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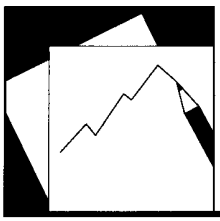

IMF Working Paper

Decomposing Financial Risks and Vulnerabilities in Eastern Europe

Andrea M. Maechler, Srobona Mitra, and DeLisle Worrell

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Decomposing Financial Risks and Vulnerabilities in Eastern Europe

Prepared by Andrea M. Maechler, Srobona Mitra, and DeLisle Worrell[1]

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Abstract

This paper assesses how various types of financial risk such as credit risk, market risk, and liquidity risk affect banking stability in the ten countries that joined the European Union most recently, and eight neighboring countries. It also examines how the quality of supervisory standards may have mitigated the vulnerabilities arising from these risk factors. Using panel data, the study finds substantial variation in the impacts of financial risks, the macroeconomic environment, and supervisory standards on banks' risk profile across different country clusters. Credit quality is of general concern especially in circumstances where credit growth is accelerating.

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Authors' E-Mail Addresses: amaechler@imf.org; smitra@imf.org; dworrell@imf.org

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I. INTRODUCTION

This paper tests for the impact of various financial risks on bank stability in eastern Europe. Risks include credit, liquidity, and market risks; and risks from the macroeconomic environment. Furthermore, the paper investigates the extent to which vulnerabilities might be mitigated by good supervisory and regulatory policies and practices. Financial sector assessment programs (FSAPs) undertaken by the IMF and World Bank in most of the countries in the region in recent years have generally reported remarkable success in financial reforms after a period of financial turbulence in the early 1990s, as reflected in rapidly improving financial stability indicators and greater resilience to financial risk exposure. However, based on experience in other parts of the world, there remains a concern that financial supervision and regulation needs to be further upgraded especially since risks from rapid credit growth and potentially unsustainable macroeconomic imbalances could materialize in the future.

The study covers data on banks of the 10 countries that joined the European Union (EU) in 2004 (EU10), and 8 countries in the surrounding region (S8).[2] The S8 share many financial characteristics with the EU10, including, in many cases, the large presence of EU-based foreign banks and financial institutions. They have also witnessed the rapid credit growth typical of much of our sample, and they share a concern about the financial sector implications of exchange rate policy. Also included in the study are three non-core EU countries (EU3) to act as a control group within the sample.[3]

In the next section, we present a literature review, which discusses the results of earlier studies and the variables used. A description of the underlying data, including regional variations by country clusters, is provided in Section III. The methodology and results are presented in Section IV, followed by conclusions in Section V.

II. LITERATURE SURVEY

The empirical test in our study explores risk factors which are most often discussed in the recent literature and in policy circles, using an existing risk measure, and incorporating information on the quality of regulation and supervision. Our discussion includes rapid growth in bank credit, exchange rate regime and volatility, the extent of foreign ownership, the size of financial institutions, macroeconomic stability, and the quality of the regulatory and supervisory framework. This section provides a background for the study, drawn from the literature, and explains the choice of variables included in the empirical test.

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[2] The EU10 comprise Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, and Slovenia. The S8 are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Romania, and Serbia and Montenegro.

[3] Adopting the terminology introduced by Schadler et al. (2004), the three "non-core" countries refer to Greece, Portugal, and Spain, as these countries joined the EU much later than the rest of their western European counterparts.

A measure of risk

An increasingly used measure of bank soundness is the risk of insolvency or distance to default, also referred to as the *z-index*. This index which is directly related to the probability of loss exceeding equity capital can be summarized by:

$$z \equiv \frac{\mu + k}{\sigma}$$

where μ is average return on assets (in percent), k is equity capital in percent of assets, and σ is the standard deviation of return on assets as a proxy for return volatility.[4] Statistically speaking, z measures the number of standard deviations a return realization has to fall in order to deplete equity, under the assumption of normality of banks' returns. A *higher* level of z corresponds to a *greater* distance to equity depletion and therefore *higher* banks stability.

Credit growth

The risk of a credit boom-and-bust is the subject that has attracted most attention, among possible financial risks in European countries. At end-December 2006, 16 European countries experienced an annual private sector credit growth exceeding 20 percent, 5 of which had rates over 50 percent (Figure 1). All of the countries with a credit growth rate above 20 percent were Central and Eastern European (CEE) countries, except for Ireland (23 percent), Spain (24 percent), and Luxembourg (34 percent). At end-December 2006, the level of financial intermediation in CEE countries remains low, with a ratio of private sector credit to GDP ranging between almost 15 percent (Albania) and 64 percent (Latvia), in contrast to an average of almost 130 percent for the Euro area. While credit growth is largely perceived as part of a welcome catch-up process after many years of limited financial intermediation, some policymakers are increasingly concerned about its negative implications on macroeconomic and financial sector soundness.

A very swift rise in credit may be the outcome of rapid income growth or the development of new credit markets such as housing and mortgage credit.[5] In such circumstances, credit expansion may coexist for some time with low and declining inflation. Credit may also

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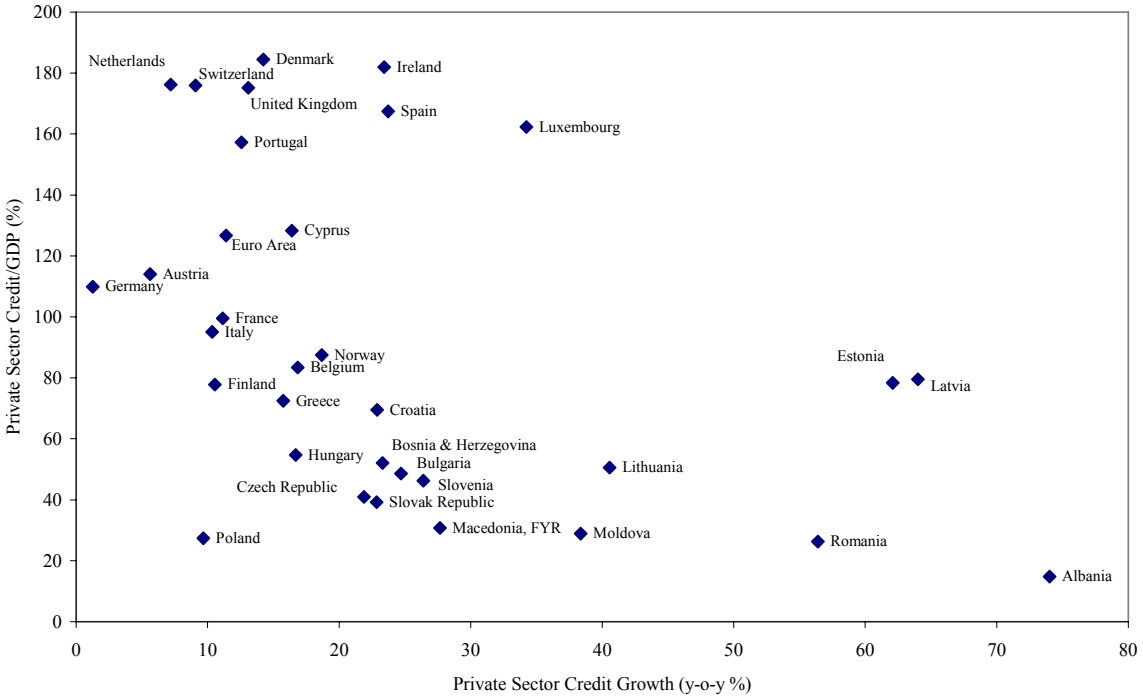
[4] A *higher z*—and higher log(z)—implies a *lower* upper bound of insolvency risk and hence a *lower* probability of bank insolvency. Ideally, the z-score should be computed based on the market values of shareholders' equity and assets rather than the book value of banks' balance sheets, as is done here to overcome the lack of data on market capitalization of most of the banks in our sample. Since book values are invariably lower than market values, our measure of z gives a more conservative (but less volatile) measure of risk than would in fact exist.. For other studies using a similar methodology, see, for example, De Nicolo (2000), Altman and Saunders (1998), and Lin, Penm, Gong, and Chang (2005).

[5] Studies of rapid credit growth include IMF (2004a)—which also considers this phenomenon in East Asia—Schadler, Drummond, Kuijs, Murgasova, and van Elkan (2004); Coricelli, and Masten (2004); Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2003); IMF (2005); IMF (2004b); and Borio and Lowe (2002), who deal with this issue in a more general context.

increase rapidly in cases of successful stabilization and significant economic reform, with credible economic policies. In practice, however, credit boom-and-bust cycles have often been associated with the absence of close financial surveillance. Thus, despite seemingly sound fundamentals, most studies generally agree that financial soundness indicators should be carefully monitored for early warnings of distress, that standards of prudential regulation and supervision should be strengthened and their implementation intensified, and that materialization of excess demand pressures should be closely analyzed.[6]

Figure 1. Credit Growth in Europe, End-2006 1/



1/ 2005-2006 y-o-y growth, except for Albania and Poland (2004-2005 y-o-y growth), Credit/GDP For 2006; 2005 for Albania, Poland and Slovenia.

In terms of policy responses, there is also widespread agreement that, should signs of financial instability appear, tightening fiscal policy can be an effective response to slow down credit growth, whereas monetary policy measures, especially in countries with closely managed exchange rates and open capital accounts, have generally proved largely ineffective. Administrative measures and direct policy tools—such as reserve requirements, credit controls, etc—are sometimes seen to encourage excessive risk-taking by diverting local currency-denominated credit demand to foreign currency sources. To maintain the quality of banks' loan portfolios, prudential tightening is the typically recommended policy response, although there is little evidence that such measures help reduce the speed of credit growth. If prudential measures are used to ration credit, there is an incentive to satisfy the

[6] A few studies, however, have found limited evidence of credit boom-induced banking crises (IMF, 2004a, and Tornell and Westermann, 2001).

excess credit demand through nonbank financial institutions, transferring the risk to nonbank financial institutions and/or non-financial borrowers.[7]

Exchange rate strategy

The literature has focused on the sustainability of exchange rate strategies rather than the implications for financial stability. But stable and sustainable exchange rate regimes are a necessary, though not sufficient, condition for financial stability. Backé and others (2004) distinguish between countries that have given up their monetary policy through the adoption of a currency board or a fixed exchange rate regime (Cyprus, Estonia, Latvia, Lithuania, Malta, and Slovenia), and all other countries, which can use the exchange rate as a stabilizing tool. No change in strategy is expected for the former group, although, in some cases, there may need to be some adjustments in the parities. Other studies seem to confirm this result. Burgess, Fabrizio, and Xiao (2003) concluded that the strategy of fixed exchange rates leading up to Euro adoption was viable for all Baltic countries, provided fiscal policy was sufficiently tight to counteract capital inflow surges. Other conditions include sound export performance and competitive (albeit appreciating) real exchange rates, owing to on-going productivity growth and economic reforms. Gulde, Kähkönen, and Keller (2000) concluded that, in general, countries with currency board arrangements (CBA) have experienced lower inflation and higher growth than countries with floating rates and simple pegs. They suggest that it may be possible to go directly from CBA to the European monetary union, given a conservative fiscal stance, a healthy financial system, cautious external debt management, and flexible labor markets.

IMF (2005) found no signs of flagrant exchange rate over- or undervaluation in accession countries, even though there was a wide range of relative competitiveness positions, suggesting that a range of parities may be manageable. Overvaluation may diminish over time, and the change will be more rapid and less costly if it is achieved by prices rather than quantities. Fiscal policy adjustment may help to reduce costs. However, not all studies concurred with this point of view. Egert and Lahrèche-Révil (2003) concluded that the Polish, Czech and Slovenian exchange rates were out of equilibrium, and De Haan, Berger, and van Fraasen (2001) argued that, while Estonia's D-Mark based currency board was very much in line with the criteria for an optimal monetary regime, Lithuania's initial choice of a U.S.-dollar based currency board was not.[8] For the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia, Borghijs and Kuijs (2004) found that the exchange rate responded little to shocks that affected output.

[7] See, for example, Hilbers et al. (2005).

[8] Both countries are now pegged to the euro.

Foreign ownership

Foreign direct investment in financial institutions may have helped to integrate countries' financial markets into the global financial system, bringing significant benefits of efficiency and stability, but it may also have highlighted country risk and financial vulnerability.[9] Naaborg and others (2003) concluded that foreign bank entry was among the most striking features of European transition countries, with foreign banks accounting for over half the number and two-thirds the assets of their banking systems within less than ten years (Table 1). These foreign banks, most of which are owned by reputable western European bank groups, have increased stability and efficiency by revamping the banking sector in many CEE countries and re-establishing public confidence in their financial system. However, the presence of these banks has also introduced new challenges for host country supervisors, who must assess the risks that may arise from a change in the parent institution's strategy or risk appetite and that are managed by the parent's centralized risk management on a group-wide basis.[10]

Table 1. Bank Ownership in Selected CEE Countries, 2003

Country	Number of Banks	Number of Foreign-Owned Banks (In percent)	Asset Share of Foreign-Owned Banks (In percent)
Estonia	6	50.0	97.3
Slovak Republic	21	90.5	96.3
Czech Republic	35	77.1	96.0
Lithuania	13	76.9	95.6
Hungary	36	80.6	83.3
Poland	60	76.7	67.8
Malta	16	62.5	67.6
Latvia	22	40.9	47.2
Slovenia	22	27.3	36.0
Cyprus	14	42.9	12.3

Macroeconomic stability

Financial vulnerability and resilience depend largely on the soundness of macroeconomic policy, as reflected in stable non-inflationary GDP growth rates, with sustainable debt and fiscal and external balances.[11] Since the emerging market crises of the 1990s, many studies

[9] See the Bank for International Settlements (2005) for an analysis of the experiences of Asia, Central and Eastern Europe, and Latin America.

[10] A discussion on the role of foreign banks as a risk transmission mechanism in emerging Europe can be found in Sorsa et al., (forthcoming). The risk implications of the centralization of operational functions in cross-border bank groups are discussed in IMF (2007).

[11] See, for example, Schinasi (2006). For an in-depth discussion on the impact of rising vulnerabilities on the macroeconomic and financial sector stability of Emerging Southeastern European countries, see Sorsa et al., forthcoming,

have confirmed a strong correlation between rising macroeconomic vulnerabilities, including large external deficits and debt and financial risks (Kaminsky, Lizondo, and Reinhart 1998). In particular, large current account deficits make emerging countries vulnerable to sudden capital flow reversals, as these deficits tend to be driven by financial market imperfections (such as liability euroization, and limited access to longer-term capital and equity finance) and financed through foreign bank funding rather than domestic saving and investment decisions, as is the case in rich countries (Blanchard, 2007; and Calvo,1998).

When foreign investors stop rolling over domestic debt, the resulting financing gaps have required a drawdown of reserves or higher interest rates. This has typically led to pressures on the exchange rate, which in turn affected bank portfolios, as holders of foreign currency or variable interest rate debt found it difficult to make repayments (Roubini and Setser, 2004). The impact of such shocks can be amplified by balance sheet mismatches and the extent to which the inflows have been channeled into productive vs. nonproductive sectors. If inflows have been absorbed primarily by nontradables, concerns about a country's debt sustainability further raise financing costs and thereby, banks' liquidity risks, market risks and credit risks (Sorsa et al., forthcoming).

The quality of regulation and supervision

Since 2001, the International Monetary Fund and the World Bank conduct joint FSAPs, in which they assess a country's ability to withstand shocks and develop in a sustainable way. An important aspect of these assessments is the capacity of regulatory systems to reduce risks and increase the system's resilience in case of a disturbance.[12] The reports include assessments of country performance in relation to a variety of internationally agreed standards and codes, which typically include the *Basel Core Principles of Effective Banking Supervision* (BCP) and other codes of good practices, such as the *Core Principles for Supervision of Systemically Important Payments Systems* (CPSS) and guidelines issued by the International Association of Insurance Supervisors (IAIS) and the International Organization of Securities Commissioners (IOSCO).

In line with earlier studies, we use some of these international standard assessments to compile scores of the overall quality of supervision and regulation.[13] Podpiera (2004) found some evidence of a positive impact of compliance with the BCP on banking sector performance. In our paper, we use a similar methodology to calculate a compliance index based on various elements of the BCP and CPSS assessments.[14] In particular, from the BCP

[12] See http://www.imf.org/external/np/fsap/fsap.asp for details.

[13] See Podpiera (2004); and Das, Iossifov, Podpiera, and Rozhkov (2005).

[14] There are other sources of risk which we were unable to explore for lack of data, including issues of financial integration among European countries (Manna, 2004; the European Commission, 2004; and Corker, de Nicolo, Tieman, and van der Vossen, 2005); capital flows, including spillovers and sudden large scale reversals (IMF, 2005; Kóbor and Székely, 2004; Vincze, 2001; and Portes and Rey, 2001); and direct and indirect euroization risks.

we use the principles that relate to prudent credit policies and loan loss provisioning (CPs 7–8); limits on large exposures (CP 9) and connected lending (CP 10); market risk management (CPs12–13); quality of financial information (CPs 14, 19, and 21); and consolidated supervision (CPs 23–24). From the CPSS, we focus on the principles related to payment systems risk management (CPSS 2–7).

FSAPs and reports on standards and codes (ROSCs) for a majority of the countries in our sample, between June 2001 and present, reveal that the regulatory frameworks of almost all countries were adequately supervised, and many were described as well supervised and regulated. In all cases where supervision was only adequate, the FSSAs reported that a process of further strengthening was already underway. Compliance with BCP was generally good, even though there remained a few areas of weaknesses, with respect to lack of transparency of bank ownership, weak governance, and inadequate credit and other risk management policies in some countries.

III. METHODOLOGY

The financial risk variables used in this paper are common to those found in similar studies, except for the data on compliance with certain financial supervisory standards, which have rarely been applied in the literature on financial risk.[15]

The model

Our model follows in the tradition of studies that focus on the joint effect of a variety of macroeconomic and prudential variables on the vulnerability of financial institutions or the financial system as a whole.[16] However, rather than test for financial institution failure, as is typical in these studies, our dependent variable is a measure of insolvency risk, or distance-to-default, of an individual bank—*logz_rol*, based on the z-index described above in Section II.

We estimate the following model to test for different risk factors that affect *logz_rol*:

$$\log z\_rol_{it} = \alpha + \beta_1(Size_{it}) + \beta_{1f}(fod_i * Size_{it}) + \sum_{s=1}^{3}\beta_{BR,s}(BR_{it}^s) + \sum_{s=1}^{3}\beta_{BRC,s}(BR_{it}^s * CP_i^{BRs}) + \beta_{MR}(MR_{it}) + \beta_{MRC}(MR_{it} * CP_i^{MR}) + \sum_{s=1}^{3}\beta_{Ms}(Mac_{it}) + \varepsilon_{it}$$

The subscript *i* stands for bank; subscript *t* for year. Our dependent variable, *logz_rol*, is a variation of De Nicolo's (2000) indicator of banking stability. In particular, *logz_rol* is computed as the sum of the average return on assets (in percent) and equity capital (as

[15] Podpiera (2004); and Das, Iossifov, Podpiera, and Rozhkov (2005) are two exceptions.

[16] They are surveyed in Worrell (2004).

percent of assets) over the standard deviation of return on assets. To take advantage of as much year-on-year variation as possible, we use a three-year rolling z-index, which is computed by using the three-year moving average of return on assets (profitability) plus the three-year moving average of equity to assets (capitalization) over the three-year standard deviation (of return on assets). All variables, including the dependent variable, are transformed into natural logarithms.

The list of explanatory variables aims to incorporate a wide variety of possible risks, from those discussed in the literature and found in FSAP reports. The right-hand side variables are grouped into those that describe bank size (*Size*), including an interaction term with foreign-owned banks (*fod*Size)*; bank-specific risks factors (BR^s), country-specific market risk factors (*MR*), and interaction of each of bank risk factors and market risk factors with the countries' compliance level with certain core principles of effective banking supervision and payment systems (CP) [17]; and variables describing the macroeconomic environment (*Mac*) that vary with country and year.[18] The bank-specific factors included are credit growth, loan loss provisions, liquidity, bank size, and foreign ownership. Market risk is measured by exchange rate volatility, while macroeconomic risks include the ratio of credit to GDP, trade openness, and the inflation rate.

The effect of various risks and risk mitigating factors on bank stability is estimated by means of pooled OLS with heteroskedasticity-corrected (White) standard errors. A log-log specification is chosen so that the estimated coefficients can be interpreted as elasticities.[19] Furthermore, to see which component of *logz_rol* is influenced by the various risk factors, we also run the same model with the individual components of *logz_rol*—profitability, equity over assets, and return-volatility—as dependent variables. Finally, to test for robustness, given substantial regional variation in the indicators, we run a simplified version of the model over pooled regional sub-samples.

Two caveats are in order. First, the specification of our model is not designed to infer causal relationships between bank stability and the various risk factors. Rather, the purpose of this paper is to identify statistically significant conditional correlations between these variables. In other words, the aim of our study is to investigate whether the presence of stronger banks is associated with, say, a stricter prudential and regulatory framework. Our results do not allow us to infer whether this stricter prudential framework has caused banks to become stronger or whether stronger banks prefer to operate in an environment with a stricter prudential and regulatory framework.

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[17] See Table 2.

[18] All variables are taken as natural logarithms, except for the dummy variables. For variables that can take 0 or negative values, we have used a transformation when taking logs as follows: $ln(1+x)$, for small x (expressed as fraction).

[19] The presence of time-invariant and country-specific supervisory variables (the CPs) makes it difficult to use a (fixed-effect) panel estimation model, which would drop a number of relevant bank-specific variables. A pooled OLS, however, enables us to exploit both variations within and between banks as well as regional variations.

Second, in many countries of our sample, a significant portion of total loans is either denominated in foreign currency (dollars or euros) or indexed to the euro. As a result, it would be important to control for the impact of dollarization and euroization on financial stability, and to examine how exchange rate volatility may affect credit or liquidity risk directly (through banks' balance sheets) or indirectly (through banks' exposures to borrowers that may not be able to repay their debts denominated in foreign exchange). Unfortunately, neither the currency breakdowns of banks' loan portfolios nor information on borrowers' ability to withstand an exchange rate shock are readily available, making it very difficult to analyze this type of risk.

Data coverage

The data is based on annual data from Bankscope over the period 1997–2004. For the 21 countries included in our three groups (EU3, EU10 and S8), we selected all banks available in Bankscope for which data was available up to (at least) 2003. This yielded a total of 334 banks. Branches and subsidiaries of multinational banks are consolidated on a national basis—that is, various subsidiaries of a foreign bank in different countries are reported as separate entities.

Explanatory variables

Bank-specific risks

Banks' risks are captured by credit risk and liquidity risk, and their interactions with the countries' compliance with certain supervisory standards.[20] A summary of various risks and risk-mitigating factors is given in Appendix Table 6; the discussion below draws on this table. See Table 2 for details on the variables used in the econometric exercise.

Credit risk

Credit risk from banks' loan portfolios (in both local and foreign currency) is the main vulnerability of banks in EU10+S8 region, as identified in several FSAP reports.[21] This is especially true in the case of a credit boom, which may hide the potential for future nonperforming loans (NPLs). There may also be indirect exchange rate-related credit risk on loans made in foreign currency (*fx*) to unhedged borrowers, even though banks keep foreign exchange open positions within the regulatory limit. We capture the risks associated with a credit boom-and-bust by including bank-by-bank credit growth (*cg*) and its square term (*cgs*) in the model. As a proxy for the riskiness of banks' lending portfolio, we include loan-loss

[20] We interact the supervisory scores with a bank-specific variable to avoid losing too many degrees of freedom.

[21] See http://www.imf.org/external/np/fsap/fsap.asp for published FSSAs by country.

provisions in percent of net interest revenue (*prov*).[22] We do not have any prior as to the sign on the coefficient of this variable. High provisioning may reflect high non-performing loans, and may be associated with a lower distance-to-default. Conversely, high provisioning could indicate prudence if a sound and profitable bank decides to boost precautionary reserves rather than distribute profits.[23]

Strong bank supervisory practices could mitigate some of the credit risk in so far as prudential guidelines encourage prudent risk management practices by banks. Assessment of these policies is made using the BCP. We used some of these assessments to see to what extent the countries and regions in EU10+S8 that have a high compliance with best practices, are better able to withstand shocks (higher *logz_rol*). For this, we interact the two principles that assess the quality of credit and provisioning policies (*CPs 7–8*) with *prov*. We also interact credit growth (*cg*) with an aggregated index that combines the four principles (*CPs 7–10*) that assess the overall quality of banks' credit risk management practices (including policies on connected lending and large exposures).

Liquidity risk

Liquidity risk is modeled by taking the ratio of liquid asset to deposits and short-term funding (*liq*). Although rising *liq* is a positive influence on stability at low levels of liquidity, excessive liquidity could be a structural problem for the bank, reducing the value of our stability indicator. Thus, a bank could be highly liquid by not lending enough and holding large quantities of government securities, often in the absence of liquid secondary markets in such securities.

A key to avoiding systemic liquidity problems is the smooth functioning of, and management of risk in, payments and settlement systems. We make use of *CPSS 2–7* to judge the level of country compliance on these policies. For a bank-specific effect, we combine *CPSS 2–7* with *liq*.

Bank size and foreign ownership

We include total assets (*ta*) to capture the size of banks. A priori the sign on the coefficient of this variable is indeterminate, because the presence of very large banks could either be stabilizing or risky for the financial system, depending on the importance of economies of scale in each banking system (See, for example, De Nicolo, 2000).

Foreign bank ownership, which is very high in Central and Eastern Europe, introduces the risk that parent banks may fund credit expansion in the region in order to relieve tightening

[22] NPLs would have been a good indicator, but using this would have led to a sharp decline in our sample size due to missing observations on most banks.

[23] As Fitch (2005) notes, prudential behavior of banks could be a risk factor if banks' risk behavior is pro-cyclical—excessively optimistic or pessimistic prudential behavior could amplify the business cycle and result in higher risk of bank failure.

profit margins at home, generating rapid credit growth in the EU10+S8 countries. As a result, the foreign branches and subsidiaries may have contributed to a disproportionately large portion of the bank group profits compared to their risk exposures. Moreover, as parent banks tend to own subsidiaries in more than one country in the region, the resulting cross-border networks of bank groups introduces the risk that problems in one bank belonging to the regional network may spread to others, and that macroeconomic deterioration may be transmitted across borders. We capture risks of foreign ownership by interacting *ta* with a dummy variable that takes the value of 1 if the bank is foreign-owned (*fod*).

Country-specific market risk

The standard deviation of monthly exchange rate changes is used as our proxy for market risk (*sd_exchg*). High exchange rate volatility is a source of potential vulnerability, but good risk management policies to monitor market risks could mitigate the balance sheet effects of such fluctuations. We capture the latter by interacting *sd_exchg* with (BCP) *CPs 12–13*— supervisors should be satisfied that banks have in place systems that accurately measure, monitor, control market and other risks, and (supervisors) have the power to impose prudential limits or capital charges against such risks.

Macroeconomic environment

As country experience reported in the literature survey suggests, the macroeconomic environment could show some broad variations in stability trends across countries and country-clusters. We chose private sector credit to GDP (*credgdp*) as an indicator for overall financial development; trade openness (*topen*) to indicate susceptibility to real foreign shocks; and the inflation rate (*infl*) to indicate overall success of monetary policy.

IV. REGIONAL VARIATION IN THE DATA

Before turning to our empirical results, we present key regional variations found in the data. For purposes of comparison, we created seven clusters—*Total* (the total pooled sample), *EU3* (Spain, Portugal, Greece), *Surroundings* (also referred to as S8—Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Romania, and Serbia and Montenegro), *High Credit Growth* (Albania, Bulgaria, Estonia, Latvia, Lithuania, Moldova, and Romania) based on the classification in Hilbers, Otker-Robe, Pazarbasioglu, and Johnsen (2005),[24] *Baltics* (Estonia, Latvia, and Lithuania), *New Member States* (also referred to as EU10— Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, and Slovenia), and *Foreign Owned Banks*. The variables and their sources are described in Table 2. Differences across clusters are depicted in Figures 2–5, which show the pooled means of various macroeconomic variables, banking characteristics, and regulatory compliance.

[24] Countries with real credit growth exceeding 16.8 percent (y-o-y) on an average between 2000 and 2004. However, the banks included in the High Credit Growth countries are not necessarily the ones with the highest average bank-by-bank *nominal* loan growth because of differences in their inflation rates.

Figure 2 suggests a number of regional variations across country clusters in the overall stability indicator (z-index):

- Compared to EU3 banks, banks in the S8 region are highly capitalized. In part owing to high interest margins, the banks in this region are also the most profitable, although they have the highest returns-volatility (measured by the standard deviation of returns on assets).

- In spite of comparatively low capitalization and average profitability levels, EU3 banks appear to enjoy a lower insolvency risk (a higher z-index) than other banks in the sample, primarily because they experience much lower returns-volatility.

- Countries experiencing high credit growth do not appear to be more vulnerable than other banks in the region, because their equity levels are high. Also, even though their rates of return are modest, they do not vary greatly.

Table 2. Variable Description 1/

Type	Indicator	Name	Description and data source 1/
Dependent variables	Banking Stability	*z_rol*	3-year rolling z-index, computed as (roaa_ma + ea_ma)/(roaa_sd)
		logz_rol	Ln(*z*_rol)
	Profitability	*roaa*	Return on Average Assets, *BS*
		roaa_ma	3-yr moving average of ROAA
		roaa_sd	3-yr standard deviation of ROAA
	Leverage (inverse of)	*ea*	Equity/Assets, *BS*
		ea_ma	3-yr moving average of ea
Size	Bank size	*ta*	Total assets, USD mill, *BS.*
Bank-risk (BR)	Loan growth in banks	*cg*	Annual percentage change in total loans in each bank. Total loans, in USD mill, *BS.*
		cgs	cg*cg
	Loan-loss provisions	*prov*	Loan-loss provisions, percent of net interest revenue, *BS.*
	Liquidity	*liq*	liquid assets, percent of customer & short-term funding, *BS.*
Market risk (MR)	Exchange rate volatility as market risk	*sd_exchg*	Standard deviation of monthly exchange rate changes in natural logs
Macro conditions (Mac)	Financial depth of country	*credgdp*	Private sector credit, percent of GDP, *IFS & WEO, IMF*.
	Trade openness	*topen*	(Exports + Imports)/GDP, *WEO*
	Inflation rate	*infl*	CPI inflation rate, *IFS*.
	Financial openness	*fopen*	foreign assets plus foreign liabilities / nominal GDP, *IFS (Banking Survey)* and *WEO*.
Supervisory framework (CP^{BR})	Loan-loss policies	*CP7_8*	Prudent credit policies and loan-loss provisioning by banks. BCP Assessment codes 7 and 8 (sum of squared)
	Credit policies	*CP7_10*	Above + limits on large exposures and connected lending, BCP Assessment codes 7 through 10 (sum of squared)
	Payment sys operation	*CPSS 2-7*	Clearly defined rules and procedures for participation in the payments system, prompt final settlement, high degree of security and operational reliability, collaterals without credit risk. CPSIPS codes 2 through 7.
Supervisory framework (CP^{MR})	Market & Other risk management	*CP 12_13*	Systems that accurately measure, monitor, control market risk, BCP Assessment Codes 12 and 13 (sum of squared).
Dummy variables	Dummy for new member states (EU10)	*dumnms=1*	Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, and Slovenia.
	Dummy for high credit growth countries, in 2004	*dumcrd=1*	Latvia, Bulgaria, Albania, Lithuania, Moldova, Estonia, Romania, from Hilbers et al (2005)
	Foreign-owned banks dummy	*fod=1*	Banks that are majority (>50%) foreign-owned.
	Dummy for Baltics	*dumbal=1*	Estonia, Lithuania, Latvia
	Dummy for Surroundings (S8)	*dumper=1*	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Romania, and Serbia and Montenegro
others	Funding of loans	*tldsf*	Total loans, percent of customer and short-term funding, *BS.*

1/ IFS = International Financial Statistics, IMF; WEO = World Economic Outlook; BS = Bankscope; assessment codes refer to the following: 4 = observed (in TFP and CPSS) or compliant (in BCP); 3 = broadly observed (in TFP and CPSS) or largely compliant (in BCP); 2 =partly observed (in TFP and CPSS) or materially non-compliant (in BCP); and 1 = non-observed (in TFP and CPSS) or non-complaint (in BCP). An 'l' in front of a variable denotes its natural log—lx=ln(x). An 's' after the name of the variable denotes its square—xs=x*x or lxs=ln(x)*ln(x).

Figure 2. Mean of Z-Index and its Components

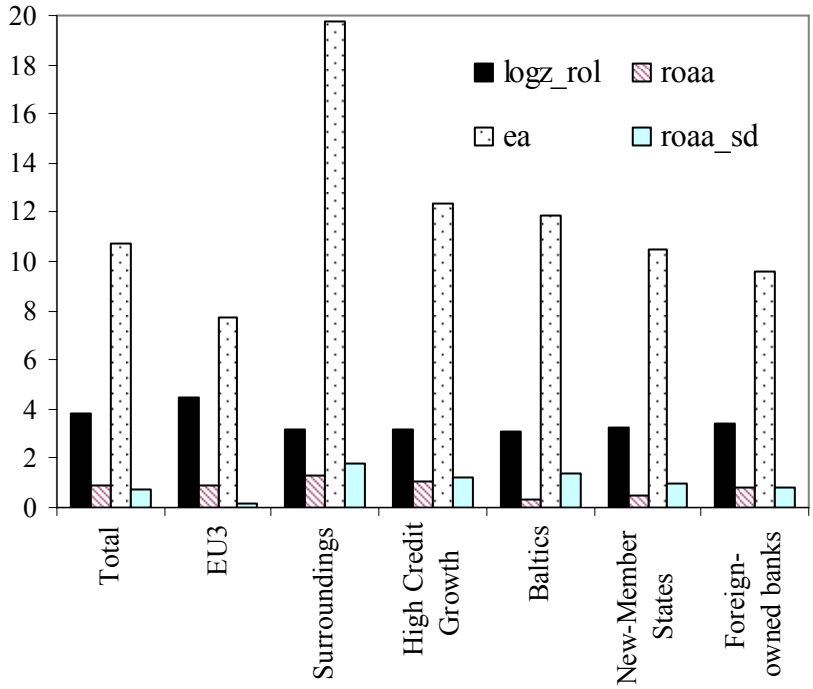


Figure 3. Mean of Macroeconomic Background

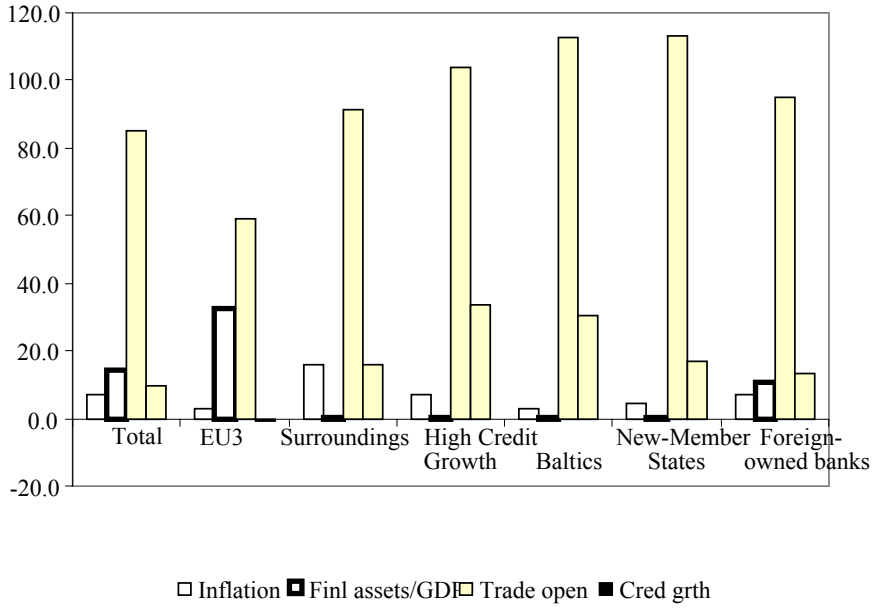


Figure 4. Mean of Banking Characteristics

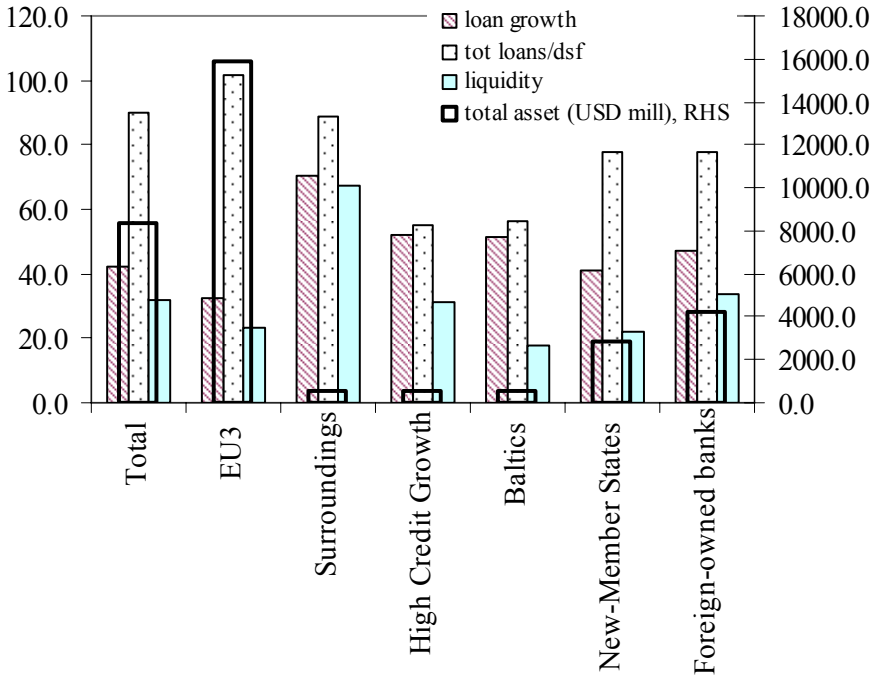
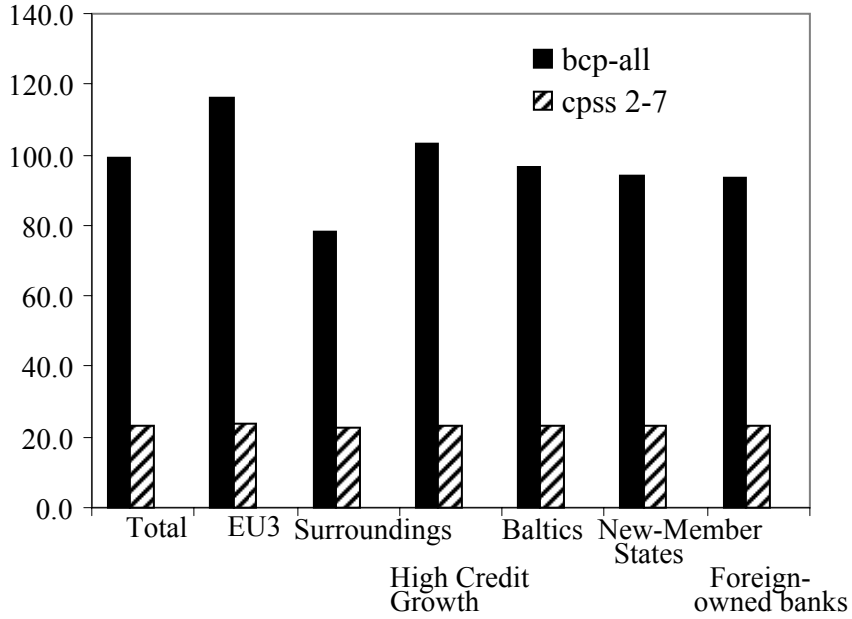


Figure 5. Mean of Regulatory Indices



The differences in macroeconomic characteristics as shown in Figure 3 are:

- The EU3 countries have the highest ratio of financial assets to GDP but the lowest trade openness, whereas the reverse is true for the *New Member States*.

- There seems to be a positive association between the inflation rate and bank insolvency risk (see Figures 2 and 3).

As far as liquidity and other bank characteristics are concerned:

- The S8 banks exhibit ample liquidity and the highest average credit growth rate (see Figure 4).[25] Despite higher profitability and capitalization, they are not more stable than the *High Credit Growth* group of banks (see Figure 2), mainly due to their higher return-volatility.

- In the EU3 and S8 countries the loans to deposit ratios are higher than for the Baltic countries and the *High Credit Growth* countries, which could reflect higher indebtedness.

Bank sizes differ considerably among groups—average EU3 banks are nearly twice as large as the average for the entire pool, and new member country banks almost five times as big as the S8 ones. However, there does not seem to be systemic association between size and the stability (*logz_rol*) (see Figures 2 and 4).

As in some other studies (Podpiera, 2004), we have converted qualitative indicators of supervisory standards to quantitative scores (see Table 2 for details). The computed scores are shown in Figure 5 and the standards are elaborated in Appendix Table 7:

- The regulatory regime shows less variation across regions, except for the S8 countries, which stand out with the lowest BCP scores.

- Overall, countries seem to benefit from fairly strong payment systems infrastructure and oversight and there is not much difference in CPSS scores between regions.

V. EMPIRICAL RESULTS

The main results are shown in Table 3. Columns 1–3 present the results with all the risks discussed in the previous section. Columns 4–6 focus on credit risk, as this has been consistently outlined as the main stability risk for banks. For each specification, we ran the regression controlling for banks in EU3 countries (columns 1 and 4), for all banks (columns 2 and 5), and banks in EU10+S8 region (columns 3 and 6). Table 4 provides estimates for the same model run on, respectively, profitability (columns 1–2), equity-to-assets (columns 3–4), and returns-volatility (columns 5–6) as dependent variables. We then run the credit risk part

[25] Because of inflation, some countries in *High Credit Growth* and *Surroundings* overlap. See also footnote 26.

of the model on sub-sections of regional banks (Table 5). Overall, we find broadly robust results across specifications.

Credit risk

In our model, several variables capture various aspects of credit risk and empirical tests yield the following results for each of them:

Credit growth

- Higher bank-by-bank credit growth is associated with greater stability (positive sign on *cg*). Regressions on the components of *logz_rol* suggest that this result is driven by the association of faster credit growth with higher profits, higher equity, and lower volatility, all of which raise the stability indicator *logz_rol* (see Table 4).

- However, banks become more vulnerable as credit growth accelerates (the quadratic effect of credit growth, *lcgs,* is strongly negative). This appears to be the case because returns become more volatile as credit growth accelerates (column 6 of Table 4), particularly in the case of the EU10+S8 group of banks.

- Two results on the credit policy regime are puzzling. First, the returns to a bank with higher credit growth are lower where the supervisory regime is stronger (there is a negative coefficient of lcg_cp710s in Table 4, columns 1-4). Second, banks operating under a stricter credit policy regime (including limits on large exposures and connected lending, *CP 7–10*), have lower stability, indicators when credit growth is higher (there is a negative coefficient of lcg_cp710s in Table 3). In future work it would be useful to explore these results further with a dynamic model. One hypothesis is that in the short run, tougher supervisory standards may adversely affect banks' profitability (through higher provisioning) and therefore reduce their apparent stability. Overtime, however, the higher costs associated with a stricter regulatory framework should translate into a greater ability to withstand shocks and therefore a lower returns-volatility and a higher value of the stability indicator. Our current model specification does not allow us to test this hypothesis.

Table 3. Risks and Stability 1/

	All risks			Credit risk only		
	Controlling for dumeu3	All banks	dumeu3=0 or EU10+S8	Controlling for dumeu3	All banks	dumeu3=0 or EU10+S8
	(1)	(2)	(3)	(4)	(5)	(6)
	logz_rol	*logz_rol*	*logz_rol*	*logz_rol*	*logz_rol*	*logz_rol*
lta	-0.04	-0.04	-0.01	-0.079**	-0.083**	-0.098**
	(1.61)	(1.64)	(0.09)	(3.14)	(3.31)	(2.86)
lprov	-1.675**	-1.562**	-1.744**	-1.356**	-1.411**	-1.258**
	(6.43)	(6.00)	(6.36)	(5.89)	(6.20)	(5.41)
lprov_cp78s	0.006**	0.005**	0.004	0.003*	0.003*	0
	(3.30)	(3.04)	(1.51)	(2.02)	(2.04)	(0.16)
lcg	1.077*	1.189*	1.588*	0.835+	0.738	1.720**
	(2.08)	(2.35)	(2.48)	(1.83)	(1.63)	(3.32)
lcg_cp710s	-0.014	-0.016+	-0.027*	-0.009	-0.008	-0.030**
	(1.46)	(1.65)	(2.48)	(1.08)	(0.90)	(3.26)
lcgs	-0.396*	-0.419**	-0.220+	-0.370**	-0.364**	-0.382**
	(2.52)	(2.70)	(1.89)	(3.00)	(2.99)	(4.32)
sd_exchg	0.284**	0.262**	0.206*			
	(3.95)	(3.66)	(2.49)			
sde_cp1213s	-0.014**	-0.013**	-0.010+			
	(4.38)	(4.02)	(1.87)			
lliq	-0.903*	-1.035**	-0.222			
	(2.30)	(2.81)	(0.32)			
lliq_cpsss	0.002**	0.002**	0.002			
	(3.22)	(3.46)	(1.43)			
fodlta	-0.053**	-0.049**	-0.052*			
	(4.83)	(4.46)	(2.24)			
lcredgdp	0.940**	0.776**	0.691**	0.622**	0.742**	0.413**
	(6.87)	(7.58)	(3.80)	(5.80)	(9.88)	(3.55)
ltopen	-0.594**	-0.255+	-0.361	-0.131	-0.366**	-0.028
	(2.82)	(1.67)	(1.20)	(0.84)	(3.34)	(0.18)
linfl	-0.307	-0.495	-1.081	-0.76	-0.742	-1.602
	(0.32)	(0.52)	(0.94)	(0.77)	(0.75)	(1.60)
dumeu3	-0.453*			0.338+		
	(2.04)			(1.77)		
Constant	5.606**	5.408**	4.958**	4.859**	5.089**	4.896**
	(16.36)	(16.22)	(9.21)	(16.99)	(20.04)	(12.92)
Observations	779	779	298	925	925	437
R-squared	0.4	0.4	0.29	0.33	0.33	0.19

1/ Absolute values of the t-statistics are in parentheses; significance at 1 percent level is shown by **, at 5 percent by *, and at 10 percent by +.

Table 4. Components of *logz_rol* 1/

	lroaa_ma		lea_ma		roaa_sdm	
	All	EU10+S8	All	EU10+S8	All	EU10+S8
	(1)	(2)	(3)	(4)	(5)	(6)
lta	0.060**	-0.006	-0.061**	-0.085**	-0.082**	-0.319**
	(2.98)	(0.16)	(6.15)	(3.51)	(2.74)	(2.66)
lprov	-1.915**	-1.705**	0.059	0.025	2.195**	2.765**
	(4.63)	(3.79)	(0.74)	(0.25)	(3.93)	(4.85)
lprov_cp78s	0.004*	0.007*	0	-0.001	-0.005	-0.008
	(2.12)	(2.03)	(0.59)	(0.55)	(1.61)	(1.32)
lcg	0.809+	0.814	0.754**	0.162	-1.936+	-2.356
	(1.79)	(1.62)	(3.70)	(0.85)	(1.68)	(1.48)
lcg_cp710s	-0.014+	-0.01	-0.011**	0	0.03	0.042
	(1.66)	(1.05)	(2.90)	(0.03)	-1.57	-1.46
lcgs	-0.011	-0.133	-0.072	0.059	0.475*	0.680*
	(0.04)	(0.48)	(1.38)	(0.85)	(2.29)	(2.12)
sd_exchg	0.061	0.056	0.116**	0.083*	-0.222	-0.354*
	(0.82)	(0.62)	(3.72)	(2.55)	(1.42)	(1.99)
sde_cp1213s	-0.002	-0.003	-0.005**	-0.006*	0.007	0.017
	(0.73)	(0.61)	(3.82)	(2.57)	(1.06)	(1.63)
lliq	0.154	1.304+	0.253	1.316**	1.995+	4.561**
	(0.43)	(1.92)	(1.08)	(6.60)	(1.93)	(2.90)
lliq_cpsss	0	-0.002	0	-0.002**	-0.002*	-0.010**
	(0.49)	(1.52)	(0.76)	(3.77)	(2.18)	(3.96)
fodlta	-0.066**	-0.046*	-0.028**	-0.026+	-0.011	0.077+
	(6.10)	(2.52)	(5.87)	(1.79)	(0.98)	(1.84)
lcredgdp	-0.625**	-0.377*	-0.323**	-0.072	-0.581**	-0.374
	(7.60)	(2.57)	(8.17)	(1.09)	(3.56)	(1.26)
ltopen	0.165	0.005	-0.312**	-0.723**	-0.013	0.179
	(1.39)	(0.02)	(5.38)	(4.98)	(0.06)	(0.39)
linfl	3.244**	4.185**	-0.033	0.679	-1.719	-1.244
	(4.08)	(4.24)	(0.07)	(1.31)	(1.01)	(0.63)
Constant	-0.738**	-0.921+	2.198**	2.318**	0.205	-0.334
	(2.99)	(1.78)	(16.18)	(9.74)	(0.47)	(0.34)
Observations	719	256	779	298	780	299
R-squared	0.27	0.34	0.42	0.52	0.31	0.30

Absolute values of the t-statistics are in parentheses; significance at 1 percent level is shown by **, at 5 percent by *, and at 10 percent by +. Columns 1–4 drop observations for which either equity/assets or roaa or both are negative.

Table 5. Regional Credit Risk 1/

	EU3	Baltics	Surrounding	EU10	High Cred Grth
	(1)	(2)	(3)	(4)	(5)
	logz_rol	*logz_rol*	*logz_rol*	*logz_rol*	*logz_rol*
lta	0.007	-0.05	0.033	-0.08	-0.028
	(0.20)	(0.55)	(0.34)	(1.60)	(0.45)
lprov	-0.317	-1.1	-0.948	-1.586**	-1.296*
	(0.31)	(1.58)	(1.39)	(5.38)	(2.49)
lprov_cp78s	-0.001	-0.003	0.006	0.003	-0.002
	(0.25)	(0.46)	(0.94)	(0.92)	(0.66)
lcg	1.267	3.200+	-0.131	2.769**	1.043
	(1.62)	(1.67)	(0.15)	(4.13)	(1.63)
lcg_cp710s	-0.009	-0.052+	0.009	-0.047**	-0.020+
	(0.68)	(1.71)	(0.42)	(4.13)	(1.70)
lcgs	-0.508**	-0.244+	-0.354*	-0.265*	-0.337**
	(2.73)	(1.79)	(2.01)	(2.10)	(3.10)
lcredgdp	2.137**	0.735*	-0.461	0.651**	0.469+
	(7.56)	(2.26)	(0.84)	(4.33)	(1.82)
ltopen	1.227	-0.332	0.729	-0.087	-0.476
	(1.20)	(0.52)	(0.89)	(0.50)	(1.27)
linfl	-23.042**	-21.461**	-4.134**	-5.325**	-1.243
	(3.05)	(3.17)	(2.66)	(2.70)	(1.10)
Constant	5.954**	5.752**	2.671+	4.991**	4.826**
	(8.59)	(7.15)	(1.85)	(10.13)	(7.64)
Observations	488	111	105	300	173
R-squared	0.20	0.29	0.08	0.28	0.18

1/ Absolute values of the t-statistics are in parentheses; significance at 1 percent level is shown by **, at 5 percent by *, and at 10 percent by +.

Loan-loss provisioning

- Higher provisioning for loan-losses is associated with a lower *logz_rol* (i.e. greater vulnerability). Evidence from the components of *logz_rol* indicates that banks with higher provisioning tend to be less profitable (see columns 1–2 of Table 4) and exhibit higher returns-volatility (see columns 5–6 of Table 4).

- A higher score on the BCP that address credit and provisioning policies (*CP 7–8*) mitigates the negative effect of provisioning on stability. (The coefficient of *lprov_cp78s* is positive and statistically significant in Table 2) Higher compliance with *CP 7–8* is associated with higher profitability (see columns 1–2 of Table 4).

Liquidity risk

Liquidity risks (*lliq*) have mixed effects on stability as defined by *logz_rol*.

- Overall, there appears to be a negative association between liquidity and stability. Individual component estimations indicate that highly liquid banks tend to exhibit

significantly higher returns-volatility. This is particularly true for the EU10+S8 group of banks (see column 3 of Table 3).

- However, banks operating in countries with a good payment systems infrastructure and oversight (*CPSS 2–7*) experience lower returns-volatility, and hence, a lower insolvency risk.

Market risk

Country-wide exchange rate volatility has a somewhat counter-intuitive effect on stability.

- Exchange rate volatility (*sd_exchg*) is associated with a higher *logz_rol* (higher stability) (see columns 1–3 of Table 3), mostly through higher capitalization and, in the case of EU10+S8, reduced return-volatility (see columns 3–4 and 6 of Table 4). This is plausible if banks anticipate the impact of possible exchange rate fluctuations on their balance sheets and allow for higher capital buffers.

- However, the positive effect of exchange rate volatility on bank stability is somewhat mitigated when bank supervisors enforce strict market risk management practices (CP 12–13). This suggests that a strict regulatory framework may induce banks to better match their capitalization levels with the underlying risks, leaving less need for extra capital buffers (*sde_cp1213s*).

Macroeconomic performance and structure

- Banks in countries with greater financial depth—a higher private sector credit (as a percent of GDP), *lcredgdp*—are more stable, which is the expected result.

- Trade openness (*ltopen*) has a negative effect on stability, especially through its negative impact on capitalization. This result may reflect the greater inherent riskiness of foreign exposures.

- Higher inflation is associated with higher profitability but has no significant effect on the stability indicator, *logz_rol*. This is a plausible result in a period of moderate inflation.

Bank structure and ownership

- Larger foreign-owned banks are less stable (negative coefficient of *fodlta*), mainly due to lower profitability, lower capitalization and a mildly higher volatility (mainly in EU10+S8). While this result is counter-intuitive, it probably reflects the inherent weakness of our stability measure. Because foreign banks typically have access to a very large pool of equity funds abroad, they may safely operate with much lower levels of capitalization of local operations, than would be the case for local banks.

- Profitability increases with size (except for EU10+S8 banks), whereas both capitalization and returns-volatility decrease in size. The effects appear to cancel each other, and the size variable is not significant for the overall stability of banks included in our sample.

Regional Credit Risk

Table 5 examines credit risk variation among the different groups defined earlier, with a simplified model containing only credit risk. Table 5 shows that the basic conclusions of the fuller model remain intact.

- For all the regions, credit acceleration is associated with greater vulnerability, although financial depth (*credgdp*) does not matter for the S8 region.

- Higher provisioning is associated with lower bank stability (negative impact on *logz_rol*) in EU10 and High Credit Growth countries. According to the regressions on the individual *logz_rol* components, this result is driven by the negative effect of higher provisioning on profitability and, in the case of EU10&S8 banks, higher returns-volatility.

- For banks operating in S8 countries, a high score in the quality of supervision of credit policies (*CPs 7–8*) is associated with lower insolvency risk, higher profitability and lower returns-volatility.

VI. CONCLUDING REMARKS

The results indicate that while a focus on credit quality is justified, it is the acceleration of credit, rather than its rate of growth, that warrants extra vigilance. The observed rates of growth of credit are associated with greater bank stability for our sample, and it is only when credit growth speeds up that banks appear more vulnerable. When credit growth accelerates it is important to ensure sound supervisory practices, in order to minimize risk exposure.

Two results on the credit policy regime may need to be further explored, using a dynamic model. First, the returns to a bank with higher credit growth fall with the strength of the supervisory regime. Second, banks experiencing rapid credit expansion in a context of stricter credit policy regime exhibit lower stability. These phenomena may result from the adjustments that banks were required to make in response to supervisory tightening (i.e., higher provisioning), but we were unable to investigate that possibility.

Higher loan-loss provisioning is associated with lower stability, mainly through lower profitability and higher returns volatility. Procyclical provisioning practices—that is, provisioning more when returns are low—could increase profit volatility. However, improved supervisory policies on provisioning help to sustain profits and reduce volatility.

Foreign banks tend to have a higher risk profile than domestic banks because of their relatively lower capitalization, which is a reflection of their ability to rely on extra funding from their parent institutions when needed. There is no significant difference between the risk profiles of larger and smaller banks, although the returns-volatility of larger banks tends to be lower, suggesting a positive diversification effect

This paper is a first attempt at identifying the role of selected risk factors in affecting banking stability and how they may be mitigated by a strong prudential and regulatory framework.

Over time, with the availability of a wider dataset, the research may be extended to a wider sample of countries, a broader range of exchange rate regimes and macroeconomic diverse profiles. Longer data series will permit the investigation of dynamic effects such as the impact of costly risk mitigation regulations on (future) financial stability benefits. Access to a currency breakdown of banks' balance sheet information and financial income statements will permit exploration of banks' exposure to credit risk induced by potential exchange rate volatility. There is a need to refine the bank instability indicator, to ensure that it more faithfully reflects market perceptions of bank risk exposure. Finally, much work remains to be done on refining the computation of financial regulation indices, from the impact of using different weighting and scoring systems to documenting changes over time.

Appendix Table 6. Sources of Risk and Risk-Mitigation Practices

		Institutional		Supervisory	
Risk	**Sources of risk**	**Risk-mitigation practices**	**Potential indicators**	**Risk-mitigation (best) practices**	**Indicators used**
Credit risk	#Credit boom with potentially high future NPLs	# High quality of risk management in banks	Loan-loss provisions/net interest revenue	# Set of guidelines to encourage banks to have prudent credit policies and practices.	CP 7, CP 8, CP 9, CP 10
		# High capitalization		#Limits on large exposures and connected lending.	
	#Fx loans to potentially unhedged borrowers	# Adequately pricing credit risks into loans rates	Private sector credit growth in each bank	# Supervisors should be satisfied with provisioning and credit policies.	
Liquidity risk	# Systemic deposit runs triggered by problems in few banks	#Holding large quantity of liquid assets (preferably without including govt securities as LA) as insurance	Liquid asset/(deposit and short-term funding)	# Understanding and management of risks and specifying responsibilities of system operator and the participants	CPSS 2-3
	# Large holdings of govt securities in the absence of liquid secondary market.	# Low maturity mis-match of assets and liabilities	Inter-bank deposits/total deposits	# Prompt final settlement with assets carrying little or no credit and liquidity risk	CPSS 4-6
		# Potentially stable and less volatile sources of funding.		# High degree of security and operational reliability.	CPSS 7
Market risk	# Sudden changes in interest rates, exchange rates, real estate prices.	# Limiting open fx positions			
		# Accounting practices that do not mark-to-market assets and liabilities in the banking book	exchange rate volatility	# Supervisors satisfied that banks have in place systems that accurately measure, monitor and control market and other risks	CP 12-13
		# Limiting exposure to equities and real estate.	exchange rate regime		

Appendix Table 6. Sources of Risk and Risk-Mitigation Practices (concluded)

		Institutional		Supervisory	
Risk	**Sources of risk**	**Risk-mitigation practices**	**Potential indicators**	**Risk-mitigation (best) practices**	**Indicators used**
Contagion risk	# Sudden stops in foreign funding if problem detected in one bank out of a network		Dummy for foreign-owned	# Globally consolidated supervision over internationally active banking organizations	CP 23
	# High foreign ownership of banking system		Dummy if bank part of a network	# Establishing contact and information exchange with various other supervisors.	CP 24
Transparency/governance				# Public reporting on major developments in sector, balance sheet, maintain public info services	FPT 7.1-7.4
				# Banks should have in place internal control & audit	CP 14
				# Validation of supervisory information--on-site & external audit	CP 19
				# Consistent accounting practices	CP 21
Dollarization	fx and fx-indexed loans to potentially unhedged borrowers	# prudent credit policies with limits on unhedged lending	(macro) Fx loans/total loans	# Supervisors should be satisfied with provisioning and credit policies.	
		# proper pricing of fx loans	(macro) Fx deposits/GDP	# Limiting open fx positions	

Appendix Table 7. Standards and Codes

Standard	Code	Definition
BCP	CP 7	Principle 7. Credit Policies An essential part of any supervisory system is the independent evaluation of a bank's policies, practices, and procedures related to the granting of loans and making of investments and the ongoing management of the loan and investment portfolios.
	CP 8	Principle 8. Loan Evaluation and Loan-Loss Provisioning Banking supervisors must be satisfied that banks establish and adhere to adequate policies, practices, and procedures for evaluating the quality of assets and the adequacy of loan-loss provisions and reserves.
	CP 9	Principle 9. Large Exposure Limits Banking supervisors must be satisfied that banks have management information systems that enable management to identify concentrations within the portfolio, and supervisors must set prudential limits to restrict bank exposures to single borrowers or groups of related borrowers.
	CP 10	Principle 10. Connected Lending In order to prevent abuses arising from connected lending, banking supervisors must have in place requirements that banks lend to related companies and individuals on an arm's-length basis, that such extensions of credit are effectively monitored, and that other appropriate steps are taken to control or mitigate the risks.
	CP 12	Principle 12. Market Risks Banking supervisors must be satisfied that banks have in place systems that accurately measure, monitor, and adequately control market risks; supervisors should have powers to impose specific limits and/or a specific capital charge on market risk exposure, if warranted.
	CP 13	Principle 13. Other Risks Banking supervisors must be satisfied that banks have in place a comprehensive risk management process (including appropriate board and senior management oversight) to identify, measure, monitor, and control all other material risks and, where appropriate, to hold capital against these risks.
	CP 14	Principle 14. Internal Control and Audit Banking supervisors must determine that banks have in place internal controls that are adequate for the nature and scale of their business. These should include clear arrangements for delegating authority and responsibility; separation of the functions that involve committing the bank, paying away its funds, and accounting for its assets and liabilities; reconciliation of these processes; safeguarding its assets; and appropriate independent internal or external audit and compliance functions to test adherence to these controls, as well as applicable laws and regulations.
	CP 19	Principle 19. Validation of Supervisory Information Banking supervisors must have a means of independent validation of supervisory information either through on-site examinations or use of external auditors.
	CP 21	Principle 21. Accounting Standards Banking supervisors must be satisfied that each bank maintains adequate records drawn up in accordance with consistent accounting policies and practices that enable the supervisor to obtain a true and fair view of the financial condition of the bank and the profitability of its business, and that the bank publishes on a regular basis financial statements that fairly reflect its condition.
	CP 23	Principle 23. Globally Consolidated Supervision Banking supervisors must practice global consolidated supervision over their internationally active banking organizations, adequately monitoring and applying appropriate prudential norms to all aspects of the business conducted by these banking organizations worldwide, primarily at their foreign branches, joint ventures, and subsidiaries.
	CP 24	Principle 24. Host Country Supervision A key component of consolidated supervision is establishing contact and information exchange with the various other supervisors involved, primarily host country supervisory authorities.

Standard	Code	Definition
CPSS	CPSS 02	Principle 2. The system's rules and procedures should enable participants to have a clear understanding of the system's impact on each of the financial risks they incur through participation in it.
	CPSS 03	Principle 3. The system should have clearly defined procedures for the management of credit risks and liquidity risks, which specify the respective responsibilities of the system operator and the participants and which provide appropriate incentives to manage and contain those risks.
	CPSS 04	Principle 4. The system should provide prompt final settlement on the day of value, preferably during the day and at a minimum at the end of the day.
	CPSS 05	Principle 5. A system in which multilateral netting takes place should, at a minimum, be capable of ensuring the timely completion of daily settlements in the event of an inability to settle by the participant with the largest single settlement obligation.
	CPSS 06	Principle 6. Assets used for settlement should preferably be a claim on the central bank; where other assets are used, they should carry little or no credit risk.
	CPSS 07	Principle 7. The system should ensure a high degree of security and operational reliability and should have contingency arrangements for timely completion of daily processing.

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