Can Banking Intermediation in the Central and Eastern European Countries Ever Catch up with the Euro Area?

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This paper focuses on the private credit flow-to-GDP ratio for measuring and comparing the degree of banking intermediation, which complements the widely used stock-flow measure. The authors find that, on the basis of this flow-flow measure, the current degree of banking intermediation in most Central and Eastern European countries (CEECs) is significantly closer to the euro area average than suggested by the traditional stock-flow measure. Nevertheless, the longer-term average of annual figures of the recent past indicates that most CEECs still have some way to go to catch up with intermediation in the euro area in a persistent manner, even on the basis of the flow-flow measure. Furthermore, the authors analyze the implications of the different concepts of convergence in the degree of banking intermediation. According to simulations, maintaining a flow-flow ratio in the CEECs equal to the euro area average of the past ten years (i.e. given full convergence in the flow-flow ratio) will also lead to convergent stock-flow ratios. However, this will only be the case at a rather late point in time, i.e. not before the end of this century, and will thus come considerably later than convergence in GDP per capita at purchasing power parity (PPP). On the other hand, for the CEECs to simultaneously achieve convergence in the stock-flow ratio and in per capita income levels, the flow-flow ratios would have to significantly and persistently exceed the euro area average of the period from 1994 to 2003 for a period of between 15 and 50 years, depending on the respective country. Drawing on the experience of major catching-up economies in the past 50 years worldwide, the authors do not completely exclude, but take a rather skeptical view on, the possibility of realizing in a sustainable manner the high level of the flow-flow ratio that would be required for the simultaneous convergence in the stock-flow ratio and in per capita income levels.

1 Introduction

Using the ratio of the stock of domestic claims on the private sector[2] or banking sector assets as a percentage of GDP is a widespread approach in financial literature when it comes to comparing the degree of banking intermediation. Institutions, such as the European Bank for Reconstruction and Development (EBRD), the European Commission (EC), the Bank for International Settlements (BIS) or the European Central Bank (ECB), regularly refer to credit-to-GDP ratios or similar stock-flow measures in their publications. They generally demonstrate the relative underdevelopment of the Central and Eastern European countries (CEECs) in terms of banking intermediation by comparing these ratios with that observed for a developed-economy benchmark (e.g. the euro area). Likewise, academic literature frequently refers to such stock-flow GDP ratios. For example, Levine et al. (1999) address the issue of causality between financial development and economic growth and identify the determinants of financial development. They measure financial development levels by means of two stock-flow ratios (i.e. liquid liabilities of the financial system and private credit, each divided by GDP), and the ratio of commercial bank assets divided by the sum of commercial bank and central bank assets. Khan et al. (2001) illustrate the detrimental, nonlinear effect of inflation on financial depth, using different stock-flow indicators of financial depth as dependent variables. Cottarelli et al. (2003) estimate an econometric model of credit-to-GDP ratios and identify the major determinants of their long-term

[2]   *The term "claims" refers to loans, securities and repurchase agreements. In this paper we focus on claims of domestic banks on households and nonmonetary corporations (i.e. nonmonetary financial institutions and nonfinancial corporations). The term "credit" is used synonymously to claims.*

development (per capita income, public debt-to-GDP ratio, inflation, financial liberalization as well as legal, regulatory and corporate culture). They find that credit-to-GDP ratios in Central and Eastern Europe (CEE) are still significantly undersized compared with the equilibrium suggested by the model.

Other authors investigate the dynamics of credit-to-GDP ratios over time. For example, Klein and Olivei (1999) observe a positive relationship between capital account liberalization and financial deepening in OECD countries. In their econometric models, they partly use changes in stock-flow measures of financial depth as dependent variables. Kaminsky and Reinhart (1999) find that growth in the domestic credit-to-GDP ratio accelerates markedly in the run-up to banking and currency crises. Demirgüc-Kunt and Detragiache (1997) report some, yet not very strong, evidence that a boom in credit to the private sector (measured by the change of the credit-to-GDP ratio) precedes banking crises. Gourinchas et al. (1999, 2001) and Cottarelli et al. (2003) investigate the dynamics of credit-to-GDP ratios over time based on the deviation of the ratio from a retrospective country-specific stochastic trend. Gourinchas et al. find that the probability of a banking or currency crisis increases significantly after a lending boom, which they define as a relative or an absolute deviation of the credit-to-GDP ratio from its stochastic trend in excess of a given threshold. Using the same methodology, Cottarelli et al. identify no signs of excessive lending booms or a looming banking crisis in the CEECs on the basis of developments up to 2002.

Pilková and Pätoprstý (2004) develop "effective" measures of financial intermediation that reflect the economic potential of transition economies and discard what they call the "cost of transition." They derive an "effective asset intermediation level" by relating a narrower definition of the total assets-to-GDP ratio. In a farther-reaching effort, they infer "effective" loans and deposit intermediation levels by relating the level of total gross loans and deposits to some kind of measure of the debtors'/depositors' income (with different methods of calculation applying to the retail and the corporate sector, and to deposits and loans). Comparing traditional and effective measures of intermediation delivers mixed results in the different segments, with regard to both absolute gaps between the CEECs and the euro area and the development of gaps over time.

Overall, existing research gives a comprehensive overview about banking intermediation in CEE on the basis of either the stock-flow measure of banking intermediation or the dynamics of this indicator. In our paper, we propose to extend the measures of banking intermediation by also focusing on a flow-flow measure, i.e. on the ratio of private credit flows[3] to GDP. We think that this measure provides further insights into banking intermediation, because compared with the private credit stock-to-GDP ratio it better reflects the banking sector's capability to mobilize new savings and inject fresh capital into the productive sectors of the economy.

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[3] *Annual credit flows are approximated by differences in credit stocks, both unadjusted and exchange rate-adjusted, at the end of the given year and at the end of the previous year.*

Another argument for taking a closer look at the flow-flow ratio is the need to correct the stock-flow measure for the inherent "time bias" or "accumulation bias," as shown in our paper. Some research papers have already touched upon this issue by focusing on the dynamics of the stock-flow measures, and we believe that this approach deserves to be further developed. Moreover, whereas numerical values of the flow-flow measure may sometimes be similar to the values of the change in the stock-flow indicator, the two measures differ conceptually, as any change in the stock-flow measure can be affected by (1) a change in the numerator (e.g. in the nominal stock of loans) and (2) a change in the denominator (i.e. in nominal GDP). By contrast, the flow-flow measure relates the change in the nominal value of the stock in a given year to that year's GDP. Hence, this measure better captures the relationship between the volume of new capital injected into the economy and economic output in a given year, whereas the difference between the two measures increases the greater the change in the denominator is. Moreover, the excessiveness of changes in the credit stock-to-GDP ratio has so far been assessed mostly on the basis of this indicator's past development. However, given their transitory character, past credit developments may not be a suitable yardstick for the CEECs, and thus an alternative benchmark may be called for. Finally, the flow-flow ratio can be related to a complementary concept of convergence in banking intermediation, which in turn may provide additional insights into the time horizon of convergence in financial wealth as measured by the stock-flow ratio.

For these reasons, we believe that the flow-flow measure represents an important complementary indicator of the level of banking intermediation. In a comprehensive exercise, i.e. when the level of banking intermediation is compared on the basis of both the flow-flow and the stock-flow measure, it should be borne in mind that the former more flexibly reflects short-term developments in banking intermediation, the economic cycle or the financing structure of households and enterprises. However, the flow-flow measure does not take into account banking intermediation in the form of relending (partially) matured claims, which in macroeconomic terms is linked to the financing of (probably more productive) replacement investment. Moreover, assuming that there may have been market imperfections in the past implying that capital was not allocated in a totally efficient way, efficiency gains might be realized in current periods owing to capital reallocation (e.g. interindustry reallocation). Obviously, this type of intermediation activity is of economic importance even if the flow-flow measure indicates that no fresh capital has been channeled into the economy.

This paper is structured as follows. In section 2, we analyze the stock-flow ratio and compare the concepts of measuring banking intermediation by credit stock and credit flow, taking into account the situation in the CEECs. Section 3 explains how we derived flow-flow ratios for the CEECs. Section 4 gives a comprehensive assessment of the current degree of banking intermediation in the CEECs, including both stock-flow and flow-flow ratios. Section 5 takes a close look at the issue of convergence in banking intermediation. Finally, section 6 concludes, touching also briefly on possible policy implications.

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2 Analysis of the Stock-Flow Measure of Banking Intermediation

The development of the stock of financial assets over time can be stylized in the following way. Let Q_t^s be the saving ratio defined as the stock of savings as a percentage of GDP in period t, S_t the stock of (domestic currency) savings in period t, Y_t nominal GDP in period t, π_t inflation from period $t–1$ to t, r_t the realized real interest rate level from period t to $t+1$, α the fraction of interest income that is redeposited (taking values between zero and one), S_t^T transaction savings (i.e. net new savings) in period t, R_t revaluation adjustments (e.g. price revaluations of marketable instruments) and y_t the growth rate of real GDP from period $t–1$ to t.

It follows from

$$Q_1^S = \frac{S_1}{Y_1} = \frac{S_0 + S_0 \times \alpha[(1 + r_0) \times (1 + \pi_1) - 1] + S_1^T + R_1}{Y_0 \times (1 + y_1) \times (1 + \pi_1)} \quad (1)$$

and under the simplifying assumption that $\alpha = 1$

$$Q_1^S = \frac{S_0 \times (1 + r_0)}{Y_0 \times (1 + y_1)} + \frac{S_1^T}{Y_0 \times (1 + y_1) \times (1 + \pi_1)} + \frac{R_1}{Y_0 \times (1 + y_1) \times (1 + \pi_1)} \quad (2)$$

that $Q_1^S > Q_0^S$ if – ceteris paribus – the realized real interest rate from period $t–1$ to t is greater than the growth rate of real GDP in the same period, or transaction savings are made in period t, or the deposit volume is positively affected by revaluations. If $\alpha \leq$, then the increase in Q_1^S will be smaller. However, more importantly for the purpose of our analysis, equation (2) implies that Q_t^S increases over time by the annual volume of transaction savings (in percent of GDP). Thus, the longer the savings accumulation lasts, the higher the saving ratio becomes.

In analogy to (1) and (2), a similar relationship can be defined for the stock of domestic (local currency) claims, i.e. loans, securities and repurchase agreements.[4]

In the case of foreign currency deposits or claims, similar relationships hold true for the deposit and claim ratios.[5] In these cases, the increase in the deposit and claim ratios over time depends on the volume of transactions, on the portion of "recycled" interest income and on revaluation adjustments in addition to the domestic nominal growth rate of GDP. Moreover, the increase in these ratios depends on nominal exchange rate changes (expressed in terms of a relative change in the volume of domestic currency per unit of foreign currency, denoted D) and, in the case of a positive "interest recycling" ratio, also on the foreign nominal interest rate level.[6]

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[4] See annex 1 for details.

[5] See annex 2 for details.

[6] If the foreign currency appreciates in nominal domestic currency terms at a positive rate of D (i.e. domestic currency per unit of foreign currency increases at a rate of D), the domestic currency changes in nominal foreign currency terms at a rate of $(1/(1+D) - 1)$, thus depreciates (i.e. foreign currency per unit of domestic currency changes at a rate of $(1/(1+D) - 1)$, thus decreases). If D is deflated by the inflation differential between domestic and foreign inflation, the real change of the foreign currency at a rate of d results. If this real change has a positive value, it means a real appreciation of the foreign currency, which implies a real depreciation of the domestic currency at a rate of $(1/(1+d) - 1)$.

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Against the background of the above equations and if we take into account that the latest bout of accumulation in the euro area started around 60 years ago (following World War II), while little more than a decade ago in the CEECs, it is not surprising that the deposit and claim ratios are significantly smaller in the CEECs than in the euro area. The financial suppression in the command economy implied that any real capital accumulation that took place was not reflected in financial capital accumulation to the same degree as in the countries that today make up the euro area. More importantly, the size of real capital accumulation itself was by far lower than in the current euro area, precluding the increase of financial wealth.

In contrast to financial market literature, public finance statistics differentiates between flow-flow and stock-flow measures. Flow-flow measures refer to budget balance, budget revenues and expenditures in percent of GDP, while stock-flow ratios express public debt as a percentage of GDP. In most cases, a flow-flow ratio, namely budget expenditures as a percentage of GDP, serves to measure the state's redistribution role in the economy. Moreover, a public finance assessment also takes explicit note of the relationship between the flow-flow measure, i.e. the budget balance in percent of GDP, and the stock-flow measure: In the absence of revaluations (e.g. net acquisition/sale of financial assets, valuation changes of the government debt stock), the stability of the debt ratio requires that the primary budget balance be matched by the differential between the realized nominal (or real) interest rate and nominal (or real) GDP growth. In other words, if the realized nominal (or real) interest rate is equal to the nominal (or real) GDP growth rate, the public debt ratio increases over time by the annual primary budget deficit.

The bias in the stock-flow ratio in measuring the degree of banking intermediation can be shown by the following example. Assume that in a particular year the banking sector is completely idle and no new deposits are taken in and no new loans are extended to the economy (e.g. long-term deposits were taken in the previous years and subsequently lent in the form of long-term loans). In this year, the stock-flow measure of banking intermediation may be changed only on the back of interest accrual or revaluation (e.g. of foreign currency claims and deposits). In this example, does the stock-flow ratio accurately reflect the financial system's intermediation activity in this particular year?

We argue that it fails to do so, as we believe that stock-flow ratios are significantly biased due to the time factor, i.e. the length of the accumulation process or the maturity of outstanding claims and deposits. Obviously, large volumes of outstanding savings and claims require sufficient capacities to handle these large volumes and to bridge lenders and borrowers across time and preferred maturities. However, the capability to handle large *existing* volumes differs from the capability to channel *fresh* capital from domestic savers to agents that need additional financial resources. A stock-flow measure of banking intermediation gives an impression of the past development of the financial sector's intermediation activity over time – and the ratio is probably the higher, the longer this history is. By contrast, a flow-flow measure gives a more accurate impression of contemporaneous processes of intermediation between new

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savings and new capital formation. Setting, for example, new domestic claims (net) of a particular year in relation to that year's GDP would produce such a flow-flow indicator.[7]

As shown by the equations above, the degree of banking intermediation in the CEECs can approach that in the euro area (EU-12) as measured by the traditional stock-flow ratio *only if* (ceteris paribus, and in particular apart from any potential price revaluation effects of marketable instruments and reclassifications, which will probably not make any significant difference) over a longer period of time

— the CEECs show sufficiently high net volumes of annual transaction deposits and claims in relative terms (i.e. as a percentage of nominal GDP in the years of the transactions)[8]; or

— in the case of local currency deposits and claims

— with regard to stocks and interest income: the realized real (domestic) interest rate exceeds the real (domestic) GDP growth rate in the CEECs by a greater margin than in the euro area (assuming the same fraction of interest income recycling); or

— in the case of foreign currency deposits and claims

— with regard to stocks: the nominal appreciation of the foreign currency (in domestic currency terms) exceeds the nominal domestic GDP growth rate in the CEECs by a wider margin than in the euro area; or

— with regard to interest income (assuming the same interest income recycling fraction): the combination of the nominal appreciation of the foreign currency (in domestic currency terms) and the foreign nominal interest rate exceeds the nominal domestic GDP growth rate in the CEECs by a wider margin than in the euro area.[9]

Nominal or real exchange rate changes can hardly be expected to contribute to an increase in the stock-flow intermediation ratio in the CEECs over the long run. This becomes evident when we take the equation for the foreign currency credit stock-to-GDP ratio (annex 2) into account and consider that the CEECs tend to experience an equilibrium real appreciation of their currencies (implying a real depreciation of the foreign currency vis-à-vis these currencies) due to the catching-up process (Égert, 2003), while their real GDP growth rates can be expected to exceed euro area real interest rates.

Moreover, there are ways of achieving a higher stock-flow intermediation ratio – e.g. in particular via a real interest rate level above the real GDP growth rate – that can hardly be regarded as conducive to real catching-up in the long run. Provided a higher contribution to real catching-up is the ultimate goal of

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[7] *Theoretically, a stock-stock measure (e.g. the ratio between the stock of claims and the value of accumulated outstanding goods and services – or wealth – in an economy) would be an adequate solution as well.*

[8] *The issue what "sufficiently high" may mean will be further explored by means of simulations in section 5. Given the fact that the deposit or credit stock-to-GDP ratios are significantly lower in the CEECs than in the euro area, an equal net volume of annual deposit flow or credit flow as a percentage of nominal GDP in the CEECs and in the euro area suffices that the stock-flow ratios in the CEECs approach those in the euro area. However, in such a case, full convergence will only be achieved in the very long run (i.e. not before the turn of this century). Earlier full convergence in the stock-flow ratios would require the flow-to-GDP ratios in the CEECs to be higher than that in the euro area.*

[9] *In the case of a recycling ratio of 1, the real appreciation of the foreign currency – in domestic currency terms – exceeds the difference between real domestic GDP growth and the foreign real interest rate in the CEECs by a greater margin than in the euro area.*

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deepening banking intermediation, such an increase in the stock-flow indicator would constitute a financial deepening, which would run against the underlying goal of deeper financial intermediation.

Consequently, given the CEECs' handicap of lacking around 50 years of banking intermediation history, one may expect the traditional stock-flow measure of banking intermediation in the CEECs to approach the EU-12 level only in the very long run. Here, the time horizon critically depends on the comparative size of the flow-flow ratio, as will be shown in section 5.

3 Deriving a Flow-Flow Measure of Banking Intermediation

A flow-flow measure of domestic banking intermediation is difficult to derive for all CEECs given the lack of statistical data on banks' net lending and net deposit-taking activity. Traditional monetary statistics are based on stock data, and the harmonized monetary financial institution (MFI) interest rate statistics recently introduced capture new deposit and lending volumes on a gross basis, i.e. without netting them against deposit withdrawals and loan repayments. Data on credit and deposit transactions have been published by the ECB for the euro area and since 2002 by Česká národní banka for the Czech Republic. Data for the other countries (and for the Czech Republic prior to 2002) must be approximated. Thus, to ensure comparability across countries, we calculated flow data from stock data for the euro area and the Czech Republic. For illustrative purposes, we limited the following calculations to "MFI claims on other domestic residents," i.e. on domestic nonbanks outside the general government.

The ECB methodology to derive transaction data from stock data is based on the following formula:

$$F_t = (L_t - L_{t-1}) - C_t - E_t - V_t \qquad (3)$$

whereby F_t denotes transactions in period t, L_t the stock in period t, C_t the reclassification adjustment in period t, E_t the exchange rate adjustment in period t and V_t other revaluation adjustments in period t.

For the purpose of our analysis, however, a different adjustment procedure seemed to be more adequate.

First, owing to the lack of data, it was impossible to adjust for reclassifications. However, reclassifications are altogether unlikely to have significantly affected the aggregate indicator of "MFI claims on other domestic residents." For the same reason, we also had to omit a certain type of revaluation adjustment, namely for price changes of marketable instruments. Nevertheless, since domestic claims on the private sector in the CEECs almost exclusively comprise loans, such price adjustments are likely to play but an insignificant role.

Second, we did not adjust for claim write-offs, which might be seen as part of either reclassifications or revaluations that had negative values and lowered L_t. The reason is that we treated claim write-offs as a cleaning process which corrects for overlending in previous periods, i.e. a high degree of past banking intermediation, which was, however, partly unsound. This is particularly true for countries where imprudent lending practices in the past led to an

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accumulation of nonperforming claims. Were claim write-offs to be adjusted, this would favor such countries in our comparison, since strong (and partially imprudent) lending would boost the flow-flow measure of intermediation, whereas the subsequent correction of this unfavorable trend would be eliminated from the calculation. In order to best capture these dynamics, we decided to base the flow-flow measure of intermediation on a value averaged out over a longer period (instead of over just one year) which ideally includes both the (partially unsound) initial lending boom periods and the later correction periods. Alternatively, we also calculated the average for the period since the last write-off.

Third, we would have preferred to separate the relending of interest income into the economy (which the ECB methodology leaves fully to the series of transactions). However, significant uncertainty about the portion of "recycled" interest income rendered such an adjustment impossible.

Finally, for the exchange rate adjustment, we estimated the stock of foreign currency claims, using the share of foreign currency loans in total loans to domestic nonbanks outside the general government. Then we calculated the exchange rate adjustment by multiplying the estimated stock of foreign currency claims at the end of the previous year by the change in the bilateral exchange rate against the euro. Given the euro's dominating role in total foreign currency loans,[10] this seems to be an acceptable approximation of the actual currency distribution of claims.

4 A Comprehensive Assessment of the Current Degree of Banking Intermediation in the CEECs

Table 1 summarizes different measures of the degree of banking intermediation in selected CEECs and the euro area. It includes the traditional measure of banking intermediation based on the stock of domestic claims (i.e. loans, securities and repurchase agreements) on nonbank sectors outside the general government, and two measures of banking intermediation based on "flows" (proxied by differences in stocks, both unadjusted and exchange rate-adjusted) for the euro area and several CEECs.

It should be noted that for the multi-year averages the measures based on "flows" are not calculated as the average annual change in the stock-to-GDP ratio. Rather, they represent the ratio of the average annual "flows" (proxied by the annual changes in outstanding claims) to average annual nominal GDP.

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[10] *For example, the euro currently accounts for around 85% of foreign currency loans to domestic nonbanks in Bulgaria, the Czech Republic and Slovakia. In Hungary, its share stands at nearly 60%, with the Swiss franc accounting for another 27% of total foreign currency loans.*

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Table 1

Domestic Credit to the Private Sector

% of GDP

	Stock-flow measure		Flow-flow measures				
	Credit stock in % of GDP		Annual difference in credit stock in % of GDP			Annual difference in credit stock (adjusted for exchange rate changes) in % of GDP	
	Average 1993–2003	**Average 1999–2003**	Average 1993–2003	**Average 1999–2003**	Average 2002–2003	**Average 1999–2003**	Average 2002–2003
Euro area	96.3	**107.7**	6.7	**7.4**	5.1	**7.5**	5.8
Czech Republic	47.1	**38.1**	0.8	**−2.0**	0.9	**−1.9**	0.9
Hungary	31.9	**35.5**	6.2	**7.1**	8.4	**7.0**	8.0
Poland	26.6	**29.8**	3.8	**3.0**	1.5	**2.6**	0.3
Slovenia	35.1	**39.8**	5.8	**6.0**	5.1	**5.7**	4.8
Slovakia	43.5	**37.8**	1.6	**0.0**	2.0	**0.1**	2.0
Bulgaria	16.9	**18.1**	4.8	**4.8**	7.6	**4.8**	7.5
Romania	11.9	**10.7**	3.6	**3.0**	4.1	**1.7**	2.8

Source: Eurostat, national central banks, authors' calculations.

Notes: Credit includes funds extended by domestic banks (i.e. MFIs) to households and nonmonetary corporations (i.e. nongovernmental nonbanks or "other domestic sectors") in the form of loans, securities and repurchase agreements.

The values represent arithmetic averages of the annual figures during the respective periods in both the numerator and the denominator. For the stock-flow measure, this means that the average value of credit stock is divided by the average value of GDP. For the flow-flow measures, the average values for annual changes in credit stock are divided by the average value of GDP.

Euro area: stock from end-1993 to end-2003; difference in stock from 1993 to 2003 (difference in stock in 1993 = change from end-1992 to end-1993).

Czech Republic: stock from 1993 to 2003; difference in stock from 1994 to 2003.

Hungary: stock from 1993 to 2003; difference in stock from 1993 to 2003.

Poland: stock from 1993 to 2003; difference in stock from 1994 to 2003.

Slovenia: stock from 1994 to 2003; difference in stock from 1995 to 2003.

Slovakia: stock from 1994 to 2003; difference in stock from 1995 to 2003.

*Bulgaria: stock from 1995 to 2003; difference in stock from 1996 to 2003.*

Romania: stock from 1993 to 2002; difference in stock from 1994 to 2002; baseline period and alternative short period are 1999 to 2002 and 2002, respectively.

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Chart 1 shows the relative size of stock-flow and flow-flow measures compared with the euro area.

Chart 1a

Relative Position of the Ratio of Domestic Credit to the Private Sector to GDP

Stock-Flow Measure: Credit Stock-to-GDP Ratio (euro area = 100)
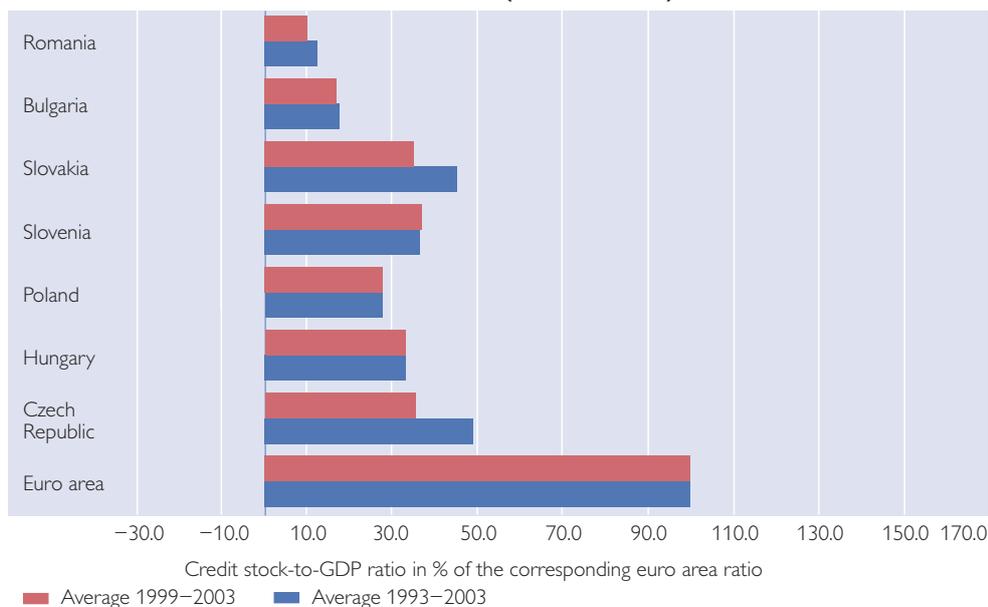
Credit stock-to-GDP ratio in % of the corresponding euro area ratio

■ Average 1999–2003   ■ Average 1993–2003

Source: Eurostat, national central banks, authors' calculations.
Note: The same notes apply as for table 1.

Chart 1b

Relative Position of the Ratio of Domestic Credit to the Private Sector to GDP

Flow-Flow Measure: Credit Flow-to-GDP Ratio (euro area = 100)
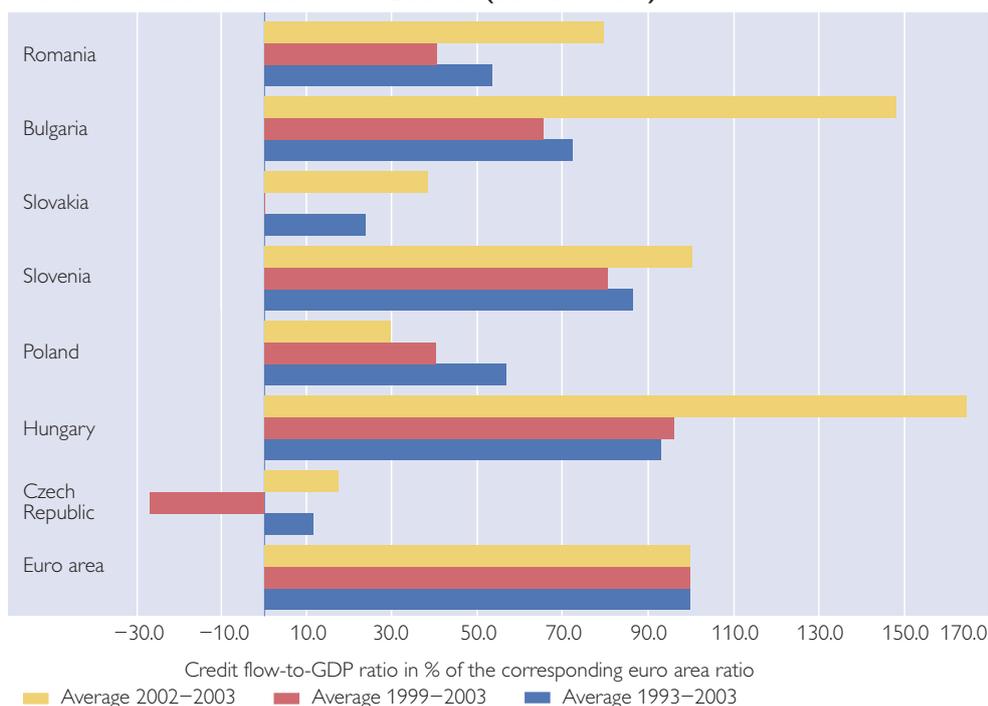
Credit flow-to-GDP ratio in % of the corresponding euro area ratio

■ Average 2002–2003   ■ Average 1999–2003   ■ Average 1993–2003

Source: Eurostat, national central banks, authors' calculations.
Note: The same notes apply as for table 1.

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Chart 1c

Relative Position of the Ratio of Domestic Credit to the Private Sector to GDP

Credit Flow-to-GDP Ratio (Adjusted for Exchange Rate Changes) (euro area = 100)
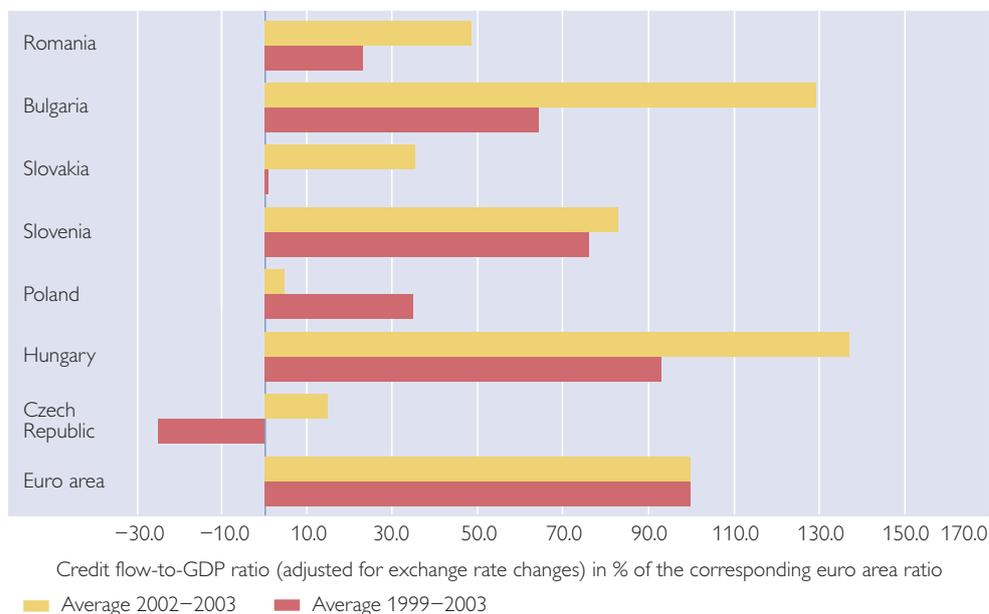
Credit flow-to-GDP ratio (adjusted for exchange rate changes) in % of the corresponding euro area ratio

■ Average 2002−2003   ■ Average 1999−2003

Source: Eurostat, national central banks, authors' calculations.
Note: The same notes apply as for table 1.

In both table 1 and chart 1, the baseline is the period from 1999 to 2003, since all three intermediation measures can be calculated for this period. To reflect the impact of debt write-offs in the Czech Republic and Slovakia, we also present an alternative longer period starting in 1993 (unless otherwise indicated) in order to include the development of lending prior to the debt write-off, and an alternative shorter period starting in 2002 in order to account for the development of lending after the debt write-off only.

It should be noted that the flow-flow measure of banking intermediation exhibits significantly larger cross-country and cross-period differences than the stock-flow measure. The dynamics of credit to the private sector over time seem to be particularly strong in the catching-up CEE economies. To smooth out excessive volatility over time, we therefore focus on multi-year average values in the flow-flow ratio. However, as table 1 and chart 1 show, the differences remain relatively large (compared with the differences in the stock-flow ratio) even after this adjustment. This phenomenon is attributable to the higher sensitivity of the flow-flow measure to short-term changes in the degree of banking intermediation, to the economic cycle or to changes in the financing structure of households and enterprises. By contrast, the stock-flow measure reflects these changes only much more sluggishly. Overall, we believe that the higher volatility of the flow-flow ratio compared with the stock-flow ratio better mirrors these cross-country and cross-period differences and helps better understand the process that takes place in the stock-flow measure between two points in time. It also seems that the persistence of these cross-country

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differences in the CEECs is clearly reflected in the persistence of the cross-country dispersion of the flow-flow measure over the past few years (measured by the annual standard deviation of flow-flow ratio values in the selected CEECs). It is noteworthy, though, that the cross-country dispersion in the CEECs over the past few years (average for the period from 1997 to 2003: 3.8%) was modestly lower than the cross-country dispersion within the euro area excluding Luxembourg (1998 to 2003: 6.9%; by 2003, the standard deviation had declined to 4.9%).

The left-hand-side blocks in table 1 and chart 1a show that, based on the traditional measure of banking intermediation, the CEECs lag behind the euro area by a wide margin. Moreover, a comparison of the baseline period (1999–2003) with the longer period (1993–2003) showed that the gap between the CEECs and the euro area did not narrow over time (with the exception of Slovenia). In two countries, the Czech Republic and Slovakia, the gap widened sharply, which is ascribable to the significant debt write-offs in both countries in the early 2000s.

A somewhat different picture emerges, however, from the flow-flow measure.

On the basis of unadjusted stock changes, as shown in the middle block in table 1 and chart 1b, banking intermediation in Hungary and Slovenia reaches levels close to or even above those recorded in the euro area. Also Bulgaria and Romania have lately shown a relatively large ratio of annual changes in the stock of domestic claims to annual GDP. All countries but two record a relative position to the euro area that is significantly better based on the flow-flow measure than on the stock-flow measure.

The two exceptions are the Czech Republic and Slovakia, where debt write-offs in the early 2000s affected the flow-flow measure more negatively than the stock-flow measure. The performance of both countries in terms of the flow-flow measure was somewhat better over the alternative longer period, but still worse than in any other of the countries under study. To some extent this might be explained by the fact that the debt write-off is likely to have affected debt accumulated prior to 1993, so that the average annual difference in stock between 1993 and 2003 possibly captures the preceding overlending period in an insufficient manner and is therefore dominated by the write-off transaction.[11] Nevertheless, given that the value for the alternative shorter period (i.e. following the debt write-off) is only insignificantly larger than the value for the longer period and looks relatively poor in comparison with most other CEECs, banking intermediation in the Czech Republic and Slovakia seems to remain comparatively less pronounced.

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[11] *This is probably particularly true for the Czech Republic, where the stock-flow ratio was as high as 65.6% already at end-1993 and has not exceeded this level afterwards, which implies that the lending boom is not captured when calculating the differences in the stock from end-1993 onward. In Slovakia, the ratio stood at 53.7% at end-1993 and increased to 56.4% by end-1996 before starting to decline owing to cleaning steps.*

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When comparing the flow-flow measure in the CEECs and the euro area, one should bear in mind the CEECs' significant financial openness. In particular, foreign direct investment inflows (in the form of both equity financing and intercompany loans) play a significant role in most CEECs and are often worth several percentage points of GDP per year. Over the past few years, these inflows were particularly large in the Czech Republic and Slovakia, i.e. in the two countries with relatively low flow-flow measures of domestic financial intermediation. Moreover, cross-border loans and – to a lesser extent – international bond issues constitute further important funding sources for the private nonbank sector in the CEECs, partly substituting for domestic bank intermediation (Reininger et al., 2002).

As no sufficient data were available on the currency structure of domestic claims, it was only possible to calculate the flow-flow measure adjusted for exchange rate valuations for the periods from 1999 to 2003 and from 2002 to 2003, and not for the alternative longer period (see the right-hand-side block in table 1 and chart 1c). Nevertheless, since the comparison with the unadjusted change in stocks shows no significant differences between the unadjusted and adjusted values, the unadjusted measure seems to be a good proxy for the degree of banking intermediation. Somewhat larger differences between the two values were observed only for Poland, Slovenia and Romania, where the exchange rate-adjusted values in the period from 1999 to 2003 as well as in the period from 2002 to 2003 showed a lower degree of banking intermediation than the unadjusted values. These were the countries which experienced the smallest real appreciation (Slovenia and Romania) or even a depreciation (Poland) during the period from 1999 to 2003. On the basis of exchange rate-adjusted stock changes, the degree of banking intermediation in Hungary, Slovenia and Bulgaria came closest to that in the euro area in the period from 1999 to 2003.

Based on flow-flow measures, banking intermediation in the CEECs compares significantly better with the euro area than on the basis of the traditional stock-flow measure. In the most recent past (2002–03), banking intermediation of new capital was even more pronounced in Hungary and Bulgaria than in the euro area, both in unadjusted and exchange rate-adjusted terms. Intermediation in Slovenia matched the euro area level in unadjusted terms during these two years. Nevertheless, for the other CEECs, the flow-flow measure also suggests that banking intermediation still has some way to go to reach euro area levels, albeit – with the exception of the Czech Republic and Slovakia – a significantly shorter way than implied by the stock-flow measure. However, as long as intermediation on the basis of the flow-flow measure continues to lag behind the euro area (even if to a diminishing extent), the gap based on the stock-flow measure is unlikely to narrow at all.

5 Convergence in Banking Intermediation

It is quite common to show by graph the correlation of lower levels of GDP per capita (at PPP) with lower ratios of private credit stock-to-GDP (see e.g. Backé and Zumer, 2005). From our point of view, such a graph demonstrates that countries that post lower per capita income levels at a certain point in time usually have had a later start, or a longer interruption, of the real capital

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accumulation process and, hence, of the increase in financial wealth. Clearly, the process of accumulation tends to lift both the income level and the stock-flow ratio.

As soon as a (low-income) catching-up country has achieved and maintains convergence in the flow-flow ratio with a (high-income) benchmark country, the implied credit growth in the catching-up country will be higher than in the benchmark country. On the basis of some simplifying assumptions, it can be shown[12] that given convergence according to the flow-flow-measure, i.e. at

$$\left(\frac{C_A^T}{Y_A} = \frac{C_B^T}{Y_B} \right) \tag{4}$$

the following relation holds true:

$$\frac{C_A^T = C_B^T}{C_A < C_B} \ or \ \left(\frac{C_A^T}{C_A} \right) > \left(\frac{C_B^T}{C_B} \right) \tag{5}$$

which means that in the catching-up country A the same volume of transaction claims (credits) as in the benchmark country B is divided by a smaller volume of claim (credit) stock. This automatically leads to a higher ratio, which is the credit growth rate. Thus, a lower level of the stock-flow measure of banking intermediation in a catching-up country implies higher credit growth given full convergence according to the flow-flow measure. This explains the strong negative correlation between annual credit growth and the level of the stock-flow measure of intermediation.

Moreover, by means of simulation we calculated paths of future stock-flow ratio (credit stock-to-GDP ratio) and flow-flow ratio (credit flow-to-GDP ratio) development under two different assumptions, which lead to two scenarios ("scenario 1" and "scenario 2").[13] Table 2a summarizes the results of these simulations, which represent a "mechanistic" approach under reasonable assumptions. For a more comprehensive overview of the simulation results, see annex 4.

Scenario 1 in table 2a shows the level the private credit stock-to-GDP ratio would reach in the CEECs at the time of convergence in GDP per capita (at PPP) levels with the euro area (EU-12), assuming (until the year of income convergence) the persistence of an annual flow-flow ratio in the CEECs (and the euro area) equal to the euro area average observed during the period from 1994 to 2003 (6.8% of GDP). We find that given full convergence in the flow-flow ratio, the private credit stock-to-GDP measure in the CEECs will be considerably larger than at the currently expected point of convergence in their per capita income levels.

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[12] *See annex 3 for details.*

[13] *The simulation is based on actual values for 2003 and the following basic assumptions for the parameters of future economic development: (1) a real growth rate of 2% and an inflation rate (GDP deflator) of 2% in the euro area; (2) a real growth rate of 4.5% (a growth differential of 2.5 percentage points) and an inflation rate (GDP deflator) of 3.5% (an inflation differential of 1.5 percentage points, as a proxy for real appreciation with constant nominal exchange rates) in the CEECs. In scenario 1, for both the euro area and the CEECs a private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail. Scenario 2 shows the implied annual private credit flow (net)-to-GDP ratios that would be necessary in the CEECs to simultaneously achieve convergence in income levels and in the private credit stock-to-GDP ratio, while for the euro area a private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail throughout the entire period, as in scenario 1.*

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Scenario 1 implies rather high annual average nominal and real credit growth rates over the next ten years (and also until the year of income convergence), as can be seen in annex 4. In fact, these credit growth rates will by far outpace the increments resulting for the euro area. This assumption is in line with the above reasoning that, given full convergence according to the flow-flow measure, the implied credit growth in the catching-up country will be higher than in the benchmark country (see also annex 3).

While the private credit stock-to-GDP ratio will be considerably higher in the CEECs in the year of income convergence than at the starting point (2003), it will nevertheless remain significantly below the private credit stock-to-GDP ratio currently recorded for the euro area (EU-12) in all CEECs. Moreover, it will trail the future private credit stock-to-GDP ratios in the euro area (EU-12) in the respective years of convergence by a wide margin. This result stands in clear contrast to what may be taken as suggested by a graph that correlates levels of GDP per capita (at PPP) with ratios of private credit stock to GDP, as mentioned above.

This leads to the question whether in this scenario, i.e. given full convergence in the flow-flow ratio, the stock-flow ratio in the CEECs will not only rise, but also catch up with the euro area (EU-12). Put differently, will banking intermediation in the CEECs ever be able to catch up with the euro area in stock-flow terms? Our simulation shows that this scenario would lead to convergence in the stock-flow ratio, but only at a rather late point in time, namely not before the end of this century, and thus considerably later than convergence in GDP per capita at PPP. In other words, based on an equal annual private credit flow-to-GDP ratio, the gap in per capita income will be overcome much earlier than the gap in the economy's accumulated capital and financial wealth (as proxied by private credit stock to GDP).

Scenario 2 reverses the simulation, allowing us to answer the question at which level the annual flow-flow ratio has to be maintained until the year of convergence in per capita income so that convergence in the stock-flow ratio will be achieved at the same time.[14] Table 2a presents the corresponding simulation results under the "scenario 2" heading. Obviously, for the assumption that convergence in the private credit stock-to-GDP ratio and in GDP per capita (at PPP) levels will be attained simultaneously to hold, a significantly higher annual private credit flow-to-GDP ratio than the euro area average of the past ten years, namely roughly double that level, would be necessary. Clearly, scenario 2 implies even higher annual average nominal and real credit growth rates over the next ten years (and also until the year of income convergence and simultaneous convergence in the private credit stock-to-GDP ratio), as shown in annex 4.

One may raise the question why this should not be the case in catching-up economies like the CEECs. Even if the flow-flow ratio converged to that in the benchmark economy at least in the long run, why should the ratio not be higher for several years of intense catching-up in per capita income and thus also imply faster catching-up in the CEECs' financial wealth? Indeed, one argument that speaks in favor of a temporarily higher private credit flow-to-GDP ratio is

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[14] For the euro area, a private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail throughout the entire period, as in scenario 1.

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the need to finance higher investment ratios in order to ensure catching-up in income levels. By contrast, one may point out that the private sector in the CEECs will probably further increase its integration into the global financial system, which implies that it will tap financing sources other than domestic credits (i.e. loans from, or securities issued to, domestic banks). While such alternative forms of financing, e.g. foreign direct equity investments, intercompany loans or foreign cross-border credits, have already played an important role for CEECs in recent years, they may to some extent dampen the expansion of domestic credit to the private sector also in the future.

Table 2a

Simulation Results for the Future Development of the Private Credit Stock-to-GDP Ratio

and the Private Credit Flow-to-GDP Ratio in the CEECs

Two scenarios for the stock-flow ratio in, and the flow-flow ratio until, the year of convergence in GDP per capita (at PPP)

	2003 Stock-flow ratio	Year of income convergence (GDP p.c., PPP)	Scenario 1:		Scenario 2:	
			Flow-flow ratio until year of	Stock-flow ratio in year of	Flow-flow ratio until year of	Stock-flow ratio in year of
			income convergence		income convergence	
Euro area	112%	2017−2055	6.8%	139%−167%	6.8%	139%−167%
Czech Republic	32%	2021	6.8%	76%	13.7%	144%
Hungary	42%	2026	6.8%	82%	13.0%	150%
Poland	29%	2038	6.8%	87%	12.5%	159%
Slovenia	43%	2017	6.8%	75%	14.0%	139%
Slovakia	33%	2033	6.8%	86%	12.6%	156%
Bulgaria	27%	2055	6.8%	89%	12.9%	167%
Romania	14%	2055	6.8%	88%	12.9%	167%

Source: Eurostat, national central banks, wiiw, authors' calculations.

Notes: The simulation is based on actual values for 2003 and the following basic assumptions for the parameters of future economic development: (1) a real growth rate of 2% and an inflation rate (GDP deflator) of 2% in the euro area; (2) a real growth rate of 4.5% (a growth differential of 2.5 percentage points) and an inflation rate (GDP deflator) of 3.5% (an inflation differential of 1.5 percentage points, as a proxy for real appreciation with constant nominal exchange rates) in the CEECs. In scenario 1, for both the euro area and the CEECs an annual private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail until the year of income convergence (i.e. convergence in GDP per capita at PPP). Scenario 1 shows for each country and for the euro area the private credit stock-to-GDP ratio that will be attained in the year of convergence in GDP per capita (at PPP) under this assumption. In scenario 2, only for the euro area an annual private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail. Scenario 2 shows for each country the implied private credit flow-to-GDP ratio that would be necessary in the CEECs to simultaneously achieve convergence in GDP per capita (at PPP) level and in the private credit stock-to-GDP ratio. The stock-flow ratio for each CEEC in scenario 2 is equal to the stock-flow ratio in the euro area in the year of income (GDP per capita at PPP) convergence of the respective country with the euro area.

Table 2b

Private Sector Credit Flow-to-GDP Ratios in Economies Undergoing Catching-up Processes since the Early 1950s

% of GDP

	Annual ratios	20-year rolling average ratios		
	Available since	Average value	Year of maximum value	Maximum value
Austria	1954	6.1	1990	7.1
Finland	1951	5.5	1990	8.0
Greece	1954	5.5	1991	6.7
Italy	1964	7.0	1984	8.8
Portugal	1954	12.2	1984	14.5
Spain	1954	10.0	1982	11.9
Ireland	1951	6.0	2004	11.0
Japan	1954	8.8	1979	11.9
Korea	1953	7.7	2003	8.9
Philippines	1951	3.5	1997	5.0
Thailand	1951	5.5	1997	10.6
South Africa	1966	7.7	2003	8.6
Argentina	1961	11.4	1990	15.1
Brazil	1965	19.3	1994	25.5
Mexico	1951	4.4	1994	5.7
Cross-country average				
Total		8.0		10.3
Excluding Austria, Finland, Italy and Japan		8.5		11.2

Source: IMF (International Financial Statistics), authors' calculations.

Note: The annual flows used to calculate the flow-to-GDP ratios are derived as changes in the year-end stock of outstanding private sector credit.

For deriving an assessment of the (net) private credit flow-to-GDP ratio that may be appropriate for catching-up economies, we turned to the past experience of major economies that had undergone a catching-up process at least for one or more decades since the early 1950s. Some of these economies have accomplished their catching-up process and have become well-established industrialized countries.

As reflected by table 2b, the evaluation of these experiences does not lead us to be very optimistic with respect to the possibility of realizing in a *sustainable manner* the high flow-flow ratio level that would be required for simultaneous convergence in the stock-flow ratio and the per capita income level. For the economies under investigation, the average value of 20-year rolling windows of the credit flow-to-GDP ratio was not higher than 8%. Even when we exclude those economies that have matured in the meantime, e.g. Austria, Finland, Italy and Japan, and, hence, posted lower values of their 20-year rolling windows in the later phase, the average value does not reach more than 8.5%. Both values are closer to the ten-year euro area average in the period from 1994 to 2003 (6.8%) than to the levels required for simultaneous convergence in the stock-flow ratio and in the per capita income level.

Granted, some countries registered higher average values of their 20-year rolling windows that are close to or even exceed the required credit flow-to-GDP ratio, as can be seen in table 2b. Naturally, the number of countries with such ratios increases if we do not look at the average, but at the maximum value of their 20-year rolling windows. However, in several of these cases, the

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higher average values were not coupled with a successful catching-up process, as for instance in Argentina or to a lesser extent in Brazil, where the periods that were more successful in terms of per capita GDP growth witnessed annual flow-flow ratios closer to the 6.8% value.[15]

In some cases, relatively high maximum values were achieved in periods when the annual private credit flow-to-GDP ratio was at excessively high levels, around times of economic instability, soaring inflation and ensuing economic crisis (with Thailand in 1997 a case in point). Nevertheless, there are also exceptions: the average values in Portugal and Spain as well as the maximum values in Ireland and Japan. For Portugal, Spain and Ireland, it should be noted that these high values were influenced in particular by the relatively high annual private credit flow-to-GDP ratios that were linked to (preparations for) EU accession, the full liberalization of capital flows and, most notably, the adoption of the euro. Since the introduction of the euro, the average annual private credit flow-to-GDP ratios of these three countries have come to between 14.2% and 18.5%. In all three countries, this average ratio was higher than in the preceding five years. However, it remains to be seen whether such high credit flow-to-GDP ratios can be maintained over an extended period of time, say, for 20 years.

Against the background of this evidence, the possibility of realizing in a sustainable manner the high level of the flow-flow ratio that would be required for simultaneous convergence in the stock-flow ratio and in the per capita income level should not be completely excluded. Even more so, as the institutional setting in which new EU Member States in CEE operate is similar to that in which Portugal, Spain and Ireland operated in the past.

6 Conclusions

The banking intermediation activities required from the financial sector in an economy comprise both the management of the existing stock of outstanding claims and the channeling of new funding/saving into new net investment.

Managing the existing stock consists, first of all, in the relending of (partially) matured claims, which in macroeconomic terms is linked to the financing of (probably more productive) replacement investment. Moreover, assuming possible market imperfections in the past that imply that capital was not allocated in a totally efficient manner, efficiency gains might be realized in current periods by capital reallocation (e.g. interindustry reallocation). Obviously, this type of intermediation activity is of economic importance even if the flow-flow measure indicates that no fresh capital has been channeled into the economy. At the same time, the potential size of this management activity is closely related to the size of the ratio of the outstanding stock of claims to GDP. As the outstanding stock of claims is to a significant extent dependent on the length of time of the preceding accumulation process, economies with com-

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[15] *It should also be noted that the relatively high average values of 20-year rolling windows of the credit flow-to-GDP ratio in Brazil resulted primarily from the very high ratios recorded during the period from 1988 to 1994, which were then followed by ratios of between 0.9% and 5.5% of GDP. Hyperinflation (1988–94) as well as inflation differences across sectors and weak GDP growth (1988–92) probably had an asymmetric impact on the nominal volume of credits (high positive real interest rates measured by consumer prices, e.g. 421% in 1990) and GDP (inflated by the GDP deflator), bringing about excessively high and clearly unsustainable credit flow-to-GDP ratios in this period.*

pletely different starting points of capital accumulation can be expected to converge with respect to the traditional stock-flow measure of banking intermediation only in the very long run. It follows that the size of this type of intermediation activity will very probably continue to differ significantly between such economies for a very long time, as will the volume of financial wealth.

Banking intermediation between new funding/saving and new net investment does not depend on the length of time of past accumulation. Thus, economies with completely different starting points of capital accumulation can converge with respect to this type of banking intermediation in a significantly shorter period of time by comparison. The proposed flow-flow measure lends itself to measuring the degree of this type of banking intermediation (i.e. the channeling of new funding/saving into new claims to finance net investment and thus new capital stock). Therefore, the flow-flow measure should receive much more attention when comparing the degree of banking intermediation between different economies than is currently the case.

It follows that to measure catching-up in banking intermediation it is necessary to take a close look at the flow-flow measure proposed in this paper. Specifically, the flow-flow measure can serve as an additional tool to assess the sustainability of high credit dynamics, beside the traditional analysis of annual credit growth rates or changes in the private credit stock-to-GDP ratio. Not only private credit flow-to-GDP ratios in the CEECs that are far above the usual level of private credit-flow-to-GDP ratios in the euro area, but also private credit flow-to-GDP ratios in the CEECs equal to the usual level of euro area private credit-flow-to-GDP ratios (i.e. given full convergence in the flow-flow ratio) imply already relatively high nominal and real private credit growth rates. This obervation should lead monetary policymakers to be wary of assessing private credit growth as being too high and requiring restrictive responses. However, central bankers clearly have to remain vigilant, in particular when private credit growth rates approach very high levels, such as those that would be required for simultaneous convergence in the stock-flow ratio and in the per capita income level.

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Annexes

Annex 1

The time bias in the (local currency) credit stock-to-GDP ratio:

$$Q_1^C = \frac{C_1}{Y_1} = \frac{C_0 + C_0 \times \beta[(1+r_0) \times (1+\pi_1) - 1] + C_1^T + R_1}{Y_0 \times (1+y_1) \times (1+\pi_1)}$$

and under the simplifying assumption that $\beta = 0$

$$Q_1^C = \frac{C_0}{Y_0 \times (1+y_1) \times (1+\pi_1)}$$
$$+ \frac{C_1^T}{Y_0 \times (1+y_1) \times (1+\pi_1)} + \frac{R_1}{Y_0 \times (1+y_1) \times (1+\pi_1)}$$

whereby Q_t^C denotes the domestic claims ratio, defined as the stock of domestic claims as a percentage of GDP in period t, C_t the stock of domestic claims in period t, β the fraction of interest income which is relent (taking values between zero and one), C_t^T transaction claims (i.e. net new claims on domestic sectors) in period t, R_t revaluation adjustments (e.g. price revaluations of marketable instruments or claim write-offs). Similar to the saving ratio, the domestic claims ratio increases over time (ceteris paribus) on the back of the annual volume of net new claims (as a percentage of GDP). Again, the longer the accumulation period, the higher the domestic claims ratio tends to be. A positive recycling factor β has a positive impact on the claims ratio, which is amplified by a positive differential between the realized real interest rate and the real GDP growth rate.

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Annex 2

The time bias in the foreign currency credit stock-to-GDP ratio:

$$Q_1^{C,FX} = \frac{C_0^{FX} \times (1+D)}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

$$+ \frac{C_0^{FX} \times \chi[(1+r_0^f) \times (1+\pi_1^f) \times (1+D) - 1]}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

$$+ \frac{C_1^{FX,T}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)} + \frac{R_1^{FX}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

and assuming $\chi = 1$

$$Q_1^{C,FX} = \frac{C_0^{FX} \times (1+D)}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)} + \frac{C_0^{FX} \times (1+r_0^f) \times (1+\pi_1^f) \times (1+D)}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

$$- \frac{C_0^{FX}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)} + \frac{C_1^{FX,T}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

$$+ \frac{R_1^{FX}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

results in

$$Q_1^{C,FX} = \frac{C_0^{FX} \times D}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)} + \frac{C_0^{FX} \times (1+d)}{Y_0 \times \frac{(1+y_1^d)}{\times(1+r_0^f)}}$$

$$+ \frac{C_1^{FX,T}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)} + \frac{R_1^{FX}}{Y_0 \times (1+y_1^d) \times (1+\pi_1^d)}$$

Annex 3

Convergence in the credit flow-to-GDP ratio and the credit growth rate:

Recall that the annual credit growth rate can be written as the ratio of transaction claims (or credits) to the stock of claims (credits) in the previous period:

$$c_1 = \frac{C_1^T}{C_0}$$

Expanding both the numerator and the denominator by GDP (for the reason of simplicity assuming no change in nominal GDP between the two periods, $Y_0 = Y_1$) leads us to

$$c_1 = \frac{C_1^T}{C_0} = \frac{\frac{C_1^T}{Y_1}}{\frac{C_0}{Y_0}}$$

Thereby, the expanded numerator corresponds to our flow-flow measure of banking intermediation, while the denominator represents the traditional stock-flow measure.

Combining
- our postulation that catching-up in terms of banking intermediation between two countries (country A being the catching-up country and country B being the benchmark country) should be measured by the flow-flow measure

$$\left(\frac{C_A^T}{Y_A}\right) \ and \ \left(\frac{C_B^T}{Y_B}\right)$$

and
- the observation that catching-up countries show a lower level of the stock-flow measure (mostly due to the time effect)

$$\left(\frac{C_A}{Y_A}\right) < \left(\frac{C_B}{Y_B}\right)$$

with
- the assumption of equality in total nominal GDP between the two countries (for the reason of simplicity, let us compare a large catching-up economy like Poland with a small benchmark economy like Belgium, assuming their nominal GDP is equal) $Y_A = Y_B$

implies that

when full convergence according to the flow-flow-measure is *achieved*, i.e. at

$$\left(\frac{C_A^T}{Y_A} = \frac{C_B^T}{Y_B}\right)$$

the following relation holds true:

$$\frac{\dfrac{C_A^T}{Y_A} = \dfrac{C_B^T}{Y_B}}{\dfrac{C_A}{Y_A} < \dfrac{C_B}{Y_B}}$$

and thus – after multiplication with nominal GDP –

$$\frac{C_A^T = C_B^T}{C_A < C_B} \ or \ \left(\frac{C_A^T}{C_A}\right) > \left(\frac{C_B^T}{C_B}\right)$$

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This finding may be extended to the situation *before* full convergence in terms of the flow-flow measure, as the catching-up country will usually be closer to full convergence in terms of the flow-flow measure than in terms of the traditional stock-flow measure. The latter can be expressed by the following combination of two inequalities:

$$\left(\frac{C_A^T}{Y_A} < \frac{C_B^T}{Y_B}\right) \ and \ \left(\frac{C_A}{Y_A} << \frac{C_B}{Y_B}\right)$$

This, in turn, implies:

$$\frac{\frac{C_A^T}{Y_A} < \frac{C_B^T}{Y_B}}{\frac{C_A^T}{Y_A} << \frac{C_B^T}{Y_B}} \ \ or \ \ \frac{C_A^T < C_B^T}{C_A << C_B} \ \ or \ \ \left(\frac{C_A^T}{C_A}\right) > \left(\frac{C_B^T}{C_B}\right)$$

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Annex 4

Simulation Results for the Future Development of the Private Credit Stock-to-GDP Ratio and the Private Credit Flow-to-GDP Ratio in the CEECs

	2003	Scenario 1:	Scenario 2:
Czech Republic			
GDP per capita (at PPP), % of euro area	64%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2021**	**2021**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**13.7%**
Average private credit growth, real, year on year (in the next ten years)		12.1%	18.7%
Private credit stock-to-GDP ratio	32%	**76%**	144%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*144%*	*144%*
Hungary			
GDP per capita (at PPP), % of euro area	57%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2026**	**2026**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**13.0%**
Average private credit growth, real, year on year (in the next ten years)		9.8%	15.4%
Private credit stock-to-GDP ratio	42%	**82%**	150%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*150%*	*150%*
Poland			
GDP per capita (at PPP), % of euro area	43%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2038**	**2038**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**12.5%**
Average private credit growth, real, year on year (in the next ten years)		12.8%	18.7%
Private credit stock-to-GDP ratio	29%	**87%**	159%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*159%*	*159%*
Slovenia			
GDP per capita (at PPP), % of euro area	72%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2017**	**2017**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**14.0%**
Average private credit growth, real, year on year (in the next ten years)		9.6%	15.9%
Private credit stock-to-GDP ratio	43%	**75%**	139%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*139%*	*139%*
Slovakia			
GDP per capita (at PPP), % of euro area	49%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2033**	**2033**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**12.6%**
Average private credit growth, real, year on year (in the next ten years)		11.7%	17.4%
Private credit stock-to-GDP ratio	33%	**86%**	156%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*156%*	*156%*
Bulgaria			
GDP per capita (at PPP), % of euro area	28%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2055**	**2055**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**12.9%**
Average private credit growth, real, year on year (in the next ten years)		13.3%	19.5%
Private credit stock-to-GDP ratio	27%	**89%**	167%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*167%*	*167%*
Romania			
GDP per capita (at PPP), % of euro area	28%	100%	100%
Year of convergence in GDP per capita (at PPP)		**2055**	**2055**
Private credit flow (net)-to-GDP ratio, annual figures (up to convergence year)		6.8%	**12.9%**
Average private credit growth, real, year on year (in the next ten years)		20.3%	27.6%
Private credit stock-to-GDP ratio	14%	**88%**	167%
compare: private credit stock-to-GDP ratio in the euro area (EU-12)	*112%*	*167%*	*167%*

Source: Eurostat, national central banks, wiiw, authors' calculations.

Notes: The simulation is based on actual values for 2003 and the following basic assumptions for the parameters of future economic development: (1) a real growth rate of 2% and an inflation rate (GDP deflator) of 2% in the euro area; (2) a real growth rate of 4.5% (a growth differential of 2.5 percentage points) and an inflation rate (GDP deflator) of 3.5% (an inflation differential of 1.5 percentage points, as a proxy for real appreciation with constant nominal exchange rates) in the CEECs. In scenario 1, for both the euro area and the CEECs an annual private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail until the year of income convergence (i.e. convergence in GDP per capita at PPP). The column "scenario 1" shows for each country and for the euro area the private credit stock-to-GDP ratio that will be attained in the year of convergence in GDP per capita (at PPP) under this assumption as well as the implied annual credit growth in the next ten years. In scenario 2, only for the euro area an annual private credit flow (net)-to-GDP ratio of 6.8% is assumed to prevail. The column "scenario 2" shows for each country the implied private credit flow-to-GDP ratio which would be necessary in the CEECs to simultaneously achieve convergence in GDP per capita (at PPP) levels and in the private credit stock-to-GDP ratio as well as the implied annual credit growth in the next ten years.