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The Impact of Macroeconomic Factors on Risks in the Banking Sector: A Cross-Country Empirical Assessment

Olga Bohachova*

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ABSTRACT

This paper explores the links between macroeconomic conditions and individual bank risk. Using capital adequacy ratios as a broad measure of risk sustainability, a linear mixed effects model for a large international panel of banks for the years 2001-2005 is estimated. In OECD countries, banks tend to hold higher capital ratios during business cycle highs, this effect being even stronger for a subsample of EU banks. In non-OECD countries, periods of higher economic growth are associated with lower capital ratios. This indicates procyclical behavior. Banks accumulate risks more rapidly in economically good times and some of these risks materialize as asset quality deteriorates during subsequent recessions. Furthermore, higher inflation rates are associated with higher capital ratios of banks, implying that inflation-induced economic uncertainty stimulates banks to restrict credit. As far as regulatory and institutional environment is concerned, econometric estimates show that banks in non-OECD countries with deposit insurance tend to be more risky, whereas evidence of a negative relationship between concentration of the banking sector and banks' risk taking is statistically less robust.

Key words: international banking, macroeconomic conditions, banking risk

JEL classification: F37, F41, G21

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1. Motivation

The goal of this paper is to explore the links between macroeconomic fundamentals and bank risk in an international perspective. Although negative consequences of adverse macroeconomic events are not limited to the banking sector alone, it has been recognized that banks play a special role in the economy, and their failure markedly reinforces the adverse developments that may have caused them to fail (Sijben 2002, p. 363). Given that banks are theoretically more prone to (economically undesirable) risk taking than non-financial institutions (Hellwig 1995) and that weak macroeconomic fundamentals simultaneously affect a large number of institutions, it is all the more important to understand macroeconomic influences on risk positions of banks.

Empirical studies that model the relationship between macroeconomic factors and individual bank risk are relatively rare (e.g., Buch et al. 2007, Wedow 2006, Baele/Vander Vennet et al. 2004). Most research linking banking risks and macroeconomic environment addresses episodes of banking crises. Detailed reviews of their approaches can be found in Bell/Pain (2000) and Demirgüç-Kunt/Detragiache (2005). These studies include papers that focus on country level positions as well as those that use both individual bank data and macroeconomic data. One line of research was on the connection between financial liberalization and bank crises, finding that excessive risk taking is a likely result of liberalization that lacks sufficient prudential regulation and adequate supervising institutions. Another line of research focused on international shocks and the connection between the exchange rate regime and bank crises. Here conclusions diverge, since researchers find evidence both „pro“ and „contra“ a fixed exchange rate regime’s ability to reduce the likelihood of bank crises as well as evidence of equal susceptibility to crises under fixed and floating exchange rate regimes alike.

Although this literature provides valuable insights concerning bank risk and identifies macroeconomic conditions that are associated with banking vulnerabilities, this kind of research focuses on crises episodes only. This leaves out a vast banking universe elsewhere that is having a “tranquil” time. Even or perhaps particularly in tranquil times assumption and transformation risks remains the core function of banking. Therefore, extending empirical research to individual bank risk and linking it to macroeconomic factors in non-crisis settings can provide a more rounded view of contemporary financial systems.

This paper provides a broad-based cross-country time-series econometric analysis of possible correlations between macroeconomic conditions and bank risk at the individual bank level. In section 2, theoretical hypotheses of linkages between macroeconomic factors and risk-taking behavior of banks are formulated. Section 3 describes the data and the empirical model used to test the hypotheses. As a broad measure of bank risk, capital adequacy ratios for a large international panel of banks from the Bankscope database are used. Higher capital ratios imply greater loss resilience and less risk of financial distress. Robustness tests are conducted with capital over risk (unweighted) assets as a dependent variable. To account for the hierarchical structure of the data set, a linear mixed effects model with random country and bank intercepts is estimated. The empirical analysis distinguishes between banks domiciled in OECD, the countries of the EU-15, and non-OECD countries.

Section 4 presents estimation results for the model. In economically advanced countries, banks tend to hold higher capital ratios during business cycle highs, whereas in non-OECD countries, capital ratios are lower in periods of rapid economic growth. Furthermore, higher inflation rates are associated with higher capital buffers of banks, implying that inflation-induced economic uncertainty stimulates banks to ration credit. Currency appreciation appears to have a negative, albeit statistically less robust, relationship with bank risk in OECD countries. Also, no robust results can be reported on the connection of bank risk with the terms of trade and market interest rates. Section 4 also contains results for bank level variables as well as country level variables that reflect institutional/ regulatory environment. In line with theoretical predictions, the existence of an explicit deposit insurance scheme in non-OECD countries is shown to be conducive to higher risk taking by banks, whereas a negative relationship between concentration (higher concentration meaning higher charter values of banks) and banks' risk taking holds for most model setups, but fails to be confirmed in baseline regressions with OECD banks. Section 5 concludes.

2. Theoretical hypotheses linking bank risk to macroeconomic fundamentals

2.1 Business cycle conditions

Since banks perform intermediary functions for the real sector, they are exposed to business cycle conditions that largely determine the aggregate health of the real sector. As economic conditions worsen during stagnation and recession periods, the riskiness of intermediation tends to rise. Banks are vulnerable to adverse selection and moral hazard behavior of their borrowers. These are forms of information asymmetries, and asymmetric information and agency costs have been shown to be typically high during business cycle troughs (Baele/Vander Vennet 2005). Furthermore, an economic slowdown is likely to have a negative effect on bank profits because typically low interest rates in a recession contribute to the erosion of banks' interest margins. Also, fee revenues are likely to fall in the environment of declining stock markets and the lack of merger and acquisition deals. In sum, it can be expected that bank risk is correlated negatively with the business cycle, rising at times when economic activity slows.

It should be noted that cyclical downturns are not always the *cause* of higher riskiness in banking, they can also help reveal weaknesses in bank risk structures that were built up during business cycle upturns. There is evidence that financial systems tend to behave procyclically, that is, business and financial cycles co-move.[1] In an economic upturn, when collateral value is high, banks lend funds more readily and asset (credit) growth accelerates. Depending on a bank's risk practices, this may sow the seeds of excessive credit risk that will become apparent in a subsequent recession, once profitability of bank borrowers deteriorates and their loan servicing ability as well as the value of their collateral declines.[2] Thus it may be necessary to distinguish between the magnitude of risk that a bank already has on its balance sheet and its concurrent risk-taking behavior. For instance, in a business cycle downturn the bank may in fact behave more risk-aversely by tightening

[1] A financial cycle is defined as the sequence of rapid credit expansion and asset price increases and their reversals that can end in financial distress. The direction of causation in these co-movements – whether the business cycle influences the financial one or vice versa – is a matter of debate, and researches have seen in the crises in Asia and Latin America in the 1990s evidence on the causal role of financial factors (Borio et al. 2001). A possible scenario is mutual causation, with one type of cycle reinforcing the other.

[2] In the 1990s this was the background of banking problems in Japan, the US, the UK, Australia, Sweden, Norway, Finland as well as in emerging markets. In Japan, banking distress was connected with the bursting of the asset price bubble and was exacerbated but not directly caused by the following recession (Lindgren et al. 1996, p. 51).

credit conditions for new borrowers while the risk associated with its assets – acquired previously – may still increase due to factors mentioned above.

2.2 Exchange rate fluctuations

The theoretical impact of exchange rate fluctuations on bank risk depends on the interplay between currency moves and a bank's foreign exchange exposure. Domestic currency depreciation can be expected to hurt banks whose foreign exchange liabilities substantially exceed their assets denominated in foreign currencies. However, Lindgren et al. (1996) identify the effect of exchange rate levels on the performance of banks' borrowers as its primary impact on bank profitability, i.e., they attach greater importance to the connection between exchange rate and credit risk than to currency risk as such. On aggregate, domestic currency depreciation is likely to increase credit risk for bank loans extended to importers and decrease credit risk of the exporting sector. Changes in a bank's overall risk position will be determined by its net exposure to exporting or importing corporate borrowers. Exchange rate moves are likely to have a different effect on banks with different kinds of exposure.

The magnitude of exchange rate moves can be a risk source of its own. Excessive exchange rate volatility impairs economic and financial stability in a country and was found to have played a significant role in inducing banking crises in many countries (Lindgren et al. 1996). Given the fairly "crude" measure of exchange rate fluctuations used in subsequent empirical analysis (annual percentage change of the exchange rate), it is the meaning of these kinds of moves that our econometric model may help reveal. A sufficiently strong depreciation of a currency can be expected to induce disintermediation and increase bank risk as depositors withdraw their money and seek to invest it in "hard" currency assets.

2.3 Shifts in the terms of trade

Shifts in the terms of trade also affect bank risks by influencing the profitability of bank borrowers, that is, they too primarily affect credit risk. A drop in the terms of trade occurs when imports become more expensive relative to exports, eroding the purchasing power in a country. Falling terms of trade can be expected to increase banks' credit risk.

An empirical motivation for considering the terms of trade in our model comes from numerous historical examples suggesting that a worsening in the terms of trade can have a detrimental impact on the banking system. Shifts in the terms of trade were an important factor in banking problems in Chile in the early 1980s, Malaysia in the mid-1980s as well as countries of Eastern and Central Europe, the Baltics, and the former Soviet Union republics in the early 1990s (Lindgren et al. 1996, p. 52). Deterioration in the terms of trade on the order of 10 percent or more seems to have systematically preceded banking crises, as documented by Kaminsky/Reinhart (1999) and Caprio et al. (1997).

2.4 Interest rate changes

Interest rate risk associated with changes in market interest rates constitutes a central source of market risk for banks. Besides, a rise in market interest rates, whose direct effect is an increase in bank returns for newly made or variable interest loans, nonetheless bears a danger of increased credit risk. In the light of asymmetric information theories, higher interest rates tend to exacerbate the problem of *adverse selection* – that is, in the context of credit relationships, the selection of borrowers with high probability of adverse project outcomes, or "bad risks." High interest rates will deter potential borrowers with safe projects, so that the risk composition of the pool of loan applicants will shift toward bad risks. Moreover, a rise in interest rates will change the *ex post* incentives for borrowers inducing them to take on riskier projects (borrowers' *moral hazard*) (Stiglitz/Weiss 1981). Thus, in a setting of information asymmetries a rise in interest rates will ceteris paribus increase credit risk on banks' balance sheets.

2.5 Inflation

An increased rate of inflation diminishes real rates of return on bank assets and therefore induces credit rationing. Consequently, high inflation countries will have less financial intermediation (Boyd et al. 2001). While there is evidence that higher rates of inflation lead to a decrease in the quantity of bank assets and thus the quantity of credit risks, higher inflation can have a negative impact on earnings of existing borrowers thereby impairing the quality of previously extended loans. If the credit rationing effect proves to be stronger, higher inflation rates may result, ceteris paribus, in banks taking fewer risks on their balance sheets.

On the other hand, not only high inflation, but also disinflation can have a detrimental impact on the financial sector and increase bank risk. Rapid disinflation in a previously high-inflation environment will result in high real interest rates that will exert a contracting influence on the economy and raise credit risk both due to shrinking profits of borrowers and increased risk incentives similar to those accompanying a rise in nominal interest rates (Mishkin 1996).

3. Data and empirical model

3.1 Data and sample construction

Banking data used for subsequent empirical analysis of theoretical hypotheses presented in section 2 are taken from the Bankscope database that includes accounting and structural data on over 25,000 banks worldwide (BvDEP 2007). In the first step, all banks for which end-year information on assets, loans and equity is available in the years 1999 through 2005 are included in the sample. Observations were dropped on banks with negative equity as well as banks from countries for which macroeconomic data were not available. Macroeconomic and institutional data come from the International Country Risk Guide, the World Development Indicators, Beck et al. (2000, updated 2007), Demirgüç-Kunt et al. (2005) – all available online – as well as Datastream and cover the years 2001-2005.

Extending the time frame in this study would constrain it to a much smaller sample of countries since the data for earlier years is not available for over a half of countries in the sample. Since the main subjects of interest for this study – country-level macroeconomic indicators – do not have within-country variation in a given year, a larger number of countries in the sample create a wider field of cross-sectional between-country variation. Depending on the model specification and availability of macro data, our sample contains 34 to 120 countries with a total of 1,832 to 4,931 banks, respectively. Over the whole period of five years the sample contains a maximum of 24,202 observations. A list of countries and numbers of banks is included in TABLE 1.

Having a large number of countries and banks in the sample allows testing the models on more homogenous subsamples. Baseline regressions will be run for subsamples of banks

domiciled in OECD and non-OECD countries as well as a subsample of banks in the "old" European Union (EU-15).[3]

3.2 Quantifying bank risk

A big challenge for the empirical model at hand is to identify an appropriate measure of bank risk. In theoretical discussions, the term „bank risk" often implies expected and/or unexpected losses (in the statistical sense) for a bank or a group of banks, where „'expected losses' refer to the average or mean losses anticipated over a particular period, while ‚unexpected losses' refer to a measure of the dispersion, or degree of uncertainty that surrounds that outcome" (Borio et al. 2001, p. 3). For the purposes of econometric modeling, however, this is not an observable measure of bank risk for our sample and a risk proxy is needed.

Various proxies for bank risk have been suggested in literature. A measure of risk that is frequently used in academic research is derived from stock price developments (stock returns, beta, and volatility). Stock data as a basis for calculating bank risk has the advantage of good availability and high frequency, but also the limitation that it can only be used for exchange-listed banks and therefore would not be applicable for a substantial number of banks in our sample. Moreover, its ability to reflect bank risk is closely linked to the degree of capital market efficiency as well as banks' transparency, since share prices inform about bank conditions as they are being *perceived* by investors. Research by Hyytinen (2002) suggests that this link is not necessarily sufficient. He investigates changes in investors' perceptions of the banking sector's systematic risk prior und during banking crises in Norway, Sweden and Finland in the late 1980s – early 1990s and finds that the distressed state of the banking sector was correctly reflected in the risk parameters of bank stocks only when banking distress became apparent, that is, banking sector weaknesses that led to the crises were not "noticed" by investors "until the damage had been done and severe problems begun to realize in full" (Hyytinen 2002, p. 621).

Another risk measure that has become increasingly popular in academic research involves ratings assigned to banks by commercial rating agencies (Sironi 2003, Demirgüç-Kunt et

[3] Particularly in the EU the long-time political and economic unification processes as well as the introduction of the euro are likely to have created a fairly homogenous banking environment in comparison with other country constellations. See also Baele/Ferrando et al. (2004) for evidence on the (high) degree of European financial integration.

al. 2006). Since Bankscope does not provide time series on ratings, this potentially attractive risk measure cannot be used in our panel setting. Besides, a wave of rating downgrades that came in the wake of the ongoing subprime credit crisis showed that rating adjustments, like adjustments of stock beta, may come significantly later than the accumulation of risks.

De Nicolo (2001) uses a time average of the capital-to-assets ratio adjusted for the mean and standard deviation of bank returns on assets as a measure of a bank's insolvency risk. Since one of the components of this risk proxy relates bank assets to its capital (equity), it measures the bank's loss resilience. Although this may go beyond a narrow definition of risk, it accounts for the fact that whether a bank's level of risk is "high" or "low" is not a matter of absolute levels, but of how well a bank can weather unfavorable conditions given its capitalization base.[4] This in essence regulatory view of bank risk allows for a better comparability of risk between banks.

Along these lines, we will use a similar measure – regulatory capital adequacy ratios – as a broad proxy for bank risk, or vulnerability of banks to the consequences of risk taking. The total capital adequacy ratio is defined as Tier 1 and Tier 2 capital as a percentage of risk-weighted assets and off balance sheet risks (Bankscope). Lower capital ratios are associated with greater risk since losses can deplete bank capital more quickly. Admittedly, this measure has its weaknesses as well. It is not free of accounting differences across countries, although systematic country differences can be mitigated somewhat by choosing an appropriate estimation procedure (see section 3.2). It does not show to which extent changes in risk exposures over time stem from adjustments of asset quantity, asset quality or capital (but can be split in numerator and denominator to investigate these issues). Nonetheless, the capital adequacy ratio has important advantages for our large cross-country sample of banks: the calculation of the ratio involves a detailed treatment of risks (weighting, on and off balance) and follows internationally uniform rules set by the Basel Committee.

[4] Arguably, other risk measures such as those based on stock data or ratings incorporate capitalization information as well, along with other relevant risk factors. As an empirical example, Baele et al. (2004) show that stock returns of poorly capitalized banks reacted stronger to macroeconomic factors during periods of recession than those of well capitalized banks, implying that stock markets do perceive low capitalization as a risk.

Alternatively, the ratio of total capital to risky assets (calculated as total assets less liquid assets) will be used to check the robustness of results. One should keep in mind, though, that this measure of risk is conceptually somewhat different from the capital adequacy ratio since it makes no differentiation in the degree of riskiness of asset classes and does not consider off-balance risks. Its advantage is that it can be calculated for virtually all banks whereas the capital adequacy ratio is available only for about a half of the banks in the sample. In regressions banks are dropped for which either of the ratios is negative or exceeds 100%, considering that these are atypical for the banking sector. This eliminates only a very small fraction of banks in the sample.

3.3 Explanatory variables

3.3.1 Macroeconomic conditions

Of primary interest in subsequent regressions are macroeconomic conditions whose theoretical relationship with bank risk was briefly discussed in section 2. The annual rate of growth of real GDP at constant prices will be used as a broad measure of business cycle conditions. Since we do not intend to predict bank risk by macroeconomic factors, contemporaneous (as opposed to lagged)[5] GDP growth will be used. As a measure of real interest rate levels in a country, average rates on overnight interbank loans less inflation rate for a given year are taken. Since there are many different kinds of interest rates, this choice is dictated by data availability. Moreover, different kinds of interest rates usually co-move: rises in interbank rates reflect rises in policy interest rates and induce in turn rises of money market rates and usually long-term fixed-income securities yields (Görgens et al. 2004, p. 279). The terms of trade, the annual inflation rate, and the annual percentage change in a country's exchange rate are also included in the model as explanatory variables.

One must keep in mind, though, that these macroeconomic factors and conditions are not independent. To show just a few of the interdependencies, business cycles appear to be correlated with exchange rate movements, with currency appreciating during economic highs and depreciating during troughs, although this pattern is less apparent during some periods (IMF 1998). Interest rates are related to business cycles by way of expansionary or contracting impulses they send to the real economy. High inflation rates are likely to be

[5] Besides, regressions that included lagged GDP growth showed that it had poor or no explanatory power.

associated with weak currency in a country. The interdependence of macroeconomic factors reinforces their individual influence on bank risk, but can also make an empirical assessment of their relative importance for bank risk difficult.

A look at correlation coefficients of explanatory macroeconomic variables shows that some of correlations are not neglectable, indicating that multicollinearity may indeed be a problem (see TABLE 3). Therefore it makes sense to run additional regressions where macroeconomic factors of interest are included individually in separate specifications (along with control variables). Interpreting the model where all macroeconomic variables are included simultaneously, one should keep in mind that the statistical significance of estimated coefficients might be weakened by the presence of collinear relationships.

3.3.2 Country level (systemic) control variables

All models contain a set of control variables that capture potentially risk-relevant effects. Since the presence of explicit deposit insurance was theorized to be conducive to moral hazard in banking (Matutes/Vives 2000) and was empirically shown to have a significant influence on the probability of a banking crisis (Demirgüç-Kunt/Detagiache 1998), a dummy variable is included that equals to one for countries that had explicit deposit insurance schemes in place for the period under consideration.

The degree of concentration in the banking sector is gauged by the percentage share of the assets of three largest banks in total banking assets of a country. A greater degree of concentration implies lesser competition and thus higher charter values of banks (see Hellmann et al. (2000), Keeley (1990)). Theoretically, banks that experience less competition should show more risk aversion, ceteris paribus holding larger capital ratios.

Furthermore, GDP per capita is included as an explanatory variable to control for banking sector differences stemming from the degree of economic development of a country. The direction of possible correlation of this variable with bank risk is open. It has been shown that affluent countries with higher GDP per capita are ceteris paribus less susceptible to banking crises (Demirgüç-Kunt/Detagiache 1998). It is possible that banks in more affluent countries (which tend to be more advanced economically) are more prudent and thus hold higher capital relative to risk-weighted assets. It is also possible that, possessing more

refined techniques of risk measurement, they can afford it to have lower capital ratios which are still perceived to be risk-adequate.

3.3.3 Bank level factors

To control for bank level factors that reflect its risk-taking behavior, the rate of loan growth is included in the regressions, calculated as the mean percentage change over the previous two years. It has been observed that banking crises are often preceded by lending booms (Gavin/Hausmann 1998, Llewellyn 2002, Edwards/Végh 1997). Likewise, it is plausible that excessive credit growth at an individual bank fills the bank's balance sheet with more risks.

Another potentially relevant bank level variable is the degree of diversification. Similarly to Baele/Vander Vennet et al. (2004), functional diversification is gauged by calculating the share of a bank's interest income in its total revenues; larger values indicate a smaller degree of functional diversification. Both variables contain a few values that are multiples of the next largest values in the sample; these were removed as extreme outliers. Furthermore, a few banks that had negative diversification values due to negative revenue or interest income were dropped since negative diversification makes no economical sense and would bias the results.

Finally, the logarithm of bank assets is included to proxy for bank size, considering empirical findings that bank risk may increase in size (De Nicolo 2001). All models contain a full set of year dummies that capture systematic time influences. TABLE 2 gives a summarizing overview of all variables and their data sources.

3.4 Estimation method

Choosing an appropriate estimation method, it is important to take into account the hierarchical structure of the data at hand. First, it contains a time-series component: for each bank there are repeated observations during the period 2001-2005. These are likely to be correlated „within" banks due to bank-specific factors. Second, banks are clustered within countries. It is reasonable to assume that country-specific correlations between banks also exist due to common cultural and legal environment.

Using linear mixed models methodology (see Rao 1997 or Rabe-Hesketh/Skrondal 2005, pp. 217-228), bank-specific and country-specific effects will be estimated as random bank and country intercepts ζ_{ij} and ζ_j in the following equation:

$$capital\_ratio_{ijt} = \beta_1 + X_{jt}\beta_2 + Z_{jt}\beta_3 + C_{ijt}\beta_4 + T_t\beta_5 + \zeta_{ji} + \zeta_j + \varepsilon_{ijt}$$

Other equation components contain variables discussed above: $\boldsymbol{capital\_ratio}_{ijt}$ is a vector of observations on the two alternative risk measures (capital adequacy ratio or the ratio of capital to unweighted risky assets), $\boldsymbol{X}_{jt}$ is a matrix of macroeconomic variables, which are of primary interest here, $\boldsymbol{Z}_{jt}$ contains country level regulatory/systemic variables, $\boldsymbol{C}_{ijt}$ is a matrix of bank level variables, $\boldsymbol{T}_t$ is a matrix of year dummies, and $\boldsymbol{\beta}_i$'s are vectors of fixed effects that are estimated across banks and countries. $\boldsymbol{\varepsilon}_{ijt}$ is a normally and independently distributed error term, and subscripts *i*, *j*, and *t* stand for bank, country and year, respectively. The above equation is estimated by restricted maximum likelihood. Estimated fixed effects and their standard errors are reported in TABLES 4 and 5. To save space, coefficients of year dummies are not reported since they are not particularly important for the purposes of this paper.

It should be noted that estimation consistency relies on the fairly stringent assumption that compound errors $\zeta_{ij} + \zeta_j + \boldsymbol{\varepsilon}_{ijt}$ are uncorrelated with the regressors (also see Wooldridge 2002, pp. 257-264). The standard approach to treating possible endogeneity – the use of instrumental variables – would require additional data that may not be accessible for a large number of countries. A simpler solution to use a fixed effects estimator (Skrondal/Rabe-Hesketh 2007, p. 282) would lead to an exclusion of time-invariant variables (such as deposit insurance) and imprecise estimates for those variables that exhibit only little variation over time.

4. Empirical results

4.1 The effects of macroeconomic conditions on bank risk

The main focus of the models is the relationship between bank risk and general economic conditions captured by the rate of GDP growth; it is included in all model specifications.

An association of banking distress with lower economic growth has been repeatedly found in empirical research on financial crises (Lindgren et al. 1996, Gorton 1988, Kaminsky/Reinhart 1999, Demirgüç-Kunt/Detagiache 1998/2005 etc.). At the individual bank level, there is evidence that bank profit volatility has a significant positive correlation with the volatility of GDP growth (Buch et al. 2007). Not surprisingly, econometric estimates of our model indicate that business cycle conditions have a significant impact on capital adequacy ratios of banks. While OECD banks show a strongly positive and statistically highly significant tendency to hold *larger* capital ratios during periods of faster GDP growth, non-OECD banks behave procyclically, holding *smaller* capital ratios during business cycle upturns (see TABLE 4). This implies that banks in economically advanced countries on average behave more prudently, apparently boosting their capital base during economically good times when it is easiest to do so. (Additional regressions with bank capital as a dependent variable confirm that capital of banks in OECD, particularly in EU-15, countries moves in tandem with the business cycle.) During periods of slower or negative growth their capital ratios tend to decline, possibly reflecting the deterioration of asset quality and falling equity values. This pattern is equally evident in the subsampe of EU banks, whose capital ratios show an even stronger positive reaction to higher economic growth.

Interestingly, Wedow (2006), who estimates the effect of business cycle fluctuations on capital buffers (defined as Basel Accord capital ratio minus 8%) of a panel of West German savings and cooperative banks in 1993-2003, finds strong evidence that banks' capital buffers rise in business cycle downturns and fall during upturns. Although his results refer to a much narrower sample of banks and to a different time frame and are therefore not directly comparable to the results of this study, they suggest that differences between countries within relatively homogenous international banking communities are worth exploring in further studies.

In non-OECD countries banks appear to follow theoretical lines described in section 2.1: more risks are taken during economic upswings, leading to lower capital ratios. However, this relationship is less robust in regressions with alternative capital ratios (capital over unweighted risky assets). The positive relationship between capital buffers and GDP growth remains highly statistically significant for OECD banks, including the EU subsample, whereas the coefficient on GDP growth for non-OECD banks changes sign for

some model specifications and often lacks statistical significance. Nonetheless, the general lack of significant positive correlation which was found for OECD countries shows that different mechanisms are at work in the non-OECD subsample, so that the negative relationship shown in the models with risk-weighted capital ratios appears to be plausible.

As with GDP growth, the effect of exchange rate appreciation on bank risk is different for OECD and non-OECD countries. For the former this effect tends to be positive, although it becomes statistically significant at the 1% level only with the risk-unweighted capital ratio (see TABLE 5). This is found for the EU subsample as well. In non-OECD countries, the statistically significant estimates usually tend to be negative, implying that the appreciation of the currency leads to a fall in banks' capital ratios. This result is consistent with the above findings on the relationship between banks' capital buffers and business cycle fluctuations as expressed by growth rates: since the frequently observed empirical pattern has been the appreciation of the exchange rate during economic highs (IMF 1998) and there is also a positive correlation of GDP growth rates and currency appreciation in the data at hand (see TABLE 3), the reaction of banks' capital ratios to medium-term exchange rate movements is likely to go in the same direction as their reaction to swings in overall economic activity.

A difference in risk behavior of OECD and non-OECD countries can also be observed regarding their reactions to the changes in the terms of trade. While capital ratios of banks in economically advanced countries tend to rise as the terms of trade fall, which is another indication of prudent behavior, the correlation between the terms of trade and capital buffers of banks domiciled in non-OECD countries is positive and statistically significant, implying a positive welfare effect for banks associated with a terms of trade increase that is reflected in what might be a „passive adjustment" of capital ratios. All in all, however, no firm conclusions can be drawn about the impact of the terms of trade shifts on bank risk since in many model specifications, particularly for the more homogenous samples of EU banks, the estimated coefficients are not statistically significant.

Surprisingly, real interest rates proved to have a rather weak explanatory power across most model specifications. While the relationship between interest rates and capital adequacy ratios of banks in OECD countries is positive and statistically highly significant, it changes sign in regressions with capital over unweighted risky assets. For banks in non-

OECD countries, coefficients on the interest rate variable lack statistical significance in all model specifications. By contrast, researchers of macroeconomic determinants of banking crises have found a strong link between banking distress and higher interest rates (Kaminsky/Reinhart 1999, Demirgüç-Kunt/Detagiache 2005). Admittedly, the annual average of overnight interest rates variable used in this study may be too crude to capture the whole impact of interest rate changes on bank behavior. Besides, interest rates data were unavailable for over a half of countries in the sample. It is possible that an alternative interest rate measure or other model setups would produce less ambiguous results.

Matters appear to be clearer for the impact of inflation on bank risk. Most model specifications with capital ratios as the dependent variable show a positive relationship between capital ratios and inflation. This can be an indication of the theoretical relationship shown in section 2.5: all else equal, higher inflation induces banks to ration credit thereby reducing their risky assets. Not surprisingly, this relationship is even more marked in regressions where capital over *unweighted* risk assets was used, since here the quantity effect of credit rationing is more transparent than in metrics with risk-*weighted* assets.[6] Of all macroeconomic variables, the response of bank risk to inflation appears to be the most uniform across countries worldwide.

4.2 Country level control variables

Results for systemic control variables are generally mixed. The coefficient of the deposit insurance dummy is negative and statistically significant for banks in non-OECD countries in most model specifications,[7] showing that banks in countries without explicit deposit insurance schemes tend to hold larger capital adequacy ratios. This supports the notion that explicit deposit insurance encourages risky behavior on the part of the banks (moral hazard). For banks in OECD countries, no significant relationship between capital ratios and deposit insurance could be found.[8]

[6] The only exception is the negative coefficient in model specification [5] for the subsample of EU-15 banks, which is significant at the 10% level (see TABLE 5).

[7] The robustness of this result is weakened by the change of sign in the model which includes the terms of trade and by the generally weaker statistical significance of the coefficients in models with unweighted risky assets.

[8] Considering that only two out of 27 OECD countries in the sample did not have explicit deposit insurance during the period under consideration, the explanatory power of the deposit insurance dummy in the OECD subsample is naturally limited.

The impact of general income levels in a country (measured as GDP per capita) has a positive and statistically strongly significant relationship with capital adequacy ratios of EU banks, implying that banks in more affluent European countries are generally less risky. However, the statistical significance for this subsample largely disappears in robustness tests with the ratio of capital to unweighted risky assets. By contrast, these regressions show that banks in non-OECD countries with higher GDP per capita tend to hold *lower* unweighted capital ratios; this is also the case for two model specifications with OECD subsample.

Results are also mixed for the impact of banking sector concentration, measured as the share of assets of three largest banks in total bank assets, on bank risk. The theoretically plausible positive relationship between concentration and capital ratios (that is, a *negative* relationship between concentration and banks' risk taking due to higher charter values) is confirmed in regressions with capital over unweighted risky assets and is also prevalent in baseline regressions with capital adequacy ratios for the subsamples of non-OECD and EU banks. By contrast, a counterintuitive positive relationship between risk and concentration in baseline regressions is found for OECD banks, which weakens the overall robustness of results for this variable.

4.3 Bank level variables

A look at statistically significant bank level control variables shows that both measures of bank risk are almost universally negatively related to bank size and the rate of loan growth. Thus, larger banks tend to hold lower capital ratios, all else equal. In this sense, they are more risky. This is largely in line with the findings of De Nicolo (2001). Similarly, more rapid loan growth over the past two years is associated with lower capital ratios. Furthermore, banks with a higher degree of specialization in lending business (measured as the percentage share of interest income in total revenues) tend to hold less capital, all else equal. This implies that specialized banks are more exposed to credit risk not only due to specialization itself, but also due to their risk practices of holding smaller capital cushions.

5. Conclusions

Risk taking and risk transformation belong to the core functions of banking. However, whenever risk taking becomes excessive so that the solvency of a bank is jeopardized, the consequences for the financial and the real sectors may be grave. Since adverse macroeconomic developments simultaneously affect a large number of institutions, it is important to understand macroeconomic influences on risk positions of banks.

Theoretical and empirical research emphasizes the connection between the business cycle and bank risk. Generally, risks tend to accumulate on banks' balance sheets during booms, often accompanied by rapid lending growth, and lead to losses during economic recessions when default rates of bank borrowers pick up while asset prices fall. However, results of this paper show that banks' efforts to mitigate the accumulation of risks vary across countries. In economically advanced countries, banks tend to increase their capital ratios during booms, building up capital when it is easiest to do so, which would cushion a rise in losses during the next recession. In non-OECD countries, capital ratios rise during recessions, which may be explained by a substantial reduction in risk-weighted assets when losses are high and when macroeconomic risks prevail.

The paper also shows that higher inflation rates are usually associated with higher capital buffers of banks. This implies that inflation-induced economic uncertainty appears to stimulate banks to restrict lending, possibly in order to mitigate adverse selection, since higher inflation usually leads to higher interest rates. Currency appreciation appears to have a negative, albeit statistically less robust, relationship with bank risk in OECD countries. Also, results for the terms of trade and changes in market interest rates are not very robust.

For country level variables other than macroeconomic factors, econometric results obtained in this study are frequently in line with theoretical predictions, although some of them turn out to be insufficiently robust. Banks in non-OECD countries with explicit deposit insurance schemes tend to hold smaller capital adequacy ratios und thus assume riskier positions, which theory predicts to be a result of moral hazard incentives of deposit insurance. The impact of general income levels in a country (measured as GDP per capita) on capital adequacy ratios was shown to be positive for EU banks, implying that banks in more affluent European countries are generally less risky. However, the robustness of these

results is not very strong. Results are also mixed for the impact of banking sector concentration on bank risk, where the theoretically plausible negative relationship between concentration (higher concentration meaning higher charter values of banks) and banks' risk taking holds for most model setups, but fails to be confirmed in baseline regressions with OECD banks.

While this paper presents an overall view of possible connections between macroeconomic factors and individual bank risk in an international perspective, some extensions can provide a fruitful ground for further research. First, it remains open to what extent individual bank risk in an open economy may be affected by macroeconomic developments or shocks abroad. Second, a broader view of bank risk should explore more extensively the role microeconomic factors alongside macroeconomic fundamentals. Third, although regression results point to some statistically significant relationships between macroeconomic fundamentals and banks' risk-taking behavior, cross-sample variations in these relationships (e.g., OECD countries vs. non-OECD countries) suggest that responses of bank behavior to macroeconomic developments are fairly heterogeneous.

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Table 1: Sample description

Country	Obser-vations	Banks	Country	Obser-vations	Banks	Country	Obser-vations	Banks
Albania	23	5	Guatemala	105	21	Pakistan	74	15
Algeria	8	2	Guyana	8	2	Panama	50	10
Angola	8	2	Honduras	40	8	Paraguay	63	13
Argentina	170	38	Hong Kong	5	1	Peru	50	10
Armenia	15	3	Hungary	90	18	Philippines	25	6
Australia	6	2	Iceland	2	2	Poland	55	11
Austria	584	117	India	186	38	Portugal	28	7
Azerbaijan	18	4	Indonesia	182	38	Qatar	20	4
Bahamas	36	8	Iran	8	2	Romania	71	15
Bahrain	41	9	Ireland	60	12	Russia	188	39
Bangladesh	126	26	Israel	50	10	Saudi Arabia	45	9
Belarus	30	6	Italy	2045	410	Senegal	20	5
Belgium	197	41	Japan	2830	567	Sierra Leone	15	4
Bolivia	60	12	Jordan	68	14	Singapore	5	1
Botswana	8	2	Kazakhstan	54	11	Slovak Republic	50	10
Brazil	258	53	Kenya	98	20	Slovenia	48	12
Bulgaria	72	15	Korea	75	15	South Africa	10	2
Burkina Faso	20	5	Kuwait	55	12	Sri Lanka	37	8
Cameroon	15	4	Latvia	45	9	Sudan	8	2
Canada	149	30	Lebanon	115	23	Sweden	80	16
Chile	75	15	Libya	7	2	Switzerland	906	188
China	92	19	Lithuania	30	6	Syria	1	1
Colombia	84	17	Luxembourg	320	69	Taiwan	165	33
Congo	2	1	Madagascar	12	3	Tanzania	5	1
Costa Rica	55	11	Malawi	7	2	Thailand	75	15
Croatia	90	18	Malaysia	155	32	Togo	2	1
Cuba	7	2	Mali	12	3	Trinidad & Tobago	35	7
Cyprus	41	9	Malta	25	5	Tunisia	20	4
Czech Republic	69	14	Mexico	56	15	Turkey	69	14
Denmark	295	59	Moldova	21	5	Uganda	49	10
Dominican Republic	35	7	Mongolia	8	2	Ukraine	75	15
Egypt	130	26	Morocco	28	7	United Arab Emirates	90	18
El Salvador	30	6	Mozambique	12	3	United Kingdom	477	107
Estonia	20	4	Netherlands	60	12	Uruguay	15	3
Ethiopia	25	5	New Zealand	15	3	United States	4,401	882
Finland	5	1	Nicaragua	12	3	Venezuela	111	23
France	727	149	Niger	8	2	Vietnam	79	16
Gambia	2	1	Nigeria	59	12	Yemen, Republic	16	4
Germany	5,830	1,171	Norway	80	16	Zambia	37	8
Ghana	68	14	Oman	30	6	Zimbabwe	28	8
Total observations:	24,202		Total banks:	4,931		Total countries:	120	

Source: Bankscope, own calculations. Table contains numbers for maximum sample size. Sample sizes vary substantially across regressions, constrained by data availability on explanatory variables.

Table 2: Description of variables and their data sources

Variable	Definition	Source
(Alternative) dependent variables:		
Capital adequacy ratio	Tier 1 and Tier 2 capital as a percentage of risk-weighted assets and off balance sheet risks (as reported by banks)	Bankscope
Ratio of capital to risky assets	Capital funds over total assets less liquid assets	Bankscope
Explanatory variables:		
GDP growth	Annual percentage change of real gross domestic product, in constant prices	International Country Risk Guide
Currency appreciation	Annual percentage change of nominal exchange rate against the dollar (against the euro in case of the United States). Positive values indicate currency appreciation.	International Country Risk Guide
Real interest rate	Annual average of interest rates on overnight bank loans minus annual inflation rate	Datastream
Inflation	Annual rate of inflation as unweighted average of Consumer Price Index	International Country Risk Guide
Terms of trade	Net barter terms of trade (2000 = 100)	World Development Indicators
GDP per capita	Annual gross domestic product per head of population in thousand USD	International Country Risk Guide
Deposit insurance	Dummy; 1 if an explicit deposit insurance scheme in place	Demirgüç-Kunt et al. 2005
Concentration of banking sector	Share of assets of three largest banks in a country in total bank assets	Beck et al. (updated 2007)
Bank size	Natural logarithm of bank's assets	Bankscope
Loan growth	Average percentage change in loan volume over the past two years (three data points)	Bankscope
Degree of functional specialization	Share of interest income in a bank's total revenue	Bankscope

Table 3: Pairwise correlations between macroeconomic indicators

	GDP growth	Currency appreciation	Terms of trade	Real interest rate
GDP growth	1			
Currency appreciation	0.2054***	1		
Terms of trade	-0.0094***	-0.0323***	1	
Real interest rate	-0.3546***	-0.2347***	0.0512***	1
Inflation rate	-0.1825***	-0.9098***	0.0134***	-0.1102***

*** significant at 1% level in a two-tailed t-test.

Table 4: Regressions with capital adequacy ratio

Results presented in this table are based on a restricted maximum likelihood estimation of a linear mixed effects model with year dummies. In each regression, the dependant variable is the capital adequacy ratio of a bank, defined as Tier 1 and Tier 2 capital over risk-weighted assets and off-balance-sheet risks. Each regression is run for OECD, EU-15 and non-OECD countries separately. Regressions [1]-[5] include one further macroeconomic variable of interest at a time, to limit multicollinearity effects, regression [6] contains all explanatory variables. The Wald chi-squared statistic reports the overall significance of each specification. Standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% in a two-tailed t-test.

	[1]			[2]			[3]			[4]		[5]			[6]		
	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD	OECD	Non-OECD	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD
Size (log of assets)	-1.51*** (0.107)	-2.179*** (0.258)	-3.754*** (0.23)	-1.508*** (0.107)	-2.179*** (0.258)	-3.841*** (0.232)	-1.461*** (0.108)	-2.028*** (0.262)	-3.803*** (0.295)	-1.524*** (0.11)	-4.824*** (0.331)	-1.51*** (0.107)	-2.186*** (0.259)	-3.853*** (0.232)	-1.464*** (0.109)	-2.225*** (0.287)	-4.517*** (0.383)
Loan growth	-0.011*** (0.002)	-0.008** (0.004)	-0.003 (0.003)	-0.011*** (0.002)	-0.008** (0.004)	-0.007** (0.003)	-0.018*** (0.002)	-0.028*** (0.005)	-0.006* (0.004)	-0.01*** (0.002)	-0.01*** (0.003)	-0.011*** (0.002)	-0.008** (0.004)	-0.008*** (0.003)	-0.017*** (0.002)	-0.03*** (0.006)	-0.013*** (0.004)
Degree of specialization	-0.033*** (0.007)	-0.011 (0.019)	-0.044*** (0.015)	-0.033*** (0.007)	-0.011 (0.019)	-0.045*** (0.015)	-0.036*** (0.007)	-0.023 (0.02)	-0.076*** (0.022)	-0.041*** (0.008)	-0.085*** (0.022)	-0.036*** (0.007)	-0.01 (0.019)	-0.046*** (0.015)	-0.045*** (0.008)	-0.04* (0.024)	-0.136*** (0.032)
GDP growth	0.567*** (0.05)	1.324*** (0.22)	-0.235*** (0.056)	0.573*** (0.05)	1.319*** (0.222)	-0.203*** (0.056)	0.536*** (0.05)	1.46*** (0.249)	-0.345*** (0.075)	0.748*** (0.06)	-0.303*** (0.078)	0.578*** (0.05)	1.31*** (0.222)	-0.191*** (0.056)	0.7*** (0.063)	1.947*** (0.323)	-0.349*** (0.118)
Concentration of banking sector	-0.02*** (0.005)	0.058*** (0.013)	0.045*** (0.017)	-0.015** (0.006)	0.059*** (0.013)	0.041** (0.017)	-0.018*** (0.005)	0.045*** (0.014)	0.058 (0.038)	-0.02*** (0.005)	0.092*** (0.034)	-0.019*** (0.005)	0.059*** (0.013)	0.039** (0.017)	-0.015** (0.007)	0.046** (0.02)	-0.039 (0.078)
GDP per capita	-0.021 (0.024)	0.253*** (0.089)	0.044 (0.105)	-0.023 (0.024)	0.251*** (0.09)	0.054 (0.107)	-0.029 (0.029)	0.131 (0.118)	0.373** (0.171)	0.038 (0.031)	-0.013 (0.303)	-0.015 (0.025)	0.27*** (0.094)	0.068 (0.109)	0.005 (0.036)	0.842*** (0.217)	0.464 (0.399)
Deposit insurance	4.245 (4.473)		-1.819** (0.867)	4.331 (4.457)		-2.453*** (0.882)	3.638 (4.411)		5.43*** (1.645)	4.612 (4.534)	-4.568*** (1.259)	4.155 (4.428)		-2.39*** (0.878)	4.146 (4.328)		-1.739 (4.153)
Exchange rate				0.006 (0.004)	0.007 (0.032)	-0.019*** (0.005)									0.001 (0.005)	0.008 (0.044)	0.056** (0.028)
Terms of trade							-0.043*** (0.016)	-0.1 (0.085)	0.079*** (0.027)						-0.017 (0.016)	0.199* (0.117)	0.039 (0.041)
Real interest rate										0.199*** (0.062)	-0.096 (0.063)				0.254*** (0.082)	-0.891 (0.692)	-0.044 (0.088)
Inflation rate												0.055** (0.025)	0.141 (0.274)	0.061*** (0.012)	0.037 (0.036)	-0.193 (0.738)	0.182 (0.117)
Intercept	38.746*** (4.819)	37.978*** (4.86)	72.163*** (3.506)	38.351*** (4.812)	38.013*** (4.865)	73.786*** (3.541)	43.192*** (4.95)	50.581*** (10.277)	61.115*** (5.33)	37.302*** (4.916)	93.454*** (5.482)	38.58*** (4.78)	37.215*** (5.092)	73.557*** (3.552)	38.881*** (4.996)	10.67 (13.997)	94.188*** (9.44)
Observations	7914	2789	2525	7914	2789	2525	7736	2716	1320	7604	1367	7914	2789	2525	7461	2446	834
Number of banks	1707	628	625	1707	628	625	1663	612	372	1637	329	1707	628	625	1605	554	227
Number of countries	27	13	75	27	13	75	22	12	44	24	19	27	13	75	21	11	13
Wald chi-squared	647.28	407.21	349.05	649.61	407.09	366.69	710.84	418.91	248.49	671.59	308.70	652.78	407.48	377.58	729.27	432.34	237.93
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 5: Regressions with unweigted ratio of risky assets over capital (robustness test)

Results presented in this table are based on a restricted maximum likelihood estimation of a linear mixed effects model with year dummies. In each regression, the dependant variable is the ratio of bank capital to risky assets, calculated as total assets less liquid assets. Each regression is run for OECD, EU-15 and non-OECD countries separately. Regressions [1]-[5] include one further macroeconomic variable of interest at a time, to limit multicollinearity effects, regression [6] contains all explanatory variables. The Wald chi-squared statistic reports the overall significance of each specification. Standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% in a two-tailed t-test.

	[1]			[2]			[3]			[4]		[5]			[6]		
	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD	OECD	Non-OECD	OECD	EU-15	Non-OECD	OECD	EU-15	Non-OECD
Size (log of assets)	-2.534*** (0.091)	-3.573*** (0.141)	-5.155*** (0.227)	-2.535*** (0.091)	-3.575*** (0.141)	-5.459*** (0.229)	-1.931*** (0.084)	-3.469*** (0.139)	-5.084*** (0.286)	-2.015*** (0.086)	-6.372*** (0.369)	-2.51*** (0.09)	-3.559*** (0.141)	-5.5*** (0.23)	-1.882*** (0.084)	-3.377*** (0.143)	-6.956*** (0.452)
Loan growth	-0.008*** (0.001)	-0.014*** (0.001)	-0.005** (0.002)	-0.008*** (0.001)	-0.015*** (0.001)	-0.011*** (0.002)	-0.007*** (0.001)	-0.015*** (0.001)	-0.009*** (0.003)	-0.006*** (0.001)	-0.011*** (0.004)	-0.008*** (0.001)	-0.014*** (0.001)	-0.013*** (0.002)	-0.007*** (0.001)	-0.015*** (0.001)	-0.028*** (0.005)
Degree of specialization	-0.122*** (0.005)	-0.142*** (0.008)	-0.068*** (0.011)	-0.123*** (0.005)	-0.143*** (0.008)	-0.078*** (0.011)	-0.087*** (0.005)	-0.138*** (0.008)	-0.063*** (0.013)	-0.115*** (0.006)	-0.053*** (0.014)	-0.13*** (0.005)	-0.141*** (0.008)	-0.073*** (0.011)	-0.113*** (0.005)	-0.146*** (0.008)	-0.076*** (0.017)
GDP growth	0.132*** (0.044)	1.112*** (0.106)	-0.058 (0.041)	0.142*** (0.044)	1.165*** (0.109)	0.051 (0.042)	0.188*** (0.039)	1.101*** (0.101)	-0.096** (0.046)	0.356*** (0.049)	-0.017 (0.068)	0.215*** (0.045)	0.987*** (0.11)	0.004 (0.041)	0.298*** (0.049)	1.117*** (0.118)	0.204** (0.095)
Concentration of banking sector	0.019*** (0.004)	0.033*** (0.008)	0.058*** (0.016)	0.022*** (0.004)	0.035*** (0.008)	0.043*** (0.016)	0.002 (0.005)	0.028*** (0.008)	0.113*** (0.035)	-0.009* (0.005)	0.043 (0.034)	0.025*** (0.004)	0.041*** (0.008)	0.043*** (0.016)	0.013** (0.006)	0.043*** (0.008)	0.07 (0.078)
GDP per capita	-0.066*** (0.021)	0.012 (0.05)	-0.407*** (0.113)	-0.063*** (0.021)	-0.013 (0.051)	-0.31*** (0.114)	-0.011 (0.025)	-0.11* (0.06)	-0.618*** (0.192)	0.04* (0.024)	-1.645*** (0.324)	-0.039* (0.021)	0.091* (0.053)	-0.329*** (0.116)	-0.014 (0.028)	0.046 (0.087)	-0.173 (0.54)
Deposit insurance	-6.804 (6.113)		0.093 (0.793)	-6.755 (6.121)		-1.426* (0.805)	-7.394 (5.928)		7.019*** (1.346)	-7.432 (5.97)	-2.701** (1.227)	-7.019 (5.869)		-1.285 (0.803)	-7.429 (5.677)		-3.039 (7.933)
Exchange rate				0.01*** (0.003)	0.025** (0.011)	-0.031*** (0.003)									0.015*** (0.004)	0.058*** (0.015)	-0.027* (0.014)
Terms of trade							-0.023* (0.012)	0.017 (0.042)	0.027 (0.022)						-0.008 (0.013)	0.047 (0.053)	0.041 (0.047)
Real interest rate										-0.153*** (0.05)	0.009 (0.029)				-0.09 (0.067)	-1.011*** (0.257)	0.02 (0.04)
Inflation												0.261*** (0.024)	0.533*** (0.126)	0.093*** (0.01)	0.185*** (0.032)	-0.488* (0.267)	0.311*** (0.106)
Intercept	69.415*** (6.197)	74.098*** (3.032)	90.735*** (3.373)	69.214*** (6.204)	74.744*** (3.054)	96.388*** (3.431)	60.116*** (6.016)	73.333*** (5.014)	77.892*** (4.83)	61.242*** (6.029)	119.239*** (6.013)	67.881*** (5.974)	70.209*** (3.155)	96.132*** (3.452)	58.723*** (5.829)	68.782*** (6.458)	116.024*** (12.208)
Observations	19505	10708	4697	19505	10708	4697	18151	10381	2586	18289	1980	19505	10708	4697	17843	10086	1251
Number of banks	3943	2171	988	3943	2171	988	3660	2102	637	3694	422	3943	2171	988	3601	2043	304
Number of countries	27	13	93	27	13	93	22	12	60	24	21	27	13	93	21	11	15
Wald chi-squared	1553.3	1428.11	682.96	1564.49	1433.25	776.48	1021.64	1405.48	436.70	1166.55	445.73	1686.61	1448.37	791.16	1171.25	1401.72	369.36
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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