amendment/3879/text*.

Conlon, T., Cotter, J. and Molyneux, P. (2020). 'Beyond common equity: The influence of secondary capital on bank insolvency risk'. *Journal of Financial Stability*, vol. 47, pp. 2–18.

DeAngelo, H. and Stulz, R. M. (2013). 'Why High Leverage is Optimal for Banks'. Working Paper 19139, National Bureau of Economic Research.

Demirgüç-Kunt, A., Detragiache, E. and Merrouche, O. (2013). 'Bank Capital: Lessons from the Financial Crisis'. *Journal of Money, Credit and Banking*, vol. 45, no. 6, pp. 1147–1164.

Dhaliwal, D., Subramanyam, K. and Trezevant, R. (1999). 'Is comprehensive income superior to net income as a measure of firm performance?' *Journal of Accounting and Economics*, vol. 26, no. 1–3, pp. 43–67.

Diamond, D. W. and Rajan, R. G. (2001). 'Banks and Liquidity'. *American Economic Review*, vol. 91, no. 2, pp. 422–425.

Dong, M. and Zhang, X.-J. (2017). 'Selective Trading of Available-for-Sale Securities: Evidence from U.S. Commercial Banks'. *European Accounting Review*, pp. 1–27.

Easton, P. D. (1998). 'Discussion of revalued financial, tangible, and intangible assets: association with share prices and non-market-based value estimates.' *Journal of Accounting Research*, vol. 36, no. Supplement, pp. 235–247.

EBA (2020a). *Draft Regulatory Technical Standards on the prudential treatment of software assets under Article 36 of Regulation (EU) No 575/2013 Capital Requirements Regulation - CRR* (European Banking Authority, London). *https://eba.europa.eu/regulation-and-policy/own-funds/regulatory-technical-standards-prudential-treatment-software-assets*.

——— (2020b). *Risk assessment of the European banking system* (European Banking Authority, London). *https://eba.europa.eu/sites/default/documents/files/document_library/Risk%20Analysis%20and%20Data/Risk%20Assessment%20Reports/2020/December%202020/961060/Risk%20Assessment_Report_December_2020.pdf*.

ECB (2020). *The euro area financial sector in the pandemic crisis. Keynote speech by Luis de Guindos* (European Central Bank).

Enrich, D. and Paletta, D. (2010). 'Banks Gain in Rules Debate'. *Wall Street Journal*. July 15, 2010.

Fama, E. F. and MacBeth, J. (1973). 'Risk, Return, and Equilibrium: Empirical Tests'. *Journal of Political Economy*, vol. 81, pp. 607–636.

FASB (2008). *Noncontrolling Interests in Consolidated Financial Statements–an amendment of ARB No. 51*. Financial Accounting Standards Board, Norwalk, CT. FASB Summary of Statement No. 160.

FDIC (2012). *Risk Management Manual of Examination Policies.* Federal Deposit Insurance Corporation, Arlington, VA. *www.fdic.gov/regulations/safety/manual/index_pdf.html*.

Federal Reserve (2005). *Final Rule No. R-1193 (March 10, 2005), Risk-Based Capital Standards: Trust Preferred Securities and the Definition of Capital.* Board of Governors of the Federal Reserve System, New York and Washington. *www.gpo.gov/fdsys/granule/FR-2005-03-10/05-4690/content-detail.html* Docket Number R-1193.

——— (2006). *Instructions for Preparation of Consolidated Financial Statements for Bank Holding Companies Reporting Form FR Y–9C.* Board of Governors of the Federal Reserve System, New York. *www.federalreserve.gov/reportforms/forms/FR_Y-9C20060331_i.pdf*.

——— (2009). *Federal Reserve, OCC, and FDIC release results of the Supervisory Capital Assessment Program.* Board of Governors of the Federal Reserve System, New York. *https://www.federalreserve.gov/newsevents/pressreleases/bcreg20090507a.htm*.

——— (2013). *'Federal Reserve Board approves final rule to help ensure banks maintain strong capital positions.* Board of Governors of the Federal Reserve System, New York. *https://www.federalreserve.gov/newsevents/pressreleases/bcreg20130702a.htm*.

Federal Reserve Board (2016). *Report to the Congress on the Effect of Capital Rules on Mortgage Servicing Assets.* Federal Reserve Board, Washington. *http://www.federalreserve.gov/publications/other-reports/files/effect-capital-rules-mortgage-servicing-assets-201606.pdf*.

Felipe, J. and Adams, F. G. (2005). '"A Theory of Production" The Estimation of the Cobb-Douglas Function: A Retrospective View'. *Eastern Economic Journal*, vol. 31, no. 3, pp. 427–445.

27

Firestone, S., Lorenc, A. and Ranish, B. (2017). 'An Empirical Economic Assessment of the Costs and Benefits of Bank Capital in the US'. *Finance and Economics Discussion Series*, vol. 2017, no. 34.

Frankel, R. M., Lee, J. A. and McLaughlin, M. (2010). 'The Impact of SFAS 160: An Investigation of the Economic Consequences of the Reclassification of Minority Interest'. *SSRN eLibrary*, , no. ID 1557805.

G20 (2009). *Global Plan for Recovery and Reform*. G20 Information Centre, London. *http://www.g20.utoronto.ca/2009/2009communique0402.html*.

Gambacorta, L. and Shin, H. S. (2018). 'Why bank capital matters for monetary policy'. *Journal of Financial Intermediation*, vol. 35, pp. 17–29.

Haldane, A. G. (2012). *The dog and the frisbee* (Bank for International Settlements, Basel). *https://www.bis.org/review/r120905a.pdf*.

Harper, C. (2010). 'The Meaning of Basel: Cohen, Spillenkothen, Stiglitz Speak Out'. *Bloomberg*. September 13, 2010.

Holthausen, B. and Watts, R. (2001). 'The Relevance of Value Relevance Literature of Financial Accounting Standard Setting'. *Journal of Accounting and Economics*, vol. 31, no. 1–3, pp. 3–75.

Jensen, M. C. (1986). 'Agency Cost Of Free Cash Flow, Corporate Finance, and Takeovers'. *American Economic Review*, vol. 76, no. 2, pp. 323–329.

Jordà, Ò., Richter, B., Schularick, M. and Taylor, A. M. (2017). 'Bank Capital Redux: Solvency, Liquidity, and Crisis'. *NBER Working Paper Series*, pp. 1–55.

JPMorgan Chase (2020). *Quarterly Earnings* (JPMorgan Chase & Co., New York, NY). *https://www.jpmorganchase.com/ir/quarterly-earnings*.

Kashyap, A. K., Rajan, R. G. and Stein, J. C. (2008). 'Rethinking Capital Regulation'. In 'Federal Reserve Bank of Kansas City Symposium on Maintaining Stability in a Changing Financial System', (Federal Reserve Bank of Kansas City), pp. 431–471.

Kim, M.-S. and Kross, W. (1998). 'The impact of the 1989 change in bank capital standards on loan loss provisions and loan write-offs'. *Journal of Accounting and Economics*, vol. 25, no. 1, pp. 69–99.

Kim, S., Kim, S. and Ryan, S. G. (2019). 'Economic consequences of the AOCI filter removal for advanced approaches banks'. *The Accounting Review*, vol. 94, no. 6, pp. 309–335.

Koziol, C. and Lawrenz, J. (2012). 'Contingent convertibles. Solving or seeding the next banking crisis?' *Journal of Banking & Finance*, vol. 36, no. 1, pp. 90–104.

Laeven, L. and Majnoni, G. (2003). 'Loan loss provisioning and economic slowdowns: too much, too late?' *Journal of Financial Intermediation*, vol. 12, no. 2, pp. 178–197.

Laux, C. (2016). 'The economic consequences of extending the use of fair value accounting in regulatory capital calculations: A discussion'. *Journal of Accounting and Economics*, vol. 62, no. 2-3, pp. 204–208.

Lubberink, M. J. P. and Willett, R. J. (2020). 'The fundamental relation between firm market and accounting values is a multiplicative power law'. *SSRN eLibrary*, , no. ID 3531319, pp. 1–48.

Martynova, N. and Perotti, E. (2018). 'Convertible bonds and bank risk-taking'. *Journal of Financial Intermediation*, vol. 35, pp. 61 – 80. Banking and regulation: the next frontier.

Mehran, H. and Thakor, A. (2011). 'Bank Capital and Value in the Cross-Section'. *Review of Financial Studies*, vol. 24, no. 4, pp. 1019–1067.

Merton, R. C. (1974). 'On the Pricing of Corporate Debt: The Risk Structure of Interest Rates'. *The Journal of Finance*, vol. 29, no. 2, pp. 449–470.

Miller, M. H. and Modigliani, F. (1961). 'Dividend Policy Growth and the Valuation of Shares'. *Journal of Business*, vol. 34, pp. 411–433.

Moyer, S. E. (1990). 'Capital adequacy ratio regulations and accounting choices in commercial banks'. *Journal of Accounting and Economics*, vol. 13, no. 2, pp. 123–154.

Myers, S. C. (1977). 'Determinants of corporate borrowing'. *Journal of Financial Economics*, vol. 5, no. 2, pp. 147–176.

Ng, J. and Roychowdhury, S. (2014). 'Do Loan Loss Reserves Behave like Capital? Evidence from Recent Bank Failures'. *Review of Accounting Studies*, vol. 19, no. 3, pp. 1234–1279.

OCC (2012). *Regulatory Capital Rules: Regulatory Capital, Implementation of Basel III, Minimum Regulatory Capital Ratios, Capital Adequacy, Transition Provisions, and Prompt Corrective Action*. Office of the Comptroller of the Currency, Department Of The Treasury, Washington. *www.gpo.gov/fdsys/pkg/FR-2012-08-30/pdf/2012-16757.pdf*.

Penman, S. H., Reggiani, F., Richardson, S. A. and Tuna, I. (2018). 'A framework for identifying accounting characteristics for asset pricing models, with an evaluation of book-to-price'. *European Financial Management*, vol. 24, no. 4, pp. 488–520.

Penman, S. H. and Yehuda, N. (2009). 'The pricing of earnings and cash flows and an affirmation of accrual accounting'. *Review of Accounting Studies*, vol. 14, no. 4, pp. 453–479.

Plosser, M. C. and Santos, J. A. C. (2018). 'The Cost of Bank Regulatory Capital'. *Federal Reserve Bank of New York Staff Reports*, vol. 2018, no. 853.

Ramesh, K. and Revsine, L. (2000). 'The effects of regulatory and contracting costs on banks' choice of accounting method for other postretirement employee benefits'. *Journal of Accounting and Economics*, vol. 30, no. 2, pp. 159–186.

Simonian, H. (2010). 'Capital proposal targets UBS and Credit Suisse'. *Financial Times*. October 4, 2010.

Skinner, D. J. (2008). 'The rise of deferred tax assets in Japan: The role of deferred tax accounting in the Japanese banking crisis'. *Journal of Accounting and Economics*, vol. 46, pp. 218–239.

Thakor, A. V. (2014). 'Bank Capital and Financial Stability: An Economic Tradeoff or a Faustian Bargain?' *Annual Review of Financial Economics*, vol. 6, no. 1, pp. 185–223.

Vallascas, F. and Hagendorff, J. (2013). 'The Risk Sensitivity of Capital Requirements: Evidence from an International Sample of Large Banks'. *Review of Finance*, vol. 17, no. 6, pp. 1947–1988.

Yang, X. (2016). 'Predicting bank failures: The leverage versus the risk-weighted capital ratio'. EconomiX Working Papers 2016-15, University of Paris West - Nanterre la Défense, EconomiX.
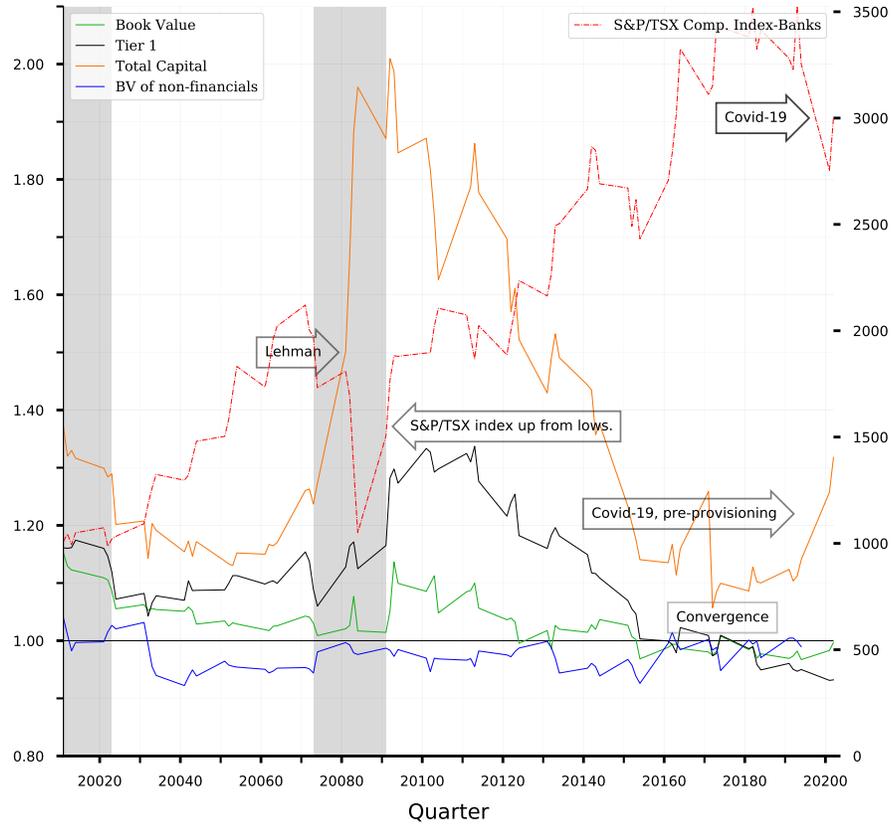
Figure 1: Comparison of market elasticities. $m = f(bv)$, $m = f(t1, \Delta)$, $m = f(tc, t2, \Delta)$, where all variables are logged values. m is the log of market value two months after the end of the quarter; $t1$ is the log of Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III; $t2$ is the log of Tier 2 or Supplementary Capital; tc is the log of total regulatory capital; and bv is the log of the book value excluding perpetual preferred stock at the end of the quarter. Δ is the log of the net absolute value of regulatory adjustments. Only slope coefficients (elasticities) of bv, $t1$, tc are shown. The dashed line shows shows the S&P/TSX Composite Index for Banks (TXBA.TS).
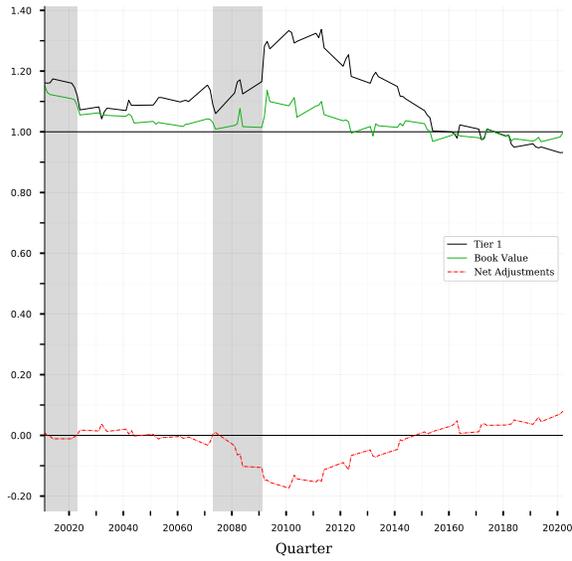
Panel 1: Market elasticities for $m = f(bv)$ and $m = f(t1, \Delta)$.
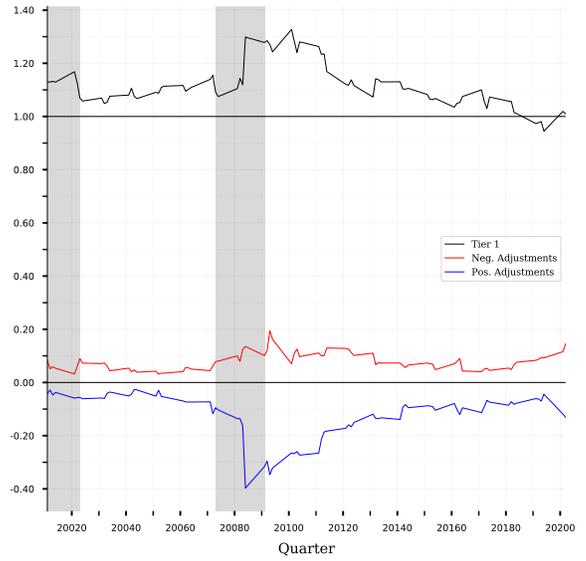
Panel 2: Market elasticities for $m = f(t1, \Delta^+, \Delta^-)$.
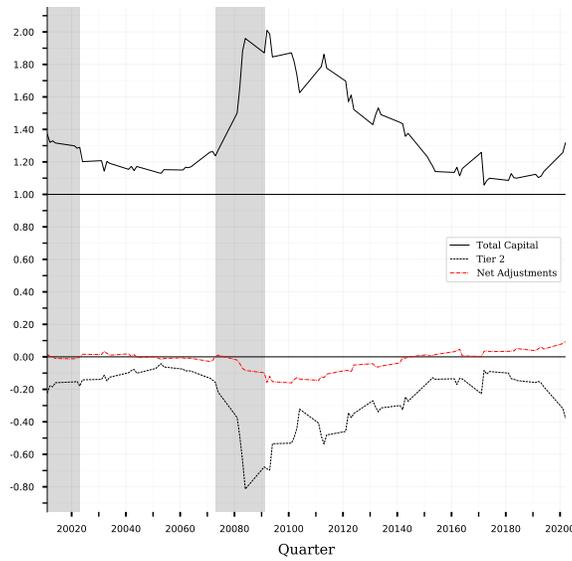
Panel 3: Market elasticities for $m = f(tc, t2, \Delta)$.

Figure 2: Market elasticities for regulatory adjustments. Variables are logged absolute values. m is the log of market value two months after the end of the quarter; $t1$ is the log of Tier 1 or Common Equity Tier 1; bv is the log of the book value excluding perpetual preferred stock at the end of the quarter. Δ is the log of the net absolute value of regulatory adjustments; adjustments that increase Tier 1 or CET1 relative to equity are (Δ^+); adjustments that decrease Tier 1 or CET1 relative to equity are (Δ^-); $t2$ is the log of Tier 2 or Supplementary Capital; and tc is the log of Total Capital.
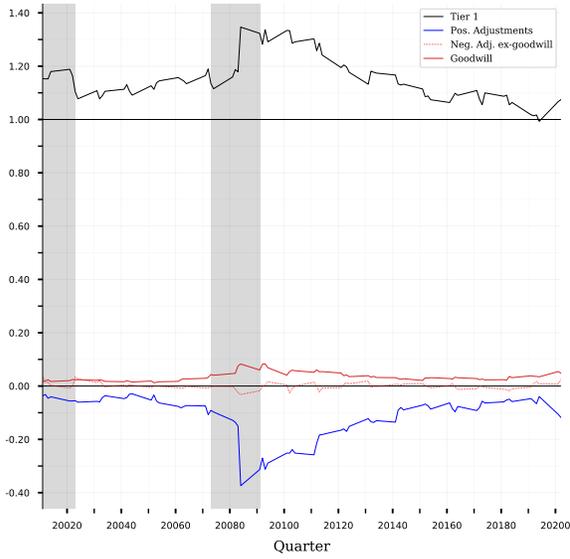
Panel 1: Comparison of market elasticities for deducted goodwill: $m = f(t1, gw, \Delta^{-'}, \Delta^{+})$, where variables are logged absolute values. $\Delta^{-'}$ is negative regulatory adjustments excluding the prudential adjustment for goodwill. Δ^{+} are adjustments that increase Tier 1 or CET1 relative to equity.
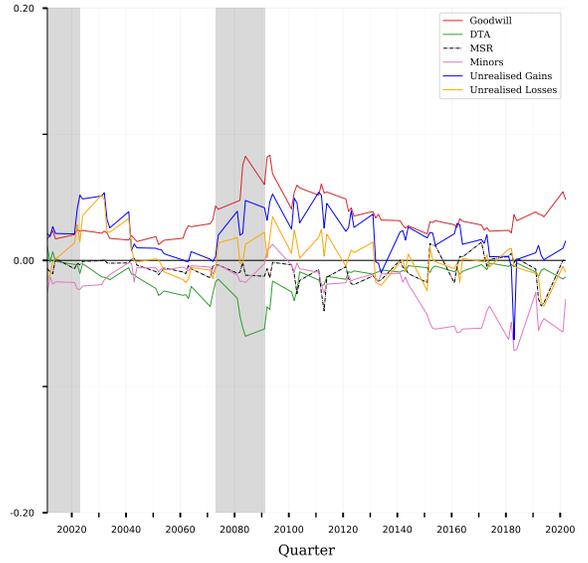
Panel 2: Comparison of market elasticities of the main regulatory adjustments– enlarged. $m = f(t1, x, \Delta^{-'}, \Delta^{+'})$, where x is one of the regulatory adjustments. Unlike the graph to the left, the elasticities of Tier 1 and aggregate positive and negative regulatory adjustments are not shown.

Figure 3: Market elasticities for distinct regulatory adjustments.
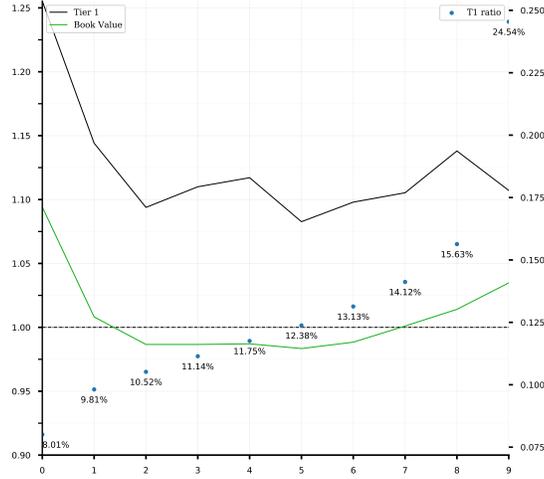
Panel 1: Book value and Tier 1 elacticities for port-
folios of bank capitalisation.
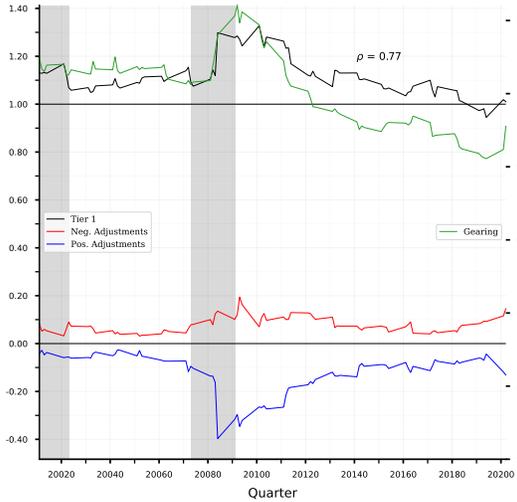
Panel 2: Tier 1 elacticities and gearing.
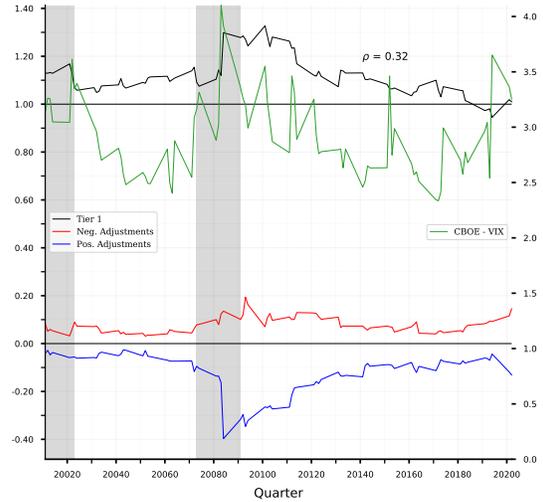
Panel 3: Tier 1 elacticities and volatility.

Figure 4: Panel 1 shows market elasticities for $m = f(t1, \Delta)$ and $m = f(bv)$, slope values only. Variables are logged absolute values. m is the log of market value two months after the end of the quarter; $t1$ is either Tier 1 or Common Equity Tier 1, the latter as defined by the U.S. implementation of Basel III; and (bv) the book value excluding perpetual preferred stock at the end of the quarter. Δ is the log of the net absolute value of regulatory adjustments. Panels 2 and 3 compare market elasticities from Figure 2 with gearing and the CBOE-VIX. Gearing is the sample average ratio of total assets over book equity. Volatility is measured by taking the log of the CBOE-VIX.
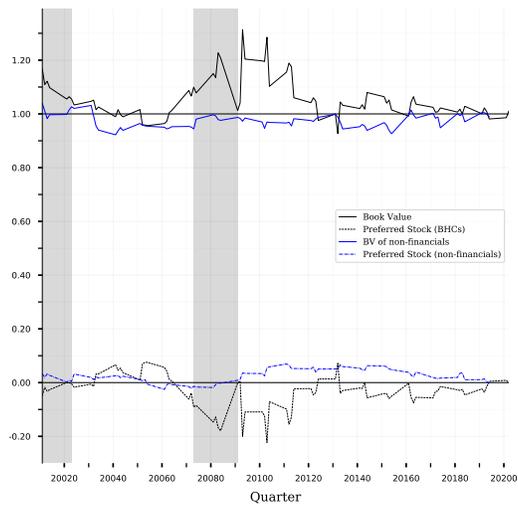
Figure 5: Comparison of market elasticities of book values and preferred stock for banks (BHCs) and non-financials. For non-financial firms, the relevant variables are Compustat items *book value of common equity* and *preferred stock*.

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]	91.5
Minority interests in consolidated subsidiaries [G214], [B589], and [P839]	26.6
Additional Tier 1 capital instruments [P860] and [P861]	18.2
Net unrealized holding losses on Available-For-Sale securities [8434] and [P844]	10.1
Accumulated loss on cash-flow hedges and Defined benefit post-retirement plans [4336], [P846], [P847] and [P849]	7.85
Perpetual Preferred Stock including Related Surplus (pre-Basel III) [3283]	3.92
Tier 1 Minority Interest Not Included In Common Equity Tier 1 Capital [P862]	3.70
Net unrealized losses on held-to-maturity securities that are included in AOCI [P848]	0.19
Qualifying mandatory convertible preferred securities of internationally active bank holding companies [G216]	0.07
Unrealized loss in fair valued financial liabilities attributable to changes in own creditworthiness [F264] and [Q258]	0.02
Other	1.83

Negative adjustments are:	Impact on Tier 1 in bp of RWA
Goodwill and Intangibles [B590], [P842], [P841]	215.2
Net unrealized holding gains on Available-For-Sale securities [8434], [A221], [P844], and [P845]	18.4
Deferred Tax Assets [5610], [P843], [P855]	11.5
Additional Tier 1 capital deductions, [P864]	5.96
Mortgage servicing rights and purchased credit card relationships [P854], [B591]	1.09
Accumulated gains on cash-flow hedges and Defined benefit post-retirement plans [4336], [P846], [P847] and [P849]	0.58
Non-qualifying Perpetual Preferred Stock [B588]	0.55
Unrealized gain in fair valued financial liabilities attributable to changes in own creditworthiness [F264] and [Q258]	0.08
Investments in the capital of unconsolidated financial institutions that exceed the relevant 10 % threshold [P851] and [P853]	0.05
Net unrealized gains on held-to-maturity securities that are included in AOCI [P848]	0.03
Significant investments in financial institutions, MSR, and DTAs over the 15 % CET1 deduction threshold [P856]	0.02
Other	0.72

Notes: Regulatory adjustments for U.S. bank holding companies covering the quarters 2001Q1–2020Q2. *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.

$n = 26,476$	Mean	Min	p5	p25	p50	p75	p95	Max	StDev
M	3,842	1.00	27.9	86.6	250	972	11,987	429,913	20,802
BV	2,936	-510	27.9	70.6	166	621	7,346	250,136	17,568
Tier 1	2,444	-505	30.6	75.4	171	573	6,616	220,674	14,677
Additional Tier 1	588	0.00	0.00	2.52	25.0	79.4	1,788	29,815	2,941
Tier 2	612	0.00	2.61	7.27	17.2	62.8	1,486	66,951	3,857
Net Adjustments	-492	-65,600	-1,196	-49.3	-1.93	11.35	88.5	52,237	3,528
Pos Adjustments	561	-1.48	0.00	5.16	23.6	77.2	1048	116,129	4,052
Neg Adjustments	1,053	0.00	0.07	3.77	21.1	132	2,067	106,163	6,820
Total Assets	31,468	141	354	828	1,878	6,283	70,141	3,213,115	195,115
Tier 1 ratio	13.0	0.00	8.53	10.5	12.0	14.1	19.2	100	5.78
Tier 2 ratio	1.54	0.00	0.73	1.09	1.25	1.68	3.46	24.4	0.88
AT1 ratio	0.95	0.00	0.00	0.10	0.76	1.40	2.79	8.29	0.97
Net Adj over RWA (%)	-0.98	-97.1	-5.84	-2.14	-0.48	0.83	2.71	26.1	3.52
Pos Adj over RWA (%)	1.39	0.00	0.00	0.08	1.05	2.37	3.75	26.1	1.46
Neg Adj over RWA (%)	2.54	0.00	0.01	0.50	1.60	3.63	7.44	97.1	3.38

Year	M	BV	Tier 1	Tier 2	Net Adj	Pos Adj	Neg Adj	$\frac{\text{Tier 1}}{\text{RWA}}$ (%)	$\frac{\text{Tier 2}}{\text{RWA}}$ (%)	$\frac{\text{AT1}}{\text{RWA}}$ (%)	Gearing	$\frac{\text{NetAdj}}{\text{RWA}}$ (%)	$\frac{\text{Pos}}{\text{RWA}}$ (%)	$\frac{\text{Neg}}{\text{RWA}}$ (%)	# of obs.
2001	2,542	993	853	312	-140	117	257	12.6	1.52		12.2	-0.54	0.96	1.50	1,747
2002	2,378	1,067	900	320	-168	138	305	13.0	1.55		11.8	-0.52	1.29	1.80	1,822
2003	2,487	1,144	966	337	-177	150	327	13.0	1.62		11.8	-0.43	1.53	1.95	1,865
2004	2,958	1,347	1,054	356	-294	169	463	12.9	1.58		11.7	-0.21	1.85	2.05	1,812
2005	2,978	1,539	1,158	389	-382	196	578	12.5	1.48		11.7	-0.23	1.99	2.22	1,824
2006	3,795	1,953	1,466	501	-487	282	770	12.1	1.49		11.6	-0.47	2.24	2.71	1,581
2007	3,707	2,197	1,586	627	-611	355	967	11.7	1.49		11.3	-0.91	2.07	2.98	1,497
2008	2,516	2,227	1,914	755	-314	787	1,101	11.3	1.61		12.4	-0.52	2.37	2.89	1,421
2009	2,088	2,413	2,395	766	-18	1,045	1,063	12.1	1.68		15.0	0.96	3.46	2.50	1,419
2010	2,953	3,000	2,515	763	-485	676	1,161	13.1	1.70		15.0	0.68	3.29	2.61	1,346
2011	2,797	3,353	2,750	738	-603	607	1,209	14.4	1.60		12.8	0.40	3.06	2.66	1,287
2012	3,254	3,667	2,947	654	-720	523	1,244	14.9	1.50		11.5	-0.11	2.67	2.78	1,268
2013	4,125	3,848	3,106	637	-742	455	1,197	14.8	1.43		10.8	-0.21	2.31	2.52	1,268
2014	4,746	4,051	3,365	634	-686	626	1,311	14.5	1.39	1.11	10.3	-0.76	1.81	2.57	1,285
2015	5,731	5,049	4,278	813	-772	970	1,741	13.3	1.41	1.21	9.67	-1.17	1.89	3.06	1,016
2016	5,997	5,729	4,874	922	-854	1,159	2,013	12.8	1.46	1.07	9.66	-1.35	1.62	2.97	952
2017	7,789	5,806	4,980	898	-826	1,184	2,010	13.0	1.47	0.95	9.37	-1.55	1.45	3.00	962
2018	7,948	5,955	5,091	890	-864	1,217	2,081	12.9	1.50	0.78	9.08	-2.01	1.45	3.46	953
2019	9,447	7,580	6,384	1,109	-1,196	1,454	2,650	12.8	1.53	0.75	8.66	-2.86	1.20	4.06	771
2020	6,455	7,717	6,538	1,336	-1,179	1,694	2,873	12.5	1.87	0.75	9.24	-2.76	1.45	4.21	380

Notes: Descriptive statistics of variables from U.S. bank holding companies over the 2001Q1 to 2020Q2. *M* is market value two months after the end of the quarter *BV* is book value excluding perpetual preferred stock at the end of the quarter [3210] – [3283]. *Tier 1* is Tier 1 capital [8274]. *Additional Tier 1* or *AT1* is item [P865]. *Tier 2* is Supplementary Capital [5311]. *Gearing* is Total Assets over Book Value (BV). *Net Adjustments* is the net of prudential adjustments, defined as *Tier 1* minus *BV*, both as previously defined. *Pos (Neg) Adjustments* are adjustments that increase (decrease) *Tier 1* relative to equity. *Total assets* is item [2170]. *RWA* is Risk-Weighted Assets [A223]. Amounts are in millions of USD. The number of observations reported in a row is the sum of the quarterly observations. 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 3 Log Model

Pooled		BV	Tier 1	TC	Net Adj	Pos Adj	Neg Adj	Tier 2	Intercept	$\Sigma\beta_{1..N}$	$\overline{R}^2$	# of obs.
I	β	1.04							-0.24	1.04	0.91	26,476
	t	85.8							-1.60			
	$t_{\beta:1}$	<u>12.6</u>										
II*	β	0.89							1.47	0.89	0.89	186,925
	t	63.8							13.7			
	$t_{\beta:1}$	<u>61.4</u>										
III	β		1.13		-0.03				-1.03	1.10	0.89	26,452
	t		49.6		-1.74				-5.51			
	$t_{\beta:1}$		<u>32.3</u>									
IV	β			1.37	-0.02			-0.24	-1.73	1.10	0.89	26,404
	t			23.6	-1.68			-6.06	-5.98			
	$t_{\beta:1}$			<u>39.8</u>								
V	β		1.12			-0.11	0.07		-0.84	1.08	0.90	22,370
	t		49.5			-9.43	8.24		-4.33			
	$t_{\beta:1}$		<u>28.7</u>									
VI**	β		1.12		-0.03				-0.98	1.10	0.88	23,906
	t		47.9		-1.73				-4.94			
	$t_{\beta:1}$		<u>19.3</u>									

Notes: The table reports results of panel data regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2020Q2, where the dependent variable (m) is the log of the market value of the bank two months after quarter end:

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

$a_{n,i,j}$ is from the following list of (N) regressors, which are 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 Tier 1 capital [8274]. *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. *Additional Tier 1* is item [P865]. *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 relies on *t*-values that account for two-dimensional within-cluster correlation. We employ time fixed-effects. $t_{\beta:1}$ denotes *t*-values for *BV*, *Tier 1*, and *TC* that test if the coefficient differs from one (1).

*: Non-financial firms only: all Compustat firms excluding those with SIC codes between 6000 and 6799 (financials) and between 4000 and 4999 (regulated industries).

**: Only banks with Total Assets > \$500*M*.

Table 4 Log Model – elasticities by period.

Period		Book Value	δ	$p_δ$	$\overline{R}^2$	Tier 1	δ	$p_δ$	$\overline{R}^2$	Total Capital	δ	$p_δ$	$\overline{R}^2$	nobs
DotCom Crisis	β	1.12			0.96	1.15			0.96	1.31			0.95	3,099
	$t_{β:1}$	89.6				117				46.3				
Pre-Crisis	β	1.04	-0.08	0.00	0.96	1.09	-0.06	0.00	0.96	1.17	-0.14	0.01	0.96	8,284
	$t_{β:1}$	14.5				48.0				26.6				
GFC onset	β	1.03	-0.01	0.29	0.84	1.13	0.04	0.15	0.81	1.61	0.43	0.00	0.82	2,517
	$t_{β:1}$	1.73				16.8				21.0				
Post-Lehman	β	1.06	0.04	0.10	0.91	1.27	0.15	0.00	0.88	1.74	0.14	0.20	0.90	5,566
	$t_{β:1}$	11.4				60.5				69.5				
Basel III	β	1.00	-0.06	0.00	0.96	1.04	-0.24	0.00	0.95	1.23	-0.51	0.00	0.95	6,938
	$t_{β:1}$	0.00				1.58				19.4				

Notes: The table reports results from panel regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2020Q2. Slope coefficients are shown for $m = f(bv)$, $m = f(t1,Δ)$, and $m = f(tc,t2,Δ)$, where variables are logged absolute values. m is the log of market value two months after the end of the quarter, bv is the log of the book value excluding perpetual preferred stock at the end of the quarter. $t1$ is the log of Tier 1; $Δ$ is the log of the net absolute value of regulatory adjustments, tc is the log of total regulatory capital, $t2$ is the log of Tier 2 or Supplementary Capital. $δ$ shows the difference in coefficient values between periods. $p_δ$ values show the significance of that difference. We define these periods: *DotCom Crisis* is the period from 2001Q1 (the start of the sample period) to 2002Q3. *Pre-Crisis* is the period from 2002Q4 to 2007Q2. *GFC onset* is the period 2007Q3 to 2009Q1. *Post-Lehman* is the period from 2009Q2 to 2013Q2. *Basel III* is the period from 2013Q3 to 2020Q2. For Book Value and Tier 1 we use 1 (one) as a reference value to determine the *t*-values. The regression model relies on *t*-values that account for two-dimensional within-cluster correlation. We employ time fixed-effects.

Table 5 Log Model – Goodwill, DTA, MSR, unrealized Gains and Losses, Minority Interests.

	Goodwill		DTA		MSR		UR Gain & Loss		Minors	
	β	t	β	t	β	t	β	t	β	t
Tier 1	1.15	62.6	1.14	48.7	1.16	53.96	1.09	23.26	1.08	11.18
Pos. adjustments (also ex AFS, Minors)	-0.10	-9.62	-0.10	-9.43	-0.11	-9.42	-0.03	-9.48	-0.04	-8.51
Neg. adj. (ex Goodwill, DTA, MSR, AFS, Minors)	0.00	-1.16	0.05	6.61	0.04	5.98	0.02	6.30	0.06	7.76
Goodwill	0.04	6.57								
DTA			-0.02	-3.20					-0.04	-8.51
MSR					0.00	-1.10				
Unrealised Gains							0.02	4.62		
Unrealised Losses							0.00	1.19		
Minors									-0.01	-2.27
Intercept	-0.89	-4.76	-0.89	-5.27	-1.01	-5.17	-0.89	-4.82	-0.87	-3.89
$Σβ_{1..n}$	1.08		1.07		1.09		1.11		1.08	
$\overline{R}^2$	0.90		0.90		0.90		0.89		0.90	
# of obs.	23,178		23,178		23,178		26,476		25,647	

Notes: The table reports results of panel regressions that rely on data of U.S. bank holding companies over the 2001Q1 to 2020Q2, where the dependent variable (m) is the log of the market value of the bank two months after quarter end:

$$m_{i,t} = β_0 + \sum_{n=1}^{N} β_n \cdot |a|_{n,i,t} + ε_{i,t} \tag{5}$$

$a_{n,i,j}$ is from the following list of (N) regressors, which are logged absolute values of the underlying values: *Tier 1* is Tier 1 [8274] *Positive Adjustments* is adjustments that increase *Tier 1* relative to equity. *Negative Adjustments* is adjustments that decrease *Tier 1* 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]. *Unrealized Gains (Losses)* represent the prudential filter on net unrealized holding gains (losses) on Available-For-Sale securities [8434], [A221], [P844], 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. For Tier 1 we use 1 (one) as a reference value to determine the *t*-values. We employ time fixed-effects.

Table 6 Log Model – Tier 1 Deciles

Decile	Tier 1 Ratio	Book Value						Tier 1		
		β_{bv}	$t_{\beta:1}$	β_0	t_{β_0}	e^{β_0}	$\overline{R}^2$	β	$t_{\beta:1}$	$\overline{R}^2$
0	8.01	1.09	4.63	1.09	-3.04	0.38	0.91	1.26	5.57	0.89
1	9.81	1.01	0.43	1.01	1.15	1.34	0.86	1.14	4.03	0.83
2	10.52	0.99	-0.88	0.99	2.78	1.74	0.90	1.09	3.20	0.89
3	11.14	0.99	-0.89	0.99	2.56	1.66	0.92	1.11	3.53	0.90
4	11.75	0.99	-0.90	0.99	2.38	1.60	0.92	1.12	3.73	0.90
5	12.38	0.98	-1.22	0.98	2.75	1.67	0.92	1.08	2.84	0.90
6	13.13	0.99	-0.73	0.99	1.97	1.51	0.93	1.10	3.14	0.91
7	14.12	1.00	0.07	1.00	1.36	1.27	0.94	1.11	3.58	0.92
8	15.63	1.01	0.72	1.01	0.23	1.06	0.91	1.14	3.52	0.88
9	24.54	1.03	1.06	1.03	-0.35	0.87	0.91	1.11	2.62	0.90

Notes: The table reports results of regressions of data sorted on a bank's quarterly Tier 1 ratio. The regressions rely on data of U.S. bank holding companies over the 2001Q1 to 2020Q2, where the dependent variable (m) is the log of the market value of the bank two months after quarter end:

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

For the Book Value regression model, $a_{1,i,j}$ is the log of the book value excluding perpetual preferred stock at the end of the quarter. For the Tier 1 regression model, $a_{1,i,j}$ is the logged value is Tier 1 capital [8274], and $a_{2,i,j}$ is the logged value of the net prudential adjustments, the latter defined as *Tier 1* minus *BV*. e^{β_0} is the exponentiated 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 relies on t-values that account for two-dimensional within-cluster correlation. $t_{\beta:1}$ means that 1 (one) is used as a reference value to determine the t-values. The number of observations per decile is 2,645.

.

Table 7 Log Model – Size Deciles

Decile	Average Total Assets	Book Value		Tier 1		Total Capital	
		β	$t_{\beta:1}$	β	$t_{\beta:1}$	β	$t_{\beta:1}$
0	381	0.85	-3.05	0.95	-0.68	1.05	0.54
1	610	1.06	0.64	1.00	0.01	1.06	0.38
2	828	0.94	-0.47	1.03	0.20	1.12	0.66
3	1,133	1.17	1.16	1.21	2.03	1.49	3.14
4	1,570	1.18	1.86	1.24	1.23	1.29	1.40
5	2,280	1.03	0.15	1.20	1.60	1.25	1.78
6	3,523	1.15	1.41	1.03	0.17	1.14	0.81
7	6,288	0.97	-0.32	0.95	-0.28	1.01	0.05
8	12,611	0.94	-0.49	0.91	-0.50	1.05	0.35
9	71,590	0.92	-2.92	0.88	-3.16	0.93	-0.75

Notes: The table reports results of regressions of data sorted on size (*Average Total Assets* [2170], in millions of USD.) The regressions rely on data of U.S. bank holding companies over the 2001Q1 to 2020Q2, where the dependent variable (m) is the log of the market value of the bank two months after quarter end:

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

$a_{1,i,j}$ is the log of the book value excluding perpetual preferred stock at the end of the quarter, or Tier 1 capital [8274], or *Total Capital*, which is Total Qualifying Capital Allowable under the Risk-based Capital Guidelines [3792]. For the Tier 1 regression model and the Total Capital regression model, $a_{2,i,j}$ is the logged value of the net prudential adjustments (*Tier 1* minus *BV*). For the Total Capital regression model, $a_{3,i,j}$ are logged values of *Tier 2* [5311]. 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. The number of observations per decile is 2,645.

Appendix A: A brief explanation of the log-linear models

We use log-linear models as an alternative to the additive-linear models because the coefficients of the latter are sensitive to, for example, sample choice, the choice of time period, outlier treatment. As the replication of Demirgüç-Kunt et al. (2013) in Appendix B shows, the coefficients of the additive-linear models are volatile and change significantly from quarter to quarter. Lubberink and Willett (2020) then show that log-linear models produce much more stable and valid coefficients. Because of these properties, the coefficients can be interpreted more easily.

A.1. The dollar-for-dollar relation for book value of equity

This appendix explains the intuition behind the log-linear models and the way we use them. We start with the intercept, which measures scale (i.e. not size) independently of the slope coefficients. See Figure A1. For 40 sample portfolios sorted on the book to market ratio, the figure shows the average market-to-book ratio (in red) and the exponentiated intercept values of a regression of the log of market values on the log of book values (in black).

[Figure A1 about here]

The figure shows a clear correspondence between Market-to-Book ratios and (exponentiated) intercept values of the log-linear regression model.

Moving to the slope estimates from the log-linear model, these provide strong support for the dollar-for-dollar hypothesis linking the book value of a firm's equity to its market value (Miller and Modigliani, 1961, Penman and Yehuda, 2009, Penman, Reggiani, Richardson and Tuna, 2018). Throughout this paper, the tables and graphs show book elasticity values close to the value of one. Figure 1, for example, shows that the elasticity on book value is close to one for both financial firms and non-financial firms, with the former being slightly greater than one and the latter slightly less. This feature is most likely due to the greater importance of earnings and dividends influencing the share price of non-financial firms.

Note that we estimate elasticities: the dollar-for-dollar relation applies to relative changes in values: a one percent change in book value explains a one percent change in market capitalization. Because we isolate the effects of scale (via the intercept), the interpretation of elasticities for banks and firms with market to book ratios unequal to one is not-problematic.

Comparing our results to those of the additive-linear model, note that its intercept term estimates firms' market values when the accounting variables are zero. The slope coefficient in the additive-linear model is an estimate that confounds the scale effect with the change in the accounting values effect. In the additive-linear model these effects are inseparable. Attempting to interpret the slope coefficient in the additive-linear model as a measure of the effect of a change in an accounting variable on market value is an example of estimation using a misspecified model. Such misspecification leads to unwanted noise in estimation and therefore increased volatility, making interpretation of coefficient estimates more difficult than it should be.

A.2. Multivariate analyses

A property of the log-linear model that is useful in interpretating the relative strength of the variables on the RHS of a regression in measuring their effects on the dependent variable is that elasticities of the components in a sum of the RHS variables add up to the elasticity of the sum with respect to the dependent variable. Thus, if M is regressed on A and A is the sum of mutually exclusive $A = \Sigma_i A_i$, then the elasticity of X with respect to M, β, is such that $\beta = \Sigma_i \beta_i$, where β_i is the elasticity of A_i with respect to M in a multivariate regression of the latter on the former. Consequently, a valid application of estimation using the log-linear model shows the percent contribution of each variable in explaining a percent change in the dependent variable. This clarity of interpreting the relative effects of different explanatory variables in models is evident in the figures in this paper and illustrates again an advantage of using elasticities estimated from a log-linear model.

A.3. Elasticities exceeding the value of one

Some of our analyses show elasticities that exceed the value of one. Our interpretation of the excess elasticities is that these reflect systemic risk (because of poorly-capitalised banks) and market volatility. To support this interpretation, we simulate market values, book values, and earnings for 100 firms and 100 periods. The initial book value is 100, then grows by 1 percent per year. The earnings elasticity is $1 - \varepsilon_{BV}$, or one minus the book elasticity (ε_{BV}). For Panel 1 the market value follows this model: $MV = f(BV_0^{\varepsilon_{BV}} \times earn^{1-\varepsilon_{BV_0}} + N(\mu, sd(t)))$, where the last term is random normal distributed with constant mean μ of 0 and a standard deviation that increases over time t.

For Panel 2 the market value follows a model that acknowledges the call option value of book equity: $MV = f(Call(TA, L, T, r, \sigma)^{\varepsilon_{BV_t}} + N(\mu, sd(t)))$. *Call* is the value of equity based on Merton (1974), where TA, L, T, r, σ are total assets, total liabilities, time to maturity, risk-free rate, and volatility, respectively.

Initial values for $\{TA, r, \sigma\}$ are $\{5, 0.01, 0.35\}$. The initial book value is 100, then grows by 1 percent per year. $TA = \frac{BV}{LR}$ where the leverage ratio is $LR = \{0.01, 0.045, 0.10, 0.25\}$. Total liabilities ($L$) are $TA - BV$.

[Figure A2 about here]

For both panels, Figure A2 plots the average standard deviation of the simulated market values for a range of book elasticity values (ε_{BV}). Panel 1 shows that book elasticity values that exceed the value of one are associated with higher market value variability. Panel 2 shows these excessive elasticities are more manifest in banks that are poorly capitalized.

A.4. Absolute values of negative variables

As negative values of variables have no logarithm, the estimates of the effect of changes in accounting variables on market values in the form of elasticities are based upon the absolute magnitudes of the model variables, without regard to their sign. When estimation is approached in this way, an increase in the magnitude of book value or earnings is expected to have a positive effect, i.e. a positive elasticity, with respect to market value. This is invariably the case. In contrast, an increase in the magnitude of a loss is expected to be associated with a negative magnitude of change or, at least, a much reduced and usually small positive magnitude of change in market value, i.e. a negative or small positive elasticity. Again, this is usually what occurs.

When data with negative and positive values are pooled, as with data containing some observations with positive earnings and some with losses, or negative earnings, the resulting estimates of the market elasticities on earnings are a weighted average of the generally more positive elasticities on positive earnings and the more negative market elasticities on the losses. The matrix form of the weights for this averaging process is discussed in Lubberink and Willett (2020) and its application to the separate positive and negative parts of any earnings data produces exactly the same result as would be obtained from estimating the elasticities with the positive and negative earnings data pooled into a single sample. Although it is more complicated than a simple weighted average of elasticities based upon the number of positive and negative observations, that calculation typically does explain most of the averaging effect.

Then again, it should be noted that most variables used in the paper are positive: market values, book values, and regulatory capital are all positive for banks. Moreover, we partition almost all regulatory adjustments into positive and negative adjustments. The exception are net adjustments, which can be negative. Figure 2 in the main text then shows that taking absolutes does not alter our inferences.
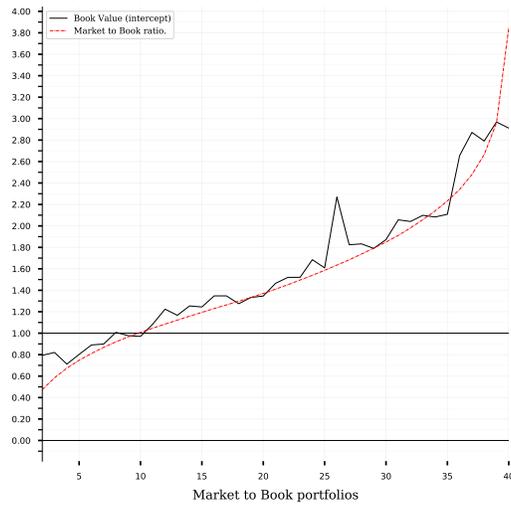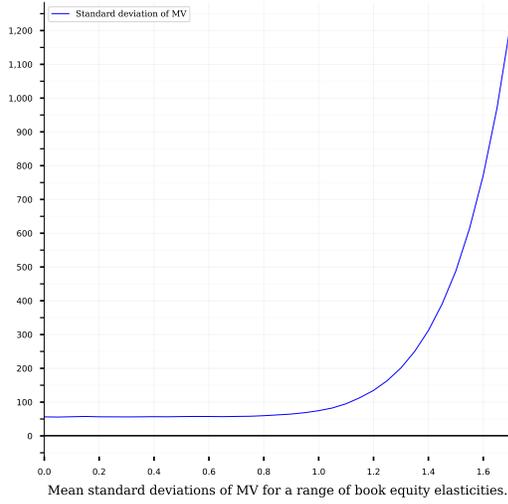
Figure A1: A comparison of Market to Book ratios of U.S. Bank Holding Companies to exponentiated intercept values of the following log-linear Book Value regression model, 2001Q1-2020Q2. $m_{i,t} = \beta_{0,i,t} + \beta_1 \cdot bv_{i,t} + \varepsilon_{i,t}$. In red is the Market to Book ratio. In black are exponentiated intercept values of the Book Value model.

Mean standard deviations of MV for a range of book equity elasticities.

Mean std. deviations of MV for a range of book equity elasticities and capitalizations.

Panel 1: A plot of the standard deviation of market values against a range of book elasticity of market values (ε_{BV}). Underlying data are simulated market values, book values and earnings for 100 firms and 100 periods. Initial book value is 100. Book values grow by 1 percent per year. The earnings elasticity is $1 - \varepsilon_{BV}$. The market value follows this model: $MV = f(BV_0^{\varepsilon_{BV}} \times earn^{1-\varepsilon_{BV}} + N(\mu, sd(t)))$, where the last term is random normal distributed with constant mean μ and a standard deviation that increases over time t.
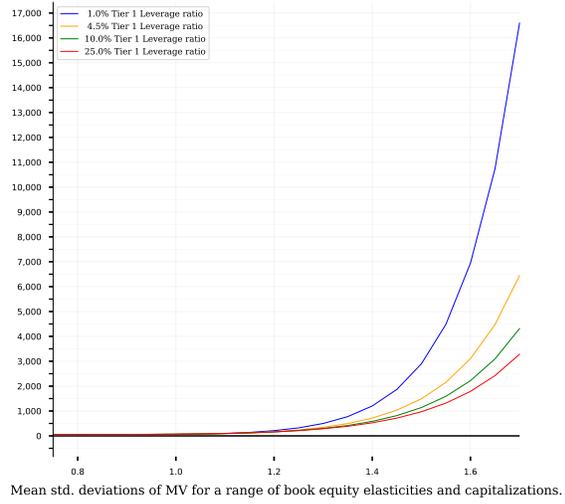
Panel 2: A plot of the standard deviation of market values against a range of book elasticity of market values (ε_{BV}), for different levels of capitalization $\frac{TA}{BV}$. The market value follows this model: $MV = f(Call(TA, L, T, r, \sigma)^{\varepsilon_{BV_t}} + N(\mu, sd(t)))$, where the last term is a random value drawn from for a normal distribution with constant mean c and a standard deviation that increases over time t. $Call$ is the value of equity based on Merton (1974), where TA, L, T, r, σ are total assets, total liabilities, time to maturity, risk-free rate, volatility, respectively. Initial values for $\{T, r, \sigma\}$ are $\{5, 0.01, 0.35\}$. Initial book value is 100, then grows by 1 percent per year. $TA = \frac{BV}{LR}$ where the leverage ratio is $LR = \{0.01, 0.045, 0.10, 0.25\}$. Total liabilities are $TA - BV$.

Figure A2: Market value volatility and elasticities.

Appendix B: A replication of an existing study that relies on scaled variables.

To compare our results to the existing literature, we replicate some of the analyses of Demirgüç-Kunt et al. (2013) (DK).[12] Our objective is to demonstrate the importance of a well-specified model and that the choice of models makes a difference. Specifically, we use the following model that regresses returns on capital components and other control variables:

$$r_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot X_{n,i,t-1} + \varepsilon_{i,t} \tag{8}$$

where r (or *return*) is the share return over the quarter. $X_{n,i,t-1}$ are observations from the following set of (N) variables: *i*) *Total Capital Ratio* is Total Qualifying Capital Allowable under the Risk-based Capital Guidelines divided by RWAs. *ii*) *T1 Leverage Ratio* is the Tier 1 Leverage Capital Ratio; *iii*) *Tangible Equity Ratio* is book equity minus goodwill and intangibles divided by total assets. *iv*) *Acc Leverage Ratio* is book equity divided by total assets. *v*) *Liquid Assets ratio* is the sum of noninterest-bearing balances and currency and coin, interest-bearing balances in U.S. Offices, and interest-bearing balances in foreign offices edge and agreement subsidiaries and IBFS, divided by total assets; *vi*) *Deposits ratio* is Deposits: noninterest-bearing and total interest-bearing deposits in foreign and domestic offices, divided by total assets; *vii*) *Asset Quality* is allowance for loan and lease losses, divided by total assets; *viii*) *Size* is the log of total assets; *ix*) *M2B* is the market to book ratio; *x*) *PER* is the ratio of price to net interest income; and *xi*) *Beta* is a bank's stock beta, estimated using 60 monthly observations of bank returns. We employ time fixed-effects. The regression model relies on *t*-values that account for two-dimensional within-cluster correlation.

Table B1 shows the descriptive statistics of the variables we use for the model above.

[Table B1 about here]

The statistics are comparable to those reported by DK. The mean (median) of Total Capital Ratio for our sample is 14% (14%), where DK report 12.6% and 11.9%. Our Tier 1 Leverage Capital Ratio is higher than the one reported by DK: 10% versus 6.7%. Given that DK use a global sample, this difference is likely the result of a stronger reliance by prudential supervisors on risk-weighted ratios outside the U.S. The market to book ratio (1.47), Loans (66%), Deposits (76%) and Size (15) are also comparable with the ratios reported

---

[12]Note that our replication is on a best efforts basis. There may be small differences between Demirgüç-Kunt et al. and our research design given that we rely on data definitions of the Federal Reserve and on CRSP, whereas Demirgüç-Kunt et al. rely on global data from Bankscope and Datastream.

by DK (1.35, 64.3%, 73.4%, and 16 respectively). Ratios that diverge because of different definitions are those of Liquid assets and Asset quality.

Given the similarities between our data and the data reported by DK, we are confident that we can compare our results to those of DK. Table B2 reports the regression results, which we compare to those reported in Table 2 of DK, the full sample.

[Table B2 about here]

Most of our results differ from those reported by DK. For example, we find that the coefficient of the Risk Weighted Capital ratio is positive (0.34) and significant, whereas DK report an insignificant coefficient with a value of 0.023 pre-crisis and a significant coefficient with a value 0.114 during the global financial crisis.

Figure B1 reports the behaviour of coefficient values of the main capital ratios over time. The figure shows that the four bank capital ratios move with a large amplitude and display swings that are difficult to explain.

[Figure B1 about here]

It is unclear what would cause the swings in coefficient values. It is also unclear why such changes would manifest itself in such a short time period.

The figure also shows that the four capital ratios move in sync. Consequently, none of the ratios clearly dominates the other. We thus cannot confirm claims made by DK about the relevance of specific measures of capital.
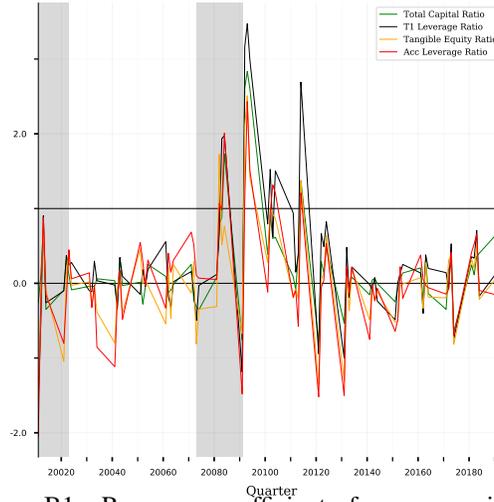
Figure B1: Response coefficients from regressions of share price returns on capital ratios: $r_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot X_{n,i,t-1} + \varepsilon_{i,t}$ where r is the share return over the quarter, net of the stock market value-weighted returns including distributions. $X_{n,i,t-1}$ are lagged observation of four capital ratios and a set of control variables.

Table B1 Descriptive Statistics – Traditional Approach

$n = 22,548$	Mean	Min	p5	p25	p50	p75	p95	Max	StDev
Return	0.01	-1.93	-0.27	-0.05	0.02	0.09	0.25	1.26	0.18
Total Capital Ratio	0.14	0.00	0.11	0.12	0.14	0.15	0.20	1.00	0.05
T1 Leverage Ratio	0.10	-0.09	0.07	0.08	0.09	0.10	0.13	10.6	0.10
Tangible Equity Ratio	0.08	-0.12	0.05	0.07	0.08	0.09	0.12	0.77	0.04
Acc Leverage Ratio	0.10	0.00	0.06	0.08	0.09	0.11	0.14	0.81	0.04
Liguid assets ratio	0.04	0.00	0.01	0.02	0.03	0.05	0.12	0.46	0.04
Deposit ratio	0.76	0.00	0.58	0.71	0.78	0.82	0.88	1.00	0.10
Loan Ratio	0.66	0.00	0.43	0.60	0.68	0.75	0.83	0.95	0.13
Asset quality	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.11	0.01
Size	15.0	13.1	13.3	13.9	14.6	15.8	18.3	21.9	1.58
Market to Book Ratio	1.47	0.03	0.41	0.98	1.36	1.87	2.79	8.96	0.74
PE ratio	8.98	0.06	1.71	4.40	6.85	11.6	23.1	49.4	6.79
beta	0.70	-0.99	-0.13	0.28	0.65	1.06	1.69	4.85	0.58

Notes: The table presents descriptive statistics of variables from U.S. bank holding companies over the 2001Q1 to 2015Q4. 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 https://www.federalreserve.gov/apps/mdrm/data-dictionary. *Return* is the share return over the quarter. *Capital* is Total Qualifying Capital Allowable under the Risk-based Capital Guidelines [3792] divided by RWAs. *T1 Leverage Ratio* is the Tier 1 Leverage Capital Ratio [7204]. *Tangible Equity Ratio* is book equity minus goodwill and intangibles divided by total assets [2170]. *Acc Leverage Ratio* is book equity divided by total assets [2170]. *Liquid Assets* is the sum of Noninterest-bearing Balances and Currency and Coin [0081], Interest-bearing Balances in U.S. Offices [0395], and Interest-bearing Balances in Foreign Offices Edge and Agreement Subsidiaries and IBFS [0397], divided by total assets [2170]. *Deposit ratio* is Deposits: Noninterest-bearing [6631] and Total Interest-bearing Deposits in Foreign and Domestic Offices [6636], divided by total assets [2170]. *Asset Quality (%)* is Allowance for Loan and Lease Losses [3123] divided by total Assets [2170]. *Size* is the log of Total Assets [2170]. *M2B* is the market to book ratio. *PER* is the ratio of Price to Net Interest Income [4074]. *Beta* is a bank's stock beta.

Table B2 Traditional Model - Results

	β	t	β	t	β	t	β	t
Total Capital Ratio	0.34	2.44						
T1 Leverage Ratio			0.01	0.77				
Tangible Equity Ratio					0.36	2.10		
Acc Leverage Ratio							0.42	2.55
Liguid assets ratio	-0.04	-0.86	-0.04	-0.89	-0.04	-0.98	-0.02	-0.51
Deposit ratio	-0.03	-1.58	-0.05	-1.82	-0.04	-1.78	-0.05	-2.03
Loan Ratio	0.05	2.20	0.02	1.11	0.01	0.55	0.01	0.40
Asset quality	-4.20	-3.49	-4.10	-3.39	-4.11	-3.44	-3.90	-3.33
log of TA	0.00	-1.47	0.00	-2.98	0.00	-1.78	0.00	-2.99
Market to Book Ratio	0.06	4.1	0.05	4.1	0.05	4.2	0.06	4.1
PE ratio	0.00	-2.26	0.00	-1.56	0.00	-2.77	0.00	-3.55
beta	0.00	-0.45	0.00	-0.47	0.00	-0.42	0.00	-0.52
Intercept	-0.03	-0.59	0.08	2.39	0.04	0.98	0.05	1.42
$\Sigma\beta_{1..N}$		-3.83		-4.11		-3.77		-3.49
$\bar{R}^2$		0.06		0.05		0.06		0.05
# of obs.		22,546		22,548		22,548		22,518

Notes: The table reports results of regressions that rely U.S. Bank Holding Companies over the 2001Q1 to 2019Q4, where the dependent variable *r* or *return* is the share return over the quarter, net of the stock market value-weighted return including distributions:

$$r_{i,t} = \beta_0 + \sum_{n=1}^{N} \beta_n \cdot X_{n,i,t-1} + \varepsilon_{i,t} \tag{9}$$

where $X_{n,i,t-1}$ are lagged observation from the following set of variables: *Total Capital Ratio* is Total Qualifying Capital Allowable under the Risk-based Capital Guidelines [3792] divided by RWAs. 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 https://www.federalreserve.gov/apps/mdrm/data-dictionary. The regression model relies on *t*-values that account for two-dimensional within-cluster correlation. The sample contains only banks with Total Assets > \$500*M*, this is because in 2006, 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).