Beating the Black Box of Risk-Weighted Capital: Is a Leverage Ratio Justified?*

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Abstract

We compare the relevance of two alternative measures of bank capitalization, namely the Basel II compliant risk-weighted assets ratio to a risk-insensitive leverage ratio, by assessing their predictive power for bank distress amid the subprime crisis. Using governmental capital injections for banks and subprime-losses as dependent variables in a set of cross-sectional regressions, we find that each of the two measures loses its predictive power, once it has been mandatory implemented by the regulator. These results could be regarded as a Goodhart's law to the extent that the two regulatory capital standards cease to be a good measure when they become a target. Our results further suggest that banks are able to circumvent each of the two regulatory requirements if they are implemented on a stand-alone basis. We thus support the decision to enhance the risk weighted capital regulation standards of Basel III with a simultaneously binding leverage ratio restriction.

Keywords: Leverage ratio, bank capital, financial crisis, Basel capital accord
JEL-Classification: G21, G28.

1 Introduction

In response to global financial distress amid the subprime crisis the risk-weighted capital requirements under the Basel II accord were subject to a critical scrutiny. Even though these capital requirements had been met by the majority of banks prior to the crisis, many institutes suffered from substantial losses and were in effect depended on governmental capital injections. As a consequence the Basel II methodology of a risk-weighted assets ratio (rwa-ratio) was called into question and provoked a widespread call to implement the competing concept of a risk-insensitive leverage ratio restriction. Currently there is a huge buzz about the leverage ratio in both, the academic and the political debate. The voices have been very active in pointing out the advantages of the leverage ratio and yet some of those advocate to replace the existing Basel II capital requirements entirely by a leverage ratio restriction.

Theoretical literature reveals a substantial drawback of risk-insensitive capital regulation. Given that banks seek to maximize their returns on equity, a risk-insensitive leverage ratio might encourage them to increase risk taking, as has been analysed by Kim and Santomero (1988). This concern, however, seems to be overshadowed by recent empirical evidence that Basel's risk weighted assets ratios fail to inform reliably about the soundness of the underlying banking system. Reasons for that are typically associated with the increasing discretionary power of banks in determining their risk weighted assets. As the first Basel accord was published, risk-weighted assets had to be defined through a simple process of applying four risk buckets before an external rating system was implemented under the Basel II accord in 2004. A more striking extension to the second Basel accord, however, consisted in the Internal Ratings Based approach (IRB).[1] Due to this approach banks were allowed to develop proprietary risk models in order to calibrate their risk-weighted assets on their own.

Regarding banks' discretionary power under the IRB, literature essentially provides two different explanatory attempts to argue why Basel's rwa-ratio fails to predict bank distress in a reliable manner. The first addresses a tactical under-evaluation

[1] See for example Basel Committe on Banking Supervision (2006) and Balthazar (2006).

of the bank's risk profile. So shows Blum (2008) in a theoretical approach that the profit maximizing strategy of a bank, regulated under Basel II, consists in obfuscating the riskiness of its asset portfolio in order to substitute costly equity by comparatively less costly debt.[2] On that score, Mariathasan and Merrouche (2012) examine bank's manipulative behaviour within an empirical framework. They find evidence for a superior predictive power of the leverage ratio compared to the rwa-ratio in explaining bank distress for a sample of large banks when the subprime-crisis was close to emerge.

The alternative explanatory attempt blames banks' increasing complexity for the malfunctioning of rwa ratios in explaining bank distress. Haldane and Madouros (2012) argue that sophisticated risk models, implemented under the IRB of Basel II, fail to capture the increasing complexity within the banking portfolios. In distinction to the former approach, banks are considered as incapable of calculating their risk exposure appropriately, instead of conducting a deliberate manipulation. The authors assess the predictive power of the two capital regulation schemes and find the same empirical results as described before. A leverage ratio clearly outperforms the predictive power of Basel's rwa ratio for banks's vulnerability in a global sample of the 100 largest banks. Further empirical evidence for an outperforming leverage ratio or at least commensurate predictive power with respect to rwa-ratios for large and global operating banks is provided by the International Monetary Fund (2009), Mayes and Stremmel (2012), Kufenko and Zimmermann (2013), and Demirguc-Kunt, Detragiache, and Merrouche (2010).[3]

The purpose of this paper is to reassess the superior predictive power of the leverage ratio and hence to verify whether a leverage ratio can truly enlighten the black box of regulatory bank capital, which is so far associated with the methodology of risk weighted assets under Basel II. Therefore we formulate the following questions: Does the leverage ratio still serve as the better predictor when we relate a sample of large

[2]Due to bail-out expectations attached to banks' debt and due to the tax-deductibility of debt interest rate payments, raising equity is much more costly from the perspective of a bank. See for example Hellwig (2010) and Admati, DeMarzo, Hellwig, and Pfleiderer (2010).

[3]To our knowledge, evidence for the superiority of risk based capital in predicting bank distress could so far mainly be found for smaller and systemically less important FDIC-banks in the United States. Haldane and Madouros (2012) do so by using *CAMEL*-risk-weightings amid the subprime-crisis, whereas Estrella, Park, and Peristiani (2000) show commensurate results of both ratios in a sample of the 1990's on the basis of Basel I risk-weights.

and global operating banks to their respective prevailing regulatory environment? To be more accurate, can we confirm the leverage ratio as the outperformer when banks are regulated under Basel II only, i.e. obliged to bank on risk-weighted assets? And does the superior predictive power of the leverage ratio still persist when banks are subject to an already mandatory leverage ratio restriction, such as in the United States and Canada?

In order to answer these questions, we develop our empirical analysis around three cornerstones. First, we construct two global bank samples: (i)*rwa banks*, subject to a rwa-ratio according to Basel II and no leverage ratio restriction and (ii) *leverage ratio banks*, which in contrast to rwa-banks are all subject to a leverage ratio restriction and did, as of 2006, not accept Basel II. Second, when modelling bank distress we focus on insolvency issues only. On that score we proxy bank distress by governmental capital injections and profits and losses, occurred in the crisis. Third, which is also of essence for our regression results, we separate our bank sample according to different accounting standards in order to avoid distortionary effects. Besides the issue of lacking comparability of leverage ratios across different accounting standards, we conjecture that their explanatory power tends to be overstated when banks' balance sheets are synthetically shrinked by a mutual netting of derivative positions. Our empirical methodology, based on these three cornerstones, provides us with the following key findings:

First, when banks are regulated under Basel II and thus subject to a mandatory rwa ratio, the leverage ratio stands out as the only significant predictor for both: the need for governmental capital injections and the amount of profits and losses occurred amid the market turmoil of the subprime crisis. Second, when banks are not regulated by the Basel II standards but subject to a leverage ratio instead, the leverage ratio has no predictive power anymore, and more surprisingly, the rwa-ratio turns out to be the significant predictor. Taken on a stand-alone basis, our first result would provide further empirical evidence for an obfuscation of inherent asset risk according to Blum (2008) when banks are allowed to run their proprietary risk models under the IRB-approach of Basel II. Likewise, the first result would support the argument of Haldane and Madouros (2012), according to which banks' sophisticated risk models simply fail to capture the increasing complexity of risks.

Our explanation, however, differs from those arguments. By taking our second key finding into account, we argue that inference of each of the two capital ratios is no longer possible once these are mandatory implemented by the regulator. Our results could be regarded as a Goodhart's law to the extent that regulatory capital standards cease to be a good measure when they become a target. Furthermore, if we follow the approach that banks manipulate risk-weighted-assets under Basel II, we have to ascertain that a leverage ratio is apparently as well prone to manipulation.

The paper is organized as follows. We first introduce the methodology, by describing the three cornerstones of our empirical framework. Then we derive hypotheses regarding the expected explanatory power of the two variables of interest, before we comment on our data sample. Section 3 presents the empirical results while a conclusion is given in section 4.

2 Empirical Methodology

2.1 Leverage Ratio Banks versus RWA Banks

We consider globally operating banks with a balance sheet of at least 50 billion US Dollar. This restriction is required to deal with large and global operating banks only, endowed with the room to calibrate their risk-weighted-assets on the basis of proprietary risk models. In order to assure that banks were not affected by the financial crisis, we use all explanatory variables published as of the end of year 2006 and do therefore not examine the following years.[4] We do not evaluate banks' balance sheet figures of preceding years either, since we need the acceptance process of Basel II to be sufficiently far processed.

We consider two different regulatory environments with either a mandatory leverage ratio restriction or binding rules of Basel II. According to those we split the bank universe into (i) *rwa banks*, comprising 110 banks from 21 countries, subject to rwa-ratios according to Basel II with no leverage ratio restriction and in (ii) *leverage*

[4]The time-frame as of 2006 as well as the restriction to use large and global banks only, to allow as well for a potential manipulation of risk-weighted-assets goes back to Haldane and Madouros (2012).

ratio banks, including 44 banks from the United States and Canada, which are all, contrary to the former sample, subject to a leverage ratio restriction and have not accepted the Basel II standards at this time. Table 1 shows the key figures of both bank samples as well as their descriptive statistics. Rwa-ratios turn out to be fairly higher on average than leverage ratios. Since all banks' safe assets with a risk weight of zero are deducted from the denominator of the rwa-ratio, we would not have expected any other result. The minimum value of rwa-ratios suggests that all rwa-banks were compliant to their respective capital requirements of Basel II. Four per cent, out of the eight per cent of overall required equity on risk-weighted-assets had to be provided under Basel II as tier 1 capital, which is obviously the case here. A comparable observation can be found for leverage ratio banks. The minimum leverage ratio restriction was set by the United States to four per cent and is evidently met by our second group of banks. As a consequence, it seems that all banks were ex ante sufficiently capitalized; at least according to their respective mandatory requirements.

A chronological overview of countries accepting Basel II and those countries, already implemented a formally binding leverage ratio restriction as of the end of 2006 can be taken from figure 1.[5] The United States and Canada already implemented a mandatory leverage ratio restriction in 1981 and 1982, respectively.[6] Contrary to the 21 countries of rwa banks, the United States did not accept the Basel II standards at this time but nevertheless published risk-weighted-assets in that period of negotiations. Hence, our study becomes possible as rwa-ratios for banks of the United States were available at Bankscope but not regulatory binding as at the end of 2006. For rwa banks the opposite is the case: leverage ratios are not implemented and not published for those banks but can be calculated easily as described below.

2.2 Proxies for Bank Distress and Hypotheses

Our approach consists in a horse race of the two different regulatory capital ratios in explaining bank distress. It would be tempting to illustrate bank distress within the

[5]The information regarding banks accepting Basel II in Table 1 goes back to Yetis (2008).

[6]See further information on countries with a leverage ratio restriction in Crawford, Graham, and Bordelau (2009)

subprime crisis by bankruptcies. But since we are interested in large and globally operating institutes, the number of actual bank failures in this field stands at a vanishingly low level, as most of those cases have been prevented by governmental intervention schemes. We therefore need to proxy bank distress. Both capital ratios of our interest are solvency-ratios and therefore suited to explain insolvencies, rather than illiquidities. Liquidity shocks, however, occur out of a sudden and may even push a solvent and well capitalized bank into bankruptcy without affecting any solvency ratio prior to that shock, as has been initially shown by Diamond and Dybvig (1983).[7] For this reason we focus on insolvency issues only, which we will proxy first by governmental capital injections and second by the profit and losses (p&l) of banks which were finally responsible for the governmental capital infusions. Note that due to the existence of abrupt liquidity shocks even substantially high observations for actual bank failures in lager samples would distort the results as those can scarcely be explained by the two solvency ratios. We do not believe either that those effects can be captured by liquidity control variables. Since we are evaluating banks' balance sheet figures, published at most quarterly and moreover on an ex post basis, it seems hardly possible to catch the sudden change of sensitive liquidity indicators on the basis of rigid balance sheet data.

We conduct two sets of cross-sectional regressions. In our first set, we examine which of the two capital ratios can ex ante better explain whether banks were ex post sufficiently capitalized during the crises, by evaluating governmental capital injections. Capital injections are modelled as a binary dependent variable within a set of linear probit-regressions, indicating 1 if there was capital injected and 0 otherwise. The logic is straightforward: The higher the capital ratio published by a bank prior to the crisis, the lower the probability for a governmental capital injection in the course of the crisis. Compared to a crude leverage ratio, Basel's rwa-ratio is supposed to indicate the capital basis in a risk-adjusted manner. To this extend it contains additional information and should particularly serve as the better predictor when banks are coming under stress. Accordingly, we formulate the following hypothesis.

[7]Diamond and Dybvic show that any bank can be pushed into a failure of illiquidity, even if its assets are entirely risk-free. This typically happens by a sudden withdrawal of banks' liabilities, either by checkable deposits or likewise by interbank loans which was the case during the subprime crisis.

Hypothesis 1

- If the risk exposure calculation under Basel II reflects the appropriate capital basis prior to the crisis, the rwa-ratio is expected be a superior predictor for banks' need for governmental capital during the crisis than an risk-insensitive leverage ratio.

The second set of regressions models banks' distress by the profits and losses (p&l) occurred during the crisis. We use average pre-tax profits as dependent variable and scale them by average assets for the sake of convenient interpretations. The underlying causality for using profits is best illustrated by banks' incentives of risk taking. Banks' incentive of risk-taking decreases in their level of equity, as has been, amongst others, examined by Myers and Majluf (1984) and Freixas and Rochet (2008). If bank equity truly mitigates risk-taking incentives, we would expect risks, taken by banks prior to crisis to lead to lower losses (higher profits) in the course of the crisis. And again, we formulate our second hypothesis accordingly:

Hypothesis 2

- If the risk exposure calculation under Basel II reflects the appropriate capital basis prior to the crisis, the rwa-ratio is expected to be a superior predictor for bank's profits than an risk-insensitive leverage ratio.

In our second hypothesis, we are hence assuming that higher capitalized banks show a better performance, which has been shown by Mehran and Thakor (2011) and as well by Berger and Bouwman (2013).[8]

[8]Note that the underlying causality between bank's equity and its profitability is considered in the long run and based upon banks' initial stock of capital. In the short run, however, Schaefer, Schnabel, and Weder di Mauro (2013) show that the announcement of higher capital requirements leads to a drop in profitability, measured by stock returns, as banks are instantly confronted with higher capital costs.

2.3 The Impact of Different Accounting Standards

A uniform accounting principle is crucial for the comparability of leverage ratios across banks. This issue has been adressed by the German Council of Economic Experts (2011) and recently stressed by Lautenschläger (2013). Figure 2 shows a stylized balance sheet of Deutsche Bank accounted under the International Financial Reporting Standards (IFRS) and as well under the United States Generally Accepted Accounting Principles (US GAAP). Obviously one and the same bank's total assets shrink enormously when those are accounted under US GAAP instead of IFRS. The difference stems from the fact that the US GAAP contains enhanced obligations to net derivative positions with the effect that the same balance sheet comes out far shorter under US-GAAP. Hence, for a given amount of Tier 1 capital, which is the numerator of the leverage ratio, the US GAAP leads to a notable increase of the leverage ratio. Figure 2 makes clear that a globally binding leverage ratio of 3 % would not be met by the Deutsche Bank under IFRS while it would be easily passed under US GAAP. For that reason a harmonized accounting principle would be required to assure that all banks are affected in the same manner before one can effectively implement a globally binding leverage ratio.

But since we are interested in the explanatory power of the leverage ratios, we are confronted with another problem arising from those differences. As the share of derivative positions varies quite substantially across US banks, the netting obligations and consequently the reduction of total assets affects the banks differently in our cross sectional sample. That means that the strict netting rules of the US GAAP increase the cross-sectional deviation of leverage ratios of US banks, compared to the remaining banks which are accounted under IFRS. This cross-sectional dispersion, which could also be expressed as cross-sectional volatility, leads to a potentially higher explanatory power of the leverage ratios. This implies that, if we estimated all banks in one global sample, we would have most likely overstated the explanatory power of banks' leverage ratios, which are accounted under the US GAAP. For this reason the implementation of an interacting dummy attached to both bank groups would not yield proper results. Our strict separation according to the different accounting standards is therefore of essence for our results.[9]

[9]The sample of leverage ratio banks contains banks accounted in US GAAP and CAN GAAP

2.4 The Data

All explanatory variables, as well as the dependent variable pre-tax profits are balance sheet figures and were retrieved from Bankscope. We downloaded all banks of early accepting Basel II countries, indicated in the white box in figure 1, if their balance sheets inhibit at least 50 billion US Dollar and if rwa ratios -according to Basel II- were available. Data on Canadian banks was partly lacking at Bankscope and was therefore completed by the Canadian database of the Office of the Superintendent of Financial Institutions Canada (OSFI). Banks accounted under local accounting standards and therefore neither fitting IFRS nor US GAAP were dropped from the sample as well.[10] We ended up with a sample of 110 rwa banks and 44 leverage ratio banks. Governmental capital infusions are either taken from the Capital Purchase Program (CPP) as a part of the Troubled Asset Relief Program (TARP), or from recapitalization schemes, retrieved from country-specific websites. We then matched the identified capital infusions to our sample of available banks. In our sample of rwa banks approx. 27% of the institutes received governmental capital whereas roughly 41% of leverage ratio banks were receivers of capital.[11] An overview of the capital injections is given in table 1. The leverage ratio is defined as tier 1 capital as of total assets whereas the rwa-ratio is calculated as tier 1 capital as of total risk-weighted assets, according to Basel II. Control-variables are defined as follows: The liquid asset ratio stands for total liquid assets as a share of total assets. Note that this variable is not meant to control for liquidity impacts on banks distress. As discussed above we are not accounting for liquidity in the underlying model, neither for the dependent nor for the explanatory variables. Since the subprime crisis was characterized by a sudden drop in market prices, we would expect banks with a larger share of liquid assets, typically priced on markets, to be hit in a harder way. According to Estrella, Park, and Peristiani (2000) we control as well for a gross turnover ratio, which is defined as the total interest rate and dividend revenue plus the total non-interest rate revenue, divided by total assets. The gross turnover ratio

at the same time. Due to the similarity of both accounting standards, we decided not to conduct further adjustments.

[10] Note that the Swiss Bank Credit Suisse was dropped from the sample of rwa banks as it was only available under US GAAP instead of IFRS.

[11] Overall, 6 rwa banks and 3 leverage ratio banks had to be omitted in the regressions for capital injections, due to missing values.

contains easily observable information for shareholders and regulators and is, due to a small extent of deductions, less prone to manipulation. Finally we control for the size of banks by taking the logarithm of total assets.

3 Results

The following chapter presents the empirical results, beginning with capital infusions and than turning to profits and losses. In order to increase the robustness of the results, we first evaluate the leverage ratio and the rwa-ratio in a separate way, before we include our controls gradually. With the purpose of tackling for country-specific circumstances we cluster standard errors on country-level for the 21 rwa banks. Standard errors for leverage ratio banks, however, are due to the small number of countries clustered on bank level.[12]

3.1 Governmental Capital Infusions

We start by regressing the binary dependent variable 'governmental capital infused between 2007 and 2008' on the two capital ratios and as well as on the described set of controls. The marginal effects of the linear probit-regressions for rwa-banks in table 2 show, in contrast to hypothesis 1, that the leverage ratios clearly outperform the explanatory power of the rwa ratios. Whereas rwa-ratios do not yield any significance across all model specifications, an increase in leverage ratio of 1% lowers the probability of receiving governmental capital about roughly 12.5%. The coefficient attached to the leverage ratio remains stable and highly significant through the model specifications and decreases only slightly when we control for bank size.

[Table 2 about here]

Figure 3 illustrates the strong causality of our results for rwa banks. Governmental capital, indicated by a red bar, has been primarily infused to banks with low

[12]Note that standard error clustering on bank level is preferred for the sample leverage ratio banks as the number of two countries is too low for an efficient clustering. Based on the underlying cross-sectional dimension, the standard error clustering on bank level is equivalent to the use of robust standard errors. We call it clustering on bank level throughout the paper for reasons of consistency. See also Angrist and Pischke (2009) for further details on the standard error clustering.

leverage ratios on the left-hand-side of the figure. Compared to these results, figure 4 illustrates that rwa-ratios of Basel II do not tell us anything about the need for governmental capital.

[Figure 3 and figure 4 about here]

Looking at the results for leverage ratio banks in table 3, we find that the leverage ratio has no explanatory power anymore in predicting capital infusions. The coefficient on the Leverage ratio even points into the unexpected direction, while the sign of the rwa-ratio, albeit insignificant, turns out to be as expected. The overall model-performance for the sample of leverage ratio banks, however, remains rather poor and does not improve by including the controls.

[Table 3 about here]

3.2 Profits and Losses (P&L)

We now focus on banks' profits and losses occurred in the course of the subprime crisis. The choice of profits before tax (pre-tax-p&l) is necessary to rule out distortions due to country-specific tax legislation. For reasons of robustness, we construct two windows of average pre-tax profits as dependent variable within the OLS-regressions. The first window includes the average of two years from 2007 to 2008, whereas the enlarged one implies three years of average pre-tax-p&l from 2007 to 2009. The enlarged period of pre-tax-p&l provides us with the advantage to detect banks' losses that are potentially carried over to following periods. A few of the banks posted the first subprime-loss in 2009 which then diminished the earned profits of the two preceding years. This issue might be attributed to the fact that some banks succeeded in exploiting the valuation freedom of their respective accounting standards, by which certain assets could serve to hide losses. Moreover, it needs to be stressed that we are not accounting for further years, than 2009. From 2010 onwards, European banks were asymmetrically hit by the European Sovereign debt crisis, which would lead to an incomparable setting with respect to the other continents.

Assessing the sample of rwa-banks in table 4a first, we - again - find evidence for a superior predictive power of the leverage ratio. Coefficients remain highly significant

in all model specifications and explain a notable reduction in average losses for an increasing leverage ratio prior to the crisis. And once again the rwa-ratio shows no explanatory power in banking systems, regulated by the Basel II standards. These results remain essentially unchanged when we evaluate the enlarged pre-tax-p&l-window, whose results are displayed in table 4b. The leverage ratio again remains the only significant variable, albeit its impact on profits stands at a slightly lower level. The overall model performance does not change substantially by including the control variables, but still stands at a solid level due to the strong impact of the leverage ratio.

[Table 4a and 4b about here]

The most striking result after all is given by the results for leverage ratio banks in table 5a and 5b: We first find similar results to the probit model before, in the sense that the leverage ratio loses its predictive power in a world where the ratio itself is a mandatory requirement. But contrary to capital infusions before, the rwa-ratio turns out to be significant in explaining profits for banks which are subject to a mandatory leverage ratio restriction. Even though significance is not as pronounced as in the complementary case, we can again observe this phenomenon in the enlarged profit window (table 5b). The significance of the rwa-ratio remains stable along the first model specifications but vanishes as soon as the gross-turnover-ratio comes into the picture. As this was not the case for the sample of rwa-banks, accounted under IFRS instead of of US GAAP, we might attribute the difference to the fact that US GAAP incorporate a stricter application of the *mark-to-market*-principle where turnovers and profits are higher correlated. Not surprisingly, the size of total assets does not matter at all, as our dependent variable is already scaled as of total assets.

[Table 5a and 5b about here]

Scatter-plots for both, rwa banks and leverage ratio banks with respect to the explanatory power of the above results are provided on the basis of the short pre-tax-P&l-window in figures 5 and 6.

[Figure 5 and 6 about here]

4 Conclusion

In this paper we investigated the relevance of two capital ratios, namely the US American and Canadian implemented leverage ratio versus the rwa-ratio, which is established under the Basel II accord. For this reason we conducted a horse race between the two capital ratios in explaining bank distress. We proxied bank distress by the need for governmental capital and the profits and losses amid the subprime crisis, with the objective to focus on insolvency reasons and to exclude illiquidity. Moreover, we avoided a potential overstatement of the predictive power of leverage ratios attached of US GAAP accounted banks, by conducting a strict separation according to different accounting standards. We found that the leverage ratio clearly outperforms the predictive power of risk weighted assets when the concerning banking system is subdued to the Basel II standards. This result is highly significant and robust in all model specifications for both: governmental capital infusions and the structure of profits and losses. The leverage ratio did not predict future bank distress anymore when the concerning banking system was subject to a mandatory leverage ratio restriction. In that case, the rwa-ratio replaces the role of the formerly significant leverage ratio when we evaluated profits and losses.

How can we interpret these results? Our results show that each capital ratio loses its predictive power for bank distress, if it is a binding constraint. Put another way, if a regulator wanted to infer from a capital ratio to future distress of its underlying banking system, he would be far better off to decide for the one, that he has not set as a minimum requirement.

Literature provides us with two different explanations why Basel's rwa-ratio does not succeed in predicting bank distress. Either banks' sophisticated risk models under Basel II simply fail to capture the increasing complexity or, alternatively, banks are tactically obfuscating their risky assets. The fact that in our results we found several times the more sophisticated rwa-ratio as the outperformer makes the first explanation, of course, less likely. The drawback regarding the other explanatory attempt, however, is that we can only assume it. A factual proof for a deliberate manipulation of banks' risky assets cannot be delivered by the data. An alternative attempt would be to label it as profit maximization, since banks are substituting

costly equity by comparably less costly debt for the sake to benefit from lower funding costs.

If we follow the approach that banks maximize their profits by circumventing the rwa-ratio, than we have to acknowledge, that they do it -on the basis of our results- as well with a mandatory leverage ratio. Leverage ratio banks might have succeeded in circumventing their leverage ratio restrictions, such that the only inference about their solvency status can be drawn by risk weighted assets. Profit-maximizing strategies could consist of either transferring risky assets to off-balance vehicles or by wrapping cash exposure across various assets classes into derivative positions. The latter strategy would yield particularly effective results when the corresponding bank is accounted under US GAAP, under which a mutual netting of derivatives leads to comparably shorter balance sheets and hence, to higher leverage ratios.

Turning back to the initial question of the paper: Is a leverage ratio justified to beat the black box of risk weighted capital? On a stand-alone basis - surely not. In that case risk weighted capital is even able to beat the black box of a simple and crude leverage ratio. This result, combined with the fact that a sole risk-insensitive capital regulation might encourage banks' risk taking, speaks clearly against a complete replacement of Basel's risk-weighted capital. Our overall results suggest that banks would most likely exploit a loophole when they are subdued to one capital regulation scheme only. And for this reason it seems most reasonable to enrich the currently scheduled Basel III requirements by a simultaneously binding leverage ratio restriction. If these two different capital ratios, mandatory implemented at the same time, will decrease the probability of further bank distress - only the future can tell.

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Table 1: Bank Sample Compositions and Descriptive Statistics

Sample I | RWA Banks

- Subject to RWA according to Basel II
- No leverage ratio restriction
- Accounting Standard: IFRS
- Balance Sheet Size ≥ 50 billion USD
- 21 countries
- 110 Banks

Summary Statistics	Min	Max	Mean	STD
Leverage ratio	0.014	0.079	0.042	0.015
RWA-ratio	0.047	0.256	0.086	0.025

Capital infused 2007-2008	Frequency	Percent	Cumulated
0	76	73.08	73.08
1	28	26.92	100
Total	104	100	

Sample II | Leverage Ratio Banks

- RWA not yet binding but published
- Leverage ratio restriction
- Accounting Standard: US/CAN GAAP
- Balance Sheet Size ≥ 50 billion USD
- 2 countries
- 44 Banks

Summary Statistics	Min	Max	Mean	STD
Leverage ratio	0.048	0.132	0.075	0.018
RWA-ratio	0.065	0.141	0.091	0.018

Capital infused 2007-2008	Frequency	Percent	Cumulated
0	24	58.54	58.54
1	17	41.46	100
Total	41	100	

Table 2: Governmental Capital Injections for RWA Banks

Marginal effects of a linear probit model | Depended variable: Governmental capital infused between 2007 and 2008

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	-12.56***		-12.56***	-11.89***	-11.67***	-8.058*
	(-4.16)		(-4.24)	(-3.84)	(-2.87)	(-1.76)
RWA-Ratio | Basel II		-0.617	0.457	0.346	0.292	0.386
		(-0.28)	(0.26)	(0.22)	(0.18)	(0.28)
Liquid Asset Ratio				0.111	0.115	-0.0927
				(0.40)	(0.41)	(-0.39)
Gross Turnover Ratio					-0.645	-0.538
					(-0.16)	(-0.15)
log (Total Assets)						0.103***
						(4.36)
Banks	104	104	104	104	104	104
Pseudo R-squared	0.1800	0.0009	0.1808	0.1821	0.1842	0.2371
Country-Clusters for Standard Errors	21	21	21	21	21	21

t statistics in parentheses

Table 3: Governmental Capital Injections for Leverage Ratio Banks

Marginal effects of a linear probit model | Depended variable: Governmental capital infused between 2007 and 2008

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	3.390		4.499	6.247	4.826	3.677
	(0.81)		(1.17)	(1.22)	(0.73)	(0.51)
RWA-Ratio | Basel II		-4.072	-4.935	-4.424	-4.395	-4.451
		(-0.91)	(-1.05)	(-0.94)	(-0.94)	(-0.99)
Liquid Asset Ratio				0.965	0.882	1.045
				(1.39)	(1.19)	(1.46)
Gross Turnover Ratio					1.566	2.312
					(0.36)	(0.50)
log (Total Assets)						-0.0535
						(-0.54)
Banks	41	41	41	38	38	38
Pseudo R-squared	0.0122	0.0156	0.0354	0.0521	0.0565	0.0611
Bank-Clusters for Standard Errors	41	41	41	38	38	38

t statistics in parentheses

Notes: The tables show the marginal effects corresponding to a linear probit model, using the binary depended variable 'governmental capital infused between the years 2007 and 2008'. The variable is set to '1' in case of a capital infusion and zero otherwise. Governmental capital infusions are either taken from the Capital Purchase Program (CPP) as a part of the troubled asset relief program (TARP), or from publicly available country-specific recapitalization schemes. All explanatory variables are taken from Bankscope as of 2006. The Leverage Ratio is defined as Tier 1 capital as of total assets, RWA-ratio is calculated as Tier 1 Capital as of total risk-weighted assets according to Basel II, Liquid Asset Ratio stands for total liquid assets as of total assets, and the Gross Revenue Ratio is defined as total interest rate and dividend revenue plus total non-interest rate revenue, divided by total assets. Standard errors of RWA Banks in table 2 are clustered on country level, whereas standard errors of Leverage Ratio banks in table 3 are clustered on bank level. Bank-level-clustering is on the basis of the underlying cross-sectional setup equivalent to robust standard errors. Stars are to be interpreted as follows: *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Table 4a: Profits & Losses for RWA Banks from 2007 to 2008

OLS Estimation | Depended variable: Average profits (losses) as of average total assets between 2007 and 2008

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	0.307***		0.311***	0.297***	0.307***	0.304***
	(8.16)		(8.96)	(7.97)	(5.59)	(5.55)
RWA-Ratio | Basel II		0.0212	-0.0122	-0.00781	-0.0116	-0.0120
		(0.64)	(-0.65)	(-0.47)	(-0.71)	(-0.74)
Liquid Asset Ratio				-0.00336	-0.00328	-0.00303
				(-0.81)	(-0.77)	(-0.71)
Gross Turnover Ratio					-0.0319	-0.0317
					(-0.35)	(-0.35)
log (Total Assets)						-0.000118
						(-0.47)
Intercept	-0.00769***	0.00302	-0.00679*	-0.00583	-0.00435	-0.00282
	(-4.09)	(0.91)	(-2.37)	(-1.83)	(-1.25)	(-0.69)
Banks	110	110	110	110	110	110
R-squared	0.3787	0.0057	0.3805	0.3843	0.3867	0.3869
Country-Clusters for Standard Errors	21	21	21	21	21	21

t statistics in parentheses

Table 4b: Profits & Losses for RWA Banks from 2007 to 2009

OLS Estimation | Depended variable: Average profits (losses) as of average total assets between 2007 and 2009

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	0.273***		0.271***	0.267***	0.271***	0.273***
	(7.91)		(7.94)	(7.66)	(5.56)	(5.63)
RWA-Ratio | Basel II		0.0362	0.00573	0.00690	0.00521	0.00536
		(1.04)	(0.31)	(0.41)	(0.31)	(0.32)
Liquid Asset Ratio				-0.00106	-0.00105	-0.00116
				(-0.27)	(-0.26)	(-0.28)
Gross Turnover Ratio					-0.0146	-0.0147
					(-0.18)	(-0.18)
log (Total Assets)						0.0000499
						(0.13)
Intercept	-0.00724***	0.000846	-0.00765**	-0.00736*	-0.00666*	-0.00731
	(-4.51)	(0.25)	(-3.09)	(-2.47)	(-2.14)	(-1.27)
Banks	110	110	110	110	110	110
R-squared	0.3397	0.0191	0.3402	0.3406	0.3411	0.3412
Country-Clusters for Standard Errors	21	21	21	21	21	21

t statistics in parentheses

Notes: The tables above the show the coefficients corresponding to an OLS-estimation, using banks' average pre-tax profits between the years 2007 and 2008 as well as between 2007 and 2009, respectively. The pre-tax profits are scaled as of average assets and are retrieved from Bankscope. All explanatory variables for the corresponding banks are as of 2006 and taken as well from Bankscope. The Leverage Ratio is defined as Tier 1 capital as of total assets, RWA-ratio is calculated as Tier 1 Capital as of total risk-weighted assets according to Basel II, Liquid Asset Ratio stands for total liquid assets as of total assets, and the Gross Revenue Ratio is defined as total interest rate and dividend revenue plus total non-interest rate revenue, divided by total assets. Standard errors are clustered on country-level. Stars are to be interpreted as follows: *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Table 5a: Profits & Losses for Leverage Ratio Banks from 2007 to 2008

OLS Estimation |Depended variable: Average profits (losses) as of average total assets between 2007 and 2008

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	0.129		0.101	0.126	-0.121	-0.154
	(1.16)		(1.06)	(1.10)	(-1.14)	(-1.43)
RWA-Ratio | Basel II		0.195*	0.169**	0.155*	0.0696	0.0658
		(1.83)	(2.05)	(1.99)	(1.03)	(0.94)
Liquid Asset Ratio				0.00188	-0.00397	0.000729
				-0.12	(-0.27)	(0.05)
Gross Turnover Ratio					0.277***	0.287**
					(3.05)	(3.01)
log (Total Assets)						-0.00151
						(-0.89)
Intercept	-0.00203	-0.0107	-0.0155	-0.0166	-0.0124	0.00686
	(-0.29)	(-1.12)	(-1.30)	(-1.19)	(-1.36)	(0.30)
Banks	44	44	44	41	41	41
R-squared	0.0450	0.0666	0.0931	0.0969	0.3286	0.3381
Bank-Clusters for Standard Errors	44	44	44	41	41	41

t statistics in parentheses

Table 5b: Profits & Losses for Leverage Ratio Banks from 2007 to 2009

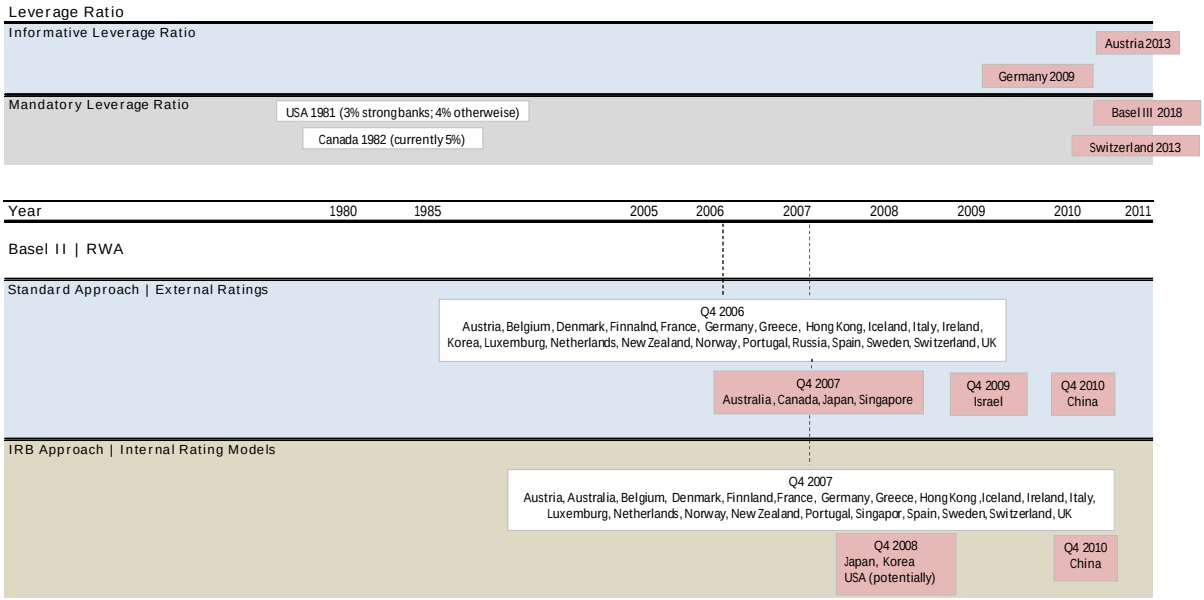
OLS Estimation | Depended variable: Average profits (losses) as of average total assets between 2007 and 2009

Ratios as of 2006	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Ratio	0.0426		0.0213	0.0375	-0.125	-0.161
	(0.66)		(0.34)	(0.47)	(-1.28)	(-1.59)
RWA-Ratio | Basel II		0.156*	0.152*	0.143*	0.0838	0.0784
		(1.90)	(1.93)	(1.86)	(1.10)	(1.05)
Liquid Asset Ratio				0.000881	-0.00350	0.00161
				(0.07)	(-0.28)	(0.13)
Gross Turnover Ratio					0.156**	0.168**
					(2.43)	(2.46)
log (Total Assets)						-0.00169
						(-1.12)
Intercept	0.00293	-0.00845	-0.00953	-0.0102	-0.00516	0.0166
	(0.66)	(-1.08)	(-0.95)	(-0.84)	(-0.46)	(0.70)
Banks	41	41	41	38	38	38
R-squared	0.0105	0.0949	0.0974	0.0954	0.2462	0.2745
Bank-Clusters for Standard Errors	41	41	41	38	38	38

t statistics in parentheses

Notes: The tables above the show the coefficients corresponding to an OLS-estimation, using banks' average pre-tax profits between the years 2007 and 2008 as well as between 2007 and 2009, respectively. The pre-tax profits are scaled as of average assets and are retrieved from Bankscope. All explanatory variables for the corresponding banks are as of 2006 and taken as well from Bankscope. The Leverage Ratio is defined as Tier 1 capital as of total assets, RWA-ratio is calculated as Tier 1 Capital as of total risk-weighted assets according to Basel II, Liquid Asset Ratio stands for total liquid assets as of total assets, and the Gross Revenue Ratio is defined as total interest rate and dividend revenue plus total non-interest rate revenue, divided by total assets. Standard errors are clustered on bank-level. Stars are to be interpreted as follows: *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Figure 1: Timeline | Implementation of Leverage Ratios and Basel II Capital Requirements



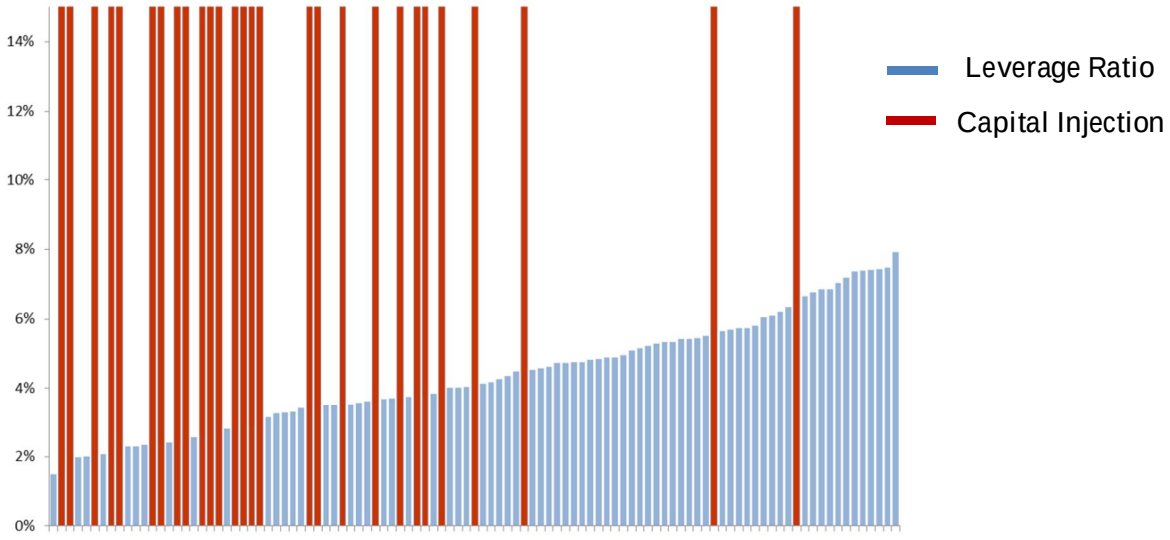
Notes: The figure above illustrates the timeline of countries implemented a leverage ratio restriction and Basel II Standards, separated by the standard and the advanced approach. Data is retrieved from Yetis (2008) and from Crawford, Graham, and Bordelau (2009).

Figure 2: Leverage Ratios under IFRS and US GAAP for the Deutsche Bank as of Q3 2011

Balance-Sheet Ratios			Regulatory Ratios	
	IFRS	US GAAP		
	Billion Euro			Million Euro
Total Assets	2282	1296	Tier 1 Capital	46638
			thereunder: Core Tier 1 Capital	34090
Total Equity	53.1	57.6	Tier 2 Capital	5175
			Total Regulatory Capital (Tier1+Tier2)	51814
Leverage Ratio	2.3%	4.4%	Risk-weighted Assets	337618

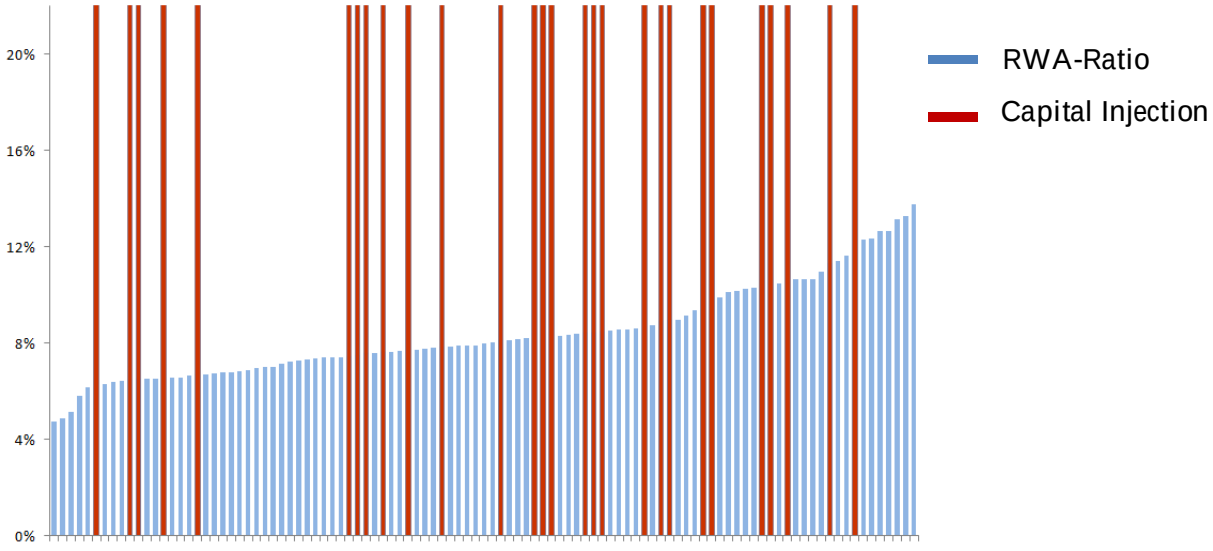
Notes: The figure illustrates the stylized balance sheet of the Deutsche Bank as of 30th September 2011 and is taken from the annual Report 2011/2012 "Assume responsibility for Europe" of the German Council of Economic Experts (2011) on page 166. Note that the Council of German Economic Experts calculates the leverage ratio as equity over total assets and yields therefore leverage ratios of 2.3% and 4.4% under IFRS and US GAAP respectively. Our results would be both smaller as we use the narrower aggregate Tier1 capital, as described above, for the numerator of the Leverage Ratio. This, however, would not change the outcome since total assets under US GAAP stand at approx. 57% of those accounted under IFRS.

Figure 3: Leverage Ratios and Capital Infusions for RWA Banks



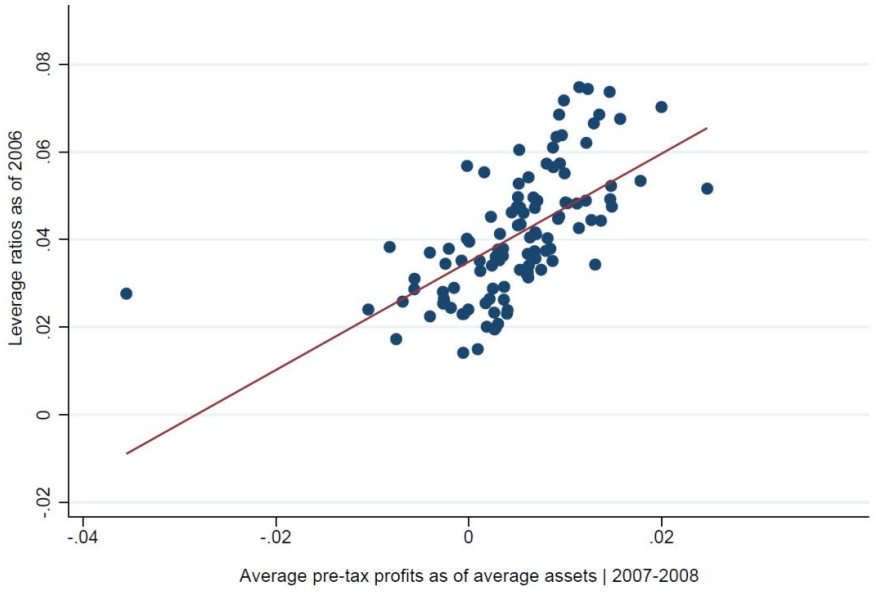
Notes: The figure illustrates the leverage ratios for rwa-banks, sorted in an ascending manner, taken as of the end of the year 2006 versus the governmental capital that has been infused in the years 2007 and 2008 as a binary dependent variable. The leverage ratio is defined as Tier1 capital as of total assets.

Figure 4: Leverage Ratios and Capital Infusions for RWA Banks



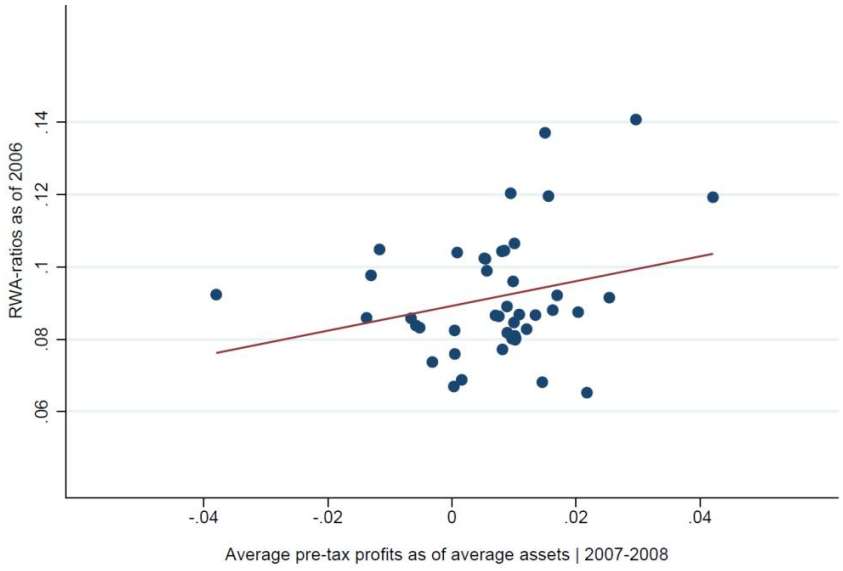
Notes: The figure illustrates the rwa-ratios for rwa-banks, sorted in an ascending manner, taken as of the end of the year 2006 versus the governmental capital that has been infused in the years 2007 and 2008 as a binary dependent variable. The rwa-ratio is defined as Tier1 capital as of risk-weighted assets according to Basel II

Figure 5: Leverage Ratios vs. Profits for RWA Banks



Notes: The figure illustrates the leverage ratios of rwa banks as of 2006 versus the average pre-tax profits as of assets from 2007 to 2008. The red line indicates the fit, obtained by the OLS-estimation. The ratios are calculated as given in the data section.

Figure 6: RWA-Ratios vs. Profits and Losses for Leverage Ratio Banks



Notes: The figure illustrates the rwa-ratios for leverage ratio banks as of 2006 versus the average pre-tax profits as of assets from 2007 to 2008. The red line indicates the fit, obtained by the OLS-estimation. The ratios are calculated as given in the data section.