

Regional Financial Interlinkages and Financial Contagion within Europe*

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Abstract

The ongoing global financial turmoil has increased the importance of understanding the potential spillover effects brought about by financial interlinkages. This article focuses on such interlinkages within Europe and potential contagion channeled through these interlinkages. It discusses the increased role of external financing as a source of funding for credit growth before the turmoil; analyzes potential channels of contagion through financial linkages; and assesses the magnitude of cross-border exposures between emerging and advanced European economies. Based on the stylized facts on these exposures, the article provides indices of exposure to regional contagion that could help identify the likely pressure points and capture potential spillover effects and propagation channels of a regional shock originating from a given country.

1. Introduction

With the substantial increase in foreign ownership of the banking systems in Central, Eastern, and Southeastern Europe (CESE), the degree of financial interlinkages among Western European and CESE countries has grown markedly. Foreign ownership of CESE banking systems has brought important benefits to the host countries, including advanced technology and risk management techniques and increased access to cross-border funding, and contributed to rapid financial deepening in CESE countries. At the same time, the rapid growth of financial links has also raised susceptibility to contagion for the host countries, as well as the home countries of the foreign banks active in many CESE countries. The ongoing global financial turmoil has increased the importance of capturing the potential spillover effects brought about by these financial interlinkages.

A number of recent initiatives attempted to capture the growing interlinkages, particularly in Europe. Wajid et al. (2007) study financial links in the Nordic-Baltic region. Several recent financial sector stability assessments by the International Monetary Fund (IMF) and the World Bank focus on cross-border exposures of domestic financial systems and regional feedback linkages, as well as on appropriate supervisory policies to address the associated risks. The IMF's *Regional Economic Out-*

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look — *Europe* (IMF, 2007 and 2008) discuss spillover effects as part of the ongoing efforts for regional surveillance of financial sector linkages. Maechler and Ong (2009) analyze the structure of bank claims and its potential implications for financial stability, both in the creditor and borrower countries of CESE. Geršl (2007) discusses the role of foreign banks and foreign lending in the Central and Eastern Europe from the financial stability perspective, analyzing the data on international banking business to explore the risk of cross-border contagion.

The present article analyzes the magnitude of cross-border financial exposures between advanced and emerging economies in Europe through banks with significant cross-border operations, and discusses the associated risks in the form of exposure to potential regional contagion. Based on consolidated international banking claims data from Bank for International Settlements (BIS) reporting banks, it explores the extent of financial interlinkages between home and host countries and provides stylized facts that could help assess the extent to which shocks from foreign markets can affect a given country. Combining the BIS data with those from the IMF's *International Financial Statistics* (IFS) and *World Economic Outlook* (WEO), and similarly to Sbracia and Zaghini (2001) and Geršl (2007), it focuses on possible contagion through a "common lender" that may be present in a number of countries. It explores how the presence of a common lender could transfer a shock in one country to other countries in the region in which the parent bank has significant direct or indirect operations.

To this effect, it uses a similar approach to Sbracia and Zaghini (2001) to compute indices of exposure to regional contagion based on the stylized facts provided by the magnitude of the interlinkages between Western European and CESE countries.¹ Under alternative assumptions about the common lender, trigger countries, and different measures of financial exposure, the indices attempt to gauge countries' susceptibility to contagion originating from potential problems in another country in the region (be it a parent bank or its subsidiary). In general, high exposure to such contagion measured this way would require that: the common lender's exposure to the country initially affected by a problem is large (implying substantial losses, and in turn a need to retrench funding); that the same lender is a dominant player in the financial systems of other countries in the region; and that these other countries must not have significant additional sources of external funding readily available.

The key findings are as follows: The financial interlinkages within Europe are economically significant. Most CESE economies are highly dependent on Western European banks, either directly by their private sector or through the local banking sectors, and the exposures are fairly concentrated. Austria, Germany, and Italy account for the largest share of bank claims on the CESE region as a whole (for the Baltics, mainly Sweden), though some CESE economies have relatively more diversified sources of funds. By contrast, the magnitude of Western European bank exposures to CESE is far smaller, except in the case of Austria and Sweden. Where the exposures to host countries are economically non-negligible, their concentration also raises concerns. Even where the exposures are well diversified, potential economic and financial spillovers within CESE could bring the overall exposure to a more considerable magnitude.

¹ Further details on the stylized facts can be found in Árvai, Driessen, and Ötker-Robe (2009).

The article also suggests that the larger the dependence of a CESE economy on flows from a common lender and the greater the latter's exposure to a trigger country, the higher is its exposure to regional contagion. Austria, Italy, and Germany as common lenders have the largest effect in propagating shocks across a wide range of CESE countries. Susceptibility to regional contagion is the largest when the common lender has activities concentrated in the CESE region. And the larger the dependence of a country on funds from home country banks, the higher is its contagion exposure. A broadly similar group of CESE countries appear to be more exposed to regional contagion than other CESE countries under alternative assumptions about the common lender, trigger countries, and different measures of financial exposure.

The contagion exposure indices do not represent an assessment of the financial or macroeconomic vulnerability and stability of individual countries studied. Instead, they gauge their susceptibility to contagion originating from potential problems in another country in the region, and help identify the likely pressure points to capture potential spillover effects and propagation channels of a regional shock originating from a given country. The actual vulnerability of a country will depend on the country's macroeconomic fundamentals, the capitalization, liquidity, and general soundness of the individual banking systems and its key institutions, the maturity structure of foreign claims on CESE countries, and the nature of the institutional regulations that affect financial relations between home and host institutions. In that sense, the indices should be seen as only one step in a full vulnerability exercise, which is beyond the scope of this article.

The remaining parts of the article are organized as follows. Section 2 provides a brief background on the increased reliance of most CESE banking sectors on foreign funds to finance the rapid credit growth, and the risks associated with relying on concentrated foreign funding. Section 3 discusses possible channels of regional contagion. Section 4 provides stylized facts on the magnitudes of cross-border exposures between CESE and Western European countries, which are used in Section 5 to compute indices of exposure to regional contagion. Section 6 provides concluding remarks.

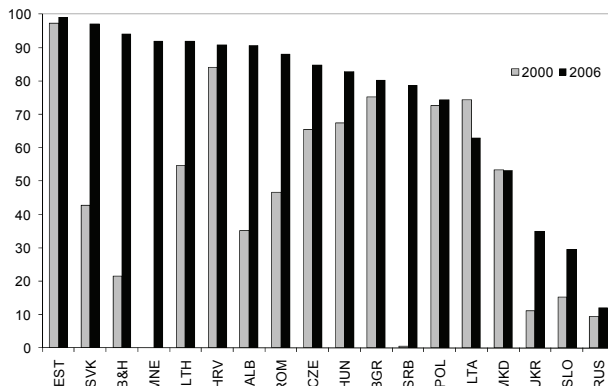
2. Background

The banking sectors of CESE countries have gone through a profound transformation since the second half of the 1990s. Foreign ownership levels are among the highest in the world (*Figure 1*), and bank credit to the private sector has expanded rapidly in recent years² (by about 23 percent a year on average in real terms across the region – see Enoch and Ötker-Robe, 2007).³ While this phenomenon partly reflected the process of catching up from low levels of financial intermediation, the fast convergence in credit ratios was mainly driven by similar business strategies of (mostly) Western European banking groups that dominate the banking sectors of

² See Arpa, Reininger, and Walko (2005); Backe, Égert, and Zumer (2006); Barisitz (2005); Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2003); Duenwald, Gueorguiev, and Schaechter (2005); Enoch and Ötker-Robe (2007); Hilbers, Ötker-Robe, Pazarbasioglu, and Johnsen (2005); and Kiss, Nagy, and Vonnák (2006).

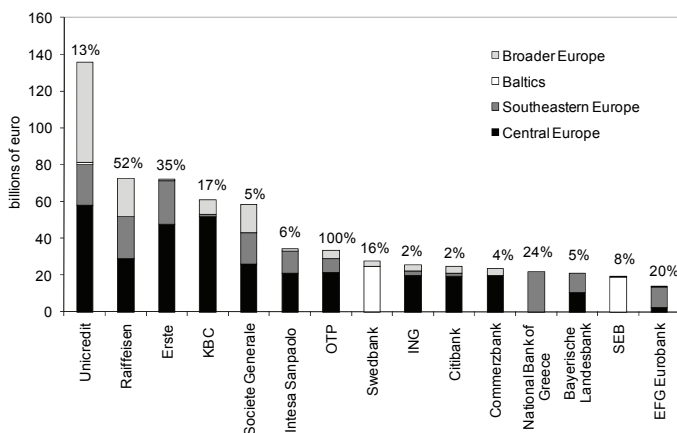
³ The pace of credit growth has slowed in a number of countries in CESE during 2008 and 2009, following the intensification of the global financial crisis and growing indications of a slowdown in economic activity.

Figure 1 Asset Share of Foreign-Owned Banks, 2000–06, in percent



Sources: European Bank for Reconstruction and Development; IMF staff calculations

Figure 2 Major Banking Groups Active in CESE, end-2007

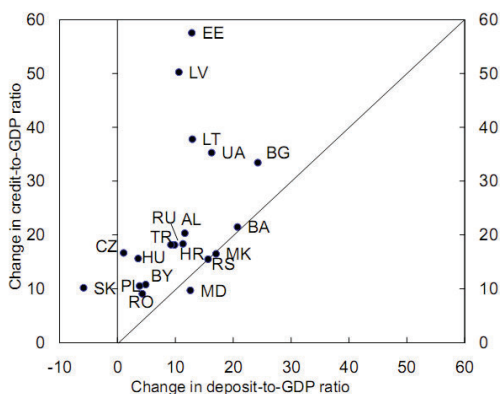


Source: Annual reports; authors' estimates for some smaller subsidiaries and branches.

most CESE countries (*Figure 2*). These banks have been taking advantage of the opportunity to expand their presence in CESE banking systems, with such operations accounting for a substantial share of their profits (see Appendix I in Árvai, Driessen, and Ötker-Robe, 2009, for more details).

With the brisk pace of private sector credit growth, dependence on non-deposit funding has increased in many countries in emerging Europe. Loan-to-deposit ratios (LTD) rose in most countries, particularly in the Baltics, where LTDs roughly doubled from the early 2000s, and in Ukraine, Hungary, and Russia, where they ranged from 120 to 150 percent in 2007. Except in a few cases (Moldova, Serbia, Macedonia, and Bosnia), the changes in the ratio of bank credit to gross domestic product (GDP) significantly exceeded those in the ratio of bank deposits-to-GDP, suggesting that deposit growth has not been able to keep up with the rapid credit growth in recent years (*Figure 3*).

Figure 3 The CESE Region: Funding of Credit Expansion, 2003–2007
(percentage points)



Sources: IMF, International Financial Statistics; and authors' calculations.

The high and rising LTDs were associated with increasing reliance on foreign funding, channeled through the banking sector. This reflected the relatively underdeveloped state of domestic capital markets as a funding source in some of these countries, and easy access by the mostly foreign-owned banks to cheap funding from their parents.⁴ Net foreign liabilities (NFL) as a ratio to private sector credit rose sharply from the beginning of the decade in many countries (most notably in the Baltics, most of the South Eastern Europe, and Belarus, Russia, and Ukraine), although the rising trend has turned around more recently in a few countries (Croatia, Hungary, Serbia, and Slovakia).⁵ Foreign funding through the banking sector has played a smaller role in Bosnia, the Czech Republic, Macedonia, Albania, Moldova, and Poland, although NFLs as a ratio to credit to the private sector have also been rapidly growing in some of these countries; by mid-2008, Albania, the Czech Republic, and Macedonia were the only countries with a negative ratio of NFL to bank credit.

The differences in funding structures suggest that some countries are more exposed than others to financial market disturbances originating from advanced markets or to spillovers from problems in other countries in the region. Banking systems heavily dependent on foreign funding to support credit growth could face a sudden shortfall of, or costly access to, funds, and experience difficulties in expanding credit, if there were a sudden reassessment of exposure to a host country (e.g., due to concerns about vulnerabilities in that country or the region).⁶ While reputational risks and long-term business links may render it unlikely that parent banks would not support their subsidiaries, the degree of support depends on market conditions; as fund-

⁴ In a few cases (e.g., Latvia, Lithuania, and Hungary), the relatively high volume of money market instruments and bond issuance by banks has provided some support for funding. In many cases, the business model of the banks (e.g., granting borrowers long-term foreign currency loans without long term financing in foreign currency) made the increasing reliance on foreign funding particularly risky.

⁵ This may be the result of a number of factors, including controls on foreign borrowing to contain credit growth and external imbalances (Croatia) or a weak macroeconomic environment (Hungary), or exchange rate changes.

⁶ Swedish banks, for instance, have reduced funding in the Baltics following a reassessment of their exposures.

ing conditions in home countries become more difficult, banks may be pressured to slow lending and liquidity provision abroad and at home (as observed more recently). Parent liquidity or solvency problems could be transmitted to local banks in concentrated and largely foreign-owned banking systems. Banks can experience difficulties in lending if access to foreign syndicated funds is also curtailed, or due to deleveraging across markets (also observed recently).

The impact of such a credit crunch would be amplified if funding from other (nonbank) sources were also limited. Some emerging European countries that had been turning to international capital markets for funding in recent years have indeed seen demand for financial sector bonds drying up since the subprime crisis in August 2007 (e.g., Eurobond issuance by the Russian and Ukrainian financial sectors) and some banks in CESE reportedly postponed their planned bond issues as a result of higher spreads. International bond issuance has been a negligible source of funding for most other countries in the region. Direct borrowing from abroad by the non-financial private sector is also likely affected by a tightening of credit conditions in international markets.

3. Possible Propagation Channels of Regional Shocks

There are a number of channels through which a financial shock can be transmitted between home and host countries. One channel through which financial contagion could be transmitted is the presence of a “common lender” that may be the main funding source for several countries.⁷ The private sectors of two countries in the region, A and B, for instance, may borrow mainly from the banking system of a third country, C (the common lender). A shock affecting A (e.g., due to a problem in a foreign-owned bank in A) may result in liquidity or solvency pressures in the banks of C, provided that the latter is highly exposed to A. The problems in A could then spillover to B, even when B’s economy is not directly linked to A’s, simply because of the presence of the third country, C, in both A and B. The parent bank’s presence in the region could therefore transfer a shock in one country to other countries in the region in which the parent bank has significant (direct or indirect) operations. Other parent banks exposed to each of the affected host countries (directly or indirectly through their subsidiaries) could in turn be affected, creating second-round effects.

Similarly, a sudden reassessment of a parent bank’s exposure to a host country could expose its subsidiary to sudden liquidity problems.⁸ Banks that are heavily dependent on parent bank funding to support credit growth could face a sudden shortfall of, or costly access to, credit, if the parent bank either withdraws its deposits or lending to the subsidiary or charges a much higher interest rate on its funding. In banking systems that are heavily concentrated and where interbank market linkages are substantial, liquidity problems can spread to other domestic or foreign-owned banks, affecting in turn the parents of the latter and the banking systems in which the parent is active – again, generating second-round effects on other banking systems in the region.⁹

⁷ See Sbracia and Zaghini (2001) for a discussion of this channel of transmission of international shocks. Also, for a graphical summary, see Diagram 1 in Árvai, Driessen, and Ötker-Robe, 2009.

⁸ For instance due to concerns about vulnerabilities in that country or a set of countries in the region.

⁹ The same reasoning applies not only to foreign funding through the parent bank but also to host country bank borrowing through syndicated lending from a group of lender countries.

Contagion could also go in the other direction, with host countries affected by problems in a parent bank. Liquidity or solvency problems experienced by a parent could spread to its subsidiaries or branches in other countries. Host country banking systems could be affected through a deterioration of confidence in the subsidiaries or branches and/or through direct funding exposure to the parent bank. A spillover to a host banking system could also be propagated through a change in the market's risk assessment of a parent bank that belongs to a banking group with a deteriorated financial standing. Other foreign banks that are exposed to the affected host banks could in turn experience problems, spreading their pressures onto those countries dependent on funding from the affected parent banks.¹⁰

The magnitude of potential contagion effects through these channels depends in general on: (i) the size of the exposures of home banks (common lender) to the host country with a problem; and (ii) the dependence of the host country on funds from the home country. As pointed out in Sbracia and Zaghini (2001), three conditions must be satisfied for such channels of transmission to operate: (1) the common lender's exposure to the country initially affected by a problem must be large, implying substantial losses, and in turn a need to restore capital; (2) the lender must be an important source of funds for other countries; and (3) the potentially affected countries must not have other sources of funding readily available. The following section provides stylized facts on these elements, to get a sense of the magnitude of the exposures between CESE and Western European countries so as to assess the significance of these transmission channels for contagion.

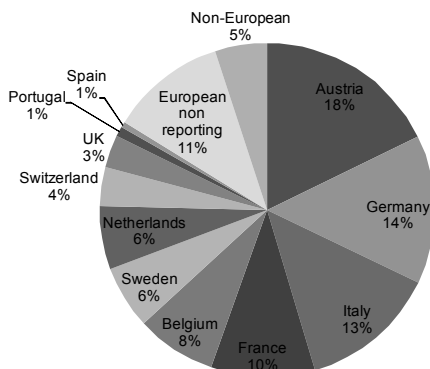
4. Stylized Facts on Cross Border Exposures and Financial Linkages

To get a sense of the magnitudes of cross-border linkages between CESE and Western European countries, we use consolidated claims of BIS reporting banks on individual CESE countries. Foreign claims reported in the BIS international banking statistics include outstanding consolidated claims of the reporting banks on local banking systems, as well as claims on the nonbank sector (i.e., direct lending, which has increased in significance in recent years – for more details see Appendix II in Árvai, Driessen, and Ötker-Robe, 2009).¹¹ From the lenders' perspective, the statistics provide the exposures of Western European countries to a given CESE economy. From the borrowers' perspective, they give an idea of the magnitude and distribution of the dependence of CESE economies on Western European banking systems, and illustrate the magnitude of control over a country's assets and liabilities by foreign banks. They do not necessarily give an indication of exposure to potential funding risks through the banking sector.¹²

¹⁰ The importance of direct funding from European money markets by CESE subsidiaries of foreign banks is generally small compared to parent bank and syndicated lending, since such direct funding is more expensive for the subsidiaries. Nevertheless, it is not negligible in some cases (e.g., in the Baltics).

¹¹ The BIS statistics differentiate between (a) cross-border claims, (b) local claims of foreign affiliates in foreign currency in a host country, (c) local claims of foreign affiliates in local currency, and (d) domestic claims in the reporting country. In BIS terminology, (a) + (b) refers to "international claims," while (a) + (b) + (c) refers to "foreign claims." That is, foreign claims include local claims of foreign-owned subsidiaries in local currency which are, to a very large extent, financed by local deposits in local currency (see BIS, 2005 and 2008). Foreign claims correspond to the direct gross on-balance sheet exposure of foreign banks to individual countries, while international claims represent the level of foreign bank claims that could result in foreign exchange outflows.

Figure 4 Foreign Claims of All BIS Reporting Banks on Emerging Europe, December 2007^a
 Shares in Foreign Claims of All BIS Reporting Banks on Emerging Europe



Notes: ^a BIS statistics do not provide detailed data on foreign claims on the private sector (e.g., to distinguish between corporates and households. Household sector direct borrowing from abroad is in general not significant).

Sources: BIS Quarterly Review, June 2008, Table 9A (immediate borrower basis) and authors' calculations.

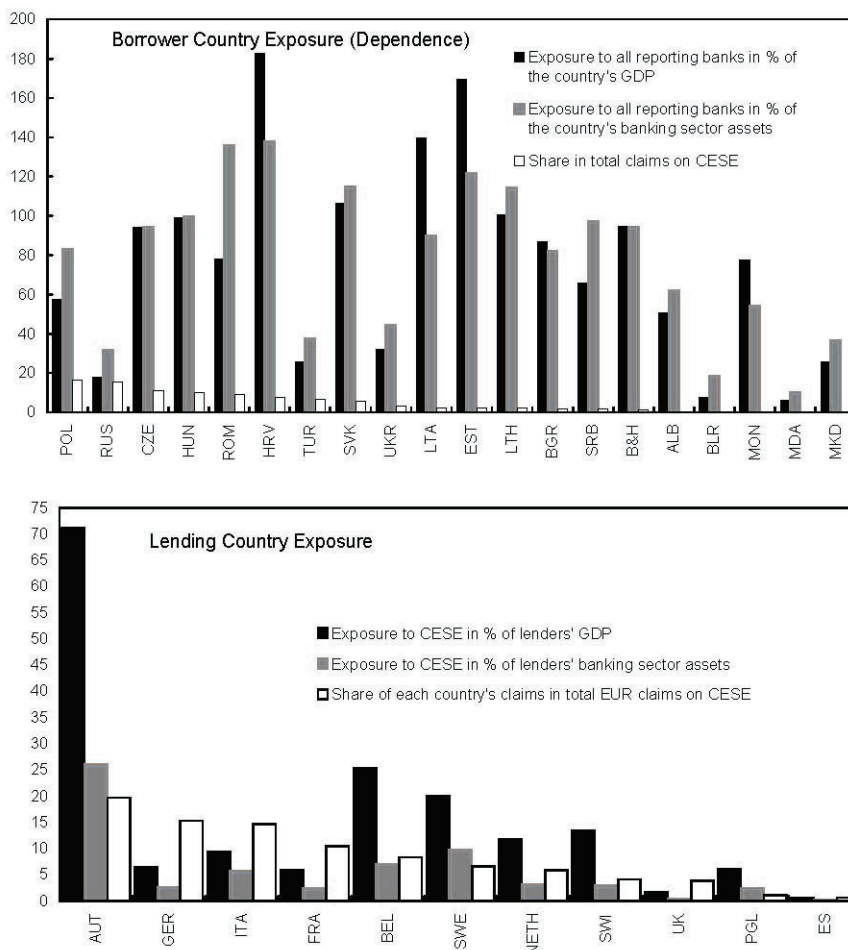
The analyses of foreign claims show that most CESE economies are indeed heavily exposed to Western European banks, either directly by their private sector or through their local banking sectors.¹³ Austria, Germany, and Italy account for the largest share of foreign claims for CESE countries as a whole, while non-European reporting banks hold less than 10 percent of the total claims on CESE (*Figure 4*). The exposures are significant for many countries, both in relation to the recipient countries' GDP and the size of their banking system assets (*Figure 5*, upper panel). Outstanding foreign claims owed to reporting banks in all western European countries are substantial (at least 100 percent of GDP) for Croatia, Hungary, the Baltics, and Slovakia. Exposures are also significant in terms of host country banking sector assets for many countries, but much less so for Russia, Turkey, Ukraine, Albania, Belarus, Moldova, and Macedonia.¹⁴ Focusing only on international claims on

¹² Exposure to funding risk may be overestimated not only by the inclusion, in foreign claims, of the local claims of foreign affiliates in local currency, but also of direct foreign borrowing by CESE nonbank private sector, since a large share of CESE companies borrowing directly from abroad are owned by large foreign companies that can have access to other funding sources. The exposures have also been computed by using only international claims on banks, to have a better sense of the funding risk.

¹³ This is even more so, given that BIS consolidated banking statistics do not include CESE-owned domestic banks among the reporting banks. For instance, the Hungarian OTP Bank with no foreign strategic owner has subsidiaries in several CESE countries, accounting for a large share of their foreign liabilities, especially in Bulgaria and Montenegro. The same point applies to Slovenian and Greek banks some of which have been very active in the region, but are not among the reporting or listed reporting banks, respectively, in BIS statistics. These figures are based on consolidated banking statistics in Table 9b of the BIS International Banking Statistics, which do not include lending between head office and branches/subsidiaries, with inter-office business netted out. The statistics also do not provide information on how the claims are funded: domestically (i.e., principally through deposits), or from abroad – including through loans from the parent bank.

¹⁴ The magnitudes of the exposures are also significant in relation to alternative economic and financial indicators (e.g., current account balance, gross FDI inflows, or banking system capital), and for a similar set of countries, albeit with different rankings depending on the indicator used (not reported here).

Figure 5 Relative Magnitude of Exposure for CESE and Western Europe, December 2007

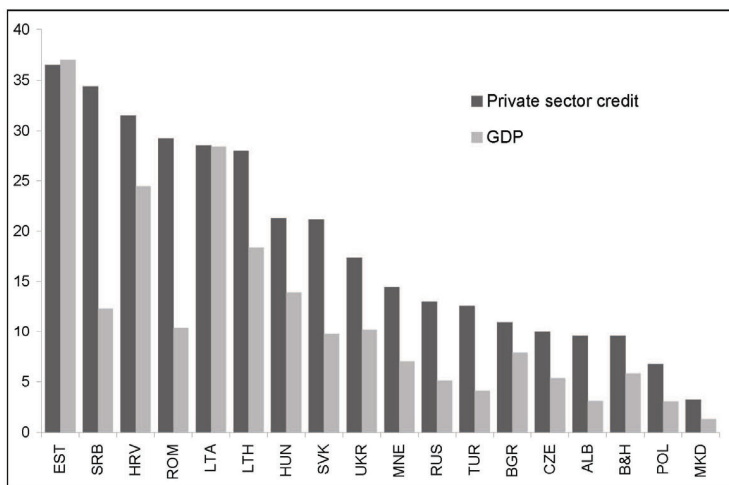


Sources: BIS, International Banking Statistics, Table 9B, June 2008; IFS; WEO; authors' calculations.

CESE banking systems also suggests heavy reliance of a number of CESE banks on external funding to support rapid expansion of lending to the private sector (*Figure 6*), in contrast to a number of others where local currency positions of reporting bank foreign offices make up a large share of the foreign claims (the Czech Republic, Slovakia, Bosnia, Poland, Albania).

On the contrary, the magnitude of western European bank exposures to CESE is far smaller, compared with that of the latter, with a few exceptions (*Figure 5*, lower panel). For Austria, the foreign claims of the reporting banks on emerging Europe amounts to over 70 percent of Austria's GDP and 26 percent of its banking system assets at end-2007. The exposures of banks in Belgium and Sweden are also relatively high in terms of their GDP (25 percent and 20 percent, respectively), but

Figure 6 CESE Banks' Exposure to Foreign Banks – International Claims on Banks, in percent of private sector credit and in percent of GDP



Sources: BIS, International Banking Statistics; WEO; and authors' calculations.

much less so in terms of banking system assets (at most 10 percent). For the remaining countries, the exposures are negligible, including for France, Germany, and Italy with active presence in the CESE.

These exposures could contribute to the potential vulnerabilities if their composition reflects heavy reliance on foreign funding and if the exposures are heavily concentrated. Most CESE countries have concentrated exposures measured by foreign claims, particularly to banks in Austria and Italy as well as to France and Germany, and the Baltic countries have large exposures to Sweden (*Table 1* in the accompanying Excel file *on the web page* of this journal). The same conclusion applies when exposures are measured by the reporting banks' international claims on CESE (i.e., excluding the local claims of foreign owned subsidiaries in local currency) or by their international claims only on the CESE banks.¹⁵

Among the countries with higher foreign claims on their economies, some have relatively more diversified sources while others rely on a few sources. For example, Czech Republic, Poland, and, to some extent, Hungary, have relatively diversified sources of funds. On the other hand, Bosnia and Herzegovina, Croatia, Romania, Serbia, and Slovakia have at least one third of their exposure to Austrian banks. Similarly, Italy accounts for 20–35 percent of the foreign claims on Bosnia and Herzegovina, Bulgaria, Croatia, Poland, and Slovakia, and the Baltic countries have at least about 60 percent of their total exposures to Sweden at the end of 2007. Such concentration of claims makes a large number of CESE countries heavily ex-

¹⁵ A slight difference to note is that when bank-to-bank claims are used, Germany and Austria have the greatest shares in the claims on many CESE countries' banks, while with foreign and international claims, Austria and Italy have the largest shares; nevertheless, Italy is still an important source. In addition, exposures of Latvian banks (and to a smaller extent, Lithuanian banks) are concentrated on Germany, as well as on Sweden.

posed to potential adverse developments in the Austrian, Italian, and Swedish banks active in the region.

Where the exposure to host countries is non-negligible economically, heavy concentration of the Western European exposures also gains importance (*Table 2* in the accompanying Excel file *on the web page* of this journal). For example, the three Baltic countries together represent about 73 percent of Sweden's exposure to all developing countries (about 20 percent and 10 percent of Sweden's GDP and banking system assets, respectively, at end-2007). Such an exposure would make Sweden vulnerable to adverse developments in any one of the Baltic countries, which could spill over to the other two economies. The exposures to CESE for other Western European countries are either well-diversified (e.g., Austria, Belgium), and/or the size of the absolute exposure is not economically significant (e.g., France, Germany, Italy, Portugal).

However, even where the exposures seem well diversified across countries, potential economic and financial contagion may bring the overall exposure to a more considerable magnitude. For example, contrary to the case of Sweden, the exposures seem well diversified across several countries for Austria, which is highly exposed to the CESE region, and exposure to a single country seems relatively small (up to 17 percent).¹⁶ However, the ultimate impact of possible adverse developments in one country may be more significant, since problems in one country can spread to others and markets may not, at least initially, differentiate between countries based on economic and financial vulnerabilities. Such spillovers could increase Austria's vulnerability to the region despite its diversified exposure.

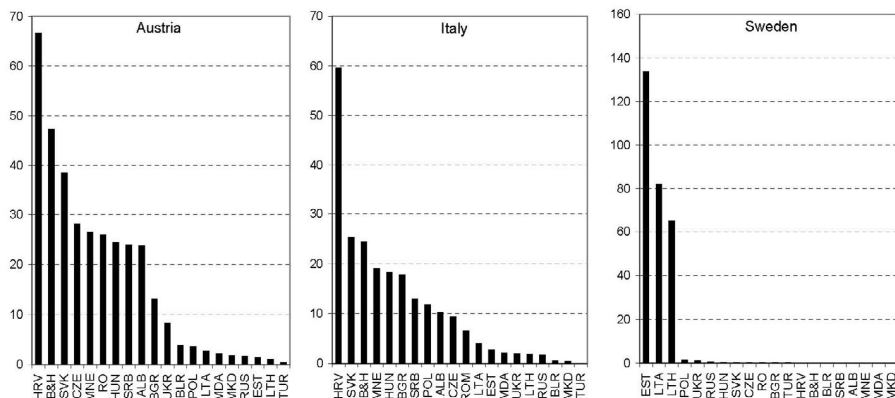
5. Implications for Exposure to Regional Contagion Risks

What do the stylized facts on the exposures of Western and CESE countries say in terms of exposure to contagion risks? We explore two forms of contagion affecting a CESE country: (i) exposure to a shock originating from the foreign bank's home country, and (ii) exposure to regional contagion triggered by a problem in another CESE country to which a Western European country has significant exposures. The stylized facts discussed above give an indication of both the borrowers' liabilities and the lenders' exposures to these countries, and can help assess the relative exposures of the CESE countries to regional contagion.

The first contagion channel involves a shock transmitted from a home to a host country, taking as trigger a country in Western Europe with active banks in the CESE region. In general, the larger a CESE country's exposure to the trigger home country, the stronger would be the adverse effects from developments in the home country banks. The measure of absolute dependence, defined as the amount of claims owed to a home country as a share of the CESE country's GDP (*Table 3* in the accompanying Excel file *on the web page* of this journal) provides an indication of the extent to which a given CESE country will be affected. To illustrate, the table suggests that any potential adverse developments in Austrian (or Italian) banks would

¹⁶ For example, while Austria makes up 36 percent of Croatia's exposure to all reporting country banks in end-2007, Croatia constitutes only 12 percent of Austria's exposure to all developing countries. The largest exposure of Austria is to the Czech Republic (17 percent), while the latter owes about 30 percent of all its foreign claims to Austria at end-2007.

Figure 7 The Impact of a Shock from Home to Host Country – An Illustration
(Foreign claims owed relative to the recipient's GDP, in percent)



Source: authors' calculations.

be felt most significantly in Croatia, Bosnia and Herzegovina, and Slovakia; similarly, any adverse developments in Swedish banks would be felt most strongly in Estonia, Latvia, and Lithuania (see *Figure 7* for an illustration).

The second contagion channel analyzes how problems in one CESE country might spread to others in the region. One such mechanism is provided by the “common lender channel”, in which a Western European banking sector has a large exposure to a trigger CESE country and is an important source of credit for other countries in the region. A shock affecting the trigger country may result in pressures in the banks of the common lender, given its high exposure to the trigger country, and could spill over to another CESE country, simply because of the large presence of the common lender in both countries.

For this propagation channel, we follow an approach suggested in Sbracia and Zaghini (2001). Using BIS international banking statistics, the authors summarize the stylized facts discussed in Section 4 in the form of indices of exposure to the common lender channel of contagion for emerging market countries in Eastern Europe, Asia, and Western Hemisphere, where Germany, Japan, and the United States, respectively, are assumed as the most common lenders. The indices attempt to evaluate contagion exposure in terms of dependence of each country on a common lender that is exposed to another country experiencing a problem. Since the calculation of such an index requires the knowledge of the trigger country, which can only be known ex-post, an ex-ante indicator is computed, instead, using as trigger the country to which the common lender has the highest exposure.

We adopt the Sbracia and Zaghini approach to the CESE countries with some variations (relating to the choice of the common lender and the trigger country), to compute indices of exposure to regional contagion. In particular, the following two indices have been computed:

$$I_i^1 = ad_{CL}^i AE_j^{CL} \quad (1)$$

$$I_i^2 = ad_{CL}^i AE_j^{CL} REB_i^{CL} \quad (2)$$

where:

$$REB_i^{CL} = \frac{A_i^{CL}}{\sum_{h \in DC} A_h^{CL} - \max_{j \neq i} A_j^{CL}}$$

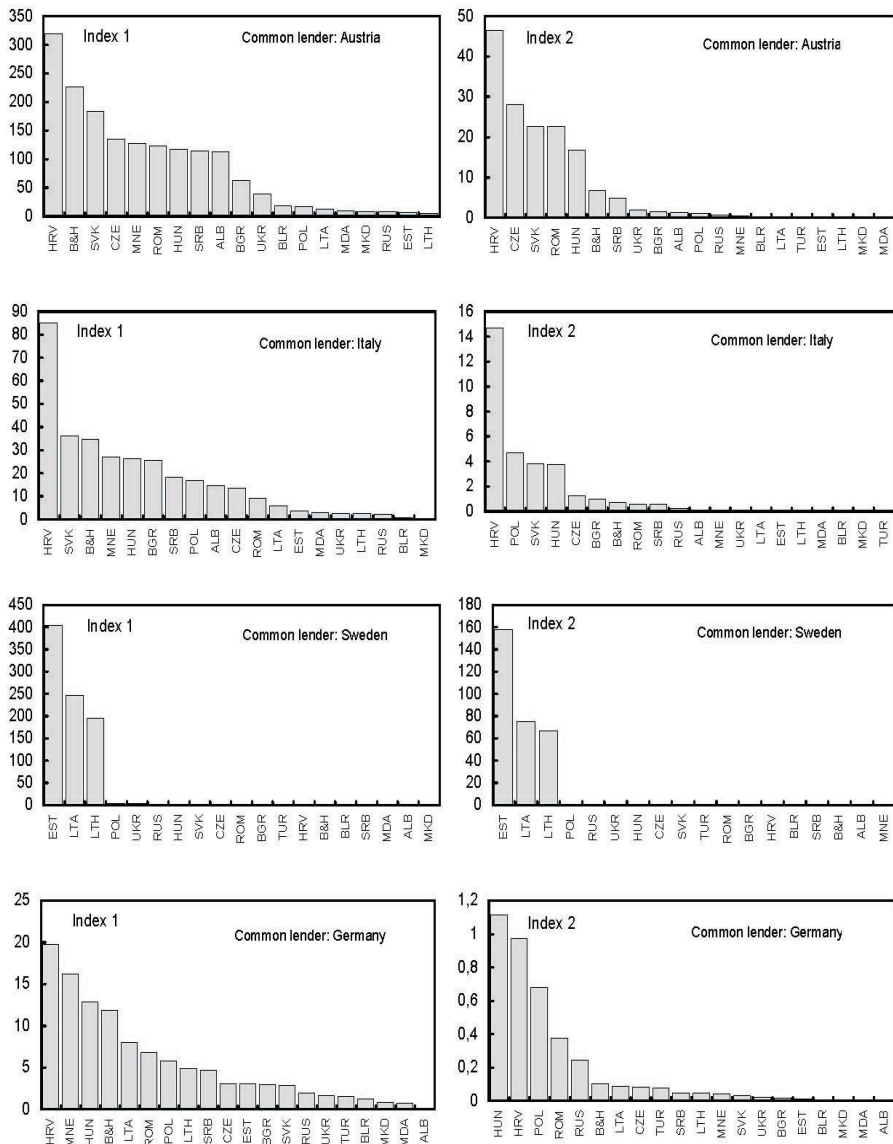
- In (1), ad_{CL}^i is the “absolute dependence” of country i on the common lender, defined as foreign claims owed by country i to the common lender (CL)’s banks in country i ’s GDP (*Table 3* in the accompanying Excel file). AE_j^{CL} is the ex-ante “absolute exposure” of the common lender to the trigger country (the country with which it has the highest exposure). The absolute exposure of the common lender to country j (*Table 4* in the accompanying Excel file *on the web page* of this journal) is defined as the ratio (in percentage terms) of the common lender’s claims vis-à-vis country j to its own funds (for the latter we use the common lender’s banking system assets). Both magnitudes are expressed in percentage terms.
- In (2), REB_i^{CL} indicates some measure of rebalancing, that is, the amount of funds that may be cut from a borrower country i , following a problem in a trigger country the common lender has exposure to. It is defined as the amount of claims of the common lender on country i , A_i^{CL} in ratio to the total amount of funds lent to all other developing countries, excluding the amount of claims on the trigger country. This ratio is an increasing function of the amount of funds that the common lender provides to country i and to the trigger country j .

There is no single country that could be unambiguously identified as the unique common lender for the CESE region (*Table 1* in the accompanying Excel file *on the web page* of this journal). Many countries in the region are highly dependent on Austria, but others also depend on Italy and Germany; and the Baltic countries depend predominantly on Sweden. The indices have therefore been computed under different assumptions for the common lender. In choosing the trigger country, we focused on 3 countries that the common lender has the largest exposures within the CESE group; as *Table 4* in the accompanying Excel file *on the web page* of this journal suggests, the absolute exposures of the common lender(s) are not overwhelmingly high with respect to any one of the recipient countries than the others in the group. Indices have been computed using both the foreign and international claims concepts, as well as international claims on banks only, to see how contagion exposures would change based on the nature of the home and host country links.

Accordingly, the indices have been computed under several cases for the common lender and associated trigger countries. In particular, Austria, Italy, Sweden, and Germany have been chosen as the common lenders, and the three countries to which each common lender has the largest exposure among the other CESE countries have been chosen as the triggers. *Figure 8* illustrates the indices for the foreign claims concept for a selected group of common lenders: Austria, Italy, Sweden, and Germany. *Figure 9* repeats the same exercise for the international claims concept.¹⁷

¹⁷ In addition, Chart 13 in Árvai, Driessen, and Ötker-Robe (2009) illustrates exposures to regional contagion when international claims only on the CESE banking sectors are used. The data are provided in the accompanying Excel file *on the web page* of this journal.

Figure 8 CESE Countries: Indices of Contagion Exposure – Foreign Claim Concept
 Foreign claims on CESE countries – Common Lenders: Austria, Italy, Sweden, Germany
 Hypothetical trigger countries are those to which the common lender has the largest absolute exposure^a



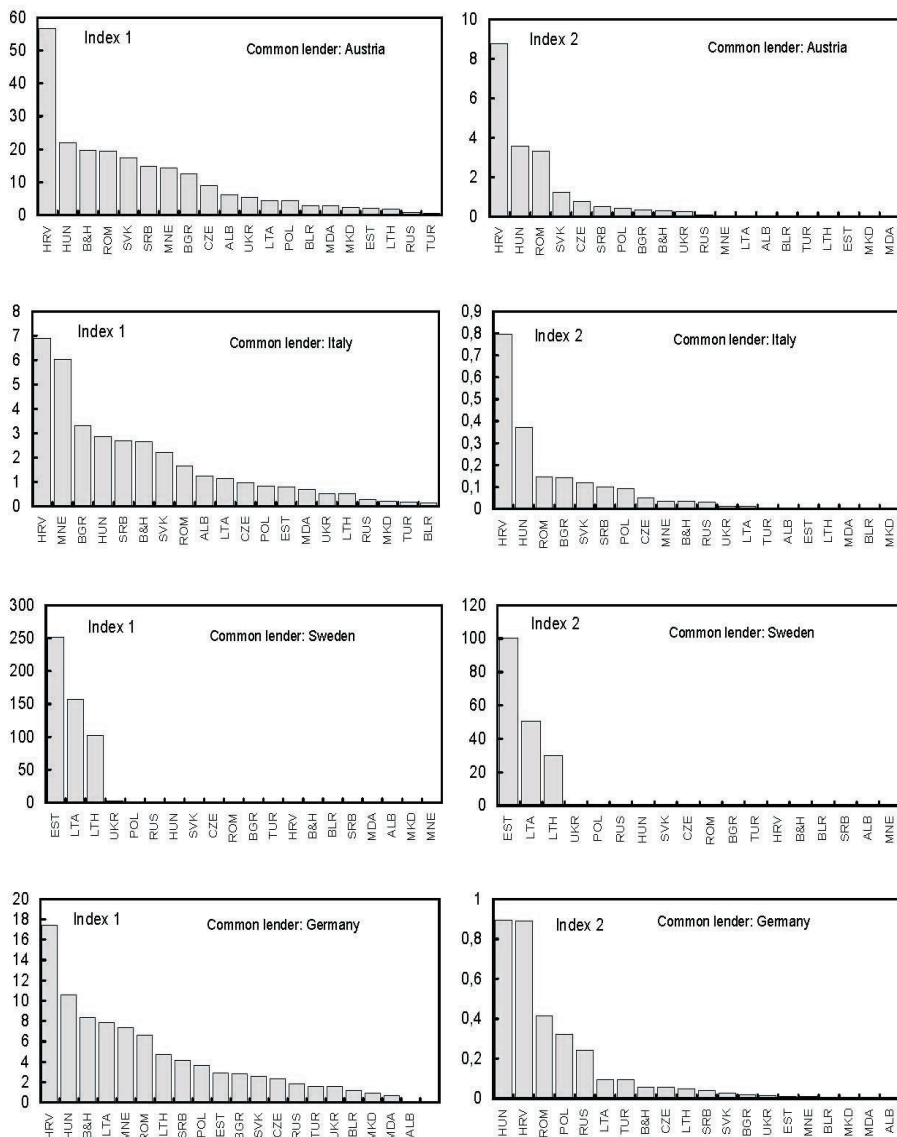
Note: ^a The figures illustrate the regional impact of a hypothetical shock to a country which each common lender has the largest absolute exposure to.

Source: Authors' computations based on BIS December 2007 data.

Figure 9 CESE Countries: Indices of Contagion Exposure – International Claims Concept

International claims on CESE countries – Common Lenders: Austria, Italy, Sweden, Germany

Hypothetical trigger countries are those to which the common lender has the largest absolute exposure^a



Note: ^a The figures illustrate the regional impact of a hypothetical shock to a country to which each common lender has the largest absolute exposure.

Source: Authors' computations based on BIS December 2007 data, more detailed bilateral data for international claims provided by the BIS.

The indices provide some interesting results for the degree of exposure of the CESE countries to regional contagion and their sensitivity to the source of contagion:

- In general, the larger the dependence of a country on funds from home country banks (directly or indirectly through the domestic banking systems), and the larger the exposure of home country banks to the trigger country, the higher the values of the contagion indices. Taking into consideration the possibility of rebalancing in the common lender's funding through a potential cutback in credit lines reduces the value of the index significantly (Index 2 vs. Index 1). The countries for which absolute dependence on foreign banks is lower drop out of the group of most exposed countries under the second index.
- Contagion indices are the highest when the common lender has activities substantially concentrated in the region. In turn, the indices are smaller when the common lender has large presence in, but smaller exposure to, CESE in terms of its economic size, since in the latter case, the exposures to any country in the region are economically too small to affect the funds available to others when problems emerge in a trigger country. Austria as the common lender would hence have the highest effect in propagating shocks across a wide range of CESE countries.
- The indices also suggest that potential contagion between Sweden and the Baltic countries is highly concentrated. Although the Baltic countries exhibit the highest exposure indices for a hypothetical problem triggered in Estonia, Latvia, or Lithuania, a potential spillover to the other CESE countries through the common lender channel seems to be contained within the Baltic region. This is because the dependence of non-Baltic CESE countries on Sweden is immaterial, making the likelihood of any rebalancing effect rather small. Contagion from the Baltics to the rest of the CESE countries therefore seems to be fairly unlikely, at least based purely on the common lender channel.¹⁸ Similarly, potential problems triggered in other CESE countries do not seem to impact the Baltic countries, except when Germany is the common lender.

Using the international claims concept produces lower contagion exposure indices (given the smaller magnitude of the exposures), but the group of countries relatively more exposed to regional contagion remains broadly the same (*Figure 8*). With significant foreign ownership of CESE banking systems, the foreign claims of the reporting banks, including local currency assets of foreign-owned affiliates, produce much higher indices than when international claims are used (the latter only include cross-border lending and foreign currency assets of foreign-owned affiliates). While the group of countries susceptible to regional contagion remains broadly the same, the ranking of countries within the group differs somewhat, in particular for Austria and Italy as common lenders, compared to Germany.¹⁹ Indices based on international claims on CESE banks are even smaller in magnitude, but do not dramatically alter the group of the more exposed countries.

¹⁸ Psychological contagion, associated with a potential worsening of market sentiment against emerging Europe in general, could, however, trigger a round of problems even though financial linkages across the countries, directly or indirectly, may be small.

¹⁹ This likely reflects the significantly higher share of cross-border claims in foreign claims for Germany than for Austria and Italy. Widespread and large subsidiary network of Austrian and Italian banks magnifies and alters the order of the vulnerability ranking of many CESE countries.

Although differences in magnitude of the exposure indices across scenarios signal varying degrees of spillover effects among countries, the group of countries most exposed to regional contagion remains broadly similar. The differences in the magnitude of the indices across different exposure concepts reflect the fact that international claims and claims on banks are a subset of the foreign claim concept, while differences across alternative triggers and common lenders reflect the differing sizes of financial exposures between home and host countries. Nevertheless, for the purposes of the article, what matters more is the information the indices contain in terms of the group of countries that appear as more exposed under various scenarios. The group of countries most exposed to regional contagion remains broadly similar regardless of the financial claims concept used, or assumptions about the common lender and trigger country.

6. Conclusions

This article has focused on the cross-border financial interlinkages across Europe. It has explored the channels through which financial contagion could be transmitted. Based on BIS country-level data on the outstanding foreign and international claims on a host economy as well as on international claims on host economy banks, it assessed the magnitude of home-host exposures and provided some stylized facts that subsequently fed into the analyses of countries' exposure to regional financial contagion. As one important channel through which such shocks could be transmitted, it has focused on the "common lender" channel and explored how the common lender could transfer a shock in one country to other countries in the region in which the parent bank has significant direct or indirect operations.

The analysis supports the hypothesis that financial interlinkages within Europe are economically significant. The financial sectors of most CESE countries are dominated by institutions that belong to a limited number of financial groups with active presence in the region, some with significantly concentrated exposures. Most CESE countries are highly exposed to Western European banks, either directly by their private sector or through the local banking sectors. Austria, Germany, and Italy account for the largest share of these claims for the CESE region as a whole, though some CESE economies have relatively more diversified sources of funds. Where the exposure to host countries is non-negligible, heavy concentration of the exposures, or even when the latter are diversified, potential economic and financial contagion within CESE could make the overall exposure much more sizeable.

The contagion analysis offers the following conclusions: The larger the dependence of a CESE country on funds from a regional common lender, the higher is its exposure to problems triggered in the common lender's banks. Moreover, the larger the dependence on a common lender, and the greater the latter's exposure to a trigger country, the higher is the susceptibility to regional contagion. Contagion indices are the highest when the common lender has activities substantially concentrated in the region, and are smaller when the common lender has large presence in, but smaller exposure to, the CESE in terms of its economic size. In the latter case, the exposures to any country in the region are economically too small to affect the funds available to others when problems emerge in a trigger country. A potential spillover of, for instance, Baltic-originated problems to the other CESE countries

may hence be limited, at least based purely on the common lender channel, since Sweden's small exposure to non-Baltic CESE makes the likelihood of any rebalancing effect small.

It is important to note that the contagion exposure indices computed here do not represent an assessment of the financial or macroeconomic vulnerability and stability of individual countries studied. While the group of countries most exposed to regional contagion remains broadly similar regardless of which financial claims concept is used, these indices only measure the degree to which shocks from foreign markets can affect a given country, and help identify the likely pressure points associated with a regional shock originating from a given country.

The actual vulnerability of a country, on the other hand, will depend on a number of other factors. These include the capitalization, liquidity, and general soundness of the individual banking systems and its key institutions, as well as the country's macroeconomic fundamentals. The actual vulnerability will also be a function of the "true ability of the common lender to rebalance," which would depend, among other things, on the maturity structure of the common lender's claims on the borrower, and the nature of the institutional regulations that affect financial relationships between home/host institutions, and hence the liquidity of funds. The exposure indices should therefore be seen as a first step to a full vulnerability exercise.²⁰

²⁰ Availability of more detailed information would help improve the quality of analyses on exposures (e.g., on the maturity composition of the claims, amount and composition of funding of domestic subsidiaries from their parents, with information provided on a bilateral basis. Some countries that appear most exposed may turn out to be less so based on such information. For example, the much smaller share of short-term foreign claims in total foreign claims on a number of countries (e.g., less than 10 percent in the Czech Republic and Poland) could reduce the degree of vulnerability to regional contagion.

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