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ABSTRACT

Basel II and Bank Lending to Emerging Markets: Micro Evidence from German Banks*

This paper investigates whether the new Basel Accord will induce a change in bank lending to emerging markets using a new loan level 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.

JEL Classification: F33, F34 and G28
Keywords: banking regulation, Basel accord and international lending

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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, see, e.g., Reisen (2001) or Griffith-Jones (2003). 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 (BIS (1999) and BIS (2001)). 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 (BIS (2003)). Nevertheless, the third Quantitative Impact Study 3 (QIS 3)[2] revealed that capital requirements for sovereign exposures will still rise by 28 per cent under the Advanced IRB[3] and 47 per cent under the

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[2] 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.

[3] 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

Foundation IRB for Group 1 banks.[4] 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, following Griffith-Jones (2003) or Calvo et. al. (2004), in a market characterised by credit rationing, spread increases may lead to the exclusion of borrowers.

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 (see Reisen (2001) for an example for this argumentation). In particular, the OECD/non-OECD distinction in principle allowed banks to hold risky assets (e.g. Mexico) without commensurate capital. According to Jeanneau and Micu (2002) or Buch (2000) the lower risk weight for short-term lending may have contributed to large inflows of short-term capital before the Asian crisis.

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

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components. Under the advanced approach, banks provide their own estimates of PD, loss given default (LGD), exposure at default (EAD) and their own calculation of maturity (M), subject to meeting minimum standards.

[4] Basel Committee 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.

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 are the relationship between regulatory and economic capital and which of them the binding constraint is. 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, Hayes and Saporta (2002) suggest that it should have no impact on credit decisions of banks already using these techniques.

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. This measure is then tested in a 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 capital flows.[5] 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

[5] Jeanneau and Micu (2002) give an overview of this literature.

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. This differentiation is of particular importance in the context of the German financial system which is composed of a few large private banks and a substantial share of public sector banks. Given the mandate of public sector banks and the guarantees extended to these banks the business policy and objectives pursued may differ substantially from private sector banks, see Koetter et al.(2004)[6].

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 (Calvo et. al. (2004). While demand factors may have partly played a role during the observation period, the developments in debt markets have been largely contributed to supply shifts (World Bank, (2003), and Goldberg (2001) for evidence with respect to US bank lending). This implies that demand should have only a limited role on flows 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

[6] The big four private banks and the public sector banks represented on average a share of over 71 percent of total cross border lending over the sample period 1996Q3 to 2002Q2.

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}).

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:

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

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 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.[7] If banks incorporate unexpected loss in their decisions,

[7] 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}.

we would expect that the estimation of (5) results in a coefficient for β_3 which is significantly negative.

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.[8] 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 exposures of 1.5 million Euro (formerly 3 million Deutsche Mark) or more at a quarterly frequency, see Nestmann et. al. (2003) for a detailed description of the data set. 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 other banks[9]) 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.

[8] See appendix for the sources of the data.
[9] 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. The group of other banks includes regional banks, mortgage banks and credit institutions with special function under private legal form. Foreign banks are not present in the dataset.

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, see Nestmann et al. (2003) for further details.

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 new capital framework. [10] 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.[11] 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

[10] The revision of the risk weight function focusing on unexpected loss only has been taken into account (see Basel Committee on Banking Supervision, 2004a).
[11] 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.

regarded as an upper limit for the true ratings of the private sector.[12] 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 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:

$$\tilde{S}_{it} = \ln\left\{\frac{S_{it}}{59 - S_{it}}\right\} \tag{6}$$

We extended their approach by additionally taking Credit-Watches into account.[13] 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

[12] 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.

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:

$$UL_{ibt}^{[pc]} = \frac{cov(PL_{ibt}, PL_{bt})}{sdv(PL_{bt})^2}(\overline{V_{bt}} - V_{bt}^{[pc]}), \tag{7}$$

[13] 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".*

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*) stands 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, J.P. Morgan (1997).[14] 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.[15] 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. 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

[14] Jackson et al. (2002) examining a similar idea also use CredtiMetrics to estimate economic capital.

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%[16] 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 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.

[15] The Basel Committee (1999) notes that most banks apply a one-year time horizon across all asset classes.
[16] 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 Committee on Banking Supervision (2004b). For the sake of simplicity we do not include losses from rating migration ("mark-to-market").

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

H_0: $UL \geq RCC\_II$, H_1: $UL < RCC\_II$,				
Variable	t-value (p-value)	Mean(*UL*) (Std. Dev. (*UL*))	Mean (*RCC_II*) (Std. Dev. (*RCC_II*))	No. of Obs.
UL[99.5]	0.80 (0.79)	10419.46 (102141.90)	9953.08 (82684.51)	26994
UL[99.9]	5.87 (1.00)	13853.70 (122173.50)	9953.08 (82684.51)	26994
UL[99.98]	9.21 (1.00)	16937.96 (141836)	9953.08 (82684.51)	26994

Source: Authors'

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%. This is also supported by evidence presented by Jackson et al. (2002). On the basis of banks' long-term ratings and Tier 1 capital holdings they find that banks aim at confidence levels of 99.9% and above.

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.

One caveat in interpreting this result is that 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 (see Blundell and Bond 1998). The choice of the lag order 2 is motivated by statistical reasons, i.e. the model with 2 lags optimizes the outcome of the AR tests. 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. As described above, the dataset comprises quarterly credit flows to 30 emerging markets between 1996-III up to 2002-II.

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 confidence 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.

Table 2: Blundell-Bond System GMM Estimation[17] 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 (0.15)	12787.10 (1.04)	-813.35 (-0.52)	328.69* (1.78)
Expected Loss (EL_{it})	8.34 (0.00)	15077.44 (1.15)	-277.25 (-0.17)	-222.89 (-0.97)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.10 (-1.31)	-0.36*** (-3.05)	-0.02 (-0.96)	-0.28*** (-2.81)
Lending Stock (L_{ibt-1})	-0.18*** (-4.67)	-0.20*** (-2.90)	-0.05** (-2.26)	-0.27* (-1.81)
Lending Stock (L_{ibt-2})	0.03 (0.45)	-0.06 (-0.80)	0.02 (1.12)	0.11** (2.18)
Constant	309523.70 (1.30)	67100.48 (1.02)	10830.86 (1.26)	861.86 (1.02)
No. of Obs.	24673	2077	6701	15895
Wald chi2	103.45***	144.86***	103.06***	63.98***
Hansen test[#] (p-value)	34.20** (0.02)	35.17* (0.03)	34.62** (0.03)	51.41*** (0.00)
AR (1) test (p-value)	-2.43** (0.02)	-3.79*** (0.00)	-1.2 (0.16)	-1.91* (0.06)
AR (2) test (p-value)	-1.31 (0.19)	-0.95 (0.34)	-0.94 (0.35)	-0.48 (0.63)

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

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

[17] 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 (2005) is applied. Regression results have been obtained combining the columns of the

may be due to soft factors that are not publicly known and part of banks' informational lead and thus represent the value added of internal ratings. However, to our knowledge, this argument applies mostly for internal ratings of firms and less so for sovereign ratings.

The choice of the instruments and the lag order of the endogenous variable is motivated by the fact we tried to optimize the results for the Hansen tests and the AR tests. Concerning the significance of the coefficients of *UL* we found that the results were robust for different lag orders and instruments. However, even for the optimal choice presented in Table 2 the Hansen test still reject the null hypothesis in most cases. For the given data there is no dynamic specification for which the null of the tests is always accepted. We therefore further check the robustness of our findings with the help of a static fixed effects model. The results (see Table 3) for the Large Banks and other banks are in line with the dynamic model. Again, for Landesbanken the coefficient of *UL* is insignificant, but the standard error is much smaller. Therefore in the regression for all banks the impact of *UL* is significant on the 1 per cent level.

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.

Table 3: Fixed Effects Estimation 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)	-389.78 (-0.27)	-14671.42 -(1.20)	3384.66 (0.91)	42.99 (0.15)
Expected Loss (EL_{it})	-1143.90 (-1.28)	-11591.71 (-1.46)	1157.59 (0.50)	-505.70*** (-2.87)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.08*** (-12.35)	-0.31*** (-8.40)	-0.02 (-1.53)	-0.28*** (-2.81)
Constant	4720.19 (0.79)	90099.32* (1.78)	-7704.82 (-0.50)	-108.09 (0.09)
No. of Obs.	25268	2087	6463	16718
R^2	0.01	0.09	0.01	0.11

t-values in brackets, *, **, *** denotes significance at 10%, 5% and 1%.

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 dynamic estimation for the time after the first Consultative Paper was published by the Basel Committee in June 1999. Now the results (given in Table 4) 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. In the corresponding fixed effects estimation the coefficient is significant for all banking groups (see Table 5). Both results support the view that lending has increasingly been determined by economic capital in preparation for Basel II.

Table 4: 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 (1.04)	16474.51* (1.69)	2261.62 (1.19)	-118.23 (-1.08)
Expected Loss (EL_{it})	9847.89 (0.87)	27435.82 (1.23)	8675.12 (0.71)	131.55 (0.83)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.18*** (-2.74)	-0.38** (-2.37)	-0.12*** (-6.54)	-0.21 (-0.85)
Lending Stock (L_{ibt-1})	-0.29 (-4.89)	-0.25** (-2.49)	-0.18*** (-4.04)	-0.10 (-1.13)
Lending Stock (L_{ibt-2})	-0.09 (-1.25)	-0.06 (0.07)	0.07*** (3.54)	0.17** (2.26)
Constant	-375102.90** (-2.37)	71364.58 (1.15)	5294.44 (0.64)	408.94 (0.85)
No. of Obs.	13776	1104	3672	9000
Wald chi2	72.59***	68.50***	344.08***	37.87***
Hansen test[#] (p-value)	41.47** (0.01)	40.01** (0.03)	44.71** (0.01)	57.64*** (0.00)
AR (1) test (p-value)	-2.08** (0.04)	-2.77** (0.01)	-1.30 (0.20)	-2.25** (0.02)
AR (2) test (p-value)	-0.84 (0.40)	-0.84 (0.40)	-2.09** (0.04)	-0.17 (0.87)

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

Table 5: Phasing In 1999Q3 – 2002Q2, Fixed Effects 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)	2482.78 (1.28)	13424.35 (0.87)	5697.94 (1.06)	-295.50 (-1.22)
Expected Loss (EL_{it})	-1687.45 (-1.32)	-23085.96** (-2.18)	943.89 (0.27)	-191.57 (-1.21)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.21*** (-21.43)	-0.40*** (-8.15)	-0.16*** (-9.99)	-0.16*** (-11.05)
Constant	8351.44 (0.99)	-43288.25 (-0.65)	-16751.54 (-0.73)	1349.68 (1.27)
No. of Obs.	15600	1248	4008	10344
R^2	0.04	0.12	0.04	0.02

t-values in brackets, *, **, *** denotes significance at 10%, 5% and 1%.

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. Since the fixed effects model cancels out the OECD dummy we only estimate the dynamic specification. The results are given in Table A5 of the appendix. In none of the cases regulatory capital is positive and significant. Thus Basel I does not seem to have impacted lending decisions in recent years. Probably, regulatory arbitrage opportunities under Basel I have only been important just after the implementation in the beginning of the 90s while playing apparently a minor role for the period of 1999 to 2002. 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 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: $UL_i[99.9] \geq RCC\_II_i$, H_1: $UL_i[99.9] < RCC\_II_i$

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: $UL_t[99.9] \geq RCC\_II_t$, H_1: $UL_t[99.9] < RCC\_II_t$

Quarter	t-value	Quarter	t-value
1996Q4	2.15/(0.98)	1999Q4	-0.16/(0.44)
1997Q1	2.26/(0.98)	2000Q1	-0.20/(0.42)
1997Q2	2.37/(0.99)	2000Q2	-0.60/(0.28)
1997Q3	2.38/(0.99)	2000Q3	-0.87/(0.19)
1997Q4	2.22/(0.99)	2000Q4	1.67/(0.95)
1998Q1	2.03/(0.98)	2001Q1	2.48/(0.99)
1998Q2	2.54/(0.99)	2001Q2	2.13/(0.98)
1998Q3	2.92/(1.00)	2001Q3	2.98/(1.00)
1998Q4	1.33/(0.91)	2001Q4	1.96/(0.97)
1999Q1	0.12/(0.55)	2002Q1	2.74/(1.00)
1999Q2	-0.95/(0.17)	2002Q2	2.71/(1.00)
1999Q3	-0.41/(0.34)		

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 (1.13)	18214.07* (1.81)	2130.11 (1.20)	631.37 (0.68)
Expected Loss (EL_{it})	-13938.09 (-0.49)	32880.29 (1.39)	4819.05 (0.83)	2118.19 (0.77)
Marginal risk contribution ($UL_{ibt}^{[99.9]}$)	-0.09 (-0.82)	-0.36** (-2.37)	-0.12*** (-6.20)	-0.13 (-0.74)
Basel I (RCC_I_{ib}) OECD dummy	-2265789.00 (-0.88)	353916.70 (1.04)	-0.26 (-0.12)	176993.40 (0.86)
Lending Stock (L_{ibt-1})	-0.31*** (-3.29)	-0.33*** (-2.88)	-0.19 (-4.03)	-0.46*** (-3.34)
Lending Stock (L_{ibt-2})	-0.08 (-1.08)	-0.06 (-0.76)	0.07 (3.15)	0.16** (2.10)
Constant	930352.80 (1.57)	41281.98 (0.54)	10454.50 (0.31)	-29588.77 (-0.87)
No. of Obs.	13776	1104	3672	9000
Wald chi2	43.82	77.56***	353.54***	53.02***
Hansen test [#] (p-value)	28.89 (0.15)	38.97** (0.03)	38.05** (0.03)	46.10*** (0.00)
AR (1) test (p-value)	-1.96* (0.05)	-2.64** (0.01)	-1.30 (0.20)	-2.10** (0.04)
AR (2) test (p-value)	-0.93 (0.35)	-0.85 (0.40)	-2.08** (0.04)	-0.52 (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
$UL_{ibt}^{[99.5]}$	29064	10911.56	105931.70	-1290.43	4719305
$UL_{ibt}^{[99.9]}$	29064	14593.62	127352.50	-1478.18	5396674
$UL_{ibt}^{[99.98]}$	29064	17863.88	147688.80	-1649.54	6032642
ΔL_{ibt}	189198	507.45	46059.80	-7361575	3083096
I_t	138217	3.78	0.61	2.73	5.17
EL_{it}	111386	-0.02	1.15	-3.16	4.57
RCC_I_{ib}	138217	0.09	0.29	0	1.00
RCC_II_{ibt}	111152	0.09	0.09	0	0.45

Table A7 : Correlation Matrix

	$UL^{[99.5]}$	$UL^{[99.9]}$	$UL^{[99.98]}$	ΔL_{ibt}	I_t	EL_{it}	RCC_I_{ib}	RCC_II_{ibt}
$UL^{[99.5]}$	1.00							
$UL^{[99.9]}$	0.99	1.00						
$UL^{[99.98]}$	0.98	1.00	1.00					
ΔL_{ibt}	-0.10	-0.11	-0.10	1.00				
I_t	0.00	0.00	0.00	-0.01	1.00			
EL_{it}	0.09	0.10	0.10	-0.02	0.00	1.00		
RCC_I_{ib}	0.02	0.03	0.03	0.02	-0.01	-0.05	1.00	
RCC_II_{ibt}	0.10	0.12	0.12	-0.02	0.00	0.91	-0.04	1.00