The implications of introducing an additional regulatory constraint on banks' business activities in the form of a leverage ratio

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Summary

This study examines the financial and macroeconomic effects of introducing a leverage ratio rule in the international banking system. The leverage ratio is a non-risk-weighted measure of a bank's capital adequacy. It is to operate alongside the traditional Basel II rules, which take account of risk in determining capital requirements. The study comes to the following conclusions. First, the leverage ratio creates undesirable incentives. It will encourage banks to shift more balance sheet items to the capital markets, to unwind derivative hedges and to cut back on lending. Second, the leverage ratio will disadvantage German banks more than other European or Anglo-Saxon banks. Third, the introduction of a leverage ratio will have a significant economic impact, which is likely to lead to a reduction in lending and thus a slowdown in economic activity. The authors of this study nevertheless assume that a regulatory leverage ratio will be introduced. They recommend, however, that an extensive transitional period be envisaged. This will give banks the opportunity to build up sufficient capital to adjust their actual leverage ratio to the permitted regulatory level. Such an approach would also help to avoid undesired economic costs.

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1. Terms of reference of the study

The Association of German Banks has commissioned the authors of this study to analyse the financial and economic effects of basing the international regulation of banks' capital on the leverage ratio. The subject matter and objectives of the study are as follows.

In an effort to strengthen the banking system, the Basel Committee has proposed a series of measures which will have the effect of increasing banks' capital requirements. Among other things, the introduction of a leverage ratio has been called for to limit the level of a bank's debt. To avoid competitive distortions, an independent leverage ratio is to be developed which, in particular, takes account of the differences between accounting regimes. Nevertheless, considerable effects on banks' business activities are to be expected. The following issues will therefore be considered:

1. A leverage ratio is a non-risk-sensitive monitoring and control measure. It must therefore be examined whether a leverage ratio is able to make a reasonable estimate of a bank's risk exposure or whether it will create incentives to misallocate capital or even offer arbitrage opportunities and possibly lead to undesirable concentrations of risk.

2. Banks have different business models, which may focus on low-risk, high-volume retail business or on investment banking activities. This raises the question of whether a leverage ratio can really be competitively neutral. Given that access to capital markets differs from one country to another, moreover, the situation in other European countries such as France needs to be taken into account in this context.

3. Owing to the anticipated constraints on banks' business volumes as a result of the leverage ratio, there may be a general contraction in the supply of credit to companies and states. This section of the study also looks at the economic impact of imposing a limit on leverage. One of the questions examined in this context is the effect on the structure of financing flows and the associated potential changes in spending as well as the ensuing consequences for the real economy. The study analyses to what extent a change in the level of the leverage ratio will reduce lending and increase the cost of credit. These changes in volumes and prices are likely to have repercussions for corporate investment and private consumption, which may in turn slow growth to a quite significant degree. In the absence of broad research findings on which to base such an analysis, the use of simulations was deemed the most appropriate approach

for the purposes of this study. The aim of this approach is to indicate at least a certain range of effects.

In addition, conclusions will be drawn from an analysis of financing flows in the Federal Republic of Germany as to whether the economic effects have implications for various sectors of the economy and for the public sector. The study will consider, against the backdrop of an important dynamic aspect, the question of the possible costs to the real economy of a change in the leverage ratio aimed at increasing financial market stability. This aspect is the fact that the ability of the banking system as a whole to increase the level of capital to an extent that will leave total lendings unchanged appears to be very limited in the short term. In the longer term, by contrast, it may be anticipated that the banking system will be able to increase the level of capital. Another important aspect to examine in this context is the international environment. Is it more difficult for banks in some countries, such as the Federal Republic of Germany, to raise their capital base in the international financial market than it is for banks in other countries, such as the US?

2. Incentive effects of the leverage ratio as a non-risk-sensitive monitoring and control measure

A lively debate is under way in the wake of the financial and economic crisis about how to prevent similar crises breaking out in the banking system. There is likely to be a broad consensus that banks will need to hold more capital in future in order to reduce risks to the financial system as a whole. In addition, the Basel Committee on Banking Supervision issued proposals in December 2009 under which capital requirements would be increased considerably by introducing a leverage ratio. The Basel Committee justifies the need for a leverage ratio by citing the "build up of excessive on- and off-balance sheet leverage in the banking system"[1]. In many cases, the Committee continues, banks built up excessive leverage while still showing strong risk-based capital ratios. Model risk is put forward as a further argument in favour of a leverage ratio. Basel II measures the risks associated with financial instruments broken down by market risk, credit risk, operational risk and liquidity risk. Market risks are then broken down further into equity, fixed-income, FX and commodity risks. Various risk models are proposed for each risk category and interrelations between risk types are also analysed. In consequence, there is a danger that some model types may be misspecified and so will be unable to show changes in the value of certain positions correctly. There is thus a risk of using flawed models, i.e. model risk. The leverage ratio is based on a

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[1] See Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), par. 202.

simple approach and is therefore devoid of model risk. Whether the problems experienced with more complex models justify not using any model at all is a question explored further below. In principle, the introduction of a leverage ratio must be seen as a supplementary regulatory measure in the international banking system which will only be relevant to banks if it is binding – meaning that it cannot be met with existing risk-adjusted regulatory capital. This is the philosophy on which the study is based. Banks will behave in such a way as to satisfy both the leverage ratio rule and the classic rule on risk-weighted assets. But only one of these rules will be binding at any one time.

2.1 Definition and size of the leverage ratio

The leverage ratio (LR) is a non-risk-sensitive, comparatively simple monitoring and control measure. It is defined as

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\begin{aligned}
LR &= \text{total assets / Tier 1 capital} \\
\text{Tier 1 capital} &= \text{common shares + retained earnings} \\
&\quad + \text{additional elements}
\end{aligned}
\tag{1}
$$

with "additional elements" standing in future for highly restricted further capital components[2]. What these will comprise is conceivable, though has yet to be specified. Additional elements must (i) be able to absorb losses, (ii) be subordinated and (iii) have no maturity date. The main criterion to qualify for Tier 1 is that the capital must be capable of helping the bank to remain a going concern. References to the leverage ratio below are based on equation (1).

Since the publication of the Basel Committee on Banking Supervision's most recent consultative document in December 2009 at the latest, it has been clear that the leverage ratio will be introduced to supplement the existing regulatory parameters governing the banks' capital base[3]. It has not yet been decided whether the leverage ratio will initially be monitored by supervisors under the second pillar of Basel II (Supervisory Review Process) or whether it will be a strict requirement of the first pillar. Nevertheless, the leverage ratio is unlikely to be part of the first Basel II pillar immediately. According to the Association of German Banks, it is still unclear when the leverage ratio will change from being a non-stringent limit under Pillar 2 and become a hard Pillar 1 criterion. And it is particularly unclear whether the convergence of accounting standards, especially IFRS and US GAAP, will be a prerequisite for this transition or whether it will be sufficient to define the leverage ratio in such a way that variations in accounting standards have no material effect. Also unclear at

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[2] See Section 5. For details of the discussion on the definition of both the numerator and the denominator in equation (1), see Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), p. 15.

[3] See also Börsenzeitung of 3 December 2009.

present is how high the required leverage ratio will be. On pp. 65 and 66 of its consultative document, the Basel Committee on Banking Supervision goes into the treatment of various on- and off-balance sheet items in some detail. Up to now, however, no specific figure has been mentioned. The US Prompt Corrective Action (PCA) Framework, which is summarised in Table 1, offers an indication of possible leverage ratios. In a 2009 working paper, the European Banking Federation also describes leverage ratios used in Canada and Switzerland, where leverage ratios of between 20 and 25 will be required in the near future (by 2013). With this information and the data in Table 1 in mind, this study assumes leverage ratios of between 20 and 25 will also be required in the European region.

Table 1: Five capitalisation categories under the US Prompt Corrective Action Framework

Capitalisation category	1 / leverage ratio	Total risk-adjusted capital
Well capitalised	$\geq 5\%$	$\geq 10\%$
Adequately capitalised	$\geq 4\%$	$\geq 8\%$
Undercapitalised	$\leq 4\%$	$\leq 8\%$
Significantly undercapitalised	$\leq 3\%$	$\leq 6\%$
Critically undercapitalised	$\leq 2\%$	not possible to calculate

Source: European Banking Federation (2009), p.2

2.2 Possible responses by the banking system to the introduction of a leverage ratio
The introduction of a leverage ratio abandons in part the Basel II philosophy, under which risk is measured horizontally because highly correlated assets and liabilities can be offset against each another. The leverage ratio, by contrast, is a vertical rule since it requires a minimum capital ratio based on the total of a bank's investments. It does not consider the risk associated with the bank's assets and liabilities or any derivative positions which may be used to hedge risks. This analysis assumes that the leverage ratio is binding, meaning that steps have to be taken by the banking industry to meet the ratio in addition to meeting the existing "horizontal" capital requirements. If the level of a bank's risk-adjusted capital is more than adequate but its leverage ratio is too high, the new rule will become binding. Viewed in isolation, therefore, the leverage ratio may result in a bank unwinding its hedge positions if it holds sufficient capital with respect to risk-weighted assets (RWAs) and its leverage ratio is problematic. The leverage ratio may also result in banks shrinking their balance sheets in some other way or seeking to acquire fresh equity. Specifically, the following three responses to a leverage ratio are conceivable:

1. One possibility is to increase the level of equity in the German banking system. By increasing the regulatory capital floor through the introduction of a leverage ratio, the banks' return on equity would fall. In consequence, they would probably only succeed

in acquiring fresh equity if a higher risk-adjusted return on equity could be achieved with the help of new projects. At first glance, a lower leverage ratio would appear to result in a bank carrying less risk. As argued below in Section 2.5, however, the leverage ratio actually creates an incentive to take on more risk. Should this indeed be the case, it will probably be extremely difficult to raise more equity from investors if returns on equity are falling while the level of risk is not only failing to fall, but possibly even rising.

2. A further possibility is for banks to avoid the increased capital requirements by securitising more positions and moving them off the balance sheet[4]. It is not yet clear to what extent the Basel Committee's new rules will preclude this response; some indications as to the treatment of off-balance sheet items can be found on pp. 65 and 66 of the December 2009 consultative document. These suggest that a 100% credit conversion factor will be applied to many off-balance sheet positions[5]. Banks are nevertheless likely to be motivated to find ways of shrinking their balance sheets while retaining the same amount of equity. This could worsen the risk position of the banking system.

3. The third possibility would be for banks to shrink their balance sheets by limiting their business activities:
   - Banks could shrink their balance sheets and comply with the leverage ratio by limiting the supply of credit.
   - Alternatively, other ways could be sought of limiting the value of a bank's investments so that the leverage ratio could be met. One option would be to unwind derivative positions, which increase the size of the balance sheet but have a hedging effect, which would then be neutralised. The balance sheet of Deutsche Bank, for instance, was reduced from around €2,200 billion to €1,660 billion between 2008 and 2009. This was essentially achieved by unwinding derivative positions[6].

It is interesting in this context to note the findings of an empirical study carried out by Adrian and Shin (2008). They demonstrate that the banks themselves adjust their leverage ratio over the course of a business cycle, with leverage increasing in upswings and falling in downturns. This suggests that the leverage ratio in the banking system behaves procyclically. A similar hypothesis was advanced in 2008, this time from a theoretical rather than an empirical

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[4] In the past, higher-rated tranches of loan portfolios were sold and lower-rated tranches were retained due to the comparatively high expected returns.

[5] Which implies equal treatment of off-balance sheet and balance sheet items.

[6] See Interim Report as at 30 September 2009.

perspective, by Kashyap, Rajan and Stein. They suggest tying the regulatory leverage ratio to some economic indicators. But this strategy would be counterproductive if Adrian and Shin's theory is correct: lower capitalisation than in economic good times would be permitted in a downturn. This shows that as yet no firm conclusions concerning the leverage ratio have been drawn and that work on the issue is still in its infancy.

Table 2: The German banking system in October 2009 (in € billion)

Total assets of banks in Germany	7 570.4
Total assets of foreign branches	1 552.6
Total	9 123.0
Lending by banks in Germany to banks (including securities)	3 018.5
Lending by banks in Germany to non-banks (including securities)	3 953.2
Total	6 971.7
Lending by foreign branches to banks (including securities)	612.5
Lending by foreign branches to non-banks (including securities)	720.6
Total	1 333.1
Total lending by banks in Germany and foreign branches	8 304.8
Equity: banks in Germany	336.9
Equity required for foreign branches	34.7
Total	371.6
Equity volatility, % p.a.	30%
Interest rate volatility, % p.a.	1.6%

Sources: Deutsche Bundesbank (2010*a*), Deutsche Bundesbank (2010*b*), Deutsche Bundesbank (2010*c*), Deutsche Bundesbank (2010*d*), and Deutsche Bundesbank (2010*e*), Reuters Datastream DAX Banks (XETRA) – PRICE INDEX and REX GENERAL BOND – TOT RETURN Index, monthly data January 1990 to December 2009

Table 3: The German banking system with a maximum permitted leverage ratio of 20

	Actual	Target
Core Tier 1 in € billion	372	456
Core Tier 1 in %	4.1	5.0
Additional capital requirement in € billion		**85**
Lending in € billion	8 305	6 614
Reduction in lending in € billion*		**1 691**

Sources: Figures from Table 2 and own calculations
* Assumption: The lower leverage ratio is met by reducing lending only, other assets remain constant.

2.3 The capitalisation of the banking system

Table 2 shows the findings of an initial analysis of the capitalisation of the German banking system. Aggregate total assets of the German banking industry, including foreign branches, is €9,123 billion. Of this amount, €1,335 billion is accounted for by five big banks[7]. According to Deutsche Bundesbank[8], this figure is not directly comparable with the balance sheet totals published by individual banks in their financial statements, which consolidate all the bank's activities, including foreign and domestic subsidiaries which do no banking business, such as investment companies. In consequence, the aggregate amounts shown in the Bundesbank statistics are significantly lower than the balance sheet totals in the banks' annual reports. Common shares plus retained earnings and less recognised losses (Tier 1 capital), including foreign branches, is €372 billion. This gives a ratio of total assets to capital of almost 24.6. According to the Bundesbank, however, this figure is definitely distorted downwards compared to the real leverage ratio[9]. As things stand, the actual leverage ratio in the German banking system cannot be established on the basis of the Bundesbank's statistics. If a leverage ratio is introduced, the Bundesbank will have to collect additional data. Table 3 nevertheless shows the target figures of certain balance sheet items in the event that the leverage ratio is not allowed to exceed 20. Based on these figures, reducing leverage will require either €85 billion new equity to be acquired or lending to be cut by €1,691 billion. Raising fresh equity will be feasible if the expected return on the newly acquired equity is at least as high as the existing expected return. The expected return can only rise after a capital increase if the average risk associated with realised projects goes up. If the lower leverage ratio achieves its objective of greater security and thus less risk in the banking system, return on equity will fall, not rise. The more likely alternative, therefore, is that credit creation by the German banking industry will contract. Section 4 of the study will evaluate the macroeconomic consequences of this fall in credit availability.

The figures in Table 3 are not robust because the Bundesbank does not currently possess all the information needed to calculate the leverage ratio. Changes in equity and lending levels will therefore have to be extrapolated. Table 4 shows the leverage ratios of some major banks in the US, UK and EU. Since the leverage ratio cannot be determined on the basis of the available Bundesbank data, two figures can be used to provide an approximation: the average leverage ratio of the three German banks in Table 4 is 40.

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[7] According to Deutsche Bundesbank (2009a), p. 110, these are Deutsche Bank AG, Dresdner Bank AG, Commerzbank AG, from January 1999 Bayerische Hypo- und Vereinsbank AG and since December 2004 Deutsche Postbank AG.

[8] Telephone call on 22 December 2009.

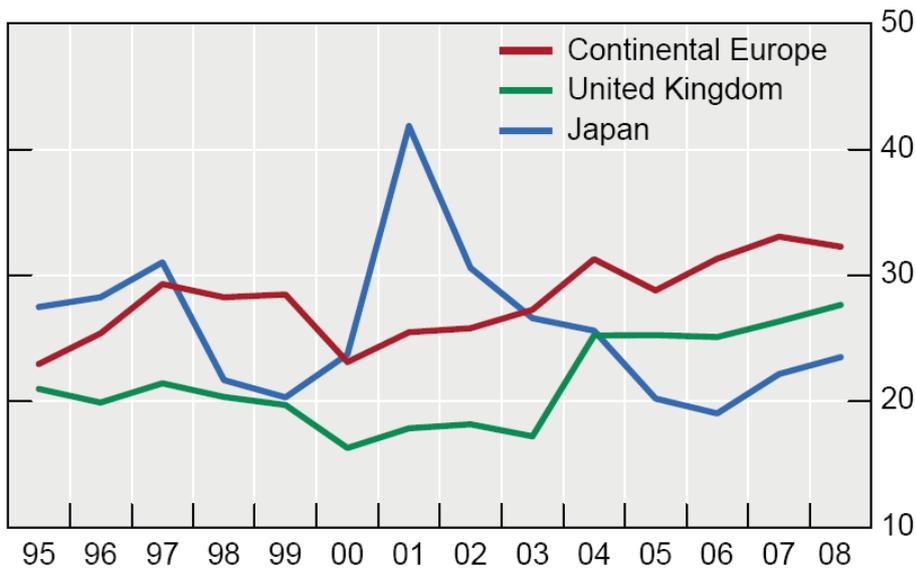[9] Telephone call with Deutsche Bundesbank on 22 December 2009.

Figure 1: Balance sheet leverage ratios of international banks
Source: Bank for International Settlements (2009), p. 4 and Bankscope

If the leverage ratio of German private commercial banks, savings banks, Landesbanken, credit cooperatives, regional institutions of credit cooperatives and private mortgage banks is calculated on the basis of Bankscope data as at the end of 2008, the average capital ratio is 2.65% and the leverage ratio is just under 38[10]. The average of all the banks in Table 4 is 26. It thus follows that the leverage ratio in the German banking industry is higher than that of its US and UK counterparts, but also higher than in Italy. This may be caused by the German treatment of capital contributed by silent partners, as well as by the ban on netting derivative positions under IFRS, unlike under US GAAP.

Given that it is not possible to establish the exact leverage ratio in Germany, the impact of a leverage ratio rule on capital requirements and on the credit supply can only be simulated, for instance. The results of two such simulations can be found in Tables 5 and 6. Table 5 shows how much additional equity would be needed in the German banking system to comply with four different leverage ratios. According to these calculations, between €21 billion and €125 billion would be required. Table 6 illustrates how the supply of credit would fall in response to various leverage ratios. Depending on the level of the ratio, total lending in Germany would contract by between €656 billion and €2,841 billion. It must also be borne in mind that these figures refer only to the level of equity needed for the German portion of the banks' operations[11]. The more stringent leverage ratio requirements would apply to their

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[10] E-mail from the Association of German Banks on 25 January 2010.

[11] Including foreign branches but excluding foreign subsidiaries.

foreign business as well, generating a further need for equity. But possible differences in the accounting standards used by German banks' foreign subsidiaries make it extremely difficult to compare this portion of the computation with the portion for German business.

The leverage ratio in continental Europe is also relatively high by international standards. What is more, it has risen significantly over the last five years. Figure 1 shows the average leverage ratios of global banks.

Table 4: Leverage ratios of various global banks (all figures in € billion)

	Tier 1 capital	RWAs	Total assets	Equity	LR
US					
Bank of America	193 073	1 565 880	2 390 675	257 683	12
Citigroup	126 285	989 711	1 888 599	140 842	15
J.P. Morgan Chase	126 541	1 237 760	2 041 009	162 253	16
Morgan Stanley	45 962	299 416	769 503	46 349	17
Goldman Sachs	59 461	409 291	882 185	65 354	15
U.S. Bancorp	21 990	231 993	265 058	25 880	12
Wells Fargo and Company	108 785	1 023 800	1 228 625	122 150	11
UK					
Barclays	42 625	406 054	1 545 338	48 687	36
HSBC	117 353	1 159 274	2 421 843	118 355	21
Lloyds Banking Group	15 777	172 648	501 002	11 002	32
Royal Bank of Scotland	47 618	594 700	1 861 155	74 151	39
Standard Chartered	21 514	205 016	411 220	23 890	19
Germany					
Deutsche Bank	33 717	287 504	1 659 557	35 657	49
Deutsche Postbank	5 481	78 451	239 280	5 278	44
Commerzbank	31 937	293 000	892 307	28 537	28
France					
BNP Paribas	41 799	527 643	2 075 551	53 228	50
Credit Agricole	31 100	320 900	1 602 500	45 000	52
Natixis	14 500	129 464	478 000	14 900	33
Italy					
Unicredit	42 436	459 287	957 709	59 300	23
Intesa SanPaolo	29 481	367 372	631 308	51 932	21
Average					26

Sources: Financial reports and own calculations
RWAs: risk-weighted assets, LR: leverage ratio = total assets / Tier 1 capital.

Table 5: Changes in the need for the German banking system to acquire fresh equity in response to various reduced leverage ratios (in € billion)

	LR	Total assets	Total lending	Theoretical equity	Δ equity
Current	38	9 123	8 305	240	
Variation 1	35	9 123		261	21
Variation 2	33	9 123		276	36
Variation 3	30	9 123		304	64
Variation 4	25	9 123		365	125

Sources: Figures in Table 2 and own calculations
LR: leverage ratio, theoretical equity: equity theoretically needed with given LR,
Δ equity: additional equity needed with given LR

- Continental Europe is represented in Figure 1 by ABN AMRO Holding, Banco Santander, BNP Paribas, Commerzbank, Credit Agricole, Credit Suisse, Deutsche Bank, Société Générale, UBS and UniCredit SpA. The average leverage ratio in mid-2008 was 31.

- The following banks in the UK are covered: Barclays, HSBC, Lloyds TSB Group and Royal Bank of Scotland. In mid-2008 the average leverage ratio was 28.5.

- The Japanese banks are Mitsubishi UFJ Financial Group, Mizuho Financial Group and Sumitomo Mitsui Financial Group. The average leverage ratio in mid-2008 was 22, down from a level of 42 during the internet bubble in the early 2000s.

Table 6: Changes in the reduction in lending by the German banking system in response to various reduced leverage ratios (in € billion)

	LR	Total lending	Maximum total assets	of which lending volume	Δ lending volume
Current	38	8 305	9 123		
Variation 1	35		8 403	7 649	-656
Variation 2	33		7 923	7 212	-1 093
Variation 3	30		7 202	6 556	-1 748
Variation 4	25		6 002	5 464	-2 841

Sources: Figures in Table 2 and own calculations
LR: leverage ratio, maximum total assets: maximum permitted total assets with given LR,
Δ lending volume: reduction in lending with given LR

Leverage ratios in continental Europe are therefore high compared to those in the UK and Japan. Figure 1 shows that there is a further dimension to regulating leverage ratios. Not only German banks would be restricted in their ability to create credit: banks in other parts of

Europe would be affected too, and their activity might also have an impact on the German real economy.

2.4 Securitisations

Banks might consider avoiding the binding limitation imposed by a leverage ratio by removing some of their loans from the balance sheet. The multi-tiered outplacement of credit risk positions and their resale as mortgage-backed securities or collateralised debt obligations was one of the reasons for the bursting of the property loan bubble in summer 2007. The risk of the underlying property loans was removed from the banks which originally granted the loans, but it remained in the financial system. This procedure is likely to be precluded in future, however, by rules proposed by the Basel Committee in its December 2009 consultative document *Strengthening the Resilience of the Banking Sector*. It is proposed on p. 63 that capital should have to be set aside to cover most securitisations. The financial system is therefore unlikely to be destabilised by banks stepping up their securitisation operations on a large scale in order to avoid the leverage ratio. However, banks might respond to a decline in their business caused by higher capital requirements in general and a lower leverage ratio in particular by increasing their capital market activities. This would represent a trend towards investment banking. Anglo-Saxon banking centres have a traditional edge in this area, as do other European centres where the three-pillar model of private commercial banks, public-sector banks and cooperative banks is less of a feature than it is in Germany. While higher capital ratios will probably not slow the trend towards greater focus on the capital markets, the introduction of the leverage ratio may create undesirable incentives with respect to securitisation. If the same amount of capital has to be set aside to cover all balance sheet items irrespective of the associated risk, low-risk items which are easier to sell in the capital market are likely to be securitised while riskier items remain on the balance sheet.

2.5 Possible methods of shrinking the balance sheet

The above-mentioned methods of shrinking the balance sheet will now be examined. Both options – (i) rationing the supply of credit and (ii) unwinding derivative positions – may have extremely adverse effects on the economy[12]. While a reduction in total lending has direct implications for the real economy, unwinding derivative positions has indirect implications. If derivatives are unwound, hedges against interest rate and FX risks on the banks' balance sheets will be reduced. Table 2 shows that the long-term volatility of the share price return of German banks is around 30%. Reducing hedge positions may lead to an increase in maturity mismatch between the assets and liabilities side of the balance sheet and thus to a higher duration gap. This would cause more volatility in the banking sector. Five comparatively moderate scenarios can be found in Table 7, which shows how a reduction in hedge positions

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[12] In its consultative document *Strengthening the Resilience of the Banking Sector* (2009), the Basel Committee on Banking Supervision envisages that financial collateral will not be taken into account when calculating total assets. The risk-mitigating effect of such collateral will consequently not be considered (see p.62).

gradually increases the duration of asset items from 5.0 to 6.0 is scenario 5. This results in a dramatic rise in equity duration from 18.9 to 43.5 in scenario 5. A 1% increase in interest rates would then cause the share price to collapse by 43.5%[13]. At the same time, asset volatility rises fairly moderately from 2% to 2.4%. The figures in Table 7 are based on the following assumptions:

- Equity volatility in the German banking system equals the volatility of the share yields of the XETRA DAX banks between January 1990 and December 209 (monthly data), i.e. 30% (see Table 2).

- Interest rate volatility[14] is 1.6% p.a. (see Table 2). In the most conservative case it may be assumed that equity in the German banking system is sensitive to interest rates only[15]. The equity duration is then the ratio of share price volatility to interest rate volatility. Based on the data in Table 2, the equity duration and thus the duration gap is 18.9. Or put more simply: if interest rates rise by 1%, bank share prices fall by 18.9%. If this duration gap is increased by unwinding interest rate swaps, for instance, share price volatility will also be implicitly increased – and with it the probability of default in the banking system. Increasing the leverage ratio by unwinding derivative positions might consequently produce a more volatile, not a more secure, banking system. In this case, the regulatory measure would have been totally counterproductive.

Table 7: Duration gap and equity volatility in the German banking system – various scenarios

Scenario	Equity duration	Equity volatility	Asset volatility	Asset duration
1	18.9	30%	2.0%	5.0
2	23.8	31%	2.1%	5.2
3	28.7	33%	2.2%	5.4
4	33.6	34%	2.3%	5.6
5	43.5	37%	2.4%	6.0

Source: Own calculations

Table 7 demonstrates that reducing hedge positions results in a relatively small increase in the risks associated with banks' asset items but also in a clear increase in the equity duration and thus possibly in a greater risk of insolvency in the banking system. The reason for the possible unwinding of derivative positions is the ban on netting proposed in the Basel

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[13] Ignoring convexity effects, which would make the drop in price less sharp.

[14] Annualised volatility of changes in the implied annual interest rates of the REX General Bond Total Return Index between January 1990 and December 2009.

[15] Meaning non-sensitive to share, currency, commodity and money markets.

Committee's December 2009 consultative document, under which even offsetting derivatives would expand the balance sheet and therefore have to be backed with capital. This procedure assumes a perfect positive correlation between a bank's derivative positions and assets although the objective of derivative hedges is exactly the opposite, namely a correlation with the bank's assets which is as negative as possible. An obligation to set aside capital for such positions consequently leads to a reduction in negatively correlated positions and a relative increase in the banking system of positively correlated positions, and thus to increased risk. The question therefore arises as to whether even a moderate cap on leverage might force the banking industry to take steps which ultimately result in a less stable system, better capitalisation notwithstanding.

Figure 2 shows the connection between the leverage ratio, asset duration and probability of default of an average bank in Germany. Taking the current leverage ratio in the German banking system used in Tables 5 and 6, it can be seen from Figure 2 that the probability of default will only fall under a declining leverage ratio if the asset duration remains constant. But if the asset duration increases slightly, as shown in Table 7 for example, the probability of default rises despite an improved leverage ratio. The reason for this is an assumed contraction of the balance sheet caused by unwinding derivative positions. Figure 2 is based on the following assumptions:

- The initial asset duration is 5.0. This gives a liability duration of 4.41 with the given equity duration of 18.9; assets and liabilities are as in Table 2.

- If the asset duration is increased, the correlation between assets and liabilities decreases. This represents a growing deviation from the "golden rule" of accounting, which says that assets should be financed at more or less matching maturities by liabilities. Equity becomes significantly more sensitive to changes in the capital market. As Table 7 shows, the asset duration starts at 5.0 and varies up to a level of 6.0 in Figure 2.

- The insolvency risk is determined by the equity duration. Figure 2 calculates how likely it is that, with a volatility of 1.6% p.a. (see Table 2), the capital market interest rate will change by as much as necessitated by the equity duration. If the equity duration is 22.5, for example, the interest rate move which would eat up all equity would be 1/22.5, or 4.4%[16]. If a normal distribution of interest rate changes with interest rate volatility of 1.6% p.a. is assumed, there is a 0.3% probability of an interest rate move of 4.4% occurring.

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[16] Ignoring the convexity of the sensitivity of equity to changes in interest rates. The actual drop in equity is smaller if convexity is taken into account. As is customary when using internal risk models, however, we have assumed linearity between interest rate and equity developments.

The leverage ratio in the German banking system is currently 38 according to Table 5. Based on the data in Table 7, we have assumed an asset duration of 5.0. The resulting probability of default can be found in Figure 2. It is 0.9%; under the given assumptions, therefore, it may be anticipated that one bank in a hundred will get into difficulties every year. If the highest permissible leverage is reduced, the probability of default also falls – as long as asset duration does not lengthen as a result of cutbacks in derivative positions. Even a slightly more risky investment policy on the part of banks can outweigh the leverage ratio's positive effect on stability. Figure 3 shows trade-offs between the leverage ratio and asset duration if the probability of default remains constant at 1% and at 2%. The graph demonstrates that lowering the leverage ratio does not in itself produce less risk in the banking system. If the permissible leverage ratio is reduced, the banking system is able to increase asset duration relatively slightly and the probability of default remains unchanged despite improved leverage. Only risk-appropriate capital charges can prevent banks from taking avoiding action of this kind to maintain their expected return on equity.
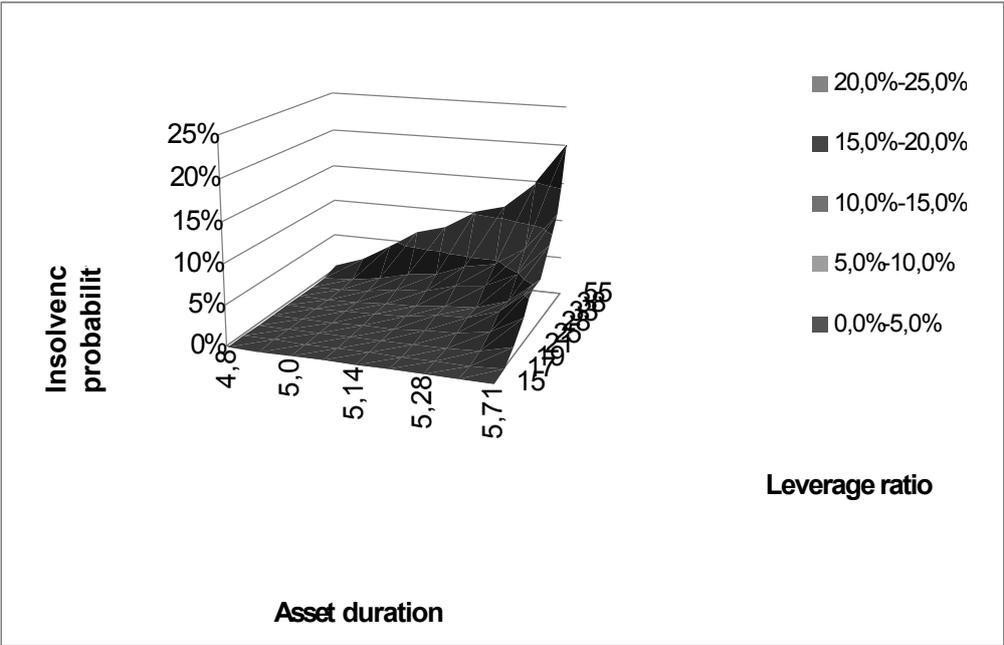
Figure 2: Leverage ratio, duration of assets in the banking system and probability of default
Source: Own calculations

This section will conclude by discussing two nuances of the argument hitherto advanced. Nuance 1 is not the threatened elimination of hedge positions but instead the replacement of loans with credit derivatives on the assets side. The level of risk-weighted assets in the banking system would then remain constant. But since the fair value of a derivative contract is normally only a fraction of its nominal value, the leverage ratio would fall. This would have two adverse effects. First, there would be less credit available to the economy if the risk

profile of the banking sector stayed the same. Second, derivative contracts of this kind would themselves be leveraged products. Though the measured leverage ratio would fall, there might be greater leverage of aggregate total assets in the banking system.

Nuance 2 relates to the interaction of the leverage ratio requirement and the rule on risk-weighted assets. It was stated in Section 1 that a bank's business would always be affected by only one of the two. If these rules are examined in conjunction with one another, a distinction needs to be made between two sets of circumstances:
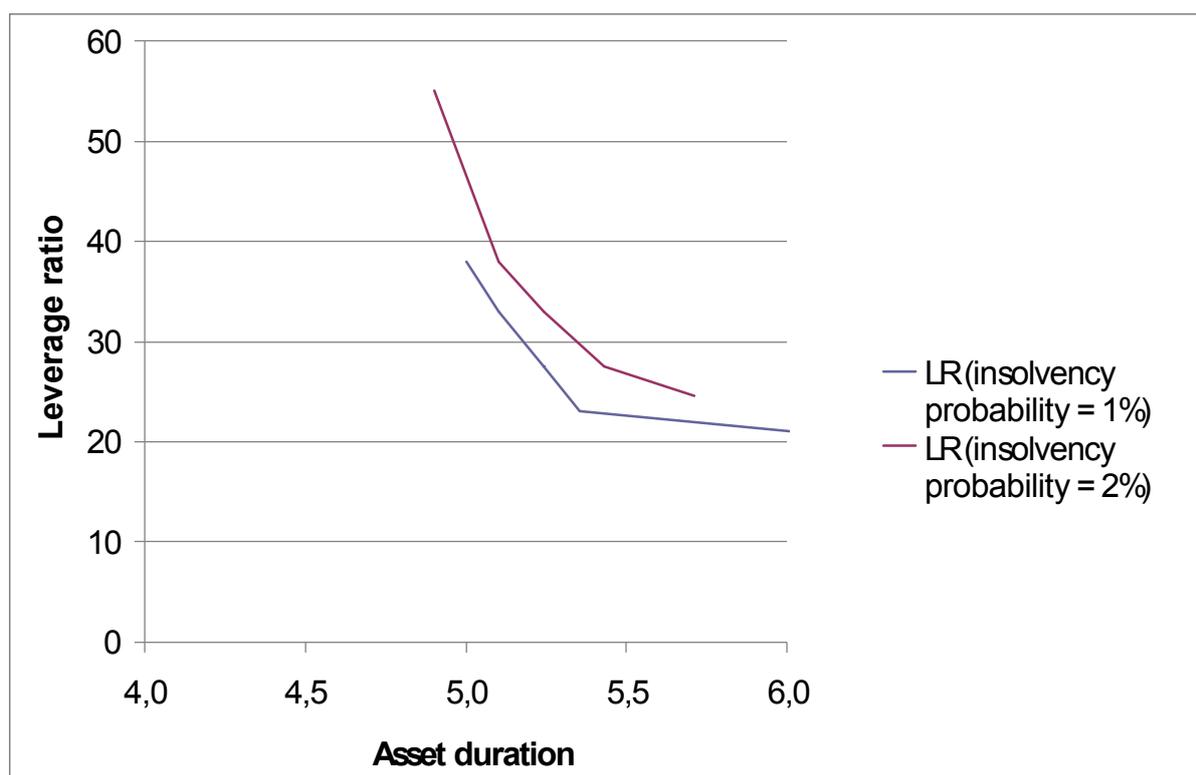
Figure 3: Curves of constant probability of default of 1.2% and 2.4% given various leverage ratio and asset duration combinations

Source: Own calculations

- If a bank's equity capital is sufficient to cover risk-weighted assets (RWAs), the leverage ratio is binding. This means that the bank has to reduce the level of assets[17]. Total assets thus fall and with them the level of risk-weighted assets. The bank now has no room to manoeuvre with its total assets, but scope to take on more risk. It could seek to take higher-yielding risks onto the balance sheet because its RWAs are now less than the maximum permitted amount. This results in less leverage, but not necessarily in less risk. Conversely, the bank could comply with the leverage ratio by unwinding risk-

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[17] Unless the bank succeeds in acquiring fresh capital.

free positions, such as German bunds. This reduces leverage but not the amount of risk-weighted assets. The actual risk of the bank's asset portfolio would rise because the remaining positions would no longer be diversified with comparatively low-risk bunds.

- If it is assumed that RWAs are binding, and not the leverage ratio, the introduction of the leverage ratio would not change the status quo.

It therefore follows that, although the leverage ratio would probably cause balance sheets to contract, there is a danger that it would also create an incentive to take on more risk to achieve a higher return. Otherwise, the leverage ratio rule would not change anything.

2.6 Experience to date with simple capital adequacy rules

The observations above make it clear that the idea of using the leverage ratio as a regulatory tool needs to be viewed with caution. Criticism is also frequently heard from industry experts, such as Christian Clausen, CEO of Sweden's Nordea Bank, who has considerable reservations about leverage ratios. In his view, banks with a low concentration of risk on their books would be especially penalised and possibly forced to cut back on sound business activities.[18]

Nevertheless, the leverage ratio obviously also has its supporters, particularly among regulators. Take, for example, an article published by Blum in 2008. The author, who works for the Swedish central bank, puts forward an agency approach and concludes that the leverage approach has the potential to reduce risk in the banking system. It is assumed that banks have an information advantage over regulators concerning the risks they have taken on. Blum argues that, under the Basel II regime, banks have an incentive to understate their risks because higher risks generate higher capital requirements. It would therefore make good sense to require a sufficiently large, risk-independent level of capitalisation. In our view, however, this argument disregards the fact that, as demonstrated above, the leverage ratio creates an incentive to take higher risks onto the trading and banking books. The solution to the problem of asymmetric information should be more effective monitoring under the second and third pillars of Basel II. The answer is not to capitulate to risk models. Blum's model assumes that a bank's worst-case return can be predicted. In consequence, the leverage ratio should be set in such a way that this worst-case return can be absorbed. But the author disregards the fact that a bank's business policy depends on the required leverage ratio. Unless a correlation is established between capital and risk, banks have an incentive to assume more risk in direct proportion to the amount of capital they are required to hold. The worst-case return is therefore not a given, as implied by Blum, but depends on the level of the

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[18] See Börsen Zeitung (2009).

bank's capitalisation. This means that the leverage ratio would need to be increased in the presence of higher risks if the worst-case return was to be absorbed. The leverage ratio would then no longer be a risk-independent requirement, however, but a requirement relating to risk-weighted assets. We consequently do not agree with Blum's 2008 paper.

In 2009, Neue Zürcher Zeitung reported on another argument from the academic arena in an article about a paper by the Basel economist Heinz Zimmermann. This argument bolstered supporters of the leverage ratio. It is demonstrated in the article that the less divergence there is between risk-weighted assets and total assets, the more positively the share price develops. Banks which minimised their measurements of risk therefore performed much worse than banks which reported more risks on their books. Yet if this argument is analysed, it turns out to support not the introduction of a risk-insensitive leverage ratio but merely an increase in banks' capitalisation. Doubtless, the objective of future regulation should be to increase banks' capital ratios[19]. This does not, however, mean that risk adequacy should be ignored. The amount of capital banks are required to hold will have to be higher than in the past but the requirements for high risks should continue to be higher than those for low risks. Zimmermann's analysis is not at odds with this hypothesis. It makes sense for the capital market to favour banks which hold higher levels of capital because this results in lower risk premiums. At the same time, however, the hypothesis could be ventured that, if leverage ratios were all the same[20], the capital market would penalise banks with a high risk exposure.

A brief observation of events makes it apparent that vertical rules for determining capital adequacy did not offer better protection in the financial crisis. To understand the process of capital regulation, it makes sense to be clear on the history of the Basel rules. The rules of the Basel Committee on Banking Supervision at the Bank for International Settlements (BIS) in Basel are rooted in the Herstatt crisis of 1974[21]. This crisis prompted concern by the G10 central bank governors that banks' capital adequacy might be too low[22]. The upshot of this concern was the Basel I rules, which were a relatively blunt instrument. The Basel Committee required banks to carry capital equivalent to at least 8% of their risk-weighted assets, though the Basel I risk weights were extremely crude. Concerns that there was too little capital in the global banking system were indeed justified. Figure 4 shows that capital ratios were at a historic low. The introduction of the Basel I rules did, in fact, succeed in improving capital adequacy ratios somewhat, even if they continued to fall far short of pre-war levels.

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[19] An interesting new approach has been put forward by Inderst and Mueller (2008), however. They argue that banks' leverage needs to be higher than that of non-financial firms because banks finance third-party projects, but the return benefits the firm and not the bank although the bank bears a share of the risk of failure. Higher leverage is consequently the only way of achieving attractive returns on equity.

[20] Meaning identical capitalisation.

[21] The Committee was established at the BIS in 1974.

[22] See Bundesanstalt für Finanzdienstleistungsaufsicht (Federal Financial Supervisory Authority) (2009).

Despite this improvement, however, it emerged over time that the Basel I rules still viewed risks too simplistically. In many risk categories, such as credit risk, weightings had very little to do with the actual risk[23]. Basel I rules often still apply today, since the more sophisticated Basel II rules took effect in the EU only recently and have yet to be implemented in national law in some other regions of the world. The EU capital requirements regime follows the Basel Committee's recommendations very closely. It comprises the recast Banking Consolidation Directive (2006/48/EC) and the recast Capital Adequacy Directive (2006/49/EC), both of which were adopted in 2006[24]. As an instrument of regulation, the leverage ratio takes an undifferentiated approach to risk that falls short even of Basel I.
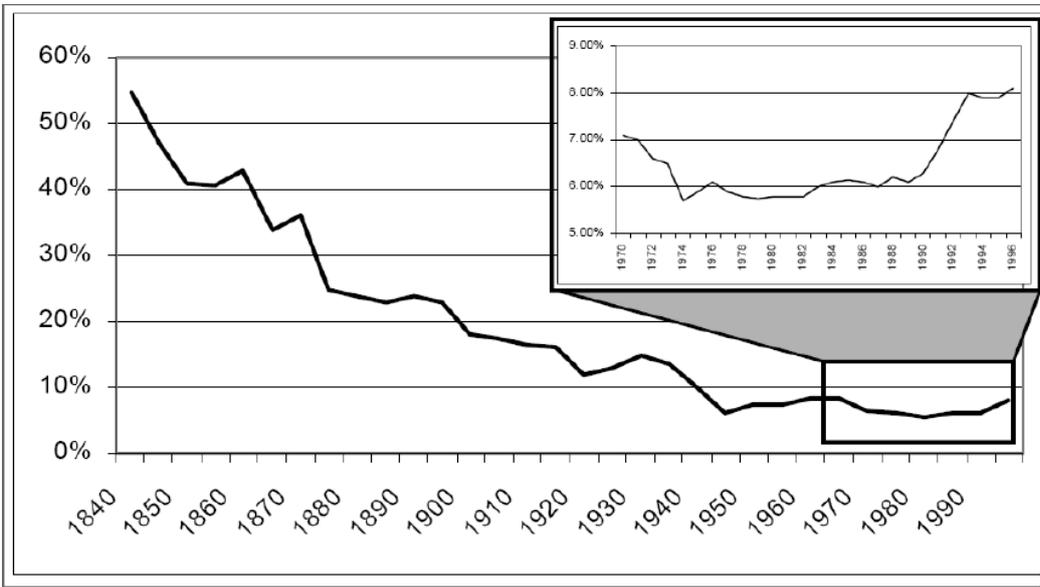
Figure 4: Long-term comparison of capital ratios in the international banking system
Source: Berger and Humphrey (1997)

Since the considerably more sophisticated Basel II rules have not been in force for very long, it is difficult to tell whether they have led to more or less business failure in the banking system. Figure 5 shows the development of bank insolvencies in Germany. The statistics are based on data compiled in 2009 by the German news magazine Capital. Each bar refers to the five-year period up to the year mentioned underneath. Even if the systemic threat of these bank failures does not depend on the number of insolvencies alone, Figure 5 nevertheless indicates the seriousness of the problem. Up to the mid-1980s there were between 10 and 20 bank insolvencies per year, and in some years considerably more. Only from the mid-1980s onwards did the number of insolvencies significantly decline. The start of this trend coincides

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[23] Credit risk positions are classified under Basel I according to the company's home country, not its credit risk quality.

[24] See Bundesanstalt für Finanzdienstleistungsaufsicht (Federal Financial Supervisory Authority) (2009).

with the introduction of Basel I. Since 2005 only one bank has become insolvent, namely Reithinger, a private bank located in Singen which failed in 2006. Whether this decline in bank insolvencies can be attributed to Basel II is a question that cannot be answered on the basis of the available data. Furthermore, the emergency bail-outs of some banks by the state in the course of the current financial and economic crisis can naturally also be regarded as insolvencies, even if these banks[25] have so far avoided collapse thanks to government intervention. Since the causes of these difficulties doubtless lie in the period before Basel II was introduced, the new rules cannot be held responsible. It is certainly true that higher capital adequacy ratios in the past would have resulted in less risk of insolvency. But capital requirements which ignored risk would not have improved the situation. Adjusting capital requirements to better reflect risk does not appear to have contributed to making the situation worse. The data in Figure 5 do, however, indicate that threats to the economy posed by collapses in the banking system became less likely after the introduction of the Basel I rules. Though it is true that the consideration of risk under Basel I falls far short of that under Basel II, the regulating effect of the leverage ratio would fall short of even Basel I.
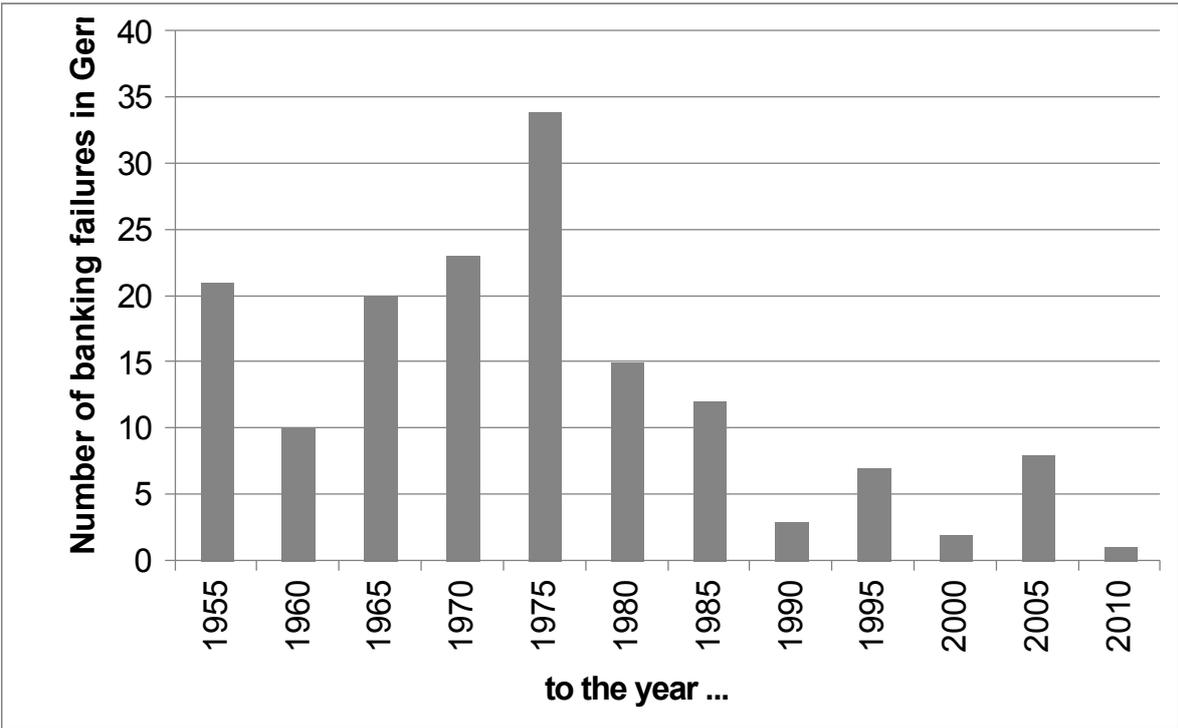

Figure 5: German banking failures from 1945 to 2009
Source: Capital (2009) and own calculations

A statement in 2009 by Standard & Poor's, which generally supports the leverage ratio, gives food for thought: "The fact that the US banking system, where the leverage ratio has been in

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[25] Hypo Real Estate Group comes to mind, for instance, but also SachsenLB, BayernLB and Commerzbank.

use for a long time and banks' leverage ratios appear better than average, has been at the epicenter of the financial crisis, in our view illustrates the limitation of that metric." Despite the existence of a regulatory leverage ratio in the US, this instrument was unable to protect US banks from the crisis.

3. Influence on competition between banking systems in various countries

Figure 8 is based on an analysis of 50 leading banks as at 30 September 2009. The differences between the average leverage ratios calculated for a total of nine countries on the basis of the annual accounts of these 50 banks are immediately evident. Germany and France have comparatively high leverage ratios of 40 and 45 respectively. In the US, by contrast, the

Figure 6: Assets versus risk-weighted assets in selected countries
Source: Thomson Reuters Datastream, financial reports and own calculations

leverage ratio is only 14. The most obvious difference between the US on the one hand and Germany and France on the other is the applicable accounting standards. German banks use IFRS, whereas US banks apply US GAAP. This can lead to considerable differences in how the leverage ratio is calculated. In its 2009 publication *IFRS compared to US GAAP: An overview*, for instance, KPMG points out on p. 147 that long and short derivative positions with the

same counterparty may be offset against each other under US GAAP, but not under IFRS. Obviously, this means that the numerator of the leverage ratio in equation (1) is smaller under US GAAP than under IFRS, which ultimately results in lower leverage ratios. It is interesting to note that, according to figures published in 2009 by both Deutsche Bank and Standard & Poor's, Deutsche Bank's total assets were €915 billion as at 30 September 2009 under US GAAP, but €1,660 billion under IFRS. The bank's leverage ratio would therefore improve significantly if it were calculated under US GAAP. Besides the netting of long and short derivative positions, another frequent argument against using the leverage ratio as a control parameter is the fact that hidden reserves would be excluded from the equation. This argument relates to the different treatment of silent partnerships in Anglo-Saxon countries. Different ways of treating hidden reserves may consequently also be responsible for the variation among the leverage ratios in Figure 8. In its 2009 consultative document *Strengthening the Resilience of the Banking Sector*, however, the Basel Committee on Banking Supervision (BCBS) indicates that differences in accounting treatments have been taken into account and cites the netting of derivatives and repos as the most important such differences (p. 62).
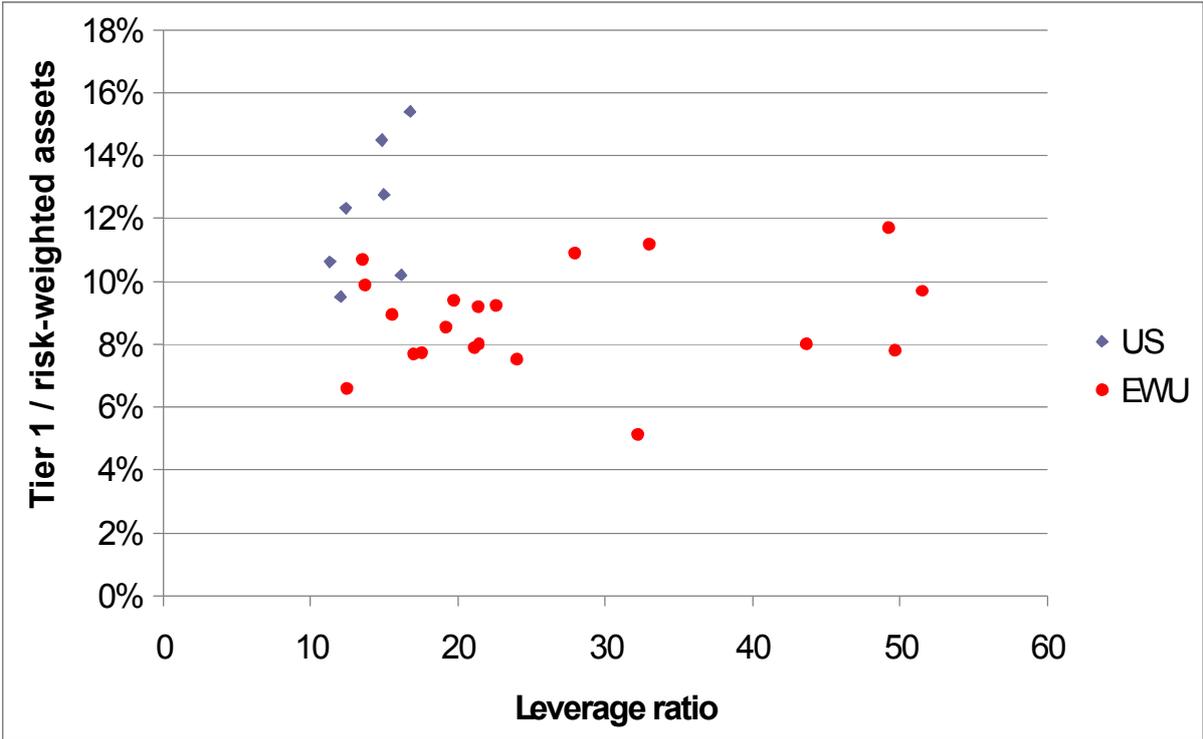

Figure 7: Leverage ratio versus Tier 1 capital / risk-weighted assets in the US and the euro area
Source: Financial reports and own calculations

At first sight, the ratio of total assets to risk-weighted assets (RWAs) in Germany and France appears much less favourable than that in the US (see Figure 6). In fact, however, accounting

standards used in the US distort the leverage ratio downwards. Deutsche Bank's risk-weighted assets account for one sixth of its total assets, for example, while the figure is around 60% at Citigroup and other US institutions. The BCBS consultative document states that the difference between US GAAP and IFRS rules on the netting of derivative contracts will not be allowed to have an impact on measuring the leverage ratio (see p. 61). It may, moreover, be inferred from the Securities and Exchange Commission's 2008 "Roadmap" that US banks will switch from US GAAP to IFRS accounting from 2014. Figure 7 also addresses the relationship between the leverage ratio and risk-weighted assets. The figure shows that, while the leverage ratio in the euro area is significantly higher than in the US, there is much less difference between the Basel II Tier 1/RWA capital ratios in the two currency areas. This can probably also be explained by differences in the accounting regimes.

It should be emphasised again at this juncture that a uniform method of calculation is essential if the leverage ratio is not to distort competition. The ideal solution would be uniform accounting standards. Support for this approach comes from various quarters. The German financial newsletter Platow Brief, for example, wrote in 2009: "There is a consensus among policymakers and banks in Germany, on the other hand, that capital contributed by silent partners should be recognised as core Tier 1 capital." There is pressure from Anglo-Saxon countries, by contrast, to recognise only common shares as core Tier 1. Excluding silent partnerships will above all penalise banks which are unable to raise funds in the capital market and therefore depend on self-financing. The Association of German Banks also fears that European IFRS banks will be placed at a disadvantage compared to US GAAP banks in the absence of a satisfactory solution to the problem of accounting differences (e.g. the netting issue mentioned above, but also the exposure value of off-balance sheet items). These concerns are shared by Mario Draghi, Chair of the Basel Financial Stability Board (FSB) and head of the Italian central bank, who has warned against introducing a leverage ratio too soon unless it can be ensured that the ratio will be measured in all countries by the same yardstick (see dpa-AFX ProFeed, 2009).

An argument examined above and relating indirectly to the leverage ratio is worth revisiting in this context. In an article written in 2009 about a lecture by the Basel economist Hans Zimmermann, Neue Zürcher Zeitung reported that banks were able to earn higher returns during the phase of the crisis between July 2007 and March 2008 if their ratio of total assets to risk-weighted assets was comparatively small, i.e. if the leverage ratio was comparatively low. As discussed above, however, it is important not to confuse cause and effect. Though it may be concluded that higher equity levels make banks significantly more resilient to crises, it does not necessarily follow that a lower leverage ratio means improved crisis resistance. Increasing the amount of capital in the banking system may well make good sense in light of the now largely weathered crisis. But the introduction of a leverage ratio is not the right way

forward. Capital requirements should be increased in a risk-adjusted manner, not across the board. Figure 9 reproduces the regression calculated by Heinz Zimmermann and discussed in Neue Zürcher Zeitung. Table 8 lists the average key ratios of the 50 banks in the nine countries observed. It emerges that, where *A/RWA*[26] is high, returns are less negative in the period under consideration. According to Figure 9 the correlation is relatively weak ($R^2 = 5\%$), but significantly negative.
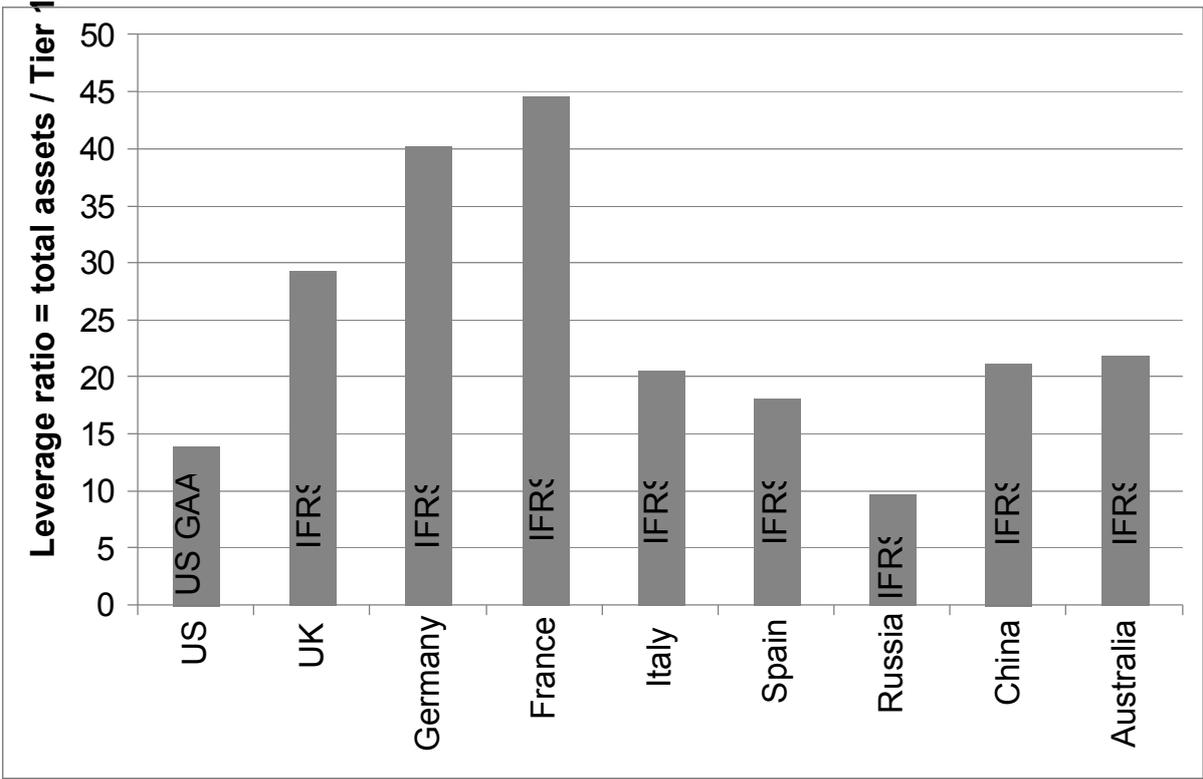
Figure 8: Average leverage ratios and accounting standards in selected countries
Source: Financial reports and own calculations

Further evidence of the correlation for the sample of banks can be found in Figure 6, which shows that the more negative the returns between July 2007 and March 2008, the higher the leverage ratio. But another phenomenon also becomes apparent. The ratio of total assets to risk-weighted assets is much lower at US banks than at German and French banks. One of the reasons for this might be that US banks, unlike their German counterparts, already have to keep an eye on their leverage ratio and consequently expend less energy than do banks in France and Germany on reducing the risk exposure of their assets. Risk-mitigating practices such as hedging, for example, or focusing on investments with a low or negligible risk play a bigger role in Germany and France than in the US. Both were discussed in Section 2.5. The risks on US balance sheets in proportion to total assets are higher on the whole than is the

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[26] Total assets divided by risk-weighted assets.

case in Germany and France. Since the leverage ratio is already an important element of US regulation, it seems reasonable to assume that banks' risks may rise in Germany and France too if a leverage ratio is introduced. Business models in continental Europe might then lean more towards those in the US. Transactions would become more profitable, but also more risky if there was a shift away from commercial and private banking and towards investment banking.

Table 8: Average balance sheet and return ratios and accounting standards in selected countries

	No. of banks	Accounting standards	Average LR	Average A/RWA	Average return July 07 to March 08
US	7	US GAAP	14	1.71	-41%
UK	5	IFRS	29	2.8	-33%
Germany	3	IFRS	40	4.0	-39%
France	3	IFRS	45	4.2	-58%
Italy	7	IFRS	21	1.5	-39%
Spain	7	IFRS	18	1.6	-32%
Russia	7	IFRS	10	1.1	-41%
China	8	IFRS	21	1.9	-15%
Australia	3	IFRS	22	2.0	-33%

Source: Thomson Reuters Datastream, financial reports and own calculations

4. Economic effects of a leverage ratio

4.1 General considerations

The introduction of a regulatory leverage ratio which, based on the existing volume of bank lending, calls for a higher level of equity backing and thus has a binding effect may lead to different adjustment responses from the banking sector. The three basic responses were outlined in Section 2.2 and will now be put in a macroeconomic context. The following three types of response can be distinguished:

1. Firstly, banks could try to increase their equity level to comply with the leverage ratio in the context of their existing lending volume. Arithmetically, this would be done via a change in the denominator of the leverage ratio (lending/equity).
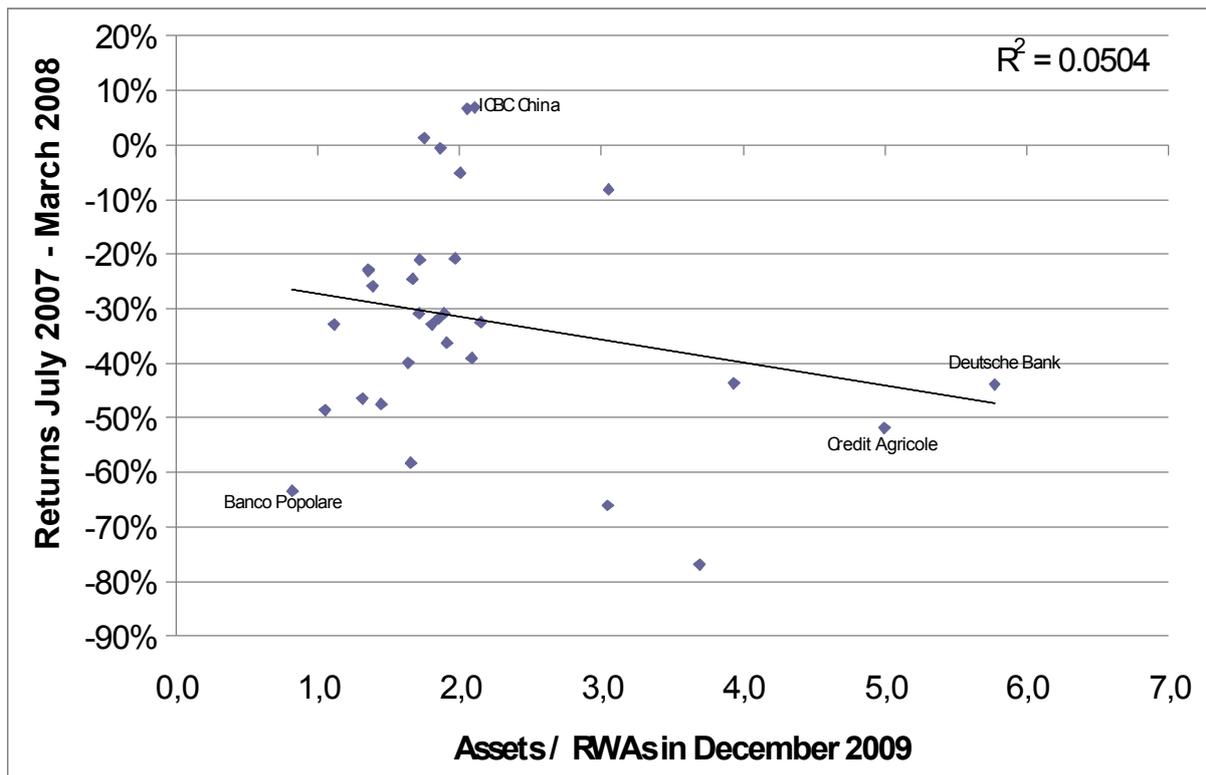
Figure 9: Returns of 50 international banks regressed to the ratio of assets to risk-weighted assets

Source: Thomson Reuters Datastream, financial reports and own calculations

2. Secondly, banks could try to comply with the leverage ratio in the context of their existing equity level by reducing their lending volume, leading to a lower volume of loans also in the economy as a whole.

3. Banks could try to securitise part of their loans so that these loans would no longer feature in their balance sheets. This presupposes that the loans then placed on the capital market would be held by business entities that are not subject to a leverage ratio. The leverage ratio would be adjusted arithmetically, like in the second case, via the volume of bank lending, although in contrast hereto, not the overall lending volume but solely the lending structure (bank-based vs capital-market-based) would change.

All three adjustment responses can be expected to have macroeconomic effects, although these differ significantly in some cases between them. What adjustment responses are to be expected depends on various factors. These include, for example, the existing legal framework, which influences whether or to what extent offloading loans on to the capital market is actually allowed in the first place. A crucial factor is also the time available for adjustment to a leverage ratio that is binding compared with the initial ratio. This timeframe

will be examined more closely below, with the analysis of the macroeconomic effects focusing in this part of the study on the first two adjustment responses.

4.2 Scope for increasing bank equity in the short term

The scope that banks as a whole have for increasing their equity significantly in the short term – within a period of up to eighteen months, for example – to achieve a significant change in the leverage ratio in the context of their existing lending volume may be seen as extremely limited. Generally speaking, three cases can be distinguished. The level of equity in the banking sector could be raised by

1. liquidating other assets, e.g. existing bank deposits or other bank liabilities, and investing them in equity instruments issued by banks

2. accumulating new savings and putting them into equity investments at banks or

3. banks ploughing back profits.

For competition-related reasons, there can be little interest in additional bank equity being held by the state. From a regulatory economics perspective, the same goes for monetary financial institutions (MFIs). Because they are not completely free to choose their asset structure, other financial institutions, including insurance corporations, can be ruled out as well when it comes to directly acquiring ownership stakes in banks. If one leaves aside foreign investment in the German banking sector, only the domestic private household and non-financial corporation sectors are ultimately eligible for acquiring equity interests in banks.

4.2.1   Case 1: Reallocation of financial assets in the economy as a whole

If one first looks solely at the scope for increasing equity in the banking system in the short term through reallocation of financial assets of domestic business entities and if, when doing so, one deliberately does not yet consider recent experience with the performance of bank shares and the impact on changed investment behaviour, it is already evident that the financial asset structures adopted so far mean that this approach is probably subject to narrow limits. At the end of 2008, only around 11% of private household financial assets were invested in shares, other equity and mutual fund units, which in turn also include bond funds (Table 9). Direct private household investment in shares totalled €165.9 billion, or less than 4% of financial assets. What is more, because of the performance of share prices, private households are generally somewhat reluctant to increase the proportion of their financial assets held in shares.

While non-financial corporations hold, overall, more financial assets in the form of shares and other equity, it must be assumed that the scope they have for converting relatively liquid investments at banks into shares and other equity is extremely limited particularly in economically difficult times. In such periods, a number of these corporations tend to display an increased demand for credit. As long as reallocation of financial assets is confined to liquidating claims on banks to acquire equity instruments at banks, other macroeconomic effects can be practically ruled out. While a debt-for-equity swap on the liabilities side of banks' balance sheets might be associated with different profit expectations, it would not affect funding opportunities for other sectors. Reallocation of financial assets entailing the liquidation of other investments to acquire equity instruments at banks would, on the other hand, have secondary effects on other financial markets. The withdrawal of funds might cause financing squeezes there which could have contractionary effects on the real economy. They would depend on two things: on which financial markets the effects outlined occur and which business entities would be affected by such a withdrawal of funds.

Table 9:   Structure of financial assets of sectors at end of 2008 (in € billion)

	Private house-holds[1]	Non-financial corps.	Central, state & local govt.	Monetary financial institutions[2]	Other financial inter-mediaries[3]	Rest of world	All sectors
Monetary gold and special drawing rights (SDRs)	.	.	.	68.4	.	.	68.4
Currency and deposits	1737.5	507.4	198.9	1144.1	802.0	1090.8	5480.7
Money market paper and bonds	1.6	12.4	0.6	88.8	10.2	172.9	286.5
	302.8	85.0	50.7	1415.4	641.5	1601.9	4097.3
Financial derivatives	.	.	1.7	.	1.0	.	2.7
Shares	165.9	655.8	45.5	192.6	249.1	350.9	1659.8
Other equity	178.2	309.2	139.0	108.3	246.2	309.2	1290.1
Mutual fund units	497.2	67.9	20.6	158.9	425.6	35.0	1205.2
Loans	.	204.8	73.3	3436.0	224.6	593.8	4532.4
Claims on insurance corporations	1228.9	44.2	0.7	.	.	73.3	1347.0
Claims arising from company pension commitments	260.9	.	.	.	.	.	260.9
Other claims	39.8	583.1	62.4	258.0	93.3	136.3	1172.9
Total	4412.9	2469.8	593.3	6870.6	2693.3	4364.0	21403.9

1) Including private non-profit institutions
2) Including Deutsche Bundesbank
3) Other financial institutions (particularly securities-based funds and open-ended property funds) and insurance corporations
Source: Deutsche Bundesbank (2009*b*)

4.2.2 Case 2: Equity formation through additional acquisition of financial assets

Building up equity in the banking system in the short term by way of additional saving also only appears feasible to a very limited extent. This is indicated by the funding gaps in the individual sectors of the German economy. A sustainedly positive funding gap (calculated as the difference between saving and asset formation) is displayed only in the private household sector. In 2008, it was just under €136 billion (see Table 10), thus more or less holding the level of previous years. Asset formation in the form of shares, other equity and mutual fund units was actually negative, however, that year. Even if the previous five years are considered for comparison purposes, the result is an average amount of only just over €4 billion for these aggregated positions.

In the case of the sector listed in European statistics as the group of non-financial corporations (mainly companies outside the financial sector), the 2008 figures do not give a representative picture. Asset formation in the form of shares, other equity and mutual fund units was relatively high that year. However, because of the weak asset markets, corporations financed the acquisition of shares by reducing other lendings and increasing borrowings. If one alternatively applies the average of the previous years here, too, a total of just over €38 billion is obtained for the three positions.

If one now takes a look at the scale on which banks (monetary financial institutions (MFIs)) financed themselves externally on an annual basis through shares and other equity, the figure for 2008 is just over €8 billion. At a little over €1 billion, the average figure for the preceding five years was also very low.

An additional obstacle to an increase in bank equity – in the short term at any rate – is a change in investors' attitude towards buying shares. No matter whether equity is increased through reallocation of financial assets or additional asset formation, this obstacle is equally important. It can be assumed that for a certain period of time even after the financial crisis there will be much less confidence in investments in financial instruments than in "normal times". As a result, investors will be particularly reluctant to make a long-term investment in the financial sector such as that constituted by an increase in equity. This must be assumed because private households and non-financial corporations recorded a drop in the value of their share portfolios of over 40% in 2008. If investors assume, in addition, that banks face an increasing adjustment burden associated with a reduction of their earnings power, this adds to the reluctance to acquire equity stakes.

Table 10: Acquisition of financial assets by sectors and its financing in 2008 (in € billion)

	Private house-holds[1]	Non-financial corps.	Central, state & local govt.	MFIs[2]	Other financial inter-mediaries [3]	Rest of world	All sectors
Acquisition of non-financial assets and saving							
Net investment[4]	53.44	67.29	-2.63	-1.55	0.97	.	117.52
Saving	188.94	60.70	-5.96	31.45	7.59	-165.20	117.52
Net lending/borrowing	135.50	-6.59	-3.33	33.00	6.62	-165.20	-
Statistical discrepancy[5]	.	37.11	.	.	.	-37.11	-
Acquisition of financial assets							
Monetary gold + SDRs	120.96	20.81	6.68	21.60	107.53	-54.01	223.57
Currency and deposits	-0.09	-14.33	0.20	15.71	-1.67	47.84	47.66
Money market paper	-7.99	2.20	38.94	40.91	-28.73	23.26	68.58
Bonds	.	14.41	-0.04	12.78	-1.59	.	25.56
Financial derivatives	-45.50	128.77	0.07	-24.48	-22.33	-45.53	-9.01
Shares	3.05	21.98	13.61	6.61	-22.30	13.73	81.27
Other equity	5.60	-7.81	0.05	-16.63	-25.29	-5.82	0.69
Mutual fund units	.	32.10	11.77	131.72	7.53	60.34	243.46
Loans	41.11	0.36	0.02	.	.	-1.79	39.71
Insurance	5.75	.	.	.	.	.	5.75
Pension provisions	-2.76	-74.06	-8.63	43.41	4.78	12.06	-25.21
Total	120.12	124.43	62.67	231.65	113.11	50.06	702.03
External financing							
Currency and deposits	.	.	3.58	182.34	5.60	32.04	223.57
Money market paper	.	3.65	5.57	53.10	2.84	-17.50	47.66
Bonds	.	5.97	35.37	-70.85	76.68	21.40	68.58
Financial derivatives	.	.	.	.	.	25.56	25.56
Shares	.	3.57	.	2.59	0.29	-15.47	-9.01
Other equity	.	13.59	.	5.69	-0.23	62.23	81.27
Mutual fund units	.	.	.	-12.15	4.24	8.61	0.69
Loans	-15.40	71.36	21.03	.	42.00	124.48	243.46
Claims	.	.	.	.	39.64	0.07	39.71
Insurance corps.	.	1.26	.	4.33	0.16	.	5.75
Pension commitments	0.02	-5.48	0.44	33.60	-64.74	10.95	-25.21
Total	-15.38	93.91	66.00	198.65	106.49	252.36	702.03
Net acquisition of financial assets[6]	135.50	30.51	-3.33	33.00	6.62	-202.31	-

1) Including private non-profit institutions
2) Credit institutions including Deutsche Bundesbank. building and loan associations and money market funds
3) Other financial institutions (mainly securities-based funds and open-ended property funds) and insurance corporations.
4) Including net receipt of non-produced financial assets
5) Net acquisition of financial assets less net lending
6) Net acquisition of financial assets less external financing   Quelle: Deutsche Bundesbank (2009*c*)

4.2.3 Case 3: Equity formation through profit retention

It is also conceivable that banks could build up additional equity using retained earnings. However, this is particularly difficult in the present crisis due to the profit squeeze. Banks' earnings situation changed dramatically in 2008, for example. Whilst in 2007 they recorded net income for the year of €20.5 billion before tax and €14.6 billion after tax, in 2008 they posted a net loss of €25 billion before tax and €26.3 billion after tax (Bundesbank 2009*b*). This was the case, although banks obtained sizeable funds by liquidating reserves. If the five years prior to 2008 are taken for comparison purposes here, too, the result is annual net income of €18.7 billion before tax (€12.3 billion after tax). This makes clear that no substantial amounts can be expected from ploughing back profits in the short term, particularly close to the financial crisis. Even though there was a marked improvement in the earnings performance of German banks in 2009, the valuation adjustments still expected mean that there is unlikely to be any significant potential in the short term for increasing equity to obtain a reduced leverage ratio.

With regard to the scope that German banks have in the short term for adjusting their actual leverage ratio to a lower regulatory leverage ratio through an increase in equity, the following conclusion can be drawn: Neither any conceivable conversion of bank debt into equity nor any additional saving or asset formation nor any profit retention can generate significant amounts in the short term. This is true particularly as the worst of the financial crisis is not yet long over and the uncertainty felt by investors remains relatively strong.

4.3 Adjustment of the actual leverage ratio to a lower regulatory leverage ratio in the short term through a reduction in lending volume: basic options

The discussion of the scope that banks have for increasing their equity in order to adjust their actual leverage ratio to a more restrictive regulatory leverage ratio shows that this option can be virtually ruled out in the short term. The following section looks at whether banks could respond to a more restrictive leverage ratio by reducing their lending volume and what effects this might have.

In order to examine the principal economic effects of a significant limitation of lending volume, a worst-case scenario was assumed in which no increase in equity is possible in the short term and no loans are offloaded from banks' balance sheets on to the capital market. The potential for, and effects of, a reduction in bank lending are thus studied here separately. That banks react exactly in this way is claimed by a number of authors of scholarly literature to be the result of higher equity requirements when the short-term effects are examined[27].

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[27] See, for example, Thakor (1996). Santos (2001) and VanHoose (2008) give an overview of various works on the impact of equity requirements on banks' behaviour.

A look was taken first at the extent to which banks can actually reduce their lending volume in the short term if required. Figures on bank loan maturities can provide initial information in this respect. Table 11 contains an overview. The figures in this table, which refer to the total value of loans provided by banks in Germany and their foreign branches, show that the majority of loans are long-term. Only 17% of all loans are short-term. If one assumes that the breakdown of loans against securities into medium and long-term loans corresponds more or less to the structure of current account lending, it can be calculated that medium-term loans account for just under 14% of lending and long-term loans for nearly 70%.

If one applies the scenarios set out in Section 2.3, one can gain an idea of the extent to which banks can manage to adjust their actual leverage ratio to a different regulatory leverage ratio through a reduction in lending. As Table 12 shows, in Variation 1 lending volume would have to be reduced by around 8% to lower an assumed initial leverage ratio of 38 to 35. While this would be possible in purely arithmetical terms by not renewing all short-term loans in the banking system, it can be ruled out, as it must be assumed that many short-term loans serve to provide liquidity needed for payments processing. Even if just the majority of these loans were not renewed, a serious disruption of payments processing could not be ruled out. In the other variations set out in Table 12 (regulatory leverage ratio of 33, 30 and 25), lending volume would have to be reduced by as much as 34.2%.

How long would adjustment of the actual leverage ratio level to alternative regulatory levels take if the approach adopted for this purpose were a reduction in lending volume? It is assumed here, for simplicity's sake, that when adjusting lending volume only half of short-term loans are available for a reduction in lending volume so as to avoid at least the above-mentioned friction in the supply of short-term liquidity and thus in payments processing. As the final column in Table 12 shows, this would require non-renewal of all other short-term loans and all maturing medium and long-term loans for a considerable period of time. Even the relatively moderate Variations 1 and 2 (reduction of the leverage ratio from 38 to 35 or 33) would mean that half of all maturing short-term loans and all maturing medium and long-term loans would no longer be renewed for the greater part of a year. The bigger the difference between the actual leverage ratio and the regulatory leverage ratio, the more likely it is that one year will not be enough to achieve adjustment to the regulatory leverage ratio. Adjustment to the regulatory leverage ratio of 30 (Variation 3) or 25 (Variation 4) would mean non-renewal of maturing loans for a period of between twelve and more than eighteen months respectively. This dramatic trend would be reinforced if achieving a reduction in lending to the public sector or – put the other way round – if the state meeting its demand for credit also in the banking sector were to be ruled out. It should be stressed here, by way of qualification, that these calculations are purely hypothetical since, among other things, the

macroeconomic impact of such a long lending contraction, with its repercussions on lending volume, is not taken into account.

Table 11: Lending by banks in Germany (up to October 2009; in € billion)

	Total	Short-term loans[1]	Medium and long-term loans[2]				
			Total	Current account loans			Securities[3]
				Total	Medium-term	Long-term	
Loans by banks in Germany to non-banks	3 953.2	521.8	3 431.3	2 694.2	384.3	2 309.9	737.1
Share of loans by banks in Germany to domestic banks Share of current account loans to domestic banks	100.0%	13.2%	86.8%	68.2%	9.7%	58.6%	18.6%
Loans to foreign banks[4]	1 739.8	371.3	1 368.5	784.9	163.3	621.6	583.6
Loans by foreign branches[5]	100%	21.3%	78.7%	45.1%	9.4%	35.7%	33.5%
	1 278.7	272.9	1 005.8	576.9	120.0	456.9	428.9
	1 333.1	209.1	1123.9	814.7	128.2	686.5	309.3
Total Share	8 304.8 100.0%	1 375.1 16.6%	6 929.5 83.4%	4 870.7 58.6%	795.8 9.6%	4 074.8 49.1%	2 058.9 24.8%

1) Term or notice period of up to one year.
2) Medium-term loans are those with term or notice period of over one year and up to and including 5 years; long-term loans are those with term or notice period of over 5 years.
3) In the case of loans to foreign banks: including negotiable money market paper.
4) Breakdown estimated on basis of assumption of same maturity structure as for lendings to domestic banks.
5) Breakdown estimated on basis of weighted maturity structure of loans by banks in Germany to non-banks and domestic banks.
Source: Deutsche Bank (2010*f*) and own calculations

Thus, for example, because of the effects on macroeconomic aggregates which will be examined below, a loan non-renewal policy operated for a period of twelve to eighteen months appears virtually inconceivable.

Drastically restricting the supply of credit in the short term can also have various structural effects. First of all, the interest-inelastic loan demand that is typically assumed for the state may have crowding-out effects on private households and enterprises, so that the short-term adjustments in lending volume are larger in their case and the macroeconomic borrower structure may also change as a result.

Table 12: **Required change in lending volume (in absolute and relative terms) to adjust leverage ratio**

	Leverage ratio	Change in lending volume[1]		Required reduction in lending[2]
		Absolute (in € billion)	in percent	
Currently	38	-	-	-
Variation 1	35	-656	-7.9	37%
Variation 2	33	-1 093	-13.2	61%
Variation 3	30	-1 748	-21.0	98%
Variation 4	25	-2 841	-34.2	159%

1) Measured against lending volume of €8. 305 billion referred to in Section 2.3 and on the assumption that medium-term loans are spread evenly over the term of 1-5 years and average life of long-term loans is 8 years.

2) On the assumption that only 50% of short-term loans to ensure payments processing were used for the reduction; on this basis, an estimated 21.5% of lending volume – based on the figures for October 2009 – would theoretically be available.

Source: Own calculations

Secondly, it can happen that significant reductions in lending are spread unevenly across enterprises of different size categories. It is therefore possible that smaller enterprises may have trouble obtaining or renewing loans because their negotiating position on the credit market is usually weaker. In Germany, small and medium-sized enterprises (the so-called *Mittelstand*) in particular would probably be hit much harder in the short term than large companies.

Thirdly, it can be assumed that banks which have to reduce their lending volume within a short time will not do so evenly across all sectors of the economy. They will instead focus more strongly on those sectors in which lending is relatively high. Moreover, they will tend to reduce their lending volume in those sectors in which loans have shorter terms. Table 13 illustrates by way of lending to domestic enterprises that the maturity structure of loan books does differ between the different sectors. Borrowing in, for example, the engineering and vehicle construction sectors is relatively less long-term than in, for instance, the construction and housing sectors.

The figures in Table 13 indicate that a reduction in lending can have a quite different impact in different business sectors and may thus also trigger structural effects on the real economy. These figures do not, however, show how hard the individual sectors would be hit by a reduction in lending, as they also depend on how high borrowing in these sectors is in relation to value added.

Table 13: Lending to domestic enterprises by business sector and maturity (in € billion)

	Lending volume[1]				Year-on-year change			
	Total	Short-term loans	Medium-term loans	Long-term loans	Total	Short-term loans	Medium-term loans	Long-term loans
Total lendings	1347	297	170	880	+14.7	-8.4	+16.6	+6.5
Manufacturing	155	46	32	77	-0.3	-6.4	+7.2	-1.0
Chemicals	12	4	3	5	-0.7	-2.0	+1.0	+0.2
Rubber, plastics	10	4	2	4	-0.3	-0.2	-0.3	+0.2
Glass, ceramics	6	2	1	3	-0.5	-0.4	-0.2	+0.1
Metals/fabric, metal prods.	25	7	4	15	+0.7	+0.0	+0.3	+0.4
Machinery, vehicles	43	14	15	14	+5.6	-2.0	+7.1	+0.5
Electrical/optical equip.	13	4	2	7	-1.6	-0.8	-0.2	-0.6
Wood, paper, printing	22	5	2	15	-3.9	-1.8	-0.6	-1.5
Textiles, clothing	5	2	1	2	-0.4	-0.3	+0.1	-0.1
Food, tobacco	19	6	2	11	+0.7	+0.9	+0.0	-0.2
GEW supply, mining	63	5	4	54	+8.2	+0.4	+2.1	+5.8
Construction	63	15	9	39	+2.3	+1.3	+1.2	-0.1
Whole./ret. trade, MV repairs	126	44	13	69	-7.9	-6.1	-0.6	-1.2
Agriculture, forestry	36	4	3	29	+1.3	+0.1	+0.2	+1.0
Transport, communication	74	7	14	52	+1.7	+0.5	+0.3	+1.0
FIs (excl. banks)	166	98	22	46	+23.5	+11.0	+4.3	+8.2
Services	664	77	72	515	-14.0	-9.0	+2.0	-7.1
Housing enterprises	181	12	8	161	-2.3	-1.6	-0.5	-0.3
Holding companies	50	15	10	24	+0.0	-0.3	+1.5	-1.2
Other RE enterprises	172	16	22	135	-0.3	-3.2	+2.8	+0.2
Hotels/restaurants	22	2	2	18	-0.1	-0.2	+0.1	-0.1
Computer & rel. activities	90	16	10	65	+0.8	+0.1	-0.3	+1.0
Health, social work	74	5	5	64	-0.1	+0.1	+0.2	-0.4
Letting of movables	24	5	10	10	-2.5	-0.9	-0.3	-1.2
Other services	51	7	6	38	-9.6	-3.0	-1.5	-5.1

1) Up to September 2009

Source: Deutsche Bundesbank (2010*f*) and own calculations

4.4 Impact of short-term adjustment of the leverage ratio: qualitative and quantitative considerations

The above reflections make clear that any adjustment of the leverage ratio in the German banking system would have to be accompanied in all scenarios considered by a drastic reduction in lending volume. Given the extent to which lending would be restricted, it must be asked what effects on macroeconomic parameters such as investment, growth and employment are likely.

It would first have to be asked, as part of a qualitative analysis, through which interdependencies a lending contraction affects economic aggregates. Following the qualitative analysis, the quantitative effects of a reduction in lending volume need to be assessed. The focus here is on the short term, so that other ways of adjusting the actual leverage ratio to a more restrictive regulatory ratio are ruled out.

If the envisaged reduction in banks' lending volume leads to a significant restriction of the supply of credit, the real economy may be affected as well via various interdependencies. They are similar to those that would arise in the case of a tight monetary policy. Where such a

policy is adopted, a given transmission mechanism is assumed via which the use of certain central bank instruments has an effect on the real economy. In the case of a lending contraction – as described above – to adjust to tighter banking regulation in the short term, it is assumed that, while monetary policy remains unchanged, the same monetary policy entails at least a quantitatively different transmission mechanism.

A direct chain of effects on the real economy is created already by banks' more restrictive lending policy ("lending channel"), as less borrowing means in turn less demand from consumers and investors. Restricting the supply of credit also leads to higher interest rates on the credit market. The accompanying real interest rate increase causes both consumer demand and investor demand to decline ("interest rate channel"). Both these direct impact channels can be reinforced by means of additional indirect impact mechanisms. For companies, for example, an interest rate increase makes financing existing debt more expensive and thus reduces their return on equity. This strengthens the effect of rising interest rates on investor demand ("financial accelerator"). Effects on the real economy via international trade relations are also conceivable. If, for example, the interest rate increase triggers inflows of capital from abroad, this tends to lead to revaluation and to a deterioration in the trade balance, with corresponding negative effects on domestic growth ("exchange rate channel"). In the event of an interest rate increase, it must also be assumed that households and enterprises will try to finance themselves by selling other assets. This tends to lead to a fall in asset prices, so that investors' assets drop in value and there are corresponding negative effects on demand for goods ("asset channel"). It could also be argued in this connection, by reference to Tobin's q theory, that corporate equity financing becomes more difficult and, as a result, the decline in investor demand is reinforced. All these factors reduce the demand for goods in the economy as a whole, creating contractionary effects on output and employment.

Besides the impact of a reduction in lending volume on output and thus indirectly on employment considered so far, there are also implications for the public sector. If there is a drop in growth, with a corresponding impact on employment, this produces three basic effects on the public sector. Firstly, the decline in growth leads to a loss of income in the form of less tax revenue. Secondly, the state faces additional spending in connection with higher unemployment. Thirdly, in the event of an interest rate increase, public spending will also rise due to the higher interest burden for existing public debt. As an effectively interest-inelastic demand for credit can be assumed for the state in the short term, the public sector will probably be hampered less than enterprises in its ability to borrow by the reduction in bank lending. At the same time, the state's interest-inelastic demand for credit means that the expected interest rate increase following a reduction in lending volume is reflected relatively clearly in a higher interest burden. Depending on which part of existing public debt falls due

in the short term and therefore requires follow-up funding, interest payments by the state on existing debt increase.

At this point, a quantitative assessment of the economic consequences of a short-term leverage ratio adjustment is now conducted. Research on the questions to be examined in this connection is still at a relatively early stage, so that no sound and reliable findings are available. This study therefore develops in the following section an approach providing an indication of the economic effects of a reduction in lending as a result of the introduction of a regulatory leverage ratio, with special emphasis on the situation in Germany.

The approach adopted here is an 'event study' approach. For this purpose, phases of a marked decline in lending to the private sector are examined in order to evaluate typical response and development paths of economic variables before and after such a lending contraction. Overall, the study analyses the situation in Germany, the US, Canada, the UK, France, Spain and Italy during the period 1980-2008. These countries are the G8 members, minus Japan, where the data available for the study is unsatisfactory. A further European industrial country, Spain, is included in its place.

Before examining lending contraction phases, it must first be established what exactly is meant by such a phase. As there are different ways of doing so, it is no surprise that the relevant empirical literature does not adopt any uniform approach on this question either. It must also be determined how the beginning and the end of such a phase is defined. We believe that two alternative definitions of a lending contraction phase make sense:

Lending contraction – definition 1: A lending contraction phase exists if at least two quarters in which the real volume of lending (to the private sector) displays positive growth rates are followed by at least two quarters in which real lending volume drops. The beginning of a lending contraction phase defined in this way is the start of the first quarter of the decline in lending volume. The lending contraction phase is deemed to be over if the real volume of lending increases in at least two quarters compared with the previous quarter.

Lending contraction – definition 2: A lending contraction phase is characterised by a drop in the real volume of lending (to the private sector) to GDP ratio and a simultaneous decline in real lending volume. Under this definition, the beginning of the lending contraction phase is the beginning of the quarter in which this condition is fulfilled. The lending contraction phase is deemed to be over if either of these criteria no longer applies for at least two quarters.

An argument for using the first definition is that phases of a decline in lending volume generally create periods in which the economy faces corresponding financial limitations.

However, it may be that the decline in lending merely reflects the fact that following a recession demand for credit also drops and, as a result, growth causality is geared to demand for credit. This argument takes into account the second definition, in which ultimately only phases in which the volume of lending declines more strongly than GDP are examined.

It should be noted, by way of qualification, that under both definitions phases in which a lending contraction is triggered by an economic downturn cannot be distinguished clearly from phases in which the trigger is on the credit supply side. This is, however, a problem associated with all criteria for defining lending contraction phases. The present study therefore adopts the strategy of conducting further analyses for both definitions in parallel. The use of both criteria also serves in this connection to test the robustness of results.

Taking both definitions as a basis, exactly 30 lending contraction phases (events) can be identified for the seven selected countries during the period 1980-2008. Applying the above definitions, particularly serious lending contraction phases are designated as "strong lending contractions"[28]. Specifically, this means:

Strong lending contraction – definition 1: A strong lending contraction is deemed to exist if a lending contraction is among the 25% worst cases under the first lending contraction definition above. The beginning and end of a strong lending contraction phase are the same as under the first lending contraction definition above.

Strong lending contraction – definition 2: A strong lending contraction is deemed to exist if a lending contraction is among the 25% worst cases under the aforementioned second lending contraction definition. The beginning and end of this strong lending contraction phase are the same as under the second lending contraction definition above.

It must be stressed that the definition of a strong lending contraction used here does not make any distinction as to whether the reduction in lending volume is triggered by the credit supply side or the credit demand side. Caution is therefore called for when interpreting the results. A strong lending contraction triggered by the supply side is often referred to as a "credit crunch". It should, however, also be borne in mind in this connection that it is virtually impossible to identify credit crunches using a simple criterion. Even if one examines only a single phase in detail, it is ultimately very difficult to judge whether a situation triggered by the supply side is actually involved. This is illustrated by the discussion on the credit market in

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[28] This definition follows the approach adopted by Claessens, Kose and Terrones (2008).

Germany in 2009/2010[29]. In the present study, the relatively simple definitions serve to operationalise the quantitative analysis.

Application of the aforementioned definitions produces exactly 8 strong lending contraction phases for the group of countries examined during the period in question. If one compares the reduction in lending which, as explained above, is needed for compliance with a regulatory leverage ratio in the short term with the size of the lending contraction that occurred in the lending contraction phases identified in the countries examined, they would fall under the group of worst lending contraction cases. By focusing on the 25% worst cases, it can be presumed that episodes are thus considered in which the supply side of the credit market was also responsible for the contraction in lending volume. The focus in the following section is therefore on examining strong lending contractions.

The event study conducted here concentrates on the performance of economic variables in the first quarters following the start of a strong lending contraction. It shows that the results obtained using the two different definitions of a strong lending contraction differ only slightly qualitatively. The economic effects discussed in the following section therefore focus on only one of the definitions. To be specific, the results obtained using the first definition are shown. The solid line in Figure 10 illustrates for the strong lending contraction cases identified the trend in lending volume before and after the start of the lending contraction. The growth rates shown are in each case rates of change in the relevant quarters compared with the same quarter of the previous year. They are thus year-on-year rates. At the same time, only real lending volumes and their rates of change are considered. The upper and lower lines show the average trends, which are a standard deviation above or below the average in the events examined. The trends show that in the strong lending contraction phases, based on distinctly positive average annual growth in lending volume (over 8%), there was a sudden drop in lending in the first four quarters. In the fourth quarter after the start of the strong lending contraction the decline in lending volume – calculated on an annual basis – was around 7% on average. The growth rate subsequently improved again from a distinctly negative level, without being accompanied by any significant increase in lending volume.

Figure 11 shows the trend in the GDP growth rate accompanying the strong lending contraction. The trend is similar to that for lending volume. There is an immediate sharp decline in economic growth in the first four quarters. Compared with the average for the eight quarters before the start of the strong lending contraction, the growth rate declines by 2.6 percentage points, touching bottom in the fifth quarter. It subsequently rises again, with

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[29] See, for example, Deutsche Bundesbank (2009*a*), *Developments in lending to the private sector in Germany during the global financial crisis*.

the result that it regains the level of the eight quarters before the start of the strong lending contraction after ten quarters. It can be deduced from this that a significant decline in lending volume over a period of one year is accompanied by a decline in growth lasting approximately 2½ years.
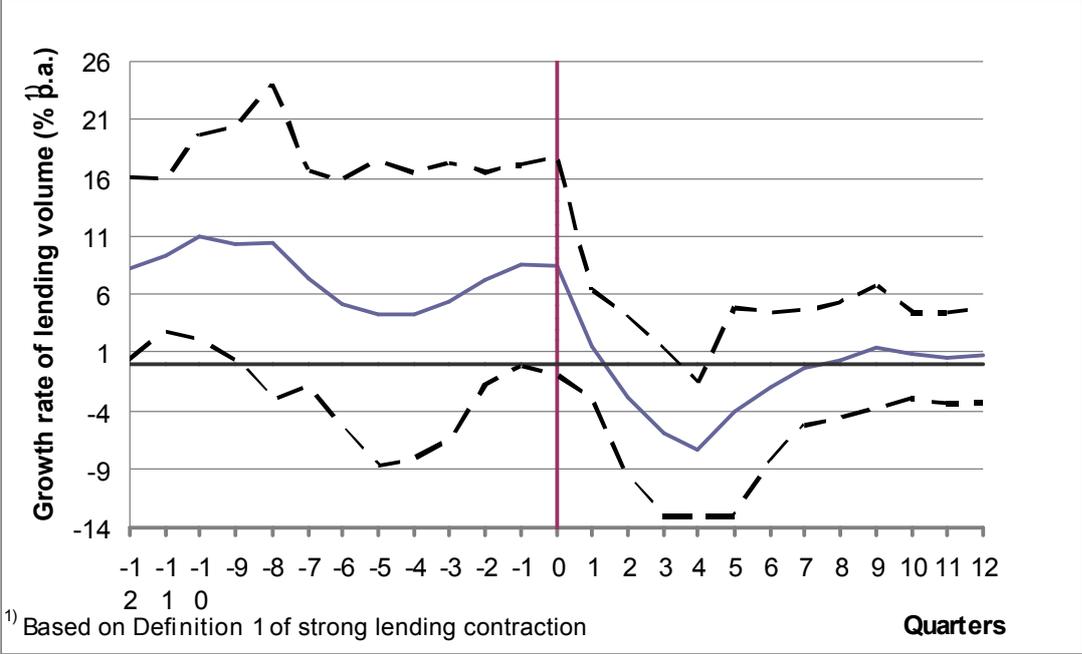
Figure 10: Development of lending volume before and after start of strong lending contraction
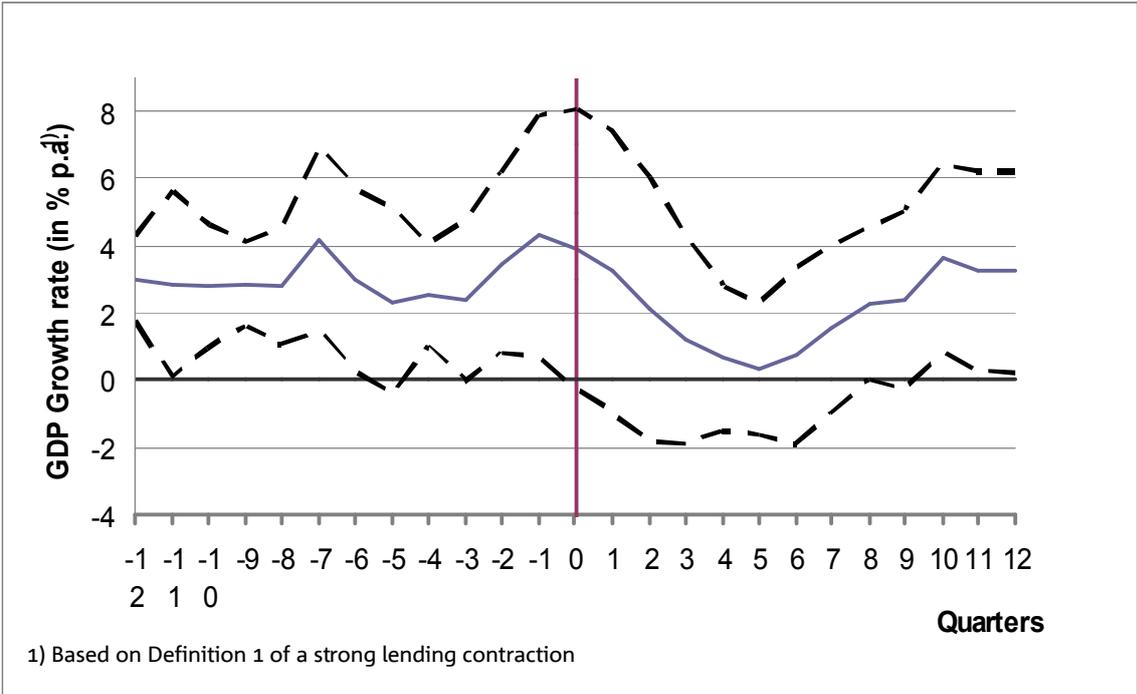
Figure 11: Development of GDP before and after start of strong lending contraction

Figure12 shows the trend in public consumption around a strong lending contraction phase. Following the start of the strong lending contraction, public consumption also displays – on a delayed basis – declining growth rates which, while less abrupt compared with the trend in GDP, are comparable in size up to the bottoming-out point.
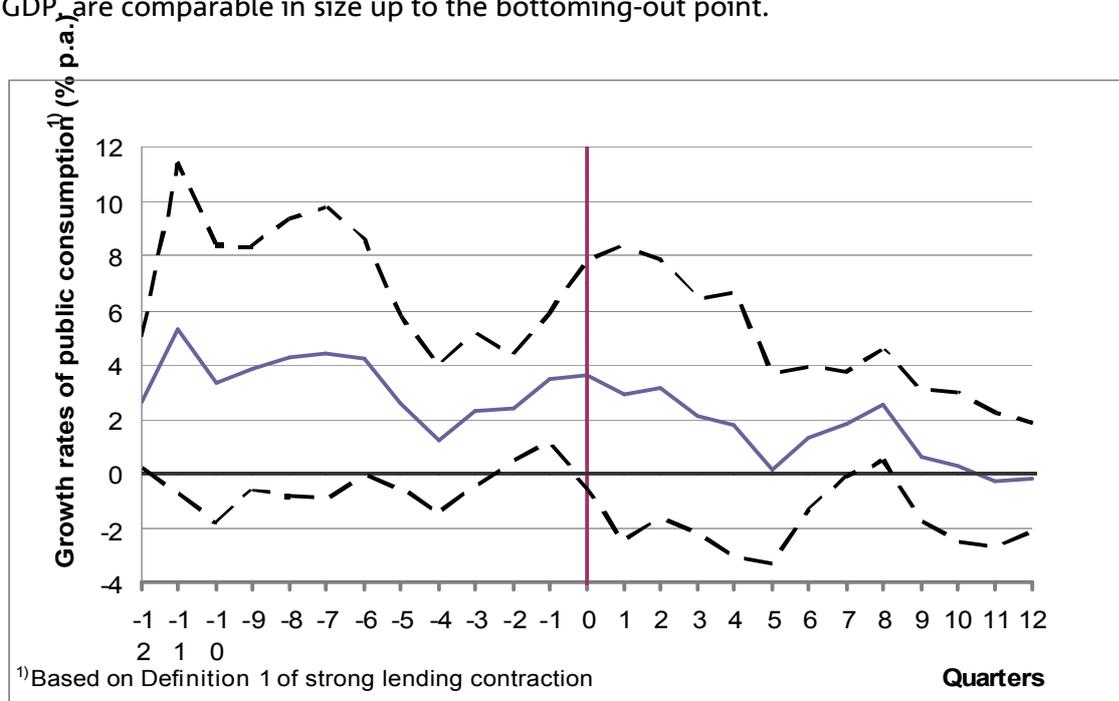

Figure 12: Development of public consumption before and after start of strong lending contraction

Figure 13 shows the average trend in the unemployment rate. As expected, there is a delayed reaction here. Following the start of the strong lending contraction, the unemployment rate does not change on average during the first two quarters. Thereafter, it starts to climb and continues to do so even when the GDP growth rate is already rising again. Averaged across the cases examined in the event study, the unemployment rate is still around two percentage points higher than the initial rate three years after the start of the strong lending contraction.

The trend in private consumption differs greatly between the individual cases examined. This is reflected in the pattern of the upper and lower lines in the first five quarters (Figure 14). The differences could be due to, among other things, different automatic stabilisers and different countercyclical fiscal policy programmes for the cases examined. If one considers the average of the cases, the growth rate starts to decline two quarters after the start of the strong lending contraction. It may be assumed that the increase in unemployment then also begins to have an effect on private consumer spending. After touching bottom in the sixth quarter, the private consumption growth rate then rises slightly again.
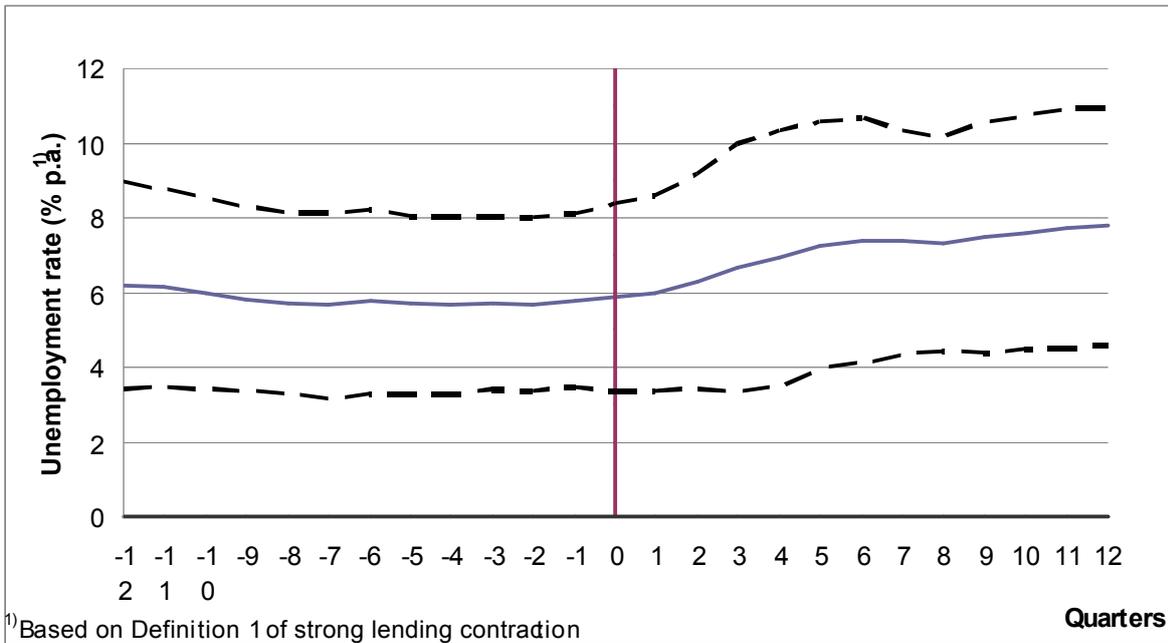
Figure 13: Development of unemployment rate before and after start of strong lending contraction
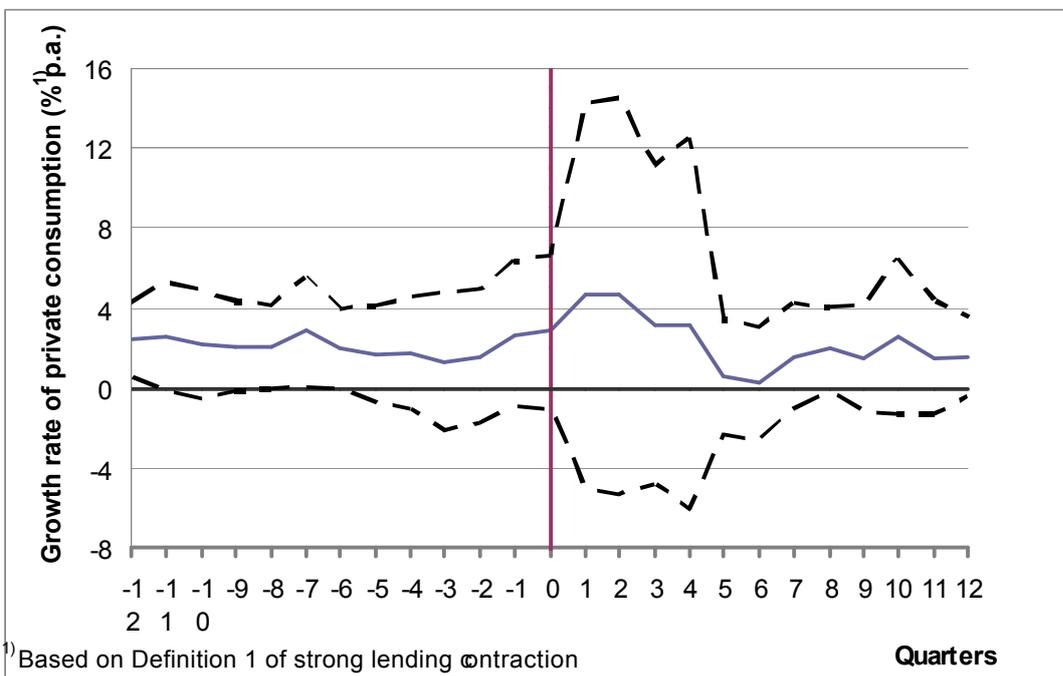
Figure 14: Development of private consumption before and after start of strong lending contraction

A look at the long-term interest rate shows that there are widely differing effects between the individual countries (Figure 15). The interest rate rises already before the strong lending contraction and subsequently remains on a higher level. It may be assumed that two contrary effects are reflected in the merely moderate overall interest rate increase. For one thing, there is upward interest rate pressure due to the tighter supply of credit. For another, the decline in

economic growth leads to an induced reduction in demand for credit, which dampens the interest rate upturn.

Figure 15: Development of long-term interest rate before and after start of strong lending contraction

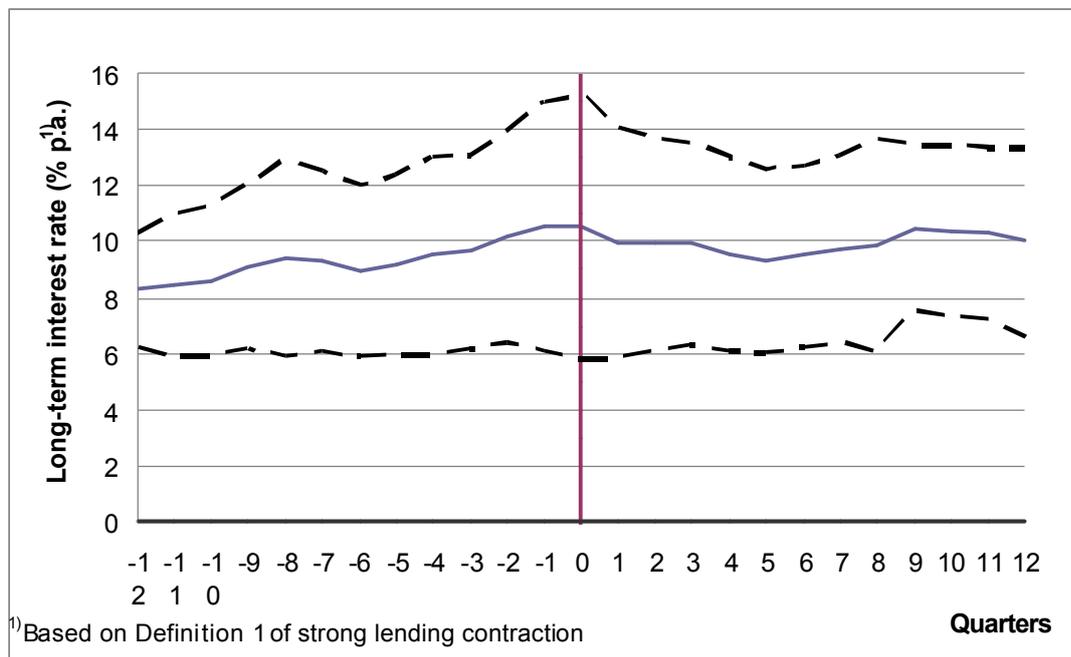Figure 16 shows that investment reacts directly to the strong lending contraction. In the first four quarters after the start of the strong lending contraction the investment growth rate drops to an average figure of zero, although here, too, the reaction varies greatly between the individual events. After four quarters investment growth is around 1.6 percentage points lower compared with the eight quarters before the strong lending contraction.

Several of the trends outlined also influence the public finances situation. Less growth results in less revenue for the state and the social insurance institutions, whereas more unemployment means more spending by both. Climbing interest rates lead, in addition, to higher public spending equivalent to the extent to which the state has to arrange follow-on financing of its debt. Taken together, these trends explain why the state's budget situation deteriorates. How much it deteriorates is influenced by the social insurance schemes and the automatic stabilisers.

If one uses the above-mentioned alternative definition of a lending contraction and strong lending contraction phase in the present event study, the resulting effects are similar. This indicates that – at least for the average of cases – the average effects outlined here are relatively robust with regard to the criterion for such phases.
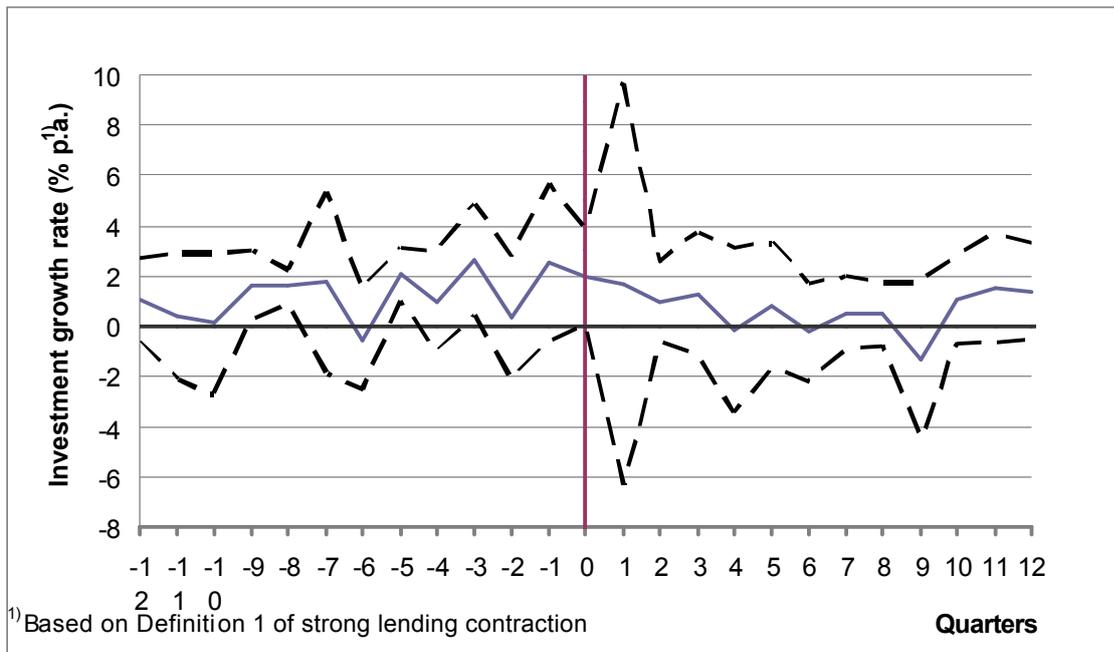
Figure 16: Development of investment before and after start of strong credit contraction

To apply the results of the event study to an assessment of the economic effects caused by the introduction of a leverage ratio for banks in Germany, it must first be assumed that the reactions determined by the study can be more or less transposed to Germany. Although this cannot automatically be assumed, such an assumption nevertheless appears justified if one wishes to pursue the approach of drawing a comparison with other lending contraction episodes. Moreover, the following section is not concerned with accurately projecting expected changes in economic parameters but with assessing the size of selected effects. Country-specific factors, such as those that must be assumed for the labour market reaction for example, are thus deliberately ignored.

If one simulates the case of a significant reduction in lending volume due to a short-term adjustment of the actual leverage ratio to a lower regulatory leverage ratio, this produces the effects shown in Table 14. For simplicity's sake, proportionality of effects is assumed, i.e. doubling the reduction in lending volume doubles the effect of the individual changes in the relevant economic parameters. Furthermore, the change in lending growth in the four variations takes into account that the required lending contraction is not based on existing zero growth, but on an observed real lending volume growth rate of around 1.5% p.a. for the period Q2 2007 to Q2 2009. The projections show that even in the more moderate variations in leverage ratio change (Variations 1 and 2) any short-term adjustment called for, which can then be made solely by limiting lending volume, is likely to lead to a considerable decline in growth and significant changes in unemployment and investment momentum. For example, the growth rate drops by 1.5 percentage points in Variation 1 and by 2.4 percentage points in Variation 2. In Variations 3 and 4, the effects are correspondingly more serious. Here, the GDP

growth rate drops by 3.7 and 5.9 percentage points respectively, and the unemployment rate rises by 2.3 and 3.6 percentage points respectively. These effects occur within 24 months if the alternative lending contractions take place within 12 months. In the case of Variations 3 and 4, it has already been shown above that a much stronger reduction in lending volume is required here if adjustment to a lower leverage ratio is to be made within the short period in which only the option of a change in lending volume is available to banks.

Table 14: **Change in growth rates of selected economic parameters following short-term reductions in lending to meet alternative leverage ratio levels in first year after start of strong lending contraction** (all figures in per cent; interest rates in percentage points)

	Growth in lending	Economic growth	Unemploy-ment	Investment	Long-term interest rate
Event study (25% worst cases)	-15.8	-2.6	+1.6	-1.6	+0.2
Variation 1 (Adjustment of actual leverage ratio from 38 to 35)	-9.4	-1.5	+1.0	-1.0	+0.1
Variation 2 (Adjustment of actual leverage ratio from 38 to 33)	-14.7	-2.4	+1.5	-1.5	+0.2
Variation 3 (Adjustment of actual leverage ratio from 38 to 30)	-22.5	-3.7	+2.3	-2.3	+0.3
Variation 4 (Adjustment of actual leverage ratio from 38 to 25)	-35.7	-5.9	+3.6	-3.6	+0.5

Source: own calculations

4.5 Assessment of adjustment periods without any reduction in lending volume

Simulation of the effects of a reduction in lending to obtain a correspondingly higher level of equity backing makes clear that the economic price of requiring quick adjustment would be very high. This makes it advisable to extend the tolerated adjustment times to allow adjustment also by building up equity. A supporting argument here is the fact that a very significant reduction in growth and a significant increase in unemployment may lead to further system instability. The danger of this cannot be denied particularly if at the starting point for the change in regulation – as is the case in Germany at the beginning of 2010 – there has already been a heavy slump in growth along with an actual decline in GDP.

Against the backdrop of these clearly negative effects, which would be unavoidable in the short term if adjustment to a regulatory leverage ratio has to be achieved relatively quickly, there is much to be said for spreading the adjustment process over a period of several years. In this case, it would be possible to achieve at least part of the adjustment of the actual leverage ratio through an increase in equity. If one leaves aside mere reallocation of existing financial assets as a source of additional bank equity, two equity formation options are left: funding new equity by building up additional assets (issuing new shares) and ploughing back profits.

How long would an adjustment of the current leverage ratio to alternative regulatory levels take if such adjustment were made without reducing lending volume but solely by building up equity? The time needed depends on the scale on which new shares are/can be issued and profits are/can be ploughed back annually within the banking system. Assumptions about this involve a high degree of uncertainty. This is because, for one thing, it may be very difficult for banks to issue shares after the crisis. For another, it is difficult to estimate how high profits will be in the banking sector in the future. In the following section, different scenarios are therefore examined in order to determine the length of possible adjustment periods.

The scenarios used have been kept relatively simple. In all scenarios, it is assumed that adjustment is made solely by building up equity. It is also assumed that the real volume of lending grows by around 1.5% annually, which is more or less equivalent to the growth rate in 2009. The result of this is that part of the equity build-up is needed solely to maintain a certain leverage ratio level. This only remains constant in the face of an increase in lending volume if equity also increases at the same rate. All calculations in the following section are based on real parameters (in 2009 prices). This means that the amounts calculated do not take into account inflation effects on either lending or equity. Such an approach is based on the assumption that general price increases are reflected in lending volume in the same way as in the funds from which an increase in equity can be obtained. On the basis of this assumption, price increases alter the amount of the funds to be raised but not the adjustment period.

To assess the scale of equity formation, the following three scenarios are used:

1. Scenario I: Adjustment through "normal-sized" share issues. In this case, it is assumed that equity is adjusted approximately on the scale of banks' external financing in the form of share offerings and other equity in 2008. This means that they accumulate around €8 billion worth of equity annually from these two sources.

2. Scenario II: "Normal-sized" share issues, plus profit retention. It is assumed here that, in addition to external financing in the form of share offerings and other equity assumed in

Scenario I, banks plough back €5 billion in profits. The latter amount is equivalent to just under 30% of the average annual profits during the period 2003-2007. A total of €13 billion worth of equity can be built up annually in this way.

3. Scenario III: Larger share issues and higher profit retention. Compared with Scenario II, this scenario assumes additional share offerings and more extensive ploughing back of profits. Together, they allow an additional €5 billion worth of equity to be accumulated annually. As a result, annual equity formation would amount to €18 billion annually.

Table 15 provides an overview of the adjustment periods produced on this basis. The scenarios make clear that adjustment of the leverage ratio to alternative regulatory levels requires a considerable period of time if a reduction in lending is to be dispensed with. Only in Variation 1, in which it is assumed that the regulatory leverage ratio merely requires adjustment of the current level from 38 to 35, are the adjustment periods between "only" 1.5 and 5.4 years[30]. Where the leverage ratio is set at 33, the adjustment period already increases from just under 3 years (Scenario III) to nearly 10 years (Scenario I). In Variations 3 and 4, it is to be expected that, even where efforts to accumulate equity exceeding those in previous years are made, a considerable period of time would elapse until sufficient equity has been built up. Even in Scenario III, in which annual equity formation is strongest, the process of adjustment to leverage ratios of 30 or 25 takes between 5 and 11 years. Overall, the banking system consequently faces considerable demands if, on the one hand, real lending volume is not to decline and, on the other hand, equity requirements are changed to align with the alternative levels discussed here. If one, for example, assumes a regulatory leverage ratio of 30 and the quickest adjustment scenario here, this requires building up just under €90 billion worth of equity within the approximately 5-year adjustment process. If one takes instead a regulatory leverage ratio of 25 and again applies the quickest adjustment scenario, over €180 billion worth of equity would have to be built up within the approximately 10-year adjustment process.

The length of the adjustment periods calculated may also be influenced by various factors. Three factors appear particularly important here. The first factor involves the assumption that lending is not transferred out of the banking system by way of securitisation. Were this to be the case, the growth in lending and thus the required equity formation would be lower. This means that the adjustment period could be shorter. This is not certain, however, as assuming that the banking system will then accumulate basically the same funds for increasing equity is not unproblematic. It is quite conceivable that if loans are shifted more strongly to the capital market share issues will become more difficult. The second factor is connected with the scale

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[30] An IMF estimate by Tressel (2010) arrives at a similar result: A 1% reduction in lending leads after 2 years to 1.24% less consumption and 2.8% less investment.

of share issuing assumed in the scenarios. The adjustment period could be shorter if banks manage to increase equity more strongly by selling additional shares to, for example, foreign investors. The third factor is banks' write-down requirements following the recent financial crisis. If these are still very significant, they put an additional strain on banks' ability to build up equity, with the result that the adjustment periods would be longer than those calculated in this study.

Table 15: Estimate of time needed to achieve change in equity (in € billion) for alternative leverage ratio levels

	Variation 1: LR = 35	Variation 2: LR = 33	Variation 3: LR = 30	Variation 4: LR = 25
1. Required equity increase for adjustment of LR in € billion (once-only) [1]	21	36	64	125
2. Additional annual equity requirement for 1.5% growth in real lending volume	4.1	4.3	4.8	5.7
3. Annual equity formation at banks through share issues and profit retention [2]				
Scenario I	8.0	8.0	8.0	8.0
Scenario II	13.0	13.0	13.0	13.0
Scenario III	18.0	18.0	18.0	18.0
4. Annual equity formation minus additional equity requirement for growth in lending volume [3]				
Scenario I	3.9	3.7	3.2	2.3
Scenario II	8.9	8.7	8.2	7.3
Scenario III	13.9	13.7	13.2	12.3
5. Resulting period needed for adjustment to regulatory leverage ratio (in years)[4]				
Scenario I	5.4	9.8	19.8	54.9
Scenario II	2.4	4.2	7.8	17.2
Scenario III	1.5	2.6	4.8	10.2

1) Figures as set out in Section 2.3
2) For an explanation of the scenarios, see text.
3) Calculated as difference between (3) and (2) for alternative scenarios.
4) Calculated as the quotient of (1) and (4) for alternative scenarios.
Source: own calculations

4.6 Longer-term economic consequences of introducing a leverage ratio

The adjustments of the actual leverage ratio to regulatory levels examined in the previous sections focussed on the economic consequences of short-term adjustment and on the time needed for alternative adjustment. They indicate that after completion of the adjustment process bank equity levels have increased. A question that arises is what further effects are conceivable in the longer term. This is something that needs to be examined particularly if it is assumed that a lower leverage ratio contributes overall to strengthening the stability of the financial system.

One of the longer-term consequences accompanying the envisaged stabilising effect on the financial market may be that financing transactions are carried out more via the capital market and less via the banking sector. It can be assumed that this route is open particularly to large companies. Overall, however, this means a structural change in the form of more capital market financing than bank financing. Incentives for this could also be created by the fact that, if more equity has to be set aside to cover loans, banks' earnings have to be generated from a relatively lower lending volume and this would cause loan interest rates to rise. This is the case if the pressure on interest margins is not passed on fully to deposit interest rates. If the cost of credit increases in the longer term, this would inevitably affect investment and growth.

Since the heavier use of capital market financing that would follow any introduction of a correspondingly restrictive leverage ratio is open mainly to the state and large companies, structural handicaps for small and medium-sized enterprises would tend to be created. As the *Mittelstand* plays a particularly important role in the German economy, the effect of the accompanying competitive disadvantages on macroeconomic performance would also be significant.

The implications of a relatively quick change in equity requirements are also discussed in scholarly literature in terms of what effect this has on lending. It is stressed that if equity requirements are raised, the higher cost of equity compared with debt will give banks incentives to restructure their lending business. A number of studies conclude that, in the face of higher financing costs, there is a stronger incentive for banks to achieve a corresponding increase in earnings by taking higher risks in lending business[31]. In the process, other lending (e.g. lending to the public sector) would then be reduced. Overall, while banks would then have obtained a higher level of equity backing, systemic risk would potentially have increased. VanHoose (2008) gives an overview of works highlighting this effect. The same effect would also be produced if banks, while not increasing risky lending, were to expand

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[31] This is only not to be expected if there is no scope for this any longer due to other regulation.

other higher-risk lines of business more strongly and scale back low-risk types of business (e.g. *Pfandbrief* business).

A longer-term increase in equity backing associated with a lower leverage ratio could also affect monetary policy. As various authors point out, monetary policy efficiency can be diminished if equity requirements for banks increase. This is the case if expansive central bank monetary policy measures cannot be passed on by banks to borrowers because bank equity levels do not allow a corresponding increase in lending volume[32]. At the same time, a leverage ratio has much softer procyclical effects than risk-based regulatory equity requirements. Some research work looks closely at the problem of the procyclical impact of equity requirements. This aspect is underlined in connection with the Basel II rules[33]. A leverage ratio works procyclically to the extent that during recessions loan defaults lead to write-downs, corresponding losses and ultimately to a reduction in equity, so that banks which have already fully utilised their leverage ratio have to reduce their lending volume. The monetary policy implications outlined here show that there may be a conflict between monetary policy and regulation. This should be taken into account when drafting regulation and using monetary policy instruments.

5. Effects of additional Basel Committee on Banking Supervision measures and systemic risk

Alongside the leverage ratio, the Basel Committee on Banking Supervision (BCBS) intends to introduce further measures which could affect calculation of banks' equity ratio. This move, together with the new leverage ratio rules, has already been dubbed "Basel III" in the media. While it is difficult to assess the scale of these additional measures, Handelsblatt reported on its front page on 29 January 2010 that rating agency Standard & Poor's is expecting further capital requirements totalling €300 billion. Table 5 indicates that the maximum additional amount of equity needed would be €125 billion. If one goes along with Standard and Poor's calculations, banks and the economy as a whole would therefore face having to generate a further €175 billion in equity on top of that needed for compliance with a regulatory leverage ratio. In the following, final chapter no attempt is made to verify the aforementioned figure presented by Standard & Poor's. It does appear to be rather high. This chapter looks instead at the burden that the measures set out in the BCBS consultative document *Strengthening the Resilience of the Banking Sector* (2009) would impose on the banking system over and above the introduction of a leverage ratio.

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[32] See, for example, Tanak (2002), Cecchetti and Li (2008) and VanHoose (2008).
[33] For the procyclical effects, see, for example, Blum and Hellwig (1995), Tanaka (2003), Cecchetti and Li (2008), Drumond (2009) or Andritzky, Kiff, Kodres, Madris, Maechler, Narain, Sacasa and Scarlata (2009).

This document specifies six additional measures in this connection:

1. improving the quality of the capital base;

2. covering counterparty credit risk exposures arising, in particular, from derivatives, repos and securities financing activities;

3. introducing a leverage ratio as an additional control parameter (as already discussed in detail above);

4. introducing additional capital buffers for cyclical business. This includes

    ... cyclicality of minimum capital requirements

    ... cyclicality of provisioning

    ... conserving core (Tier 1) capital

    ... limiting excess credit growth in boom phases;

5. requiring compliance with a minimum liquidity standard by internationally active banks.

6. introducing a capital surcharge for systemically important banks.

Overall[34], the Basel Committee therefore introduces a number of macroprudential measures to help contain systemic risks arising from procyclicality and the interconnectedness of financial institutions.

5.1 Improving the quality of capital (core Tier 1)

Measures to improve the quality of the capital base are (i) raising the quality and consistency of the common equity element of Tier 1 capital, (ii) drastically simplifying Tier 2 capital and (iii) abolishing Tier 3 capital[35]. The BCBS's 2009 consultative document points out on page 15 that more "hard" common equity will be needed. Ultimately, this is likely to mean that banks will have to provide more capital of their own. How much more capital will be needed, should be difficult to assess.

Broadly speaking, the following idea could be pursued: According to Table 2, banks in Germany had around €337 worth of Tier 1 capital[36] in October 2009. This figure is also to be found in Table 16. However, Table 16 also shows that Tier 2 capital accounts for approximately 38% of total capital in Germany[37]. If this component is therefore limited particularly strongly, up to 2.7% of RWAs[38] can then no longer be recognised as total capital in future. Consequently, this would have to be offset by raising other capital components or otherwise facing the consequences of a credit squeeze.

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[34] See Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), par. 12
[35] See Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), p. 15
[36] Common equity and retained earnings
[37] Tier 3 capital is close to 0.
[38] Risk weighted assets

Table 16: Tier 1 and Tier 2 capital of the German banking system in October 2009 (figures in € billion)

	in € billion	in % of total capital/total assets
Tier 1		
Equity: banks in Germany	336.9	62%
Tier 2		
Reserves	64.8	
Subordinated debt	105.1	
Hybrid debt instruments	18.4	
General risk provisions	18.9	
Total Tier 2	207.2	38%
Total assets of banks in Germany	7570.4	
Tier 1	336.9	4.5%
Tier 2	207.2	2.7%
Total capital	544.1	7.2%

Source: Deutsche Bundesbank (2010*f*) and Basel Committee on Banking Supervision (2006) on inclusion in Tier 1 and Tier 2.

The capital requirements resulting from the tougher Basel Committee standards for the quality of Tier 1 and Tier 2 capital are therefore likely to increase further. Specific proposals concerning the criteria for eligibility as Tier 1 capital are to be found in paragraph 87 of the 2009 BCBS consultative document. Fourteen criteria, which are more stringent those currently applying, are set. Minority shareholdings, along with goodwill, intangible assets and purchases of own shares by banks, will, for example, no longer be eligible for inclusion in Tier 1 capital. The transparency requirements for Tier 1 capital components will also rise. How much the increase in capital may ultimately be, is difficult to assess. The maximum figure is – as mentioned – 2.7%. The BCBS's reference to the fact that the requirements for inclusion as common shares and retained earnings (see equation (1)) will be harmonised internationally is also important, however.

5.2 Introduction of capital buffers to limit macroprudential risks and reduce procyclical effects

A further increase in the required capital base is likely to be produced also by additional capital buffers which are called for to cover counterparty credit risks so as to avoid cyclical effects. Specifically, four types of capital buffers are proposed for this purpose[39]:

1. Designing the minimum capital requirement cyclically: which measures are suitable for doing so, is apparently still under discussion at present. Proposals have evidently been presented by the Committee of European Banking Supervisors (CEBS) and the Financial Services Authority (FSA) in the UK. A benchmark for a cyclical capital buffer

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[39] See Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), p. 7

is, however, likely to be a bank's loss given default (LGD). Here, the loss that is incurred if a bank fails is calculated.

2. Strengthening future risk provisioning. Here, too, it is still unclear how much such a buffer could amount to. A bank's expected loss (EL) is likely to be a benchmark. In contrast to the LGD, the EL is a measure of the potential loss incurred by a bank even if it does not fail.

3. Freezing capital components as a buffer against future risk exposures. This involves building buffers on top of minimum capital. Rules obliging banks to hold more than the minimum capital required are already set out today in Pillar 2 of Basel II, though these are not yet "hard" quantitative rules. However, concrete proposals also on the quantitative implementation of this capital buffer are to be drafted before the BCBS meeting in July 2010.

4. Regulating credit growth more strongly in order to avoid systemic risk. This mainly involves calling for an additional capital requirement for systemically important banks. To avoid risks arising from the close interconnectedness of banks, consideration is also being given to raising the risk weights on exposures to financial institutions relative to the non-financial corporate sector[40]. Procyclicality strengthens shocks over time, i.e. longitudinally. The interconnectedness of large financial institutions, on the other hand, causes shocks that spread latitudinally among banks and financial institutions. In this respect, the BCBS is concerned, first and foremost, with supplementing the Basel II rules for systemically important financial institutions.

The concrete shape of the capital buffers is completely open. Yet – as in Section 5.1 – the proposed measures will also serve to further tighten the capital requirements for banks.

5.3 Systemic risk and interconnectedness
Particularly the last aspect of the capital buffers in Section 5.2 is likely to play an especially important role. It implies that systemically important financial institutions will be put at a disadvantage compared with others. Systemic risk is a break in the supply of financial services which is due to distress suffered by a large part of the financial system and which affects the real economy. The criteria for defining "systemic importance" are usually (i) the size of an institution, (ii) the substitutability of the institution's services and (iii) its level of interconnectedness within the financial system. There is in fact a list of such systemically important financial institutions that may have to accept a further capital buffer. In its 30 November 2009 issue, the Financial Times lists the following systemically important financial institutions according to the Financial Stability Board (FSB):

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[40] See Basel Committee on Banking Supervision, *Strengthening the Resilience of the Banking Sector* (2009), par. 21

- North-American banks: Citigroup, Goldman Sachs, JP Morgan Chase, Morgan Stanley, Bank of America-Merrill Lynch, Royal Bank of Canada
- UK banks: HSBC, Barclays, Royal Bank of Scotland, Standard Chartered
- European banks: UBS, Credit Suisse, Société Générale, BNP Parisbas, Santander, BBVA, Unicredit, Banca Intesa, Deutsche Bank, ING
- Japanese banks: Mizuho, Sumitomo Mitsui, Nomura, Mitsubishi, UFJ
- Insurance corporations: AXA, Aegon, Allianz, Aviva, Zurich, Swiss Re

Bank A		LR
Assets	Liabilities	
CDOs 116.64	Liability to Bank B 110.80	
	Equity 5.83	20

Bank B		
Assets	Liabilities	
Claim against Bank A 110.80	Liability to Bank C 105.26	
	Equity 5.54	20

Bank C		
Assets		
Claim against Bank B 105.26	Liability 100.00	
	Equity 5.26	20

Entire financial system		LR
Assets	Liabilities	
Claim 332.70	Liability 316.07	
	Equity 16.64	20

Figure 17: Contagion: interconnectedness of three banks A, B and C and of entire financial system

Bank A				LR
Assets		Liabilities		
CDOs	111.00	Liability to Bank B	110.80	
		Equity	0.20	564.38

Bank B				
Assets		Liabilities		
Claim against Bank A	110.80	Liability to Bank C	105.26	
		Equity	5.54	20

Bank C				
Assets				
Claim against Bank B	105.26	Liability	100.00	
		Equity	5.26	20

Entire financial system				LR
Assets		Liabilities		
Claim	327.07	Liability	316.07	
		Equity	11.00	29.73

Figure 18: Contagion: Bank A in trouble

Bank A   LR

Assets		Liabilities		
CDOs	106.00	Liability to Bank B	106.00	
		Equity	0.00	N/A

Bank B

Assets		Liabilities		
Claim against Bank A	106.00	Liability to Bank C	105.26	
		Equity	0.74	143.86

Bank C

Assets				
Claim against Bank B	105.26	Liability	100.00	
		Equity	5.26	20

Entire financial system   LR

Assets		Liabilities		
Claim	317.26	Liability	311.26	
		Equity	6.00	52.88

Figure 19: Contagion: Bank B in trouble due to distress of Bank A

Two things are noticeable about this list. For one thing, no Chinese or Russian banks feature among the world's largest financial institutions. For another, six insurance corporations are included, although these cannot be compared with banks when it comes to interconnectedness. Quite the contrary: the risk exposure of insurance corporations (life insurance corporations at any rate) is negatively correlated to that of banks because, unlike banks, assets are short-term and liabilities long-term (negative duration gap). So when banks come under pressure, insurance corporations usually do not[41]. Overall, this list and the criteria used for compiling it are non-exhaustive.

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[41] Brunnermeier, Crockett, Goodhart, Persaud and Shin (2009) point out in Chapter 3 that insurance corporations are "non-systemic large", i.e. large enterprises with no systemic importance. They say that not macroprudential but microprudential regulation is needed in their case.

Bank A			LR
Assets		Liabilities	
CDOs	101.00	Liability to Bank B	101.00
		Equity	0.00	N/A

Bank B			LR
Assets		Liabilities	
Claim against Bank A	101.00	Liability to Bank C	101.00
		Equity	0.00	N/A

Bank C			
Assets			
Claim against Bank B	101.00	Liability	100.00
		Equity	1.00	101

Entire financial system			LR
Assets		Liabilities	
Claim	303.00	Liability	302.00
		Equity	1.00	303.00

Figure 20: Contagion: Bank C in trouble due to distress of Bank B and Bank A

The idea to cushion again systemic risk is motivated by potential contagion effects. Figure 17 shows the starting situation as set out in Brunnermeier et al. (2009) (Chapter 2). It is assumed that there are three interconnected banks in the banking system. The equity ratio of all three is 5%, so that the leverage ratio of each bank and of the banking system as a whole is 20. Bank A has a liability of €100.80 to Bank B. Bank A holds a collateralised debt obligation (CDO) position of €116.64 on the assets side of its balance sheet. Bank A now gets into trouble and the CDO position is devalued to €111 (see Figure 18). Bank A's equity is just barely sufficient to absorb this devaluation. Although the other banks have not yet been affected as well, the leverage ratio of the entire banking system climbs to nearly 30. The entire system becomes more vulnerable. In Figure 19 devaluation of Bank A's CDO position is now increased to €106. This devaluation is so great that Bank A's equity reserves are no longer sufficient. Bank A's original liability to Bank B can no longer be settled in full. Bank B therefore also has to write down part of its original claim of €110.80 to €106. As a result, Bank B's leverage ratio also increases greatly.

Bank A   LR

Assets		Liabilities	
CDOs	100.00	Liability to Bank B	100.00
		Equity	0.00

(N/A)

Bank B

Assets		Liabilities	
Claim against Bank A	100.00	Liability to Bank C	100.00
		Equity	0.00

(N/A)

Bank C

Assets			
Claim against Bank B	100.00	Liability	100.00
		Equity	0.00

(N/A)

Entire financial system   LR

Assets		Liabilities	
Claim	300.00	Liability	300.00
		Equity	0.00

(N/A)

Figure 21: Contagion: financial system in trouble

Thanks to its equity level, Bank B manages to remain stable, however. In Figure 20, devaluation of Bank A's CDO position is now increased to €101. Ultimately, this devaluation causes Bank B to fail as well and Bank C, which has claims against Bank B, has to write down its claims from €105.26 to €101. Because of Bank A's distress, Bank C's leverage ratio climbs to 101, although Bank C has no contractual relationship whatsoever with Bank A. The entire system now has a leverage ratio of 303. Finally, a further slight devaluation of Bank A's CDO position to €100 leads to the collapse of the entire financial system (see Figure 21).

Figure 22 shows once again the contagion effect on the leverage ratio of the entire banking system for different degrees of devaluation of Bank A's original CDO position. The lower the level of equity in the banking system, the quicker the banking system's leverage ratio rises. The more equity is available, the more robustly the banking system reacts to a bank's distress. Figure 22 therefore also shows how important capital adequacy is. But here, too, the risk dimension should not be overlooked. Whether a minimum equity ratio of, for example, 5% constitutes capital adequacy also depends on the existing risks in the banking system. This is

made clear by Figure 23. Figure 23 shows the correlation between the banking system leverage ratio and different equity ratios as well as different volatilities of Bank A's CDO position in Figures 17 – 21. The leverage ratios are calculated in each case for the 95% quantile of Bank A's CDO position, assuming three different volatilities of 2%, 4% and 6% annually. An equity ratio of 5% can consequently imply a leverage ratio of 26 with more than 5% probability if CDO volatility is 2% annually. It can, however, also mean a leverage ratio of nearly 60 for the same level of equity if CDO volatility is 6%. It thus only makes sense for regulators to set equity ratios if at the same time risk exposure is limited upwardly. Risk-invariant leverage ratio arrangements are inappropriate also from a systemic risk perspective.
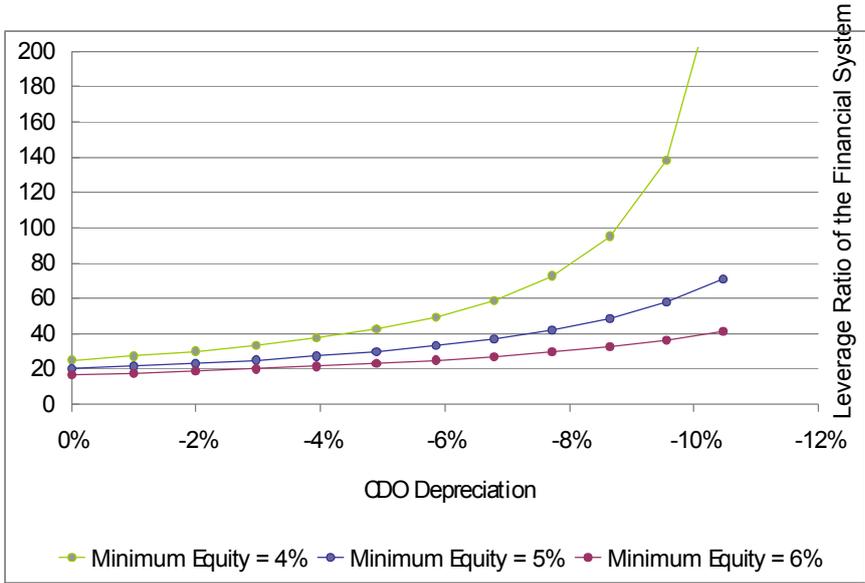

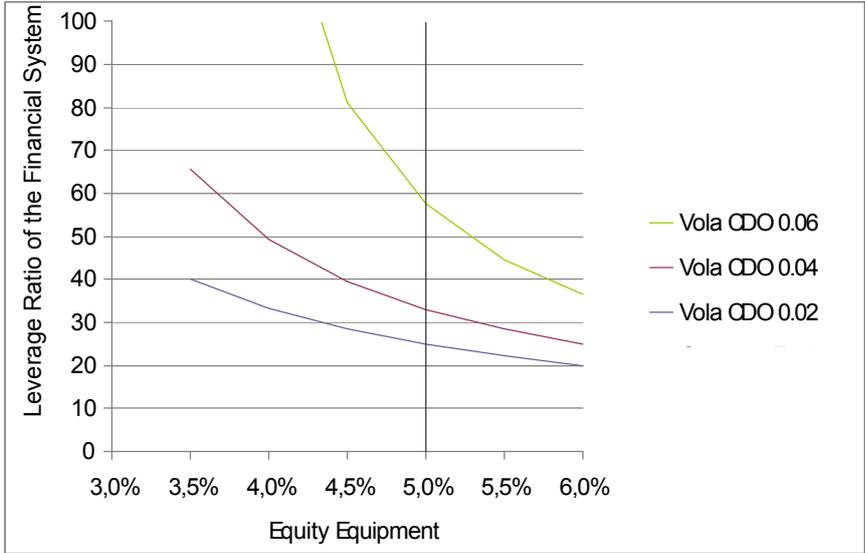Figure 22: Interconnectedness: leverage ratio of entire financial system

Figure 23: Leverage ratio of entire financial system for different risks of CDO position at Bank A

5.4 Additional capital requirements resulting from the additional measures

Sections 5.1, 5.2 and 5.3 describe the additional capital requirements resulting from the BCBS 2009 consultative document. A quantitative assessment is not yet possible at present, however, as the BCBS's ideas are still too unspecific. Even if one assumes a capital increase of 1% for improving the quality of common equity and a further 1% as an additional capital buffer for avoiding systemic risk, one would have to reckon with at least 2% additional capital. The effects on the financial system and the economy naturally go in the same direction as that explained in Sections 2 and 4. It is certainly not wrong to look for ways to strengthen the banking system's capital base. At the same time, it should be clear that raising the requirements in the short term will have significant effects on the financial markets and the economy.

6. Conclusions

This study concludes that it is right to seek a higher level of equity in the banking system. At the same time, it has been made clear that the introduction of a leverage ratio as a hard capital requirement in accordance with Pillar 1 of Basel II would be a step backwards that would increase the vulnerability, rather than the stability, of the banking system. There can be no doubt that the level of equity in the global banking system is too low. Yet, a leverage ratio does not appear to be the right way to increase equity as it sets perverse incentives and thus fails to reduce systemic risk. Responses by the banking system will probably not take the form of simply increasing Tier 1 capital since capital is unlikely to be obtainable on a sufficient scale. What is conceivable is a stronger capital market orientation of banks, although the three-pillar structure of its banking system puts Germany at a disadvantage in competition with other countries. Moreover, it must be feared that, while a large part of banking business will be conducted on the capital market, the business that remains on balance sheets will be the higher-risk business because a leverage ratio requires the same amount of equity backing regardless of the risks incurred. Since netting is not possible under IFRS[42], derivative positions are likely to be reduced on a large scale, as is already the case today at various banks. This, too, tends to lead to higher systemic risk if the derivative positions were entered into for hedging purposes.

Overall, the introduction of a leverage ratio is a step backwards from a banking perspective. It has also failed to avert any systemic risk in the US in the past. Basel II is to be introduced precisely to improve the risk incongruence of Basel I. There is, in addition, a Financial Stability Board which deals with systemic risk in a global context. The introduction of a leverage ratio would therefore double the FSB measures, with the corresponding economic implications.

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[42] And probably also if the proposals made by the Basel Committee on Banking Supervision (2009) are adopted.

Moreover, it was also shown in connection with the macroprudential risks that a risk-invariant leverage ratio could be easily undermined by increasing risk in the banking system.

As regards the macroeconomic effects of the introduction of a leverage ratio, it can be said that it is unrealistic to assume that the banking system will be able to increase equity in the short term. A reduction in lending, would, on the other hand, be conceivable in the short term, although it would have considerable negative economic consequences. This is why it is advisable to allow a transition period of several years. How long this transition period should actually be, depends on the leverage ratio that is sought (see Table 15). A lengthy transition period is also required as further write-down requirements cannot be ruled out.

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