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Financial stability in the EU new Member States, acceding and candidate countries

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Rapid credit growth in the EU new Member States, acceding and candidate countries has raised the issue of financial stability in the region. This rapid credit growth has been accompanied by the deterioration in the current account balance and the large-scale distribution of foreign currency loans.

In the first part of this study, we analyse the overall stability of the banking sector vis-à-vis the very rapid credit growth. Given the high share of foreign currency loans, we examine the exposure to exchange rate risk. We identify that the main vulnerability for the banking system stems from the open currency position held by final borrowers (households and businesses). These economic agents are generally not hedged against exchange rate risk. In the event of a depreciation in the national currency, the banking system would therefore be exposed to an increase in payment defaults on foreign currency loans. We consider this to be "indirect" credit risk for the banking system.

In the second part, we explore the likelihood of a currency crisis. We estimate an econometric model for the link between credit growth and the current account balance showing a significant negative relationship in these countries, i.e. a 1-percentage-point increase in credit flow as a percentage of GDP deteriorates the current account-to-GDP ratio by 0.5 percentage point. Consequently, excessively high credit growth would contribute to deteriorate the current account beyond a sustainable level and would increase the likelihood of a currency crisis. Currently, external vulnerability remains contained in the countries under review, though it has increased in most of them since 2000.

Lastly, we implement causality tests to evaluate the nature of credit growth. When the causality detected indicates that credit growth fuels domestic demand, and not the opposite, this could be interpreted as a potential risk for the system insofar as strong credit growth may lead to excessive demand beyond that related to a simple catching-up process. For countries where this test is significant, a causal relationship from credit growth to domestic demand has been detected in Bulgaria, Estonia, Latvia and Poland. The causality detected in Croatia and Romania is heading in the opposite direction.

Keywords: credit growth, new Member States, monetary approach to the balance of payments, currency crisis, banking crisis

Codes JEL: C33, E51, F32, G21

1| Introduction

In recent years, economists and European policy makers have been concerned with the increase in macroeconomic imbalances in the European Union's new Member States (NMS), acceding and candidate countries (ACC).[1] The very rapid growth in credit has received special attention as private sector credit growth rates exceeded 20% in 2006 in all of the countries in the region (excluding Hungary) with a peak of 58% for Latvia. This naturally raises questions concerning the financial stability of the countries concerned, since economic literature identifies strong credit growth as a leading indicator of a financial crisis (see Kaminsky and Reinhart, 1999), which was most recently confirmed during the Asian crisis of 1997.

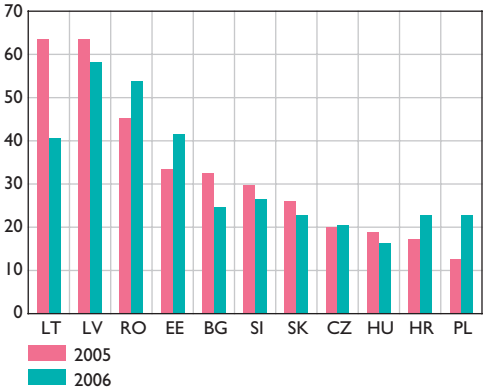
A number of recent institutional and academic studies have analysed the issue of rapid credit growth in the region. The approach regularly used consists of detecting excessive credit growth by estimating a long-term equilibrium relationship of the changes in credit stocks (Chart 2 illustrates the idea of a long-term relationship between the credit-to-GDP ratio and the level of GDP per capita). Then, by positioning the countries vis-à-vis this equilibrium relationship we can identify situations of excessive credit growth. Two studies have adopted this methodology: an ECB study carried out by Boissay et al. (2005) and a Hungarian National Bank study by Kiss et al. (2006). The main outcome of these studies was to detect excessive credit growth for the Baltic States.

One of the main weaknesses of this approach applied to the countries under review stems from the lack of sufficiently long macroeconomic series based on which the long-term equilibrium relationship may be estimated. To circumvent this difficulty, the aforementioned studies estimate the equilibrium relationship for the developed countries in the EU and apply the coefficients obtained in the case of Central and Eastern European countries. However, this approach is questionable, as it presupposes that the two groups of countries share the same structural characteristics, which is not the case for Central and Eastern European countries that are undergoing the transition from a planned to a market economy. In particular, the starting point for these economies at the beginning of the 1990s was characterised by a nonexistent financial system and an obsolete productive structure, controlled entirely by the State. Although the final point towards which these countries are converging is clear, i.e. a structure closer to that of Western Europe's developed

1 *These include Bulgaria (BG), Czech Republic (CZ), Estonia (EE), Croatia (HR), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), Slovenia (SI) and Slovakia (SK).*

Chart 1 Private sector credit growth

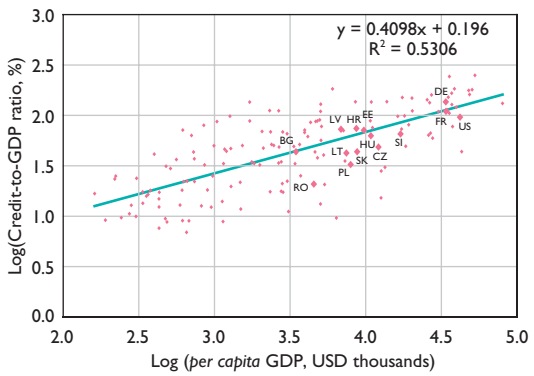
(%)



Source: BIS.

Chart 2 Relationship between *per capita* GDP and the credit-to-GDP ratio (2005)

(per capita *GDP, USD thousands*)



Source: IMF.

countries, the characteristics of the path towards convergence are unclear. Indeed, the path appears to differ from the "standard" one that the emerging market countries of Asia and Latin America have tended to follow, notably thanks to the European integration process to which the countries under review are associated. In this context, the approach can lead to results whose relevance must be evaluated with caution. Beyond these aspects, the aforementioned approach merely detects excessive credit growth for the countries under review without specifying how a return towards equilibrium could be achieved nor the impact of a potential financial crisis.

An alternative approach would be to carefully analyse the overall stability of the banking system and the impact of credit growth on the system's vulnerability. This analysis (section 2) shows an apparently healthy situation with a high share of foreign currency loans extended to households and businesses. These economic agents whose foreign currency assets are likely to be limited would then be exposed to exchange rate risk. In the event of a depreciation of the national currency, payment defaults on foreign currency loans are likely to increase and weigh on the banks' balance sheets. We define this mechanism triggered by a depreciation of the national currency as an "indirect" credit risk for the banking system.

What is the likelihood of currency depreciation in the countries under review? One of the basic indicators of external vulnerability is the size of the current account deficit. In the monetary approach to the balance of payments (see IMF, 1977), high growth in credit stocks would result, ceteris paribus, in a larger current account deficit (section 3). This in turn tends to jeopardise the economy's external stability via the accumulation of external debt and increase the risk of a currency crisis. This area of research has been analysed by a number of recent studies: Coricelli et al. (2006) and Duenwald et al. (2005) estimate an econometric relationship between credit growth and the trade balance. They find a significant negative relationship, i.e. that credit growth deteriorates the trade balance. With regard to these studies, we have extended the size of the sample by using panel data for eleven of the countries of the region.[2] The use of panel data enables us to circumvent the problem of a lack of sufficiently long macroeconomic series to permit individual estimates. We use the current account balance as a dependent variable, rather than the trade balance, in order to remain close to the original focus of the monetary approach to the balance of payments.

The fact that credit growth increases the size of the current account deficit is not sufficient to evaluate the sustainability of these deficits. A more qualitative analysis of credit growth is required. In order to achieve this, it would be necessary to evaluate the nature of credit growth: is it the flip side of the catching-up process or is it triggered exogenously by the banking system, following a strategy to gain market share? In the latter case, credit growth should lead to a liquidity surplus fuelling an overheated domestic demand. We have tried to answer this question by testing the causality between credit flow and domestic demand (section 4). When the test indicates that credit growth causes domestic demand, this may be interpreted as a situation where the distribution of credit fuels an excessive increase in demand. If the causality detected is the opposite, this would be interpreted as a healthy situation where credit growth is the flip side of the catching-up process.

2 *These include Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia.*

2| Exposure of the banking system to exchange rate risk

Banking sector overall stability

Third generation currency crisis models[3] are based on moral hazard, problems of asymmetric information and financial excesses as factors triggering balance of payments crises. They underscore the role of capital inflows in fuelling excessive credit growth, consumption booms and unsustainable current account deficits. Consequently, it is worth briefly analysing the situation of the banking sector in the countries concerned.

Banking sector stability indicators reflect a rather positive image, but trends in these indicators require close monitoring. The quality of bank portfolios, measured by the level of non-performing loans, has improved since 2000, due to the restructuring process of the banking sector following the crises at the end of the 1990s and beginning of the 2000s in a number of countries. It appears to be markedly higher than in South East Asia before the crisis of 1997 or in Argentina before the crisis of 2001. However, cross-country comparisons should be interpreted with due caution, owing to methodological and regulatory differences in the structure of non-performing loans. Furthermore, these comparisons are merely lagged indicators of a crisis as business failures occur a certain amount of time after the crisis due to the regulatory period subsequent to which late payments are classified as non-performing loans (at least three months, according to national regulations). Lastly, current non-performing loan ratios are automatically maintained at a low level, owing to the very high credit growth, which leads to a very rapid increase in the denominator of the ratio.

Moreover, loan-loss provision ratios are significantly below the level prevailing in the euro area and in Argentina prior to the crisis of 2001. Finally, capitalisation ratios, though markedly higher than the minimum national ratios of 8-12% and the Basel I ratio of 8%, have diminished since 2000 as assets have rapidly increased. The attrition rate is particularly high in Bulgaria and Latvia and could require a further injection of capital, if the current credit growth rate continues.

Banking sector exposure to exchange rate risk

In spite of the apparently healthy situation in the banking sectors of the countries under review, a rapid deterioration in the banks' balance sheets cannot be ruled out in the event of a currency crisis, if the banks are highly exposed to exchange rate risk. The analysis of this exposure can therefore indicate a potential channel of transformation from a currency crisis to a banking crisis.

This analysis, which must take into account the banks' balance sheet and off-balance sheet items, is complex. In most countries, banks' unhedged foreign currency exposure including off-balance sheet items, as a percentage of their equity capital, is low (see Table 1, which refers to an indicator calculated by the IMF, notably within the framework of Article IV missions).

We shall therefore focus on the situation of non-bank agents, particularly households and small- and medium-sized enterprises, as a rise in their foreign currency denominated debt may pose a problem for their solvency, due to their limited access to hedging instruments and their low foreign currency denominated income available for the servicing of their debt.

We can therefore draw up a typology of countries according to the difference between the relative amount of foreign currency loans to the private sector and foreign currency deposits. In certain countries, the ratio of foreign currency loans minus foreign currency deposits to GDP is negative. In other countries, however, the amount of foreign currency loans is markedly higher than that of its equivalent in deposits, i.e. accounting for between 11 and 53 GDP percentage points. This situation means that the exchange rate risk linked to a potential depreciation of the domestic currency against the euro is transferred to the borrowers;

3 *See Kaminsky (2006) for a comprehensive review of the models and indicators of financial crises.*

Table 1 Currency mismatches and the banking sector's exposure to exchange rate risk (2005)

	Banks' unhedged foreign currency exposure (as a % of equity capital)	(Foreign currency loans – foreign currency deposits) / GDP
Hungary	3.5	11
Poland	2.5	-7.1
Czech Republic	0.3	-17.8
Slovakia	-30	1.1
Estonia	80	52.3
Latvia	15	40
Lithuania	1.8	14.1
Bulgaria	-5.6	2.9
Romania	-0.6	0.7 (2004)
Croatia	5.5	-6.7 [1]

Sources: IMF, national central banks, ECB, authors' calculations.
1) incl. loans indexed to foreign currencies, which are substantial in Croatia.

it brings about an indirect credit risk for banks, since a depreciation of the domestic currency could reduce borrowers' solvency, if their income in euro is not equivalent. In such a situation, banks' collateral may be insufficient to protect them against a decline in borrowers' solvency.

An analysis at a more disaggregated level is needed as an unhedged foreign currency position may be moderate at the aggregate level but very substantial at an individual or sectoral level, which might entail systemic risk. In the case of countries for which a breakdown of foreign currency loans and deposits between households and businesses is available, i.e. Hungary (for loans only), Latvia, Bulgaria, Romania and Croatia, non-bank businesses appear to bear substantial exchange rate risk as the amount of their foreign currency liabilities is higher than their total foreign currency assets (see Table 2). As regards households, they face variable exchange rate risk exposure. In Croatia and, to a lesser extent, Hungary, households' foreign currency loans account for a significant proportion of GDP, even if the level of their foreign currency deposits is still higher. This suggests that households' potential exposure depends on the distribution of foreign currency loans and deposits across the population. The pace at which foreign currency loans increase should therefore be monitored.

Lastly, the significant presence of foreign banks in most of the countries in the panel provides a degree of protection against sudden capital outflows, but it can also lead to spillover effects between countries.

Table 2 Household and corporate exposure to exchange rate risk in the EU new Member States, acceding and candidate countries (2004, unless otherwise indicated)

	Households: foreign currency deposits as a % of GDP	Households: foreign currency and indexed loans as a % of GDP	Non-bank businesses: foreign currency deposits as a % of GDP	Non-bank businesses: foreign currency loans as a % of GDP [1]
Hungary (2005)	na	5	na	11.2
Latvia	7.3[2]	11.7[3]	11.3[2]	36.9[3]
Bulgaria	12.6	1.3	5	16
Romania	4.1	2.3	3.2	7.5
Croatia	32.6	28.8	4.9	5.6

Sources: IMF, national central banks,, Backé, Reininger and Walko (2006).
1) Excluding foreign currency-indexed loans, which are significant in Croatia.
2) Foreign currency assets.
3) Foreign currency liabilities.
na: non available

3| The relationship between credit growth and the current account deficit

The previous section highlighted that a large proportion of loans extended in the countries under review are in foreign currencies and have been taken out by private agents who have little protection against exchange rate risk. This means that the banking system faces "indirect" exposure in the event of a depreciation of the national currency. In turn, the risk of depreciation is to a large extent determined by the size of the current account deficit. It so happens that there is a strong relationship between credit growth and the size of the current account deficit, which we will investigate in this section.

Credit growth increases liquidity in the economy and should increase demand for goods and services. If supply is insufficient to meet the additional demand some of this demand will be directed abroad, thus helping to create a current account imbalance. The aim of this section is to test empirically to what extent credit growth is contributing to imbalances in the current account in the countries in the region under review.

The model estimated

We specify an autoregressive distributed lag model for the current account balance (see Appendix for methodological details concerning the autoregressive distributed lag model). The following explanatory variables are included: total flows of domestic credit, i.e. loans to the private sector plus loans to the public sector; the fiscal balance; and foreign direct investment (FDI). All of the variables are expressed as a percentage of GDP.

Credit flow constitutes our variable of interest and measures the "monetary" impact on the current account balance. The two other variables are control variables. The first is the fiscal balance, which is often advanced as a means of influencing the current account balance, notably in the IMF's recent recommendations concerning the countries in the region under review where posting fiscal surpluses is advocated in order to stabilise/reduce the current account deficit. The second variable consists of net FDI, with the countries of the region having attracted huge amounts of FDI in recent years. The latter's impact on the current account balance may be both positive (ultimately), via an increase in the economy's productive capacity and negative (in the short term) through an increase in demand for imports of capital goods.

More formally, our basic model, which is estimated using quarterly data for the period Q1 1997 to Q3 2003 for which the main sources are the IFS,[4] IMF and Eurostat databases, can be written as follows:

$$CA_{it} = \alpha + \delta_i + \sum_{j=2}^{4} \theta_j D_j + \sum_{j=1}^{4} \beta_j CA_{i(t-j)} + \sum_{j=0}^{4} \gamma_j CR_{i(t-j)} + \sum_{j=0}^{4} \mu_j FISC_{i(t-j)} + \sum_{j=0}^{4} \lambda_j FDI_{i(t-j)} + u_{it}$$

where *i* and *t* are the indices for the country and the time period respectively, *CA* denotes the current account, *D* is a variable indicating the quarter, *CR* is the nominal flow of credit, *FISC* denotes the fiscal balance and *FDI* net flows of *FDI*. All of the variables were expressed as a percentage of GDP. For each variable, the current value and last four lags are included. The dummy variables for the quarter are included in order to take account of potential seasonal effects in the current account series (for example, in countries that are tourist destinations such as Bulgaria and Croatia, the current account balance in the third quarter is generally positive).

The individual dimension of the model (denoted by *i*) comprises 11 Central and Eastern European countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia). Including both an individual and a temporal dimension, i.e. using panel data, makes it possible to

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increase the size of the sample and therefore the accuracy of the estimates. This technique is necessary for the countries in the region under review, where macroeconomic series cover a relatively short time-frame. By contrast, the estimated coefficients are common to all countries (except for the fixed effect δ_i, which is specific to them), this being a necessary constraint in order to augment the degrees of freedom of the estimates.

Estimation results

The specified model may at first sight resemble an accounting identity: by definition (X-M)/Y = (S-I)/Y + (T-G)/Y[5] and, assuming that credit flow as a percentage of GDP is equal to the investment ratio and that the savings rate is constant, the current account would be equal to the sum of the credit flow and the fiscal balance. To take this possibility into account, we have estimated a variant of the model by including the investment ratio among the explanatory variables. The results of the estimates (see Appendix) show that the coefficients of the credit flow variable are significant, which suggests that it has independent explanatory power compared to investment, which tends to invalidate the hypothesis of an accounting identity for the original model. Moreover, it appears that the estimated coefficients of the fiscal balance variable are non-significant, thus supporting the conclusion that there is no accounting identity.

Table 3 Estimation results

	Basic model	Stable model [1]
	Dependent variable: CA	
Explanatory variable	Coefficient	Coefficient
C	-0.39 (0.67)	-1.31 (0.45)***
D2	-0.96 (0.54)*	-0.66 (0.52)
D3	1.04 (0.50)**	1.06 (0.47)**
D4	-1.26 (0.56)**	-1.35 (0.46)***
CA (-1)	0.04 (0.04)	
CA (-2)	-0.15 (0.04)***	-0.11 (0.04)***
CA (-3)	-0.09 (0.04)**	-0.08 (0.04)**
CA (-4)	0.60 (0.04)***	0.60 (0.04)***
CR	-0.07 (0.02)***	-0.08 (0.02)***
CR (-1)	-0.06 (0.02)***	-0.05 (0.02)***
CR (-2)	-0.10 (0.02) ***	-0.09 (0.02)***
CR (-3)	-0.09 (0.02) ***	-0.08 (0.02)***
CR (-4)	-0.04 (0.02) **	
FISC	0.06 (0.03)*	
FISC (-1)	-0.05 (0.03)	
FISC (-2)	-0.03 (0.03)	
FISC (-3)	0.06 (0.03)**	
FISC (-4)	0.02 (0.03)	
FDI	-0.14 (0.03)***	-0.12 (0.03)***
FDI (-1)	0.04 (0.03)	
FDI (-2)	-0.03 (0.03)	
FDI (-3)	-0.05 (0.03)	
FDI (-4)	-0.05 (0.03)	
Number of observations	330	330
R^2	0.91	0.90

*In brackets: estimated standard deviation (S.D.). *, **, *** significant at the threshold of 10%, 5% and 1% respectively.*
1) The stable model is obtained by successively eliminating coefficients that are non-significant at the threshold of 5% (except for the constant and dummy variables).

5 *Notation: X-exports, M-imports, S-savings, I-investment, T-tax revenue, G-government spending.*

The model is estimated using the generalised least squares method (see Appendix for technical details concerning the estimation method). Before estimating the model, the series are tested for the presence of a unit root. Several tests, the results of which are summarised in the Appendix, reject the hypothesis of the presence of a unit root.

We also tested for endogeneity between the dependent variable and the explanatory variables. To do so, we used a Durbin-Wu-Hausman test, the method and detailed results of which are set out in the Appendix. This test indicates that it is not necessary to use instrumental variables to estimate the model.

Looking at Table 3, several variables have significant coefficients. Regarding the dummy variables, there is a significant and positive effect in the third quarter attributable to tourist activity in several of the region's countries. Similarly, there is a negative effect in the fourth quarter, which may stem from greater demand for imported products in the run-up to Christmas and the New Year. Regarding the other variables, credit flow and its four lags are all significant and have the expected sign – an increase in credit deteriorates the current account, not only in the quarter concerned but also in subsequent quarters (significant coefficients of lagged variables). The fiscal balance does not appear to have a very significant effect on the current account balance. This is an interesting result that points to a degree of neutrality regarding fiscal policy, either through "Ricardian equivalence", with government dissaving being offset by saving by private agents, or by a crowding-out effect whereby, by increasing interest rates, government dissaving discourages private investment. Lastly, net *FDI* inflows have a negative and strongly significant effect on the current account; by contrast, the first lag has a positive but non-significant effect. This shows that an increase in investment would lead in the short term to a rise in demand for imports of capital goods, which is later partly offset by an increase in supply.

The results of the stable model (column 2) largely corroborate those of the basic model. The major difference is the lack of the fiscal balance ratio among the significant explanatory variables, which supports the finding that fiscal policy is neutral, as suggested by the basic model.

The results of the stable model can be used to calculate the long-term relationship between the current account and the explanatory variables. Over the long term, it is impossible to distinguish between current and lagged variables, i.e. $CA_t = CA_{t-1} = CA$, and the same is true for the model's other variables. The inferred long-term relationship between the model's variables is thus as follows:

$$CA = -2.2 + \delta - 0.5CR - 0.2FDI$$

where δ is each country's fixed effect.

The estimated elasticity of credit flow on the current account is -0.5, which means that a 1-percentage-point increase in credit flow as a percentage of GDP deteriorates the current account-to-GDP ratio by 0.5 percentage point. These results are close to those obtained by other econometric studies that have attempted to estimate the impact of credit flow on the trade balance: Coricelli et al. (2006) find a 1-percentage point (pp) increase in credit flow to households would deteriorate the trade balance (here also expressed as a percentage of GDP) by 0.86 pp in Romania, 0.66 pp in Turkey, 0.53 pp in Bulgaria and 0.38 in Latvia. Duenwald et al. (2005) find that a 1-percentage-point increase in domestic credit flow would deteriorate the trade balance by 0.7 pp in Romania and 0.4 pp in Bulgaria. These studies also find a limited and weakly significant effect of the fiscal balance on the trade balance. For example Duenwald et al. (2005) find that a 1-percentage-point improvement in the fiscal balance ratio would improve the trade balance by 0.2 pp, the effect being significant at the 10% threshold only.

Sustainability of exchange rate regimes

We showed above that credit growth appears to have a significant impact on the deterioration of the current account. The question then arises as to how far the external position of the region's countries is

Table 4 Indicators of the sustainability of exchange rate regimes, 2006

	Exchange rate regime	Short-term external debt as a % of foreign exchange reserves	Current account as a % of GDP	Financing of the current account by net FDI as a % (2005-2006 average)
Latvia	Fixed	264.2	-21.1	32.2
Estonia	Fixed (currency board)	208.2	-14.8	91.8
Slovakia	Floating with fluctuation bands	116.9	-8.3	65.4
Lithuania	Fixed (currency board)	115.0	-11.8	36.6
Bulgaria	Fixed (currency board)	88.8	-15.8	110.7
Czech Republic	Managed float	71.2	-4.2	220.1
Hungary	Floating with fluctuation bands	67.2	-5.8	58.1
Romania	Managed float	63.1	-10.3	83.1
Poland	Independent float	52.9	-2.3	122.6
Croatia (2005)	Managed float	48.5	-5.9	105.1
Korea (1996)	Fixed	228.3	-4.2	24.0
Indonesia(1996)	Fixed	177.8	-3.1	62.0
Thailand (1996)	Fixed	126.5	-8.1	10.0
Philippines (1996)	Fixed	81.0	-4.7	44.0
Malaysia (1996)	Fixed	41.2	-4.4	86.0
Argentina (2001)	Fixed (currency board)	168.4	- 1.4	50.0

Sources: ECB, EIU, EBRD.

sustainable. We analyse the three usual indicators of external vulnerability: short-term external debt, the current account deficit, and its financing.

Owing to the relatively substantial coverage of short-term external debt by foreign exchange reserves and the extensive financing of current account deficits by net FDI inflows in the countries under review, most of the countries' vulnerability to a sudden reversal in capital flows may be regarded as moderate.

A comparison with emerging economies in periods preceding crises (Asia in 1996, Argentina in 2001) shows that the short-term external debt-to-foreign exchange reserves ratio is generally lower in the NMSs, acceding and candidate countries (see Table 4), except in Latvia and Estonia. However, regardless of the value of this ratio at a given point in time, its increase in is also an indicator of vulnerability. This ratio has risen in most countries since 2000.

As regards current account deficits, they are at significantly higher levels than in Asia in 1996 or Argentina in 2001. On the other hand, the financing of the current account deficit by FDI seems better in the NMSs, acceding and candidate countries, with the exception of Latvia and Lithuania.

The deterioration of the Baltic States' external indicators since 2000 is all the more problematic in that these countries as they have adopted fixed exchange rate regimes. The indicator for coverage of short-term external debt by foreign exchange reserves is particularly relevant for countries with fixed exchange rates as it measures the central bank's ability to withstand an attack on the currency's central rate. Moreover, macroeconomic imbalances can quickly be corrected by devaluing the exchange rate; given that this mean-working process is not available under a fixed exchange rate regime, macroeconomic imbalances can build up over long periods and then require a sharp adjustment.

In reality, the currency board regime does not completely eliminate the risk of a currency crisis, although there is an automatic stabilisation mechanism whereby money supply, which is the counterpart of foreign

exchange reserves, shrinks automatically in the event of major capital outflows. The stability of the nominal exchange rate could be maintained under these circumstances but capital outflows would have an adverse effect on domestic demand and therefore on economic activity. The authorities might then be tempted to bow to pressure and allow devaluation in order to offset the negative impact on the economy of monetary contraction by an increase in net exports.

4| Causality between credit flow and domestic demand

In the previous section we highlighted the link between credit growth and the deterioration in the current account. This finding can be attributed notably to the rise in domestic demand associated with credit growth. However, the qualitative risk assessment that could be made associated with credit growth varies according to the causal link between credit growth and domestic demand.[6] Indeed, if demand causes credit growth, it would be a natural financial catching-up process. Whereas, if credit growth causes demand, then this would be the sign of a potential risk for the system in which credit growth leads to an overheated demand.

The methodology developed by Granger enables us to determine whether credit growth causes demand to increase or vice versa. However, the results of Granger causality tests must be interpreted with caution since they are simple tests based on the past of a given variable; see Appendix for the methodological notes. We use causality tests for the countries studied. The summarised results are presented in the following chart and the in-depth results are given in the Appendix.

The results of the tests show that credit flow tends to cause domestic demand in Bulgaria, Estonia, Latvia and Poland. Among these countries, the first three registered high credit growth rates that, in the light of the causality tests, can be interpreted as a credit boom that is believed to have led to an overheated demand. It is also interesting to note that these three countries implement nominal exchange rate stability policies, thus foregoing monetary policy as a means of stabilising domestic demand. In the light of the results in the previous section, it is not surprising that Bulgaria, Estonia and Latvia are the countries with the highest current account deficits of the countries under review.

However, in Croatia and Romania, the direction of causality is the opposite, i.e. credit growth does not generate an overheated demand but rather the rise in domestic demand stemming from the catching-up process causes an increase in credit flow.

Chart 3 Causality between credit flow and domestic demand

****, **, * Significant at the threshold of 1%, 5%, 10%.*

6 *It should nevertheless be noted that the causality tested here is purely statistical. The variable y causes the variable x if we reject the assumption that the past of y does not contain any information on x that is not already contained in the past of x (Granger test; see Appendix).*

5| Conclusion

In this article we have shown that the banking system of the EU new Member States, acceding and candidate countries appears to be sound. An important factor of stability is the high penetration of foreign banks in particular from the euro area, which may act as a barrier to the propagation of financial crises since they attempt to safeguard their market share in a region of strategic significance. Nevertheless, a number of indirect vulnerabilities of the banking system do not seem to have been correctly taken into account or have been underestimated by traditional vulnerability analysis. First, this is the case for the banking system's exposure to exchange rate risk that is "indirect" since the final borrowers (households and corporations) incur the exchange rate risk through their massive exposure to foreign-currency loans.

Second, credit growth has a negative impact on the current account balance, raising the risk of a currency crisis. For instance, we identify an overall vulnerability mechanism in which credit growth raises the probability of a balance of payments crisis that in turn may have a negative impact on the banking system, as private agents hold an open currency position. However, traditional external vulnerability indicators show that the situation is generally stable with short-term external debt covered by foreign exchange reserves and current account deficits are largely financed by foreign direct investment. However, these indicators appear to have deteriorated for the Baltic States where they have reached levels comparable to those of Asian countries in 1996.

Lastly, in order to assess the sustainability of these imbalances, we have attempted to ascertain the nature of credit growth by determining whether this growth stems from a catching-up process or whether it is generated exogenously by the banking system. We tested the causality between credit flow and domestic demand. When the causality detected indicates that credit growth determines domestic demand, it could be interpreted as a potential risk for the system because strong credit growth can result in an overheated demand. We find that the direction of the causality detected goes from credit to domestic demand in Bulgaria, Estonia, Latvia and Poland, and in the opposite direction in Croatia and Romania.

APPENDIX

Autoregressive distributed lag model

An Autoregressive distributed lag model can be expressed in the general form ARDL(p,q,...,q) as follows.

$$y_{it} = a + \delta_i + \sum_{j=1}^{p} \beta_{ij} y_{i(t-j)} + \sum_{j=0}^{q} X_{i(t-j)} \gamma_{ij} + u_{it}$$
$$i = 1,...,N;\ t = 1,...,T$$

where y_{it} is the dependent variable and X_{it} is a vector ((1 x k) of k explanatory variables.

The estimation of the model provides us with short-term dynamic relationship between the variables of the model as well as a long-term relationship between the dependent variable and the explanatory variables. In order to illustrate this simply, let us take a given country, $i = 1$ for example. In the long-term relationship, it is impossible to distinguish between contemporaneous and lagged variables, i.e. we have $y_t = y_{t-1} = y$ and $X_t = X_{t-1} = X$. By replacing the latter in the above equation we obtain:

$$y = a^* + X\gamma^* + \textit{random variables}$$

where

$$a^* = \frac{a + \delta}{1 - \sum_{j=1}^{p} \beta_j}; \quad \gamma^* = \frac{1}{1 - \sum_{j=1}^{p} \beta_j} \sum_{j=0}^{q} \gamma_j$$

Estimation method

The model is estimated by the generalised least squares (GLS) method. We take into account any heteroscedasticity between countries, as well as a conditional correlation between the residuals of the country i and j. More formally, we assume that $E(u_{it}u_{jt}|X_t) = \sigma_{ij}$ and $E(u_{is}u_{it}|X_t) = 0$ so that the variance-covariance matrix is expressed for all t as follows:

$$\Omega_N = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1N} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{N1} & \sigma_{N2} & \cdots & \sigma_{NN} \end{bmatrix}$$

The residuals from the initial estimation are used to estimate Ω_N. Then the GLS estimator is expressed as follows:

$$\hat{B}_{GLS} = \left(\sum_i X'_i \hat{\Omega}_N^{-1} X_i \right)^{-1} \left(\sum_i X'_i \hat{\Omega}_N^{-1} y_i \right)$$

Unit root tests

Table 1 Unit root tests

	Variable			
Test statistic	**CA**	**CF**	**FISC**	**FDI**
Null: unit root (assumes common root process)				
Levin, Lin and Chu	-2.64 (0.00)	-3.23 (0.00)	-10.57 (0.00)	-13.24 (0.00)
Breitung	-4.57 (0.00)	-4.72 (0.00)	-7.38 (0.00)	-7.9 (0.00)
Null: unit root (assumes individual root process)				
Im, Persan and Shin	-4.52 (0.00)	-4.98 (0.00)	-10.96 (0.00)	-11.96 (0.00)
ADF	66.99 (0.00)	70.56 (0.00)	164.8 (0.00)	168.4 (0.00)
PP	186.2 (0.00)	194.9 (0.00)	214.8 (0.00)	167.1 (0.00)

Tests in level form. In brackets: P-values, i.e. probability of error if the null hypothesis is rejected.

Testing for endogeneity

The results of the estimations would not be asymptotically valid if one or more of the explanatory variables were endogenous, i.e. non-predetermined or non-exogenous. To test for this possibility we use a Durbin-Wu-Hausman (DWH) test. The null hypothesis of the test is that the estimations by GLS are consistent. A rejection of the null hypothesis indicates that it is necessary to estimate the model using instrumental variables.

There are generally two difficulties in this approach: (i) identifying the variables that may be subject to endogeneity and (ii) finding the appropriate instrumental variables to replace them. As the lagged variables are predetermined, only the contemporaneous variables could be subject to endogeneity. *A priori*, credit flow could be restricted and the fiscal balance improved using monetary policy and fiscal policy respectively. Policy makers may respond by tightening both policies in the event of a significant widening of the current account deficit. This means that the current values of credit flow and fiscal balance variables, CF and FISC may be endogenous. However, FDI flows may be considered as exogenous *a priori* and determined by the overall sentiment of foreign investors and the economy's expected future productivity gains. As instrumental variables for the current value of the variables CF and FISC, we use the fifth and sixth lagged values of the respective variables, i.e. CF(-5), CF(-6), FISC(-5), FISC(-6).

Before carrying out the DWH test, we perform a test of over-identifying restrictions to assess the validity of the variables as instruments. We regress the residuals of the instrumental variables of the original model to the set of instruments. The test statistic is n times the R^2 of this regression, with n being the number of observations of the regression. The test statistic follows asymptotically a χ^2 $(l - k)$ distribution, with l being the number of instruments and k the initial number of independent variables. The P-value for the test is 0.76, which means that we can consider the original model to be well specified and the instruments to be valid.

We then perform the DWH test by adding to the original model additional regressors that are the orthogonal projections of the endogenous variables to the space generated by the instruments. Under the null hypothesis the coefficients of these additional regressors are not jointly significant, which means that an estimation by instrumental variables adds nothing to the initial estimations. Using Fisher's Exact Test, the P-value for the test statistic is 0.15, which means that we cannot reject the null hypothesis by which the GLS estimations are valid.

Model augmented by the investment ratio

Explanatory variable	Dependent variable: CA	
	Coefficient	
C	3.98**	(1.93)
D2	-0.73	(0.66)
D3	1.62***	(0.53)
D4	-1.56**	(0.68)
CA (- 1)	0.01	(0.04)
CA (- 2)	-0.14***	(0.04)
CA (- 3)	-0.08*	(0.04)
CA (- 4)	0.58***	(0.04)
CF	-0.04**	(0.02)
CF (- 1)	-0.03*	(0.02)
CF (- 2)	-0.08***	(0.02)
CF (- 3)	-0.08***	(0.02)
CF (- 4)	-0.04*	(0.02)
INVEST	-0.63***	(0.07)
INVEST (- 1)	-0.02	(0.04)
INVEST (- 2)	-0.02	(0.03)
INVEST (- 3)	-0.11***	(0.04)
INVEST (- 4)	0.57***	(0.07)
FISC	0.05	(0.03)
FISC (- 1)	-0.02	(0.03)
FISC (- 2)	-0.02	(0.03)
FISC (- 3)	0.02	(0.03)
FISC (- 4)	0.02	(0.03)
FDI	-0.12***	(0.03)
FDI (- 1)	0.02	(0.03)
FDI (- 2)	-0.03	(0.03)
FDI (- 3)	0.00	(0.03)
FDI (- 4)	-0.07**	(0.03)
Number of observations	330	
R^2	0.87	

*In brackets: estimated S.D. *, **, *** Significant at the threshold of 10%, 5%, 1% respectively In brackets: estimated S.D.*

Causality tests

The Granger causality test [Granger (1969) "Investigating causal relations by econometric models and cross-spectral methods", Econometrica, No. 37] between two variables x and y consists in determining whether the past of y contains any information on x that is not already contained in the past of x (i.e. test of non-causality of y on x). The test is calculated as follows. First, we estimate the following two models:

$$x_t = a_0 + \sum_{j=1}^{q} a_j x_{t-j} + \sum_{j=1}^{q} \beta_j y_{t-j} + u_{1t}$$

$$y_t = \delta_0 + \sum_{j=1}^{q} \delta_j y_{t-j} + \sum_{j=1}^{q} \gamma_j x_{t-j} + u_{2t}$$

$$t = 1, \ldots, T$$

The null hypothesis that y does not cause x consists in testing the joint nullity of the beta parameters:
$H_0 : \beta_1 = \ldots = \beta_q = 0$

The null hypothesis that x does not cause y consists in testing the joint nullity of the gamma parameters:
$H_0 : \gamma_1 = \ldots = \gamma_q = 0$

Results of the causality tests

	Null hypothesis:	Obs	F-Statistic	P-value
Bulgaria	Domestic demand does not cause (in the sense of Granger) credit flow	38	1.73275	0.19250
	Credit flow does not cause (in the sense of Granger) domestic demand		6.92232	0.00309
Czech Republic	Domestic demand does not cause (in the sense of Granger) credit flow	38	2.064907	0.142907
	Credit flow does not cause (in the sense of Granger) domestic demand		0.946157	0.398510
Estonia	Domestic demand does not cause (in the sense of Granger) credit flow	38	1.289326	0.288970
	Credit flow does not cause (in the sense of Granger) domestic demand		4.882131	0.013888
Croatia	Domestic demand does not cause (in the sense of Granger) credit flow	38	2.514380	0.096300
	Credit flow does not cause (in the sense of Granger) domestic demand		0.840420	0.440560
Hungry	Domestic demand does not cause (in the sense of Granger) credit flow	38	1.872390	0.169730
	Credit flow does not cause (in the sense of Granger) domestic demand		0.751260	0.479670
Lituanie	Domestic demand does not cause (in the sense of Granger) credit flow	38	1.183800	0.318780
	Credit flow does not cause (in the sense of Granger) domestic demand		0.980370	0.385830
Latvia	Domestic demand does not cause (in the sense of Granger) credit flow	38	0.507510	0.606610
	Credit flow does not cause (in the sense of Granger) domestic demand		3.046720	0.061060
Poland	Domestic demand does not cause (in the sense of Granger) credit flow	38	0.970300	0.389520
	Credit flow does not cause (in the sense of Granger) domestic demand		3.318200	0.048630
Rumania	Domestic demand does not cause (in the sense of Granger) credit flow	38	3.055943	0.060588
	Credit flow does not cause (in the sense of Granger) domestic demand		1.400391	0.260768
Slovenia	Domestic demand does not cause (in the sense of Granger) credit flow	38	0.219690	0.803930
	Credit flow does not cause (in the sense of Granger) domestic demand		0.758210	0.476490
Slovakia	Domestic demand does not cause (in the sense of Granger) credit flow	38	2.037470	0.146440
	Credit flow does not cause (in the sense of Granger) domestic demand		0.310720	0.735040

Number of lags included: 2.

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