Betting against Bank Profitability

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Key Words: Banks; Profitability; Risk-taking.

JEL Codes: G11, G12, G21.

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1. Introduction

Regulators have been increasingly concerned with excessive risk-taking by banks following the global financial crisis, as evidenced by 'ring-fencing' rules introduced in the US and UK that impose restrictions on banking activities.[1] Limiting banks' activities to only include core retail and wholesale financial intermediation functions is likely to constrain their ability to grow their asset base and reduce their profitability.[2] However, such a limitation may be necessary given the inclination of banks to focus on absolute levels of returns rather than jointly considering returns with risk (Stiroh and Rumble, 2006) and evidence that bank profitability is related with tail risk (Meiselman, Nagel, and Purnanandam, 2018). Motivated by these regulatory changes in banking, we examine how banks' profitability affects their cost of capital by examining risk-adjusted stock returns. Consistent with the argument that existing theoretical asset pricing models do not hold for banks (Gandhi and Lustig, 2015; DeAngelo and Stulz, 2015), we report evidence of a negative relationship between bank profitability and risk-adjusted stock returns; a result that stands at odds with the empirical evidence from non-financial stocks (Fama and French, 2015; Novy-Marx, 2013). We attribute this result to the 'betting against beta' anomaly that has been documented across a range of markets (Frazzini and Pedersen, 2014). As banking is a spread business, profit ratios are more closely linked with risk compared with other sectors, and Baker and Wurgler (2015) report that riskier banks generate lower than expected stock returns.

Despite the economic importance of banks[3] and the fact that they comprise a large proportion of the overall market capitalisation of U.S equity markets,[4] relatively little is known about the determinants of bank stock returns. Evidence on the explanatory power for bank stock returns of factors that are related with the cross-section of returns for nonfinancial stocks is mixed. Baek and Bilson (2015) and Barber and Lyon (1997) find that value and size premia commonly exist in both financial and nonfinancial firms. Schuermann and Stiroh (2006) report that the Fama and French (1993) three factors have explanatory power over bank stock returns. However, Cooper, Jackson, and Patterson (2003) and Viale, Kolari, and Fraser (2009) find that neither the book-to-market ratio (B/M) nor firm size is important in explaining bank returns. Viale et al. (2009) argue that bank-specific factors, particularly the level and slope of the interest rate yield curve, explain bank

[1] Limitations on banks' ability to engage in market-based activities were introduced as part of The Dodd-Frank Wall Street Reform and Consumer Protection Act 2010 in the US and The Financial Services (Banking Reform) Act 2013 in the UK.
[2] Demirgüç-Kunt and Huizinga (2010) report that the proportion of market-based activities are positively related with bank profitability. Restrictions on these activities would therefore be expected to reduce the profitability of banks.
[3] In 2017, 20.8% of US GDP came from the financial service industry. The number is from the Bureau of Economic Analysis (https://www.bea.gov/news/2018/gross-domestic-product-industry-4th-quarter-and-annual-2017).
[4] As at January 2018, the twenty largest banks listed on the NYSE accounted for more than 10% of the total market capitalisation.

stock returns. Evidence supporting the relevance of bank-specific factors is also reported by Gandhi and Lustig (2015) who show that a bank size factor, which is constructed to be orthogonal to the Fama and French (1993) factors, is negatively related to risk-adjusted bank stock returns. A positive relationship between profitability and stock returns has recently been documented within nonfinancial firms (Novy-Marx, 2013). Given the uncertainty regarding the factors that affect bank stock returns, this study provides an examination of the relationship between profitability and stock returns amongst banks.

The theoretical relationships that underpin the theoretical pricing of non-financial stocks, such as the Modigliani and Miller Propositions, have been argued to be incompatible with banks given implicit government guarantees (Gandhi and Lustig, 2015) and bank-specific activities that create value yet are not captured in theoretical models, such as liquidity provision (DeAngelo and Stulz, 2015). As there is a theoretical basis to show that the factors explaining the expected returns of non-financial stocks may have less explanatory power for banks, alternative factors may play a more prominent role. Baker and Wurgler (2015) report that the low risk anomaly, where stocks with a lower beta have higher risk-adjusted returns, is applicable in the context of banking stocks. They apply this anomaly to explain that more capitalised banks should have higher expected returns, given their lower risk exposures. A similar argument can be extended to any characteristic of banks that is associated with risk.

Bank profitability has been linked with risk-taking and, in particular, more profitable banks have been shown to have greater exposure to non-interest income (Demirgüç-Kunt and Huizinga, 2010).[5] Increased exposure to non-interest income has previously been shown to increase the volatility of bank stock returns, but not the average return (Stiroh, 2006). Therefore, the profitability of a bank may be related to its risk-taking propensity, particularly amongst larger banks that are able to use their scale to engage in more risky market-based activities (Laeven, Ratnovski, and Tong, 2016) and may be incentivised to take excessive risks due to implicit government guarantees that induce moral hazard problems (Clark, Francis and Simaan, 2018). Indeed, Martynova, Ratnovski, and Vlahu (2015) argue that more profitable banks have higher risk-taking incentives. As such, we follow Bouwman, Kim, and Shin (2017) and account for potential differences in risk by comparing risk-adjusted returns, while also comparing the systematic risk exposures of banks with differing degrees of profitability. In light of the low risk anomaly, we

[5] Prior to the global financial crisis in 2007–2009, Citigroup had a record profit in 2006. Citigroup was the largest bank in terms of core capital by The Banker in 2006 (The Banker, 2006). During the crisis, Citigroup incurred substantial losses and was eventually aided by the Government through The Troubled Asset Relief Program (US Department of The Treasury, 2008) . This example is indicative of the link between bank profitability and excessive risk-taking.

examine whether the stock returns of more profitable banks have higher risk exposures and use these differences in risk to explain why a negative relationship between profitability and risk-adjusted stock returns might be expected in the context of banks.

We report five key results that demonstrate a negative relationship between bank profitability and risk-adjusted stock returns that can be attributed to the low risk anomaly. First, we show that more profitable banks have significantly higher betas compared with less profitable banks. Second, bank profitability is positively related with contemporaneous bank values, indicating that there is more investor demand for these riskier stocks. Third, bank profitability is negatively associated with subsequent risk-adjusted returns. This negative relationship between profitability and returns is particularly intriguing, given this relationship is in the opposite direction compared with results reported for nonfinancial firms (Novy-Marx, 2013). Fourth, the negative relationship between profitability and abnormal bank stock returns is concentrated within large banks, which is the subset of banks for which the relationship between profitability and risk is particularly pronounced. Finally, we document that the zero-investment portfolio that takes a long position in the most profitable banks and a short position in the least profitable banks exhibits a time series pattern of returns that is consistent with the low risk anomaly. Frazzini and Pedersen (2014) argue that leverage-constrained investors substitute leveraged positions for even higher exposure in high beta stocks when funding constraints are high, resulting in subsequent negative returns that are larger in magnitude. We show that the negative returns generated by highly profitable banks are more pronounced after periods where funding constraints bind.

The paper proceeds as follows. Section 2 provides an overview of the relevant literature. The data is outlined in Section 3. The relationship between banks' operating profitability and risk-adjusted returns is examined in Section 4. Sections 5 and 6 explore competing explanations for the observed negative relationship between bank profitability and abnormal returns and robustness tests are outlined in Section 7. Section 8 provides a summary.

2. Literature Review and Hypothesis Development

Many empirical asset pricing studies, such as Fama and French (1992), Cooper et al. (2003) and Novy-Marx (2013), exclude financial firms because "…the high leverage that is normal for these firms probably does not have the same meaning as for nonfinancial firms, where high leverage more likely indicates financial distress" (Fama and French, 1992, p. 427). However, Barber and Lyon (1997) argue that this exclusion is unwarranted given Fama and French (1992) find that size and the B/M are the determinants of returns and not leverage. Given the desire for asset pricing models that explain the full feasible set of equities (Baek and Bilson, 2015), coupled with the exclusion of banking stocks from many studies that examine the factors affecting the cross-section of equity returns, a separate literature has emerged that examines the efficacy of asset pricing factors exclusively in banks and other financial firms. Barber and Lyon (1997) report that both the size and B/M factors are priced within financial firms and Schuermann and Stiroh (2006) report that these variables are the dominant explanatory factors for the subset of bank returns. A similar result is also reported by Baek and Bilson (2015), who find that both the value and size premia exist across both financial and nonfinancial firms, although these factors are less pronounced within financial firms. In contrast, both Viale et al. (2009) and Cooper et al. (2003) report no evidence that either size or B/M is relevant in explaining bank returns. Gandhi and Lustig (2015) report evidence of a size anomaly in US bank stock returns that is independent of the SMB factor constructed using all firms, which suggests that bank-specific factors may explain their returns.[6]

There is empirical evidence that profitability is positively related to the cross-section of non-financial stock returns (Novy-Marx, 2013). This profitability anomaly has become so pervasive that Fama and French (2015) incorporate a profitability factor, along with an investment factor, into a five-factor asset pricing model. The positive relationship between profitability and expected stock returns in Novy-Marx (2013) and Fama and French (2015) is motivated by Miller and Modigliani (1961) who show:

$$\frac{M_t}{B_t} = \sum_t \frac{E[Y_{t+\tau} - \Delta B_{t+\tau}]/(1+r)^\tau}{B_t} \quad (1)$$

where M_t is the market value of the firm, B_t is the book value of the firm, Y_t is the earnings of the firm, and r is the expected rate of return. Fama and French (2015) argue that if $\frac{M_t}{B_t}$ is fixed, there should be a positive relationship between profitability and the expected rate of return. However, Equation (1) relies on one of two assumptions, either: the firm is entirely funded by equity; or capital structure is irrelevant such that firm value is entirely derived from investment decisions. Banks are unique in that neither of these assumptions are likely to hold. High leverage ratios amongst banks are not only ubiquitous, but optimal (DeAngelo and Stulz, 2015). The Modigliani and Miller (1958) proposition of capital structure irrelevance would also not be expected to hold in the banking sector given this proposition does not take into account either the value of liquidity provision by banks (DeAngelo and Stulz, 2015), nor the protection against

[6] Other bank-specific factors that have been shown to be related with bank stock returns include interest rate factors (Viale et al., 2009), a specific finance sector return on equity factor (Adrian, Friedman, and Muir, 2015) and a real estate loans risk factor (Carmichael and Coën, 2018).

liquidation risk, and hence reduced cost of capital, that some banks receive via government guarantees (Gandhi and Lustig, 2015).

As the theoretical underpinning of the Fama and French (2015) model may be limited to non-bank stocks, alternative explanations not reliant on the same assumptions may have a more prominent role in explaining bank stock returns. Baker and Wurgler (2015) empirically confirm that there is a low-risk anomaly in bank stock returns. This anomaly is that less risky stocks have higher stock returns, as opposed to the traditional expectation of a positive risk-return relationship (Ang, Hodrick, Xing, and Zhang, 2006).

A common feature across each of these explanations is that stocks with higher levels of risk will contemporaneously be price more highly and subsequently generate lower abnormal returns.[7] According to the low risk anomaly, the CAPM generates abnormal returns that are a function of the beta of the stock, as follows:

$$r_i = \alpha_i + r_f + \beta_i(r_m - r_f) \quad (2)$$

where r_i is the return of stock *i*, α_i is the abnormal return, r_f is the risk-free return, β_i is the stock's beta and r_m is the return on the market.

The CAPM assumes that α_i in Equation (2) is zero. However, Frazzini and Pedersen (2014) argue that due to constraints on borrowing, investors have a limited ability to take a levered position in the market portfolio. Therefore, investors that seek higher expected returns will instead increase (decrease) their demand for high (low) beta stocks, resulting in abnormal returns that are a function of beta as follows:

$$\alpha_i = \gamma(\beta_i - 1) \quad (3)$$

where γ is the first derivative of the relationship between α_i and β_i. Baker and Wurgler (2015) report that γ is -0.68% per month for banking stocks, thereby demonstrating that high beta banking stocks have negative abnormal returns.

Baker and Wurgler (2015) argue that an implication of the low risk anomaly is that an increase in bank capital simultaneously reduces risk but increases the cost of capital. The low risk anomaly is also likely to be relevant with regards to the relationship between bank profitability and stock returns. Given the nature of banking as a 'spread' business, higher profitability is generally

[7] The abnormal returns of riskier stocks should be relatively lower, but the raw returns need not be. The low beta anomaly relies on the slope of the security market line being flatter than expected but not necessarily negative.

positively associated with risk exposures.[8] Martynova et al. (2015) argue that in the presence of leverage constraints, a more profitable core banking business allows banks to increase their leverage and increase their exposure to risky market-based activities. Profitability from core banking business has also been shown to be related with risk. Fahlenbrach, Prilmeier, and Stulz (2018) report that banks with high loan growth subsequently perform poorly; a result that they attribute to excessive risk-taking. Consistent with the proposition of a positive profitability-risk relationship in banks, Meiselman et al. (2018) report that high profitability in good times is a better indicator of systematic tail risk exposure compared with traditional measures, particularly when those profits arise from non-interest income.

Therefore, our first hypothesis is that the nature of banking business results in the relationship between profitability and stock returns differing from non-financial stocks. In accordance with the low risk anomaly, if banks with high profitability also have high levels of risk, they will also have higher valuations and lower subsequent abnormal stock returns:

$H_{1,A}$: Bank profitability is positively related with the beta of bank stock returns.

$H_{1,B}$: Bank profitability is positively related with the contemporaneous market-to-book value of banks.

$H_{1,C}$: Bank profitability is negatively related with subsequent abnormal stock returns.

The relationship between bank profitability and risk should differ across banks of different scale. It has been established that larger banks are able to use their scale to engage in a greater proportion of risky market-based activities (Saunders, Schmid, and Walter, 2016). While these activities tend to be associated with increased average profitability, these increases have also been shown to be associated with a higher variance in profit and a worsened risk-return trade-off (DeYoung and Rice, 2004). A range of studies have reported that, contrary to the perspective of mean-variance portfolio theory, risk increases as banks diversify their activities into non-interest sources of income.[9] It has been argued that there are negative returns to scale for market-based banking activities, as large banks may inefficiently over-invest in trading activities as a result of agency problems (Boot and Ratnovski, 2016; Laeven and Levine, 2007).

A second reason that the relationship between bank profitability and risk-taking is more pronounced is that as scale increases, banks become more likely to fall within the gambit of too

[8] Given both systematic risk (Frazzini and Pedersen, 2014) and idiosyncratic volatility (Ang et al., 2006) have been shown to be negatively with abnormal stock returns, our proposed channel should be observed regardless of whether the increased risk-taking in more profitable banks increases either exposure to market-wide risk or bank-specific risk.

[9] See, for example, Brunnermeier, Dong, and Palia (2012), DeYoung and Roland (2001), Stiroh (2006) and Williams (2016).

big to fail (TBTF) guarantees. These implicit guarantees provide banks with a series of path-dependent put options over their assets that, in theory, should reduce tail risk amongst banks that are more likely to experience distress, such as unprofitable banks. Gandhi and Lustig (2015) report that large banks earn lower risk-adjusted returns and attribute this result to the reduction in tail risk induced by TBTF guarantees. However, Gandhi and Lustig (2015) do not examine cross-sectional differences in the impact of government guarantees within the subset of banks that benefit from these policies. For banks with a very low probability of default, the imposition of a government guarantee may induce them to improve their profitability by taking on more risk than they otherwise would. Clark et al. (2018) argue that TBTF guarantees create a market distortion, whereby large banks are incentivised to take on excessive risk and invest inefficiently, thereby providing an alternative explanation for the negative abnormal stock returns generated by large banks. Empirical evidence supports the argument that implicit government guarantees have a dark side in that they induce moral hazard problems, particularly risk shifting. Cordella and Yeyati (2003) provide a theoretical model that suggests government bailout policies increase bank risk-taking, while Dam and Koetter (2012) show that banks take on more risks when the expected probability of a government bailout is higher. In summary, TBTF guarnatees might be expected to reduce the risk of banks with low profitability while incentivising increased risk-taking by highly profitble banks.

Given the low risk anomaly is the channel that is proposed to explain the negative risk-adjusted returns generated by more profitable banks, if the profit-risk relationship is increasing in bank scale then the negative abnormal returns generated by highly profitable banks should be more pronounced for larger banks:

$H_{2,A}$: The positive relationship between bank profitability and risk is more pronounced for large banks.

$H_{2,B}$: The negative relationship between bank profitability and risk-adjusted stock returns is more pronounced for large banks.

Black, Jensen and Scholes (1972) and Frazzini and Pedersen (2014) argue that the negative abnormal returns generated by high beta stocks can be attributed to leverage-constrained investors. When these investors seek to increase their expected returns, they do so by over-weighting high beta stocks rather than holding the market portfolio with leverage, as implied by the capital asset pricing model. This over-weighting of high beta stocks increases their prices and lowering future risk-adjusted returns. Leverage constraints should be quite pervasive, given many mutual funds have leverage restrictions established by the Investment Company Act of 1940 and often self-impose stringent zero-leverage constraints (Boguth and Simutin, 2018).

Leverage constraints become binding when there is less leverage available than desired by investors. During periods of funding period constraints, an increased proportion of leveraged investors are required to de-leverage as they hit their margin constraint. Therefore, when funding liquidity constraints increase there is an increased demand for high beta stocks; resulting in a contemporaneous increase in the price of these stocks and subsequent increase in the magnitude of negative abnormal returns. Given the low beta anomaly is the channel that is proposed to explain the negative relationship between profitability and bank stock returns, this negative relationship should be more pronounced following periods when funding liquidity constraints bind.

H_3: The negative relationship between profitability and risk-adjusted bank stock returns is larger in magnitude following periods where funding liquidity constraints bind.

3. Data and Methodology

3.1 Data and sample

Data used in this study are drawn from five sources. Monthly stock returns, market capitalizations and the number of shares outstanding are obtained from the Centre for Research in Security Prices (CRSP) database. Accounting data is provided by the quarterly Compustat database. In Section 7 we construct a conditional value-at-risk measure using 3-month repo rates sourced from Bloomberg and treasury security rates sourced from the H.15 release of the Federal Reserve Bank. We obtain the U.S. 10-year Government Bond Total Return Index and an index of investment grade corporate bonds from Datastream, which are used to demonstrate that our results are robust to the use of the Gandhi and Lustig (2015) model of expected bank returns in Section 7.

The sample period spans the period from July 1995 to December 2016. The sample period is shorter than Gandhi and Lustig (2015), due to the relatively poor coverage of banking stocks by Compustat before 1995.[10] For instance, the average number of stocks on an annual basis before 1995 is 61, which is insufficient to create portfolios in the process of constructing asset pricing factors, compared with an average of 498.4 across our sample period. Our sample period includes two key periods of upheaval in the banking sector: the global financial crisis of 2008 and 2009 and the initiation of significant regulatory changes after 2011, including the commencement of the

[10] Bouwman et al. (2017) also identify this poor coverage of bank stocks prior to 1995 and use the same starting point for their sample.

Dodd-Frank Act and the implementation of Basel III. We follow Minton et al. (2019) and undertake additional analysis excluding both of these periods. The results, reported in the Internet Appendix, are robust to these alternative sample periods.

To identify banking stocks, we strictly follow Gandhi and Lustig's (2015) procedures. We only retain commercial banks with header Standard Industrial Classification (SIC) code 60 or historical SIC code 6712. Bank holding companies are part of our sample as a result of this definition. We exclude banks that are not incorporated in the United States given they are subject to regulations in their country of incorporation, which may differ from the regulatory regime faced by banks that operate and are incorporated in the United States. Foreign banks identified by share codes ending 2 or 5 and closed-end funds are excluded. To mitigate survivorship bias, stocks with negative capital ratios are excluded from our sample.

Our main variable of interest is banks' operating profitability. Operating profitability is measured as banks' return on assets as at the end of the most recent financial year. Table 1 provides a summary of the descriptive statistics for the sample, as well as across portfolios of banks sorted on operating profitability. We apply this measure to allow direct comparison with studies that examine the relationship between profitability and returns in non-financial stocks (see, for example, Novy-Marx, 2013). However, since we also show that our results are robust to a measure of bank profitability that is also magnified by leverage: the return on equity. The results from this analysis, which are reported in the Internet Appendix, are substantively similar to the main results reported in this paper.[11]

As shown in Table 1 the banks in our sample are economically important, with a mean market capitalisation (MV) of $350.5 million and mean total assets (AT) of $8438.6 million across all years. Across the profitability-sorted portfolios, it is evident that banks with higher operating profitability tend, on average, to have a higher market-to-book ratio (MV), which indicates that they are priced more highly. More profitable banks also exhibit lower annual growth in assets (AG) and a higher ratio of deposits to assets (Deposits/AT). With specific regards to bank risk and risk-taking activities, more profitable banks have a higher average beta, while two banks-specific measures of risk are also higher for more profitable banks: the average ratio of non-interest income to revenue (NNII/Rev) and marginal expected shortfall (MES). The higher proportion of NNII among more profitable banks is consistent with Demirgüç-Kunt and Huizinga (2010). Taken as a whole,

[11] ROE is a measure of profitability that is magnified by leverage. Therefore, given our results are robust to the use of either ROA or ROE, it indicates that the relationship between profitability and risk-adjusted returns is not simply a leverage effect.

evidence shown in Table 1 suggests that more profitable banks are riskier but also have higher market values.

[INSERT TABLE ONE ABOUT HERE]

3.2 Model of expected returns

We calculate risk-adjusted returns on banking stocks using the Fama and French (2015) five-factor model to estimate expected returns. The factors used in this model are constructed in a manner consistent with prior studies, although we only use bank stocks to construct these factors rather the entire universe of stocks. The use of only bank stocks to construct the risk factors in our model of expected returns is important, given it has been demonstrated that bank-specific factors explain bank stock returns (Gandhi and Lustig, 2015).[12] At the end of June in year *t*, all stocks in the sample are independently sorted into two size groups (split at the median) and three groups based on their book-to-market ratio (split into terciles) using accounting information from December of year *t-1*. The intersections of these two sorts produce six portfolios. The monthly value-weighted returns of these portfolios are computed and they are rebalanced annually. The value factor (*HML*) is the mean returns of the two high book-to-market portfolios less the mean returns of the two low book-to-market portfolios. The operating profitability (*RMW*) and asset growth (*CMA*) factors are constructed using the same method as *HML* except that the second sort is constructed using terciles based on operating profitability and change in total assets, respectively. Our *RMW* and *CMA* factors are constructed in a manner that is consistent with Fama and French (2015) using our sample of banks stocks. Based on the three sets of independent sorts (size-BM, size-OP and size-AG), nine small- and big-sized portfolios are created. The size factor (*SMB*) is the return difference of the average of the nine small-sized portfolios and the average of the nine big-sized portfolios following Fama and French (2015). In Section 6 we report the results of robustness tests that apply alternative models of expected returns.

The Fama-French five-factor model is used as the basis for calculating risk-adjusted returns across a range of different portfolios. This model is specified as follows:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MRP,i}(r_{M,t} - r_{f,t}) + \beta_{SMB,t}SMB_t + \beta_{HML,i}HML_t + \beta_{CMA,i}CMA_t + \beta_{RMW,i}RMW_t + \varepsilon_{i,t} \quad (4)$$

[12] In unreported results, we examine the explanatory power of factor models constructed using both the entire universe of stocks and only bank stocks. The adjusted R^2 is substantially higher when only bank stocks are used to construct the Fama and French (2015) factors, indicating that the use of factors constructed using the entire universe of stocks would result in a misspecification in the estimation of expected returns for bank stocks.

where $r_{i,t}$ is the return on portfolio *i* across month *t*, $r_{f,t}$ is the risk-free return across month t and $r_{M,t}$ is the value-weighted market return across month t. SMB_t, HML_t, CMA_t and RMW_t are the value-weighted returns on the size, value, asset growth and profitability factors, respectively across month *t*. In Equation (4) above, the risk-adjusted return is represented by the intercept (α_i).

4. How bank profitability is related with risk, bank value and stock returns

In this section, we perform two sets of tests to examine Hypothesis One. The first set of tests examines the relationship between bank profitability, risk and risk-adjusted stock returns. The second set of results examines how bank profitability is related with bank value.

4.1 Bank profitability, risk and stock returns

To examine the profitability anomaly in the context of bank stocks, we examine both the raw and risk-adjusted returns across profitability-sorted portfolios. These portfolios are formed by splitting the universe of banks into quintiles based on operating profit and calculating the value-weighted returns for each portfolio. Each of the portfolios is formed at the end of June in year *t*, using accounting variables from December of year *t-1*. A lag of six month is to ensure that financial reports are released publicly before portfolio construction takes place. These portfolios are rebalanced annually, and their monthly returns are value-weighted. Risk-adjusted returns for each of the five resultant portfolios are calculated using Equation (4). This analysis provides important insights into the first set of hypotheses as it allows for an examination of the differences in betas and risk-adjusted returns across profitability-sorted portfolios of banks.

The results from the analysis of profitability-sorted portfolios are reported in Table 2. There is no statistically significant difference between the raw returns of the portfolios of stocks in the highest and lowest quintile of profitability. This result is at odds with Novy-Marx (2013), who reports that the equivalent hedge portfolio formed using non-financial stocks generates returns that are positive and statistically significant. It is argued that the reason the positive relationship between profitability and stock returns is not observed within bank stocks because the nature of banking business means that there is a strong positive relationship between profitability and risk, thereby bringing into play the low risk anomaly.

Consistent with the argument that the relationship between profitability and stock returns differs for banks due to the low risk anomaly, a negative and statistically significant relationship is observed between bank profitability and risk-adjusted returns. Risk-adjusted returns monotonically decrease when moving from the quintile of banks with the lowest to the quintile of banks with the highest profitability. Further, the hedge portfolio that takes a long position in the portfolio of the most profitable banks and a short position in the portfolio of the least profitable banks generates a return of minus 46 basis points per month, which is significantly different from zero. This difference is also economically significant, as it annualises to a return differential of 5.52%.

The results reported in Table 2 also demonstrate that more profitable banks are riskier. The beta of the portfolio of stocks in the highest profitability quintile is 13 basis points higher than the beta of stocks with the lowest profitability. This difference is statistically significant and provides a plausible rationale for the negative relationship between profitability and abnormal returns in bank stocks. Leverage-constrained investors who seek higher expected returns would substitute leveraged positions in the market portfolio with high beta assets, resulting in an excess demand for these assets and subsequent returns that are lower than those predicted by models of expected returns. Given Table 2 shows that more profitable stocks have higher betas, it follows that the hedge portfolio that takes a long (short) position in the quintile of most (least) profitable banks generates a negative abnormal return.

[INSERT TABLE TWO ABOUT HERE]

4.2 Profitability and bank value

The first set of hypotheses propose that the negative relationship between bank profitability and risk-adjusted returns can be explained by more profitable banks being riskier and leverage-constrained investors' preference for higher risk assets. To accord with this argument, more profitable banks should have more demand and higher prices. Therefore, we examine the relationship between bank profitability and the market-to-book ratio. This analysis answers the call of Cochrane (2011), who argued that "market-to-book ratios should be our left-hand variable, the thing we are trying to explain, not a sorting characteristic for expected returns". Our analysis is similar to Minton, Stulz and Taboada (2019), who examine the relationship between bank value and size to test that argument that TBTF status makes banks more attractive to investors. Following Minton et al. (2019), we measure bank value using the book-to-market ratio.

Formative evidence in Table 1 suggests that the market-to-book value of more profitable banks are, on average, higher than less profitable banks. We formalise this analysis by estimating regressions that investigate the determinants of the price of banks by estimating the following regression:

$$M/B_{i,t} = \beta_0 + \beta_1 OP_{i,t} + \beta_2 AG_{i,t} + \beta_3 NNII/Rev_{i,t} + \beta_4\, Loans/AT_{i,t} + \beta_5 AT_{i,t} + \beta_6 Deposits/AT_{i,t} + \beta_7 RET_{i,t} + \beta_8 Beta_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where $M/B_{i,t}$ is the market-to-book ratio for bank *i* in year *t*, *OP* is the operating profitability of bank *i*, *AG* is the annual growth in assets, *NNII/Rev* is the ratio of non-interest income to bank revenue, *Loans/AT* is the ratio of loans to assets, *AT* is the value of the bank's total assets, *Deposits/AT* is the ratio of deposit funding to total assets, *RET* is the average stock returns over the past year and *Beta* is the market beta of the bank. Each of the vaiables represented in Equation (5) is measured annually and the model is estimated with year fixed effects.

The relationship between profitability and bank value should be more pronounced in larger banks due to their use of market-based activities and the implicit guarantees provided to them by the government. Further, given our proposed channel for the negative abnormal returns generated by profitable banks is because these banks are riskier, and therefore more highly valued by leverage-constrained investors, the relationship between profitability and bank valuation should also be stronger for riskier banks. Therefore, we estimate Equation (5) augmented with interaction terms between profitability and both bank size and beta as follows:

$$M/B_{i,t} = \beta_0 + \beta_1 OP_{i,t} + \beta_2 AT_{i,t} \times OP_{i,t} + \delta_1 X_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$M/B_{i,t} = \beta_0 + \beta_1 OP_{i,t} + \beta_2 Beta_{i,t} \times OP_{i,t} + \delta_1 X_{i,t} + \varepsilon_{i,t} \quad (7)$$

Where $X_{i,t}$ is the vector of control variables from Equation (5) for bank *i* in year *t* and δ_1 is the associated vector of coefficients.

The results from the analysis of the relationship between profitability and bank value are reported in Table 3. From this table, it is evident that there is a positive relationship between operating profitability and bank value. This relationship is accentuated amongst larger banks, given the interaction between profitability and bank size is positive and statistically significant. The interaction between beta and operating profitability is also positive, albeit not significantly different from zero. Taken as a whole, the results reported in Table 3 are consistent with there being an excess demand for more profitable banks that results in an increase in their valuation and a decrease in future expected returns. This increase in bank valuations is more pronounced for banks that are larger and have a higher beta.

[INSERT TABLE THREE ABOUT HERE]

5. The relationship between bank profitability and risk-adjusted stock returns across banks of different scale

In this section, we examine Hypothesis Two, which proposes that the relationship between bank profitability and risk-adjusted returns may be conditional on bank scale. Large banks tend to operate substantially differently compared with smaller banks, which often results in a riskier asset base, lower risk-weighted capital ratios and greater organisational complexity (Laeven et al., 2016). Larger banks also have greater exposure to government guarantees (Gandhi and Lustig, 2015), and these guarantees should particularly reduce the risk of unprofitable banks that are more likely to encounter financial distress. We examine bank risk by using an approach similar to Meiselman et al. (2018), who examine how pre-crisis profitability is related with a bank's negative stock return performance during the crisis period. We extend this analysis by looking at the impact of pre-crisis profitability on crisis period performance conditioned on bank size. To undertake this analysis, we independently double-sort banks on operating profitability and size as at the end of the bank's fiscal year in 2006. In each of the size quintiles, we form a portfolio that takes a long position in the quintile of the most profitable banks and a short position in the quintile of the least profitable banks. These portfolios are held across the period from September 2007 to October 2010[13] and the value-weighted buy-and-hold returns are calculated for each portfolio. In Section 7, we also report how the relationship between profitability and risk differs across banks of different scale using measures of systemic risk that are specific to the banking literature.

Figure 1 reports the buy-and-hold returns across the five size-sorted profitability hedge portfolios. Across the crisis period, $1 invested in this hedge portfolio within the largest banks decreased in value to be worth $0.5232 by the end of the crisis. In contrast, the hedge portfolios across all of the smaller quintiles have a terminal value that is greater than unity. These results indicate that within the largest quintile of banks there is a positive relationship between profitability and bank risk, however this relationship appears to reverse for smaller banks. Our results are not inconsistent with Meiselman et al. (2018), as they argue that the relationship between profitability and bank risk is more apparent for the market-based activities of banks as opposed to traditional relationship-based activities. The largest banks generate a substantially greater proportion of their revenue from market-based activities (Saunders et al., 2016).

[INSERT FIGURE ONE ABOUT HERE]

The results reported in Figure 1 have important implications for the proposition that the negative relationship we observe between profitability and abnormal bank stock returns can be explained

[13] This is the same crisis period as the one used by Meiselman et al. (2018).

by the betting against beta anomaly. Given the relationship between profitability and risk appears to be confined to the largest banks, the negative relationship between profitability and risk-adjusted returns should similarly only be observed within this subset. We therefore further examine how bank scale affects the relationship between bank operating profitability and stock returns by calculating the risk-adjusted returns of portfolios that are double-sorted using quintiles based on bank size[14] and operating profitability. We undertake this analysis by independently sorting the universe of banks into quintiles based on total assets and quintiles based on profitability, resulting in 25 portfolios that are rebalanced annually. Risk-adjusted returns are estimated for all of these portfolios using Equation (4).

Table 4 reports the results from the estimation of Equation (4) for the 25 portfolios double-sorted on bank size and profitability. In this table, the risk-adjusted returns on the hedge portfolio that takes a long position in high profitability banks and a short position in low profitability banks are shown to be size-dependent. The negative relationship evidenced in Table 2 only exists for the largest subset of banks. These results can be reconciled with the abnormal returns for the univariate sorts on bank profitability, given Table 2 reports value-weighted returns and therefore these results are likely to be dominated by larger banks.

Large banks increase their profitability through higher exposure to systematic risk and leverage-constrained investors value this increased risk, resulting in higher contemporaneous valuations and negative subsequent abnormal returns. Adding further evidence to this argument, the market beta of large banks is also significantly larger for those in the highest quintile of profitability compared to those in the lowest quintile. This higher beta indicates large profitable banks have higher exposure to market risk compared with large banks that are less profitable and is consistent with the argument that the 'betting against beta' anomaly is the channel that explains the negative relationship between profitability and risk-adjusted returns in banks.

The results reported in Table 4 also have implications for the bank-specific size factor that is documented by Gandhi and Lustig (2015). The bank size effect appears to be dependent on operating profitability as the difference in abnormal returns between large and small banks is negative and statistically significant, albeit only at the 10% confidence level, for the two quintiles of banks with the highest operating profitability, however not significant across the remaining quintiles. The observation that the bank size effect is dependent on operating profitability is difficult to reconcile with Gandhi and Lustig's (2015) explanation that the bank size anomaly is

[14] Given the systemic importance of banks is gauged using their asset size, we measure bank size as their total assets. However, in robustness tests reported in the Internet Appendix, it is shown that all of our results are qualitatively similar when market capitalisation is used to sort banks into size quintiles.

explained by reduced tail risk due to TBTF guarantees, as the reduction in tail risk and associated lower stock returns should be more pronounced in less profitable stocks. The beta on the portfolio of large banks is also significantly larger than the beta on the portfolio of small banks when conditioned on a high level of profitability. These results imply that the negative abnormal returns generated by both large and highly profitable banks are jointly dependent and therefore are likely to be explained by the same phenomenon; an increased exposure to systematic risk.

[INSERT TABLE FOUR ABOUT HERE]

6. Conditional relationship between bank profitability and risk-adjusted stock returns

In this section, we examine Hypothesis Three by testing whether the negative relationship between bank profitability and risk-adjusted returns is more pronounced following periods when funding constraints bind. Frazzini and Pedersen (2014) outline that the intuition behind the betting against beta anomaly is that leverage constrained investors overweight high beta stocks and underweight low beta stocks rather than applying leverage to obtain higher expected returns. This overweighting of high beta assets should be accentuated when investors have a reduced ability to borrow, and as such the betting against beta anomaly will be more pronounced following periods when funding constraints are elevated. Therefore, we examine whether the negative relationship between bank profitability and abnormal stock returns in large banks is a manifestation of the betting against beta anomaly by also comparing the returns on profitability hedge portfolios during periods where funding constraints bind and periods of normalcy.[15]

We condition the sample period using three measures that are related with the magnitude of funding constraints.[16] First, during periods of poor market performance investors are subject to margin calls, which necessitates a reduction in leveraged positions. Therefore, following periods of large negative aggregate market returns investors will de-lever, resulting in an increased demand for high beta assets from investors who seek an expected return that is higher than the market portfolio. We therefore identify funding constraints as periods where the market return in the previous three months is in the bottom quintile of the sample (*MKTLAG=1*) and we compare these abnormal returns to all other periods (*MKTLAG=0*). Second, given Brunnermeier and Pedersen (2009) report that funding liquidity and market liquidity are reinforcing, and volatility is

[15] Given our analysis above shows that the relationship between profitability and bank risk-taking is conditional on bank scale, and therefore the negative relationship between profitability and risk-adjusted returns is driven by the largest banks, the portfolio sorts used in this section focus on the largest quintile of banks.

[16] The dates associated with funding constraints binding across each of these three measures are outlined in the Internet Appendix.

related with market liquidity, we examine the returns on profitability-sorted portfolios after periods where volatility is elevated. We follow identify periods of elevated volatility as being those where the VIX index exceeds the 80th percentile of the sample (*VIX=1*) and compare the profitability-sorted portfolios in these periods to all other periods (*VIX=0*). Further, Boguth and Simuntin (2018) argue that the systematic risk exposure of mutual funds reveals their demand for borrowing and hence can be used as a measure for the unobservable tightness of funding constraints. Therefore, they argue that these constraints can be measured using the weighted average beta of the aggregate equity market holdings of all actively managed funds. We apply this variable as an alternative measure of funding constraints, measuring periods where funding constraints bind as being those where this aggregate mutual fund beta is in the top quintile (*FUNDBETA=1*) and compare the returns to other periods (*FUNDBETA=0*).[17]

The results of the analysis of risk-adjusted returns following periods that exhibit differing degrees of funding constraints are reported in Table 5. The average abnormal monthly return generated by the profitability hedge portfolio is -1.30% following periods where the aggregate market returns were low and only -0.53% during other periods. This difference in returns is statistically significant and shows that the negative abnormal returns generated by highly profitable banks are more pronounced following periods when funding constraints bind. Similarly, following periods of high volatility, the average monthly returns on the profitability hedge portfolio are -1.33%, compared with -0.60% in all other periods. This difference is also statistically significant. When the aggregate mutual fund beta is used as a measure of funding constraints the average profitability hedge portfolio monthly return is -0.82% when funding constraints bind and -0.68% otherwise. As such, following periods when mutual funds have less ability to access borrowing the profitability hedge portfolio return increases in magnitude, although this difference is not statistically significant. Across all three specifications of funding constraints, the negative returns generated by the profitability hedge portfolio are larger in magnitude following periods when funding constraints bind. This variation in returns across market states is consistent with leverage constrained investors' preference for higher risk assets being the mechanism that explains the negative relationship between bank profitability and risk-adjusted returns.[18]

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[17] We thank Oliver Boguth for making this data available on his website. As the data is only available until December 2014, we undertake this analysis across the shortened sample period from 1995 to 2014.

[18] Bali, Brown, Murray and Tang (2017) propose a lottery-demand-based explanation for the betting against beta anomaly. We explore the impact of lottery-demand (proxied by maximum daily return) by estimating returns to size-MAX-profitability triple-sorted portfolios. The negative relationship between bank profitability and risk-adjusted returns are observed among low MAX stocks in large banks. As such, lottery-demand is less likely to be an explanation of the profitability effect documented in this paper. Results are reported in the Online Appendix.

[INSERT TABLE FIVE ABOUT HERE]

7. Robustness tests

To ensure the robustness of our observed relationship between bank profitability and risk-adjusted stock returns, we undertake a series of additional robustness tests. First, we expand on our results showing a size-dependent relationship between bank profitability and risk by examining how profitability is related to measures of risk from the banking literature. Second, given market-based banking activities and banks' franchise value have both been linked with excessive risk-taking, we provide evidence to show that our observed negative relationship between operating profitability and abnormal stock returns is not subsumed by either of these measures. Finally, we demonstrate that our results are robust to the use of alternative models to calculate risk-adjusted returns.

7.1 Profitability, size and bank-specific risk measures

In Sections 4 and 5 we show that more profitably banks have higher exposure to equity market risk and that this relationship is particularly evident within the largest banks. To further examine whether the low risk anomaly might be the channel that explains the negative relationship between bank profitability and risk-adjusted returns, we formally test the relationship between bank profitability and risk and also show how this relationship differs across banks of different scale. Rather than focusing on market risk as in our analysis above, in this section we use two measures of the risk from the banking literature that proxy for the systemic risk of a bank.

Following Acharya, Engle, and Richardson (2012), we use the ex-ante marginal expected shortfall (MES) as our first measure of systemic bank risk. MES is calculated as the average return of each bank in the worst five per cent of the trading days in the market for that year, as follows:

$$MES_{5\%}^{i} = D_{5\%,t} \times r_{i,t} \quad (8)$$

where $MES_{5\%}^{i}$ is the marginal expected shortfall for bank i, $D_{5\%,t}$ is a dummy variable that takes the value of one when the daily market return is less than or equal to the 5^{th} percentile of all daily returns for the year and $r_{i,t}$ is the stock return of bank *i* across day *t*. MES is calculated annually for each bank for the previous fiscal year. As identified by Williams (2016), MES has several advantages over other measures of tail risk in banking, such as Value at Risk. These advantages include the lack of distributional assumptions, ease of computation and the incorporation of extreme events in the calculation rather than discarding returns beyond an arbitrary cut-off point.

The second bank risk measure that we employ is the conditional value-at-risk (ΔCoVar). To estimate CoVar, we closely follow Adrian and Brunnermeier (2012) to compute the difference between CoVar conditional on the financial institution being in distress and CoVar in the median state of the institution. Two quantile regressions are estimated using weekly data:

$$X_t^i = \alpha^i + \gamma^i M_{t-1} + \varepsilon_t^i \quad (9)$$

$$X_t^{system} = \alpha^{system|i} + \beta^{system|i} X_t^i + \gamma^{system|i} M_{t-1} + \varepsilon_t^{system|i} \quad (10)$$

where X_t^i represents market value of asset returns of individual financial institutions, which is computed as the weekly growth in market valued total assets, M_{t-1} is a vector of lagged state variables, including market volatility proxied by VIX from CBOE, the change in the 3-month Treasury bill rate, the liquidity spread between the 3-month repo rate and the 3-month T-bill rate, the change in the slope of the yield curve (10-year treasury note minus 3-month T-bill rate), weekly value-weighted equity market return, value-weighted return of the real estate sector, as well as the change in the credit spread between 10-year BAA-rated bonds and the 10-year treasury bill rate.

We obtain the estimated value of VaR and CoVar using the estimated parameters from the quantile regressions:

$$VaR_t^i = \alpha^i + \gamma^i M_{t-1} \quad (11)$$

$$CoVar_t^i = \alpha^{system|i} + \beta^{system|i} X_t^i + \gamma^{system|i} M_{t-1} \quad (12)$$

$\Delta CoVar_t^i$ (q=5%) for an individual financial institution is computed as:

$$\Delta CoVar_t^i(q) = CoVar_t^i(q) - CoVar_t^i(50\%) = \beta^{system|i}\left(Var_t^i(q) - Var_t^i(50\%)\right) \quad (13)$$

We then multiply $\Delta CoVar_t^i(q)$ by -1 so that it is an increasing systemic risk measure.

When using regression models to examine the relationship between banks' profitability and tail risk we control for a number of bank-specific factors that have been shown to be related with bank risk. We include five balance sheet variables that Engle, Moshirian, Sahgal, and Zhang (2014) argue may be related with cross-sectional variation in the level of systemic bank risk that is perceived by the equity market. Given non-traditional banking activities may provide a channel that allows banks to partially circumvent capital adequacy regulations and increase agency-induced risk-taking, our first variable is a measure of the bank's non-interest income scaled by total revenue (*NNII/Rev*). As non-deposit funding tends to be more volatile, we use the ratio of deposit-based funding to total assets (*Deposits/AT*) as a further control. As capital can provide a buffer to protect the bank during adverse periods, we control for the level of bank capitalization using the ratio of total equity to bank assets (*BE/AT*). The annual growth in bank assets (*AG*) is used to control for those banks that grow their traditional asset base more quickly, given Fahlenbrach et al. (2018) report that banks with greater asset growth are also riskier. Finally, we follow Engle et al. (2014) and include the ratio of loans to assets as a measure of the amount of outstanding loans (*Loans/AT*). The baseline regression that is estimated can be specified as follows:

$$BankRisk_{i,t} = \beta_0 + \beta_1 OP_{i,t-1} + \beta_2 AG_{i,t-1} + \beta_3\, BE/AT_{i,t-1} + \beta_4\, Loan/AT_{i,t-1} + \beta_5 Deposit/AT_{i,t-1} + \beta_6 NNII/Rev_{i,t-1} + \varepsilon_{i,t} \quad (14)$$

Where $BankRisk_{i,t}$ is one of the two measures of bank risk described above (MES and ΔCoVar) for bank *i* in year *t*. Each of the vaiables represented in Equation (14) are measured annually and the model is estimated with year fixed effects. The dependent variables are measured as at the end of June in year *t* and the independent variables are measured in December of year *t-1*.

To examine how the relationship between operating profitability and risk differs across banks of different scale, we also augment Equation (14) with a matrix of interaction dummy variables that identify banks in the smallest and largest quintiles of book value respectively. These augmented models of bank risk are specified as follows:

$$BankRisk_{i,t} = \beta_0 + \beta_1 D_{Small,i,t-1} + \delta_1 A_{i,t-1} + D_{Small,i,t-1} \times \delta_2 A_{i,t-1} + \varepsilon_{i,t} \quad (15)$$

$$BankRisk_{i,t} = \beta_0 + \beta_1 D_{Small,i,t-1} + \delta_1 A_{i,t-1} + D_{Large,i,t-1} \times \delta_2 A_{i,t-1} + \varepsilon_{i,t} \quad (16)$$

Where $A_{i,t}$ is the vector of independent variables from Equation 14, δ are the associated vectors of coefficients, $D_{Small,i,t-1}$ is a dummy variable that takes the value of one if bank *i* is in the smallest quintile of banks and zero otherwise and $D_{Large,i,t-1}$ is a dummy variable that takes the value of one if bank *i* is in the largest quintile of banks and zero otherwise.

The results from the estimation of Equations 14 to 16 are reported in Table 6. Of note, the dummy variable interaction for large banks is positive and significant when MES is the dependent variable, while the dummy variable interaction for small banks is negative and significant when both MES and ΔCoVar are the dependent variables. This relatively higher level of tail risk within larger banks is inconsistent with the proposition put forward by Gandhi and Lustig (2015) that the negative abnormal returns generated by large banks can be attributed to lower exposure to tail risk. The coefficient on the OP variable is consistently negative across all models and risk measures, indicating that, on average, more profitable banks have lower levels of risk. However, similar to the abnormal returns reported above, this relationship between banks' profitability and tail risk is shown to be size dependent. The interaction term between the small bank dummy variable and the OP variable is negative and significant when both ΔCoVar is used as dependent variables, indicating that the negative relationship between operating profitability and tail risk is stronger within smaller banks. Similarly, the interaction term between the dummy variable indicating a large bank and the OP variable is positive and significant when MES is used as the measure of tail risk. Across both models, adding together the coefficient on the OP variable with the coefficient on the interaction between D_{Large} and OP results in a positive value. This result provides evidence to support the notion that higher operating profitability in larger banks is associated with higher levels of tail risk, hence the negative abnormal returns generated by these banks can be attributed to excessive risk-taking.

The coefficients on the control variables reported in Table 6 are consistent with previous studies that have documented a relationship between various components of bank activities and risk. We report that the proportion of total assets funded by deposits is negatively related with bank tail risk, while the proportion of revenue sourced from non-interest income is positively related with bank risk. These results are consistent with Demirgüç-Kunt and Huizinga (2010), who argue that banking strategies that are heavily reliant on non-deposit funding and non-interest income are highly risky.

[INSERT TABLE SIX ABOUT HERE]

7.2 Risk-adjusted returns in triple-sorted portfolios

We further explore the relationship between bank profitability and stock returns by examining the risk-adjusted returns of portfolios triple-sorted on profitability, size and bank characteristics that should be related with the betting against beta anomaly. Frazzini and Pedersen (2014) argue that leverage-constrained investors have a preference for higher beta stocks, resulting in this stocks having higher contemporaneous values and negative subsequent risk-adjusted returns. Therefore, if the relationship between bank profitability and risk-adjusted stock returns can be explained by the betting against beta anomaly, this relationship should be accentuated in stocks with a higher pre-ranking beta and a higher franchise value. While beta is a direct measure of systematic risk, franchise value itself may also be related with risk. Saunders and Wilson (2001) argue that there is an endogenous relationship between franchise value and risk-taking, reporting evidence to show that an increase in franchise value may come about due to high-risk activities and as such reducing risk-taking would simultaneously reduce the bank's franchise value. We therefore examine the abnormal returns generated by portfolios of stocks triple-sorted on size, profitability and both beta and franchise value.

We also examine how the relationship between profitability and stock returns differ based on banking activities that have been shown to be associated with risk-taking. To support the betting against beta explanation for our results, the relationship between profitability and risk-adjusted returns should be more pronounced where the profit is generated from activities increase exposure to systematic risk. Meiselman et al. (2018) argue that the relationship between bank profitability and systematic risk exposure should be particularly apparent for market-based banking activities as opposed to tradition relationship-based activities where profit may be a source of rents and positive net present value. We measure the intensity of market-based activities as the ratio of non-interest income to revenue (*Mkt_Activity*) and examine the abnormal returns on portfolios triple-sorted on profitability, size and *Mkt_Activity*. The one aspect of traditional banking activity that has been associated with risk is the growth, as opposed to the level, of bank loans (Fahlenbrach et al., 2018). We proxy for loan growth using the increase in the banks' assets over the past year (*AG*) and report the abnormal returns for portfolios triple-sorted on size, profitability and *AG*.

The abnormal returns generated by triple-sorted portfolios are reported in Table 7. The triple sorts on profitability, size and both beta and franchise value are reported in Panels A and B respectively. Across these two panels, it is evident that the size-dependent relationship between profitability and risk-adjusted stock returns is robust to additional sub-sampling, as profitability tends to be positively associated with abnormal returns amongst small banks and negatively associated with returns in larger banks. In Panel A, the negative relationship between profitability and abnormal stock returns is only statistically significant amongst the banks with the highest betas. The abnormal returns from the portfolios that are triple-sorted on size, operating profitability and franchise value are reported in Panel B of Table 7. The negative abnormal returns generated by large banks on the profitability hedge portfolios are only statistically significantly different from zero for those large banks with a high franchise value. The pattern of returns in both Panels A and B are consistent with the negative relationship between profitability and risk-adjusted returns being attributable to the betting against beta anomaly.

In Panel C of Table 7 we report risk-adjusted returns for portfolios that are triple sorted on size, operating profitability and *Mkt_Activity*. For the smallest sample of banks, the risk-adjusted returns on the profitability hedge portfolio are positive and statistically significant in two out of three instances. For large banks, there is again a negative relationship between profitability and risk-adjusted returns, although this relationship is only statistically significant for large banks with a large volume of market-based activities. This relationship does not hold for smaller banks, possibly due to the lower prevalence of market-based activities as bank scale reduces (Laeven et al., 2016). Given market-based activities tend to increase exposure to systematic risk (Martynova et al., 2015), this result provides further evidence to support the hypothesis that the negative relationship between profitability and risk-adjusted stock returns within large banks can be explained by their high exposure to risk and the previously identified investor preference for higher beta assets (Frazzini and Pedersen, 2014).

Finally, Panel D of Table 7 reports the abnormal returns on the portfolios triple-sorted on profitability, size and *AG*. The negative relationship between profitability and abnormal returns within large banks is robust in this panel, however the relationship is only statistically significant within the subset of large banks with the highest asset growth. This result is consistent with the contention put forward by Fahlenbrach et al. (2018) that loan growth is associated with bank risk-taking, and the argument that the negative relationshp between bank profitability and risk-adjusted returns can be attributed to the betting against beta anomaly.

[INSERT TABLE SEVEN ABOUT HERE]

7.3 Alternative Models of Expected Returns

We also conduct additional tests to ensure that our results are robust to the model of expected returns that is applied. To demonstrate the robustness of our risk-adjusted returns, we report our main results using two alternative models. The first is the Fama and French (1993) three-factor model, which is specified as follows:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MRP,i}\left(r_{M,t} - r_{f,t}\right) + \beta_{SMB,t}SMB_t + \beta_{HML,i}HML_t + \varepsilon_{i,t} \qquad (17)$$

Gandhi and Lustig (2015) argue that as banks manage bond portfolios with varying maturities and credit risk, models of expected returns for banks should incorporate bond factors. Therefore, the second alternative model of expected returns is the model applied by Gandhi and Lustig (2015), which is specified as follows:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MRP,i}\left(r_{M,t} - r_{f,t}\right) + \beta_{SMB,t}SMB_t + \beta_{HML,i}HML_t + \beta_{LTG,t}LTG_t + \beta_{CRD,i}CRD_t + \varepsilon_{i,t} \qquad (18)$$

Where LTG_t is the excess returns on an index of 10-year U.S. treasury bonds in month *t* and CRD_t is the excess returns on an index investment grade corporate bonds, maintained by Datastream.

Both of the bond market factors and the size factor are constructed in a manner consistent with Gandhi and Lustig (2015).

The results from these alternative models of expected returns are reported in Table 8. The same pattern of abnormal returns can be observed across the 25 double-sorted portfolios when these alternative models are employed. In both panels of this table, the relationship between operating profitability and abnormal stock returns is negative and significantly different from zero at the 10% confidence level, but only for the largest subset of banks. Furthermore, when these alternative models of expected returns are used there is only evidence of the bank-specific size factor in the two highest profitability quintiles; providing further evidence of an interaction between these factors.

[INSERT TABLE EIGHT ABOUT HERE]

8. Summary

Contrary to evidence for non-financial stocks, we show that bank profitability is negatively related to risk-adjusted stock returns. Theoretical asset pricing models that explain the returns of non-financial stocks are argued to be less applicable in the context of banks due to the impact of government guarantees of the pricing of risk (Gandhi and Lustig, 2015) and the unique value of characteristics of banking that are not captured in theoretical models, such as liquidity creation (DeAngelo and Stulz, 2015). The nature of the banking business model is that bank profitability is intrinsically related with risk, thus bringing into play the betting against beta anomaly.

Consistent with the proposition that the negative relationship between profitability and risk-adjusted stock returns can be explained by leverage-constrained investors overweighting high risk assets, we show that banks with higher profitability have a higher beta and these banks also have higher franchise value. The negative abnormal returns generated by highly profitably banks are accentuated after periods when leverage constraints bind, as increased leverage constraints increase the incentive for investors to substitute leveraged positions with higher beta assets, resulting in a contemporaneous increase in the value of high beta stocks and more negative subsequent abnormal returns. The relationship between profitability and risk is particularly pronounced in larger banks, due to government guarantees and the use of market-based activities by larger banks. Similarly, the negative relationship between profitability and bank stock returns is concentrated within the largest banks.

Our results have several important implications for both regulators and future research. First, the results provide evidence to complement recent studies that argue government guarantees create moral hazard problems that manifest in the form of excessive risk-taking (see, for example, Dam and Koetter, 2012; Duchin and Sosyura, 2014). While profitability is associated with lower levels of risk-taking across our full sample of banks, the direction of this relationship is reversed for the subset of the largest banks. Given large banks may be protected by implicit government guarantees, we argue that this excessive risk-taking, and the resultant negative risk-adjusted stock returns given investors do not reward these excessive risks, can be explained by moral hazard problems. As such, high operating profitability is not necessarily always a panacea that protects against banks taking excessive risks.

Second, the results demonstrate that the determinants of both bank risk and bank stock returns differ across banks of different scale. Large banks differ substantially from small banks, particularly in terms of the composition of their assets and the regulatory framework within which they operate. Despite these differences, extant studies that examine both risk and stock returns in banking tend to test hypotheses across the full sample rather than petitioning across banks of different scale. Future researchers should consider examining how their results compare across partitions of small and large banks given the lack of homogeneity across banks of different scale.

Finally, our results have important implications for models that seek to explain the expected stock returns of banks. Our results tend to suggest that asset pricing models that are developed for non-financial stocks may not be directly applicable to banks, which is consistent with evidence reported in previous studies (see, for example, Cooper et al., 2003; Viale et al., 2009). In particular, we provide the first evidence to show that the profitability anomaly, which has been widely documents in previous studies (Novy-Marx, 2013; Fama and French, 2015), does not apply in the context of bank stocks due to their unique characteristics. These characteristics should be considered by any future studies that develop asset pricing models to explain bank stock returns.

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Figure One: Buy and hold risk-adjusted profitability hedge returns during the financial crisis

This table reports the buy-and-hold risk-adjusted returns on hedge portfolios that take a long position in the quintile of banks with the highest profitability and a short position in the quintile of banks with the lowest profitability. These portfolios are constructed across five subsets of banks sorted on size. Small (large) are banks in the lowest (highest) quintile based on market capitalisation. Profitability is calculated using data from the end of the banks' 2006 fiscal year. The buy-and-hold returns are calculated as the value of $1 invested at the start of the crisis period in September 2007 and held to October 2010.

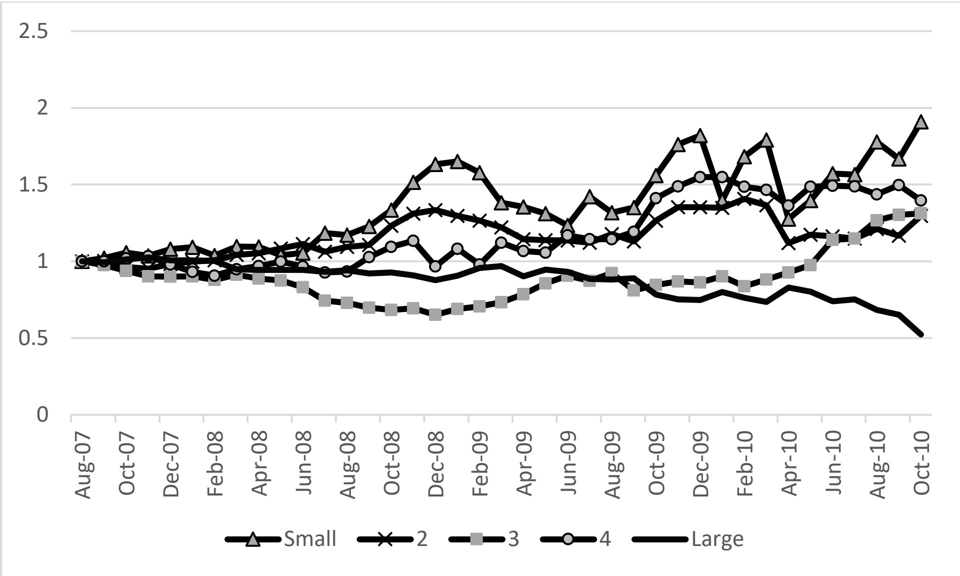

Table One – Descriptive Statistics

This table reports descriptive statistics for the banks included in our sample. Descriptive statistics are reported for operating profitability (OP), market capitalisation (MV), total assets (AT), annual growth in assets (AG), the ratio of non-interest income to revenue (NNII/Rev), the ratio of book equity to total assets (BE/AT), the ratio of loans to total assets (Loans/AT), the ratio of market value to book value (M/B), the ratio of deposites to total assets (Deposits/AT), and market beta (Beta) is measured using daily data from the past year, the marginal expected shortfall (MES) and the conditional value-at-risk (ΔCoVar). The results are reported for the full sample (Full) and for Low OP represents the quintile of bank stocks with low operating profitability and High OP represents the quintile with the highest operating profitability each year.

Sample	Statistic	OP	MV	AT	AG	NNII/ Rev	BE/AT	Loans/ AT	M/B	Deposits /AT	Beta	MES	ΔCoVar
Full	Mean	0.039	350.5	8438.6	0.107	0.138	0.095	0.661	0.385	0.755	0.471	0.012	0.0141
Full	Median	0.040	276.8	5420.7	0.114	0.133	0.094	0.656	0.916	0.753	0.508	0.009	0.0146
Full	σ	0.005	195.5	9827.7	0.044	0.039	0.006	0.026	0.400	0.022	0.270	0.009	0.0517
Low OP	Mean	0.025	390.9	27687.0	0.113	0.090	0.089	0.639	0.075	0.708	0.492	0.012	0.0166
Low OP	Median	0.028	257.2	44037.9	0.130	0.084	0.089	0.633	0.614	0.706	0.484	0.008	0.0159
Low OP	σ	0.007	299.4	9118.7	0.065	0.038	0.011	0.033	0.028	0.038	0.320	0.011	0.0335
OP = 2	Mean	0.033	322.4	4600.5	0.110	0.108	0.094	0.673	0.346	0.743	0.427	0.011	0.0119
OP = 2	Median	0.035	236.6	3151.3	0.121	0.106	0.094	0.676	0.714	0.743	0.361	0.008	0.0136
OP = 2	σ	0.005	267.2	4290.9	0.038	0.034	0.007	0.025	0.192	0.032	0.292	0.008	0.0480
OP = 3	Mean	0.038	307.0	2872.8	0.111	0.128	0.096	0.676	0606	0.763	0.433	0.011	0.0147
OP = 3	Median	0.039	170.7	1943.0	0.119	0.125	0.095	0.677	0.904	0.758	0.476	0.009	0.0137
OP = 3	σ	0.004	285.9	2270.2	0.040	0.035	0.005	0.025	0.488	0.023	0.304	0.010	0.0243
OP = 4	Mean	0.044	332.7	2965.0	0.104	0.159	0.096	0.663	0.851	0.779	0.480	0.012	0.0114
OP = 4	Median	0.045	166.0	1657.7	0.104	0.151	0.095	0.654	0.949	0.778	0.491	0.010	0.0156
OP = 4	σ	0.004	285.5	2812.8	0.048	0.041	0.006	0.029	1.718	0.022	0.332	0.009	0.0635
High OP	Mean	0.053	403.1	4378.8	0.097	0.204	0.099	0.655	0.937	0.785	0.522	0.013	0.0159
High OP	Median	0.054	204.6	2863.6	0.094	0.192	0.098	0.650	1.049	0.784	0.520	0.011	0.0156
High OP	σ	0.004	357.8	3664.1	0.044	0.052	0.006	0.030	1.994	0.021	0.290	0.010	0.0281

Table Two – Univariate profitability-sorted portfolio risk-adjusted returns

This table reports the raw returns (r_i) to profitability-sorted portfolios and the results from the regressions using the Fama-French (2015) five-factor model where the dependent variable is the returns on operating profitability-sorted portfolios. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

	r_i	α	B_{MRP}	B_{SMB}	B_{HML}	B_{RMW}	B_{CMA}	Adj. R^2
Low	0.74**	0.62**	0.56***	-0.63***	-0.16**	-1.32***	-0.13	0.73
	(2.03)	(3.23)	(11.43)	(-11.22)	(-2.35)	(-16.60)	(-1.47)	
2	0.77**	0.55**	0.53***	-0.63***	-0.16**	-0.69***	-0.03	0.58
	(2.24)	(2.46)	(9.28)	(-9.63)	(-1.98)	(-7.43)	(-0.29)	
3	0.76**	0.53**	0.50***	-0.64***	-0.02	-0.48***	0.03	0.51
	(2.22)	(2.16)	(8.02)	(-9.05)	(-0.2)	(-4.82)	(0.30)	
4	0.81***	0.51**	0.57***	-0.51***	-0.12	-0.27***	0.13	0.54
	(2.59)	(2.37)	(10.22)	(-8.15)	(-1.55)	(-3.05)	(1.30)	
High	0.59*	0.16	0.69***	-0.61***	-0.17**	0.00	0.12	0.66
	(1.70)	(0.78)	(13.18)	(-10.35)	(-2.26)	(0.06)	(1.21)	
Hedge	-0.16	-0.46***	0.13***	0.01	0.00	1.32***	0.25***	0.74
	(-0.62)	(-3.56)	(3.75)	(0.38)	(-0.07)	(24.61)	(4.08)	

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level.

Table Three: Determinants of bank franchise value

Following Asness, Frazzini, and Pedersen (2014), we regress bank i's log market-to-book (MB) ratio on operating profitability (OP) and control variables (annual growth in assets (AG), the ratio of non-interest income to revenue (NNII/Rev), the ratio of loans to total assets (Loans/AT), total assets (AT), the ratio of deposites to total assets (Deposits/AT), bank i's return over the prior year (RET) and the bank's beta (Beta) which is estimated using daily returns over the previous 12 months. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

Intercept	-0.3058**	0.2927	-0.4268***
	(-2.24)	(0.84)	(-3.15)
OP	12.3601***	-8.3577	10.8466***
	(10.11)	(-1.05)	(5.43)
OP*AT		2.6169**	
		(2.69)	
OP*Beta			2.2482
			(1.42)
AG	0.5146***	0.4805***	0.5047***
	(-5.46)	(5.71)	(5.47)
NNII/Rev	-1.1452***	-1.063***	-1.1656***
	(-5.98)	(-4.77)	(-5.94)
Loans/AT	-0.3513***	-0.3395***	-0.3226***
	(-3.70)	(-3.84)	(-3.4)
AT	-0.0335	-0.1049*	-0.0129
	(-1.22)	(-1.76)	(-0.46)
Deposits/AT	0.8900***	0.8581***	0.9196***
	(6.54)	(7.06)	(6.36)
RET	0.1010	0.0659	0.0471
	(0.45)	(0.23)	(0.17)
Beta	-0.2076***	-0.2352***	-0.3212***
	(-3.68)	(-3.73)	(-4.02)
Adj. R^2	0.2252	0.2472	0.2359

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level.

Table Four: Double-sorted bank size and profitability Fama and French (2015) regressions

This table reports the regression outputs where the dependent variables are returns on portfolios of banks double-sorted on asset size and profitability and the independent variables are the Fama and French (2015) five factors. Coefficients are reported on the left-hand side of each panel and the associated Newey and West (1987) *t*-statistics are reported on the right-hand side of each panel.

Intercept Coefficient

Size		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.37	0.26	0.64	0.83	0.62	0.25
	2	0.17	0.46	0.42	0.83	0.69	0.52
	3	0.54	0.69	0.68	0.57	0.53	-0.02
	4	0.32	0.59	0.85	0.67	0.63	0.31
	Big	0.66	0.61	0.44	0.45	-0.06	-0.72
	Hedge	0.28	0.34	-0.20	-0.38	-0.68	

Intercept t-stat

	Low	2	3	4	High	Hedge
Small	0.67	1.47	3.45***	3.81***	1.99**	0.39
2	0.65	2.41**	2.12**	3.72***	2.59***	1.71*
3	2.30**	2.98***	3.05***	2.15**	2.04**	-0.07
4	1.04	2.32**	2.93***	2.48**	2.40**	1.25
Big	3.23***	2.17**	1.63	2.04**	-0.23	-3.57***
Hedge	0.49	1.44	-0.90	-1.75*	-1.81*	

Market risk premium Coefficient

Size		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.70	0.37	0.40	0.34	0.53	-0.17
	2	0.37	0.40	0.42	0.39	0.66	0.29
	3	0.51	0.49	0.41	0.44	0.58	0.08
	4	0.68	0.48	0.54	0.53	0.53	-0.15
	Big	0.57	0.54	0.50	0.62	0.72	0.14
	Hedge	-0.13	0.17	0.11	0.28	0.18	

Market risk premium t-stat

	Low	2	3	4	High	Hedge
Small	4.91***	8.08***	8.29***	6.07***	6.72***	-1.05*
2	5.63***	8.12***	8.34***	6.76***	9.73***	3.75***
3	8.40***	8.27***	7.22***	6.53***	8.83***	1.25*
4	8.74***	7.36***	7.26***	7.67***	7.96***	-2.30**
Big	11.04***	7.60***	7.18***	10.93***	10.61***	2.79***
Hedge	-0.86	2.81***	1.89*	5.04***	1.91*	

SMB Coefficient

Size		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.22	0.23	0.23	0.14	0.12	-0.10
	2	0.12	0.23	0.22	0.25	0.00	-0.12
	3	-0.01	-0.08	-0.22	-0.14	-0.29	-0.28
	4	-0.14	-0.41	-0.48	-0.52	-0.56	-0.42
	Big	-0.71	-0.92	-0.86	-0.63	-0.74	-0.03
	Hedge	-0.93	-1.15	-1.08	-0.77	-0.86	

SMB t-stat

	Low	2	3	4	High	Hedge
Small	1.34	4.37***	4.18***	2.25**	1.35	-0.53
2	1.56	4.09***	3.78**	3.92***	-0.02	-1.33
3	-0.08	-1.14	-3.45***	-1.88*	-3.84***	-4.09***
4	-1.55	-5.48***	-5.63**	-6.71***	-7.39***	-5.83***
Big	-12.14***	-11.34***	-10.86***	-9.75***	-9.70***	-0.48
Hedge	-5.52***	-16.66***	-17.04***	-12.18***	-7.94***	

HML Coefficient

Size	Profitability: Low	2	3	4	High	Hedge
Small	-0.21	0.02	-0.03	-0.03	-0.07	0.14
2	0.15	0.05	-0.04	-0.07	-0.23	-0.39
3	0.28	-0.08	-0.03	-0.11	-0.33	-0.62
4	0.00	-0.06	-0.09	-0.02	-0.28	-0.29
Big	-0.19	-0.18	-0.03	-0.14	-0.09	0.10
Hedge	0.02	-0.20	0.00	-0.12	-0.02	

HML t-stat

	Low	2	3	4	High	Hedge
Small	-1.02	0.28	-0.38	-0.36	-0.62	0.60
2	1.62	0.69	-0.59	-0.90	-2.4	-3.47***
3	3.32***	-0.89	-0.35	-1.15	-3.53***	-7.11***
4	0.04	-0.63	-0.89	-0.24	-2.98***	-3.16***
Big	-2.55**	-1.77*	-0.31	-1.79*	-0.90	1.40
Hedge	0.09	-2.30 **	-0.06	-1.46	-0.12	

RMW Coefficient

Size	Profitability: Low	2	3	4	High	Hedge
Small	-0.84	-0.30	-0.20	-0.18	-0.01	0.83
2	-0.52	-0.40	-0.35	-0.23	-0.05	0.47
3	-0.65	-0.40	-0.39	-0.24	-0.31	0.34
4	-0.78	-0.42	-0.45	-0.23	-0.26	0.52
Big	-1.42	-0.76	-0.52	-0.28	0.06	1.48
Hedge	-0.58	-0.46	-0.32	-0.10	0.08	

RMW t-stat

	Low	2	3	4	High	Hedge
Small	-3.66***	-4.09***	-2.63***	-2.05**	-0.09	3.23***
2	-4.87***	-5.12***	-4.36***	-2.47**	-0.46	3.72***
3	-6.67***	-4.20***	-4.21***	-2.23**	-2.88***	3.48***
4	-6.25***	-4.02***	-3.75***	-2.08**	-2.43**	5.05***
Big	-17.00***	-6.66***	-4.64***	-3.10***	0.60	17.99***
Hedge	-2.42**	-4.73***	-3.54***	-1.10	0.49	

CMA Coefficient

Size	Profitability: Low	2	3	4	High	Hedge
Small	0.36	-0.21	-0.23	-0.15	-0.18	-0.54
2	-0.13	-0.26	-0.30	-0.14	0.09	0.23
3	-0.12	-0.10	-0.08	0.01	-0.17	-0.05
4	0.18	0.00	0.13	0.20	0.07	-0.11
Big	-0.14	0.04	0.07	0.19	0.19	0.33
Hedge	-0.50	0.25	0.30	0.33	0.37	

CMA t-stat

	Low	2	3	4	High	Hedge
Small	1.38	-2.47**	-2.59***	-1.43	-1.24	-1.85*
2	-1.11	-2.90***	-3.27***	-1.34	0.74	1.58
3	-1.09	-0.95	-0.71	0.05	-1.42	-0.47
4	1.24	-0.04	0.95	1.55	0.56	-0.91
Big	-1.43	0.31	0.55	1.78*	1.54	3.47***
Hedge	-1.82*	2.24**	2.88***	3.24***	2.11**	

* denotes significance at the 10% level
** denotes significance at the 5% level
*** denotes significance at the 1% level

Adjusted R^2

Size	Profitability: Low	2	3	4	High	Hedge
Small	0.16	0.28	0.26	0.15	0.17	0.08
2	0.22	0.31	0.29	0.18	0.30	0.15
3	0.40	0.31	0.32	0.22	0.39	0.31
4	0.39	0.38	0.37	0.41	0.45	0.32
Big	0.74	0.57	0.54	0.59	0.59	0.60
Hedge	0.13	0.61	0.60	0.51	0.27	

Table Five: Profitability-sorted portfolio abnormal returns across market states

This table reports the results from risk-adjusted returns, estimated using the Fama-French five-factor model. Risk-adjusted returns are calculated for portfolios sorted into quintiles based on profitability, conditional on being in the largest quintile of banks each year. The risk-adjusted returns are reported for periods where funding constraints bind and periods of normalcy. Three measures of funding constraints are employed. The first measure is when the lagged three-month market returns are in the bottom quintile (*MKTLAG=1*) compared with all other periods (*MKTLAG=0*). The second proxy for funding constraints is when the VIX is in the top quantile (*VIX=1*) compared with all other periods (*VIX=0*). The third measure is when the average beta of mutual funds is in the top quintile (*FUNDBETA=1*) compared with all other periods (*FUNDBETA=0*). Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

	Low	2	3	4	High	Hedge
MKTLAG=1	1.54***	1.03**	0.77	0.43	0.25	-1.30**
	(3.81)	(2.09)	(1.41)	(1.02)	(0.49)	(-2.52)
MKTLAG=0	0.64***	0.62	0.49	0.47*	0.11	-0.53***
	(2.83)	(2.04)	(1.64)	(1.79)	(0.46)	(-2.79)
Difference	0.90**	0.41	0.28	-0.04	0.14	-0.77*
	(2.34)	(0.83)	(0.55)	(-0.09)	(0.32)	(-1.90)
VIX=1	0.39	-0.76	-0.64	-0.08	-0.94*	-1.33***
	(0.72)	(-0.98)	(-0.86)	(-0.13)	(-1.65)	(-2.98)
VIX=0	1.10***	0.97***	0.69**	0.60	0.50**	-0.60***
	(4.85)	(3.38)	(2.44)	(2.36)	(2.02)	(-2.70)
Difference	-0.71	-1.73***	-1.33**	-0.68	-1.44***	-0.73*
	(-1.59)	(-2.83)	(-2.25)	(-1.34)	(-3.01)	(-1.84)
FUNDBETA=1	0.85	0.26	-0.01	0.29	0.03	-0.82*
	(1.47)	(0.41)	(-0.02)	(0.50)	(0.04)	(-1.85)
FUNDBETA=0	0.85***	0.52	0.44	0.37	0.17	-0.68***
	(3.58)	(1.64)	(1.53)	(1.44)	(0.64)	(-2.82)
Difference	0.00	-0.26	-0.45	-0.08	-0.14	-0.14
	(0.00)	(-0.37)	(-0.78)	(-0.13)	(-0.18)	(-0.28)

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level

Table Six: Relationship between operating profitability and bank risk

This table reports the results from panel data regressions with two measures of bank risk as the dependent variable: marginal expected shortfall (MES) and the conditional value-at-risk (ΔCoVar. The independent variables are operating profitability (OP), annual growth in assets (AG), the ratio of book equity to total assets (BE/AT), the ratio of loans to total assets (Loans/AT), the ratio of deposits to total assets (Deposits/AT) and the ratio of non-interest income to revenue (NNII/Rev). The regressions are also estimated with interaction dummies that take the value of one for banks in either the smallest (D_{Small}) or largest (D_{Large}) quintile of total assets. All of the regressions are estimated using year fixed effects and Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

	BankRisk = MES			BankRisk = ΔCoVar		
	Baseline	D_{Small}	D_{Large}	Baseline	D_{Small}	D_{Large}
Intercept	0.019***	0.0180***	0.0020	0.006	0.0140	-0.0210*
	(11.156)	(10.329)	(0.846)	(0.586)	(1.344)	(-1.718)
D		-0.0210***	0.0140***		-0.1050***	0.0370
		(-4.586)	(4.187)		(-3.719)	(1.629)
OP	-0.041**	-0.0290*	-0.0610***	-0.131	-0.0260	-0.2190*
	(-2.561)	(-1.799)	(-3.531)	(-1.414)	(-0.256)	(-1.921)
D×OP		-0.0270	0.0960***		-0.5270**	0.2420
		(-0.664)	(3.224)		(-2.103)	(1.235)
AG	0.005***	0.0040***	0.0030***	0.011**	0.0060	0.0110*
	(5.113)	(4.059)	(2.933)	(2.141)	(1.014)	(1.839)
D×AG		-0.0050**	-0.0010		0.0040	-0.0120
		(-2.283)	(-0.625)		(0.291)	(-1.055)
BE/AT	-0.019***	0.0030	0.0100**	0.055*	0.0340	0.0950***
	(-3.846)	(0.617)	(2.067)	(1.960)	(0.994)	(3.037)
D×BE/AT		0.0020**	-0.0820***		0.2220***	-0.1030
		(0.198)	(-6.546)		(3.442)	(-1.25)
Loans/AT	-0.002	-0.0030*	0.0000	0.007	0.0030	0.0120
	(-1.307)	(-1.791)	(0.170)	(0.869)	(0.296)	(1.391)
D×Loans/AT		0.0040	-0.0020		0.0210	-0.0200
		(1.499)	(-0.657)		(1.174)	(-1.007)
Deposits/AT	-0.019***	-0.0180***	-0.0010	-0.017*	-0.0250**	0.0080
	(-11.742)	(-11.106)	(-0.678)	(-1.852)	(-2.427)	(0.678)
D×Deposits/AT		0.0210***	-0.0040		0.1050***	-0.0050
		(4.937)	(-1.157)		(4.015)	(-0.215)
NNII/Rev	0.022***	0.0160***	0.0180***	0.036***	0.0140	0.0390***
	(10.36)	(7.436)	(8.193)	(2.892)	(1.069)	(2.639)
D×NNII/Rev		-0.0100*	-0.0230***		0.0530	-0.0470*
		(-1.868)	(-5.489)		(1.589)	(-1.704)
Adj. R^2	0.297	0.383	0.458	0.031	0.052	0.042

* denotes significance at the 10% level,
** denotes significance at the 5% level
*** denotes significance at the 1% level.

Table Seven: Abnormal returns on portfolios triple-sorted on size and proportion of non-interest income

This table reports risk-adjusted returns using the Fama-French five factor model. Returns in Panel A are based on portfolios that are triple-sorted on size, operating profitability and beta. Returns in Panel B are based on portfolios that are triple-sorted on size, operating profitability and franchise value. Returns in Panel C are based on portfolios that are triple-sorted on size, operating profitability and the proportion of operating profit that is derived from market-based activity. Returns in Panel D are based on portfolios that are triple-sorted on size, operating profitability and asset growth. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

Panel A: Risk-adjusted returns for portfolios triple-sorted on size, profitability and beta

		Small Banks				Medium Banks				Large Banks			
		Beta				Beta				Beta			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.18	0.16	0.26	0.08	0.69***	0.3	0.25	-0.44*	0.55	0.46*	0.68***	0.19
		(0.75)	(0.67)	(0.80)	(0.25)	(2.73)	(1.05)	(0.84)	(-1.67)	(1.54)	(1.79)	(3.16)	(0.49)
	2	0.64***	0.63***	0.72**	0.08	0.41**	0.49*	0.88***	0.46*	0.60*	0.51*	0.68**	0.07
		(3.31)	(2.86)	(2.25)	(0.30)	(2.00)	(1.92)	(2.78)	(1.80)	(1.92)	(1.84)	(2.49)	(0.27)
	High	0.82***	0.90***	0.86***	0.04	0.77***	0.71***	0.36	-0.41*	0.68**	0.42*	0.27	-0.44
		(3.75)	(3.38)	(2.62)	(0.13)	(3.48)	(2.94)	(1.10)	(-1.75)	(2.27)	(1.77)	(1.06)	(-1.30)
	Hedge	0.64***	0.73***	0.60*		0.08	0.41*	0.11		0.27	-0.05	-0.41*	
		(2.74)	(2.76)	(1.70)		(0.41)	(1.93)	(0.42)		(0.70)	(-0.20)	(-1.93)	

Panel B: Risk-adjusted returns for portfolios triple-sorted on size, profitability and franchise value

		Small Banks				Medium Banks				Large Banks			
		Franchise Value				Franchise Value				Franchise Value			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.31	0.48**	-0.37	-0.66	0.68***	0.69***	0.68**	0.00	0.33	0.91***	0.76***	0.43
		(1.28)	(2.23)	(-0.87)	(-1.51)	(2.59)	(2.84)	(2.30)	(0.01)	(1.38)	(3.85)	(3.22)	(1.63)
	2	0.64***	0.49**	0.40	-0.24	0.74***	0.62***	0.67***	-0.06	0.50	0.77***	0.68***	0.17
		(3.13)	(2.56)	(1.55)	(-0.91)	(2.95)	(2.58)	(2.60)	(-0.28)	(1.07)	(2.70)	(2.73)	(0.46)
	High	0.85***	0.83***	0.69***	-0.15	0.74**	0.57**	0.39	-0.34	0.01	0.87***	0.17	0.15
		(3.31)	(4.36)	(3.02)	(-0.65)	(2.32)	(2.33)	(1.56)	(-1.31)	(0.04)	(2.85)	(0.72)	(0.39)
	Hedge	0.54**	0.35*	0.98**		0.06	-0.12	-0.28		-0.32	-0.04	-0.59***	
		(2.11)	(1.67)	(2.28)		(0.24)	(-0.60)	(-1.10)		(-0.75)	(-0.14)	(-2.85)	

Panel C: Risk-adjusted returns for portfolios triple-sorted on size, profitability and the proportion of market-based banking activities

		Small Banks				Medium Banks				Large Banks			
		Mkt_Activity				Mkt_Activity				Mkt_Activity			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.20	0.59**	-0.12	-0.31	0.27	0.46	0.60**	0.34	0.59**	0.64**	0.84***	0.26
		(0.61)	(2.27)	(-0.50)	(-1.07)	(0.78)	(1.53)	(2.51)	(1.05)	(2.08)	(2.42)	(3.96)	(0.86)
	2	0.82**	0.80***	0.56***	-0.25	0.73**	0.51**	0.46*	-0.27	0.69***	0.42	0.69**	0.00
		(2.46)	(3.67)	(2.78)	(-0.89)	(2.31)	(2.13)	(1.65)	(-0.97)	(2.64)	(1.56)	(2.12)	(0.01)
	High	0.94***	0.96***	0.50**	-0.44	0.85***	0.50**	0.49*	-0.35*	0.19	0.44*	0.14	-0.05
		(3.89)	(3.82)	(1.97)	(-1.56)	(3.51)	(2.04)	(1.77)	(-1.67)	(0.88)	(1.65)	(0.37)	(-0.13)
	Hedge	0.74**	0.37	0.62**		0.58*	0.04	-0.11		-0.39	-0.20	-0.70**	
		(2.33)	(1.36)	(2.42)		(1.88)	(0.14)	(-0.47)		(-1.59)	(-0.79)	(-1.98)	

Panel D: Risk-adjusted returns for portfolios triple-sorted on size, profitability and asset growth

		Small Banks				Medium Banks				Large Banks			
		Asset Growth				Asset Growth				Asset Growth			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.20	0.31	0.19	-0.01	0.34	0.61**	0.43*	0.09	0.68***	0.96***	0.73***	0.04
		(0.79)	(1.36)	(0.73)	(-0.04)	(1.18)	(2.21)	(1.65)	(0.36)	(2.69)	(3.74)	(3.47)	(0.17)
	2	0.94***	0.63***	0.48**	-0.46**	0.47	0.74***	0.54**	0.06	0.42	0.50*	0.73***	0.31
		(3.73)	(2.94)	(2.01)	(-2.04)	(1.58)	(3.21)	(2.05)	(0.27)	(1.34)	(1.89)	(2.84)	(1.35)
	High	0.90***	0.75***	0.42	-0.48	0.66***	0.58**	0.69**	0.03	0.42*	0.51**	-0.01	-0.44
		(3.47)	(3.26)	(1.50)	(-1.46)	(3.02)	(2.40)	(2.32)	(0.12)	(1.91)	(2.10)	(-0.05)	(-1.57)
	Hedge	0.70**	0.43**	0.23		0.32	-0.03	0.26		-0.26	-0.45*	-0.74***	
		(2.35)	(1.97)	(0.76)		(1.23)	(-0.14)	(1.21)		(-0.96)	(-1.78)	(-2.86)	

* denotes significance at the 10% level, ** denotes significance at the 5% level *** denotes significance at the 1% level.

Table Eight: Portfolios double-sorted on bank size and profitability

This table reports the abnormal returns on portfolios of banks double-sorted on bank asset size and operating profitability. To calculate these abnormal returns, the Fama and French (1993) (Panel A) and Gandhi and Lustig (2015) (Panel B) models of expected returns. Coefficients are reported on the left-hand side of each panel, and the associated Newey and West (1987) adjusted *t*-statistics are reported on the right-hand side of each panel.

Panel A: Abnormal returns using the Fama and French (1993) model

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.17	0.21	0.61***	0.80***	0.62**	0.45
		(0.30)	(1.11)	(3.22)	(3.65)	(2.01)	(0.69)
	2	0.06	0.38*	0.35*	0.78***	0.67**	0.62**
		(0.21)	(1.91)	(1.72)	(3.50)	(2.55)	(1.99)
	3	0.40	0.61**	0.60***	0.52*	0.46*	0.06
		(1.58)	(2.54)	(2.60)	(1.93)	(1.78)	(0.25)
	4	0.14	0.50*	0.75**	0.61**	0.57**	0.43
		(0.41)	(1.89)	(2.48)	(2.23)	(2.15)	(1.61)
	Big	0.35	0.44	0.33	0.38*	-0.05	-0.40*
		(1.13)	(1.42)	(1.14)	(1.67)	(-0.20)	(-1.73)
	Hedge	0.17	0.23	-0.28	-0.42*	-0.67*	
		(0.29)	(0.90)	(-1.2)	(-1.85)	(-1.79)	

Panel B: Abnormal returns using the Gandhi and Lustig (2015) model

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.31	0.21	0.65***	0.85***	0.64**	0.33
		(0.52)	(1.08)	(3.37)	(3.81)	(2.03)	(0.50)
	2	0.04	0.41**	0.40*	0.83***	0.67**	0.63**
		(0.14)	(2.01)	(1.94)	(3.60)	(2.46)	(1.98)
	3	0.47*	0.65*	0.62*	0.66**	0.49*	0.02
		(1.78)	(2.65)	(2.62)	(2.42)	(1.82)	(0.08)
	4	0.18	0.57**	0.82***	0.65**	0.65**	0.47*
		(0.51)	(2.11)	(2.65)	(2.31)	(2.40)	(1.72)
	Big	0.34	0.48	0.36	0.43*	-0.04	-0.38*
		(1.08)	(1.54)	(1.21)	(1.83)	(-0.15)	(-1.72)
	Hedge	0.03	0.28	-0.29	-0.42*	-0.68*	
		(0.05)	(1.07)	(-1.23)	(-1.81)	(-1.77)	

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level

Internet Appendix

"Betting against bank profitability"

Table A.1: Correlation Matrix

This table reports the correlation matrix for the key variables used in our analysis. The variables are marginal expected shortfall (MES), standard deviation of equity returns (SD), conditional value-at-risk (ΔCoVar), annual growth in assets (AG), the ratio of book equity to total assets (BE/AT), the ratio of loans to total assets (Loans/AT), the ratio of deposits to total assets (Deposits/AT) and the ratio of non-interest income to revenue (NNII/Rev), and the ratio of non-interest income to revenue (NNII/REV).

	BE/AT	MES	NNII/REV	AG	Deposits/AT	GP/AT	Loans/AT	SD	ΔCoVar
BE/AT	1								
MES	-0.057	1							
NNII/REV	-0.145	0.153	1						
AG	-0.020	0.090	0.037	1					
Deposits/AT	-0.138	-0.167	-0.001	0.022	1				
GP/AT	0.118	0.047	0.585	-0.036	0.183	1			
Loans/AT	-0.001	-0.088	-0.184	0.016	0.168	0.001	1		
SD	-0.253	0.042	0.008	-0.058	0.129	-0.023	0.029	1	
ΔCoVar	-0.026	0.277	0.065	0.019	-0.057	-0.005	-0.035	0.017	1

Table A.2: Abnormal returns for portfolios double sorted on operating profitability and market capitalisation

This table reports the abnormal returns using the Fama-French five-factor model for portfolios of banks double-sorted on market capitalisation and operating profitability. The results are reported to demonstrate that the main results are robust to alternative measures of bank size. Coefficients are reported on the left-hand side of each panel, and the associated Newey and West (1987) adjusted *t*-statistics are reported on the right-hand side of each panel.

		Profitability					
		Low	2	3	4	High	Hedge
Market Cap	Small	0.14	0.46*	0.72***	1.00***	0.80***	0.66*
		(0.40)	(1.89)	(3.28)	(3.62)	(2.69)	(1.72)
	2	-0.01	0.54**	0.65***	0.80***	0.63***	0.64***
		(-0.03)	(2.36)	(3.03)	(3.80)	(2.91)	(2.69)
	3	0.46	0.53	0.54**	0.78***	0.65***	0.18
		(1.74)	(2.17)	(2.24)	(2.95)	(2.85)	(0.81)
	4	0.40	0.58**	0.63*	0.66**	0.50	0.10
		(1.24)	(2.24)	(1.96)	(2.37)	(1.84)	(0.45)
	Big	0.80***	0.65**	0.51**	0.44*	0.08	-0.71***
		(3.99)	(2.48)	(1.98)	(1.96)	(0.37)	(-3.62)
	Hedge	0.66	0.19	-0.21	-0.56**	-0.71**	
		(1.91)	(0.78)	(-1.01)	(-2.14)	(-2.11)	

Table A.3: Abnormal returns for portfolios double sorted on return on equity and size

This table reports the abnormal returns using the Fama-French five-factor model for portfolios of banks double-sorted on size and return on equity. The results are reported to demonstrate that the main results are robust to alternative measures of profitability. Coefficients are reported on the left-hand side of each panel, and the associated Newey and West (1987) adjusted *t*-statistics are reported on the right-hand side of each panel.

		Return on Equity					
		Low	2	3	4	High	Hedge
Size	Small	0.21	0.62***	0.63**	0.93***	0.62	0.43
		(0.66)	(2.80)	(2.48)	(3.62)	(1.52)	(0.97)
	2	0.12	0.58***	0.78***	0.49**	0.72***	0.60**
		(0.39)	(2.61)	(4.02)	(2.20)	(2.79)	(2.42)
	3	0.17	0.57**	0.67***	0.64***	0.78***	0.61***
		(0.56)	(2.18)	(2.96)	(2.76)	(2.93)	(2.60)
	4	0.52	0.55**	0.68**	0.58*	0.62**	0.10
		(1.52)	(1.99)	(2.21)	(1.85)	(2.26)	(0.41)
	Big	0.89***	1.03***	0.40	0.34	0.20	-0.69**
		(2.84)	(4.21)	(1.50)	(1.62)	(0.81)	(-2.51)
	Hedge	0.68*	0.41*	-0.23	-0.58**	-0.45	
		(1.93)	(1.88)	(-0.90)	(-2.40)	(-1.04)	

Table A.4: Double-sorted size and profitability abnormal bank returns across market states based on the banking sector returns

This table reports the results from risk-adjusted returns, estimated using the Fama-French five-factor model. Risk-adjusted returns are calculated for two sets of portfolios: five portfolios single-sorted on operating profitability and 25 portfolios that are constructed by double sorting the universe of banks on total assets (size) and operating profitability (profitability). The risk-adjusted returns are reported across two sub-periods. Panel B reports the results for periods where funding constraints bind, defined as being after months where the banking sector index return is in the bottom decile of observations from across the sample period and Panel A reports results for 'normal' periods where the banking sector index return is not in this bottom decile. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

Panel A: Abnormal returns during normal periods

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	0.68*	1.01***	1.24***	1.44***	1.39***	0.70*
		(1.84)	(3.91)	(5.65)	(5.08)	(4.40)	(1.69)
	2	0.46*	1.07***	1.19***	1.43***	1.16***	0.71***
		(1.65)	(4.42)	(5.60)	(6.85)	(5.31)	(2.75)
	3	1.11***	1.12***	1.12***	1.56***	1.19***	0.08
		(4.02)	(4.50)	(4.59)	(5.86)	(5.15)	(0.37)
	4	1.15***	1.26***	1.44***	1.35***	1.21***	0.07
		(3.54)	(4.72)	(4.47)	(4.85)	(4.63)	(0.27)
	Big	1.33***	1.37***	1.18***	0.97***	0.50**	-0.82***
		(6.50)	(5.24)	(4.66)	(4.22)	(2.07)	(-3.75)
	Hedge	0.64*	0.37	-0.06	-0.47	-0.88**	
		(1.69)	(1.32)	(-0.26)	(-1.63)	(-2.43)	

Panel B: Abnormal returns during market stress

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	-2.56	-2.00	-1.21	-1.60	-0.67	1.89
		(-1.15)	(-1.33)	(-0.72)	(-0.63)	(-0.34)	(0.66)
	2	-2.93	-1.86	-1.60	-0.85	-1.11	1.82
		(-1.42)	(-1.32)	(-0.88)	(-0.59)	(-0.74)	(1.07)
	3	-3.21**	-1.10	-2.29	-3.31**	-0.86	2.36
		(-2.06)	(-0.65)	(-1.42)	(-2.02)	(-0.59)	(1.46)
	4	-0.04	-1.73	1.18	-0.98	0.19	0.23
		(-0.01)	(-1.01)	(0.51)	(-0.43)	(0.07)	(0.14)
	Big	-1.84	-1.24	-1.34	-3.37**	-3.63***	-1.79*
		(-1.47)	(-0.62)	(-0.66)	(-2.25)	(-2.70)	(-1.71)
	Hedge	0.72	0.76	-0.13	-1.77	-2.97	
		(0.30)	(0.57)	(-0.10)	(-0.93)	(-1.15)	

Table A.5: Abnormal returns on portfolios double-sorted on size and proportion of non-interest income

This table reports risk-adjusted returns using the Fama-French five factor model. The returns in Panel A are based on portfolios that are double-sorted on banks' total assets (size) and the proportion of operating profit that is derived from market-based activity (*Mkt_Activity*). Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

		Mkt_Activity					
		Low	2	3	4	High	Hedge
Size	Small	0.04	0.65***	0.76***	0.60**	0.42	0.37
		(0.17)	(2.82)	(3.14)	(2.23)	(1.20)	(1.08)
	2	0.08	0.40*	0.78***	0.75***	0.33	0.25
		(0.37)	(1.90)	(3.43)	(3.19)	(1.12)	(1.00)
	3	0.64**	0.67***	0.53**	0.84***	0.39	-0.25
		(2.57)	(2.81)	(2.20)	(3.13)	(1.48)	(-1.08)
	4	0.57*	0.54*	0.53*	0.60**	0.62**	0.05
		(1.88)	(1.93)	(1.81)	(2.10)	(2.12)	(0.23)
	Big	0.79***	0.68***	0.38	0.81***	0.23	-0.55*
		(3.50)	(2.77)	(1.45)	(4.20)	(0.94)	(-2.08)
	Hedge	0.74***	0.03	-0.37*	0.21	-0.19	
		(2.83)	(0.13)	(-1.65)	(0.81)	(-0.60)	

Table A.6: Abnormal returns on portfolios double-sorted on operating profitability and franchise value

This table reports risk-adjusted returns using the Fama-French five factor model. The returns are based on portfolios that are double-sorted on banks' operating profitability (Profitability) and franchise value. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

		Profitability					
		Low	2	3	4	High	Hedge
Franchise Value	Low	-0.07	0.48*	0.76*	0.72*	-0.09	-0.02
		(-0.22)	(1.78)	(1.69)	(1.87)	(-0.22)	(-0.05)
	2	0.74***	0.37	0.35	0.56*	0.57	-0.17
		(2.69)	(1.10)	(1.01)	(1.74)	(1.58)	(-0.45)
	3	0.99***	0.82***	0.97***	0.98***	0.71**	-0.28
		(3.44)	(2.97)	(3.64)	(3.69)	(2.18)	(-0.73)
	4	0.15	0.53	0.37	0.58**	0.47*	0.32
		(0.45)	(1.83)	(1.39)	(2.14)	(1.80)	(1.11)
	High	0.70***	0.56**	0.70**	0.49**	0.04	-0.67**
		(2.85)	(2.19)	(2.57)	(2.05)	(0.15)	(-2.56)
	Hedge	0.77**	0.08	-0.06	-0.23	0.13	
		(2.15)	(0.29)	(-0.17)	(-0.61)	(0.29)	

Table A.7: Abnormal returns on portfolios double-sorted on profitability and asset growth

This table reports risk-adjusted returns using the Fama-French five factor model. The returns are based on portfolios that are double-sorted on banks' profitability and annual growth in assets (*AG*). Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

		Profitability					
		Low	2	3	4	High	Hedge
AG	Low	0.36	-0.21	0.47	0.79***	0.27	-0.09
		(1.27)	(-0.58)	(1.5)	(2.64)	(1.11)	(-0.28)
	2	0.51*	0.6**	0.69**	0.7***	0.58**	0.06
		(1.67)	(2.29)	(2.38)	(2.72)	(2.31)	(0.21)
	3	0.97**	0.7***	0.36	0.63**	0.48*	-0.49
		(2.46)	(3.17)	(1.22)	(2.34)	(1.86)	(-1.3)
	4	0.51	0.62**	0.84***	0.54**	0.37	-0.13
		(1.62)	(2.16)	(2.9)	(2.02)	(1.32)	(-0.4)
	High	0.58***	0.76***	0.53*	0.29	0.19	-0.39
		(2.6)	(2.61)	(1.74)	(1.01)	(0.58)	(-1.19)
	Hedge	0.22	0.98***	0.07	-0.49*	-0.08	
		(0.77)	(3.05)	(0.24)	(-1.78)	(-0.25)	

Table A.8: Abnormal returns on portfolios double-sorted on operating profitability and leverage

This table reports risk-adjusted returns using the Fama-French five factor model. The returns are based on portfolios that are double-sorted on banks' operating profitability (Return on Assets) and leverage (Total Assets – Book Equity + Market Cap)/ Market Cap) in Panel A and triple sorts on size, profitability and leverage in Panel B. In Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

Panel A: Double sorts on profitability and leverage

	Profitability					
	Low	2	3	4	High	Hedge
Low Lev	0.61**	0.54**	0.41	0.1	0.16	-0.45
	(2.12)	(2.17)	(1.62)	(0.38)	(0.65)	(-1.4)
2	0.76***	0.69***	0.57*	0.66***	0.67**	-0.09
	(2.64)	(2.66)	(1.92)	(2.72)	(2.53)	(-0.33)
3	0.25	0.78***	0.7**	1.04***	0.57*	0.32
	(0.75)	(3.09)	(2.44)	(3.59)	(1.94)	(0.93)
4	0.61	0.37	0.83***	0.71**	0.39	-0.22
	(1.52)	(1.13)	(2.74)	(2.09)	(1.11)	(-0.47)
High Lev	0.04	0.41	1.12**	0.75*	-0.12	-0.16
	(0.12)	(1.02)	(2.24)	(1.75)	(-0.28)	(-0.37)

Panel B: Triple sorts on size, profitability and leverage

		Small Banks				Medium Banks				Large Banks			
		Leverage				Leverage				Leverage			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.11	0.6**	0.06	-0.05	0.55*	0.63**	0.38	-0.17	0.73***	0.77***	0.49	-0.24
		(0.44)	(1.98)	(0.21)	(-0.16)	(1.80)	(2.41)	(1.20)	(-0.51)	(3.94)	(2.94)	(1.23)	(-0.62)
	2	0.61***	0.74***	0.66***	0.05	0.58**	0.65***	0.44	-0.14	0.50*	0.58**	0.9***	0.40
		(2.75)	(2.81)	(2.90)	(0.22)	(2.38)	(2.76)	(1.61)	(-0.65)	(1.86)	(1.99)	(3.25)	(1.64)
	High	0.71**	0.64***	1.03***	0.32	0.62**	0.6**	0.66***	0.04	0.21	0.30	0.60**	0.38
		(2.05)	(2.6)	(4.65)	(0.92)	(2.20)	(2.51)	(2.62)	(0.16)	(0.80)	(1.04)	(2.55)	(1.21)
	Hedge	0.60	0.04	0.97***		0.07	-0.03	0.28		-0.52**	-0.47*	0.11	
		(1.58)	(0.14)	(3.66)		(0.25)	(-0.16)	(1.28)		(-2.32)	(-1.69)	(0.31)	

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level

Table A.9: Alternative sample period returns

This table reports risk-adjusted returns for portfolios single sorted on both operating profitability and double-sorted on size and profitability. The risk-adjusted returns are calculated for the pre-GFC period from 1995 to 2006 in Panel A and for the period prior to the Dodd-Frank Act (1995 to 2010) in Panel B. Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

Panel A: Risk-Adjusted returns in the pre-GFC sample

	Low	2	3	4	High	Hedge
All	1.23***	0.97***	0.87***	0.97***	0.76***	-0.47***
	(4.63)	(3.78)	(3.13)	(3.78)	(3.05)	(-3.15)
Small	0.69**	0.49**	0.92***	1.15***	1.14**	0.45
	(2.39)	(2.28)	(3.78)	(3.54)	(2.27)	(0.85)
2	0.45	0.69***	0.65**	1.17***	1.32***	0.87*
	(1.30)	(2.81)	(2.48)	(3.84)	(3.28)	(1.90)
3	0.85***	0.89***	0.85***	0.99***	0.97***	0.12
	(3.17)	(3.09)	(3.19)	(3.16)	(3.16)	(0.45)
4	0.79**	0.97***	1.26***	0.90***	0.95***	0.15
	(2.30)	(3.21)	(3.89)	(3.05)	(2.86)	(0.44)
Large	1.30***	1.15***	0.80***	1.01***	0.50	-0.79***
	(4.75)	(3.99)	(2.58)	(3.68)	(1.48)	(-3.09)

Panel B: Risk-adjusted returns in the pre-Dodd-Frank sample

	Low	2	3	4	High	Hedge
All	0.54**	0.22	0.26	0.32	0.05	-0.49***
	(2.26)	(0.79)	(0.87)	(1.26)	(0.20)	(-3.14)
Small	0.29	0.03	0.53**	0.76***	0.56	0.27
	(1.04)	(0.15)	(2.37)	(2.74)	(1.45)	(0.63)
2	-0.10	0.26	0.28	0.74***	0.50	0.60
	(-0.32)	(1.15)	(1.16)	(2.71)	(1.49)	(1.60)
3	0.34	0.49*	0.44*	0.32	0.23	-0.10
	(1.26)	(1.79)	(1.68)	(1.06)	(0.73)	(-0.36)
4	0.14	0.30	0.52	0.34	0.30	0.16
	(0.38)	(0.98)	(1.51)	(1.08)	(0.97)	(0.51)
Large	0.61**	0.21	0.17	0.33	-0.15	-0.76***
	(2.42)	(0.61)	(0.50)	(1.26)	(-0.46)	(-3.13)

* denotes significance at the 10% level
** denotes significance at the 5% level
*** denotes significance at the 1% level

Table A.10: Double-sorted bank size and profitability using alternative models of risk-adjusted returns

This table reports the abnormal returns on portfolios of banks double-sorted on bank asset size and operating profitability. To calculate these abnormal returns we use factors constructed using the full universe of stocks rather than applying bank-specific factors. The two models used to estimate expected returns are the Fama and French (1993) model (Panel A) and Gandhi and Lustig (2015) model (Panel B). Coefficients are reported on the left-hand side of each panel, and the associated Newey and West (1987) adjusted *t*-statistics are reported on the right-hand side of each panel.

Panel A: Abnormal returns using the Fama and French (1993) model

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	-0.14	0.28	0.54**	0.85***	0.68**	0.82*
		(-0.33)	(1.04)	(2.56)	(3.05)	(2.27)	(1.95)
	2	-0.34	0.31	0.43*	0.63***	0.44**	0.78**
		(-0.97)	(1.33)	(1.96)	(3.21)	(2.30)	(2.36)
	3	0.01	0.24	0.24	0.49**	0.48**	0.47*
		(0.04)	(1.07)	(1.14)	(2.16)	(2.36)	(1.75)
	4	-0.18	0.09	0.08	0.19	0.04	0.22
		(-0.68)	(0.38)	(0.32)	(0.83)	(0.19)	(0.91)
	Big	0.10	-0.01	-0.10	-0.05	-0.27	-0.37*
		(0.41)	(-0.04)	(-0.37)	(-0.23)	(-1.10)	(-1.66)
	Hedge	0.24	-0.30	-0.64**	-0.90***	-0.95**	
		(0.53)	(-0.78)	(-2.13)	(-2.80)	(-2.29)	

Panel B: Abnormal returns using the Gandhi and Lustig (2015) model

		Profitability					
		Low	2	3	4	High	Hedge
Size	Small	-0.11	0.30	0.53**	0.95***	0.75**	0.86**
		(-0.25)	(1.07)	(2.44)	(3.32)	(2.48)	(1.97)
	2	-0.32	0.33	0.46**	0.62***	0.46**	0.78**
		(-0.89)	(1.37)	(2.07)	(3.04)	(2.31)	(2.28)
	3	0.00	0.24	0.17	0.58**	0.53**	0.53*
		(0.00)	(1.03)	(0.8)	(2.49)	(2.57)	(1.92)
	4	-0.32	-0.01	0.03	0.14	0.00	0.32
		(-1.19)	(-0.03)	(0.13)	(0.59)	(-0.02)	(1.29)
	Big	0.05	-0.06	-0.19	-0.10	-0.37	-0.41*
		(0.19)	(-0.24)	(-0.73)	(-0.49)	(-1.44)	(-1.75)
	Hedge	0.16	-0.36	-0.72**	-1.05***	-1.12***	
		(0.33)	(-1.00)	(-2.43)	(-3.24)	(-2.66)	

* denotes significance at the 10% level ** denotes significance at the 5% level *** denotes significance at the 1% level

Table A.11: Identification of months following substantial funding constraints

This table reports the identifies the dates used in subsamples the examine the conditional returns on profitability hedge portfolios following periods when funding constraints bind compared with normalcy. As a point of comparison, periods of NBER recessions are also reported.

Year	Month	NBER	LAGMKT	FUNDBETA	VIX
1995	7	0	1	1	0
1995	8	0	1	1	0
1995	9	0	0	1	0
1995	10	0	1	1	0
1995	11	0	0	1	0
1995	12	0	0	0	0
1996	1	0	0	0	0
1996	2	0	1	0	0
1996	3	0	0	0	0
1996	4	0	0	0	0
1996	5	0	0	0	0
1996	6	0	0	1	0
1996	7	0	0	0	0
1996	8	0	0	0	0
1996	9	0	0	1	0
1996	10	0	0	0	0
1996	11	0	1	0	0
1996	12	0	1	0	0
1997	1	0	0	0	0
1997	2	0	1	0	0
1997	3	0	0	0	0
1997	4	0	0	0	0
1997	5	0	0	1	0
1997	6	0	0	0	0
1997	7	0	1	0	0
1997	8	0	1	0	0
1997	9	0	0	0	0
1997	10	0	1	0	1
1997	11	0	0	0	1
1997	12	0	0	1	0
1998	1	0	0	0	0
1998	2	0	0	0	0
1998	3	0	1	0	0
1998	4	0	1	0	0
1998	5	0	1	0	0
1998	6	0	0	0	0
1998	7	0	0	0	0
1998	8	0	0	0	1
1998	9	0	0	0	1
1998	10	0	0	1	1

1998	11	0	0	0	1
1998	12	0	1	0	0
1999	1	0	1	0	1
1999	2	0	1	0	1
1999	3	0	0	0	0
1999	4	0	0	0	0
1999	5	0	0	0	0
1999	6	0	0	0	0
1999	7	0	0	0	0
1999	8	0	0	0	0
1999	9	0	0	0	1
1999	10	0	0	0	0
1999	11	0	0	0	0
1999	12	0	0	1	0
2000	1	0	1	1	0
2000	2	0	0	1	0
2000	3	0	0	0	0
2000	4	0	0	0	1
2000	5	0	0	0	0
2000	6	0	0	0	0
2000	7	0	0	0	0
2000	8	0	0	1	0
2000	9	0	1	1	0
2000	10	0	0	0	0
2000	11	0	0	0	1
2000	12	0	0	0	1
2001	1	0	0	0	0
2001	2	0	0	0	1
2001	3	1	0	0	1
2001	4	1	0	0	1
2001	5	1	0	0	0
2001	6	1	0	1	0
2001	7	1	0	0	0
2001	8	1	0	0	0
2001	9	1	0	0	1
2001	10	1	0	1	1
2001	11	0	0	0	0
2001	12	0	0	0	0
2002	1	0	1	0	0
2002	2	0	0	0	0
2002	3	0	0	1	0
2002	4	0	0	0	0
2002	5	0	0	0	0
2002	6	0	0	0	1
2002	7	0	0	0	1
2002	8	0	0	0	1

2002	9	0	0	0	1
2002	10	0	0	0	1
2002	11	0	0	0	1
2002	12	0	0	0	1
2003	1	0	0	0	1
2003	2	0	0	0	1
2003	3	0	0	0	1
2003	4	0	0	0	0
2003	5	0	0	0	0
2003	6	0	1	0	0
2003	7	0	1	0	0
2003	8	0	1	1	0
2003	9	0	0	0	0
2003	10	0	0	0	0
2003	11	0	0	1	0
2003	12	0	0	1	0
2004	1	0	1	0	0
2004	2	0	1	1	0
2004	3	0	1	0	0
2004	4	0	0	0	0
2004	5	0	0	0	0
2004	6	0	0	0	0
2004	7	0	0	1	0
2004	8	0	0	0	0
2004	9	0	0	0	0
2004	10	0	0	0	0
2004	11	0	0	0	0
2004	12	0	1	0	0
2005	1	0	1	1	0
2005	2	0	0	0	0
2005	3	0	0	0	0
2005	4	0	0	0	0
2005	5	0	0	0	0
2005	6	0	0	0	0
2005	7	0	0	0	0
2005	8	0	1	0	0
2005	9	0	0	0	0
2005	10	0	0	1	0
2005	11	0	0	0	0
2005	12	0	0	0	0
2006	1	0	0	0	0
2006	2	0	1	0	0
2006	3	0	0	0	0
2006	4	0	0	1	0
2006	5	0	0	1	0
2006	6	0	0	1	0

2006	7	0	0	1	0
2006	8	0	0	1	0
2006	9	0	0	1	0
2006	10	0	0	1	0
2006	11	0	0	0	0
2006	12	0	0	0	0
2007	1	0	0	0	0
2007	2	0	0	0	0
2007	3	0	0	0	0
2007	4	0	0	0	0
2007	5	0	0	1	0
2007	6	0	1	0	0
2007	7	0	0	0	0
2007	8	0	0	1	0
2007	9	0	0	1	0
2007	10	0	0	0	0
2007	11	0	0	0	0
2007	12	1	0	0	0
2008	1	1	0	0	1
2008	2	1	0	0	1
2008	3	1	0	1	1
2008	4	1	0	0	0
2008	5	1	0	0	0
2008	6	1	0	1	0
2008	7	1	0	0	0
2008	8	1	0	0	0
2008	9	1	0	0	1
2008	10	1	0	0	1
2008	11	1	0	0	1
2008	12	1	0	1	1
2009	1	1	0	0	1
2009	2	1	0	0	1
2009	3	1	0	0	1
2009	4	1	0	0	1
2009	5	1	1	0	1
2009	6	0	1	0	1
2009	7	0	1	0	1
2009	8	0	1	0	1
2009	9	0	1	0	1
2009	10	0	1	0	1
2009	11	0	0	0	0
2009	12	0	0	0	0
2010	1	0	0	0	0
2010	2	0	0	0	0
2010	3	0	0	0	0
2010	4	0	0	0	0

2010	5	0	1	0	1
2010	6	0	0	0	1
2010	7	0	0	0	0
2010	8	0	0	0	1
2010	9	0	0	0	0
2010	10	0	1	0	0
2010	11	0	1	0	0
2010	12	0	1	1	0
2011	1	0	1	1	0
2011	2	0	1	0	0
2011	3	0	1	0	0
2011	4	0	0	0	0
2011	5	0	0	0	0
2011	6	0	0	1	0
2011	7	0	0	0	0
2011	8	0	0	0	1
2011	9	0	0	0	1
2011	10	0	0	0	1
2011	11	0	0	0	1
2011	12	0	0	0	0
2012	1	0	1	0	0
2012	2	0	0	0	0
2012	3	0	1	0	0
2012	4	0	1	0	0
2012	5	0	0	1	0
2012	6	0	0	0	0
2012	7	0	0	0	0
2012	8	0	0	0	0
2012	9	0	0	0	0
2012	10	0	0	0	0
2012	11	0	0	0	0
2012	12	0	0	0	0
2013	1	0	0	0	0
2013	2	0	0	0	0
2013	3	0	0	0	0
2013	4	0	1	0	0
2013	5	0	0	0	0
2013	6	0	0	0	0
2013	7	0	0	0	0
2013	8	0	0	0	0
2013	9	0	0	0	0
2013	10	0	0	1	0
2013	11	0	0	0	0
2013	12	0	1	0	0
2014	1	0	1	1	0
2014	2	0	0	0	0

2014	3	0	0	0	0
2014	4	0	0	1	0
2014	5	0	0	0	0
2014	6	0	0	0	0
2014	7	0	0	0	0
2014	8	0	0	0	0
2014	9	0	0	0	0
2014	10	0	0	0	0
2014	11	0	0	1	0
2014	12	0	0	0	0
2015	1	0	0		0
2015	2	0	0		0
2015	3	0	0		0
2015	4	0	0		0
2015	5	0	0		0
2015	6	0	0		0
2015	7	0	0		0
2015	8	0	0		1
2015	9	0	0		0
2015	10	0	0		0
2015	11	0	0		0
2015	12	0	0		0
2016	1	0	0		0
2016	2	0	0		0
2016	3	0	0		0
2016	4	0	0		0
2016	5	0	1		0
2016	6	0	1		0
2016	7	0	0		0
2016	8	0	0		0
2016	9	0	0		0
2016	10	0	0		0
2016	11	0	0		0
2016	12	0	0		0

Table A.12: Abnormal returns on portfolios triple-sorted on size, profitability and maximum daily return (MAX)

This table reports risk-adjusted returns using the Fama-French five factor model. based on portfolios that are triple sorted on size, operating profitability and maximum daily return (MAX). Newey and West (1987) adjusted *t*-statistics are reported in parentheses under their associated coefficients.

		Small Banks				Medium Banks				Large Banks			
		MAX				MAX				MAX			
		Low	2	High	Hedge	Low	2	High	Hedge	Low	2	High	Hedge
Profitability	Low	0.87***	0.71**	-0.40	-1.27***	0.98***	0.55*	-0.09	-1.07***	1.05***	0.56**	0.01	-1.04***
		(3.13)	(2.43)	(-1.39)	(-4.15)	(4.01)	(1.95)	(-0.29)	(-3.79)	(4.93)	(2.07)	(0.02)	(-2.60)
	2	1.08***	0.83***	0.27	-0.81***	0.96***	0.74***	-0.2	-1.16***	0.93***	0.68**	0.27	-0.68**
		(5.20)	(3.24)	(1.08)	(-3.33)	(4.34)	(2.88)	(-0.66)	(-5.11)	(3.74)	(2.50)	(0.72)	(-2.10)
	High	1.23***	1.18***	0.35	-0.88***	1.17***	0.68***	0.08	-1.10***	0.50**	0.41	-0.38	-0.88**
		(4.55)	(4.74)	(1.44)	(-3.34)	(5.35)	(2.83)	(0.25)	(-4.38)	(2.16)	(1.58)	(-1.15)	(-2.47)
	Hedge	0.36	0.47	0.75***		0.19	0.14	0.17		-0.55***	-0.15	-0.39	
		(1.22)	(1.45)	(2.73)		(0.95)	(0.66)	(0.63)		(-2.63)	(-0.61)	(-0.91)	