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How will Basel II affect bank lending to emerging markets? An analysis based on German bank level data

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Abstract

This paper investigates whether the new Basel Accord will induce a change in bank lending to emerging markets using a comprehensive new data set on German banks` foreign exposure. We test two interlinked hypotheses on the conditions under which the change in the regulatory capital would leave lending flows unaffected. This would be the case if (i) the new regulatory capital requirement remains below the economic capital and (ii) banks' economic capital to emerging markets already adequately reflects risk. On both accounts the evidence indicates that the new Basel Accord should have a limited effect on lending to emerging markets.

Keywords: Basel Accord, Banking Regulation, International Lending,

JEL Codes: F34, G28, F33

Non-technical Summary

The new Basel Accord on capital requirements for banks (Basel II) defines regulatory capital requirements in line with the underlying risk of lending and therefore marks a substantial modification from previous regulation. This will raise regulatory capital requirements for higher risk asset classes, which include the emerging markets. Higher regulatory capital has an impact on lending flows only if regulatory capital requirements become binding. In other words, if banks have already calculated economic capital based on similar risk models in the past and these remain binding no further change should occur. This paper tests these two interlinked hypothesis. We expect that lending patterns will remain unchanged if:

(1) regulatory capital requirements remain below the economic capital and

(2) banks' lending is already based on risk modelling.

To test the first hypothesis we calculate the economic capital of the foreign portfolio of German banks as unexpected loss using a Value at Risk model. We find that economic capital seems to be binding.

The second condition is tested by estimating the influence of unexpected loss in explaining lending to emerging markets. We find that unexpected loss is a significant determinant of the banks' loan decisions, in particular for Large Banks as well as Landesbanken and in recent years also for other banking groups. Thus, it appears that risk modelling has already guided lending decisions.

Overall, the evidence from both tests points in the same direction and we conclude that the new Basel Accord should have a limited effect on lending to emerging markets.

Nichttechnische Zusammenfassung

Mit Inkrafttreten der neuen Baseler Eigenmittelvereinbarung (Basel II) werden sich die regulatorischen Eigenkapitalanforderungen, die an eine Bank gestellt werden, an den Kreditrisiken des Portfolios orientieren. Als Konsequenz werden die regulatorischen Eigenkapitalanforderungen für Kredite mit hohen Risiken, z. B. Kredite an Schwellenländer, steigen. Ob diese Erhöhung eine Reduktion der Kreditvergabe zur Folge haben wird, hängt davon ab, ob die neuen Anforderungen bindend sein werden. Keine Änderungen in der Kreditvergabe sind zu erwarten, wenn Banken das ökonomische Kapital bereits in der Vergangenheit auf der Grundlage ähnlicher Modelle berechnet haben und das ökonomische Kapital auch nach der neuen Regelung bindend bleibt. Im vorliegenden Diskussionspapier werden die Ergebnisse aus einem Test beider miteinander verbundenen Hypothesen präsentiert. Wir erwarten keine Veränderung in der Kreditvergabe, sofern

(1) das regulatorische Eigenkapital kleiner ist als das ökonomische Kapital der Banken

(2) und Banken die Kreditvergabe bereits auf der Basis von Risikomodellen steuern.

Die erste Bedingung wird getestet, indem das ökonomische Kapital für die Auslandsportfolien der deutscher Banken als unerwarteter Verlust anhand eines Value-at-Risk-Modells berechnet und anschließend mit dem regulatorischen Eigenkapital verglichen wird. Die Ergebnisse weisen darauf hin, dass das ökonomische Kapital bindend ist.

Zur Überprüfung der zweiten Bedingung wird der Einfluss des unerwarteten Verlusts zur Erklärung der Kreditvergabe an Schwellenländer geschätzt. Die Ergebnisse bestätigen, dass der unerwartete Verlust einen signifikanten Beitrag bei der Erklärung der Kreditvergabeentscheidungen hat. Das gilt besonders für Groß- und Landesbanken und in den letzten Jahren auch für andere Bankengruppen. Die These, dass Banken schon in der Vergangenheit bei der Kreditvergabe Risikomodelle herangezogen haben, wird daher gestützt.

Zusammenfassend deuten beide Ergebnisse darauf hin, dass die Einführung des neuen Baseler Akkords nur eine geringe Auswirkung auf die Kreditvergabe an Schwellenländer haben wird.

Content

How will Basel II affect bank lending to emerging markets? An analysis based on German bank level data[#]

1 Introduction

Since 1999 the Basel Committee on Banking Supervision has been working on a revised Capital Accord, which should align regulatory capital requirements with the actual risk associated with banks' assets calculated with modern risk management techniques. The new Accord will increase regulatory capital for lower rating classes and, as a consequence, many observers feared that bank lending to emerging markets would decline.[1] The aim of this paper is to investigate this claim bringing to bear a new and comprehensive dataset of German bank lending.

At the outset it is worth mentioning that the series of revisions of the new Accord have already contributed to dampening fears of a large impact on lending to high risk lenders. After the first consultative proposals for Basel II were released in June 1999 and January 2001 the Committee received a large number of responses.[2] Concerns about a negative impact on lending to lower rating categories, a characteristic shared by most small and medium sized firms and emerging markets, lead to a reduction of these risk weights in the subsequent revisions.[3] Nevertheless, the third Quantitative Impact Study 3 (QIS 3)[4] revealed that capital requirements for sovereign exposures will still rise by 28 per cent under the Advanced IRB[5] and 47 per cent under the Foundation IRB for Group 1 banks.[6]

[#] The authors would like to thank Dirk Tasche and the participants of a seminar at the Deutsche Bundesbank for helpful comments. Many thanks also to Heinz-Michael Ritter and Bjoern Wehlert for support with the database for German foreign claims.

[1] Reisen (2001), Griffith-Jones (2003)

[2] BIS (1999) and BIS (2001)

[3] BIS (2003)

[4] During the development of the new capital framework, the Basel Committee on Banking Supervision carried out a number of impact studies to assess the effect that it would have on banks' minimum capital. The most extensive study, QIS 3, was carried out in 2002/2003 and the results were published in May 2003, see Basel Committee on Banking Supervision 2003a and 2003b. This included data from 365 banks from 43 countries.

[5] The Committee proposes to permit banks a choice between two broad methodologies for calculating their capital requirements for credit risk. One alternative will be to measure credit risk in a standardised manner. Under the other alternative, banks that have received supervisory approval to use the Internal Ratings-Based Approach (IRB) may rely on their own internal estimates of risk components in determining the capital requirements. For many asset classes, the Committee has made available two approaches within the IRB framework: a foundation and an advanced approach. Under the foundation approach, as a general rule, banks provide their own estimates of probability of default (PD) and rely on supervisory estimates for other risk components. Under the advanced approach, banks provide their own estimates of PD, loss given default

Given the prominent role of Group 1 banks in lending to emerging markets, this rise in requirements might potentially lead to large adjustments in international bank lending to emerging markets.

Furthermore, even in the absence of large changes in capital costs, Basel II might have a significant impact on bank lending flows since small spread changes may induce large portfolio reallocations. And, in a market characterised by credit rationing, spread increases may lead to the exclusion of borrowers.[7]

Fewer possibilities for regulatory arbitrage might lead to shifts in the pattern of flows to emerging markets. The simple categorisation under Basel I gave banks leeway for capital arbitrage by choosing higher-risk assets within a given risk category.[8] In particular, the OECD/non-OECD distinction in principle allowed banks to hold risky assets (e.g. Mexico) without commensurate capital. The lower risk weight for short-term lending may have contributed to large inflows of short-term capital before the Asian crisis.[9]

The existing literature initially predicted very large effects of Basel II on emerging markets spreads (see Reisen (2001), Griffith-Jones (2003)). However, this result was mainly due to a somewhat unrealistic assumption about required rates of return for high-risk assets. Using a more realistic assumption of a hurdle rate for risk adjusted returns Powell (2002) and Weder and Wedow (2002) find much smaller changes in credit spreads.

However, the critical questions in assessing the impact of Basel II is the relationship between regulatory and economic capital and which of them is the binding constraint. In this paper we test these two interlinked hypothesis: Is economic or regulatory capital the binding constraint? And: have banks already based credit decisions according to economic capital in the past? To the extent that the new Accord succeeds in aligning regulatory capital requirements with economic capital, which are based on modern risk management techniques, it should have no impact on credit decisions of banks already using these techniques.[10]

(LGD), exposure at default (EAD) and their own calculation of maturity (M), subject to meeting minimum standards.

[6] Basel Committe on Banking Supervision (2003b), in the QIS 3 banks have been split into two groups – Group 1 banks are large, diversified and internationally active with Tier 1 capital in excess of EUR 3bn, and Group 2 banks are generally smaller and, in many cases, more specialised.

[7] Griffith-Jones (2003), Calvo et.al. (2004)

[8] Reisen (2001)

[9] Jeanneau and Micu (2002) and Buch (2000)

[10] Hayes and Saporta (2002)

Weder and Wedow (2002) address this question by computing a measure of economic capital and testing its' influence on lending flows of BIS reporting banks. The advantage of that approach is that it included most lenders, however, this comes at the cost of an extremely aggregate perspective.

In this paper we adopt a micro view, which allows us to control for individual bank and group characteristics. We compute bank level measures of economic and regulatory capital for a sample covering roughly 95% of total foreign lending by German banks. The data set has recently been compiled at the Deutsche Bundesbank and includes about 50 banks and all credits from 1996 to 2002, thus representing on average 95% of German banks' total foreign lending. To quantify the risk positions in German banks' foreign lending we calculate unexpected loss using a Value at Risk model.[11] This measure is then tested in a dynamic panel model on the determinants of lending to emerging markets.

We find that Basel II regulatory capital would not have been binding in the past, which is a prerequisite for the hypothesis of the neutrality of Basel II. Our results also support the hypothesis that banks already base their lending decisions on credit risk models if we restrict our sample to the more recent period and to Large Banks and Landesbanken. Given that these banks provide the lion's share of bank lending to emerging markets, and more banks are in the process of adopting modern risk management techniques, we conclude that by the time Basel II will be adopted (year-end 2006) it will have only a negligible effect on German banks' loans to emerging markets.

The remainder of the paper is organised as follows. Section 2 describes the model of bank lending and the empirical strategy. Section 3 describes the data set, section 4 presents the results. Section 5 concludes.

2 How do capital requirements impact on bank lending flows?

Our approach to estimating the impact of Basel II on banks' lending to emerging markets is to model banks' lending decisions. For this purpose we need to establish a model of international bank lending. Most of the existing literature on international capital flows has taken a macroeconomic approach, focusing on push and pull factors as determinants of

[11] We adopt a credit portfolio model following CreditMetrics, see J.P Morgan (1997).

capital flows.[12] Thus these studies use aggregated data by creditor country and do not permit a detailed analysis of individual bank behaviour. One exception, Goldberg (2001), uses bank-level data for lending to emerging markets but likewise focuses on macroeconomic push and pull determinants of capital flows. In contrast, our aim is to model and test individual bank behaviour and therefore we propose a microeconomic approach, using bank-level data for the determinants of lending flows. An advantage of studying the effects of capital regulation at the individual bank level is that it permits differentiation between size and ownership structure.

In what follows, we focus on the supply side of the international credit market based on the assumption that emerging countries are mostly constrained by the supply side.[13] This implies that demand should have only a limited role on flows[14] and that bank lending can be modelled by a loan offer curve. We use a general loan offer curve by which credit decisions depend on the expected yield over a minimum margin. The minimum margin is the total sum of all costs that a loan causes for a bank. Consequently, credits which are priced below the minimum margin are not profitable and will thus not be supplied. The components of the minimum margin are the risk-free interest rate, handling charges, the expected loss of the loan, and opportunity costs for the capital allocation associated with the loan. The opportunity costs for the capital allocation refer to regulatory capital if the regulatory capital requirements are binding. Otherwise they refer to economic capital which usually is measured with the unexpected loss. Accordingly the loan supply function is:

$$L_{ib} = L_{ib}(R, H_{ib}, EL_{ib}, UL_{ib}) \;\; if\, RCC_{ib} \leq UL_{ib} \text{ and} \tag{1}$$

$$L_{ib} = L_{ib}(R, H_{ib}, EL_{ib}, RCC_{ib}) \;\; if\, RCC_{ib} > UL_{ib}\,, \tag{2}$$

where L_{ib} is the amount of credit supplied by bank b to borrower i. R is the risk-free interest rate which is equal for all banks, H_{ib} are bank and country specific handling charges and EL_{ib} is the expected loss of a loan to country i. UL_{ib} is the unexpected loss for a loan to country i. It is also called marginal risk contribution. Finally, RCC_{ib} are regulatory capital requirements, alternatively under Basel I (RCC_I_{ib}) or under Basel II (RCC_II_{ib}).

[12] Jeanneau and Micu (2002) give an overview of this literature.
[13] Calvo et.al. (2004)
[14] See Goldberg (2001) for evidence from US bank lending.

From (1) and (2) it is apparent that regulatory capital requirements will drive banking behaviour only if they exceed economic capital. This means that the increase of capital costs predicted in the context of Basel II will not be relevant for bank lending to emerging markets, provided that they remain below the unexpected loss. It is the explicit intention of the Basel Committee to bring regulatory capital into line with economic capital from below, and not to top it. Hence, if the Basel Accord achieves its purpose, our model predicts that bank lending to emerging countries on average will be unaffected by Basel II.

Although (1) and (2) constitute a quite general model, there may be some practical problems related notably to the calculation of economic capital. The methods used to calculate unexpected loss are rather complex, and therefore it is not certain whether it is common business practice to measure economic capital by means of the unexpected loss. Alternatively, banks could proxy economic capital by regulatory capital. If so, according to (1) and (2), banks' lending to emerging economies will decline irrespective of the amount of unexpected loss, simply because under Basel II the regulatory costs for loans to risky countries will rise. Capital arbitrage considerations may also pose a problem in this set-up. Banks may simply base their decision to lend on regulatory capital whenever it falls below economic capital. As a consequence, Basel II would have an impact on lending to countries which see their regulatory capital requirements rise compared with their current treatment.

Consequently, Basel II will not affect banks' lending if economic capital exceeds regulatory capital (under Basel I and Basel II) and, additionally, if the banks consider the unexpected loss in their lending decisions.

The condition that economic capital exceeds regulatory capital can be formulated as a test, either separately for each country *i*,

$$H_0: UL_i \geq RCC\_II_i, \; H_1: UL_i < RCC\_II_i \,, \tag{3}$$

with

$$UL_i = \frac{1}{\sum_{b=1}^{B} T_b} \sum_{b=1}^{B} \sum_{t=1}^{T_b} UL_{ibt} \;\text{ and }\; RCC\_II_i = \frac{1}{\sum_{b=1}^{B} T_b} \sum_{b=1}^{B} \sum_{t=1}^{T_b} RCC\_II_{ibt} \,,$$

where B is the total number of banks in our sample and T_b is the number of time periods that are available for bank b. Alternatively the hypothesis can be tested on the aggregate:

$$H_0: UL \geq RCC\_II, H_1: UL < RCC\_II, \tag{4}$$

with

$$UL = \frac{1}{\sum_{i=1}^{I}\sum_{b=1}^{B} T_{bi}} \sum_{i=1}^{I}\sum_{b=1}^{B}\sum_{t=1}^{T_b} UL_{ibt} \text{ and } RCC\_II = \frac{1}{\sum_{i=1}^{I}\sum_{b=1}^{B} T_{bi}} \sum_{i=1}^{I}\sum_{b=1}^{B}\sum_{t=1}^{T_b} RCC\_II_{ibt},$$

where I is the total number of countries.

The assumption that banks measure economic capital by means of unexpected loss when calculating their minimum margins will be tested in a panel regression framework. Following equations (1) and (2) and the assumption that bank lending to emerging markets is constrained by the supply side, we model credit flows as follows:

$$\Delta L_{ibt} = \alpha_0 + \beta_1 R_t + \beta_2 EL_{it} + \beta_3 UL_{ibt} + \sum_{j=4}^{n} \beta_j Z_{j,ibt} + \mu_{ib} + \varepsilon_{ibt}, \tag{5}$$

where ΔL_{ibt} is the first difference of credit supplied by bank b to borrower i in period t, and $Z_{j,ibt}$ is a set of control variables which in our case are the first two lags of the stock of bank lending, time dummies and dummies for large banks and Landesbanken. ε_{ibt} is iid with mean zero and constant variance and μ_{ib} is not correlated with the other right-hand variables. The individual effect μ_{ib} captures unobservables at the bank level such as handling charges, but also time-invariant characteristics that may drive credit to foreign countries, such as cultural affinity or geographical distance.[15] If banks incorporate unexpected loss in their decisions, we would expect that the estimation of (5) results in a coefficient for β_3 which is significantly negative.

[15] There are three possible panel dimensions available in the present data set: time, banks and countries. Out of the latter two we created a new bank-country dimension which allows us to combine both dimensions and to capture the specific lending relation within the individual effect μ_{ib}.

3 Empirical Strategy and Data

In order to test (3) and (4) and estimate (5) we have to deal with the fact that most of the variables involved cannot be observed directly. The exception is the risk-free interest rate, which we measure by the German capital market interest rate.[16] In the following we describe how we estimate credit flows (ΔL), and proxies for the regulatory capital (RCC), the expected loss (EL) and the marginal risk contribution (UL).

3.1 Estimating credit flows

We calculate ΔL_{ibt} from the Deutsche Bundesbank's credit register. The credit register reports loans of 1.5 million Euro (formerly 3 million Deutsche Mark) or more at a quarterly frequency.[17] Since the raw data are not consolidated at banking group level and because of various structural changes, we restrict the sample to large banks (all big banks, Landesbanken and a large number of private banks) and the time period 1996Q3 to 2002Q2. Our sample provides on average 95% of German banks' total foreign lending over the time period. Table A1 in the appendix provides a list of the number of banks used in the analysis.[18]

Data for ΔL_{ibt} can be obtained by taking first-order differences of the credit stock data. Since changes in stocks can be attributed to credit flows as well as to currency changes, we corrected the stocks for currency fluctuations before taking differences.[19]

[16] See appendix for the sources of the data.

[17] See Nestmann et. al. (2003) for a detailed description of the data set. The concept of credit exposure applied by the credit register is regulated in section 19 of the Fifth Act amending the Banking Act, which has been in force since the end of 1995. Accordingly, foreign country exposure covers on-balance sheet and off-balance sheet positions. Off-balance sheet items include derivatives (other than written option positions), guarantees assumed in respect thereof, and other off-balance sheet transactions. The following items are deemed not to be exposures according to section 20 (6) of the Banking Act: shares in other enterprises, irrespective of how they are shown in the balance sheet, and securities in the trading portfolio. Additionally, exposures to German public authorities (central, state and local government) and exposures to the European Communities are not reported. The credit risk with respect to the off-balance sheet items such as swaps, options and futures is captured by using the credit equivalent amount measured by the marking-to-market method. Thus, the creditor does not carry the full risk for the principal amount but only for the replacement costs.

[18] Banks included under "other banks" consist mainly of private banks. They do not dominate the sample since these banks maintain exposures to a relatively small number of countries.

[19] The information on the currency composition of German bank lending was obtained from the Bundesbank's External Economics division. Flows were consistently corrected for Euro-US$ exchange rate fluctuations. The procedure for exchange adjustments is as follows. First, stock data are converted from Deutsche Mark into Euro to obtain a consistent series in Euro for the whole period. In a second step the respective shares for bank claims in Euro, US dollar and other currencies are obtained. We then convert the

3.2 Estimating the regulatory capital

The regulatory capital costs under Basel I are based on the criterion of OECD membership. Therefore, in our regression framework, RCC_I_{ib} is a dummy-variable with the value one if the country is a member of the OECD and zero otherwise.

RCC_II_{ibt} is calculated according to the Basel II foundation internal ratings based (IRB) calibration as formulated in the fourth consultative paper. [20] It is expected that many of the German banks will use the foundation IRB approach once Basel II is implemented. For this reason we concentrate on this approach and neglect the alternatives (standardised or advanced IRB methods). We use Standard & Poor's (S&P) sovereign ratings as proxies for banks' internal ratings and match them with the corresponding probabilities of default for corporates. The literature has argued that the rating criteria of German banks for sovereigns are very similar to those used by the international rating agencies.[21] Therefore, S&P ratings should be a close proxy for banks' internal ratings of public creditors. Due to a lack of data we use sovereign ratings for the private sector, too. In this case sovereign ratings can be regarded as an upper limit for the true ratings of the private sector.[22] The regulatory capital charge is then obtained by applying the probability of default to the Basel II formula. Since no information on the respective maturity or loss given default rate (LGD) is available, we use benchmark values with a maturity of 2.5 years and an LGD of 45%.

3.3 Estimating the expected loss

Expected loss EL_{it} is measured by an index based on the S&P ratings described in the previous section. The rating should reflect the expected loss of the exposure for a given loss given default and thus be closely related to the risk spread of a given borrower. Cantor and Packer (1996) were the first to propose a numerical rating score. In their paper, ratings were assigned a score from 1 for AAA to 20 for a selective default. Since then a number of

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US dollar share (still denominated in Euro) back into US dollar at the respective end-of-quarter exchange rate (e_t) before applying the exchange rate of the previous period (e_{t-1}) to obtain the US dollar share again in Euro and free of exchange rate movements between the two periods. While we recognise that Euro exchange rates against other currencies may be relevant, it should be noted that exposures in Euro and US$ are predominant for German bank lending (see Nestmann et. al. 2003). Additionally, regressions on the flows without currency corrections did not exhibit any different results.

[20] The revision of the risk weight function focusing on unexpected loss only has been taken into account (see Basel Committee on Banking Supervision, 2004a).

[21] Krahnen (2000), see Brunner et. al. (2000) for a discussion of internal rating procedures of German banks; the difference between banks' and rating agencies' ratings should lie in the soft information internal to banks acquired through banks' relationship with borrowers.

[22] To obtain an idea of the possible bias arising in this context we also performed separate estimations for the public sector, but the results did not differ.

studies have followed and extended their proposal. For example, Bartholdy and Lekka (2002) additionally include rating outlooks and thus achieve an even finer distinction of risks. In their approach each rating is assigned a score S_{it} ranging from 1 for an AAA rating to 58 for a selective default. Further, they applied a logit-type transformation of the rating score:

$$\tilde{S}_{it} = \ln\left\{\frac{S_{it}}{59 - S_{it}}\right\}.$$

We extended their approach by additionally taking Credit-Watches into account.[23] Consequently, a rating change should be more imminent when a rating is under credit watch than under a rating outlook. For this reason, we attempt to take this additional information into account by adding (subtracting) a 2 to a given rating score when a rating is under positive (negative) credit watch, while only a 1 is added (subtracted) when a positive (negative) outlook is assigned to a given rating. As a result, the rating score is considerably expanded and allows for more variation (see Table A4 for details). It should be noted, however, that different specifications and transformations of the rating scores lead to similar results in the regression.

3.4 Estimating the marginal risk contribution

U_{ibt} is the marginal risk contribution of a loan to the unexpected losses of the whole credit portfolio. Hence in a first step the unexpected loss has to be determined at the portfolio level and in a second step it is disaggregated at the country level.

The most widespread gauge of a portfolio's unexpected loss is the Value at Risk (VaR). VaR is the maximum loss over a target horizon such that with a pre-specified high probability, *pc,* the actual loss will be smaller. It can be determined from the distribution of the portfolio losses at the target horizon as the difference between the mean of the portfolio value and the value at the *pc*-percentile. To obtain the marginal risk contribution, the VaR is weighted by the ratio which divides the covariance between the portfolio loss (PL_{bt}) and the loss to country *i* (PL_{ibt}) by the portfolio's variance of the portfolio loss. Note that these weights ensure that the marginal risk contributions add up to the VaR:

[23] Standard & Poor's (2003b) define a credit watch as "*..highlighting the potential direction of a short- or long term rating where the focus is on identifiable events and short term trends that cause the rating to be placed under special surveillance".*

$$UL_{ibt}^{[pc]} = \frac{cov(PL_{ibt}, PL_{bt})}{sdv(PL_{bt})^2}(\overline{V_{bt}} - V_{bt}^{[pc]}), \quad (8)$$

where PL_{bt} stands for the bank's portfolio loss, PL_{ibt} stands for the bank's portfolio loss to country i, $\overline{V}_{bt}$ stands for the mean value of bank b's portfolio at time t, $V_{bt}^{[pc]}$ is the portfolio value at the percentile pc (we alternatively use pc = 99.5%; 99.9% and 99.98%) and *cov* (*sdv*) stand for the covariance (standard deviation) operator. The values for the weights and for the VaR have to be taken from the distribution of the portfolio value.

The credit portfolio's value distribution can be estimated using a credit risk model. Our database lends itself to using a simplified version of CreditMetrics.[24] The basic assumptions of CreditMetrics are that the returns of a creditor are normally distributed, further, that a default occurs when the returns of a creditor fall under a certain threshold, and that the probability of the default event can be taken from the probability of default associated with the creditor's rating. As for the estimation of RCC, here we also use the Standard & Poor's country ratings and the one-year probabilities of default for corporates to compute default thresholds.[25] We further assume that the correlation between the returns of a country can be measured by the returns from stock market indices and compute a correlation matrix of the returns for all countries in the sample with the stock market total return indices provided by Morgan Stanley. It should be noted that the index is only available for a total of 51 countries (see Appendix for a list of country names).

The current value of a bank's overall portfolio at the beginning of a period is given by the sum of the bank's individual exposures to each country L_{ibt} which we take from the credit register as described above.[26] We then simulate returns using a multivariate normal distribution with mean zero and the correlation matrix from the stock market total return indices. Default occurs when the simulated return falls below the threshold given by the critical value that is derived from the default probability. In line with the Consultative Paper 4, we assume that loss given default (LGD) is constant and equals 45%[27] and calculate the simulated portfolio value at the end of the period. We then repeat this exercise 100,000 times in order to obtain the simulated loss distribution of bank b in period t. In

[24] J.P. Morgan (1997)
[25] The Basel Committee (1999) notes that most banks apply a one-year time horizon across all asset classes.
[26] It should be noted that the country exposures have been corrected by deducting public guarantees, since the risks are transferred to a guarantor which exhibits practically zero risk.
[27] We further assumed that the correlation between probabilities of default and LGD is constant and equal to zero. The same applies to LGD between borrowers. This is consistent with the assumptions of the Basel

order to obtain a panel of observations for U_{ibt} we also calculate class distributions for each banking group and each period in our sample.

Summary statistics and a correlation matrix are given in Appendix Tables A6 and A7.

4 Results

We start by analysing the question of whether economic capital is binding when compared with a hypothetic regulatory capital according to Basel II over the last 6 years. This will be the case if economic capital exceeds regulatory capital (*RCC_II*). We first test the hypothesis of equation (4), that is comparing the means of *UL* and *RCC_II*, both calculated over all periods, countries and banks. The results of the t-test are reported in Table 1.

Table 1: Comparison of economic capital and hypothetic regulatory capital according to Basel II

H_0: $UL \geq RCC\_II$, H_1: $UL < RCC\_II$,	
Marginal Risk Contribution	t-value (p-value)
UL[99.5]	0.44 (0.66)
UL[99.9]	6.52 (1.00)
UL[99.98]	10.07 (1.00)

The tests indicate that regulatory capital is not binding, because the mean of economic capital exceeds or equals the regulatory requirement. This result still holds when choosing a confidence level of 99.5%. To our knowledge banks typically do not work with confidence levels lower than 99.5%.

However, the outcome of the test could be driven by single countries or quarters. To check the robustness of our results, we also computed test statistics according to equation (4), i.e. for individual countries at the 99.9% confidence level and, additionally, for individual quarters (see Tables A2 and A3 in the appendix). We find only a few countries and no period for which regulatory capital is binding. So overall, the data confirm our thesis that (at least on average) economic capital exceeds regulatory capital.

Committe on Banking Supervision (2004b). For the sake of simplicity we do not include losses from rating migration ("mark-to-market").

One caveat in interpreting this result is that of the test might depend on the specific model we used to proxy the marginal risk contributions, namely CreditMetrics. There are other models in use like Credit Risk + (Credit Suisse First Boston 1997), Credit Portfolio View (Wilson 1998), or KMV (Kealhofer 1995) and it would be interesting to experiment with them. The first best choice would be to use data on the actual marginal risk contributions in each bank, however, such data has not been collected.

As a second condition for the neutrality of Basel II we test whether banks' lending decisions are influenced by the marginal risk contribution. To this end we estimate the regression given in (5). Since we use the lagged endogenous variable as explanatory, we apply the Blundell/Bond system GMM estimator.[28] We show the results for the full bank sample, and separately for Large banks, Landesbanken and remaining other banks, which are mainly small private banks.[29]

Table 2 presents the results. For the full sample of banks neither of our variables of interest is significant. This seems to be mainly due to the heterogeneity between banking groups. When differentiating between banking groups the following picture emerges: The coefficient for marginal risk contribution (*UL*) is negative and significant at the 1 percent conficence level for Large Banks and other banks. Unexpected loss seems to have determined lending by these banking groups. For the Landesbanken, on the other hand, unexpected loss is not statistically significant.

Somewhat surprisingly, the interest rate and expected loss are insignificant in most estimates. A possible reason for the latter might be that banks use internal ratings, which differ significantly from the ones of S&P. For instance Krahnen (2000) argues that internal ratings of German banks are more volatile than ratings of external rating agencies, which may be due to soft factors that are not publicly known and part of banks' informational lead and thus represents the value added of internal ratings. However, to our knowledge, this argument applies mostly for internal ratings of firms and less so to sovereign ratings.

[28] See Blundell and Bond 1998

[29] As described above, the dataset comprises quarterly credit flows to 30 emerging markets between 1996-III up to 2002-II.

Table 2: Blundell-Bond System GMM Estimation[30] of Equation (5), Dependent Variable: Credit Flows (ΔL_{ibt}), 1997q1-2002q2, time dummies included

	All Banks	Large Banks (Big Four)	German Landesbanken	Other
Interest Rate (R_t)	557.38	12787.10	-813.35	328.69*
	(0.15)	(1.04)	(-0.52)	(1.78)
Expected Loss (EL_{it})	8.34	15077.44	-277.25	-222.89
	(0.00)	(1.15)	(-0.17)	(-0.97)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.10	-0.36***	-0.02	-0.28***
	(-1.31)	(-3.05)	(-0.96)	(-2.81)
Lending Stock (L_{ibt-1})	-0.18***	-0.20***	-0.05**	-0.27*
	(-4.67)	(-2.90)	(-2.26)	(-1.81)
Lending Stock (L_{ibt-2})	0.03	-0.06	0.02	0.11**
	(0.45)	(-0.80)	(1.12)	(2.18)
Constant	309523.70	67100.48	10830.86	861.86
	(1.30)	(1.02)	(1.26)	(1.02)
No. of Obs.	24673	2077	6701	15895
Wald chi2	103.45***	144.86***	103.06***	63.98***
Hansen test[#]	34.20**	35.17*	34.62**	51.41***
(p-value)	(0.02)	(0.03)	(0.03)	(0.00)
AR (1) test	-2.43**	-3.79***	-1.2	-1.91*
(p-value)	(0.02)	(0.00)	(0.16)	(0.06)
AR (2) test	-1.31	-0.95	-0.94	-0.48
(p-value)	(0.19)	(0.34)	(0.35)	(0.63)

t-values in brackets, *, **, *** denotes significance at 10%, 5% and 1%.
[#]Hansen test for over-identifying restrictions.

It is important to note that the results are largely based on data before the first Basel II proposals were published. Since then Landesbanken (like many other banks) may have been modernizing their risk management taking the proposals into account. We test whether this "phasing in" is important by limiting the estimation for the time after the first Consultative Paper was published by the Basel Committee in June 1999. Now the results (given in Table 3) confirm that overall banks have based their international lending decisions on unexpected loss considerations. The variable unexpected loss enters significantly in the lending equation for the full sample, Large Banks and Landesbanken.

[30] Only asymptotically more efficient two-step Blundell-Bond system GMM estimates are reported. To compensate for the downward bias in two-step estimates of the standard errors the finite-sample correction derived by Windmeijer (2000) is applied. Regression results have been obtained combining the columns of the instrument matrix and thus use only one instrument for each variable and lag distance, rather than one for each time period, variable and lag distance.

This results support the view that lending has increasingly been determined by economic capital in preparation for Basel II.

Table 3: Phasing In 1999Q3 – 2002Q2, Blundell-Bond System GMM Estimation of Equation (5), Dependent Variable: Credit Flows (ΔL_{ibt}), time dummies included

	All Banks	Large Banks (Big Four)	German Landesbanken	Other
Interest Rate (R_t)	5454.88	16474.51*	2261.62	-118.23
	(1.04)	(1.69)	(1.19)	(-1.08)
Expected Loss (EL_{it})	9847.89	27435.82	8675.12	131.55
	(0.87)	(1.23)	(0.71)	(0.83)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.18***	-0.38**	-0.12***	-0.21
	(-2.74)	(-2.37)	(-6.54)	(-0.85)
Lending Stock (L_{ibt-1})	-0.29	-0.25**	-0.18***	-0.10
	(-4.89)	(-2.49)	(-4.04)	(-1.13)
Lending Stock (L_{ibt-2})	-0.09	-0.06	0.07***	0.17**
	(-1.25)	(0.07)	(3.54)	(2.26)
Constant	-375102.90**	71364.58	5294.44	408.94
	(-2.37)	(1.15)	(0.64)	(0.85)
No. of Obs.	13776	1104	3672	9000
Wald chi2	72.59***	68.50***	344.08***	37.87***
Hansen test[#]	41.47**	40.01**	44.71**	57.64***
(p-value)	(0.01)	(0.03)	(0.01)	(0.00)
AR (1) test	-2.08**	-2.77**	-1.30	-2.25**
(p-value)	(0.04)	(0.01)	(0.20)	(0.02)
AR (2) test	-0.84	-0.84	-2.09**	-0.17
(p-value)	(0.40)	(0.40)	(0.04)	(0.87)

t-values in brackets, *, **, *** denotes significance at 10%, 5% and 1%.
[#]Hansen test for overidentifying restrictions.

Next we check whether the result is robust to the inclusion of regulatory capital according to Basel I (*RCC_I*). Recall from above that under Basel I all OECD countries have a zero capital requirement, while non OECD countries have a risk weight of one hundred. Given the results of Table 2 we would expect that regulatory capital had no influence on lending decisions. We now test the question from another angle by including both Basel I regulatory capital (which is simply an OECD dummy) and unexpected loss in the lending equation. The results in the Appendix Table A5. In none of the cases regulatory capital is positive and significant. Thus Basel I does not seem to have impacted lending decisions,

and regulatory arbitrage opportunities under Basel I seem to have played a minor role only. The result further corroborates our hypothesis that the introduction of Basel II will not lead to considerable adjustments in the banks' portfolios. Finally, it should be noted that the significance of unexpected loss is not robust to the inclusion of the OECD dummy for the overall results and other banks. Since the correlation between the variables of interest is low (see Appendix Table A7) we cannot attribute this finding to the collinearity among the variables, but rather to the heterogeneity among the group of other banks.

5 Conclusion

The empirical evidence presented in this paper suggests that Basel II will have a limited effect on loans to emerging markets, as least if German Banks are representative of other banking systems. According to the evidence presented here the Basel Committee seems to have achieved the goal of bringing regulatory capital in line with economic capital from below. It seems to be that the capital costs will not rise on average and, additionally, that most internationally active banks have already adopted modern risk assessment tools for their decisions.

Specifically we showed that on average economic capital is higher than regulatory capital under Basel II. This is true for plausible levels of confidence in calculating economic capital based on a Value at Risk Model. We then proceeded to estimate a dynamic panel regression of determinants of lending to emerging markets. We find that economic capital is a significant determinant of the Large banks' loan decisions. When we restrict the sample to more recent years economic capital enters significantly for all banks. Further, we find no evidence that banks have biased their lending towards OECD emerging markets for which capital costs are zero under Basel I. We therefore expect that by the time the Basel II rules will become effective they will have only a negligible effect on German banks' loans to emerging markets.

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7 Appendix

Data sources and country lists

Source	Type of Data
Standard and Poor's (2003c)	Foreign Currency Long Term Sovereign Credit ratings
Standard and Poor's (2003a)	1 Year Average Default Rates by Rating Modifiers for Corporates
Bundesbank	Foreign Exposures of Banks
Bundesbank	Currency Composition of Foreign Exposures
Thomson Financial Datastream	Morgan Stanley Capital Market Indices (MSCI)
Bundesbank	Riskless Interest Rate

Countries with available MSCI stock market indices:

Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, South Korea, Luxembourg, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Russia, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, USA, Venezuela

Countries used in the Regression Analysis

Argentina, Brazil, Chile, China, Colombia, Egypt, Hong Kong, Hungary, India, Indonesia, Israel, Jordan, South Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Russia, Singapore, South Africa, Sri Lanka, Taiwan, Thailand, Turkey, Venezuela

Table A1: Number of banks

Time	Large Banks	Landesbanken	Other	Total
1996q3	5	13	31	49
1997q3	5	13	34	52
1998q3	4	13	40	57
1999q3	4	13	32	49
2000q3	4	13	35	52
2001q3	4	13	32	49
2002q2	4	12	32	48

Table A2: By country: Is regulatory capital according to Basel II binding?

H_0: $UL_i \geq RCC\_II_i$, H_1: $UL_i < RCC\_II_i$

Country	t-value	Country	t-value
Morocco	-8.22/(0.00)	Hong Kong	-10.63/(0.00)
Egypt	-7.09/(0.00)	Thailand	-9.44/(0.00)
South Africa	-3.56/(0.00)	Turkey	12.88/(1.00)
Colombia	-10.66/(0.00)	Poland	2.93/(1.00)
Peru	-8.79/(0.00)	Hungary	1.71/(0.96)
Chile	-12.72/(0.00)	Russia	0.93/(0.83)
Israel	-9.17/(0.00)	Mexico	1.53/(0.94)
Jordan	-6.99/(0.00)	Brazil	8.27/(1.00)
Pakistan	-2.86/(0.00)	Argentina	4.01/(1.00)
India	-3.76/(0.00)	Indonesia	3.31/(1.00)
Malaysia	-4.04/(0.00)	Singapore	1.92/(0.97)
Philippines	-9.64/(0.00)	South Korea	3.59/(1.00)
China	-8.71/(0.00)	Venezuela	-0.07/(0.47)

p-value in brackets

Table A3: By quarter: Is regulatory capital according to Basel II binding?

H_0: $UL_t \geq RCC\_II_t$, H_1: $UL_t < RCC\_II_t$

Quarter	t-value	Quarter	t-value
1996Q4	2.20/(0.99)	1999Q4	0.17/(0.43)
1997Q1	2.26/(0.99)	2000Q1	0.22/(0.41)
1997Q2	2.37/(0.99)	2000Q2	0.65/(0.26)
1997Q3	2.41/(0.99)	2000Q3	0.72/(0.23)
1997Q4	2.25/(0.99)	2000Q4	1.93/(0.97)
1998Q1	2.04/(0.98)	2001Q1	2.53/(0.99)
1998Q2	2.54/(0.99)	2001Q2	2.14/(0.98)
1998Q3	2.88/(1.00)	2001Q3	2.86/(1.00)
1998Q4	1.23/(0.89)	2001Q4	2.16/(0.98)
1999Q1	0.09/(0.54)	2002Q1	2.82/(1.00)
1999Q2	0.95/(0.17)	2002Q2	3.05/(1.00)
1999Q3	0.42/(0.34)		

t-value, p-value in brackets

Table A4: Numerical rating score

Standard and Poor's rating	Rating score
AAA	1
AA+	4
AA	9
AA-	14
A+	19
A	24
A-	29
BBB+	34
BBB	39
BBB-	44
BB+	49
BB	54
BB-	59
B+	64
B	69
B-	74
CCC+	79
CCC	84
CCC-	89
CC	94
SD	97

Source: Bartholdy & Lekka (2002), plus (minus) 1 if the rating is assigned a positive (negative) outlook, plus (minus) 2 if the rating is put on a positive (negative Credit Watch).

Table A5: Sensitivity Test: Blundell-Bond System GMM Estimation of Equation (5), including Basel I regulatory capital, 1999Q3 – 2002Q2, Dependent Variable: Credit Flows (ΔL_{ibt}), time dummies included

	All Banks	Large Banks (Big Four)	German Landesbanken	Other
Interest Rate (R_t)	10231.15	18214.07*	2130.11	631.37
	(1.13)	(1.81)	(1.20)	(0.68)
Expected Loss (EL_{it})	-13938.09	32880.29	4819.05	2118.19
	(-0.49)	(1.39)	(0.83)	(0.77)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.09	-0.36**	-0.12***	-0.13
	(-0.82)	(-2.37)	(-6.20)	(-0.74)
Basel I (RCC_I_{ib}) OECD dummy	-2265789.00	353916.70	-0.26	176993.40
	(-0.88)	(1.04)	(-0.12)	(0.86)
Lending Stock (L_{ibt-1})	-0.31***	-0.33***	-0.19	-0.46***
	(-3.29)	(-2.88)	(-4.03)	(-3.34)
Lending Stock (L_{ibt-2})	-0.08	-0.06	0.07	0.16**
	(-1.08)	(-0.76)	(3.15)	(2.10)
Constant	930352.80	41281.98	10454.50	-29588.77
	(1.57)	(0.54)	(0.31)	(-0.87)
No. of Obs.	13776	1104	3672	9000
Wald chi2	43.82	77.56***	353.54***	53.02***
Hansen test [#]	28.89	38.97**	38.05**	46.10***
(p-value)	(0.15)	(0.03)	(0.03)	(0.00)
AR (1) test	-1.96*	-2.64**	-1.30	-2.10**
(p-value)	(0.05)	(0.01)	(0.20)	(0.04)
AR (2) test	-0.93	-0.85	-2.08**	-0.52
(p-value)	(0.35)	(0.40)	(0.04)	(0.60)

t-values in brackets, *, **, *** denotes significance at 10%, 5% and 1%.
[#]Hansen test for over-identifying restrictions

Table A6: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
$UL_{ibt}^{[99.5]}$	32697	9997.56	100305.10	-1290.43	4719305.00
$UL_{ibt}^{[99.9]}$	32697	13729.30	123270.20	1478.19	5396674.00
$UL_{ibt}^{[99.98]}$	32697	16782.47	143003.30	-1649.54	6032642.00
L_{ibt}	197424	604.66	52416.51	-7361575.00	6652457.00
I_t	146992	3.78	0.61	2.73	5.17
EL_{it}	120161	-0.17	1.32	-4.57	4.57
RCC_I_{ib}	146992	0.10	0.31	0.00	1.00
RCC_II_{ibt}	119342	0.07	0.07	0.00	0.45

Table A7 : Correlation Matrix

	$UL^{[99.5]}$	$UL^{[99.9]}$	$UL^{[99.98]}$	L_{ibt}	I_t	EL_{it}	RCC_I_{ib}	RCC_II_{ibt}
$UL^{[99.5]}$	1.00							
$UL^{[99.9]}$	0.98	1.00						
$UL^{[99.98]}$	0.97	1.00	1.00					
L_{ibt}	-0.08	-0.09	-0.09	1.00				
I_t	0.00	0.00	0.00	-0.01	1.00			
EL_{it}	0.08	0.09	0.09	-0.01	0.00	1.00		
RCC_I_{ib}	0.02	0.04	0.04	0.02	-0.01	0.02	1.00	
RCC_II_{ibt}	0.09	0.10	0.10	-0.02	0.00	0.84	-0.04	1.00

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