Bank reactions after capital shortfalls

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Abstract

This paper investigates whether European banks have capital targets and how deviations from the target have an impact on a banks equity composition and activity mix. Assuming that a banks reaction to higher capital requirements will be similar to the reaction when it deviates from an internal, optimal capital ratio, our results could help in understanding the potential reaction of financial institutions to changes in capital requirements. Furthermore, by providing evidence on the behavior of banks during the recent financial crisis, we contribute to the debate on how banks tend to deleverage their balance sheets during economic downturns. Using quarterly data for a group of European banks between 2004Q1 and 2011Q3, we show that there are notable asymmetries in bank reactions to deviations from optimal equity levels. More specifically, overcapitalized banks prefer to reshuffle risk-weighted assets or increase asset holdings when deviating from their optimal Tier 1 ratio, whereas they rather try to increase equity levels or reshuffle risk weighted assets without changing asset holdings when being below target.

Furthermore, when looking at a simple common equity ratio, we do find evidence for deleveraging and lower loan growth for undercapitalized banks during the recent financial

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crisis, whereas in the pre-crisis periods banks primarily react to deviations from their optimal target by adjusting equity levels, for example through changes in retained earnings.

1 Introduction

The recent financial crisis intensified the debate on bank capital regulation. It led to new Basel III capital requirements and formal recommendations by the European Banking Authority (EBA) on recapitalization needs for a group of systemically important European banks. The actual impact of these higher capital requirements on a banks‘ balance sheet composition and ultimately on the real economy, however, remains a highly debated issue. Banks can comply with higher regulatory capital standards by either raising more capital or shrinking their balance sheet (deleveraging). If banks choose the latter option, it can be costly for the real economy through credit crunch effects and fire sales (G.Hanson, Kashyap, and Stein (2011)). If banks shrink their assets by reducing lending activities, this will have an impact on firm investments and overall employment. At the same time, if (a large number of) banks decide to sell off parts of their securities portfolio, prices of these securities will drop, potentially inducing a fire-sale spiral. Furthermore, crisis situations make it more likely that banks choose to shrink their balance sheet instead of raising more equity capital. Bolton and Freixas (2006), for example, show that asymmetric information about a banks‘ net worth makes equity capital more costly. As asymmetric information is a particulary severe problem during crisis periods, raising equity capital will be more difficult when it is mostly needed. This comes on top of other costs related to equity issuances; Myers and Majluf (1984) notice that a new equity issue-instead of reducing assets- may signal that managers believe that the stock is overvalued, leading to negative stock market responses. Also, given the debt overhang problem (Myers (1977)), bank shareholders will always prefer shrinking assets rather than raising new capital. Thus, from a theoretical point of view, it is very likely that banks resort to shrinking assets when facing capital constraints during crisis periods.

Figure 1: Bank reaction to capital deviations

Bank (t=1)	
Loans 70	Deposits 60
Securities 30	MMfunding 30
	Equity 10

Bank (t=2)	
Loans 70	Deposits 60
Securities 29	MMfunding 30
	Equity 9

Bank (t=3)	
Loans 70	Deposits 60
Securities 20	MMfunding 21
	Equity 9

In this paper, we contribute to a better understanding of bank deleveraging mechanisms by looking at bank balance sheet reactions after deviations from optimal capital levels. Using a sample of about 90 European banks between 2004 and 2011 we study (i) whether these banks have an internal, optimal capital ratio, (ii) how banks react to a deviation from their optimal capital level, (iii) whether this reaction differs during crisis situations and (iv) whether this reaction is symmetric in terms of being below or above the optimal level. We study the impact of deviations on six different balance sheet factors, namely Tier 1 capital, common equity, retained earnings, risk weighted assets, total assets and bank loans. Assuming that a banks reaction to higher capital requirements will be similar to the reaction when it deviates from an internal, optimal capital ratio, the results in this paper could help in understanding the potential reaction of financial institutions to changes in capital requirements.[1] Furthermore, by providing evidence on the behavior of banks during the recent financial crisis, we contribute to the debate on how banks tend to deleverage their balance sheets during economic downturns.

The example in Figure 1, which is inspired by Adrian and Shin (2010), illustrates why optimizing banks will potentially adjust asset and liability positions when being away from their optimal capital ratio. Assume a simplified bank balance sheet with only loans and securities at the asset side and funded by deposits, money market funding and equity.

The equity ratio of this bank is 10 percent at t=1. Assume that this is the optimal equity

[1] This assumption is strengthened by the findings of Francis and Osbourne (2009), who show that , at least in the UK,regulatory capital requirements are positively associated with banks‘ targeted ratios. Furthermore, survey results from Alfon et al. (2004) show that higher capital requirements are associated with higher capital ratios.

target for this bank. If a banks equity is hit by a shock at t=2, for example by a loss of 1 on the securities, the equity ratio falls to 9/99 = 9.09 percent. If the bank wants to get to its optimal level, it will have to adjust its balance sheet. It could get back to its optimal equity ratio by increasing its equity with 0.99. This could be done by retaining more earnings or by raising external equity. A deviation from the optimal equity ratio could thus impact the composition and size of equity. However, raising equity is costly and will not always be the preferred funding measure. The pecking order theory, for example, emphasizes that, when external funding is needed, firms will prefer debt above equity (Myers and Majluf, 1984). Furthermore, the market-timing theory on capital structure posits that firms will issue securities depending on the relative cost of debt and equity (REF). It could therefore be expected that in many cases banks will choose other options than raising extra capital . In our example, a possible alternative strategy could be to diminish the short term money market funding with an amount of 9 and at the same time sell off 9 securities, which would bring the capital ratio back to 9/90= 10 percent. Another alternative would be to diminish the amount of loans, by simply decreasing their loan supply or by selling more loans through securitization. This simple example shows that, if banks are actively trying to hold their capital ratio at an optimal level, this can have an impact on various balance sheet items. The same type of reasoning could be made when the bank is hit by a positive capital shock.

Next to looking at how banks adjust their balance sheet, we also focus on potential asymmetries in the adjustment behavior. More specifically, we are interested in banks that are below their optimal capital levels, since their behavior could help in understanding the potential reaction after rising capital requirements or during distressed situations. Furthermore, we make a difference between bank behavior before and during the recent financial crisis. Previous studies have showed that economic conditions can have a significant impact on banks‘ capital management (see, e.g., Jokipii and Milne (2008); Francis and Osborne (2012)). There are two possibilities;

banks could take a forward looking, over the cycle approach or they could behave more short sighted. If the former is true, then banks will increase bank capital levels during business cycle expansions to build up buffers for bad times. Increased recognition of the build up of risk during economic booms and the potential realization of bad loans in a following stage would thus lead to the build up of excess capital during boom periods (see, e.g. Borio, Furfine, and Lowe (2001)). However, banks could also choose to hold less capital during boom periods, as potential risks are perceived to be less likely to materialize. When risks do materialize, existing capital cushions will not be sufficient to cope with rising losses. Furthermore, markets will potentially require higher buffers during these downturns and banks that want to maintain their credit ratings - in order to prevent higher funding costs - will have to increase their capital levels. As raising external capital or retaining more earnings is hard during crisis periods, banks will have a higher incentive to reduce their lending or securities portfolio during economic downturns.

This paper is related to different strands of the existing literature on (bank) capital structure. First of all, our paper relates to the recently emerging empirical literature that studies the impact of deviations of bank capital relative to a bank-specific capital target on bank characteristics. This approach finds it origin in a study of Hancock and Wilcox (1994) and was recently used inBerrospide and Edge (2010).who look at the impact of capital deviations on bank lending in the U.S., andFrancis and Osborne (2012), who focus on the impact of individual bank capital requirements on bank lending and balance sheet composition for a group of U.K banks..

Second, this paper relates to the literature on optimal (bank) capital structure (see, e.g. Lemmon, Roberts, and Zender (2008), Flannery and Rangan (2006), Berger, DeYoung, Flannery, Lee, and Oztekin (2008), Gropp and Heider (2010)).These papers mainly focusses on the determinants of optimal (bank) capital levels and how fast firms can adjust towards this optimal level, whereas we are more interested in how banks adjust towards this optimal level, i.e. either by adjusting asset side and/or capital components.

Third, our work is closely related to the extensive literature on the impact of bank capital and capital regulation on real economic growth. A primary focus of this literature has been on the impact of capital regulation on credit supply. A first strand of papers within this category look at the potential impact of the introduction of the 1988 Basel Capital Accord on the 1990-1991 slowdown in the U.S..Berger and Udell (1994) examine whether the Capital Accord contributed to the 1990-1991 credit crunch in the U.S. and find, among other things, that banks with weaker capital ratios have more substantial credit reallocation effects than others. Peek and Rosengren (1995) show that capital regulations contributed to a slowdown in credit supply during the 1990-1991 recession in the state of New England. Others focussed on the indirect role of capital in the monetary transmission process. Kishan and Opiela (2000), for example, focus on U.S. banks between 1980 and 1995 and define undercapitalized banks as banks with a capital ratio under 8%. They find that these banks are more responsive to monetary policy, especially when they are small. Altunbas, Fazylov, and Molyneux (2002) and Gambacorta and Mistrulli (2004) find similar results for a sample of respectively European and Italian banks. Berrospide and Edge (2010) study the lending behavior of large bank holding companies in the U.S. and find rather small effects of bank capital on lending. Using a loan level dataset on Spanish bank loans, Jimenez, Ongena, Peydro, and Saurina (2011) show that banks with low capital grant fewer loans in times of tighter monetary policy and that a decrease in bank capital leads to a positive effect on loan granting.

Only a couple of existing studies have focussed on the impact of deviations from optimal capital levels, mainly focussing on the impact on credit growth (Berrospide and Edge (2010) for the US; Francis and Osborne (2012) for a group of UK banks and Memmel and Raupach (2010) for a group of German banks). We contribute to this strand of literature in three ways: i) by focussing on a broad range of balance sheet components that could be affected by capital shortfalls, ii) by allowing for asymmetric reactions for capital surplusses and capital shortfalls

and iii) by studying potential differences in bank reactions during the recent financial crisis. Until now, Francis and Osborne (2012) is the only paper we know of that also focusses on other bank characteristics than bank lending within this capital deviation setup[2]. They look at a sample of about 150 UK banks between 1996 and 2007 and study the impact of capital deviations on different balance sheet characteristics, while putting a special focus on the impact of bank-specific capital requirements[3]. Although our empirical strategy is similar to the one used in Francis and Osborne (2012), our study differs from theirs in a number of ways. First, we take into account potential asymmetries in the reaction to deviations from the optimal capital level. More specifically, we allow banks that are below their optimal level to react differently than banks that are above the optimal level. Second, our sample allows to analyze the impact of the recent financial crisis on bank capital management. Third, we focus on both a risk-weighted capital ratio (Tier 1 capital over Risk Weighted Assets) and a simple (inverse) leverage ratio (Equity over Total Assets).

One important question is which concept of capital we should focus on. From a regulatory perspective, a lot of emphasis is placed on the Tier 1 ratio, i.e. the ratio of Tier 1 capital over risk weighted assets. The Basel II capital standard included a Tier 1 target. Thus, if we want to analyze potential reaction of banks to higher capital requirements, looking at the Tier 1 ratio is the most interesting avenue. However, as Blum (2008) argues, capital measures based on cruder risk-exposure proxies than risk-weighted assets may be more relevant for stock market participants or debt holders, because they may view the risk weightings as highly opaque and uninformative. As funding costs are an important issue for bank managers, it is well possible that banks - just like other firms - also optimize a simple leverage ratio. Therefore, we use both

[2] Memmel and Raupach (2010) also look at adjustment behaviour, but they mainly focus on which type of bank tends to adjust faster than others. In terms of how banks adjust, they only make a difference between asset and liability side adjustments. Furthermore, their empirical framework differs considerably from ours.

[3] Francis and Osborne (2012) have access to confidential individual bank data on capital requirements for U.K. bank, which are imposed by the banking regulator in the UK (FSA), which allows them to look at the impact of capital regulation on bank capitalization levels.

the Tier 1 ratio and a simple common equity ratio, as both could potentially reveal a different story.

2 Data and Empirical strategy

2.1 Sample selection

We start with a sample of financial institutions located in EU-27 countries and Norway for which we have quarterly data in either Bloomberg or Worldscope between 2004Q1 and 2011Q3. Next, we rely on Bankscope to identify bank types. We remove all banks which are not commercial banks, saving banks, cooperative banks, real estate banks or bank holding companies. We also exclude banks for which no information is available on bank capital or other variables needed to calculate optimal capital ratios. This leaves us with a sample of 93 banks from 22 European countries[4]. Macroeconomic indicators are provided by Thomson Datastream. The securitization dummy used in the loan regressions is based on data coming from Dealogic (DCM Analytics).

To assess the impact of deviations from capital targets, we first need to estimate bank capital targets. Thus, in the first subsection we derive the deviations from the capital target by developing a dynamic capital adjustment model, which will also allow us to investigate the adjustment speed towards capital targets, whereas in a second part we assess the impact of the estimated deviations on bank-specific balance sheet characteristics.

2.2 Dynamic capital adjustment model

In this part, we develop a dynamic capital adjustment model which allows us to estimate bank capital targets and, although not the primary focus of this paper, will also gives us the possibility to assess the adjustment speed towards these targets. In line with the existing capital structure

[4] Austria, Belgium, Bulgaria, Czech Republic, Germany, Denmark, Spain, Finland, France,United Kingdom, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Sweden and Slovenia

literature (see, e.g.Flannery and Rangan (2006) ,Berger, DeYoung, Flannery, Lee, and Oztekin (2008) , Francis and Osborne (2012)), we model the possibility that target capital ratios might differ across banks and over time as follows :

$$K^*_{i,t} = \beta X_{i,t-1} \tag{1}$$

Where $K^*_{i,t}$ is the bank-specific, time-varying optimal capital ratio and $X_{i,t}$ is a vector of of bank specific characteristics. Following existing literature on the determinants of optimal capital structure (see, e.g., Gropp and Heider (2010) Berger, DeYoung, Flannery, Lee, and Oztekin (2008),Lemmon, Roberts, and Zender (2008)) we include proxies for size (ln(Total Assets), earnings (Return on Equity), bank risk behavior (Loan Loss Provisions) and bank business model characteristics (Loan ratio, Deposit ratio, Income diversification, Cost-Income ratio) as bank specific determinants of the optimal capital level. Size is included as larger banks could potentially face lower risk , through diversification benefits or better access to funding, hence lowering required capital. Changes in earnings can have an impact on retained earnings, as dividend payments are rarely adjusted for most banks. When banks are more risky, markets will probably require more capital to be held, which is why we include loan loss provisions. The other indicators included also reveal information on bank riskiness and funding costs, which is why they could be of importance for bank capital levels.

Immediate adjustment of the capital ratio towards this target will create substantial adjustment costs, leading to a partial adjustment model which looks as follows:

$$K_{i,t} - K_{i,t-1} = \lambda(K^*_{i,t} - K_{i,t-1}) + \varepsilon_{i,t} \tag{2}$$

Where $K_{i,t}$ is the effective bank capital ratio and where λ can be seen as the adjustment speed towards the target ratio. A low λ would indicate that banks are rather passive in terms

of capital management and that they slowly adjust towards their target capital levels, whereas a high λ would point at actively managed capital ratios. The problem with specification 2 is that the target ratio is not directly observable. Therefore, we integrate equation 1 into equation 2 and slightly rearrange the model:

$$K_{i,t} = \lambda(\beta X_{i,t-1}) + (1-\lambda)K_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

Equation 3 can then be estimated using the Blundell and Bond (1998) GMM estimator, which corrects for the biased adjustment speeds caused by the dynamic setup of the panel. Moreover, this will not only give us an estimate of the average adjustment speed of the banks in our sample, but also allows us to calculate the optimal bank capital level by using the estimated coefficients from Equation 3:

$$K^*_{i,t} = est(\beta)X_{i,t-1} \tag{4}$$

This estimated optimal capital ratio will then be used in a following step to assess the impact of a deviation from the optimal ratio on bank behavior.

The dynamic capital adjustment model allows us to check whether banks have a target capital level and how fast they can move towards this optimal level. The model thus gives us information on the reaction of one specific balance sheet characteristic - being the capital ratio itself - to deviations from the target capital level. If we want to know the impact of deviations from the capital target on other balance sheet characteristics, we need some additional steps. First of all, we can use the optimal capital ratio (see eq.4) to calculate the deviations ($DEV_{i,t}$) from the target capital level:

$$DEV_{i,t} = est(\beta)X_{i,t-1} - K_{i,t} \tag{5}$$

A negative (positive) value would imply a capital deficit (surplus) relative to the bank-specific capital target. Banks could react to these deviations in a number of ways. For example, when a bank is below its Tier 1 target, it could change the numerator by raising external capital or by retaining a bigger share of its earnings. It might also choose to reshuffle its asset portfolio in such a way that the risk weighted assets decrease, or by shrinking the securities or loans portfolio, which would increase the Tier 1 ratio.

While checking the impact of deviations from the capital target on one of these factors, we also want to control for asymmetric reactions, i.e. do banks react differently when they are above or below their target. Therefore, we regress the change in each equity factor on the deviation from the target and a group of control variables, while using interaction terms between dummies and the deviation to control for possible asymmetric effects.

$$\Delta BS_{i,t} = \alpha_i + \beta_1 * DEV_{i,t-1} + \beta_2 * DEV_{i,t-1} * D_{i,t-1} + \beta_3 * D_{i,t-1} + \delta * CV_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

Where $\Delta BS_{i,t}$ is the growth rate for one of the balance sheet variables which could be affected by the deviation of a bank from its optimal capital level. The dummy variable $D_{i,t-1}$equals one when a bank is below its optimal capital level and allows us to differentiate between the impact of capital shortfalls and capital surplusses on a banks balance sheet composition. We study the impact on six balance sheet factors, namely Tier 1 capital, total capital, retained earnings, risk weighted assets, total assets and bank loans. Unfortunately, data availability issues do not allow us to dig deeper into a banks' asset composition and for example study specific loan or securities portfolio compositions. However, we do believe that combining the different components for which we do have information available already provides interesting insights into how European financial institutions manage their capital ratios.

3 Results

3.1 Speed of adjustment and optimal capital levels

Before we can analyze the impact of capital deviations we need to calculate the optimal capital levels. Table 2 shows the results for the speed of adjustment regressions (see equation 3) for our two capital measures, being the Tier 1 capital ratio (column 1-3) and a simple equity ratio (column 4-6). These ratios are regressed on their own one period lagged value and a group of macro-economic and bank-specific control variables, while also taking into account bank- and time fixed effects. For each capital ratio, we run a pooled OLS regression, a panel regression including bank fixed effects and a Blundell-Bond System GMM regression. We are especially interested in the System GMM results, as the dynamic setup of our panel leads to biased and inconsistent estimates when using the pooled OLS or fixed effects estimators (Nickell, 1981). We include the OLS and fixed effects estimations as a sort of robustness check for our GMM results. More specifically, it can be shown that pooled OLS estimates tend to overestimate the coefficient for the lagged variable while fixed effects estimators underestimate its true value. As a consequence, a good estimate should at least be between the fixed effects and pooled OLS coefficient. This is the case for both the Tier 1 as well as the equity regression. Furthermore, the J-statistic also confirms the validity of our instruments. Looking at the results, we see that for both capital measures the lagged dependent variable is highly significant and between 0 and 1, indicating that banks do adjust towards an optimal capital level. The speed of adjustment is quite different for the two capital indicators, with the common equity ratio adjusting faster towards the optimal level than the Tier 1 capital ratio. On average, it takes a bank about 3.1 quarters to close half of its Tier1 capital gap, while half of the common equity gap is on average filled in about half a year.Possible explanations could be that banks are more concerned about their optimal leverage ratios or that it simply is easier to adjust common equity ratios than Tier

1 ratios.

Next, we use these estimation results to calculate time varying, bank specific optimal capital ratios and the deviations from this optimal level (see equation 4 and 5). Table 1 shows the summary statistics for the optimal ratios and the corresponding deviations. In a following step, we analyze the impact of the capital deviations on a group of balance sheet characteristics.

3.2 Impact of capital ratio deviations

In what follows, we analyze the impact of the capital deviations on a group of balance sheet characteristics. We divide the balance sheet characteristics in two groups, depending on whether they belong to the numerator (Tier 1 or Equity Capital) or the denominator (Total or Risk Weighted Assets) of the capital ratio. Table 3 to Table 12 show the results from this analysis. In each table, we analyze the impact of deviations from optimal Tier 1 or Equity levels on either Tier 1 capital, Total Equity, Risk Weighted Assets, Total Assets, Retained Earnings or Loans. The first two columns show the results when not taking into account potential asymmetries between being below or above the optimal capital level. The last two columns do look at differences between capital surplusses and shortfalls by interacting the deviations from the optimal level with a dummy indicating whether a bank is below(dummy =1) or above (dummy=0) the optimal level. For both regressions, we look at two separate periods, being a pre-crisis period running from the first quarter of 2004 untill the last quarter of 2007, and a crisis period running from the first quarter of 2008 untill the third quarter of 2011. In all regressions, we control for macroeconomic conditions and central bank policy actions by including quarterly GDP growth, quarterly inflation rate and changes in the 3 month euribor (or a country-specific equivalent for non-EMU countries). Following Hancock, Laing, and Wilcox (1995), Berrospide and Edge (2010) and Francis and Osborne (2012), we include two lags of these macro variables. We also control for bank specific characteristics that could have an impact on our left hand side variables. We

include bank size (ln(Total Assets)), a bank efficiency measure (cost-income ratio), a credit risk indicator (loan loss provisions), an income diversification measure (share of non-interest income in total income) and a funding structure measure as bank-specific control variables. Furthermore, we also take into account the potential impact of bank bailouts on a banks balance sheet structure by adding a bank bailout dummy which equals one from the moment a bank received a bailout. Finally, when focussing on loan growth, we also control for the impact of bank securitization by including a securitization dummy which equals one if the bank securitized loans in that quarter. All right hand side variables are standardized, which means that the coefficients show the impact of a one standard deviation change of the independent variable on the dependent variable. We also control for bank specific unobservable characteristics and seasonal influences by adding bank and time fixed effects. Furthermore, we also cluster standard errors at the bank level.

3.2.1 Impact of Tier 1 capital deviations

A natural point to start our analysis is by looking at the impact of capital deviations on actual capital levels. Table 3 shows the impact of deviations from the optimal Tier 1 ratio on the growth in Tier 1 capital the following quarter. As expected, deviations from the optimal capital level are negatively correlated with changes in Tier 1 capital growth, both before and during the recent financial crisis, although we only find a significant negative impact in the crisis periods. However, these first two columns do not take into account potential differences in adjustment behavior between banks that are below and banks that are above their optimal capital level. The last two columns do control for potential asymmetries by interacting the deviation variable with a dummy indicating whether a bank is above (dummy=1) or below (dummy=0) the capital target. Interestingly, these two columns show that the results in the first two columns are fully driven by banks that are below their target levels. These banks try to increase their capital ratios by increasing Tier 1 capital. Banks that are above the optimal level, on the other hand, do not have

an incentive to reduce their capital levels. This does not mean that these banks are not interested in getting back to their optimal capital target; it only indicates that they prefer other measures to adjust their capital ratios. Digging one step deeper by looking at the impact of deviations from the Tier 1 ratio on Retained earnings (table 4) only shows us that the adjustments do not systematically happen through adjustments in retained earnings. The alternative for these banks is adjusting the denominator of the capital ratio by making changes to their risk weighted assets (RWA). Table 5 shows the impact of deviations from the optimal Tier 1 ratio on the growth in Risk Weighted Assets. The first two columns again confirm our general expectations; deviations from the optimal level are positively correlated with RWA growth, both before and during the current financial crisis. Column 3 of Table 5 shows that both banks that are below and banks that are above the optimal level make adjustments to their Risk Weighted Assets to get back to their optimal levels. Combining this result with the insights we got from table 3 , this indicates that banks that are above their internal target prefer to leave their capital base unchanged and instead expand their RWA, whereas undercapitalized banks try to manage both capital levels and their risk weighted assets. Furthermore, the results show that undercapitalized banks react stronger to deviations from the optimal ratio than banks that are above this optimal level, especially in terms of adjustments in Tier 1 capital, as the change in capital levels is about five times as strong for undercapitalized banks compared to banks that are equally for above their optimal capital level. Finally, the size of the reactions is fairly similar for both the pre-crisis and the crisis period.

Changes in risk weighted assets can be caused by a change in risk weightings, a real change in total assets or a combination of both. Table 6 provides more information on this issue. The table shows the impact of deviations from the optimal Tier 1 ratio on the growth in total assets. We only find a significant impact on real asset growth for banks that are above their optimal capital ratio, indicating that banks prefer to fine tune their risk weighted assets instead of making actual changes to the size of their balance sheet when being below their Tier 1 capital target. This holds

for both the crisis and the pre-crisis period. In Table 7 we focus on the impact of devations from optimal capital levels on loan growth. We do not find any significant effect of Tier 1 deviations on loan growth.

3.2.2 Impact of common Equity deviations

As mentioned before, capital measures based on cruder risk-exposure proxies than risk-weighted assets may be more relevant for stock market participants or debt holders, because they may view the risk weightings as highly opaque and uninformative. It is thus well possible that banks - just like other firms - also optimize a simple leverage ratio. Therefore, we also analyze the impact of deviations from a simple common equity ratio, for which, in contrast to the Tier 1 ratio, the assets are not risk adjusted. Table 2 already indicated that banks do optimize their equity ratio. As with the Tier 1 ratio, we again start our analysis by looking at the impact of deviations from the optimal level on the numerator of the target ratio, which in this case is common equity. As expected, Table 8 shows that deviations are negatively correlated with changes in common equity, both before and during the recent crisis. Both banks that are above and banks that are below the target do adjust their capital levels, although undercapitalized banks react significantly stronger. Table 9 shows that at least part of the adjustment in equity levels is achieved through changes in retained earnings. This is particulary true for banks that above their optimal levels, although during the recent crisis undercapitalized banks also tried to shore up equity levels by retaining a bigger part of their earnings. Focussing on the impact of deviations on changes in total assets (Table 10), we find striking differences between the pre-crisis and the crisis period. Whereas during normal period banks do not react on equity deviations by adjusting their balance sheet size, we do find a significant impact during the recent crisis. This effect is particulary strong for banks that are below their optimal equity level, suggesting the presence of a deleveraging effect. In other words, deviations from the optimal capital level lead

to significant changes in balance sheet growth for banks that are below their optimal level during the recent crisis period, confirming that banks are lowering asset growth in order to raise their capital ratios. Table 11 shows that at least a part of this asset side deleveraging is happening via lower loan growth. During the 2008-2011Q3 period, undercapitalized banks had significantly lower loan growth rates than others, while this did not hold during the pre-crisis period.

4 Conclusions

In this paper, we contribute to a better understanding of bank deleveraging mechanisms by looking at bank balance sheet reactions after deviations from optimal capital levels. Using a sample of about 90 European banks between 2004 Q1 and 2011 Q3, we study (i) whether these banks have an internal, optimal capital ratio, (ii) how banks react to a deviation from their optimal capital level, (iii) whether this reaction differs during crisis situations and (iv) whether this reaction is symmetric in terms of being below or above the optimal level. We focus both on Tier 1 capital ratios and a simple common equity ratio. We do find evidence for capital optimalization, both in terms of the Tier 1 ratio and the common equity ratio. Furhtermore, we show that there are notable asymmetries in bank reactions to deviations from optimal equity levels. More specifically, overcapitalized banks prefer to reshuffle risk-weighted assets or increase asset holdings when deviating from their optimal Tier 1 ratio, whereas they rather try to increase equity levels or reshuffle risk weighted assets without changing asset holdings when being below target. When looking at a simple common equity ratio, we do find evidence for deleveraging and lower loan growth for undercapitalized banks during the recent financial crisis, whereas in the pre-crisis periods banks primarily react to deviations from their optimal target by adjusting equity levels, for example through changes in retained earnings. These results confirm the importance of taking into account potential asymmetries when looking at reactions after deviations from optimal capital levels and can help in understanding how banks react to a sudden shortfall in

bank capital levels.

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Table 1: Bank Specific Variables - Summary Statistics

This table shows the summary statistics for the bank-specific variables used througout this paper. Our total sample consists of quarterly data for 77 European banks from 2004Q1 until 2011Q3 The consist of two panel. The first panel shows the summary statistics for the capital ratios and bank business model variables. This data is coming from Bloomberg and Datastream. Based on these variables, we can calculate a banks optimal capital ratio and the deviation from this optimal level (see table 2 for more info). The summary statistics for these optimal levels and deviations are shown in the second part of the table.

Variable	**Mean**	**Std. Dev.**	**N**
Tier 1 Ratio	9.13	2.44	1454
Equity over Total Assets	6.05	2.9	1823
ln(Total Assets)	10.93	1.74	1823
Return on Equity	10.81	12.54	1823
Loan to Assets Ratio	0.70	0.15	1823
Deposit Ratio	0.47	0.16	1823
% LoanLossProvisions	0.14	0.15	1823
Income diversification	0.29	0.15	1823
CostIncome Ratio	2.34	8.37	1823
GDP growth	0.11	5.67	1823
Inflation rate	0.58	0.78	1823
Variable	**Mean**	**Std. Dev.**	**N**
Tier 1 ratio - deviation	0.01	0.29	1454
Equity over Total Assets - deviation	0.12	0.49	1823
Tier 1 ratio - optimal	9.43	2.43	1454
Equity over Total Assets - optimal	5.5	1.4	1823

Table 2: Bank Capital - Speed of Adjustment

This table shows the results for the speed of adjustment regressions for our two capital measures. The dependent variable in the first three columns is the Tier 1 Capital ratio (Tier1 Capital over Risk Weighted Assets), while the dependent variable in the last three columns is the Total Capital ratio (Total Capital over Total Assets). Both capital variables are regressed on their own one-period lagged observation, a group of bank-specific business model characteristics and two macro-economic control variables (GDP growth and Inflation rate). All regressions also include time fixed effects. For each capital variable we use three different regression approaches, being OLS, panel with bank Fixed Effects and System GMM. Since we are dealing with a dynamic panel setup, the System GMM approach is the preferred approach. For the panel regressions, we report robust standard errors, clustered at the bank level. The GMM standard errors are Windmeiijer robust standard errors.We use a two step GMM procedure, using a collapsed instrument set of two lags of the right hand side variables. For each regression, the table also mentions the speed of adjustment of the banks towards their optimal capital level (calculated as one minus the coefficient on the lagged dependent variable) and how many quarters it takes for the average bank to fill half of the difference between the optimal and the current capital level ("half").

VARIABLES	(2) OLS	(3) FE	(4) SGMM	(5) OLS	(6) FE	(7) SGMM
Tier1Ratio	0.879***	0.637***	0.804***			
	(0.0258)	(0.0553)	(0.0894)			
Equity ratio				0.965***	0.717***	0.728***
				(0.0106)	(0.0340)	(0.0922)
ln(TotalAssets)	-0.0398	-0.710	-0.0906	-0.0236*	-0.155	-0.172
	(0.0247)	(0.451)	(0.295)	(0.0133)	(0.112)	(0.214)
Return on Equity	0.00708**	2.36e-05	0.00106	0.000192	0.000590	0.0125
	(0.00318)	(0.00359)	(0.00946)	(0.00201)	(0.00233)	(0.00825)
Loan to Assets Ratio	-0.977***	-2.388***	-2.187**	-0.0586	-0.955***	0.156
	(0.318)	(0.561)	(0.876)	(0.162)	(0.353)	(0.843)
Deposit Ratio	-0.0841	0.992	1.740	-0.0513	-0.301	-0.466
	(0.265)	(0.672)	(1.171)	(0.167)	(0.508)	(0.686)
% LoanLossProvisions	0.140	0.253	0.170	-0.0512	-0.230	-0.209
	(0.259)	(0.291)	(0.427)	(0.152)	(0.187)	(0.281)
Income diversification	-0.370**	-0.141	0.000798	0.00930	-0.0938	-0.156
	(0.178)	(0.231)	(0.291)	(0.119)	(0.132)	(0.200)
CostIncome Ratio	0.00160	0.00182	-0.00611**	0.000554	0.000190	-0.000772
	(0.00291)	(0.00248)	(0.00291)	(0.00115)	(0.00106)	(0.00175)
GDP growth	0.0371***	0.0340**	0.0279	0.00286	0.00306	0.00599
	(0.0101)	(0.0142)	(0.0504)	(0.00506)	(0.00559)	(0.0281)
Inflation rate	0.0965**	0.0562	-0.00123	0.0856***	0.0645**	-0.0438
	(0.0477)	(0.0439)	(0.407)	(0.0321)	(0.0311)	(0.117)
Constant	1.972***	11.46**		0.526**	3.984***	
	(0.610)	(5.293)		(0.262)	(1.271)	
Observations	1,399	1,399	1,399	1,823	1,823	1,823
R-squared	0.843	0.712		0.953	0.627	
Speed Of Adjustment	0.121	0.363	0.196	0.0345	0.263	0.272
Half	5.379	1.535	3.185	19.72	2.275	2.180
Number of banks	79	79	79	93	93	93
System GMM			YES			YES
Twostep			YES			YES
IVlags			two			two
AR2pval			0.138			0.215
Jstatpval			0.541			0.242
Cluster		bank			bank	

Table 3: Tier 1 Deviation - Impact on Tier 1 Capital

This table shows the impact of deviations from the Tier1 optimal capital level on Tier 1 capital growth. We regress Tier1 capital growth on the deviation from the optimal Tier 1 ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below are above the optimal capital level.In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Tier1 capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target (‘Beta-Shortfall‘), and the corresponding t-statistic (‘T-statistic‘) All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Tier 1 Growth 2004-2007	Tier 1 Growth 2008-2011Q3	Tier 1 Growth 2004-2007	Tier 1 Growth 2008-2011Q3
Deviation Tier 1 Ratio	-0.448	-2.299***	-0.653	-2.393***
	(0.783)	(0.559)	(0.785)	(0.550)
Deviation x Shortfall Dummy			-10.69***	-9.586***
			(2.947)	(1.791)
Shortfall Dummy			-1.033	-1.611
			(1.791)	(1.184)
Beta-Shortfall			*-11.34*	*-11.98*
T-statistic			*-3.858*	*-6.034*
GDP growth	-0.00254	0.655	0.0944	0.598
	(0.883)	(0.723)	(0.831)	(0.731)
GDP growth$_{t-1}$	0.680	0.188	1.084**	0.516
	(0.605)	(0.608)	(0.521)	(0.658)
change in interest rate	0.334	0.115	-0.111	0.0903
	(0.897)	(0.159)	(0.854)	(0.154)
inflation rate	-0.286	-0.514	-0.377	-0.521
	(1.031)	(0.538)	(1.020)	(0.550)
change in interest rate$_{t-1}$	0.481	0.364	-0.0384	0.395
	(1.127)	(0.292)	(1.175)	(0.292)
inflation rate$_{t-1}$	-1.577	0.734	-1.150	0.995*
	(1.147)	(0.540)	(1.055)	(0.571)
Size	-2.041	-1.551	-2.529	-1.347
	(2.398)	(1.144)	(2.261)	(1.039)
Cost Income ratio	-0.412	0.197	-0.177	0.412**
	(0.604)	(0.183)	(0.678)	(0.171)
Loan Loss Provisions	0.348	-0.153	-0.0298	-0.0155
	(0.804)	(0.324)	(0.818)	(0.358)
Deposit ratio	-1.890	-0.950	-3.478**	-2.915***
	(1.588)	(1.055)	(1.538)	(1.031)
Income Diversification	0.0867	-0.141	-0.130	-0.258
	(0.507)	(0.233)	(0.492)	(0.242)
bailout		-1.024		-1.523
		(2.919)		(2.803)
Constant	1.259	1.062	-0.166	-2.529
	(2.404)	(1.772)	(2.365)	(1.791)
Observations	452	764	452	764
R-squared	0.152	0.112	0.193	0.153
Number of bankid	59	70	59	70
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 4: Tier 1 Deviation - Impact on Impact on Retained Earnings

This table shows the impact of deviations from the Tier1 optimal capital level on Retained Earnings growth. We regress Retained Earnings growth on the deviation from the optimal Tier 1 ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level.In column 3 and 4, we take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Tier1 capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target (‘Beta-Shortfall‘), and the corresponding t-statistic (‘T-statistic‘) All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Ret. Earnings 2004-2007	Ret. Earnings 2008-2011Q3	Ret. Earnings 2004-2007	Ret. Earnings 2008-2011Q3
Deviation Tier 1 Ratio	-0.0559	-0.219	-0.187	-0.191
	(1.307)	(0.370)	(1.308)	(0.368)
Deviation Tier 1 Ratio x Shortfall Dummy			-3.271	0.300
			(5.718)	(1.437)
Shortfall Dummy			0.542	0.230
			(3.248)	(0.801)
Beta-Shortfall			*-3.458*	*0.109*
T-statistic			*-0.575*	*0.0726*
GDP growth	-1.391*	0.187	-1.339*	0.186
	(0.784)	(0.335)	(0.734)	(0.335)
GDP growth$_{t-1}$	0.244	1.177**	0.372	1.165**
	(0.812)	(0.511)	(0.818)	(0.502)
change in interest rate	-3.697	0.0543	-3.428	0.0539
	(4.782)	(0.0797)	(4.654)	(0.0790)
inflation rate	1.682	-0.568	1.675	-0.572
	(1.498)	(0.360)	(1.452)	(0.360)
change in interest rate$_{t-1}$	4.085	0.209	5.263	0.208
	(5.653)	(0.278)	(5.598)	(0.278)
inflation rate$_{t-1}$	-0.277	-0.191	-0.0361	-0.196
	(1.122)	(0.381)	(1.162)	(0.383)
Size	-14.51	0.971	-11.98	0.961
	(9.992)	(0.654)	(10.43)	(0.660)
Cost Income ratio	-0.104	0.00973	-0.156	0.00647
	(1.198)	(0.135)	(1.173)	(0.136)
Loan Loss Provisions	0.805	-0.399	0.621	-0.403
	(2.292)	(0.310)	(2.450)	(0.308)
Deposit ratio	-3.982	0.787	-4.920*	0.810
	(2.780)	(0.903)	(2.877)	(0.942)
Income Diversification	-0.676	0.655***	-0.661	0.653***
	(0.673)	(0.228)	(0.677)	(0.229)
bailout		3.130		3.158
		(2.197)		(2.221)
Constant	3.963	2.640***	2.337	2.651***
	(4.665)	(0.818)	(5.145)	(0.976)
Observations	214	799	214	799
R-squared	0.249	0.174	0.256	0.174
Number of bankid	63	75	63	75
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES		
cluster	bankid	bankid	bankid	bankid

Table 5: Tier 1 Deviation - Impact on Risk Weighted Assets

This table shows the impact of deviations from the Tier1 optimal capital level on growth in Risk Weighted Assets . We regress Risk Weighted Assets growth on the deviation from the optimal Tier 1 ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level.In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Tier1 capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	RWA growth 2004-2007	RWA growth 2008-2011Q3	RWA growth 2004-2007	RWA growth 2008-2011Q3
Deviation Tier 1 Ratio	1.674***	1.651***	1.694***	1.614***
	(0.549)	(0.506)	(0.504)	(0.480)
Deviation x Shortfall Dummy			2.102	1.458
			(1.642)	(1.377)
Shortfall Dummy			-0.560	-0.184
			(0.950)	(0.865)
Beta-Shortfall			*3.796*	*3.073*
T-statistic			*2.254*	*2.135*
GDP growth	0.463	0.469	0.453	0.477
	(0.384)	(0.413)	(0.393)	(0.410)
change in interest rate	3.044***	0.0753	3.097***	0.0829
	(0.856)	(0.0988)	(0.819)	(0.0966)
inflation rate	-0.589	0.475	-0.547	0.471
	(0.641)	(0.366)	(0.634)	(0.360)
GDP growth$_{t-1}$	0.0226	-1.170***	-0.0791	-1.231***
	(0.470)	(0.428)	(0.473)	(0.442)
change in interest rate$_{t-1}$	0.496	0.0713	0.601	0.0696
	(0.835)	(0.320)	(0.852)	(0.318)
inflation rate$_{t-1}$	-1.383*	-0.134	-1.488**	-0.190
	(0.700)	(0.410)	(0.703)	(0.404)
Size	-1.570	-2.139*	-1.472	-2.173**
	(1.364)	(1.116)	(1.391)	(1.081)
Cost Income ratio	0.104	-0.377**	0.0332	-0.417**
	(0.507)	(0.169)	(0.496)	(0.169)
Loan Loss Provisions	0.361	0.173	0.466	0.150
	(0.664)	(0.338)	(0.657)	(0.341)
Income Diversification	-0.0879	-0.375	-0.0279	-0.349
	(0.411)	(0.236)	(0.385)	(0.235)
Deposit Ratio	-2.676	5.635	-0.0770	7.779*
	(6.362)	(4.212)	(6.324)	(4.431)
bailout		4.777**		4.867**
		(2.167)		(2.154)
Constant	-0.221	-2.098	-0.939	-2.385
	(3.282)	(2.024)	(3.239)	(2.026)
Observations	451	763	451	763
R-squared	0.197	0.116	0.204	0.119
Number of bankid	59	70	59	70
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 6: Tier 1 Deviation - Impact on Total Assets

This table shows the impact of deviations from the Tier1 optimal capital level on growth in Total Assets. We regress Total Asset growth on the deviation from the optimal Tier 1 ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level.In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Tier 1 capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Asset Growth 2004-2007	Asset Growth 2008-2011Q3	Asset Growth 2004-2007	Asset Growth 2008-2011Q3
Deviation Tier 1 Ratio	0.917***	1.041***	0.922***	1.057***
	(0.305)	(0.302)	(0.308)	(0.315)
Deviation x Shortfall Dummy			-0.267	-0.514
			(1.286)	(0.898)
Shortfall Dummy			0.189	-0.0140
			(1.000)	(0.516)
Beta-Shortfall			*0.655*	*0.544*
T-statistic			*0.481*	*0.564*
GDP growth	0.669*	1.035***	0.670*	1.034***
	(0.391)	(0.220)	(0.391)	(0.221)
change in interest rate	0.822	-0.00508	0.818	-0.00808
	(0.891)	(0.0825)	(0.889)	(0.0833)
inflation rate	0.0105	-0.464*	0.00505	-0.456*
	(0.475)	(0.260)	(0.479)	(0.261)
GDP growth$_{t-1}$	0.239	-0.312	0.255	-0.290
	(0.333)	(0.216)	(0.329)	(0.221)
change in interest rate$_{t-1}$	-0.0698	0.480**	-0.0786	0.478**
	(0.709)	(0.204)	(0.714)	(0.203)
inflation rate$_{t-1}$	-0.222	-0.549*	-0.203	-0.530*
	(0.540)	(0.299)	(0.538)	(0.305)
Size	-1.221	-5.345***	-1.235	-5.341***
	(2.269)	(1.531)	(2.271)	(1.513)
Cost Income ratio	-0.206	-0.0171	-0.190	-0.00470
	(0.326)	(0.120)	(0.335)	(0.124)
Loan Loss Provisions	-1.118**	-0.410**	-1.128**	-0.398*
	(0.435)	(0.203)	(0.433)	(0.203)
Income Diversification	0.184	0.395**	0.179	0.388**
	(0.267)	(0.165)	(0.273)	(0.167)
Deposit Ratio	13.82***	7.704**	13.14**	7.043*
	(4.545)	(3.594)	(5.046)	(3.858)
bailout		2.118		2.085
		(1.533)		(1.527)
Constant	-1.718	2.318	-1.515	2.365
	(2.586)	(1.555)	(2.655)	(1.578)
Observations	515	885	515	885
R-squared	0.184	0.220	0.185	0.221
Number of bankid	72	80	72	80
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 7: Tier 1 Deviation - Impact on Loans

This table shows the impact of deviations from the Tier1 optimal capital level on Loan growth. We regress Loan growth on the deviation from the optimal Tier 1 ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate), loan securitization and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level. In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Tier 1 capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	LoanGrowth 2004-2007	LoanGrowth 2008-2011Q3	LoanGrowth 2004-2007	LoanGrowth 2008-2011Q3
Deviation Tier 1 Ratio	1.544	-0.844	1.437	-0.752
	(1.057)	(0.561)	(1.275)	(0.803)
dev_wTier1ratio_stdIA			0.132	0.175
			(2.095)	(1.048)
Shortfall Dummy			-0.240	0.436
			(1.627)	(0.859)
Beta-Shortfall			1.570	-0.578
T-statistic			0.898	-0.620
GDP growth	-0.0140	-0.508	-0.00764	-0.504
	(1.292)	(0.475)	(1.302)	(0.475)
change in interest rate	0.426	0.823***	0.448	0.816***
	(1.213)	(0.295)	(1.225)	(0.293)
inflation rate	0.535	-1.963***	0.538	-1.956***
	(1.176)	(0.632)	(1.177)	(0.627)
GDP growth$_{t-1}$	-0.111	-0.0600	-0.105	-0.0607
	(0.866)	(0.445)	(0.855)	(0.458)
change in interest rate$_{t-1}$	0.165	-0.129	0.205	-0.135
	(1.308)	(0.329)	(1.360)	(0.323)
inflation rate$_{t-1}$	1.156	-0.435	1.163	-0.433
	(1.148)	(0.370)	(1.156)	(0.370)
Size	-4.272	-10.12***	-4.245	-10.12***
	(4.028)	(2.005)	(4.020)	(1.965)
Cost Income ratio	-0.110	0.156	-0.119	0.152
	(0.410)	(0.160)	(0.407)	(0.160)
Loan Loss Provisions	0.815	0.0487	0.839	0.0426
	(1.542)	(0.446)	(1.572)	(0.446)
Income Diversification	0.112	-0.00812	0.102	-0.00408
	(0.806)	(0.541)	(0.794)	(0.540)
Deposit Ratio	-5.831	5.763	-5.678	5.832
	(12.95)	(7.068)	(13.09)	(7.188)
bailout		2.225		2.138
		(2.819)		(2.789)
securitization dummy	0.315	1.187	0.336	1.202
	(1.364)	(1.181)	(1.399)	(1.176)
Constant	5.798	-3.586	5.866	-0.905
	(5.454)	(3.752)	(5.327)	(3.941)
Observations	507	822	507	822
R-squared	0.152	0.124	0.152	0.124
Number of bankid	70	79	70	79
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 8: Bank Common Equity Deviation - Impact on Capital Growth

This table shows the impact of deviations from the optimal equity ratio on changes in total equity. We regress total equity growth on the deviation from the optimal Equity ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank control variables (Total assets, cost income ratio, loan loss provisions, deposit ratio and income diversification). In the first two columns, we do not differentiate between banks that are below or above the optimal equity level. In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal total equity level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Equity Growth 2004-2007	Equity Growth 2008-2011Q3	Equity Growth 2004-2007	Equity Growth 2008-2011Q3
Deviation Capital Ratio	-5.161***	-1.999***	-4.363***	-1.577**
	(0.822)	(0.729)	(0.817)	(0.726)
Deviation ETA x Shortfall Dummy			-7.194***	-7.191***
			(1.896)	(1.883)
Shortfall Dummy			-1.361	-1.813*
			(1.034)	(0.956)
Beta-Shortfall			*-11.56*	*-8.768*
T-statistic			*-6.161*	*-3.878*
GDP growth	0.00304	0.742*	-0.00229	0.806**
	(0.512)	(0.380)	(0.513)	(0.376)
GDP growth$_{t-1}$	0.0276	-0.568	-0.144	-0.767*
	(0.516)	(0.372)	(0.505)	(0.401)
change in interest rate	1.348*	0.350**	1.754***	0.402**
	(0.679)	(0.157)	(0.662)	(0.160)
inflation rate	0.569	-1.464***	0.471	-1.232***
	(0.591)	(0.440)	(0.587)	(0.437)
change in interest rate$_{t-1}$e	-1.194	0.397	-1.463	0.645*
	(1.028)	(0.350)	(1.038)	(0.370)
inflation rate$_{t-1}$	0.395	-0.340	0.209	-0.361
	(0.748)	(0.421)	(0.764)	(0.409)
Size	-2.023**	-0.218	-3.513***	-0.0138
	(0.964)	(3.137)	(0.745)	(3.561)
Cost Income ratio	-0.281	-0.0425	-0.113	0.00352
	(0.285)	(0.167)	(0.271)	(0.159)
Loan Loss Provisions	-0.946**	-0.571**	-0.936**	-0.697**
	(0.474)	(0.238)	(0.422)	(0.268)
Deposit ratio	1.321	-0.116	1.677**	0.580
	(0.815)	(0.696)	(0.760)	(0.768)
Income Diversification	0.618	-0.107	0.725*	0.0596
	(0.433)	(0.267)	(0.426)	(0.274)
bailout		-0.176		-4.37e-05
		(2.761)		(2.560)
Constant	5.063***	-1.212	3.370**	-2.492*
	(1.376)	(1.312)	(1.434)	(1.428)
Observations	743	1,104	743	1,104
R-squared	0.229	0.154	0.256	0.179
Number of bankid	83	95	83	95
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 9: BankBank Common Equity Deviation - Impact on Retained Earnings

This table shows the impact of deviations from the optimal equity ratio on Retained Earnings. We regress Retained Earnings growth on the deviation from the optimal equity ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank control variables (Total assets, cost income ratio, loan loss provisions, deposit ratio and income diversification). In the first two columns, we do not differentiate between banks that are below or above the optimal equity level. In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Total Capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Ret. Earnings 2004-2007	Ret. Earnings 2008-2011Q3	Ret. Earnings 2004-2007	Ret. Earnings 2008-2011Q3
Deviation Capital Ratio	-5.568***	-1.757***	-5.149***	-1.782***
	(1.406)	(0.440)	(1.446)	(0.446)
Deviation ETA x Shortfall Dummy			7.551**	-1.860
			(3.101)	(1.576)
Shortfall Dummy			4.489***	-0.445
			(1.625)	(0.841)
Beta-Shortfall			2.402	-3.642
T-statistic			0.652	-2.043
GDP growth	-1.107**	-0.153	-1.106**	-0.137
	(0.467)	(0.266)	(0.454)	(0.269)
GDP growth$_{t-1}$	-1.619**	0.733	-1.485**	0.659
	(0.671)	(0.443)	(0.721)	(0.448)
change in interest rate	-3.511	0.0412	-3.881	0.0556
	(3.187)	(0.0585)	(2.935)	(0.0603)
inflation rate	1.020	-0.780***	1.025	-0.733**
	(0.936)	(0.291)	(0.932)	(0.288)
change in interest rate$_{t-1}$e	1.146	0.274	-0.929	0.335
	(3.625)	(0.236)	(3.685)	(0.250)
inflation rate$_{t-1}$	0.819	-0.392	0.833	-0.392
	(0.625)	(0.323)	(0.614)	(0.325)
Size	-2.893	1.390**	-1.562	1.433*
	(7.877)	(0.682)	(7.552)	(0.757)
Cost Income ratio	-0.946	-0.0609	-0.982	-0.0545
	(0.745)	(0.167)	(0.705)	(0.167)
Loan Loss Provisions	1.269	-0.440	1.186	-0.440
	(2.091)	(0.286)	(2.012)	(0.287)
Deposit ratio	-1.570	1.672**	-1.808	1.841**
	(2.057)	(0.721)	(2.150)	(0.753)
Income Diversification	-0.706	0.572***	-0.860*	0.615***
	(0.530)	(0.210)	(0.489)	(0.203)
bailout		2.917		2.932
		(2.039)		(2.055)
Constant	5.272*	-2.977***	5.437*	-3.276***
	(3.000)	(0.835)	(3.198)	(0.906)
Observations	251	1,004	251	1,004
R-squared	0.288	0.145	0.319	0.147
Number of bankid	73	90	73	90
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES		
cluster	bankid	bankid	bankid	bankid

Table 10: Bank Bank Common Equity Deviation - Impact on Asset Growth

This table shows the impact of deviations from the optimal equity ratio on Total Assets. We regress Total Assets growth on the deviation from the optimal equity ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate) and bank bank control variables (Total assets, cost income ratio, loan loss provisions, deposit ratio and income diversification). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level. In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Total Capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target (‘Beta-Shortfall‘), and the corresponding t-statistic (‘T-statistic‘) All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	Asset Growth 2004-2007	Asset Growth 2008-2011Q3	Asset Growth 2004-2007	Asset Growth 2008-2011Q3
Deviation Capital Ratio	0.123	1.155**	0.0334	0.958*
	(0.481)	(0.476)	(0.501)	(0.485)
Deviation x Shortfall Dummy			0.633	1.929**
			(1.172)	(0.806)
Shortfall Dummy			0.0433	0.0276
			(0.733)	(0.492)
Beta-Shortfall			*0.667*	*2.887*
T-statistic			*0.542*	*3.454*
GDP growth	0.279	0.928***	0.281	0.908***
	(0.254)	(0.202)	(0.255)	(0.204)
change in interest rate	1.343**	0.0324	1.303**	0.0230
	(0.636)	(0.0820)	(0.649)	(0.0847)
inflation rate	-0.304	-0.371*	-0.293	-0.440**
	(0.283)	(0.205)	(0.283)	(0.203)
GDP growth$_{t-1}$	0.451	0.150	0.470	0.218
	(0.275)	(0.187)	(0.283)	(0.181)
change in interest rate$_{t-1}$	0.107	0.476**	0.137	0.409**
	(0.731)	(0.193)	(0.737)	(0.193)
inflation rate$_{t-1}$	-0.102	-0.570***	-0.0835	-0.552***
	(0.301)	(0.205)	(0.302)	(0.202)
Size	-0.906	-5.602***	-0.783	-5.651***
	(0.914)	(1.688)	(0.974)	(1.575)
Cost Income ratio	-0.166	-0.0295	-0.183	-0.0450
	(0.203)	(0.112)	(0.201)	(0.110)
Loan Loss Provisions	-0.431	-0.411**	-0.433	-0.378**
	(0.347)	(0.186)	(0.340)	(0.182)
Income Diversification	-0.00737	0.231	-0.0180	0.183
	(0.216)	(0.161)	(0.212)	(0.165)
Deposit Ratio	4.545	7.338**	4.367	5.957**
	(3.405)	(3.075)	(3.456)	(2.985)
bailout		2.417		2.457
		(1.500)		(1.546)
Constant	1.959	-3.090*	2.229	-1.845
	(1.747)	(1.640)	(1.825)	(1.685)
Observations	743	1,104	743	1,104
R-squared	0.133	0.224	0.134	0.229
Number of bankid	83	95	83	95
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid

Table 11: Bank Bank Common Equity Deviation - Impact on Loan Growth

This table shows the impact of deviations from the optimal Total Capital ratio on Loans. We regress Loan growth on the deviation from the optimal Total Capital ratio, a group of macro-economic control variables (GDP growth, interest rate changes and the inflation rate), loan securitization and bank size (Total assets). In the first two columns, we do not differentiate between banks that are below or above the optimal capital level. In column 3 and 4, we do take into account potential assymetric reactions by interacting the deviation variable with a dummy which is equal to one when a bank is below its optimal Total Capital level. For these two regressions, we also calculate the actual coefficient for the banks that are below their target ('Beta-Shortfall'), and the corresponding t-statistic ('T-statistic') All regressions are done for a pre-crisis (2004Q1-2007Q4) and a crisis period (2008Q1-2011Q3). All regressions include bank and time fixed effects. Standard errors are robust and clustered at the bank level. All indepent variables are normalized around their sample mean, which means that the coefficients show the impact of a one standard deviation change on the dependent variable.

VARIABLES	LoanGrowth 2004-2007	LoanGrowth 2008-2011Q3	LoanGrowth 2004-2007	LoanGrowth 2008-2011Q3
Deviation Capital Ratio	0.236	1.241**	0.474	1.362***
	(0.661)	(0.510)	(0.693)	(0.475)
Deviation x Shortfall Dummy			-0.922	0.243
			(1.418)	(1.009)
Shortfall Dummy			0.309	0.814
			(0.743)	(0.617)
Beta-Shortfall			*-0.448*	*1.605*
T-statistic			*-0.292*	*1.671*
GDP growth	0.240	1.258***	0.225	1.265***
	(0.313)	(0.240)	(0.315)	(0.241)
change in interest rate	1.047	0.168*	1.114	0.159*
	(0.844)	(0.0874)	(0.853)	(0.0877)
inflation rate	0.0256	-0.574**	0.0178	-0.568**
	(0.349)	(0.279)	(0.349)	(0.277)
GDP growth$_{t-1}$	0.377	0.402	0.340	0.385
	(0.392)	(0.265)	(0.396)	(0.277)
change in interest rate$_{t-1}$	1.090	0.675**	0.992	0.666**
	(0.678)	(0.329)	(0.710)	(0.328)
inflation rate$_{t-1}$	-0.110	-1.114***	-0.134	-1.130***
	(0.414)	(0.235)	(0.418)	(0.234)
Size	-1.111	-4.065***	-1.239	-4.134***
	(0.916)	(1.115)	(0.954)	(1.106)
Cost Income ratio	0.426	-0.195	0.457	-0.195
	(0.392)	(0.162)	(0.399)	(0.163)
Loan Loss Provisions	-0.742**	-0.658***	-0.733**	-0.650**
	(0.339)	(0.240)	(0.337)	(0.250)
Income Diversification	0.124	0.114	0.146	0.119
	(0.300)	(0.316)	(0.296)	(0.320)
Deposit Ratio	-1.207	-5.435	-1.091	-5.033
	(6.990)	(3.879)	(6.925)	(3.958)
bailout		2.622		2.439
		(2.000)		(2.040)
secdum	1.150	1.279*	1.166	1.299*
	(0.873)	(0.701)	(0.872)	(0.700)
Constant	4.522	2.863	4.060	2.377
	(3.225)	(2.093)	(3.194)	(2.199)
Observations	583	955	583	955
R-squared	0.172	0.210	0.173	0.211
Number of bankid	67	82	67	82
BANK_FE	YES	YES	YES	YES
TIME_FE	YES	YES	YES	YES
cluster	bankid	bankid	bankid	bankid