

**Czech Republic, Republic of Estonia, Hungary, Republic of Latvia,  
Republic of Lithuania, Republic of Poland, Slovak Republic,  
and Republic of Slovenia—Export Structure and Credit Growth**

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**Export Structure and Credit Growth**

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Approved by the European Department

September 14, 2006

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## I. THE DYNAMICS OF PRODUCT QUALITY AND INTERNATIONAL COMPETITIVENESS<sup>1</sup>

### A. Introduction

1. **Of the new members entering the European Union (EU) in May 2004, several had achieved a decade of impressive export growth, expanding significantly their shares of world markets.** What factors lay behind this performance? This paper places in international context the achievements of the eight Central and Eastern European countries (the CEE-8).<sup>2</sup> Though the timing and pace varied, the gains in market shares are evident for six of these eight countries (Figure 1); only Slovenian and Latvian market shares remained relatively flat. In benchmarking this performance, the goal of the paper is to more broadly help identify the determinants of international competitiveness.

2. **The puzzle is that the market share gains by the CEE-8 were achieved despite the appreciation of real exchange rates** (Figure 1). Of course, the bivariate relationship between real exchange rates and evolution of market shares does not control for other developments during this period. Nevertheless, the question does arise: Is the real exchange rate irrelevant? If not, what other factors compensated for the appreciation to explain the apparently strong competitiveness of these economies? And will these favorable factors continue to power export growth?

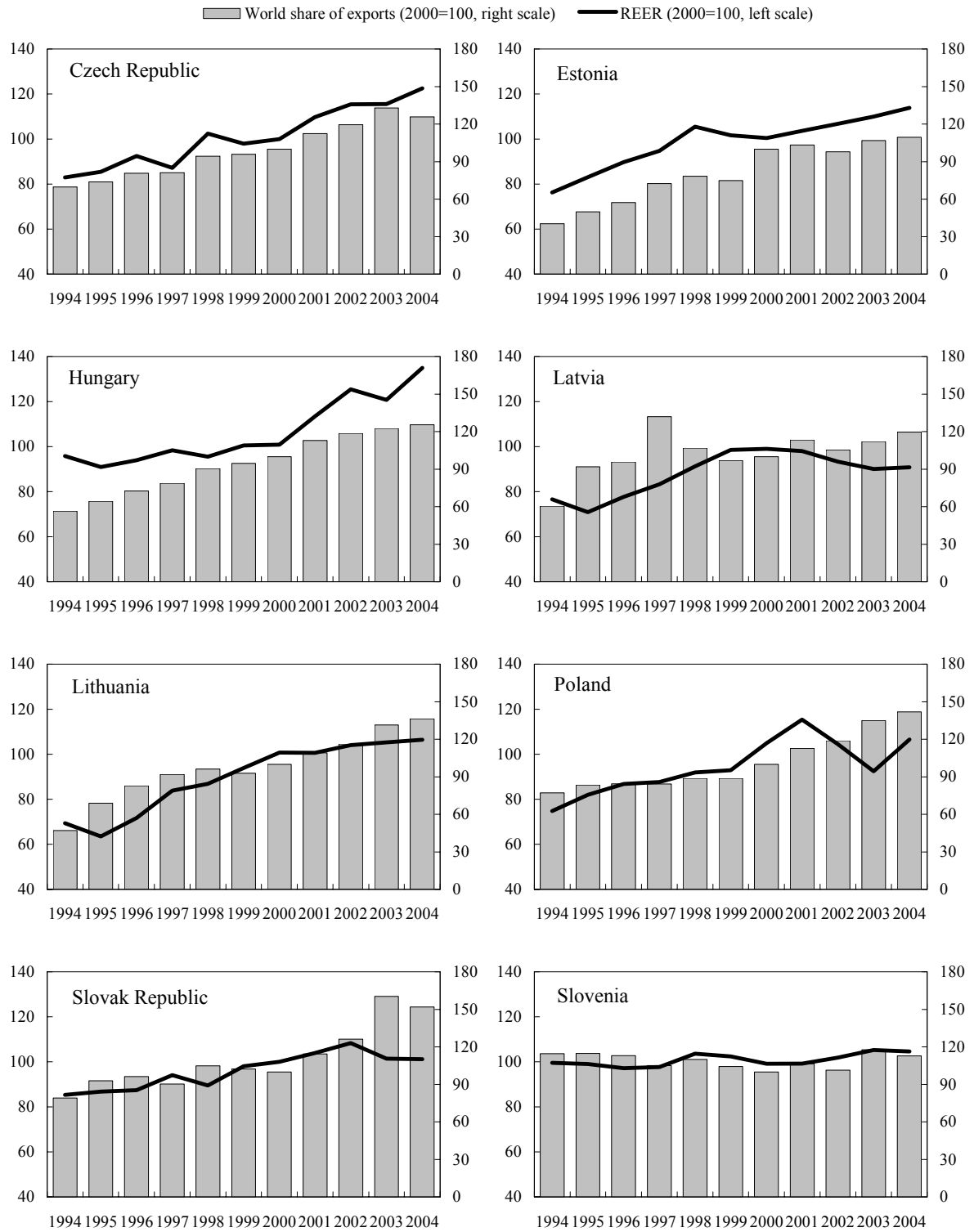
3. **The key to the puzzle is that a structural transformation was also achieved during this period.** This transition from planned economic systems was accompanied by extensive privatization and restructuring, alongside the dismantling of trade barriers and the inflow of foreign direct investment. Forced to compete with international producers, domestically and in foreign markets, firms in the CEE-8 survived by reducing their quality-adjusted prices. This, in turn, required both cost reduction and quality enhancement. Meanwhile, the composition of production shifted toward higher-technology products. This paper documents that transformation. Building from data at the six-digit level of disaggregation, the evidence shows an impressive shift in product quality—measured by the unit value of a country’s exports relative to the unit value of world exports—and in the technological intensity of exports (Figure 2). At the same time, while the pace and timing of the shift once again varied across countries, there was also a movement from relatively low-technology products principally to the medium-technology range, and more slowly, to the production and export of high-technology products.

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<sup>2</sup> The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia.

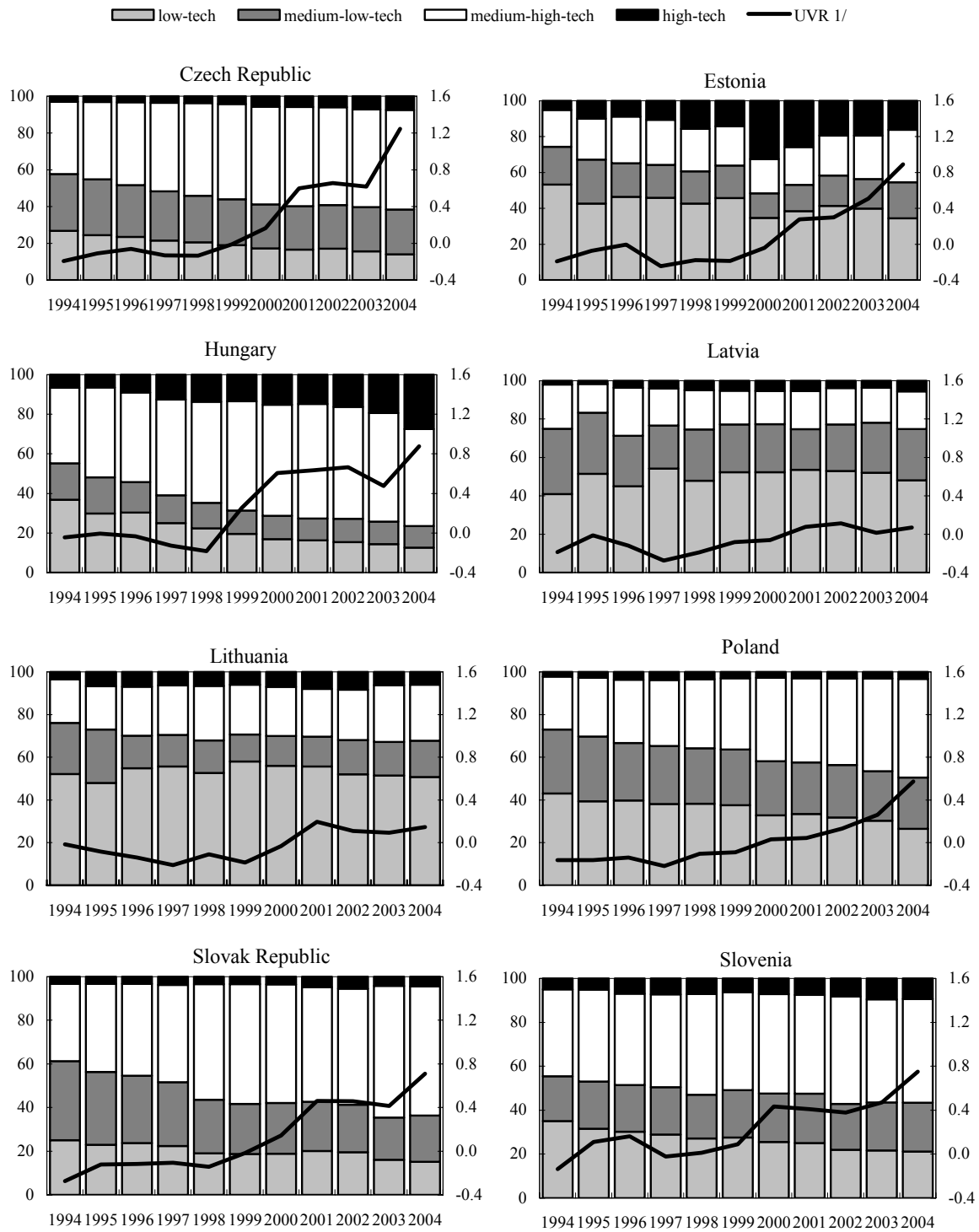
Figure 1. CEE-8: Market Share and REER, 1994-2004 1/



Sources: UN Comtrade database; IMF, International Financial Statistics; and IMF staff calculations.

1/ Market share is the share in percent of a country's manufacturing exports in the global manufacturing trade.

Figure 2. CEE-8: Moving Up the Technology and Quality Ladder, 1994-2004  
(Share in percent of country exports)



Sources: UN Comtrade; and IMF staff calculations.

1/ UVR is the unit value of a country's exports divided by the unit value of world exports. Expressed in logarithm so that a value of zero means country unit value equals world unit value.



4. **The empirical analysis shows that, in a cross-section of countries, over the period 1994-2004, quality and technology upgrading associated with the structural transformation were, indeed, also associated with increased market share.** The analysis strongly suggests that, when trading in international markets, countries benefit from higher product quality. The implication, therefore, is that the observed association for the CEE-8 between improved product quality and increased market share was not accidental but rather the outcome of the apparent value attached to higher-quality products in international markets. The cross-country analysis leads to four specific conclusions of relevance to the CEE-8:

- A small initial market share allows for a catch-up process: coming out of their transition from planned economies, the CEE-8 started with relatively small market shares and took advantage of the catch-up potential.
- Controlling for initial market share, both a higher starting product quality, proxied by the unit value ratio, and an increase in this ratio over time have helped expand market share; however, the evidence also suggests that this process may have diminishing returns.
- Once quality variations are accounted for, real exchange rate appreciation appear to hurt a country's ability to expand its world market share.
- Higher product quality has, as expected, been especially relevant for so-called differentiated products, which are valued for the range and quality of their attributes. Higher product quality of differentiated products from a country appears "twice blessed" in the sense that this quality also helps gain market share in "reference-priced" and "homogenous" products, possibly by enhancing that country's reputation or economies of scale in sourcing and transportation costs.

5. **The message for the CEE-8, therefore, is complimentary but also cautionary.**

These countries have gone through a catch-up phase during which they have also put to good use their human capital in moving up the technology and quality ladder. These factors have allowed them to maintain the dynamism of their exports despite exchange rate appreciations. However, looking ahead, the task will become harder, for several reasons. First, the market share gains made possible by the particularly small world market shares at the time of transition have been largely achieved. Second, the task of technology and quality upgrading was facilitated by the opportunities for relatively easy gains through privatization and restructuring. A new generation of restructuring and technical progress will require more sophisticated efforts and measures. Finally, there is some evidence that technological upgrading may have diminishing returns. However, it will be necessary to keep pace with technical change in competitor economies to maintain market shares and limit the risk of falling behind. Hence, the pressures for continued productivity gains will only increase over time.

6. **This paper builds on an incipient empirical literature linking product quality and export performance.** Dulleck and others (2005) report the improvements in the product quality and technology content of exports from the CEE-8. In their empirical analysis, however, they focus on assessing whether improved product quality/technology of a particular product is associated with an increasing share of that product in the country's basket of exports. Instead, the question we ask is whether the country's share of world markets (either for all goods or for different baskets of goods) is a function of country product quality. This paper is closest in spirit to that by Hallak (2006), who examines the role of product quality in explaining bilateral trade. However, he asks a narrower question, which is whether richer countries have a greater demand for quality. In other words, his analysis focuses on the direction of trade flows in relation to quality characteristics. Also, he limits his analysis to a cross-section of countries, rather than examining changes over time within countries.<sup>3</sup>

7. **The rest of this paper is organized as follows.** Section B presents several bivariate relationships to motivate an empirical framework for analyzing the evolution of market shares. Section C presents the basic regressions explaining the changes in market shares for 58 countries (accounting for almost 94 percent of the world trade) over the period 1994 to 2004. Section D conducts a similar analysis for different product groups. Section E concludes.

## **B. Explaining Market Shares: An Empirical Framework**

8. **We begin with the proposition that a large initial market share constrains the subsequent increase in market share.** This intuition is based on the presumption that, whereas newer entrants have a significant catch-up possibility, a country's share saturates at some point. To test this intuition, an appropriate measure of market share is needed. To motivate such a measure, Figure 3 plots, for select economies, the share of their GDP in world GDP against the share of their exports in world trade. Figure 3a, for 1994, shows the countries clustered around the 45-degree line; the CEE-8 were already slightly above that line, especially Slovakia and Slovenia. By 2004, these countries had acquired more of a presence in world GDP but especially in world trade. In conducting the analysis, therefore, two measures of market share are possible. First, the simple share of exports in world markets, as shown in Figure 3, can be used. The concern with such a measure is that it also reflects the size of the country and not just its competitive capability. Second, the export share can be normalized by the country's GDP share in world GDP. This latter measure is a metric of how far ahead a country's trading relationships are relative to its production capabilities. A large normalized market share would indicate reduced potential for further

---

<sup>3</sup> Also, as we discuss below, comparison of product quality across countries is challenging. Instead, we focus on the quality changes in a fixed basket of goods over time within a country.

inroads into world markets, absent expansion of domestic production capacity. Because this analysis relies primarily on within-country variation over a decade, the change in country size during that period can be quantitatively important in some cases; however, in general, the findings remain similar irrespective of the measure used.

9. **The data do support the expected inverse relationship between initial share and the subsequent increase in market shares.** Figure 4a shows this relationship for the simple measure of market share, and Figure 4b for the normalized measure. Countries with smaller shares in 1994 had made, on average, larger gains by 2004, showing the possibility of catch-up. The countries in Eastern Europe benefited from this process. Note also, for example, that the Czech Republic is above the line, implying that its market share gain was due to more than its initial low level of initial market penetration and despite its substantial exchange rate appreciation during this period. Other CEE-8 are in a similar position. This finding prompts us to examine what other factors were at work.<sup>4</sup>

10. To examine the role of technology and quality upgrading in the evolution of market shares, we constructed measures along two dimensions: quality and technology composition. As noted, based on trade data detailed at the six-digit level according to the Harmonized System (HS), unit value ratios (*UVRs*) are constructed. These are the ratios of a country's export unit values to the global average. For every country in the sample, we fix the basket of goods throughout the period under consideration.<sup>5</sup> By considering an unchanging basket of goods, we eliminate effects arising from greater product variety exported by a country (which may be of value to international buyers) and the shift to products with higher technology content, both of which may allow a country to raise the average prices at which it sells its exports. With these two effects eliminated, and because the analysis focuses on changes over time within a country, the *UVR*, in principle, proxies product quality, on the premise that a higher price reflects higher quality (see Hallak and Schott, 2005). The concern remains that the *UVR* is picking up other influences, especially if local monopolies exist and competition does not arbitrage away differences in quality-adjusted prices. To the extent that is the case and the *UVR* does not measure "quality," the estimates will be biased downward. Hence, a finding that a higher *UVR* helps increase market share would provide a conservative

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<sup>4</sup> Noteworthy is China's impressive performance. Figure 3a shows that China's absolute gain in market share between 1994 and 2004 was large. However, Figure 3b suggests that China's export expansion was largely commensurate with its catch-up potential and growing economy.

<sup>5</sup> Products are dropped if there are missing values in the construction of the unit values or if there are erratic movements in the unit values.



Figure 4a. Increases in Market Shares Relative to Initial Market Shares, 1994-2004

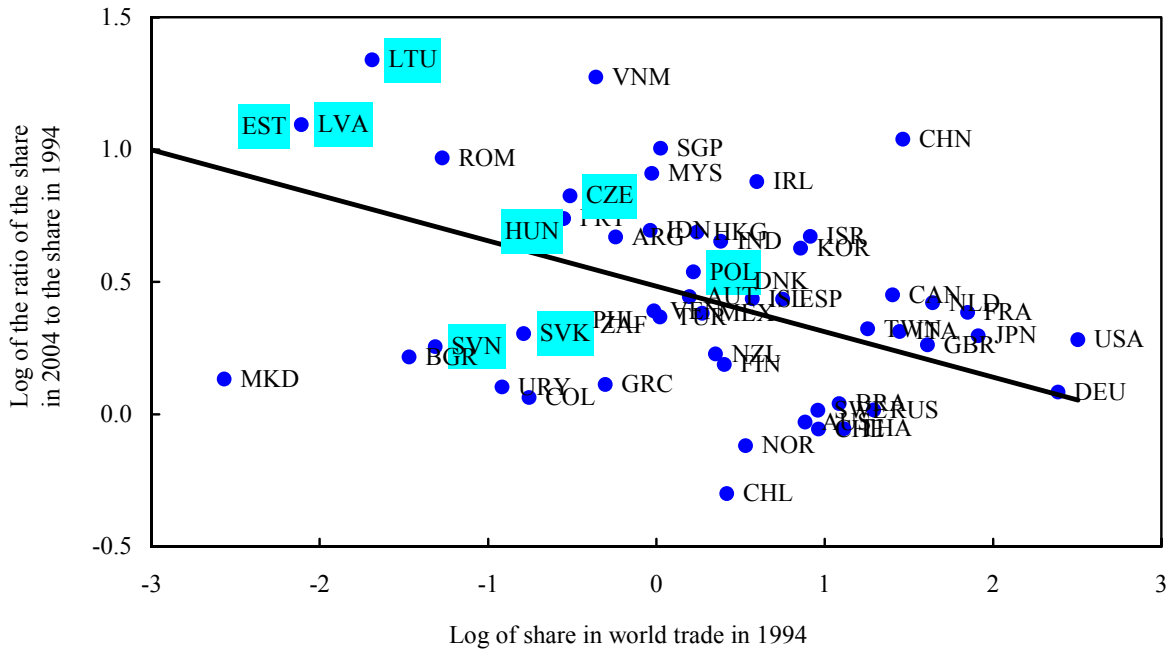
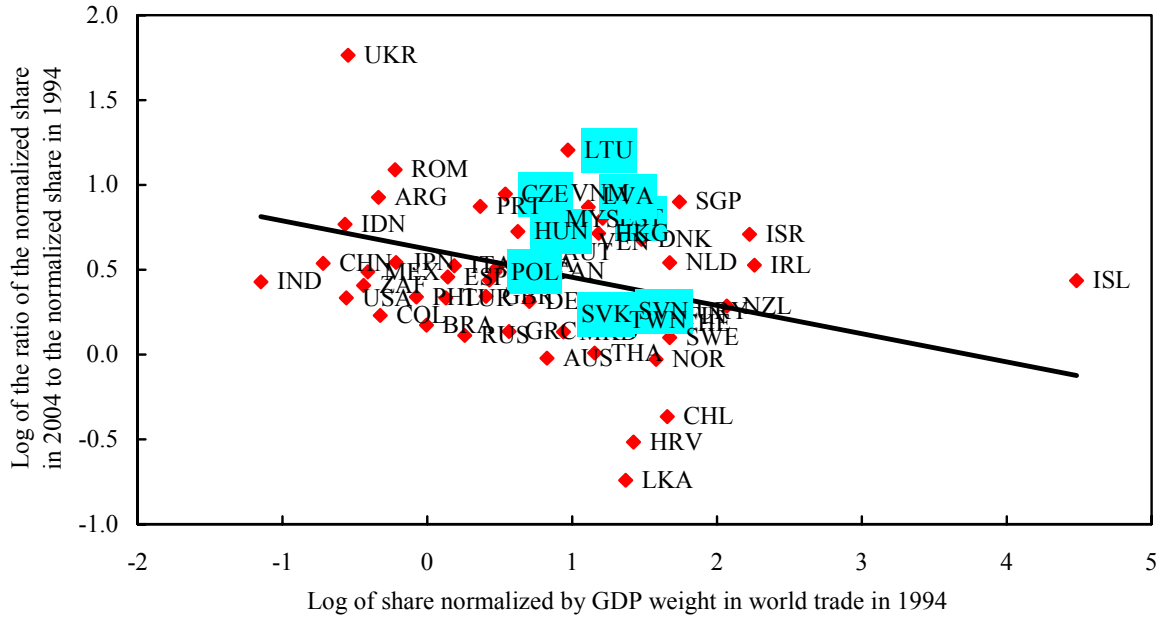
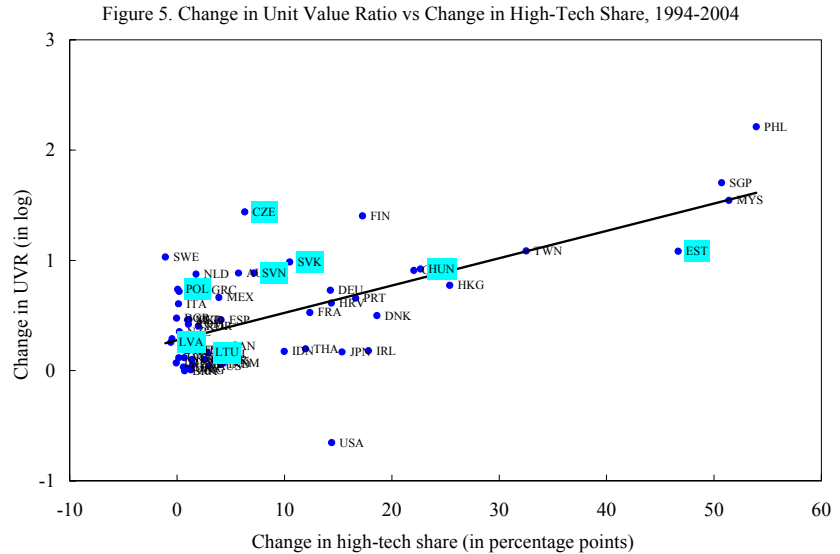


Figure 4b. Increases in Normalized Market Shares Relative to Initial Normalized Market Shares, 1994-2004



estimate of the effects of quality. There remains the possibility that the UVR is picking up changes in the relative shares of products within the fixed basket of goods. To control for this, using higher R&D intensity as a metric for higher technology, we obtain measures of a country's technology composition (for the fixed basket of goods, the technology composition changes to the extent that shares within that basket evolve).<sup>6</sup> Figure 5 shows that an increase in the high-tech share of a country's export composition is (imperfectly) correlated with its unit value ratios. Among developing countries/emerging markets, East Asia and the CEE-8 were the forerunners in technology and quality upgrading, whereas Latin America lagged (Figure 6).



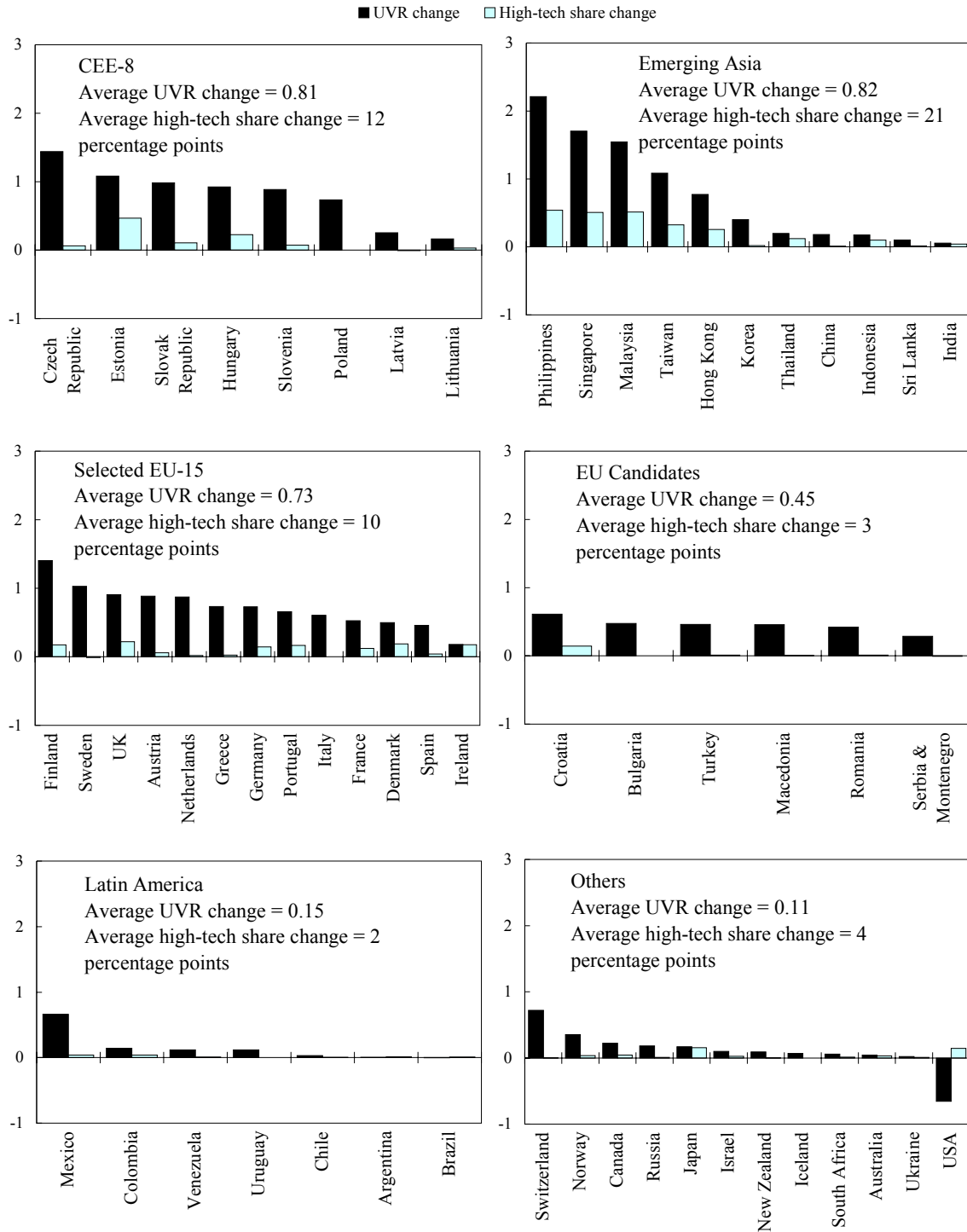
#### 11. These considerations lead to the following base empirical specification:

$$\log \left( \frac{\text{normalized market share}_{i,t+1}}{\text{normalized market share}_{i,t}} \right) = f \left( \log \text{normalized market share}_{i,t}, \log UVR_{i,t}, \Delta UVR_{i,t+1}, \Delta REER_{i,t+1} \right).$$

Throughout, we use the change in the *normalized market share* as the variable to be explained.  $i$  refers to a country.  $\Delta UVR_{t+1}$  is the log change in  $UVR$  from period  $t$  to period  $t+1$ , and  $\Delta REER_{t+1}$  is the log change in the real effective exchange rate ( $REER$ ) from period  $t$  to period  $t+1$ . Thus, we examine if the initial  $UVR$  influences the subsequent evolution of a country's market share and allow also for the possibility that the change in the  $UVR$  helps gain market share over the period considered. Because of the difficulties in measuring the equilibrium value of the exchange rate, especially for developing economies, we consider only the change in  $REER$ .

<sup>6</sup> See the Appendix for details. Using the same R&D metric for all countries does not allow for the possibility that the technology for even a narrowly defined product category may differ across countries. The assumption is that international competition induces countries to adapt or innovate, though in possibly differing ways. In using a common categorization for all countries, we follow, for example, Rajan and Zingales (1998), who apply the U.S. measure of dependence on external finance to all countries.

Figure 6. Change in Unit Value Ratio and High-Tech Share, 1994-2004 1/



Sources: UN Comtrade database, and IMF staff calculations.

1/ Average changes in UVR and high-tech shares are unweighted means across each country group. The changes are computed as the log difference for UVR and as the absolute change for high-tech share.

12. **Panel regressions with country fixed effects allow analysis of within-country changes in market shares.** The period from 1994 to 2004 is divided into three subperiods, 1994–97, 1998–2001, and 2001–04, since annual changes are too noisy to give reliable results. We also ran the regressions for five-year periods with very similar findings. All regressions include country dummies, which are not reported. Since the dependent variable is the change in the market share, which, on average, does not change systematically for all countries in the same direction over time, we do not include time dummies. For 58 countries (covering almost 94 percent of world trade) and the three time periods, we have, in principle, 174 observations. The Appendix lists the countries.

### C. Base Results

13. **Three factors are found to be significant in determining the evolution of market shares** (Table 1). First, as Figure 4 above foreshadowed, the change in market share is inversely related to the starting share. Second, the initial *UVR* is positively associated with the subsequent increase in market share at a high level of statistical significance. Thus, of two countries starting each with a 1 percent share of the world market, the one with a starting unit value at the world average (and, hence, a log *UVR* equal to zero) will see its market share unchanged over the next three-year period (assuming no change in *UVR* and *REER*). A similar country with a starting unit value that is 10 percent above the world average will increase its market share to 1.05 percent. Third, the change in *UVR* over the three-year period is also positively and significantly associated with an increased market share. Once we control for these factors, the direction of the effect of a real exchange rate change is such that an appreciation hurts; however, in this specification, the statistical significance is weak.

Table 1. Base Specification – Dependent Variable: Ratio of End-of-Period Share to Beginning-of-Period Share

	(1)	(2)	(3)	(4)
Initial share	-0.912*** [7.25]	-0.996*** [8.48]	-0.984*** [8.55]	-1.005*** [8.72]
Initial UVR		0.343*** [4.61]	0.516*** [5.09]	0.516*** [5.12]
UVR change			0.191** [2.46]	0.186** [2.40]
REER change				-0.287 [1.50]
Constant	0.811*** [8.30]	0.786*** [8.70]	0.715*** [7.70]	0.735*** [7.88]
Observations	174	174	174	174
Number of countries	58	58	58	58
<i>R</i> -squared	0.31	0.42	0.45	0.46

Notes: Absolute value of t-statistics in brackets. \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. All variables are in logarithms.



14. **These relationships work differently for developed and developing countries.**<sup>7</sup>

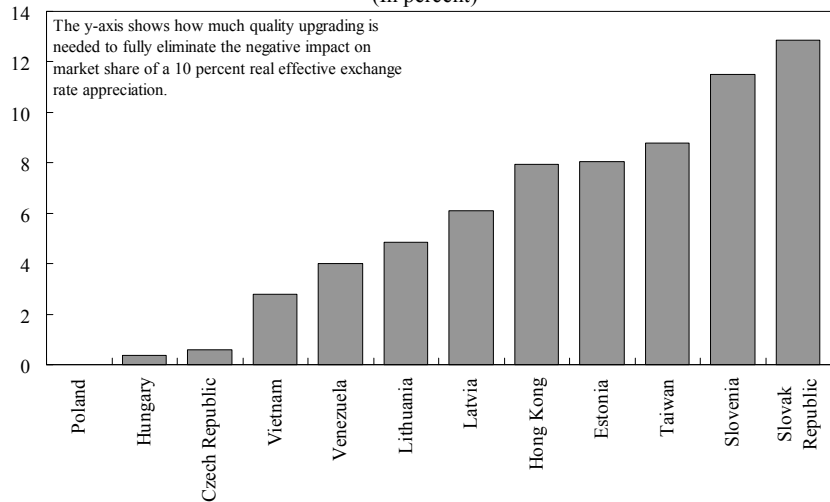
Not surprisingly, the inertia set by initial market shares is significant in developed countries (Table 2, columns 1 and 2), implying that it is difficult for them to increase their international presence from their well-established world market positions. Because the initial market share is so potent, the effect of other variables is more modest, though the initial *UVR* has a strong bearing for exports from the EU-15. *REER* has the “wrong” sign for developed economies. In contrast, the developing country group is less constrained by its market share history (Table 2, columns 3-5), allowing more space for market share increase through technology and quality upgrading. Also, developing countries are apparently punished more for real exchange rate

appreciations. Figure 7 plots how much quality upgrading is required to compensate for a given level of exchange rate appreciation in order to keep a country’s market share constant. Using the coefficients in Table 2, column 3, we calculate the *UVR* change that would leave the market share unchanged if a 10 percent *REER* appreciation

occurred. Since this calculation takes the initial share and initial *UVR* in 1994 as given for each country, the required rise in *UVR* depends on the actual initial conditions a country starts with and, therefore, differs across countries. Reflecting the catch-up effect, countries with smaller initial market shares and higher initial quality levels can do less upgrading than those with less advantageous initial conditions and still achieve the same results.

15. **The evidence is mixed on whether the gains from technology and quality upgrading are nonlinear** (Table 3). In the rest of the analysis, we focus only on developing countries. In exploring a number of extensions, we first briefly consider if quality variations have nonlinear effects. The square of *UVR* does have a negative sign, indicating that continued *UVR* enhancement brings declining gains, though the coefficient is not significant at the 5 percent level. However, the sum of the evidence, including the observation noted above that such quality enhancements play a limited role for developed economies, suggests

Figure 7. UVR Upgrade Requirement to Compensate for 10 percent REER Appreciation (In percent)



<sup>7</sup> The term “developing countries” follows the World Bank classification, with the countries highlighted in Appendix Table 1.

that there are limits to gains from this upgrading process. This (and their already large market shares) may explain the smaller gains made recently by East Asian countries (compared with the CEE-8) despite their continued impressive technology and quality upgrading.

Table 2. Differences between Developed and Developing Countries –  
Dependent Variable: Ratio of End-of-Period Share to Beginning-of-Period Share

Sample	(1) EU-15	(2) Developed Countries	(3) Developing Countries	(4) EU-8, Emerging Asia, Latin America	(5) EU-8, EU candidates, Emerging Asia, Latin America
Initial share	-1.896*** [6.11]	-1.721*** [6.75]	-0.876*** [7.14]	-1.013*** [5.57]	-0.886*** [7.04]
Initial UVR	0.259* [1.94]	0.142 [0.96]	0.529*** [4.63]	0.597*** [5.73]	0.513*** [4.55]
UVR change	0.056 [0.45]	-0.097 [0.78]	0.288*** [3.39]	0.292*** [3.98]	0.286*** [3.40]
REER change	2.087*** [4.25]	1.362*** [3.38]	-0.597*** [2.93]	-0.646*** [3.11]	-0.699*** [2.96]
Constant	2.139*** [5.68]	1.769*** [6.34]	0.538*** [6.52]	0.581*** [4.98]	0.528*** [6.16]
Observations	42	63	111	81	99
Number of countries	14	21	37	27	33
R-squared	0.84	0.75	0.51	0.57	0.55

Notes: Absolute value of t statistics in brackets. \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. All variables are in logarithms.

Table 3. Non-linearities in the Effects of Quality Upgrading –  
Dependent Variable: Ratio of End-of-Period Share to Beginning-of-Period Share

Sample	(1) Developing Countries	(2) Developing Countries	(3) Developing Countries
Initial share	-0.834*** [6.79]	-0.857*** [6.61]	-0.846*** [6.43]
Initial UVR	0.790*** [4.33]	0.579*** [3.73]	0.633*** [3.52]
UVR change	0.255*** [2.97]	0.292*** [3.40]	0.329*** [3.11]
REER change	-0.545*** [2.69]	-0.597*** [2.92]	-0.593*** [2.88]
Initial UVR, squared	-0.168* [1.82]		
Initial share*Initial UVR		-0.058 [0.48]	-0.126 [0.76]
Initial share*UVR change			-0.069 [0.60]
Constant	0.517*** [6.31]	0.527*** [6.16]	0.524*** [6.06]
Observations	111	111	111
Number of countries	37	37	37
R-squared	0.53	0.51	0.51

Notes: Absolute value of t statistics in brackets. \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. All variables are in logarithms.

16. **Finally, two other considerations deserve attention.** First, does the quality improvement reflect technical change? In other words, within the fixed basket of goods we consider, does a higher *UVR* primarily reflect the fact that the composition of this fixed basket is moving to higher-tech products with higher unit values? Second, could the apparent influence of *UVRs* be a proxy for the possibility that countries are able to sell products at higher prices to importing countries growing rapidly and, hence, that the gain arises from astute selection of destination rather than from the effort to raise product quality? These questions are addressed in Table 4. Two findings are worth highlighting. First, taken by itself, a move toward higher technology is associated with an increase in market shares. However, in the “horse race” between *UVRs* and technology shares, *UVRs* win.

The implication is that there is some collinearity between improving product quality and technological upgrading, that is, countries experiencing one process also go through the other. However, within the fixed basket of goods, better quality of the individual products is more important than shifts to higher-technology products.<sup>8</sup> Second, the growth of partner country GDP per capita is important: countries exporting to rapidly growing partners experience more rapid expansion of international market shares.<sup>9</sup> However, this finding does not negate the importance of quality improvements.

#### **D. Identifying Quality Effects Across Product Categories**

17. **Presumably, quality matters more for some products than for others.** In his important contribution, Rauch (1999) has identified the degree to which product varieties are differentiated within a product group. He concludes, using supporting evidence, that the degree of differentiation influences the information necessary to trade these products. The more differentiated the product, Rauch finds, the greater the role of informal (ethnic) information networks in successfully conducting international trade in that product. In this section, we examine whether the degree of product differentiation is also consistent with quality variations that allow greater scope for pricing differentials.

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<sup>8</sup> It may still be the case—and this analysis does not examine the proposition—that a more ambitious change in production structure (elimination of low-tech products and graduation to new high-tech products) is necessary for increasing world market shares.

<sup>9</sup> To calculate the growth rate of trading partners’ GDP per capita, we use the GDP per capita (in purchasing power parity terms) of a given country’s trading partners in each year. We first take the average of these using the share of each trading partner in that country’s exports as weights, and then calculate the annualized growth rate of this trade-weighted average. The alternative is to first calculate the growth rate for each trading partner and then take the trade-weighted average of the growth rates. The values obtained through these two methods are highly correlated, and the regression results are virtually the same.

Table 4. Does Quality Upgrading Reflect Technology Upgrading? –  
 Dependent Variable: Ratio of End-of-Period Share to Beginning-of-Period Share

Sample: Developing Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	High and Medium Tech Upgrading			High Tech Upgrading		Impact of Trading Partners' Income	
Initial share	-0.877*** [6.98]	-0.821*** [6.11]	-0.843*** [6.59]	-0.879*** [7.16]	-0.841*** [6.93]	-0.864*** [6.81]	-1.131*** [8.72]
Initial UVR	0.442*** [3.63]			0.383** [2.15]			0.523*** [5.27]
UVR change	0.293*** [3.37]			0.221** [2.12]			0.399*** [5.07]
REER change	-0.584*** [2.89]	-0.611*** [2.78]	-0.601*** [2.76]	-0.566*** [2.77]	-0.595*** [2.86]	-0.551** [2.52]	-0.485*** [2.74]
Initial high and medium tech share	0.188 [1.51]	0.328** [2.59]	0.282*** [3.01]				
High and medium tech share change	-0.011 [0.12]	0.054 [0.54]					
Initial high tech share				0.099 [1.46]	0.209*** [4.58]	0.109*** [3.58]	
High tech share change				0.051 [1.08]	0.112*** [2.84]		
Trading partners' GDP per capita growth							0.148*** [4.36]
Constant	0.870*** [4.09]	1.178*** [5.60]	1.124*** [6.10]	0.929*** [3.32]	1.400*** [7.72]	1.088*** [7.18]	-0.002 [0.01]
Observations	111	111	111	109	109	109	108
Number of countries	37	37	37	37	37	37	36
R-squared	0.54	0.44	0.43	0.55	0.52	0.46	0.65

Notes: Absolute value of t statistics in brackets. \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. All variables are in logarithms.

18. **Following Rauch (1999), we classify goods into three categories, reflecting the differences in their price-setting mechanisms:**<sup>10</sup>

- Differentiated products do not have well-defined product standards and are not traded on specialized exchanges. They carry the largest potential for quality variation.
- Reference-priced products are goods that have referable standards with reference prices that are available in specialized publications; however, they are not traded on organized exchanges. Quality variation is possible but less so than for differentiated goods.
- Homogenous products are goods that have clearly defined standards and/or are internationally traded on organized exchanges. Hence, they have well-defined prices and the smallest potential variation in quality.

Table 5 reports the standard deviations of the *UVRs* for the three categories. As expected, differentiated products have the highest standard deviations, followed by reference goods, and then by homogenous goods (which are clustered quite tightly around a single international price). Notice, however, that there is some tendency for homogenous products to become more differentiated over time, as the information intensity in trade increases and technological advances help expand the spectrum of product varieties. Figure 8 shows the *UVRs* for all three categories in the CEE-8. The changes in the aggregate country *UVRs* are driven by the changes in the *UVRs* of differentiated products, for which quality differentiation is intuitively expected to be the strongest.

Table 5. Scope of Quality Variation Across Product Groups 1/

Year	Differentiated Goods	Reference-Priced Goods	Homogeneous goods
1994	0.31	0.31	0.11
1998	0.78	0.44	0.22
2001	0.56	0.43	0.33
Total	0.67	0.41	0.24

1/ The table summarizes the standard deviation of *UVRs*.

19. **The analysis in Section C is repeated for these three categories of products** (Table 6). Some findings stand out. First, for the differentiated and reference-priced products, their initial *UVR* and the *UVR* change work strongly, but these variables have little influence on the market shares of commodities. This is as we would expect, though the fact

<sup>10</sup> Appendix Table 3 provides examples of products in each category.

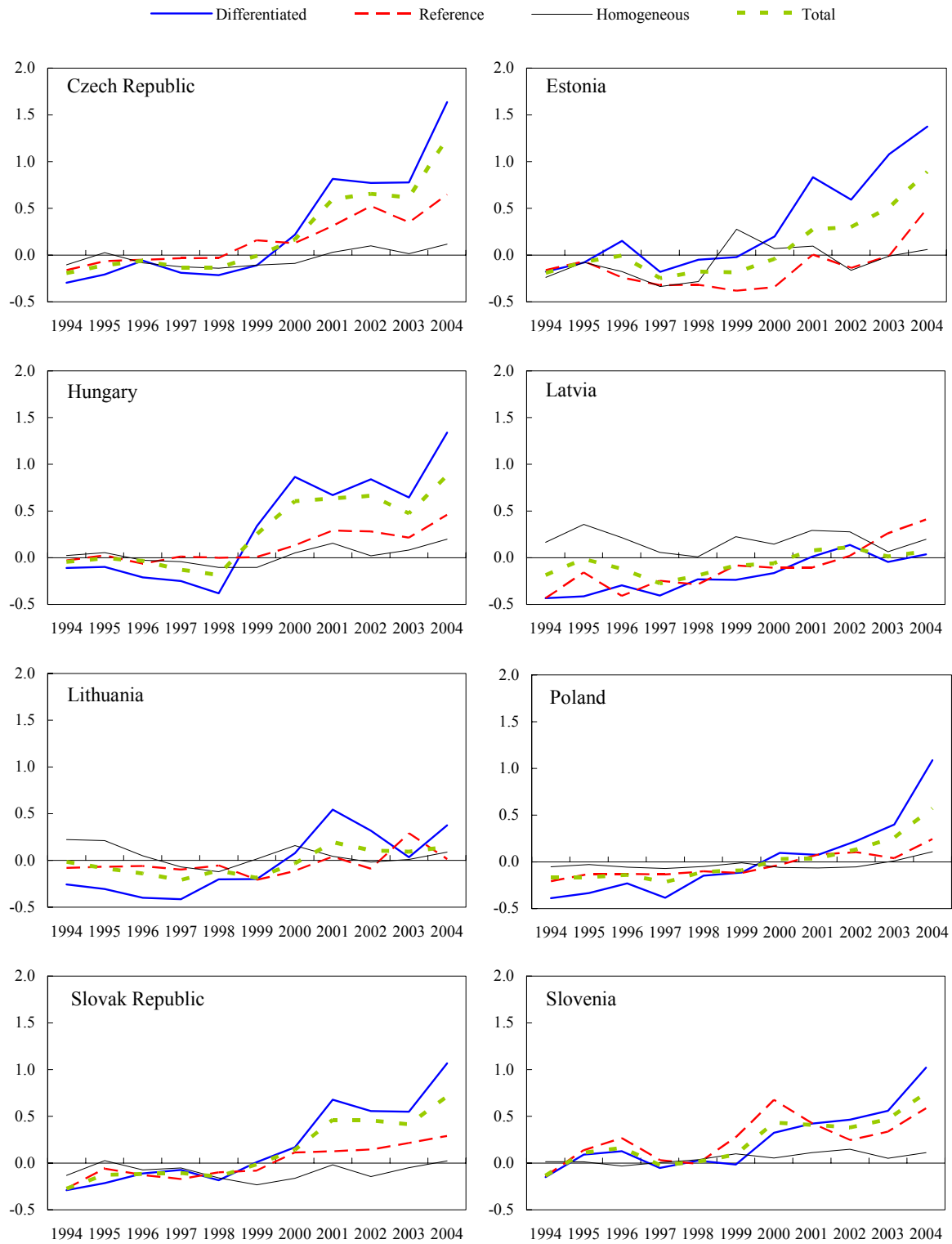
that quality levels and changes work at least as strongly for reference-priced goods as for differentiated goods is something of a surprise (Hallak, 2006, obtained a similar result). Second, differentiated goods, however, appear to play a special role, through spillover benefits for reference-priced goods. One interpretation is that the quality of a country's differentiated goods serves as a signal of a country's general ability to develop quality products; as such, a high *UVR* for these goods benefits other exports. In contrast, if the *UVR* of reference-priced goods is higher, the exporting country makes less headway in differentiated goods—as if resources were diverted to the reference-priced goods. Third, the appreciation of the real exchange rate has the expected negative effect. This effect is, surprisingly, most pronounced for differentiated goods, followed by homogenous and reference-priced goods, where for the latter two the statistical significance falls below the conventional levels. Finally, growth of partner GDP helps expand market shares, as above, but mainly for reference-priced and homogenous goods.

### E. Conclusions

20. **The analysis in this paper helps explain some part of the process through which the CEE-8 gained world market shares over the period 1994–2004.** Essentially, they benefited from a catch-up process. Though their normalized export shares (export shares in world markets divided by share of GDP in world GDP) were not small even in 1994, there was scope for expansion, given that these are, with perhaps the exception of Poland, small, open economies. Trade liberalization created the opportunities for expanded trade, and the economic reforms instigated privatization, restructuring, and the expanded use of foreign capital and management skills. These developments allowed a process of quality and technology upgrading. The results of this paper show that such upgrading is consistent with gains in international market share. The results also indicate that, while quality and technology tend to improve together, the primary factor in gaining market share may well be quality improvements. This interpretation is also consistent with the finding that quality improvements in differentiated products help not only the exports of differentiated products but also “spill over” to benefit reference-priced goods. In other words, quality improvements appear related to building country reputation (as suggested by Shapiro, 1983). Reputation building, in turn, is valuable when a country is still not well established in international markets and information about its export quality and delivery capabilities has still to be established. That the catch-up process is associated with such information signaling is also consistent with Rauch's analysis. Finally, though it appears in a simple bivariate comparison that the real effective exchange rate appreciation did not hurt the CEE-8, the multivariate analysis suggests that, if exchange rates had not appreciated, performance could have been even better.

21. **Looking ahead, the task becomes challenging for several reasons.** First, the increased market share makes further gains more difficult. Second, there is some evidence of decreasing returns to improved quality. Thus, with reduced prospects of catching up, and

Figure 8. CEE-8: UVRs According to Potential Quality Differentiation, 1994-2004 1/



Source: UN Comtrade database; and IMF staff calculations.

1/ UVR is the unit value of a country's exports divided by the unit value of world exports. Expressed in logarithm so that a value of zero means country unit value equals world unit value.

Table 6. Product Groups According to Price-Setting Mechanism –  
 Dependent Variable: Ratio of End-of-Period Share to Beginning-of-Period Share (Calculated Specifically for Each Product Group)

Sample: Developing Countries	(1)	(2)	(3)	(4)	(5)	(6)
	Differentiated Goods		Reference-Priced Goods		Homogeneous Goods	
Initial share	-1.147*** [11.28]	-1.102*** [10.71]	-1.131*** [5.63]	-1.171*** [6.09]	-0.804*** [5.85]	-0.762*** [5.61]
Initial UVR of differentiated goods	0.541*** [6.44]	0.589*** [6.80]		0.247*** [2.76]		0.137 [0.99]
Initial UVR of reference-priced goods		-0.217* [1.84]	0.717*** [3.04]	0.523*** [2.22]		0.308 [1.55]
Initial UVR of homogeneous goods					0.173 [0.34]	0.069 [0.14]
UVR change	0.342*** [4.93]	0.347*** [5.09]	0.483** [2.48]	0.409*** [2.18]	-0.174 [0.60]	-0.182 [0.64]
REER change	-0.570*** [2.93]	-0.572*** [2.99]	-0.203 [0.89]	-0.182 [0.84]	-0.51 [1.50]	-0.463 [1.38]
Trading partners' GDP per capita growth	0.047 [1.15]	0.04 [0.99]	0.262*** [6.85]	0.194*** [4.41]	0.238*** [4.37]	0.195*** [3.11]
Constant	-0.024 [0.12]	0.009 [0.05]	-0.404** [2.03]	-0.118 [0.54]	-0.137 [0.50]	-0.05 [0.17]
Observations	108	108	108	108	108	108
Number of countries	36	36	36	36	36	36
R-squared	0.72	0.74	0.54	0.59	0.50	0.54

Notes: Absolute value of t statistics in brackets. \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent.  
 All variables are in logarithms.



continued (and possibly heightened) technological competition, the pressure to maintain market shares will increase. Continued policy efforts to raise productivity will therefore be needed.

22. **To the Fund's evolving analysis of competitiveness, this paper adds some new dimensions.** There may be merit in examining not only export shares in the global economy but also the normalized shares to assess how export performance is responding to changes in domestic production capabilities. Second, the role of product quality and technology upgrading could be important in some circumstances, but its importance will need to be assessed in context. In any event, this study demonstrates that a careful harnessing of disaggregated data can provide useful insights into the structural change of a country's export composition. Finally, analyzing exports along the dimensions in which they are differentiated can also have an important bearing on competitiveness. The analysis of competitiveness, therefore, has not become easier!

## Appendix

The Appendix reports on the country sample, data sources, industry taxonomies, construction of the *UVR*, and selected products under the Rauch classification of traded goods.

### A. The Sample

We started with 119 countries, accounting for approximately 99 percent of world manufacturing trade in the period 1994-2004. We ranked these countries according to their market shares and examined data coverage, both for trade-related variables and the control variables mentioned above. We retained those countries that had the data necessary for this analysis. The final data set covers the period between 1994 and 2004 for 58 countries. In Appendix Table 1, we provide the original list of countries, with the names of those countries included in the final sample in bold and those classified as “developing countries” highlighted. These countries account for 93.5 percent of global trade in manufactured products. For the purpose of this paper, we compute each country’s export share as a fraction of the global trade in manufacturing products (Appendix Table 2).

### B. Data Sources

The trade data come from the UN Comtrade database and consist of the trade values and quantities of export flows. The export data are at the six-digit product level, according to the Harmonized System (HS) classification, the most disaggregated level available from Comtrade.<sup>11</sup> For each product, an observation consists of the country of origin, time, trade value in dollars, quantity, and units in which the quantity is expressed.

The real effective exchange rate, based on the consumer price index (CPI), is taken from the IMF’s *International Financial Statistics* (IFS).

The income level of trading partners is calculated using the GDP per capita from *International Financial Statistics* and the trade weights from *World Economic Outlook* database. To check robustness, both nominal and purchasing power parity (PPP) based measures are used. The results reported here use trading partners’ income level in PPP terms, but the results using the alternative measure based on nominal GDP per capita are virtually the same.

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<sup>11</sup> For the European Union, 8-digit trade data are available from the Eurostat database COMEXT, and, for the United States, 10-digit data are available from the U.S. Census Bureau. The COMTRADE database accounts for a country’s exports to the world market.

Appendix Table 1. List of Countries 1/2/

Albania	Cyprus	<b>Indonesia</b>	Myanmar	<b>South Africa</b>
Algeria	<b>Czech Republic</b>	Iran	Namibia	<b>Spain</b>
Angola	Côte d'Ivoire	<b>Ireland</b>	<b>Netherlands</b>	<b>Sri Lanka</b>
<b>Argentina</b>	<b>Denmark</b>	<b>Israel</b>	<b>New Zealand</b>	Sudan
Armenia	Dominican Rep.	<b>Italy</b>	Nicaragua	<b>Sweden</b>
<b>Australia</b>	Ecuador	Jamaica	Niger	<b>Switzerland</b>
<b>Austria</b>	Egypt	<b>Japan</b>	Nigeria	Syria
Azerbaijan	El Salvador	Jordan	<b>Norway</b>	<b>Taiwan POC</b>
Bangladesh	<b>Estonia</b>	Kazakhstan	Oman	Tanzania
Belarus	Ethiopia	Kenya	Pakistan	<b>Thailand</b>
Belgium	<b>Finland</b>	<b>Korea, Rep. of</b>	Panama	Togo
Bolivia	<b>France</b>	Kuwait	Papua New Guinea	Trinidad and Tobago
Bosnia and Herzegovina	Gabon	<b>Latvia</b>	Paraguay	Tunisia
Botswana	Gambia, The	Lebanon	Peru	<b>Turkey</b>
<b>Brazil</b>	<b>Germany</b>	Libya	<b>Philippines</b>	Uganda
<b>Bulgaria</b>	Ghana	<b>Lithuania</b>	<b>Poland</b>	<b>Ukraine</b>
Burkina Faso	<b>Greece</b>	<b>Macedonia</b>	<b>Portugal</b>	UAE
Cameroon	Guatemala	Madagascar	<b>Romania</b>	<b>United Kingdom</b>
<b>Canada</b>	Guinea	Malawi	<b>Russia</b>	<b>United States</b>
<b>Chile</b>	Guinea-Bissau	<b>Malaysia</b>	Saudi Arabia	<b>Uruguay</b>
<b>China</b>	Haiti	Mali	Senegal	<b>Venezuela</b>
<b>Colombia</b>	Honduras	<b>Mexico</b>	<b>Serbia and Montenegro</b>	<b>Vietnam</b>
Congo	<b>Hong Kong SAR</b>	Moldova	Sierra Leone	Yemen
Congo, Dem. Rep.	<b>Hungary</b>	Mongolia	<b>Singapore</b>	Zambia
Costa Rica	<b>Iceland</b>	Morocco	<b>Slovak Republic</b>	Zimbabwe
<b>Croatia</b>	<b>India</b>	Mozambique	<b>Slovenia</b>	

1/ Countries included in the final sample that produced the reported results in the paper are in bold.

2/ Countries that are classified as "developing countries" are highlighted.

Appendix Table 2. Country Exports as a Share of World Exports 1/

	1994	1997	2001	2004	1994	1997	2001	2004
Argentina	0.42	0.48	0.46	0.49	Macedonia	1.48	1.11	0.77
Australia	0.91	0.85	0.79	0.69	Malaysia	1.91	1.96	1.93
Austria	3.10	2.62	2.71	3.20	Mexico	0.32	0.51	0.47
Brazil	0.39	0.37	0.36	0.43	Netherlands	3.49	3.75	3.98
Bulgaria	0.68	1.08	1.09	1.23	New Zealand	1.85	1.74	1.39
Canada	1.29	1.56	1.43	1.10	Norway	1.81	1.58	1.52
Chile	1.36	1.22	1.14	1.34	Philippines	0.51	0.55	0.64
China	0.42	0.39	0.45	0.55	Poland	0.75	0.77	1.02
Colombia	0.21	0.21	0.29	0.27	Portugal	1.76	1.67	1.69
Croatia	1.49	0.88	0.88	1.16	Romania	0.53	0.66	1.26
Czech Republic	1.49	1.79	2.63	3.04	Russia	0.36	0.45	0.51
Denmark	3.51	2.98	2.92	3.17	Serbia and Montenegro	0.09	0.62	0.58
Estonia	1.20	2.16	3.08	2.45	Singapore	4.66	4.96	4.24
Finland	2.75	2.84	2.86	2.80	Slovak Republic	1.66	1.76	2.22
France	1.99	1.89	1.91	2.01	Slovenia	3.78	3.47	3.51
Germany	2.44	2.48	2.57	2.99	South Africa	0.53	0.62	0.69
Greece	0.58	0.55	0.50	0.51	Spain	1.34	1.38	1.37
Hong Kong SAR	3.55	2.89	2.35	1.99	Sri Lanka	0.87	0.82	0.84
Hungary	1.22	1.83	2.44	2.81	Sweden	3.84	4.17	3.52
Iceland	3.91	3.19	3.25	2.73	Switzerland	5.30	4.85	4.37
India	0.19	0.19	0.18	0.19	Taiwan POC	2.30	1.90	1.91
Indonesia	0.40	0.40	0.54	0.46	Thailand	1.09	1.06	1.30
Ireland	4.75	4.16	5.00	6.30	Turkey	0.62	0.58	0.84
Israel	1.69	1.69	2.04	1.92	Ukraine	0.23	0.57	0.64
Italy	1.75	1.68	1.61	1.77	United Kingdom	1.44	1.53	1.42
Japan	0.86	0.90	0.92	0.99	Uruguay	1.43	1.10	0.88
Korea	1.23	1.29	1.34	1.52	USA	0.55	0.64	0.63
Latvia	0.61	1.34	1.15	0.97	Venezuela	0.49	0.49	0.40
Lithuania	0.50	0.98	1.17	1.28	Vietnam	0.41	0.61	0.76

Sources: UN Comtrade database; and staff calculations.

1/ Shares are computed using the common basket of products for the country and the benchmark (world). Trade values are summed up across products within a country and then divided by the sum of trade values of the same products exported by all countries.

### C. Construction of Variables

We construct measures of technology and quality change at the country level using the detailed trade data at the product level. As in similar studies, the sample of products is limited to those of the manufacturing sectors. We use the Classification of Economic Activities in the European Community (NACE). Manufactures of coke products, refined petroleum products, and nuclear fuel are excluded from the analysis.

The technology content of products is based on the taxonomy provided by Hatzichronoglou (1997). Products are classified into four groups: high technology, medium-high technology, medium-low technology, and low technology.<sup>12</sup> This classification is based on a cutoff procedure using R&D intensities in select OECD economies in two-digit International Standard Industrial Classification (ISIC) product categories.

The measure of product quality is the relative unit value of a country's exports with respect to the unit value of all exports to a given market. Referred to as the "unit value ratio (*UVR*)" and commonly used in the trade literature, this concept of measuring quality by relative unit value has its basis in the idea that consumers would be willing to pay more for the same product if they perceive it to be of better quality.

We first calculate the unit value of each product that a specific country exports by dividing the trade value by the quantity. Then, we calculate the world unit value for the same basket of goods. We then divide the country's unit value for each product in the basket by the world unit value for the corresponding products. Finally, we aggregate these product unit value ratios into a single unit value ratio, using the weights of each product in the overall exports of the country. The reported *UVR* takes the logarithm of this ratio. Hence, a negative *UVR* corresponds to a quality lower than world standard.

Four remarks on *UVR* follow. First, products that fail to appear consistently in a country's export basket are excluded from the *UVR* calculations. Thus, the *UVR* measures the changes in the relative quality of the products that the country has been exporting on a continuous basis. Second, the basket of goods on which *UVR* calculations are based on is the intersection of the set of goods a country exports and the set of goods comprising the world exports. To calculate the *UVR*, the quantities should be expressed in the same units across the sample of countries. Third, the weights used in aggregating the country's product unit values change as the export composition changes. Hence, the aggregated unit value reflects not only the quality but also the composition of exports. Finally, market shares are calculated using the same basket of goods as for the *UVR*.

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<sup>12</sup> The mapping between the Hatzichronoglou (1997) taxonomy and the HS is based on conversion tables from the UN Statistics Division, and in our judgment for a small number of products left out of the conversion tables.

Appendix Table 3. Partial List of Products in Rauch Classification

Differentiated	Reference-Priced	Homogeneous
Soya sauce	Soya bean flour and meal	Coffee, not roasted or decaffeinated
Vitamins and their derivatives	Tar distilled from coal or lignite	Barley
Beauty, make-up, skin-care	Propane, liquefied	Rice in the husk (paddy or rough)
Artificial waxes	Mercury	Soya beans
Chemical preparations for photography	Sulphates of copper	Crude soya-bean oil
Activated carbon	Methanol (methyl alcohol)	Raw cane sugar, in solid form
Prepared rubber accelerators	Ionones and methylionones	Raw beet sugar, in solid form
Articles of apparel and clothing accessories	Vaccines for human medicine	Cocoa beans, whole or broken, raw
Vulcanized rubber thread and cord	Medicaments of alkaloids or derivatives	Tobacco, not stemmed/stripped
Hygienic or pharmaceutical articles	Fertilizers	Ores and concentrates
Articles of apparel of leather	Cellulose and its chemical derivatives	Lignite, not agglomerated
Wooden frames for paintings and photographs	Plates of polymers of ethylene	Petroleum oils and oils
Parquet panels of wood	Gummed or adhesive paper	Carbon
Textile wall coverings	Woven fabrics of cotton	Aluminium oxide, other than artificial
Articles of gold or silversmith	Woven fabrics of synthetic fibres	Natural rubber latex, in primary form
Flanges, stainless steel	Asphalt or similar material article	Latex of synthetic rubber
Chain, roller, iron or steel	Ferro-alloys	Cotton, not carded or combed
Table knives having fixed blades	Flat-rolled products of stainless steel	Wood in the rough form
Carbon or graphite electrodes	Rails, iron or steel	Diamonds unsorted whether or not worked
Electrical insulators	Pipes and tubes, copper-zinc base	Silver in unwrought forms
Rail locomotives	Chain and parts thereof of copper	Gold in unwrought forms, non-monetary
Automobiles	Plates, sheet, strip and foil, nickel	Platinum, unwrought or in powder form
Aircraft under-carriages and parts	Foil, aluminium	Iron, unrefined
Optical devices, appliances and instruments	Tin bars, rods, profiles and wire	Copper-zinc base alloys, unwrought
Clocks and watches	Molybdenum and articles thereof	Nickel, unwrought, not alloyed
Playing cards	Magnesium and articles thereof	Powders, molybdenum
Ball point pens	Nickel-iron electric accumulators	Magnesium

Appendix Table 4. Taxonomies 1/

Taxonomy	Source	Method	Example
Factor intensity	Peneder (2001)	Statistical cluster analysis, using data on labor and capital use, share of R&D and advertising in total turnover at the NACE 3-digit level	Mainstream: Articles of paper and paperboard Labor-intensive: Wooden containers Capital-intensive: Pulp, paper, and paperboard Marketing-driven: Publishing Technology-driven: Office machinery and computers
Skill intensity	Peneder (2001)	Statistical cluster analysis, using data on employment shares of high, medium and low-skilled labor for selected OECD countries at the ISIC 2-digit level	Low-skill: Basic metal processing Medium-skill/blue-collar: Steam generators Medium-skill/white-collar: Electric motors, generators and transformers High-skill: Machinery for production
Technological intensity	Hatzichronoglou (1997)	Cut-off procedure, using data on R&D intensities for OECD countries at the ISIC 2-digit level	High-tech: Pharmaceuticals Medium-high-tech: Other chemicals Medium-low-tech: Rubber and plastic products Low-tech: Food, beverages, and tobacco
Hi-tech product list (HTP)	Hatzichronoglou (1997)	Cut-off procedure modified with subjective expert opinion, using data on R&D intensities for selected OECD members at the SITC 5-digit level	Includes storage units of digital automatic data processing machines, but excludes other parts of digital automatic data processing machines
Information and Communication Technology (ICT)	OECD	Statistical identification of industries whose products are intended to fulfill the function of information processing and communication including transmission and display, or use electronic processing to detect, measure and/or record	Includes manufacture of insulated wire and cable, but excludes electricity distribution and control apparatus Includes manufacture of industrial process control equipment, but excludes manufacture of medical appliances

1/ These taxonomies are based on product classification systems different from HS. Mapping of classifications is done using the conversion tables from UN Statistics Department.

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## II. CREDIT GROWTH AND BANK SOUNDNESS IN THE NEW MEMBER STATES<sup>13</sup>

### A. Introduction and Summary

23. **In tandem with economic convergence and financial deepening, credit to the private sector in the New Member States (NMS) has expanded at a fast clip during the last decade.**<sup>14</sup> A confluence of factors has contributed to credit expansion—low levels of financial development in the NMS and pent-up demand pressures following decades of socialist economic management; good macroeconomic discipline and accession to the European Union (EU), which helped lower the country risk premium; and improved access to foreign capital following the entry of foreign banks and the opening of capital accounts. All in all, rapid credit growth has played an important role by helping channel domestic and foreign savings to households and investors and supporting financial sector development and economic growth in the NMS.

24. **Yet, the brisk pace of credit growth has also raised concerns about macroeconomic and prudential risks.** Quantifying these risks is a challenge, since the NMS have not gone through a full credit cycle yet, and financial soundness indicators tend to improve in the upward phase of the credit cycle. Experiences in industrial and emerging market countries suggest that credit booms can be associated with unsustainable domestic demand booms, overheating, and asset price bubbles. Financial sector difficulties also cannot be ruled out, for example, loan losses in a deep recession or following a large exchange rate depreciation. How significant these risks are in the NMS and what role public policy should play in containing them are key questions facing policymakers in the NMS.

25. **The academic and policy literature provides some general answers.** Many macro-level studies have found that bank intermediation in the NMS is still below the equilibrium levels consistent with the levels of economic development of these countries and the structural characteristics of their banking sectors. Adjustment toward equilibrium is expected to continue in the coming years, but, if it occurs at an excessively rapid pace, it can lead to macroeconomic and financial instability (Schadler and others, 2004; Coricelli and Masten,

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<sup>13</sup> Prepared by Natalia Tamirisa and Deniz Igan (both EUR). The project was led by Juan Jose Fernández-Ansola (EUR). Ashoka Mody (EUR) and Poonam Gupta (Delhi School of Economics) contributed in the initial stages of the project. Cooperation of the central banks of the Czech Republic, Estonia, Lithuania, Poland, the Slovak Republic, and Slovenia in providing breakdowns of bank loan data is gratefully acknowledged. The authors also thank Jochen Andritzky, Martin Čihák, Wim Fonteyne, Gavin Gray, Paul Hilbers, Andy Jobst, Ashoka Mody, Ceyla Pazarbasioglu, Vassili Prokopenko, Christoph Rosenberg, Franek Rozwadowski, Piritta Sorsa, Rachel van Elkan, Jan Willem van der Vossen, and Kal Wajid for helpful comments and Ugo Panizza (Inter-American Development Bank) for sharing data. The paper benefited from an internal note on credit growth in the Czech Republic prepared by Natalia Tamirisa and Martin Čihák (MFD).

<sup>14</sup> The eight Central and Eastern European countries that joined the European Union in May 2004: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia.

2004; Cottarelli, Dell’Ariccia, and Vladkova-Hollar, 2005; and Égert, Backé, and Zumer, 2006).<sup>15</sup> So far rapid credit growth in the NMS has not resulted in a deterioration in financial soundness indicators, but prudential risks appear to be rising in some countries (Hilbers and others, 2005; and Iossifov and Khamis, 2006). Supervisors and regulators need to remain vigilant and possibly consider using macroeconomic and prudential policies to contain the risks. A recent microeconomic study by Maechler, Mitra, and Worrell (2006) found that, although loan growth generally had been associated with an improvement in the soundness of NMS banks, when it became excessive, loan growth could weaken bank soundness.<sup>16</sup> Other bank-level econometric studies have focused on the role of foreign-owned banks in credit expansion in the NMS. These studies generally have not found any significant differences in the rate of credit growth through foreign- and domestically owned banks, but confirmed that foreign-owned banks have a competitive advantage owing to their higher efficiency and liquidity (Micco, Panizza, and Yañez, 2004; de Haas and van Lelyveld, 2005; and Aydin, 2006).

**26. This paper examines the prudential risks associated with rapid credit growth taking into account the role of bank soundness as a determinant of credit growth in the NMS.** The econometric analysis is based on a simultaneous equation framework, where credit growth and bank soundness are modeled as depending on each other and various macroeconomic and bank-specific factors. By recognizing the two-way causality between credit growth and bank soundness, the study brings together the different strands of the literature discussed above: macro-level studies examining the drivers of credit growth and micro-level analyses focusing on the impact of credit growth on bank soundness. The study also draws on recent literature emphasizing the role of bank soundness as a factor driving credit growth (Dell’Ariccia, Detragiache, and Rajan, 2005; and Neir and Zicchino, 2006): weaknesses in bank balance sheets can reduce the supply of loans to the private sector and private investment both in a financial crisis and in normal times.

**27. The study tests two hypotheses about the prudential risks associated with rapid credit growth.** The first is that rapid credit growth in the NMS has not weakened banks, in line with the existing analyses of financial soundness indicators and published stress-testing results. The second is that credit has been growing more rapidly in sounder banks, as one would expect, given that many rapidly expanding NMS banks are owned by banks from advanced countries. These hypotheses can help understand how significant the prudential risks associated with rapid credit growth are and how best to address them.

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<sup>15</sup> The topic of rapid credit growth in the NMS has also been discussed in the financial stability reports of EU central banks and private sector reports (for example, Fitch Ratings, 2005).

<sup>16</sup> Their study defined excessive credit growth using the quadratic effect. The sample included Cyprus and Malta, in addition to the eight NMS covered in this study.

28. **The analysis uses a detailed bank-level data set.** The core of the data set is the publicly available data on balance sheets of banks that operated in the NMS during 1994–2004. These data are complemented by confidential supervisory data on bank loans broken down by type and currency of indexation or denomination. The data set allows differences to be identified between subgroups of the NMS (the Baltics and the central and eastern European countries),<sup>17</sup> different types of banks (domestically and foreign-owned), and different types of loans (household and corporate, and denominated in or indexed to domestic and foreign currency).

29. **The main econometric finding is that credit growth in the NMS has had an insignificant negative impact on bank soundness so far but has recently become ubiquitous and unrelated to bank soundness.** In contrast to the late 1990s, rapid credit growth during 2001–04 was not limited to relatively sound and stable banks. With weaker banks expanding credit as rapidly as sounder banks and some of these banks being weak in the absolute sense as well, the prudential risks associated with rapid credit growth (that is, the likelihood that bank soundness might deteriorate in the future) appear to have increased. These risks might or might not materialize, depending largely on the quality of banks' current lending decisions and risk management practices. The finding that rapid credit growth has not significantly weakened banks yet is consistent with the conclusions based on a review of financial soundness indicators and market indicators (see, for example, Hilbers and others, 2005; and Iossifov and Khamis, 2006). This finding provides some comfort that banks will continue to manage the risks associated with rapid credit growth properly in the future. However, the past might not be a guide to the future: higher prudential risks simply might have not yet become apparent in financial soundness indicators, as loan portfolios take time to mature. The key econometric finding of the paper is robust using alternative measures of bank soundness and model specifications.

30. **The above finding points to several common prudential policy implications in the NMS:**

- Without strong statistical evidence that rapid credit growth has weakened bank soundness, the finding that weaker banks have started to expand credit growth just as rapidly as sounder banks suggests that supervision, rather than an across-the-board tightening of regulations, needs to be the “first line of defense” against the financial risks associated with rapid credit growth. Strong supervision is essential for ensuring sound lending and risk management practices at the individual bank level in an environment of rapid credit growth.

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<sup>17</sup> The Baltics comprise Estonia, Latvia, and Lithuania; and the Central and Eastern European countries (CEECs) comprise the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia.

- Prudent supervisors in the NMS need to pay particular attention to the practices of rapidly expanding weak institutions. A selective, risk-based prudential policy response should help contain the financial risks associated with rapid credit growth, while maximizing the benefits of rapid credit growth for economic and financial development. It would be also consistent with the risk-based approach to supervision that the NMS are moving to as they implement the new capital adequacy accord (Basel II).
- The econometric analysis shows that weaker banks with large and rapidly growing household or foreign currency loan exposures are expanding faster than other banks, although there is no statistically significant evidence that rapid growth in household or foreign currency loans has weakened banks. These results suggest that supervisors in all NMS need to give priority to assessing the practices of rapidly expanding and relatively weak banks with large household or foreign currency credit exposures.
- Another finding of the paper is that foreign-owned banks in the NMS are willing to take on more credit risks than domestically owned banks, although these higher risks seem commensurate with the strength of parent banks. This finding points to the importance of strong cross-border cooperation with foreign supervisors and foreign bank owners in the NMS. Besides regular information exchanges with foreign supervisors and the signing of memoranda of understanding with foreign bank owners, cooperation can include, for example, joint supervisory inspections and crisis management exercises.
- Assessing the prudential risks associated with rapid credit growth in the NMS is complicated, given the short lending history of the region, the tendency for financial soundness indicators to improve in the upward phase of the credit cycle, and the fact that recent loan decisions have not been tested by significant macroeconomic shocks. In this context, it is important to complement bank-level risk analysis and supervision with macroprudential risk assessments and financial sector surveillance drawing on both aggregate and disaggregated data. Regular information exchanges between supervisors and units responsible for financial stability analyses would help supervision be forward looking and proactive.
- Well-developed market institutions supporting sound credit growth would help banks assess and manage risks better. For example, easy access to high quality financial information would enable banks to adequately assess prospective borrowers' debt-servicing capacity. Deep and efficient securities markets would broaden opportunities for risk sharing.

31. **Lastly, the findings suggest a differentiated policy approach depending, all other things equal, on the magnitude of the identified financial risks:**

- The strongest prudential policy response seems to be warranted in the Baltics, where weaker banks are expanding more rapidly (Latvia and Lithuania) or credit growth seems to have weakened banks (Estonia). The finding that rapid credit growth in Latvia has improved bank soundness in recent years provides some comfort but does not guarantee that prudential risks will be contained in the future, especially given that recent credit growth seems to have been concentrated in weaker banks.
- A more moderate prudential response seems appropriate in the Czech Republic, Hungary, and Slovenia, where credit growth has recently become independent of bank soundness. It is also comforting that credit growth in Slovenia has so far strengthened banks, although the same caveat applies regarding the validity of this result for the future. In the Czech Republic and Hungary recent credit growth does not appear to have had any significant effect on bank soundness.
- In the remaining NMS (Poland and the Slovak Republic), sounder banks are expanding more rapidly and credit growth has not had a significant impact on bank soundness, which justifies the least intensive response.

A different intensity of prudential policy response can be achieved by tightening prudential policies to a different degree or using different types of prudential policy measures (see Hilbers and others, 2005, for a classification of such measures).

32. **The above country-specific policy implications of the cross-country analysis are only suggestive, with the formulation of the final policy recommendations deferred to individual Article IV consultations.** By examining pooled bank-level data for the NMS in an econometric model, the cross-country analysis complements detailed country-specific analyses typically undertaken during Article IV consultations with individual countries. Cross-country analysis allows country-specific trends to be examined in a broader regional context, helping ensure the consistency of policy advice across countries in the region, while detailed country-specific analyses provide a comprehensive assessment of experiences and circumstances in individual countries. The latter are beyond the scope of this paper, but are essential for formulating country-specific policy recommendations.

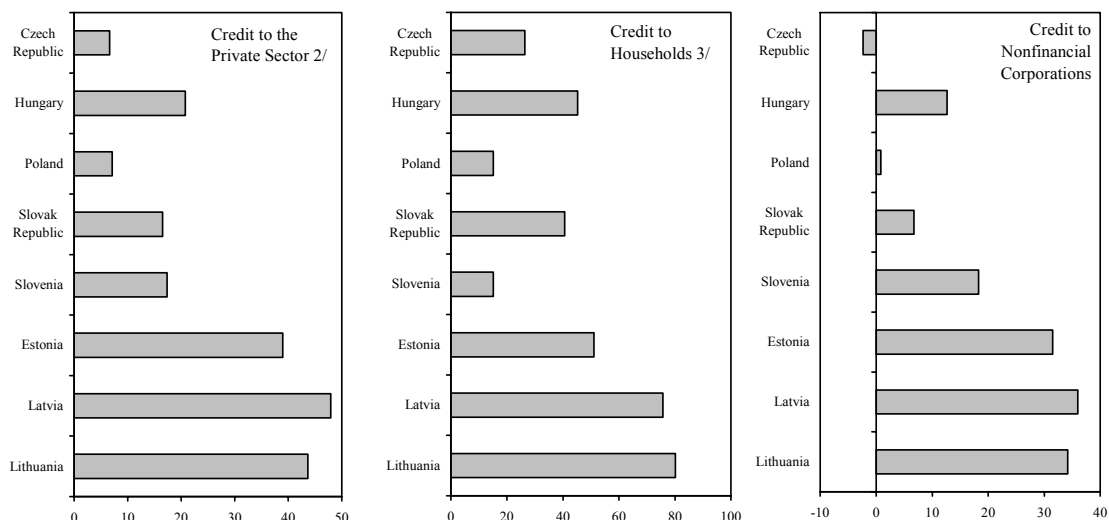
33. **The rest of the paper is organized as follows.** Section B describes trends in credit to the private sector in the NMS and identifies the key factors underlying rapid credit growth. The section also discusses prudential risks associated with credit growth based on the available financial soundness indicators and the published findings of stress-testing exercises. Section C describes the econometric approach used in this paper and the data set, and presents the results. Section D outlines policy implications. Section E concludes.

## B. Background

### Credit developments

34. **Credit to the private sector in most NMS has been growing at double-digit rates for several years now** (Figure 1). Credit in the Baltics expanded at a rate 3 times faster than in the CEECs during 2002–06 (44 percent versus 14 percent, respectively). In the latter subgroup, the Czech Republic and Poland stood out as the countries with the slowest rate of credit growth to the private sector.<sup>18</sup>

Figure 1. NMS: Growth of Credit to the Private Sector, 2002-06 1/  
(Average annual percent change)



Sources: National central banks; and IMF *International Financial Statistics*.

1/ Data as of July 2006 except for Latvia (June 2006) and Slovenia (March 2006). Data starting in 2004 for the Slovak Republic.

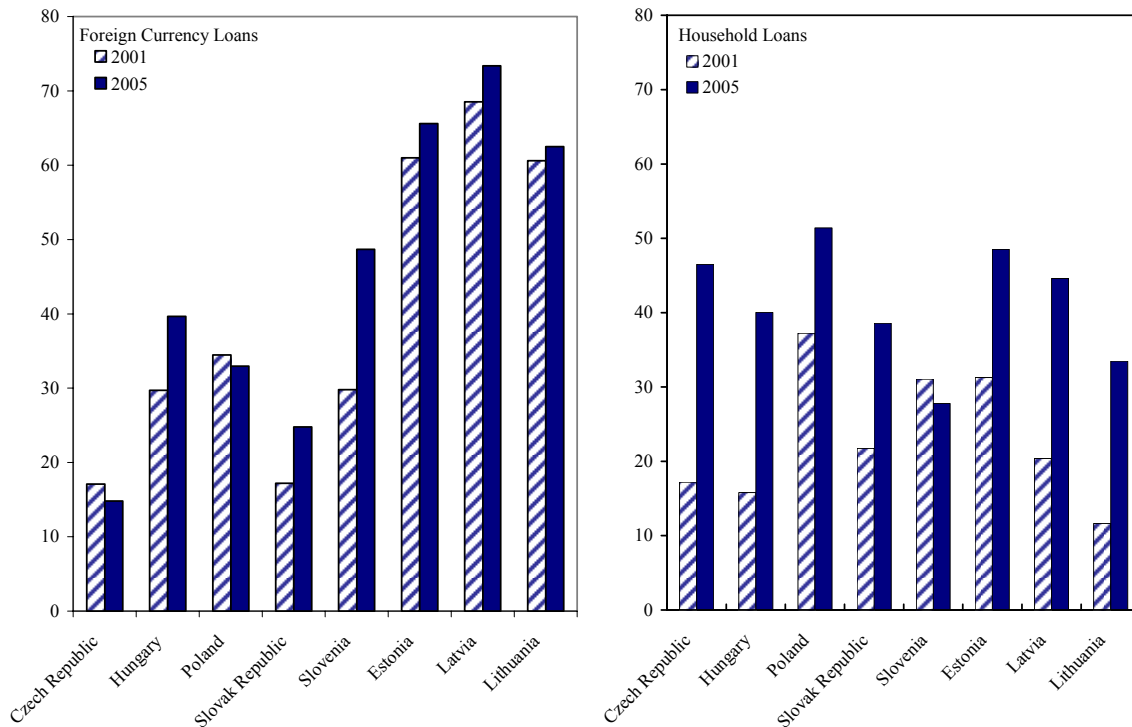
2/ Data in nominal terms.

3/ Includes credits to nonprofit institutions serving households (NPISH), except for Latvia, Lithuania, and Slovenia, where credit to NPISH is included under credit to nonfinancial corporations.

35. **In most NMS, household credit has been growing more strongly than corporate credit in recent years, and, by end-2005, household loans had rivaled corporate loans in importance in banks' portfolios** (Figure 2). The importance of foreign-currency-denominated or indexed lending has varied across the NMS. In the Baltics, the composition of total outstanding loans to the private sector has traditionally been heavily tilted toward foreign currency loans. In 2005, for example, foreign currency loans carried, on average, twice the weight in total outstanding loans in the Baltics (above 60 percent) that they did in the CEECs (around 30 percent). Among the CEECs, Hungary and Slovenia have experienced rapid growth in the share of foreign-currency-denominated loans in total loans to the private sector, while the Czech Republic has remained the least exposed, with a further decreasing share.

<sup>18</sup> See Tamirisa and Čihák (2006) for an analysis of the factors that contributed to slow credit growth in Poland.

Figure 2. NMS: Foreign Currency and Household Lending, 2001 and 2005  
(In percent of total outstanding loans to the private sector)

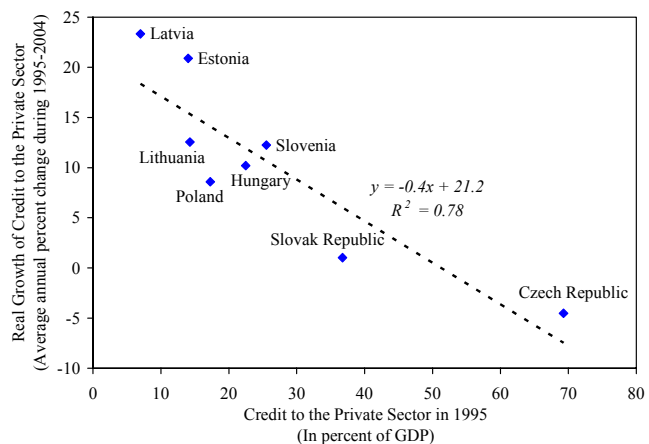


Sources: National central banks; and IMF staff estimates.

### Factors driving credit growth in the NMS

36. **Rapid credit growth in the NMS in part reflects the deepening of their financial systems.** Credit to the private sector is generally expected to grow faster than nominal GDP in emerging market and transition countries as their financial systems develop. The levels of bank intermediation in the NMS in the early years of transition indeed were significantly below what would have been expected, given their levels of economic development, and macro-level studies agree that an increase in credit-to-GDP ratios in the NMS is needed to bring these ratios to the levels consistent with the countries' incomes (Schadler and others, 2004; Cottarelli, Dell'Araccia, and Vladkova-Hollar, 2005; and Hilbers and others, 2005). Such an equilibrium adjustment manifests itself in credit growth being higher in those NMS with lower initial ratios of bank intermediation (Figure 3).

Figure 3. NMS: Financial Catching Up



Sources: IMF *International Financial Statistics*, and staff estimates.



37. **Macroeconomic conditions have been favorable for credit expansion.** Successful disinflation and improved economic prospects, both due to income convergence and the business cycle, have helped unleash pent-up demand for credit (Figure 4). Real lending rates have declined gradually during the last decade, in part reflecting a trend decline in policy rates. In some NMS, currency appreciation has been an important factor in stimulating demand for credit. Predictable exchange rates and expectations of long-term appreciation might have created incentives for borrowing in foreign currency and, against the backdrop of ample global liquidity in recent years, might have stimulated capital inflows funding credit expansion (Text Table 1). In some countries, incentives created by easy monetary and/or fiscal policies may have contributed to strong growth in bank credit.

Text Table 1. Exchange Rate Regimes in the NMS

	1995-2000		2001-2006		Progress in Euro Adoption	
	IMF Classification 1/	Volatility vis-à-vis Euro 2/	IMF Classification 1/	Volatility vis-à-vis Euro 2/	ERM II	EMU 3/
Czech Republic	Intermediate - until 1997	1.4	Float	1.0	Has not joined yet	No official target date (most probably in 2010)
Hungary	Intermediate	1.0	Intermediate	0.6	Has not joined yet	Target date set for January 1, 2010
Poland	Intermediate	1.9	Float	1.5	Has not joined yet	No official target date
Slovak Republic	Intermediate - until 1998	1.4	Float - until 2005	0.8	Joined on November 28, 2005	Target date set for January 1, 2009
Slovenia	Float	1.8	Float - until 2004	0.6	Joined on June 28, 2004	Plans to introduce euro on January 1, 2007
Estonia	Fixed	0.2	Fixed	0.0	Joined on June 28, 2004	Target date set for January 1, 2008
Latvia	Fixed	3.1	Fixed	1.5	Joined on May 2, 2005	Target date set for January 1, 2008
Lithuania	Fixed	4.1	Fixed	0.3	Joined on June 28, 2004	Target date set for January 1, 2007

Sources: IMF *Annual Report on Exchange Arrangements and Exchange Restrictions* and *International Financial Statistics*; European Central Bank; National central banks, and IMF staff estimates.

1/ "Fixed" includes currency boards, conventional pegs, and narrow bands. "Intermediate" includes tightly managed floats and broad bands. "Float" includes managed and independent floats.

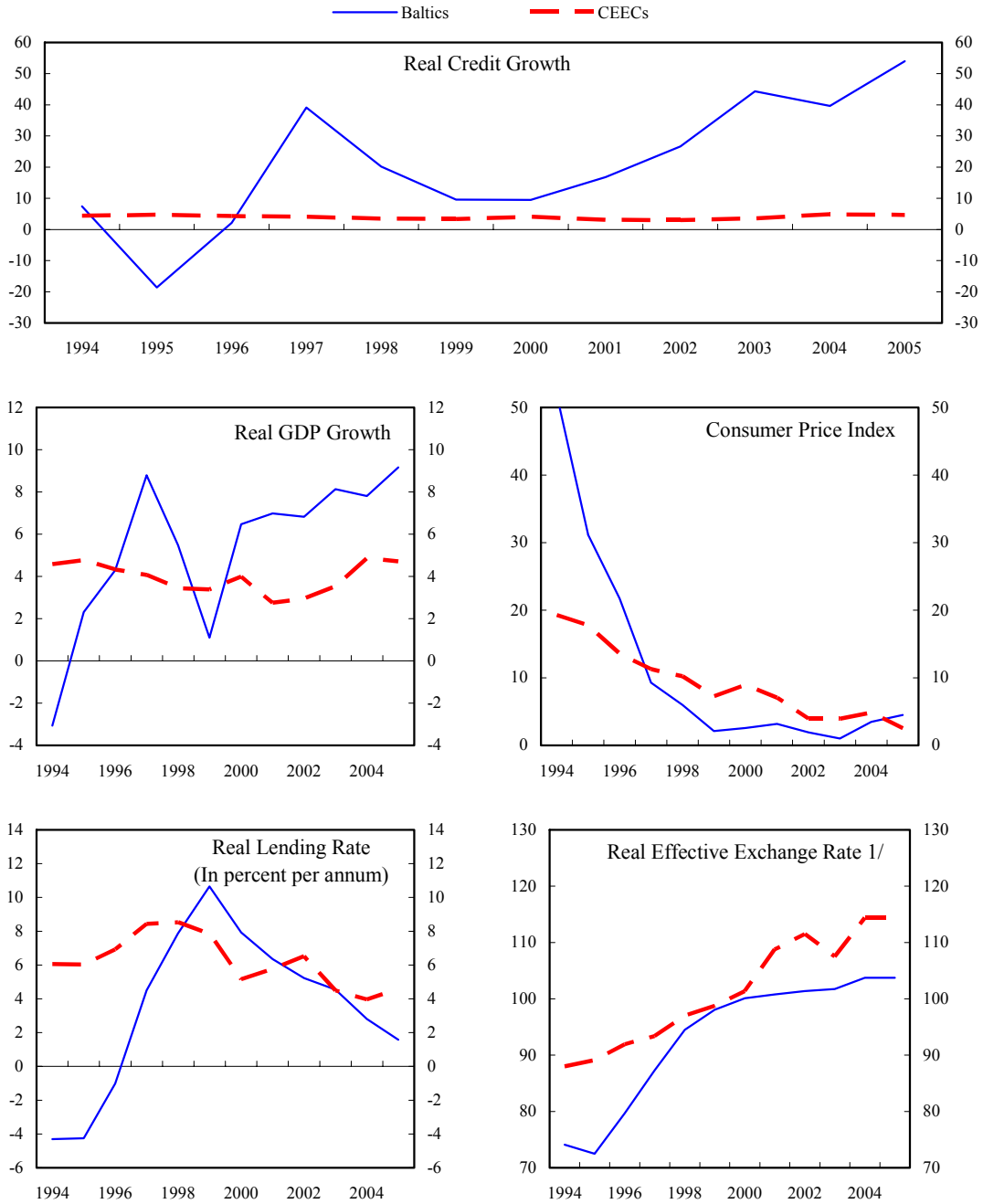
2/ Volatility is calculated as the annualized standard deviation of the nominal exchange rate using monthly data from January 1995 to July 2006 and is expressed in percent.

3/ Latest information available from European Commission and national authorities.

38. **Structural changes in the banking sectors of the NMS have created incentives for a rapid expansion of credit to the private sector.** Bank privatization in the late 1990s—early 2000s improved the incentive structure for banks, while the entry of foreign banks has brought additional expertise and know-how into the sector. Against the backdrop of favorable macroeconomic conditions, increased investor confidence in NMS, and EU accession, many foreign-owned banks have considered the NMS to be important future markets, where the strategic benefits of expanding market shares justify taking on additional credit risks. Higher profitability of lending in NMS markets, compared with other EU markets, is another factor that has encouraged the expansion of foreign-owned banks in the NMS in recent years.

39. **Subsidies and tax policies have stimulated the growth of selected credit markets.** Construction saving subsidies have promoted saving and lending through building societies in some countries, for example, the Czech Republic and Hungary. A favorable tax treatment of housing loans, including tax exemption of construction saving yields and the deductibility

Figure 4. NMS: Macroeconomic Environment and Credit to the Private Sector, 1994-2005  
(Annual percent change, unless indicated otherwise)



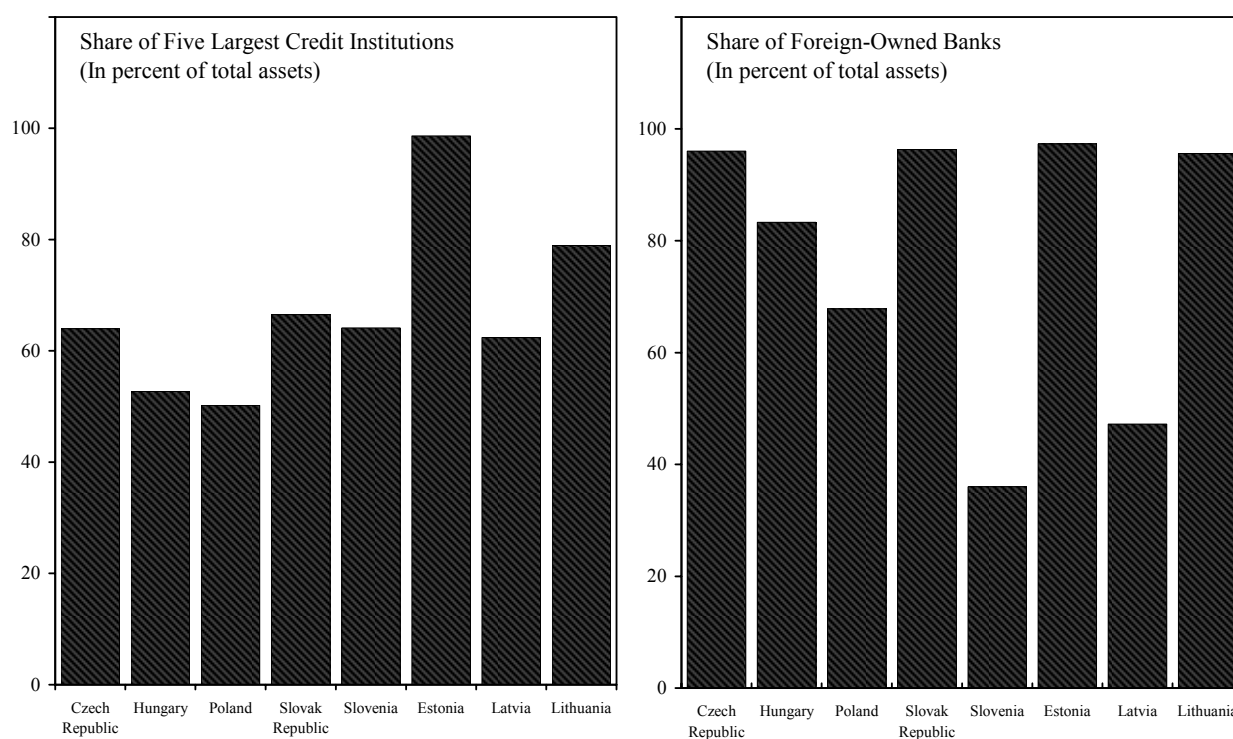
Sources: IMF *International Financial Statistics*, and staff estimates.  
1/ CPI-based index with 2000 as base year.

of housing loan interest payments, also have encouraged credit growth in some countries. Open-ended government interest rate subsidies may have stimulated the growth of consumption lending in some countries, for example, in Hungary. In Estonia, the deductibility of mortgage interest has encouraged real estate borrowing.

### Structure of NMS financial systems

40. **Although there are intraregional differences, the financial systems of the NMS share certain structural characteristics.** Commercial banks constitute the bulk of NMS financial systems, and private sectors in the NMS rely considerably more on bank financing than stock market financing. The concentration of NMS banking sectors is higher than the EU-25 average, but this is largely due to the Baltics: the share of the five largest credit institutions in the CEECs stands at about the EU average (60 percent), whereas in the Baltics it is almost 80 percent (Figure 5). Foreign presence is large in all NMS, with an average of

Figure 5. NMS: Concentration and Foreign Participation in the Banking System, 2004



Sources: European Central Bank; and IMF staff estimates.

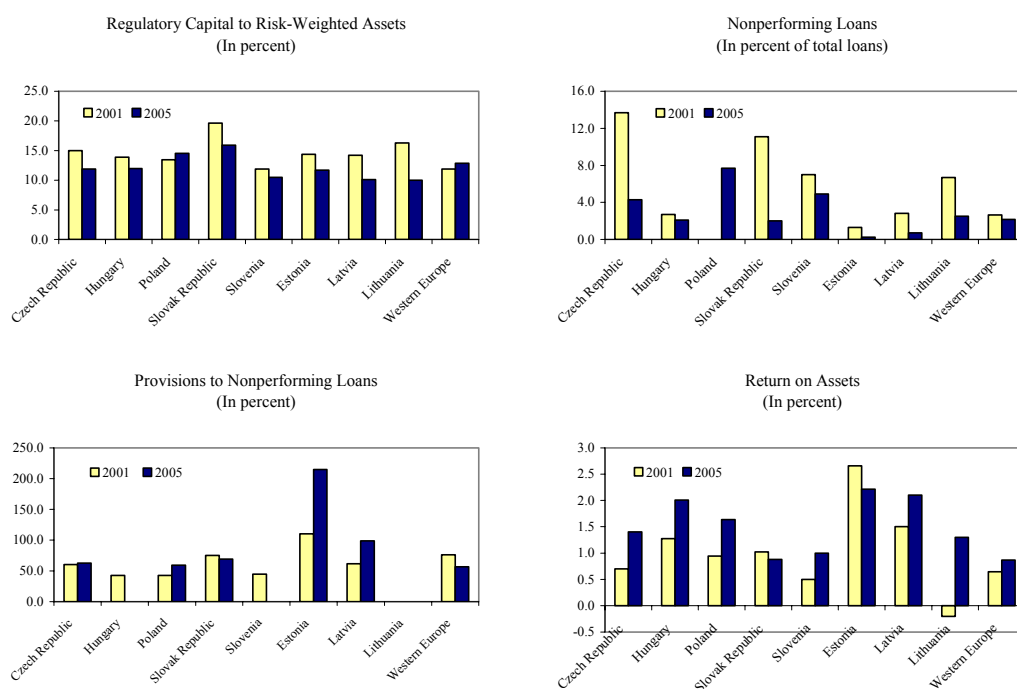
77 percent of bank assets owned by foreigners. Still, the variance is wide across countries, ranging from 36 percent in Slovenia to 97 percent in Estonia. The form of foreign bank ownership also differs across the NMS. In Hungary, Latvia, and Poland, at least 90 percent of foreign-owned affiliates are subsidiaries, while in the Czech Republic, Lithuania, and Slovenia the proportion is about 70 percent. In Estonia, only one half of foreign-owned affiliates are subsidiaries (ECB, 2005), although they account for 90 percent of the banking

sector's assets. The proportion of branches in the total number of foreign affiliates in the Baltics is higher than in the CEECs.

### Financial soundness indicators

41. **Financial soundness indicators for the NMS are generally favorable** (Figure 6). Capital ratios are comparable to those in Western Europe,<sup>19</sup> while returns on assets are generally higher. Although nonperforming loans are somewhat higher, the coverage of nonperforming loans by provisions is similar to Western Europe's. Within the NMS, the banking sectors in the CEECs appear more capitalized than those in the Baltics, but at the same time asset quality and provisions against bad loans are, on average, lower in the Baltics and profitability is higher. These macroprudential indicators should not be interpreted as providing much comfort, however, because most of them are backward looking and tend to show an improvement in the ascending part of the credit cycle.

Figure 6. New Member States: Selected Financial Soundness Indicators



Sources: National Banks; IMF's Global Financial Stability Report; IMF country reports; and IMF staff estimates.

<sup>19</sup> Western Europe comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

42. **Market indicators of banking system soundness point to moderate macroprudential risks and a wide range of systemic risks among the NMS** (Text Table 2).<sup>20</sup> According to Fitch's composite indicators of banking system soundness, macroprudential risk is at medium level in all NMS, except Poland. This conclusion is based

Text Table 2. Fitch's Summary Indicators of Bank Soundness 1/

Banking System Indicator	Macroprudential Indicator		
	1	2	3
A	Switzerland	Australia, Luxembourg, Netherlands, Spain, UK, USA	
B	Belgium, Bermuda, Canada, Chile, Denmark, France, Germany, Hong Kong SAR, Italy, Mexico, Singapore, Sweden	Austria, Bahrain, <b>Czech Republic, Estonia</b> , Finland, Kuwait, New Zealand, Norway, Portugal, Qatar, Saudi Arabia	Iceland, Ireland, South Africa
C	Brazil, Japan, Korea, Malaysia, Malta, Oman, UAE	Greece, <b>Latvia</b> , San Marino, <b>Slovenia</b>	
D	Benin, Colombia, Cyprus, El Salvador, Indonesia, Israel, Lebanon, Panama, Peru, Philippines, <b>Poland</b> , Taiwan, Thailand, Venezuela	Bulgaria, Costa Rica, Croatia, <b>Hungary</b> , India, Kazakhstan, <b>Lithuania</b> , Romania, <b>Slovak Republic</b> , Turkey, Ukraine	Russia
E	Argentina, Bolivia, China, Ecuador, Egypt, Tunisia, Uruguay	Dominican Republic, Iran, Vietnam	Azerbaijan

Source: Fitch Ratings, September 2006.

1/ The banking system indicator measures intrinsic bank systemic risk on a scale from A (very high quality) to E (very low quality). The macroprudential indicator measures the vulnerability of the banking system to macroeconomic shocks as low (value of 1), medium (value of 2), or high (value of 3).

on an early warning model of above-trend private sector credit growth and takes into account the possibility of asset price bubbles and currency overvaluation. The Fitch's banking system indicator combines the system average of individual bank ratings and a qualitative assessment of systemic risks, taking into account asset quality, capital adequacy, liquidity, and foreign exchange exposures, among other things.<sup>21</sup> In four out of the eight NMS (the

<sup>20</sup> Market indicators of NMS banks are worse than in major advanced countries but broadly comparable to those of banks from other emerging markets. The exceptions are the market indicators for Czech and Estonian banks, which are stronger.

<sup>21</sup> The assessment of systemic risks is based on the existence and severity of nine factors: (i) interbank positions; (ii) high borrower indebtedness; (iii) foreign currency borrowing without foreign currency resources; (iv) exposure to sovereign risk; (v) common exposure to a particular sector, industry, company, or individual; (vi) deposit concentration; (vii) coexistence of low liquidity and low capital ratios and a large share of demand deposits; (viii) inadequate regulatory and supervisory framework, opaqueness, and poor corporate governance; and (ix) other systemic factors (for example, off-balance-sheet operations and unprovisioned contingent liabilities).

Czech Republic, Estonia, Latvia, and Slovenia) the institutions that own the majority of banking system assets have adequate or high ratings, and are identified risks moderate or low. Other NMS are deemed to have banking systems with mostly low-rated institutions and high identified systemic risks.<sup>22</sup> Financial strength ratings by Moody's are broadly comparable to Fitch's.

### **Financial risks and stress tests**

43. **Generally, the main risk to bank soundness associated with rapid loan growth is credit risk.** Credit risk can arise from a number of sources: inappropriate loan assessments and difficulties in monitoring and assessing risks; aggressive lending strategies; overvalued asset prices or exchange rates; and an excessive concentration of loans. Risks associated with rapid credit growth to households are in many respects similar to those associated with lending to corporates, but the key difference is the much larger number of loans involved (which, on one hand, helps diversification of risks, and, on the other, can make credit decisions and management more labor intensive) and the lower availability of reliable financial data.

44. **Market risks can also become an issue in an environment of rapid credit growth.** Interest rate risk can rise, for example, if rapid credit growth is accompanied by a move toward a greater use of fixed-rate or foreign currency instruments without banks' hedging the risk of adverse movements in the prices of these assets. Direct foreign exchange risk may arise from net open foreign exchange positions and external borrowing to fund credit growth. Housing price risk is a concern from the perspective of collateral valuation. Maturity and liquidity risks generally arise from long-term loans financed through short-term borrowing by banks.

45. **In the NMS, published stress test results point to the resilience of these countries' banking systems to credit risk and market risk.** A review of stress-testing results presented in the IMF's Financial System Stability Assessments (FSSAs) and Financial Stability Reports during 2001–04 suggests that NMS banking systems should be able to sustain significant macroeconomic shocks (Box 1). However, the dispersion of stress testing exercises and results across individual banks might be large in some NMS; also, some FSSA stress-testing exercises preceded the acceleration of credit in the NMS. In sum, although stress testing results are fairly positive so far in all NMS that disclose them to the public, there are growing concerns about financial risks associated with rapid credit growth. These risks are difficult to quantify given the relatively short credit history of the region.

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<sup>22</sup> Fitch's report on bank systemic risk is as of September 2006. Compared to the report dated July 2005, macroprudential risks in the NMS have, on average, increased while systemic risks stayed mostly the same.

### Box 1. Stress Testing in Selected NMS 1/

**Czech Republic.** Recent Financial Stability Reports present results of extensive stress tests (market risk, credit risk, scenario analysis, indirect foreign exchange risk, and contagion). Stress testing results suggest that the banking system is basically stable. A recent shift from credit to interest rate risk has been found. However, credit risks remains the most important source of risk for the Czech banking system.

**Hungary.** Stress tests presented in recent Financial Stability Reports cover only market risk and credit risk. Results are positive, pointing to an improvement in the banking sector's resilience to shocks.

**Latvia.** Stress tests cover market risk and credit risk. The conclusion of recent analyses was that vulnerability to credit risk has increased, and that household lending presents the most important risk.

**Poland.** The Financial Stability Report concludes that the banking system is highly resilient to shocks, although some analyses do not represent stress tests in a conventional sense. The report flags indirect exchange rate risks associated with foreign currency mortgage lending. This finding is echoed by the accompanying FSSA.

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1/ As reported in published FSSAs and Financial Stability Reports. See Čihák (2006) for a detailed comparison of Financial Stability Reports produced by central banks across the world.

### C. Econometric Analysis Using Bank-Level Data

46. **This section extends the above analyses by examining bank credit growth soundness in the NMS in an empirical model.** Sounder banks are generally expected to have a competitive advantage in meeting the demand for credit, given their larger capital cushions and presumably better risk management. But if loan portfolios grow faster than banks' ability to assess and manage risks, credit risk might increase and asset quality decline, leading to higher provisions and lower profits. Retained earnings and, hence, capital adequacy ratios might also decline. A simultaneous equation model allows the two-way relationship between bank credit growth and soundness to be explored.

#### The empirical model

47. **We model credit growth and bank soundness as functions of each other and various macroeconomic and bank-specific factors.** Credit growth is measured as the annual percent change in total outstanding loans of individual banks, while the soundness of banks is measured by their distance to default (Box 2). Lagged dependent variables are included in the model to allow for possible persistence in loan growth and distance to default. A parsimonious baseline specification was selected by sequentially testing the relevance of various macroeconomic and bank-specific variables identified in the recent literature as structural determinants of credit growth and bank soundness.

### Box 2. Distance to Default 1/

Distance to default (DD) has become an increasingly popular measure of bank soundness (see, for example, Danmarks Nationalbank, 2004; and De Nicoló and others, 2005). Its popularity stems from the fact that it is directly related to the probability of default, that is the probability that the value of assets becomes smaller than the value of debt. It can be summarized as  $DD \equiv (k + \mu) / \sigma$ , where  $k$  is equity capital as percent of assets,  $\mu$  is average return as percent on assets, and  $\sigma$  is the standard deviation of return on assets as a proxy for return volatility. DD measures the number of standard deviations a return realization has to fall in order to exhaust equity, assuming that banks' returns are normally distributed. Because a higher DD corresponds to a lower upper bound of insolvency risk, a higher DD therefore implies a lower probability of insolvency risk.

Typically, market values of equity are used to calculate this index (see, for example, De Nicoló and others, 2005). In particular, daily market data on equity are combined with annual accounting data to calculate the market value and the volatility of assets, based on the option-pricing model by Black and Scholes (1973) and Merton (1974). Advantages of using stock market data include the fact that they aggregate information dispersed among market agents and potentially can provide forward-looking assessments of risks. However, this approach is also based on relatively strong assumptions; in particular, it requires bank stocks to be traded in well-functioning and liquid markets. Since this assumption might not hold in relatively illiquid NMS stock markets, this paper mainly uses a simpler annual measure of DD based only on balance sheet and income statement data (also known as z-score; for example, Maechler, Mitra, and Worrell, 2006). DD is calculated using annual data on equity capital and return on assets. The standard deviation of returns is calculated for the entire sample period to obtain a sufficiently long-term view on the risks faced by a given bank.

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1/ The box is based on Tamirisa and Čihák (2006).

48. **A starting point for the selection of the baseline specification was macroeconomic variables reflecting the demand-side determinants of bank loan growth and the effect of macroeconomic conditions on bank soundness.** Although there is some variation in the set of variables used in the macro-level studies of credit growth,<sup>23</sup> most studies include: (i) GDP per capita, to indicate the catching-up phenomenon, whereby credit growth tends to be slower in countries with a higher level of economic and institutional development; (ii) real GDP growth, positively correlated with the demand for bank loans; (iii) real interest rates, which tend to be negatively correlated with demand for loans; and (iv) real exchange rate depreciation, which is expected to reduce the demand for foreign currency loans. These macroeconomic variables reflect the risks faced by a bank and, hence, might affect its soundness. Although all of these variables were found to affect bank loan growth, only GDP per capita was found to be an important determinant of distance to default, suggesting that bank soundness is positively correlated with the level of economic and

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<sup>23</sup> Schadler and others (2004); Coricelli and Masten (2004); Cottarelli, Dell'Araccia, and Vladkova-Hollar (2005); and Égert, Backé, and Zumer (2006).



institutional development of a country.<sup>24</sup> No statistically significant effect of bank credit growth on bank soundness was identified; however, bank loan growth was retained in the distance to default equation in the baseline specification, given the focus of the study on the relationship between bank loan growth and bank soundness.

49. **Next, the set of explanatory variables was expanded to include bank-specific variables likely to affect bank soundness and the rate at which banks expand their loan portfolios.** These variables reflect the supply-side determinants of credit growth, the importance of which was emphasized by Dell'Arriccia, Detragiache, and Rajan (2005) and Neir and Zicchino (2006). In line with the recent studies of bank soundness (De Nicoló and others 2005; and Maechler, Mitra, and Worrell, 2006), measures of bank profitability (proxied by the net interest margin), liquidity (the liquidity ratio), and efficiency (the cost-to-income ratio) are also included as explanatory variables in the equations for bank credit growth and bank soundness.

50. **More profitable, liquid, and efficient banks are likely to be sounder and able to expand credit at a faster rate.** One might also expect bank soundness and loan growth to be positively correlated with bank size and foreign ownership and negatively correlated with state ownership (the share of capital owned by foreigners and the government, respectively).<sup>25</sup> These variables indirectly might capture the effect of financial and other institutional reforms on banks' incentives and their ability to lend to the private sector. Indeed, bank credit growth was found to depend on distance to default, the cost-to-income ratio, the net interest margin, and the share of bank capital owned by the state. Bank size and liquidity and the share of capital owned by foreign banks were found to matter most for bank soundness.

51. **The parsimonious baseline specification is thus as follows:**

Equation 1: Bank Credit Growth

$$BankCreditGrowth_{ijt} = f(BankCreditGrowth_{ij,t-1}, GDPperCapita_{j,t-1}, GDPgrowth_{j,t-1}, RIR_{j,t-1}, \Delta RER_{j,t-1}, DistanceToDefault_{ij,t-1}, CostToIncome_{ij,t-1}, InterestMargin_{ij,t-1}, Public_{ijt}),$$

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<sup>24</sup> Including additional measures of institutional development (for example, the banking reform index produced by the European Bank for Reconstruction and Development), regulatory measures (such as supervision quality measures), or a measure of financial development (bank credit to the private sector as a share of GDP) did not improve the specification. These variables were excluded to achieve a parsimonious specification.

<sup>25</sup> An alternative measure of foreign ownership (a dummy variable for this share exceeding 50 percent) also suffers from the drawback that it might not reflect effective foreign control of a bank in which privatization modalities have prevented the selling of more than 49 percent of ownership of the bank.

## Equation 2: Distance to Default

$$DistanceToDefault_{ijt} = f(DistanceToDefault_{ij,t-1}, BankCreditGrowth_{ij,t-1}, GDPperCapita_{j,t-1}, Liquidity_{ij,t-1}, Size_{ij,t-1}, Foreign_{ijt}).$$

where  $i$  denotes individual banks,  $j$  denotes countries, and  $t$  is the year index.

*BankCreditGrowth* is the annual percent change in real bank credit to the private sector. *RIR* is the real interest rate and  $\Delta RER$  is the annual percent change in the real exchange rate. *CostToIncome* and *InterestMargin* stand for the cost-to-income ratio and the net interest margin. *Public* and *Foreign* are measures of public and foreign ownership.

52. **These two equations can be estimated jointly using the three-stage least squares method.** As Arellano (1990) pointed out, three-stage least squares (3SLS) is a convenient method for estimating linear models using panel data with a relatively short time dimension and including lags of the dependent variables. Applied studies commonly use 3SLS to estimate systems of equations with lagged dependent variables (for example, Hall, 1987; and Sab and Smith, 2002). There are several advantages to using 3SLS in this context. First, unlike a commonly used method for estimating single-equation dynamic panel models—the method suggested by Arellano and Bond (1991)—3SLS applies to a simultaneous equation setting. Second, by taking into account the cross-equation correlation, 3SLS yields more efficient estimates for simultaneous equation systems than two-stage least squares (2SLS). Third, 3SLS has the desirable feature of leaving the autocovariance matrix of errors unrestricted, so that the resulting estimates are robust to the residual autocorrelation of an arbitrary form. Hence, 3SLS renders unbiased estimates, in contrast to 2SLS, in models with lagged dependent variables.

53. **Unit root and other tests reveal no signs of specification problems when the baseline specification is estimated using 3SLS.** However, if autocovariances in a 3SLS model with lagged dependent variables and a sufficient number of strictly exogenous variables satisfy some restrictions, 3SLS might be inefficient. Thus, it is necessary to examine the covariance structure of the baseline specification to confirm the absence of specification problems. Testing for unit roots is complicated by the fairly short time dimension of the data set. Nonetheless, feasible unit root tests for three-dimensional panel data (Kónya and Ohashi, 2005) reject unit roots at the 1 percent significance level. The Hausman specification test, based on a model excluding lagged dependent variables, is inconclusive, but the examination of the residual structure of this model points to nonstationarity problems due to the failure to capture persistence. These specification analyses confirm that the baseline specification is adequately specified by including lagged dependent variables. In any event, estimating the baseline specification, while excluding these variables, does not significantly alter the main parameters. (Likewise, results are broadly robust to estimating the bank credit growth and the distance to default equations separately using the Arellano-Bond method.)

## Data and basic statistics

54. **Estimating the model requires bank-level and macroeconomic data.** Bank financial ratios are calculated using bank balance sheet data from the Bankscope database published by the *Bureau van Dijk*.<sup>26</sup> Bankscope covers most banks operating in the NMS (around 80 percent),<sup>27</sup> which on average account for more than 80 percent of total assets of NMS banking systems (Text Table 3). The Bankscope sample of NMS banks is fairly diverse, including domestically and foreign-owned banks; large, medium-sized, and small banks; and subsidiaries and branches. Nonetheless, the sample is somewhat biased toward larger banks, as suggested by the fact that the coverage of banks in many NMS (the Czech Republic, Estonia, Hungary, Lithuania, and Poland) is higher when measured as a share of total bank assets than as the share of the total number of banks. The sample used in the study includes 217 commercial banks that operated in the NMS during 1995–2004. The average number of observations per bank (around 7) is less than the maximum possible number (10), which is not surprising given significant structural changes in the NMS banking sectors during the last decade. Macroeconomic data needed to calculate real GDP growth, GDP per capita, real interest rates, and real exchange rates were taken from the IMF's *International Financial Statistics*. For more details on data definitions and sources, see Appendix.

Text Table 3. Sample Coverage

	Number of Banks		Proportion of Banks Included in the Sample 1/		Average Number of Observations per Bank
	Total	Bankscope	Number	Assets	
Czech Republic	35	26	74.3	97.6	7.2
Hungary	36	23	63.9	81.7	8.3
Poland	60	33	55.0	85.6	7.6
Slovak Republic	21	20	95.2	83.1	7.1
Slovenia	22	18	81.8	79.9	7.8
Estonia	6	5	83.3	94.1	7.9
Latvia	22	21	95.5	93.2	8.0
Lithuania	13	9	69.2	93.7	6.2

Sources: European Central Bank; Bankscope; and IMF staff estimates.

1/ In percent of the total number of banks and total bank assets, respectively.

55. **Sample statistics point to a significant dispersion in credit growth and distance to default at the bank level.** Histograms suggest that the distribution of distance to default is asymmetric, skewed toward positive values (Figure 7). The distribution of credit growth values is more balanced, although, like with distance to default, there is a fat tail

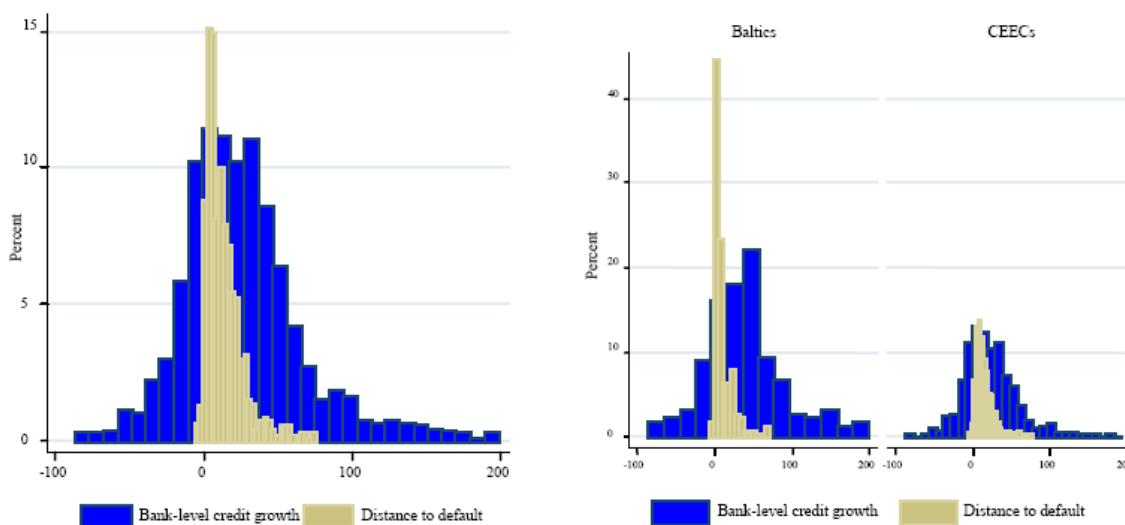
<sup>26</sup> For subsample analyses, total bank loan data from Bankscope were supplemented with supervisory data on breakdowns of bank loan portfolios by the currency of loan denomination or indexation and the type of borrower (household or corporate). These additional data were provided by the central banks of the NMS (except Hungary and Latvia) for research purposes on the condition of strict confidentiality.

<sup>27</sup> Except for Hungary and Poland, where the coverage measured by the number of banks is slightly lower (64 percent and 55 percent, respectively).

corresponding to banks' rapidly expanding their balance sheets. Both in the CEECs and the Baltics, banks were lending at higher rates on average during 2001–04 than 1995–2000, and the variation of credit growth rates across banks decreased over time (Text Table 4). Banks in the Baltics on average were growing faster than banks in the CEECs in both periods. Distance to default on average has increased in both subgroups of the NMS over time, but the improvement has been more significant in the Baltics. However, the variation in banks' distance to default increased in recent years, especially in the Baltics.

56. **This basic statistical analysis implies that CEEC and Baltic banks have grown stronger over time and have stepped up their lending activities; at the same time, the heterogeneity of banks in terms of their soundness also increased, especially in the Baltics.** Together with the finding of decreased variation in bank credit growth, increased heterogeneity in bank soundness implies that weak and sound banks are expanding at similar rates, especially in the Baltics. The econometric analysis presented in the next subsection builds on this observation by exploring the relationship between credit growth and bank soundness in a multivariate and simultaneous equation setting, controlling for other relevant factors.

Figure 7. Histograms for Credit Growth and Distance to Default, 1995-2004 1/



Sources: Bankscope and IMF staff estimates.

1/ Distance to default is measured by the number of standard deviations a return realization would have to fall for bank equity to be depleted.

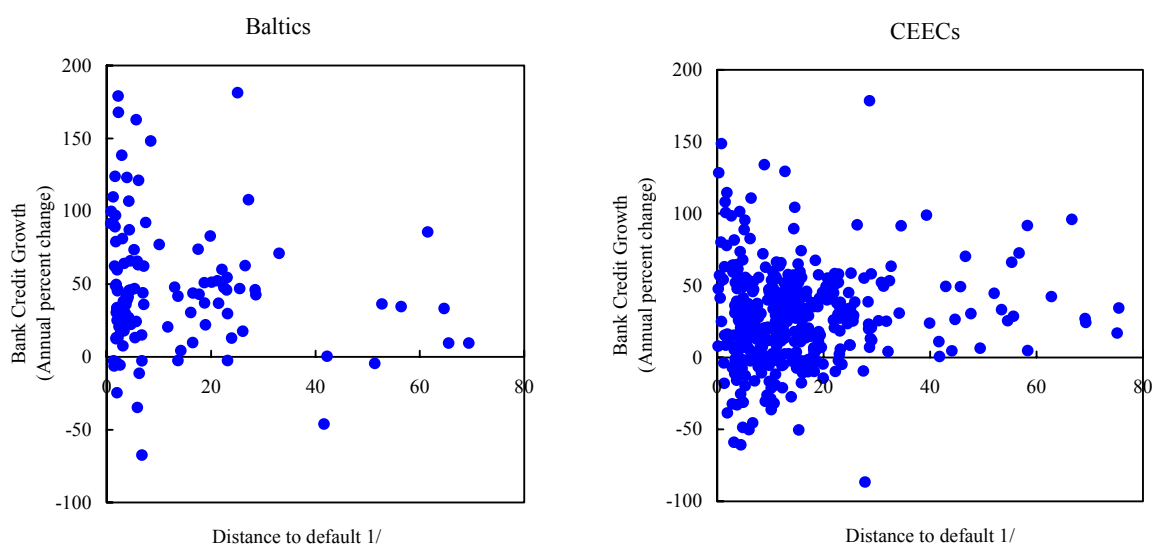
Text Table 4. Summary Statistics by Period and Region

Variable	1995-2004				1995-2000				2001-2004			
	CEECs		Baltics		CEECs		Baltics		CEECs		Baltics	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Bank credit growth	22.2	37.2	38.3	50.9	17.9	40.1	28.7	56.6	27.3	32.7	46.8	43.8
Distance to default	14.4	12.7	10.2	13.0	14.0	12.5	7.7	9.2	14.8	13.0	12.5	15.3
Net interest margin	4.1	2.9	4.7	2.4	4.5	2.6	6.1	2.5	3.6	3.1	3.3	1.3
Cost-to-income ratio	69.4	76.7	81.8	76.4	67.4	99.7	95.5	107.8	71.9	31.8	69.6	19.2
Liquidity ratio	17.3	17.0	14.3	15.0	17.4	16.1	11.2	9.8	17.2	18.0	17.1	18.0
Bank size	6.7	1.3	5.3	1.4	6.4	1.3	4.8	1.3	7.0	1.3	5.8	1.3
Real GDP growth	3.1	2.2	6.7	2.9	2.9	2.4	5.3	3.5	3.3	1.9	8.1	1.2
GDP per capita	63.5	25.2	38.8	11.0	58.1	23.5	30.9	3.9	70.1	25.7	45.8	10.6
Real interest rate	2.9	3.6	0.0	3.4	3.2	3.5	-0.5	4.5	2.5	3.7	0.5	1.9
Real depreciation	-0.1	0.4	-0.3	0.8	0.2	0.3	-0.1	0.8	-0.4	0.3	-0.5	0.7
Foreign ownership	43.4	45.9	36.4	41.6	36.2	44.4	31.1	39.7	52.2	46.3	41.1	42.8
Public ownership	11.1	29.1	7.9	23.2	15.3	33.7	12.5	29.2	6.1	21.5	3.7	15.0

Source: IMF staff estimates.

57. **Data also suggest that credit growth in the NMS was broad based during 1995–2004.** Neither a positive nor a negative correlation between credit growth and distance to default is apparent in the scatter plots for credit growth and distance to default of the Baltic and CEEC banks (Figure 8). Some banks with small distances to default have been downsizing, while others have been expanding their loan portfolios as rapidly, if not faster, than banks with large distances to default. The latter generally have been growing at moderate rates. Correlation analysis points to positive correlation between bank loan growth and bank soundness in the entire sample and in subsamples for 1995–2000 and 2001–04. The correlation coefficient is negative only for the Baltic banks in 2001–04.

Figure 8. Correlation Between Bank Credit Growth and Distance to Default, 2001-2004



Sources: Bankscope and IMF staff estimates.

1/ Distance to default is measured by the number of standard deviations a return realization would have to fall for bank equity to be depleted.

## Econometric results

58. **The signs of coefficients in the baseline specification are in line with expectations** (Table 1):

- Higher real GDP growth and lower real interest rates are found to have a statistically significant positive impact on credit growth. Credit growth in the NMS also reflects financial catching-up: the coefficient on GDP per capita is negative and statistically significant for the whole period under consideration, although its statistical significance declined in the period 2001–04 from 1995–2000.<sup>28</sup> Higher bank efficiency, as measured by the cost-to-income ratio, also has boosted credit growth, especially in the earlier period. This, together with the significant negative coefficient on the share of bank capital owned by the state, implies that financial sector reforms have given the private sector greater access to credit. In the 2001–04 period, bank profitability became a significant driver of credit growth.
- In the distance-to-default equation, the coefficient on the lagged distance to default is positive and statistically significant, suggesting that banks that were sound and stable in the past are likely to remain so in the future. Other significant determinants of distance to default are bank size and GDP per capita, with larger banks and banks in more developed countries being sounder. The coefficient on the foreign ownership variable is positive and statistically significant during 2001–04. This finding suggests that the opening of the NMS banking sectors to foreign participation has been associated with an improvement in bank soundness during the period in question. Liquidity is also found to contribute positively to bank soundness, especially during 2001–04.

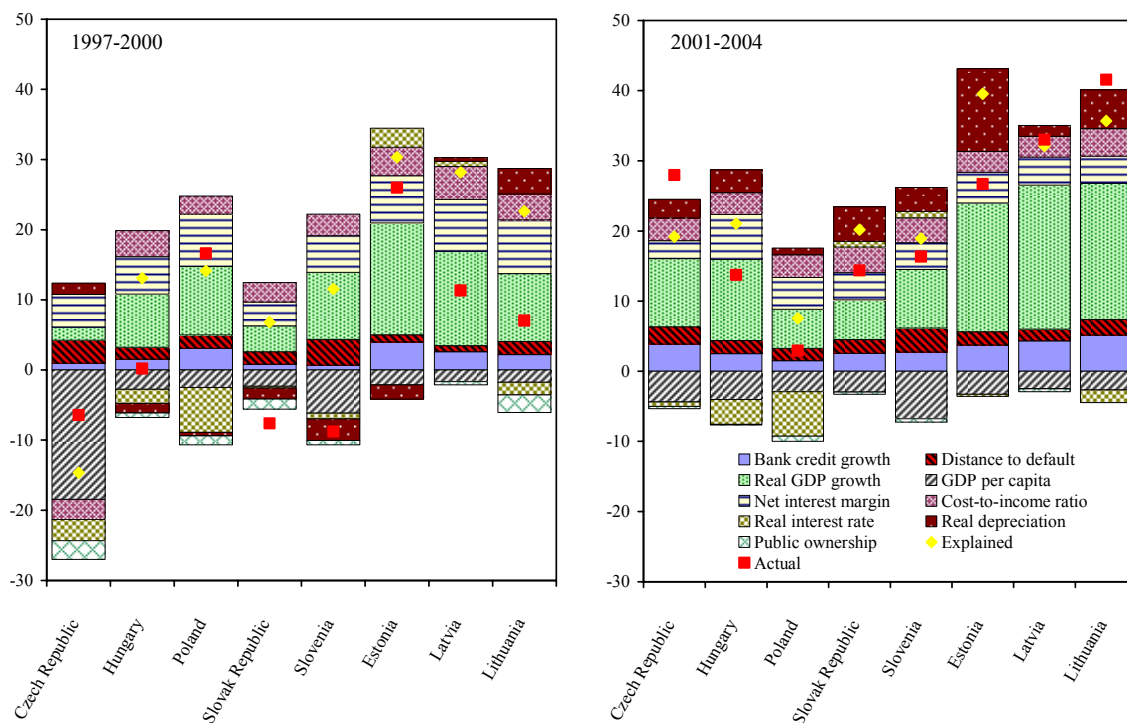
### *Which factors have been driving credit growth in the NMS?*

59. **Credit growth in the NMS has reflected both macroeconomic and bank-specific factors** (Figure 9). Economic growth has been the single most important driver of credit growth in the NMS during 1997–2004. In recent years, exchange rate appreciation has contributed substantially to an increase in credit growth in most NMS. A positive contribution of real GDP growth to credit growth has been larger in the Baltics than in the CEECs, while the negative contribution of GDP per capita has been generally smaller in the

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<sup>28</sup> Changes in the exchange rates did not have a statistically significant impact on credit growth in regressions for the entire period, but this finding seems to reflect differences in how changes in the exchange rate affected credit growth in subperiods: during 1994–2000, real depreciation had a strong positive impact on credit growth, while during 2001–04 real appreciation was associated with stronger credit growth, possibly due to the increased importance of foreign currency lending.

Figure 9. NMS: Decomposition of Predicted Credit Growth, 1997-2004  
(In percent per year)



Source: IMF staff estimates.

Baltics. This suggests that higher credit growth rates in the Baltics largely reflect these countries' higher economic growth and lower levels of development. Relatively large real exchange rate appreciations in Estonia and Lithuania and comparatively low real interest rates in Estonia and Latvia helped fuel credit growth during 2001–04. Bank-specific factors seem somewhat less important than macroeconomic factors in explaining credit growth in the NMS. The importance of bank efficiency (cost-to-income ratio) has remained broadly unchanged throughout the period in question, while the positive contribution of profitability (net interest margin) seems to have declined over time in the NMS.

60. **Slower credit growth in the CEECs has largely reflected weaker economic activity than in the Baltics.** Relatively high income levels in the Czech Republic and Slovenia have implied less scope for financial catching up in these countries. Real interest rates have exerted downward pressure on credit growth in Poland and Hungary, while the contribution of real interest rates to credit growth in the Czech Republic, the Slovak Republic, and Slovenia has been small. High profitability was an important factor explaining strong credit growth in Poland during 1997–2000, and in Hungary during 2001–04, while in Slovenia bank soundness contributed to credit growth throughout the period in question. Exchange rate appreciation had a significant impact on credit growth rates in most NMS between 2001 and 2004, particularly in Estonia, Lithuania, and the Slovak Republic.

**61. The predicted values of credit growth are fairly close to the actual rates.**

Predicted credit growth rates for the second half of the 1990s were generally above actual rates in most countries. In the later period, 2001–04, actual credit growth rates on average were below the predicted rates for the CEECs countries, but on average above the predicted rates in the Baltics. Predicted credit growth rates for all NMS were higher during 2001–04 than in the second half of the 1990s, reflecting improvements in macroeconomic conditions and the strengthening of the financial systems.

*How significant are prudential risks in the NMS?*

**62. Credit growth in the NMS had a negative, but statistically insignificant, impact on bank soundness both during 1994–2000 and 2001–04** (Table 1, Column 6, compared to Table 1, Column 4). This finding is consistent with the conclusions based on a general analysis of financial soundness indicators in Hilbers and others (2005) and Iossifov and Khamis (2006), who have not found any significant deterioration in financial soundness indicators in the NMS. Market indicators for the NMS banking systems discussed earlier point to similar conclusions. However, unlike the econometric analysis using bank-level data, these other analyses do not draw on the information contained in the disaggregated data on the dispersion of soundness indicators across banks; they largely examine average, system-wide soundness indicators.

**63. In contrast to the late 1990s, the pace of credit growth in the NMS during 2001–04 was no longer dependent on bank soundness—weaker banks were expanding credit just as rapidly as sounder banks** (Table 1, Column 5, compared to Table 1, Column 3). With some relatively weak banks being weak in the absolute sense as well, the implication of this econometric finding is that the prudential risks associated with rapid credit growth in the NMS have risen in recent years. Rapid expansion by weak banks risks undermining the soundness of the banking system in future years, to the extent that weak banks have incentives to try to outgrow their initial problems by venturing into high-risk/high-return activities, which might magnify the eventual costs of dealing with the underlying weaknesses. The prudential risks associated with rapid expansion by weak banks might become apparent in financial soundness indicators only with a delay, or not at all, if weak banks strengthen their risk management practices, avoid taking on excessive risks, and build up sufficient capital cushions.

**64. The above econometric findings are generally robust to alternative specifications of the model and alternative measures of bank soundness:** controlling for time- and country-specific factors, using alternative measures of foreign and public ownership, and adding an explicit measure of financial development (Tables 2a–2c). Using an alternative, narrower measure of bank soundness (the share of nonperforming loans in total outstanding loans) implies that, during 2001–04, weaker banks were expanding more rapidly than sounder banks: the coefficient on nonperforming loans (NPLs) in the credit growth equation is positive and statistically significant during 2001–04, while, during 1995–2000, it was negative and statistically insignificant (Table 2d). Regressions with loan loss reserves as a



measure of bank weakness show that the positive statistically significant effect of bank weaknesses on the rate of bank credit growth has increased in recent years (Table 2e). Regressions using the annual percent change in NPLs as a measure of bank weakness indicate that credit growth in recent years has been associated with slower growth in NPLs, possibly reflecting generally favorable macroeconomic conditions in recent years.

65. **The results are also broadly robust to alternative ways of calculating distance to default.** In particular, calculating the volatility of returns for the corresponding subperiods rather than for the entire period renders a statistically significant negative coefficient on credit growth in the bank soundness for the period 2001–04. However, this approach to calculating distance to default implies a more sanguine assessment of risks facing individual banks than the baseline approach of calculating the volatility of returns for the entire sample period, as since the volatility of returns has declined in recent years in part owing to favorable macroeconomic conditions. Results also do not change significantly when a quadratic term of distance to default is included to capture possible nonlinearities in the relationship between credit growth and bank soundness (following Maechler, Mitra, and Worrell, 2006): the quadratic term is found to be statistically insignificant. Assuming faster feedback effects between bank credit growth and soundness (by replacing lagged bank credit growth and distance to default with their contemporaneous values in the respective equations) also does not alter the results.

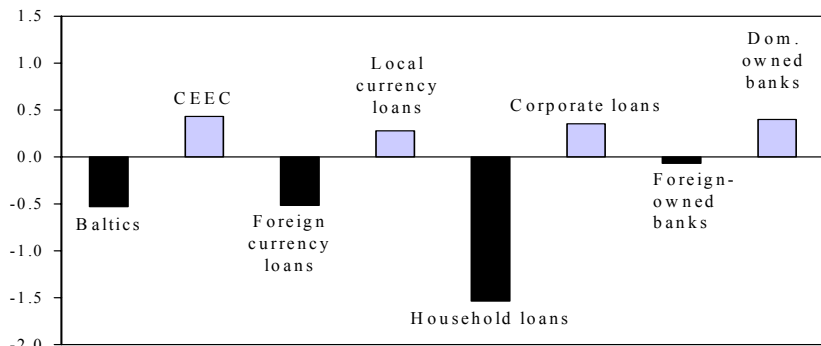
66. **The relationship between credit growth and bank soundness seems to have differed across different subgroups**—the CEECs and the Baltics, foreign- and domestically owned banks, foreign currency and domestic currency loans, and household and corporate loans. For all subgroups,

there is no strong statistical evidence that rapid credit growth has weakened bank soundness. However, the importance of bank soundness as a factor driving bank credit growth has varied across subgroups (Figure 10).

The soundness of banks in the CEECs, domestically owned banks, and banks lending mostly in local

currency or to corporates is found to have a positive and statistically significant effect on bank credit growth in recent years, implying that credit has been growing more rapidly through sounder banks. The opposite is true of credit growth in the Baltics and lending in foreign currency, to households, or through foreign-owned banks: weaker banks seem to be

Figure 10. NMS: Effect of Bank Soundness on Credit Growth, 2001-04 1/ (In percent per year)



Source: IMF staff estimates.

1/ The effect of a one-unit increase in distance to default on bank credit growth, corresponding to the coefficient on distance to default in the credit growth equation. Distance to default is measured by the number of standard deviations a return realization would have to fall for equity to be depleted. See Tables 3a, 4a, 5 and 6 for details.

expanding these types of loans at a faster rate. The negative correlation between bank soundness and credit growth seems to be the highest in household lending. The detailed econometric results underlying these conclusions are discussed in the next subsection.

*Do prudential risks in the Baltics and the CEECs differ?*

67. **Although credit growth had a statistically insignificant effect on bank soundness in both subgroups during 1994–2000 and 2001–04, the role of weaker banks in credit expansion in the Baltics appears to have increased over time** (Table 3a). The opposite is true in the CEECs: sounder banks were expanding more rapidly during 2001–04, while during 1994–2000 no statistically significant differences in the rates of credit growth through weaker and sounder banks were identified. These results are consistent with trends in sample statistics (Text Table 4): the means for credit growth and distance to default increased over time in both subgroups, while the dispersion of banks by the degree of soundness increased primarily in the Baltics. These results are generally robust to excluding the lagged dependent variable (Table 3b) and estimating regressions separately on the CEEC and Baltic subsamples (Tables 3c–3d). The finding that, in contrast to the CEECs, weaker banks in the Baltics have been expanding credit more rapidly in recent years implies that recent credit growth in the Baltics has been associated with greater prudential risks than in the CEECs.

68. **Several factors might explain the finding of higher prudential risks in the Baltic banking systems.** It could simply be that, in the context of more rapid Baltic credit growth—ten times higher in real terms than in the CEECs (Figure 4)—ensuring sound credit assessment and risk management at the individual bank level is much more challenging. The higher degree of foreign participation in the Baltic banking sectors might also be providing additional (but possibly false) comfort that the banking system can withstand larger shocks, as parent banks will provide capital or liquidity if their Baltic subsidiaries experience problems. This rationale might be flawed if the parent bank perceives the reputational risk associated with a failure of its NMS subsidiary or branch as insignificant and prefers to close the subsidiary. This might raise funding costs for all banks in the NMS in question and give rise to contagion within the NMS banking sector. The fact that more foreign bank affiliates in the Baltics are branches than subsidiaries might also make supervision more difficult, as branches generally are subject to less host country regulation than subsidiaries.

*Do prudential risks depend on bank ownership and type of lending?*

69. **Foreign-owned banks in the NMS seem to be taking on somewhat greater risks than domestic banks.** Less sound foreign-owned banks appear to be lending more aggressively in the NMS than domestically owned banks, possibly because of easy access to funding through their parent banks (Table 4a). (Controlling for the distance to default of parent banks indeed shows that, although rapid credit growth in recent years has become uncorrelated with the distance to default of NMS affiliates of foreign banks, it remains positively correlated with the distance to default of their parent banks.) Separate regressions, using the samples of foreign- and domestically owned banks, show that lending by foreign-

owned banks does not depend on bank soundness; for domestically owned banks a positive relationship is identified between credit growth and bank soundness (Tables 4b–4c). Among foreign-owned affiliates, Nordic banks stand out as the ones whose lending is the least related to bank soundness (Text Table 5). This result is consistent with the earlier discussed finding of higher prudential risks in the Baltics, since Nordic banks are particularly active in the Baltic countries (Iossifov and Khamis, 2006).

Text Table 5. Summary of Country-Specific Results for Different Foreign Bank Owners, 2001-04 1/

	Are Banks with Weaker Parents Expanding More Rapidly? (1)	Has Rapid Credit Growth Weakened Banks? (2)
Austria	Yes?	No?
Germany	No?	Yes?
France	Yes?	Yes?
Nordic countries	Yes	Yes?
United States	Yes?	No?
Italy	Yes?	Yes?
Belgium	Yes?	No?
Netherlands	No?	Yes?

Source: IMF staff estimates.

1/ "Yes (?)" indicates a negative and statistically significant (insignificant) coefficient; "No (?)" indicates a positive and statistically significant (insignificant) coefficient. The coefficients correspond to the interaction terms of the parent bank's distance to default and country dummies and measure the marginal effect of bank soundness of parent banks from a given country vis-à-vis the average effect for all other banks. In other respects, the models used for the analysis of the country-specific effects pertaining to parent banks follow the baseline specification (Table 1).

**70. The rapid growth of foreign-currency-denominated lending and household lending seems to pose greater prudential risks to NMS banks than other types of lending.** Credit growth through banks with large and rapidly expanding foreign currency loan portfolios is negatively correlated with bank soundness, suggesting that weaker banks are expanding at a faster rate (Table 5). The opposite is true of banks that are not actively engaged in foreign currency lending: loans are growing more rapidly through sounder banks. A similar result is found for banks with large and rapidly growing loan exposures to the household sector (Table 6).<sup>29</sup> These findings point to greater prudential risks in banks that are aggressively lending in foreign currency and to the household sector. Such banks seem willing to take on greater risks for the sake of increasing their market share.

#### *Do prudential risks differ across the NMS?*

**71. Prudential risks associated with rapid bank credit growth vary considerably across countries** (Text Table 6). This finding is obtained by decomposing the effect of bank

<sup>29</sup> Data limitations preclude examining credit growth broken down by both the currency of denomination and the type of borrower.

soundness on credit growth and the effect of credit growth on bank soundness in full-sample regressions into an average and a marginal, country-specific effect (Table 7). In Estonia, credit growth has become independent of bank soundness in recent years and has weakened bank balance sheets. Weaker banks in Latvia and Lithuania are lending at a faster rate, although credit growth in Latvia has had a significant positive effect on bank soundness so far and an insignificant negative effect in Lithuania. In the Czech Republic, Hungary, and Slovenia, weaker banks have recently started expanding as rapidly as stronger banks, but credit growth has not significantly weakened banks in the Czech Republic and Hungary and in Slovenia credit growth seems to have improved bank soundness. In Poland and the Slovak Republic, sounder banks are expanding more rapidly than weaker banks, and credit growth has had an insignificant effect on bank soundness.

Text Table 6. Summary of Country-Specific Results for Different Types of Lending, 2001-04 1/

	<u>Total Loans</u>		<u>Foreign Currency Loans</u>		<u>Loans to Households</u>	
	Are Weaker Banks Expanding More Rapidly?	Has Rapid Credit Growth Weakened Banks?	Are Weaker Banks Expanding Foreign Currency Loans More Rapidly?	Has Rapid Foreign Currency Credit Growth Weakened Banks?	Are Weaker Banks Expanding Household Loans More Rapidly?	Has Rapid Household Credit Growth Weakened Banks?
	(1)	(2)	(3)	(4)	(5)	(6)
Czech Republic	No?	Yes?	No?	No?	No?	No?
Hungary	No?	Yes?	n.a.	n.a.	n.a.	n.a.
Poland	No	Yes?	No?	Yes?	No?	No?
Slovak Republic	No	No?	No?	No?	No?	No?
Slovenia	No?	No	No?	No?	No?	No?
Estonia	No?	Yes	No?	No?	Yes?	Yes?
Latvia	Yes	No	n.a.	n.a.	n.a.	n.a.
Lithuania	Yes	Yes?	Yes?	Yes?	Yes?	Yes?

Source: IMF staff estimates.

1/ "Yes (?)" indicates a negative and statistically significant (insignificant) coefficient; "No (?)" indicates a positive and statistically significant (insignificant) coefficient; "n.a." means that data needed for the econometric analysis were not available. The coefficients correspond to the interaction terms of credit growth/distance to default and country dummies (Columns 1/2), interaction terms of a dummy variable for banks with large and rapidly growing foreign currency or household loan portfolios and country dummies (Columns 3/4 and 5/6). These coefficients measure the marginal effect vis-a-vis the average effect for all other banks. The models used for the analysis of country-specific effects follow the baseline specification (Table 1) and include country dummies and interaction terms. See Table 7. Country-specific results for foreign currency lending are available upon request.

72. **The findings about country-specific effects for foreign currency and household lending are less conclusive**, largely because bank-level data for these types of lending are dummy variables identifying banks with large and rapidly growing foreign currency and household loans (Appendix) rather than bank loan growth, as used in the analysis of total lending. Hence, no statistically significant cross-country differences are identified for these types of lending (Text Table 6).

#### D. Policy Implications

73. **The econometric results suggest that rapid credit growth in the NMS has not had a significant negative effect on bank soundness so far, but it has become ubiquitous**

**in recent years—with relatively weak and sound banks lending at an equally rapid pace.** A significant buildup of financial risks in the weaker banks risks undermining their soundness over time. Even if the weaker banks are nonsystemic, distress in these institutions might lead to contagion within the financial system and have systemic consequences. The econometric findings thus point to three main policy priorities in the NMS:

- close supervision of rapidly growing banks to ensure that these banks have adequate risk management systems in place and are pricing risks properly, in conjunction with the strengthening of prudential guidance for banks;
- improvements in market infrastructure and institutions supporting sound credit growth, such as credit bureaus and disclosure of information about financial risks to customers; and
- better understanding of the implications of credit growth for financial stability in the context of financial sector surveillance and macroprudential risk assessments (for specific measures in this area, see Box 3).

The upcoming implementation of the Basel II capital framework in major banks should help strengthen risk-based supervision; however, the benefits of Basel II are likely to come only over time, and the short-term impact is ambiguous. (Box 4 discusses prudential responses to rapid credit growth in the context of Basel II).

74. **The econometric results point to the need for a stronger prudential policy response in the Baltics than in the CEECs.** In the Baltics, there is either evidence that weaker banks are expanding more rapidly (Latvia and Lithuania) or that rapid credit growth has already weakened banks (Estonia). A stronger prudential policy response might involve, for example, using such risk-based measures as higher capital requirements and tighter loan classification and provisioning rules, differentiated on the bank-by-bank basis depending on the underlying risks.<sup>30</sup> There is also a need to calibrate the prudential policy response to individual country circumstances in the CEECs. The strongest case for strengthening prudential regulations exists in the Czech Republic, Hungary, and Slovenia, where credit growth recently has become independent of bank soundness. In Poland and the Slovak Republic, sounder institutions are expanding at a faster rate, suggesting that the prudential response can be less intense than in the above countries, all other things equal.

75. **Designing an effective prudential policy response to rapid credit growth is challenging.** Overly intrusive measures would unduly penalize rapidly expanding banks that are managing risks properly and might hinder financial deepening and economic convergence of the NMS. While creating additional distortions, overly intrusive policy

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<sup>30</sup> See Hilbers and others (2005) for a classification of policy options in responding to rapid credit growth.

measures might be ineffective, as banks may simply transfer business to the nonbank sector or offshore. Together with the lack of statistically significant evidence that rapid credit growth has weakened banks in the NMS, the above considerations suggest the need for giving priority to risk-based supervision as a way to contain the risks associated with rapid credit growth.

76. **In all NMS, priority needs to be given to strengthening the supervision of banks actively engaged in household and foreign currency lending.** Although, like corporate lending, lending to households has not yet had any identifiable adverse effect on bank soundness, and there are no statistically significant differences between the soundness of banks with large and rapidly growing household portfolios and that of other banks, the finding that weaker banks are expanding credit to households at a faster rate than other banks is a cause for concern. The same result holds for banks with large and rapidly growing foreign currency loan portfolios. This points to the need for close monitoring of household and foreign currency loan exposures and management practices of banks actively engaged in these types of lending. If supervisors identify weaknesses in this area, consideration might need to be given to introducing stronger provisioning or capital requirements for riskier banks or changing the risk weight on foreign currency or household lending.

77. **Other policy measures might also help manage prudential risks in the area of household lending.** Creating a regulatory framework conducive to the development of mortgage-backed instruments can help banks offload from their balance sheets some of the risks associated with household loans. Yet another policy approach would be to reduce or remove subsidies and tax incentives, which exist in some countries for real estate borrowing. Designing an effective policy framework in the area of household and foreign currency lending is particularly important, given the ample scope for a further expansion of this lending: market penetration in household lending remains considerably below the EU average, and investors expect NMS currencies to continue to appreciate as income convergence continues.

78. **Ensuring strong supervision of foreign-owned banks is also important.** The econometric results in this paper show that rapidly expanding foreign-owned banks, especially Nordic banks, are taking on more financial risks than domestically owned banks, although the strength of their parent banks compensates for the greater risk taking. This finding underscores the need for strong cross-border cooperation with foreign supervisors to ensure that any emerging signs of weaknesses are addressed in a timely and effective manner. Besides regular exchanges of supervisory information, which reportedly are already taking place in most NMS, cross-border cooperation with foreign supervisors might include tripartite meetings on the findings of NMS supervisory inspections (including not only

### Box 3. Strengthening Financial Sector Surveillance in the NMS 1/

Specific measures that could be taken to strengthen financial sector surveillance include the following:

**Financial Soundness Indicators**—NMS central banks and supervisory agencies already monitor a range of aggregate financial soundness indicators pertaining to the corporate and household sectors. It is important to monitor the distribution of these indicators, as aggregate data can conceal significant weaknesses in certain groups of households or enterprises. It might be useful to consider if the set can be expanded further to cover a broadest possible range of indicators (Sundararajan and others., 2002).

**Sectoral Models**—An econometric model of the household and corporate sector can help elaborate on the interaction among asset prices, household loans, private consumption expenditures, and housing investments. Evaluating the effect of macroeconomic conditions on the debt-servicing capacity of households and enterprises, and thereby on the credit risk of banks, is a critical complement of financial soundness indicators.

**Stress Testing**—Judging by published Financial Stability Reports and discussions with selected country authorities, most NMS have made significant progress recently in developing stress tests. Further improvements might be needed in stress testing household loan portfolios, for example, by (i) using disaggregated data on household debt to model the distribution of household indebtedness; and (ii) linking credit risk scenarios to changes in the underlying macroeconomic variables, based on country-specific models or other countries' experiences.

**Early Warning Systems**—The early warning systems based on backward-looking CAMEL (capital, asset quality, management, earnings, and liquidity) indicators can be enhanced further by including indicators that help predict bank failures. These can include credit growth rates, deposit rates, interbank market indicators (for example, spreads and access levels), indicators of banks' resilience (for example, postshock capital adequacy ratios from stress tests), and market-based measures (for example, if available, distance to default measures, or spreads on bank-issued bonds).

**Contagion Models**—Interbank contagion stress tests could provide insights into the possibility of contagion through various channels, including reputational effects.

**Loan Databases**—NMS central banks and supervisory agencies already collect data from a broad variety of sources. The immediate priority in many countries is collecting disaggregated data on household and corporate credit, for example, from a credit registry or large borrowers' registry, which would help refine stress testing. Further improvements in data collection might also be needed in such areas as (i) market indicators, especially housing prices; (ii) bankers' opinions; and (iii) flow of funds data.

**Balance Sheet Analysis**—Constructing national balance sheet accounts for the NMS might provide insights into balance sheet risks associated with rapid credit growth and the intersectoral distribution of these risks.

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1/ This box is based on Tamirisa and Čihák (2005).

#### **Box 4. Basel II and Prudential Risks Associated with Rapid Credit Growth 1/**

Will the introduction of the Basel Committee on Banking Supervision (BCBS)'s new "International Convergence of Capital Measurements and Capital Standards—A Revised Framework" (Basel II) help to address the risks associated with the rapid credit growth?

**The adoption of Basel II will bring more attention to risk management practices, disclosure, and market discipline.** Implementation of Basel II should align the prudential regulations closer with good risk management practices and encourage banks to develop their risk management systems. While much of the debate on Basel II has centered on Pillar 1 (capital adequacy), countries may benefit more, in the medium term, from implementation of Pillars 2 (supervisory practices) and 3 (expanded market discipline and disclosure).

**The role of Basel II in dampening the macroprudential risks should not be overstated, however.** The impact depends substantially on the implementation of the framework in individual banks. Basel II offers banks a number of options, while giving the new framework the necessary flexibility, also create challenges for microprudential and macroprudential surveillance. The framework also gives flexibility to supervisors (for example, under Pillar 2, they can differentiate capital requirements across banks, depending on the underlying risks). At least in the short term, before more experience is gained in implementing the new prudential framework, there may be a need for additional prudential measures, as per the discussion in the main text of this paper. A number of considerations are important in this respect:

- Basel II is by construction a microprudential framework that does not explicitly take into account macroprudential and macroeconomic concerns. Banks' risk management systems may therefore not be able to factor in the second- or further-round impacts of their actions on other market players.
- The EU Capital Requirements Directive (CRD; 2006/48/EC), through which the EU has implemented Basel II, will effectively limit member countries' scope to introduce rules that are stricter than the directive. The Brussels authorities seek to achieve as much convergence across the EU as possible in implementing the CRD and to avoid using the right to be stricter. Nevertheless, the use of bank-specific capital requirements under Pillar 2 will be the responsibility of the home supervisor (that is, supervisors from other EU countries in the case of the NMS, since many large banks in the NMS are foreign banks from those countries). The fact that the implementation of Basel II is likely to limit policy options available to the NMS supervisors for tightening prudential requirements reinforces the need for cooperation with foreign bank supervisors and regulators.
- The implications of Basel II for credit growth remain to be seen. Banks may tend to increase their holding of low-risk assets (with lower capital charges) and may reduce their holdings of those assets, which under Basel II generate a higher capital charge and put upward pressure on lending rates. These factors could shift the flow of credit from higher-risk sectors (for example, commercial real estate) to less risky sectors (for example, residential housing). The quantitative impact studies performed so far suggest that, at least in the short term, the implementation of Basel II will on average mean lower, rather than higher, capital requirements. These results need to be interpreted cautiously, but at the minimum they suggest that, in the short term, the scope for credit expansion is likely to increase rather than decrease.

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1/ The main contributor to this box is Martin Čihák. For a more detailed discussion of Basel II and its implications, see "Implementation of Basel II—Implications for the World Bank and IMF" (2005), available at [www.imf.org](http://www.imf.org).



representatives of NMS subsidiaries and NMS supervisors but also home country supervisors), joint inspections by home and host country supervisors of NMS foreign affiliates, and joint crisis management exercises. The challenge in implementing this recommendation is providing sufficient incentives for home country supervisors (and foreign bank owners) to get involved in cases where NMS subsidiaries account for only a small fraction of the parent bank's balance sheet or income statement.

### E. Concluding Remarks

79. **This study explores the prudential aspects of credit growth in the NMS using a regional bank-level data set and recognizing the two-way causality between credit growth and bank soundness.** The econometric analysis shows that credit growth in the NMS during the last decade has reflected financial deepening and various macroeconomic factors, such as strong economic growth, declining real interest rates, and exchange rate appreciation. Bank-specific factors, such as efficiency, profitability, soundness, and the degree of state ownership, have also influenced credit growth. Bank soundness has largely been a function of bank-specific factors (history, size, liquidity, and the degree of foreign ownership) and the level of economic and institutional development of the country where the bank is located.

80. **The econometric analysis suggests that rapid credit growth in the NMS has not weakened banks significantly so far but it has recently become independent of bank soundness.** These findings are broadly consistent with the conclusions based on a general analysis of financial soundness indicators and market indicators for the NMS, which do not point to any apparent signs of a deterioration in bank soundness in the NMS. The econometric findings imply, however, that, in the probabilistic sense, the prudential risks associated with rapid credit growth in the NMS have risen in recent years. Bank soundness indicators are not pointing to such emerging prudential risks, because they are largely based on system-wide statistics and do not take into account the dispersion of soundness indicators across individual banks. Based on the econometric analysis using bank-level data, increased prudential risks are most apparent in lending to households or in foreign currency and in the Baltic countries, where weaker banks are found to be expanding at a faster rate. Foreign banks seem willing to take on greater risks than domestic banks, and credit growth through the NMS affiliates of foreign-owned banks has been unrelated to their soundness; however, it is comforting that it has remained positively correlated with the soundness of their parent banks.

81. **Rapid expansion by weaker banks, some of which might also be weak in the absolute sense, raises prudential concerns.** Prudential risks might or might not materialize, depending, among other things, on the quality of banks' current lending decisions and risk management and macroeconomic conditions. If loan portfolios grow faster than banks' ability to assess and manage risks, credit risk might increase and asset quality might decline, reducing capital adequacy ratios. An overly rapid fall in capital levels—even if still in line with regulatory requirements—could damage confidence in the institution or lead to its

undercapitalization. This effect might not appear immediately, as portfolios take time to mature and risks to materialize, in particular when the new loans are highly profitable and earnings increase in the short term. Or, it might not materialize at all if banks strengthen their risk management capacity and build up capital cushions to compensate for increased risks.

**82. The finding that rapid credit growth in the NMS has not significantly weakened banks so far but has been associated with rising prudential risks underscores the importance of forward-looking and risk-based supervision.** Such supervision can help keep the risks associated with rapid credit growth at manageable levels, while maximizing the benefits of rapid credit growth for financial development and economic growth. The results in this paper imply a differentiated supervisory response across countries, depending on how significant the prudential risks associated with rapid credit growth are. A stronger policy response might be justified in countries where rapid credit expansion has weakened banks and/or weak banks are expanding rapidly. For example, a supervisor might need to ask for additional capital contributions or take other prudential action against a rapidly expanding weak bank to prevent slippages and an excessive buildup of risks. Particular supervisory attention also needs to be given to banks that are rapidly expanding credit to households and credit denominated or indexed to foreign currency. Financial sector surveillance and macroprudential analyses need to complement supervision and risk assessments conducted at the individual bank level. Close cooperation with foreign supervisors is essential throughout the region, given the important role foreign banks play in credit expansion in the NMS.

**83. Notwithstanding the above, the econometric findings need to be interpreted with caution.** The extensive robustness analyses using alternative measures of bank soundness provide a certain degree of comfort in the validity of the main conclusions of the paper. However, a broader and more forward-looking analysis, for example, country-specific stress testing, would be useful, since bank soundness measures tend to be a lagging indicator of prudential risks in an environment of rapidly growing credit. Since detailed country-specific stress testing is beyond the scope of this cross-country paper, and the paper's conclusions are tentative. They are intended to serve as only one of the many analytical inputs into Article IV consultations with individual countries.

**84. There are several ways to extend the econometric analysis presented in this paper.** Expanding the data set would compare the bank soundness implications of credit growth in the NMS to those in other emerging market countries. Also, it might be useful to explore the feasibility of compiling a more detailed regional bank-level data set using supervisory data.

Table 1. Baseline Specification

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.096*** [5.83]	-0.002 [1.14]	0.100*** [3.89]	-0.002 [0.76]	0.095*** [4.71]	-0.001 [0.54]
Distance to default (lagged)	0.229** [2.16]	0.896*** [85.84]	0.350* [1.94]	0.854*** [59.85]	0.147 [1.20]	0.927*** [62.15]
Real GDP growth (lagged)	2.646*** [5.53]		2.415*** [2.92]		2.475*** [4.38]	
GDP per capita (lagged)	-0.116** [1.99]	0.017*** [2.83]	-0.301*** [3.19]	0.029*** [3.90]	-0.057 [0.73]	0.007 [0.77]
Net interest margin (lagged)	0.689 [1.47]		1.757** [2.25]		1.200** [2.00]	
Cost-to-income ratio (lagged)	-0.017 [1.13]		-0.037** [1.96]		0.046 [1.49]	
Real interest rate (lagged)	-0.558* [1.65]		-0.864 [1.58]		-0.999** [2.24]	
Real depreciation (lagged)	-4.911* [1.95]		14.750** [2.45]		-7.414*** [2.65]	
Public ownership	-0.178*** [3.73]		-0.153** [2.39]		-0.067 [0.89]	
Liquidity ratio (lagged)		0.020*** [2.67]		0.013 [1.17]		0.027** [2.55]
Bank size (lagged)		0.311*** [3.33]		0.240** [2.07]		0.324** [2.22]
Foreign ownership		0.008*** [2.80]		0.012*** [3.28]		0.003 [0.69]
Constant	16.366*** [3.37]	-2.668*** [4.10]	15.992** [2.17]	-2.660*** [3.18]	12.721* [1.87]	-2.252** [2.25]
R-squared	0.13	0.91	0.16	0.92	0.15	0.90
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of z statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 2a. Robustness Analysis: Controlling for Country- and Year-Specific Factors

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.097*** [6.11]	-0.001 [0.83]	0.099*** [3.89]	-0.002 [0.76]	0.082*** [4.08]	0 [0.13]
Distance to default (lagged)	0.173* [1.69]	0.898*** [86.27]	0.405** [2.30]	0.852*** [59.03]	0.064 [0.54]	0.931*** [62.58]
Real GDP growth (lagged)	1.977*** [3.17]		2.602** [2.07]		2.942** [2.47]	
GDP per capita (lagged)	-0.509 [1.27]	0.055* [1.75]	-3.756** [2.35]	0.061 [0.62]	0.062 [0.11]	0.066 [1.49]
Net interest margin (lagged)	1.500*** [3.00]		0.680 [0.78]		1.950*** [3.21]	
Cost-to-income ratio (lagged)	-0.019 [1.27]		-0.035* [1.90]		0.038 [1.27]	
Real interest rate (lagged)	-0.873 [1.49]		-0.44 [0.52]		-0.85 [0.77]	
Real depreciation (lagged)	-2.191 [0.57]		6.885 [0.91]		-4.169 [0.93]	
Public ownership	-0.161*** [3.47]		-0.156** [2.47]		-0.067 [0.92]	
Liquidity ratio (lagged)		0.027*** [2.73]		0.022 [1.49]		0.033** [2.45]
Bank size (lagged)		0.333*** [3.26]		0.252* [1.96]		0.442*** [2.81]
Foreign ownership		0.006** [2.14]		0.012*** [3.09]		0.002 [0.44]
Constant	69.404 [1.43]			-5.524 [0.51]		
R-squared	0.22	0.91	0.24	0.92	0.21	0.91
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of  $z$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 2b. Robustness Analysis: Using An Alternative Measure of Foreign Ownership

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)	0.098*** [5.98]	-0.002 [1.14]	0.105*** [4.07]	-0.002 [0.73]	0.095*** [4.69]	-0.001 [0.52]
Distance to default (lagged)	0.240** [2.27]	0.896*** [85.80]	0.350* [1.93]	0.854*** [59.79]	0.149 [1.22]	0.926*** [62.11]
Real GDP growth (lagged)	2.723*** [5.65]		2.533*** [3.02]		2.486*** [4.40]	
GDP per capita (lagged)	-0.102* [1.71]	0.016*** [2.65]	-0.272*** [2.74]	0.029*** [3.90]	-0.056 [0.72]	0.006 [0.65]
Net interest margin (lagged)	0.732 [1.53]		1.934** [2.35]		1.196** [1.99]	
Cost-to-income ratio (lagged)	-0.017 [1.10]		-0.037* [1.95]		0.046 [1.50]	
Real interest rate (lagged)	-0.569* [1.68]		-0.918* [1.67]		-0.990** [2.22]	
Real depreciation (lagged)	-4.801* [1.89]		15.157** [2.50]		-7.446*** [2.65]	
Foreign-owned banks	2.457 [0.88]	0.589** [2.03]	4.222 [0.89]	1.134*** [2.98]	-0.346 [0.11]	0.129 [0.30]
Publicly owned banks	-13.059*** [2.76]	-0.343 [0.67]	-9.498 [1.47]	0.288 [0.50]	-5.264 [0.73]	-0.689 [0.74]
Liquidity ratio (lagged)		0.020*** [2.62]		0.012 [1.12]		0.026** [2.49]
Bank size (lagged)		0.337*** [3.27]		0.208 [1.57]		0.367** [2.34]
Constant	13.170** [2.36]	-2.670*** [4.05]	10.448 [1.15]	-2.520*** [2.95]	12.674* [1.72]	-2.337** [2.31]
R-squared	0.13	0.91	0.16	0.92	0.15	0.90
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of  $t$  statistics in brackets; \* significant at 10 percent, \*\* significant at 5 percent, \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 2c. Robustness Analysis: Adding a Measure of Financial Development

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)	0.095*** [5.81]	-0.002 [1.14]	0.101*** [3.88]	-0.002 [0.79]	0.095*** [4.74]	-0.001 [0.51]
Distance to default (lagged)	0.228** [2.15]	0.896*** [85.65]	0.350* [1.94]	0.853*** [59.39]	0.136 [1.11]	0.927*** [62.22]
Real GDP growth (lagged)	2.611*** [5.12]		2.435*** [2.64]		2.154*** [3.55]	
GDP per capita (lagged)	-0.113* [1.87]	0.017*** [2.69]	-0.303*** [3.16]	0.030*** [3.96]	-0.012 [0.14]	0.003 [0.27]
Credit-to-GDP ratio (lagged)	-0.023 [0.20]	0.000 [0.02]	0.012 [0.07]	-0.009 [0.76]	-0.353 [1.52]	0.025 [0.91]
Net interest margin (lagged)	0.66 [1.34]		1.774** [2.07]		1.200** [2.01]	
Cost-to-income ratio (lagged)	-0.018 [1.14]		-0.037* [1.95]		0.047 [1.55]	
Real interest rate (lagged)	-0.556* [1.65]		-0.869 [1.56]		-1.173** [2.54]	
Real depreciation (lagged)	-4.895* [1.94]		14.749** [2.45]		-7.518*** [2.70]	
Public ownership	-0.177*** [3.71]		-0.154** [2.39]		-0.068 [0.91]	
Liquidity ratio (lagged)		0.020** [2.50]		0.017 [1.39]		0.024** [2.21]
Bank size (lagged)		0.311*** [3.25]		0.270** [2.21]		0.315** [2.15]
Foreign ownership		0.008*** [2.79]		0.013*** [3.34]		0.003 [0.69]
Constant	17.213*** [2.66]	-2.672*** [4.07]	15.545 [1.51]	-2.708*** [3.23]	23.190** [2.38]	-2.719** [2.44]
R-squared	0.13	0.91	0.16	0.92	0.16	0.90
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of  $z$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 2d. Robustness Analysis: Using a Narrower Measure of Bank Soundness—Nonperforming Loans

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth	Equation 2: Nonperforming Loans	Equation 1: Bank Credit Growth	Equation 2: Nonperforming Loans	Equation 1: Bank Credit Growth	Equation 2: Nonperforming Loans
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)	0.075 [1.43]	-0.04 [1.09]	0.089 [1.28]	-0.033 [0.76]	-0.011 [0.17]	-0.043 [0.84]
Nonperforming loans (lagged)	-0.006 [0.14]	0.120*** [3.88]	-0.025 [0.47]	0.076** [2.22]	0.262*** [2.75]	0.754*** [9.88]
Real GDP growth (lagged)	2.625*** [2.58]		3.129** [2.15]		2.109** [2.23]	
GDP per capita (lagged)	-0.280** [2.16]	-0.035 [0.41]	-0.386** [2.02]	0.017 [0.15]	-0.219* [1.86]	-0.145 [1.63]
Net interest margin (lagged)	2.097* [1.82]		2.506 [1.59]		5.397*** [3.04]	
Cost-to-income ratio (lagged)	-0.085*** [3.22]		-0.099*** [3.09]		0.099 [1.48]	
Real interest rate (lagged)	-1.332** [2.33]		-1.674** [2.00]		-1.245* [1.84]	
Real depreciation (lagged)	3.792 [0.68]		13.587 [1.52]		-10.722** [2.26]	
Public ownership	-0.204*** [2.63]		-0.198* [1.92]		-0.119 [1.12]	
Liquidity ratio (lagged)		-0.359*** [2.86]		-0.276 [1.58]		-0.171 [1.27]
Bank size (lagged)		-1.573 [1.49]		-1.496 [1.12]		-2.052 [1.62]
Foreign ownership		0.107*** [2.59]		0.131** [2.35]		0.034 [0.73]
Constant	28.265** [2.55]	32.515*** [3.66]	28.711* [1.73]	27.793** [2.55]	0.711 [0.05]	31.198*** [2.75]
R-squared	0.23	0.15	0.24	0.12	0.46	0.62
Observations	221	221	145	145	76	76

Source: IMF staff estimates.

Notes: Absolute value of  $t$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is the ratio of nonperforming loans to total loans. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 2e. Robustness Analysis: Using a Narrower Measure of Bank Soundness—Loan Loss Reserves

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth	Equation 2: Loan Loss Reserves	Equation 1: Bank Credit Growth	Equation 2: Loan Loss Reserves	Equation 1: Bank Credit Growth	Equation 2: Loan Loss Reserves
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)	0.086*** [4.04]	-0.012 [0.50]	0.085*** [2.70]	-0.023 [0.50]	0.100*** [3.66]	-0.004 [1.56]
Loan loss reserves (lagged)	11.592*** [4.12]	62.940*** [19.88]	11.837*** [3.83]	62.020*** [13.86]	59.944* [1.76]	68.459*** [22.26]
Real GDP growth (lagged)	2.808*** [4.86]		1.970** [2.07]		2.299*** [3.28]	
GDP per capita (lagged)	-0.085 [1.22]	0.034 [0.43]	-0.235** [2.20]	0.055 [0.36]	-0.002 [0.03]	0.002 [0.21]
Net interest margin (lagged)	0.417 [0.58]		2.607*** [2.62]		0.242 [0.19]	
Cost-to-income ratio (lagged)	-0.041** [2.11]		-0.059*** [2.71]		0.192** [2.25]	
Liquidity ratio (lagged)	-0.744* [1.65]		-0.984 [1.49]		-0.839 [1.35]	
Bank size (lagged)	-2.961 [1.02]		14.165** [2.15]		-2.938 [1.01]	
Real interest rate (lagged)	-0.230*** [4.15]		-0.177** [2.40]		-0.158* [1.85]	
Real depreciation (lagged)		0.109 [1.03]		0.187 [0.83]		0.009 [0.96]
Foreign ownership		-1.101 [0.88]		-2.813 [1.19]		0.341*** [2.68]
Public ownership		-0.026 [0.59]		-0.029 [0.33]		-0.009** [2.20]
Constant	21.241*** [3.32]	7.831 [0.90]	16.696* [1.84]	18.093 [1.07]	5.478 [0.51]	-0.78 [0.91]
R-squared	0.15	0.42	0.18	0.42	0.17	0.70
Observations	585	585	301	301	284	284

Source: IMF staff estimates.

Notes: Absolute value of  $t$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is loan loss reserves as a proportion of total loans. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.



Table 3a. Are the Baltics and the CEECs Different? Full-Sample Analysis

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.096*** [5.84]	-0.001 [0.53]	0.095*** [3.64]	0.002 [0.51]	0.094*** [4.70]	-0.003 [1.08]
Bank credit growth in Baltic banks (lagged)		-0.002 [0.73]		-0.006 [1.38]		0.009 [1.38]
Distance to default (lagged)	0.313*** [2.59]	0.897*** [85.85]	0.241 [1.23]	0.854*** [59.73]	0.433*** [3.01]	0.928*** [62.28]
Distance to default of Baltic banks (lagged)	-0.346 [1.43]		0.684 [1.46]		-0.961*** [3.72]	
Real GDP growth (lagged)	2.522*** [4.43]		2.514*** [2.85]		1.790** [2.35]	
GDP per capita (lagged)	-0.118* [1.74]	0.018*** [2.89]	-0.293*** [2.84]	0.030*** [3.67]	-0.05 [0.56]	0.009 [0.87]
Net interest margin (lagged)	0.703 [1.50]		1.758** [2.25]		1.467** [2.47]	
Cost-to-income ratio (lagged)	-0.018 [1.17]		-0.035* [1.87]		0.054* [1.78]	
Real interest rate (lagged)	-0.477 [1.30]		-0.944 [1.53]		-0.817* [1.82]	
Real depreciation (lagged)	-5.078** [1.99]		15.087** [2.49]		-8.315*** [3.01]	
Public ownership	-0.178*** [3.74]		-0.155** [2.42]		-0.076 [1.03]	
Baltic banks	5.086 [0.96]	0.404 [0.96]	-6.839 [0.81]	0.302 [0.50]	18.209*** [2.77]	-0.162 [0.26]
Liquidity ratio (lagged)		0.021*** [2.76]		0.015 [1.35]		0.029*** [2.78]
Bank size (lagged)		0.337*** [3.37]		0.252** [1.96]		0.364** [2.37]
Foreign ownership		0.008*** [2.85]		0.012*** [3.19]		0.002 [0.56]
Constant	15.241*** [2.91]	-3.031*** [3.80]	17.060** [2.15]	-2.883*** [2.69]	7.321 [1.04]	-2.631** [2.15]
R-squared	0.13	0.91	0.16	0.92	0.17	0.90
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of *t* statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 3b. Are the Baltics and the CEECs Different? Robustness to Excluding Lagged Dependent Variable

	1995-2004		1995-2000		2001-2004	
	Equation 1:	Equation 2:	Equation 1:	Equation 2:	Equation 1:	Equation 2:
	Bank Credit Growth	Distance to Default	Bank Credit Growth	Distance to Default	Bank Credit Growth	Distance to Default
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)		0.002 [0.27]		0.018* [1.94]		-0.007 [0.83]
Bank credit growth in Baltic banks (lagged)		0.002 [0.16]		-0.006 [0.46]		-0.009 [0.47]
Distance to default (lagged)	0.444*** [3.60]		0.447** [2.26]		0.507*** [3.43]	
Distance to default of Baltic banks (lagged)	-0.283 [1.14]		0.955** [2.03]		-0.911*** [3.38]	
Real GDP growth (lagged)	2.742*** [4.71]		2.846*** [3.19]		2.047*** [2.59]	
GDP per capita (lagged)	-0.164** [2.39]	0.176*** [9.46]	-0.372*** [3.59]	0.193*** [8.28]	-0.048 [0.53]	0.154*** [5.13]
Net interest margin (lagged)	0.784 [1.63]		1.697** [2.14]		1.306** [2.11]	
Cost-to-income ratio (lagged)	-0.018 [1.12]		-0.034* [1.76]		0.049 [1.56]	
Real interest rate (lagged)	-0.505 [1.34]		-0.902 [1.44]		-0.774* [1.66]	
Real depreciation (lagged)	-6.800*** [2.63]		12.365** [2.03]		-9.252*** [3.23]	
Public ownership	-0.186*** [3.82]		-0.180*** [2.79]		-0.051 [0.66]	
Baltic banks	5.64 [1.05]	-1.05 [0.82]	-6.337 [0.74]	-2.492 [1.36]	18.013*** [2.64]	0.283 [0.15]
Liquidity ratio (lagged)		0.029 [1.25]		0.056* [1.65]		0.013 [0.41]
Bank size (lagged)		-0.754** [2.48]		-1.042*** [2.68]		-0.417 [0.87]
Foreign ownership		0.016* [1.82]		0.025** [2.13]		0.004 [0.33]
Constant	18.173*** [3.42]	6.756*** [2.79]	21.119*** [2.66]	6.092* [1.87]	9.023 [1.24]	7.271* [1.93]
R-squared	0.10	0.12	0.14	0.21	0.13	0.07
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of z statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 3c. Are the Baltics and the CEECs Different? Full Sample: Robustness to Subsample Analysis (the Baltics)

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.057* [1.65]	-0.002 [0.59]	-0.008 [0.18]	-0.001 [0.54]	0.103* [1.76]	0.003 [0.35]
Distance to default (lagged)	0.149 [0.52]	0.853*** [35.01]	1.802*** [3.00]	0.750*** [26.00]	-0.282 [1.03]	0.887*** [25.73]
Real GDP growth (lagged)	3.352* [1.91]		1.973 [0.91]		1.027 [0.32]	
GDP per capita (lagged)	-0.08 [0.10]	0.115*** [2.60]	-2.579 [1.54]	0.222*** [2.79]	-1.246 [1.20]	0.096 [1.37]
Net interest margin (lagged)	-1.452 [0.75]		-1.123 [0.42]		-3.153 [1.13]	
Cost-to-income ratio (lagged)	0.007 [0.15]		0.012 [0.25]		0.396** [2.55]	
Real interest rate (lagged)	-2.320* [1.85]		-5.162*** [3.21]		1.197 [0.35]	
Real depreciation (lagged)	0.218 [0.03]		22.708** [2.19]		-11.33 [1.34]	
Public ownership	-0.147 [0.89]		0.112 [0.51]		-0.102 [0.44]	
Liquidity ratio (lagged)		-0.007 [0.30]		0.052** [2.03]		-0.027 [0.79]
Bank size (lagged)		0.339 [1.16]		0.207 [0.80]		0.293 [0.60]
Foreign ownership		-0.004 [0.49]		-0.005 [0.62]		-0.004 [0.26]
Constant	24.151 [0.80]	-4.914*** [2.68]	90.082 [1.59]	-7.395*** [3.10]	64.605 [1.40]	-4.202 [1.22]
R-squared	0.08	0.88	0.27	0.92	0.16	0.88
Observations	176	176	76	76	100	100

Source: IMF staff estimates.

Notes: Absolute value of z statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 3d. Are the Baltics and the CEECs Different? Full Sample: Robustness to Subsample Analysis (CEECs)

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.116*** [6.11]	-0.001 [0.67]	0.191*** [5.48]	0.001 [0.25]	0.088*** [4.27]	-0.003 [1.16]
Distance to default (lagged)	0.313*** [2.81]	0.910*** [79.49]	0.151 [0.87]	0.868*** [54.21]	0.395*** [2.91]	0.944*** [58.77]
Real GDP growth (lagged)	1.804*** [2.98]		1.497 [1.57]		1.944*** [2.59]	
GDP per capita (lagged)	-0.093 [1.46]	0.015** [2.45]	-0.218** [2.30]	0.027*** [3.12]	-0.043 [0.52]	0.006 [0.64]
Net interest margin (lagged)	1.043** [2.18]		1.518** [1.98]		1.702*** [2.96]	
Cost-to-income ratio (lagged)	-0.018 [1.10]		-0.040** [2.10]		0.034 [1.18]	
Real interest rate (lagged)	-0.242 [0.64]		0.656 [0.97]		-0.930** [2.19]	
Real depreciation (lagged)	-7.888** [2.40]		41.678*** [4.21]		-10.505*** [2.98]	
Public ownership	-0.164*** [3.46]		-0.141** [2.30]		-0.053 [0.72]	
Liquidity ratio (lagged)		0.025*** [3.18]		0.014 [1.16]		0.038*** [3.70]
Bank size (lagged)		0.331*** [3.13]		0.241* [1.66]		0.389** [2.51]
Foreign ownership		0.010*** [3.20]		0.014*** [3.18]		0.003 [0.60]
Constant	12.836** [2.57]	-3.130*** [3.68]	7.077 [0.96]	-2.870** [2.38]	7.527 [1.13]	-3.056** [2.47]
R-squared	0.13	0.91	0.21	0.91	0.15	0.91
Observations	705	705	348	348	357	357

Source: IMF staff estimates.

Notes: Absolute value of z statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 4a. Are Foreign-Owned Banks Different from Domestically Owned Banks? Full-Sample Analysis

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.097*** [5.91]	-0.002 [1.14]	0.104*** [4.03]	-0.003 [0.99]	0.096*** [4.75]	-0.001 [0.30]
Credit growth in foreign-owned banks (lagged)		0.001 [0.36]		0.003 [0.71]		-0.001 [0.26]
Distance to default (lagged)	0.429*** [3.10]	0.897*** [85.76]	0.456** [2.15]	0.855*** [59.74]	0.398** [2.26]	0.927*** [62.12]
Distance to default of foreign-owned banks (lagged)	-0.448** [2.12]		-0.380 [0.96]		-0.466** [1.96]	
Real GDP growth (lagged)	2.665*** [5.54]		2.436*** [2.89]		2.485*** [4.42]	
GDP per capita (lagged)	-0.134** [2.18]	0.016*** [2.77]	-0.293*** [2.88]	0.028*** [3.77]	-0.094 [1.17]	0.007 [0.76]
Net interest margin (lagged)	0.652 [1.36]		1.874** [2.27]		1.158* [1.94]	
Cost-to-income ratio (lagged)	-0.016 [1.01]		-0.036* [1.88]		0.048 [1.57]	
Real interest rate (lagged)	-0.539 [1.60]		-0.900 [1.64]		-0.947** [2.13]	
Real depreciation (lagged)	-5.123** [2.02]		15.275** [2.52]		-7.924*** [2.82]	
Foreign ownership	8.069** [2.09]	0.622** [2.12]	8.709 [1.31]	0.932** [2.46]	5.85 [1.29]	0.284 [0.64]
Public ownership	-12.897*** [2.75]		-9.254 [1.43]		-5.129 [0.72]	
Liquidity ratio (lagged)		0.020*** [2.65]		0.013 [1.18]		0.026** [2.48]
Bank size (lagged)		0.311*** [3.31]		0.241** [2.08]		0.331** [2.25]
Constant	12.857** [2.31]	-2.594*** [3.96]	10.782 [1.19]	-2.559*** [3.05]	11.156 [1.51]	-2.277** [2.26]
R-squared	0.14	0.91	0.16	0.92	0.16	0.90
Observations	881	881	424	424	457	457

Source: IMF staff estimates.

Notes: Absolute value of  $t$ -statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 4b. Are Foreign-Owned Banks Different from Domestically Owned Banks? Robustness to Subsample Analysis (Foreign-Owned Banks)

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default	Equation 1: Bank Credit Growth	Equation 2: Distance to Default
	(1)	(2)	(3)	(4)	(5)	(6)
Bank credit growth (lagged)	0.074*** [2.67]	-0.0003 [0.16]	0.109*** [2.67]	0.0002 [0.10]	0.051 [1.37]	-0.001 [0.07]
Distance to default (lagged)	-0.101 [0.64]	0.949*** [66.51]	-0.035 [0.11]	0.890*** [28.53]	-0.043 [0.26]	0.972*** [64.47]
Real GDP growth (lagged)	3.282*** [4.75]		3.435*** [2.72]		2.412*** [3.03]	
GDP per capita (lagged)	-0.005 [0.05]	-0.002 [0.17]	0.396 [1.43]	0.03 [1.26]	-0.244** [2.04]	-0.01 [0.88]
Net interest margin (lagged)	1.149 [1.54]		3.376** [2.23]		1.725** [2.11]	
Cost-to-income ratio (lagged)	-0.049** [2.20]		-0.075*** [2.98]		0.255*** [2.97]	
Real interest rate (lagged)	-0.502 [1.06]		-0.453 [0.56]		-1.153* [1.95]	
Real depreciation (lagged)	-3.42 [0.96]		13.022 [1.56]		-10.618*** [2.73]	
Public ownership	-0.458 [1.42]		-0.744 [1.64]		-0.228 [0.49]	
Liquidity ratio (lagged)		0.031*** [3.55]		0.015 [0.87]		0.043*** [4.31]
Bank size (lagged)		0.326** [2.33]		0.232 [0.87]		0.354** [2.26]
Constant	15.105** [1.96]	-2.050** [2.06]	-18.79 [1.13]	-2.123 [1.09]	9.591 [0.88]	-2.258* [1.96]
R-squared	0.13	0.92	0.18	0.85	0.18	0.95
Observations	415	415	168	168	247	247

Source: IMF staff estimates.

Notes: Absolute value of  $t$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 4c. Are Foreign-Owned Banks Different from Domestically Owned Banks? Robustness to Subsample Analysis (Domestically Owned Banks)

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.102*** [4.95]	-0.002 [0.78]	0.096*** [2.90]	-0.002 [1.01]	0.111*** [4.61]	-0.001 [0.28]
Distance to default (lagged)	0.529*** [3.60]	0.845*** [55.40]	0.586*** [2.65]	0.840*** [52.80]	0.398*** [2.18]	0.850*** [30.73]
Real GDP growth (lagged)	2.149*** [3.12]		2.044* [1.80]		2.925*** [3.38]	
GDP per capita (lagged)	-0.197*** [2.59]	0.034*** [4.45]	-0.402*** [3.54]	0.031*** [4.10]	0.035 [0.30]	0.036** [2.42]
Net interest margin (lagged)	0.531 [0.83]		1.989** [2.02]		0.738 [0.84]	
Cost-to-income ratio (lagged)	0.012 [0.55]		0.007 [0.23]		0.026 [0.81]	
Real interest rate (lagged)	-0.562 [1.16]		-1.365* [1.83]		-0.098 [0.14]	
Real depreciation (lagged)	-6.142* [1.68]		18.402** [2.20]		-6.741* [1.67]	
Public ownership	-0.157*** [3.03]		-0.130* [1.84]		-0.055 [0.71]	
Liquidity ratio (lagged)		-0.009 [0.71]		0.003 [0.18]		-0.014 [0.67]
Bank size (lagged)		0.193 [1.52]		0.206* [1.65]		0.109 [0.44]
Constant	16.023** [2.08]	-1.806** [2.08]	15.186 [1.34]	-2.186** [2.42]	2.612 [0.24]	-1.034 [0.64]
R-squared	0.16	0.90	0.20	0.94	0.18	0.86
Observations	466	466	256	256	210	210

Source: IMF staff estimates.

Notes: Absolute value of  $t$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems.

Table 5. Are Banks with Large and Rapidly Growing Foreign Currency Exposure Different from Other Banks?

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.105*** [4.40]	-0.001 [0.13]	0.157*** [4.25]	0.012*** [2.60]	0.073** [2.51]	-0.006 [1.64]
Credit growth in banks exposed to foreign exchange risk (lagged)		-0.013 [1.34]		-0.028*** [2.74]		0.007 [0.32]
Distance to default (lagged)	0.346*** [2.70]	0.903*** [61.23]	0.422** [2.44]	0.850*** [43.69]	0.279* [1.68]	0.936*** [45.40]
Distance to default of banks exposed to foreign exchange risk (lagged)	-0.680* [1.66]		0.006 [0.01]		-0.794* [1.74]	
Real GDP growth (lagged)	2.681*** [4.46]		3.497*** [3.91]		3.495*** [4.27]	
GDP per capita (lagged)	-0.123* [1.96]	0.018** [2.43]	-0.225*** [2.77]	0.036*** [3.92]	-0.118 [1.32]	0.013 [1.09]
Net interest margin (lagged)	0.881 [1.28]		3.754*** [4.54]		1.242 [1.00]	
Cost-to-income ratio (lagged)	0.011 [0.49]		0.007 [0.36]		-0.037 [0.52]	
Real interest rate (lagged)	-0.638 [1.55]		-0.133 [0.23]		-1.015* [1.94]	
Real depreciation (lagged)	-3.919 [1.54]		26.407*** [4.98]		-4.679 [1.51]	
Public ownership	-0.160*** [3.16]		-0.075 [1.28]		-0.079 [0.96]	
Banks exposed to foreign exchange risk	33.429*** [3.69]	-0.123 [0.15]	23.238 [1.48]	0.676 [0.64]	29.541*** [2.80]	-0.858 [0.70]
Liquidity ratio (lagged)		0.035*** [3.17]		0.034*** [2.07]		0.049*** [3.29]
Bank size (lagged)		0.282** [2.03]		0.381** [2.16]		0.125 [0.62]
Foreign ownership		0.007* [1.70]		0.011* [1.88]		-0.001 [0.15]
Constant	9.808* [1.78]	-2.945*** [2.67]	-20.243*** [2.85]	-4.465*** [3.14]	18.981* [1.90]	-1.544 [0.96]
R-squared	0.21	0.91	0.41	0.94	0.22	0.90
Observations	455	455	197	197	258	258

Source: IMF staff estimates.

Notes: Absolute value of  $t$ -statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems. Banks that are exposed to foreign exchange risk are defined as those with higher-than-average proportion of foreign-currency-denominated loans and higher-than-average rate of growth in the proportion of foreign-currency-denominated loans. The sample is composed of Czech, Estonian, Lithuanian, Polish, Slovak, and Slovenian banks.



Table 6. Are Banks with Large and Rapidly Growing Exposure to Households Different from Other Banks?

	1995-2004		1995-2000		2001-2004	
	Equation 1: Bank Credit Growth (1)	Equation 2: Distance to Default (2)	Equation 1: Bank Credit Growth (3)	Equation 2: Distance to Default (4)	Equation 1: Bank Credit Growth (5)	Equation 2: Distance to Default (6)
Bank credit growth (lagged)	0.127*** [6.42]	-0.0005 [0.19]	0.180*** [5.45]	0.006 [1.50]	0.086*** [3.80]	-0.004 [1.18]
Credit growth in banks exposed to households (lagged)		0.003 [0.31]		-0.004 [0.52]		0.011 [0.58]
Distance to default (lagged)	0.417*** [3.36]	0.899*** [62.97]	0.613*** [3.33]	0.849*** [44.60]	0.355*** [2.38]	0.931*** [46.23]
Distance to default of banks exposed to households (lagged)	-0.791** [2.28]		-0.886** [2.16]		-1.889*** [2.86]	
Real GDP growth (lagged)	2.483*** [4.31]		3.991*** [4.49]		3.585*** [4.64]	
GDP per capita (lagged)	-0.154*** [2.59]	0.018** [2.52]	-0.375*** [4.68]	0.033*** [3.74]	-0.065 [0.79]	0.01 [0.92]
Net interest margin (lagged)	0.955 [1.62]		2.318*** [3.00]		1.830** [2.05]	
Cost-to-income ratio (lagged)	0.023 [1.20]		0.006 [0.30]		0.03 [1.01]	
Real interest rate (lagged)	-0.725* [1.84]		-0.447 [0.76]		-0.766 [1.57]	
Real depreciation (lagged)	-2.586 [1.06]		26.291*** [5.04]		-4.706 [1.61]	
Public ownership	-0.172*** [3.49]		-0.103* [1.76]		-0.059 [0.76]	
Banks exposed to households	33.672*** [4.22]	-0.659 [0.86]	50.436*** [4.35]	0.524 [0.60]	28.312*** [2.68]	-1.537 [1.11]
Liquidity ratio (lagged)		0.027*** [2.65]		0.02 [1.30]		0.039*** [2.84]
Bank size (lagged)		0.300** [2.27]		0.389** [2.32]		0.156 [0.81]
Foreign ownership		0.008* [1.93]		0.015*** [2.70]		0.001 [0.22]
Constant	10.593** [2.02]	-2.869*** [2.77]	-8.001 [1.16]	-4.131*** [3.09]	7.025 [0.93]	-1.536 [1.01]
R-squared	0.24	0.91	0.45	0.93	0.24	0.89
Observations	500	500	215	215	285	285

Source: IMF staff estimates.

Notes: Absolute value of  $z$  statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems. Banks that are exposed to households are defined as those with higher-than-average proportion of loans to households and higher-than-average rate of growth in the proportion of loans to households. The sample is composed of Czech, Estonian, Lithuanian, Polish, Slovak, and Slovenian banks.

Table 7. Cross-Country Differences in Total Loans: Full Sample, 2001-04

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default	Eq. 1: Bank Credit Growth	Eq. 2: Distance to Default
Bank credit growth (lagged)	-0.0002 [0.06]	-0.0001 [0.26]	0.0003 [0.12]	-0.0002 [0.59]	-0.0002 [0.70]	-0.0001 [0.39]	-0.0004* [0.36]	0.0004 [0.40]	0.063*** [2.76]	-0.0001 [0.39]	-0.0004* [1.37]	-0.0001 [0.33]				
Bank credit growth (lagged) in the Czech Republic																
Bank credit growth (lagged) in Hungary																
Bank credit growth (lagged) in Poland I/																
Bank credit growth (lagged) in the Slovak Republic																
Bank credit growth (lagged) in Slovenia																
Bank credit growth (lagged) in Estonia																
Bank credit growth (lagged) in Latvia																
Bank credit growth (lagged) in Lithuania																
Distance to default (lagged)	0.129 [0.93]	0.121 [0.96]	0.040 [0.31]	0.079 [0.62]	0.129 [0.97]	0.138 [1.12]	0.245* [1.82]	0.283** [2.21]	0.018** [2.50]	0.245* [1.82]	0.283** [2.21]	-0.006 [0.50]				
Distance to default (lagged) in the Czech Republic																
Distance to default (lagged) in Hungary																
Distance to default (lagged) in Poland I/																
Distance to default (lagged) in the Slovak Republic																
Distance to default (lagged) in Slovenia																
Distance to default (lagged) in Estonia																
Distance to default (lagged) in Latvia																
Distance to default (lagged) in Lithuania																
R-squared	0.17	0.90	0.16	0.90	0.16	0.90	0.15	0.90	0.15	0.90	0.15	0.90	0.15	0.90	0.18	0.90
Observations	457	457	457	457	455	455	457	457	457	457	457	457	457	457	457	457

Source: IMF staff estimates.

Notes: Absolute value of  $t$ -statistics in brackets; \* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent. The dependent variable in the first equation is annual percent change in outstanding loans. In the second equation, the dependent variable is distance to default. The latter is estimated based on bank accounts. All variables, except foreign and public ownership, on the right-hand side of both equations are lagged by one year to avoid simultaneity problems. The regression equations follow the baseline specification, as in Table 1, with the addition of country-specific dummy and interaction variables one at a time. For concerns of space and simplicity, only the coefficients of interest are reported. The sample is composed of Czech, Estonian, Lithuanian, Polish, Slovak, and Slovenian banks.

I/ Excluding data for an outlier, a small, rapidly growing Polish bank with a large share of irregular loans, in the regressions with Polish dummy and interaction variables. See background paper for the 2006 Article IV Consultation with Poland.

## Appendix. Data Sources and Definitions

Macroeconomic data were taken from the February 2006 version of the IMF's *International Financial Statistics*. Bank-level data were downloaded from the February 2006 version of Bankscope<sup>31</sup> and cleaned up by carefully matching bank identities and deleting duplicate entries, as well as the entries with possible measurement errors. The Bankscope data set was complemented with confidential supervisory data on the composition of bank loans obtained from the central banks of all NMS, except Latvia and Hungary, as well as data on bank ownership from various sources, such as *Euromoney* and banks' websites. Details on the coverage and compatibility of different components of the data set are also presented below. Appendix Tables 1–2 present the summary statistics for the final data set. The definitions of variables and units of measurement for bank-level and macroeconomic data are presented in Appendix Table 3.

**Matching bank identifiers.** Bankscope uses a unique identifier for each bank. This identifier remains unchanged when the bank's name changes and sometimes even when the bank is merged with or acquired by another bank. Only if a merger or an acquisition intrinsically changes the bank is a new identifier assigned to the new bank. Data for the banks operating in the NMS during 2002–04 were first downloaded using the February 2006 update of Bankscope. The data were then merged with the historical data set provided by Ugo Panizza, using the unique identifiers and cross-checking based on the 2002 data.

**Avoiding duplications.** Bankscope includes both consolidated and unconsolidated balance sheet data. When both are available for the same bank, a different identifier is assigned to each type of data. Moreover, at the time of mergers, the banks involved might stay in the data set along with the merged entity. To make sure that observations are not duplicated for the same bank, the following procedure was applied to include information from only one of the balance sheets. First, using the "rank" variable in Bankscope, which ranks the banks within a country, nonranked banks were dropped to avoid duplications. However, a second step was necessary to make sure that the duplication was not due to a merger event. If a bank was not ranked but had assets greater than the country average, its history of mergers and acquisitions was examined carefully. Next, the premerger banks were reranked to ensure that they were included in the data set, and the postmerger banks were deranked to exclude them from the premerger period. Many such banks had both consolidated and unconsolidated balance sheets. To be able to identify individual banks, the unconsolidated data were preserved when

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<sup>31</sup> The Bankscope data set for 1995–2002 was provided by Ugo Panizza. These data were used in an econometric study of bank ownership and performance in developing and industrial countries (Micco, Panizza, and Yañez, 2004).

both balance sheets were available. If unconsolidated data were unavailable, consolidated data were used to avoid dropping the banks from the sample.

**Excluding outliers.** To ensure that the analysis is not affected by potential measurement errors and misreporting, about 4 percent of the observations on the tails of the distributions of the two main variables (bank-level credit growth and distance to default) were dropped.

**Coding ownership.** Bankscope does not provide historical information about bank ownership; it provides only the share held by foreign and public investors in the current year. Thanks to extensive work by Micco, Panizza and Yañez (2004), the historical ownership data up to 2002 were available for the study. While extending the time coverage to 2004, the most recent ownership information from Bankscope data on NMS banks was obtained. This information was complemented with information from banks' websites and Bankscope data on parent banks to update ownership information for 2003 and 2004.

**Merging in loan breakdowns.** The central banks in six of the eight NMS included in the study provided bank-by-bank data on the composition of loans, as collected by supervisory authorities. The data covered the period from 1995 to 2005 (except in the Czech Republic, where the coverage was from 2000 to 2005) and broke down total loans into (i) loans to households in local currency, (ii) loans to corporates in local currency, (iii) loans to households in foreign currency, and (iv) loans to corporates in foreign currency. For confidentiality reasons, most countries were unable to disclose the identity of the banks. Banks from the supervisory data set and from the Bankscope data set were matched using data on total loans and total assets. To reduce the likelihood of measurement errors and ensure data consistency, dummy variables identifying banks with rapidly growing household and foreign currency portfolios, rather than actual data on household and foreign currency loans, were used.

Appendix Table 1. Summary Statistics

	Observations	Mean	Standard Deviation	Minimum	Maximum
Bank credit growth	1,087	25.31	40.80	-86.74	198.24
Distance to default	1,087	13.55	12.89	-6.27	75.48
Net interest margin	1,086	4.21	2.79	-4.50	23.61
Cost-to-income ratio	1,081	71.99	76.90	-959.51	946.87
Liquidity ratio	1,077	16.74	16.61	0.00	98.39
Bank size	1,087	6.40	1.44	2.30	10.30
Real GDP growth	1,087	3.83	2.78	-2.97	12.05
GDP per capita	1,087	58.52	25.16	24.60	147.32
Real interest rate	1,087	2.29	3.74	-19.52	10.73
Real depreciation	1,087	-0.13	0.52	-2.94	2.59
Foreign ownership	1,087	41.98	45.20	0.00	100.00
Public ownership	1,087	10.50	28.09	0.00	100.00

Sources: Bankscope; and IMF staff estimates.

Appendix Table 2. Summary Statistics by Country

	Observations	Mean	Standard Deviation		Observations	Mean	Standard Deviation
<b>Czech Republic</b>				<b>Slovenia</b>			
Bank credit growth	159	25.99	46.19	Bank credit growth	133	15.93	24.95
Distance to default	159	13.32	14.49	Distance to default	133	24.27	14.36
Net interest margin	159	2.38	1.54	Net interest margin	133	3.88	1.90
Cost-to-income ratio	157	73.58	116.09	Cost-to-income ratio	133	70.87	37.23
Liquidity ratio	159	26.32	21.15	Liquidity ratio	133	12.71	7.26
Bank size	159	7.15	1.26	Bank size	133	6.18	1.05
Real GDP growth	159	2.44	2.33	Real GDP growth	133	3.66	1.51
GDP per capita	159	69.28	13.13	GDP per capita	133	112.30	14.40
Real interest rate	159	1.97	2.70	Real interest rate	133	0.13	1.95
Real depreciation	159	-0.14	0.33	Real depreciation	133	0.07	0.60
Foreign ownership	159	46.65	46.23	Foreign ownership	133	11.76	29.35
Public ownership	159	11.09	29.88	Public ownership	133	8.29	25.03
<b>Hungary</b>				<b>Estonia</b>			
Bank credit growth	192	20.73	36.11	Bank credit growth	34	40.67	36.64
Distance to default	192	12.15	9.15	Distance to default	34	9.95	9.51
Net interest margin	191	4.85	3.35	Net interest margin	34	4.61	1.84
Cost-to-income ratio	191	74.61	59.54	Cost-to-income ratio	34	76.94	31.46
Liquidity ratio	187	7.55	6.26	Liquidity ratio	31	7.50	11.96
Bank size	192	6.68	1.23	Bank size	34	5.82	1.63
Real GDP growth	192	3.77	2.01	Real GDP growth	34	6.93	2.32
GDP per capita	192	58.40	15.50	GDP per capita	34	47.25	14.54
Real interest rate	192	2.68	2.28	Real interest rate	34	-1.20	6.15
Real depreciation	192	-0.09	0.35	Real depreciation	34	-0.66	1.73
Foreign ownership	192	62.19	45.10	Foreign ownership	34	54.53	40.33
Public ownership	192	5.94	22.70	Public ownership	34	0.00	0.00
<b>Poland</b>				<b>Latvia</b>			
Bank credit growth	262	25.49	36.95	Bank credit growth	137	36.99	54.27
Distance to default	262	12.51	9.47	Distance to default	137	8.86	12.76
Net interest margin	262	5.18	3.19	Net interest margin	137	4.66	2.57
Cost-to-income ratio	259	62.45	38.64	Cost-to-income ratio	137	82.63	95.15
Liquidity ratio	261	11.85	10.40	Liquidity ratio	137	12.22	15.26
Bank size	262	6.76	1.49	Bank size	137	5.09	1.18
Real GDP growth	262	3.24	2.04	Real GDP growth	137	6.94	2.18
GDP per capita	262	46.96	4.60	GDP per capita	137	36.40	8.86
Real interest rate	262	6.38	2.88	Real interest rate	137	-0.31	2.47
Real depreciation	262	-0.02	0.16	Real depreciation	137	-0.14	0.26
Foreign ownership	262	39.46	45.04	Foreign ownership	137	23.60	36.12
Public ownership	262	15.62	33.08	Public ownership	137	6.40	18.93
<b>Slovak Republic</b>				<b>Lithuania</b>			
Bank credit growth	119	17.65	35.60	Bank credit growth	51	40.18	50.61
Distance to default	119	12.72	14.47	Distance to default	51	13.94	15.02
Net interest margin	119	3.04	1.88	Net interest margin	51	4.67	2.28
Cost-to-income ratio	119	69.35	120.21	Cost-to-income ratio	51	82.93	21.99
Liquidity ratio	118	38.37	18.44	Liquidity ratio	51	23.91	11.12
Bank size	119	6.48	1.13	Bank size	51	5.57	1.53
Real GDP growth	119	1.89	2.60	Real GDP growth	51	6.07	4.48
GDP per capita	119	46.50	10.44	GDP per capita	51	39.51	10.88
Real interest rate	119	-0.27	2.72	Real interest rate	51	1.79	2.26
Real depreciation	119	-0.22	0.58	Real depreciation	51	-0.63	0.72
Foreign ownership	119	52.95	45.21	Foreign ownership	51	58.56	42.95
Public ownership	119	13.14	31.35	Public ownership	51	17.11	35.68

Sources: Bankscope; and IMF staff estimates.

Appendix Table 3. Variable Description

Variable	Measuring	Description 1/	Data Source
Distance to default	Risk of insolvency	Return on average assets plus equity (valued at market prices) as a percent of assets divided by the standard deviation of return on average assets	
Net interest margin	Profitability	Interest income, on a taxable equivalent basis, earned on assets less interest expense paid on liabilities and capital divided by average earning assets	Bankscope
Cost-to-income ratio	Efficiency	Total operating expenses divided by total operating income	
Liquidity ratio	Liquidity	Net liquid assets divided by total deposits	
Bank credit growth		Annual percentage change in total loans	Bankscope
Bank size	Bank risk	Logarithm of total assets	
Foreign ownership		Share of capital held by foreign investors	Bankscope, banking sector publications, banks' websites
Public ownership		Share of capital held by the government	
GDP per capita		Real GDP per capita, in hundreds of USD	
Real GDP growth	Market risk	Annual growth rate of real GDP	IFS and WEO
Real interest rate		Money market rate minus inflation 2/	
Real depreciation		Annual percentage change in real exchange rate expressed in domestic currency per USD	

1/ Data used for all calculations are in USD, unless noted otherwise.

2/ In cases where data on money market rate are missing, deposit rate is used instead.

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