

# Judit Krekó and Marianna Endrész: The role of foreign currency lending in the impact of the exchange rate on the real economy\*

*The purpose of our article is to define how the FX debt of the private sector changes the impact of the exchange rate on the real economy: to identify the balance sheet channels through which depreciation of the exchange rate has a negative impact on GDP and the factors which determine whether the overall impact of depreciation will be contractionary or expansionary. In our analysis, we identified three balance sheet channels. Depreciation of the nominal exchange rate increases the debt burden of companies and households which are indebted in foreign currency and have no FX income, leading in turn to lower investments and consumption. Although the direct FX exposure of the banking sector is not significant, if banks face binding capital and/or liquidity constraints, changes in the exchange rate may have an indirect impact on the credit supply of banks through a number of channels.*

*Looking at the impact of a weaker exchange rate on growth, our calculations show that the effect of depreciation on the lending ability of the banking system is of key importance. If we only take into account the impact of the exchange rate on the balance sheets of the households and corporate sector, the impact on competitiveness is presumably stronger, but the impact of depreciation on household income and the profitability of companies with FX debts and no natural hedge will use up approximately 50% of the expansionary effect of increased competitiveness. However, if there is also a strong balance sheet adjustment in the banking sector, the overall impact of depreciation may well be contractionary. The effect of the exchange rate on the banks' credit supply should, at least in such a strong form, be considered as a temporary phenomenon associated with the crisis. In parallel with the consolidation of the global financial environment and further improvement in the capital position and profit prospects of the banking sector, the credit supply channel is also expected to attenuate.*

## INTRODUCTION

The international financial crisis that began in 2008 has changed our views significantly in respect of the room for manoeuvre in monetary policy. This was predominantly due to the FX exposure of the private sector. Since the end of 2008, monetary policy has faced a major dilemma. Although the outlook for the real economy and inflation have been pointing towards monetary easing for months, it has become questionable whether monetary policy is capable of conducting a counter-cyclical policy at all. In a small open economy, we expect exchange rate depreciation as a result of monetary easing to improve the competitiveness of export companies and to generate GDP growth – at least over the short term. At the same time, due to unhedged FX debts, depreciation causes deterioration in the balance sheets of the private sector with FX debts, which may lead to a decrease in capital investments and consumption and threaten financial stability. In our analysis, we seek to define how FX

lending changes the impact of the exchange rate on the real economy. We also seek to identify the balance sheet channels through which depreciation of the exchange rate lowers growth and the factors which determine whether depreciation of the exchange rate has an overall positive or negative influence on growth.

The structure of the analysis is as follows. In Chapter 1 we provide a brief overview of the literature on the consequences of FX debt. Based on the review of the empirical literature describing the experiences of previous decades, we can conclude that FX debt may significantly modify the impact which the exchange rate has on the real economy. Chapter 2 summarises the balance sheet channels that are relevant in Hungary, through which depreciation of the exchange rate may impair the performance of the economy by affecting the balance sheet of economic agents. In Chapter 3 we provide an empirical analysis of the importance of the various balance sheet channels and summarise our main conclusions.

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\* The views expressed in this article are those of the author(s) and do not necessarily reflect the official view of the Magyar Nemzeti Bank.

## CONTRACTIONARY DEPRECIATION – FINDINGS OF EMPIRICAL STUDIES

The financial crises of the 1990s, particularly the Asian crisis, highlighted the fact that in emerging countries major episodes of exchange rate depreciations are often accompanied by serious, protracted recession. This phenomenon is known as “contractionary depreciation/devaluation” in the economic literature. Although the contractionary impact of the exchange rate may stem from a number of sources,<sup>1</sup> starting from the 1990s the fact that the exchange rate worsens the balance sheets of economic agents with heavy FX debts took priority. According to Frankel (2004), the FX exposure recorded in the balance sheet plays a major role in the process where, despite significant depreciation in the real exchange rate, the adjustment of the balance of payments typically transpires through deep recession (expenditure reduction) rather than economic restructuring, i.e. lower consumption and export growth (expenditure switching). Reviewing financial crises in emerging countries, Reinhart and Calvo (2000) claim that in currency crises exports clearly fall in the first 8 months despite major depreciation and that a severe recession ensues. If depreciation is also accompanied by a banking crisis, the decline of exports ceases only after the 20th month on average. The authors also concluded that this was primarily due to the FX exposure in the balance sheets.

According to several critics, e.g. Magendzo (2002), the analyses describing the correlation between depreciation and economic downturns apply the term ‘contractionary devaluation/depreciation’ misleadingly and excessively. Major depreciation and a fall in output are often triggered by the same variables, which are not discussed in the analyses (for example, an increase in foreign interest rates, a decrease in external demand, etc.). Corresponding to this, De Gregorio and Lee (2004) concluded that the fall in output resulting from depreciation was primarily due to external factors rather than to weakening exchange rates during the crisis period in Asia and Latin America (decreasing external demand, low central bank reserves, etc.).

Analyses which control for the variables indicated above and try to directly capture the role of FX exposure in the impact of the exchange rate are less affected by the problem of endogeneity. According to most of these studies, it can also be empirically concluded that FX debt significantly reduces the expansionary impact of the exchange rate, although the overall impact of the exchange rate was

recessionary only in a few number of cases and with significant FX debt.

Similar to most analyses, Cespedes (2005) examined the contractionary impact of the exchange rate in his econometric analysis of 82 countries by cross-product of external debt and real exchange rate changes. According to his results, balance sheet effects have a significantly negative influence on the impact of the real exchange rate on the real economy. Consequently, devaluation may cause a significant fall in output during the first two years in countries with a high external debt and a sizeable domestic FX loan portfolio, as the competitive effect is delayed. Subsequently, however, the competitive effect is stronger and so over the medium term the overall impact of depreciation may be expansionary. High corporate indebtedness and, within that, a high share of FX loans, as well as a less developed financial system all amplify the contractionary impact of the exchange rate. In the econometric analysis conducted by Bebczuk et al. (2006), depreciation turned out to be recessionary only in a small number of cases and in those countries where the FX loans of the private sector accounted for over 84% of GDP.

The strength of contractionary impacts is influenced mostly by the *vulnerability of the balance sheets of the economic actors*. Apart from FX exposure, from the perspective of vulnerability, total indebtedness is also an important factor, as it influences the effectiveness of credit constraints on companies and households. Consequently, higher indebtedness increases the probability of a contractionary impact (e.g. Cespedes et al., 2004; Krugman, 1999).

In respect of vulnerability, the liquidity and capital position of the banking sector, the depth of financial intermediation and global liquidity are important factors (see Aghion, Bachetta and Banerjee, 2001; Christiano, Gust and Roldos, 2004). These factors affect the way the external financing premium of companies/banks responds to changes in the balance sheets and the effectiveness of financing constraints.

The strength of contractionary impacts is also affected by the degree of depreciation (Krugman, 2001; Eichengreen, 2002; Choi and Cook, 2004). A larger shock is more likely to catch economic actors unaware, and it is less likely for buffers to be available to mitigate the shock. In their econometric analysis, Rajan and Shen (2001) concluded that devaluation had a contractionary impact only during exchange rate crises.

<sup>1</sup> In emerging countries contractionary depreciation may, in addition to the impacts of the FX debts on the balance sheet, have other reasons, e.g. increasing import prices holding back capital investments (Cooper, 1971; Edwards, 1987).

Empirical results are not conclusive as to whether high FX debt itself increases the probability of financial crises/‘sudden stops’ (Bordo et al., 2009; Levy and Yeyati, 2006; Calvo et al., 2008). On the other hand, analyses seem to agree that FX debt increases the cost of financial crises. Analysing 23 financial crisis periods during the 1990s, Cavallo et al. (2002) showed that in a financial crisis countries with high external debt overshoot their exchange rates and output in these countries fell by a larger extent than in countries with lower external debt. Analysing over 300 financial crisis periods during the 1980s and 1990s, Guidotti et al. (2004) found that a ‘sudden stop’ led to much higher output loss when FX debt was also high.

A group of what is called third-generation crisis models developed as a response to the Asian crisis (e.g., Krugman, 1999; Aghion et al., 2002; Cespedes et al., 2003) describes the mechanism through which FX exposure recorded in the balance sheet contributes to the development of a financial crisis. These models capture the consequences of FX lending with what is called the “open economy Bernanke–Gertler mechanism”, focusing on the FX exposure recorded in the balance sheets of companies and/or banks, and financial frictions. In conformity with the assumption proposed by Bernanke and Gertler (1989), in these models, access to external funds by banks and/or companies (the available quantity or risk premium) depends on their net worth. Depreciation reduces the net value of companies/banks, because of an increase in the value of FX debt expressed in the local currency, and thus deteriorates profitability and access to external funds, leading to less capital investment and lower output.

The open economy Bernanke–Gertler mechanism may, ultimately, trigger a self-fulfilling currency crisis in the majority of models, pushing the economy towards a bad equilibrium: for example, erosion of foreign investors’ confidence leads to capital outflows and, indirectly, depreciation, resulting in less capital investment and recession through balance sheet effects, thereby justifying deteriorating expectations.

Another group of models points out that taking into account the feedback between risk premiums and the exchange rate, the question is not how the economy adjusts to a shock of a given magnitude, as in the case of a flexible exchange rate FX debt amplifies the shock. In the model of Choi and Cook (2004) for example, the deterioration of banks’ balance sheets leads to a higher country risk premium and, indirectly, to further depreciation of the exchange rate, which again causes more deterioration in the balance sheets of banks, etc. Ultimately, this feedback mechanism results *in overshooting of the exchange rate*, and much higher real

exchange rate fluctuations than would be justified by the initial real shock, which, on balance, results in *higher exchange rate volatility*.

The time horizon of impacts on the real economy is another important factor. For example, as is also emphasised by Cespedes (2005), Proano et al. (2006), balance sheet effects are faster than the competitiveness effect, and therefore, concurrently with nominal depreciation, the decline may be greater in the first few years; a weaker real exchange rate, however, can even offset the initial negative effects over the longer term. Another long-term issue is how monetary policy affects the FX exposure recorded in the balance sheets. With a monetary policy protecting the exchange rate (a more stable exchange rate, a higher and more volatile domestic interest rate), the incentives for FX lending restraining the impact of monetary policy may survive over the long run.

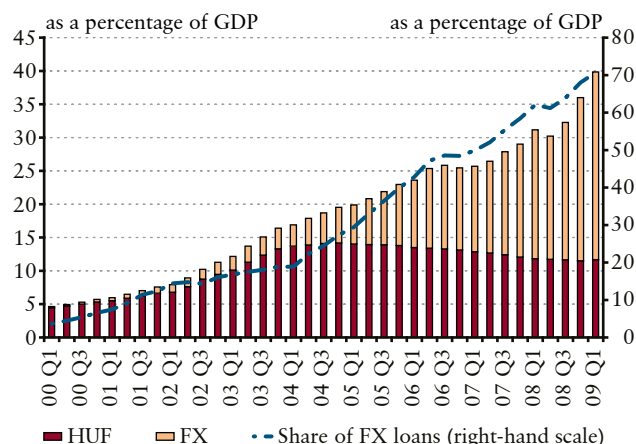
In summary, empirical analyses suggest that sizeable FX debt or external debt amplifies the impact of external shocks and weakens the role that nominal exchange rate plays in mitigating these shocks, making it more difficult for the economy to adjust and increasing the costs of financial crises.

## BALANCE SHEET CHANNELS IN HUNGARY

In Hungary, the FX exposure of the private sector is somewhat different than in the Asian and Latin American countries or the stylised economy depicted in the third generation crisis models, most of which focus on the exposure recorded in corporate balance sheets. The FX debt of companies is also high in Hungary (31% of GDP at the end of 2008), yet it does not necessarily mean FX exposure, given the high share of exports (85% of GDP). However, the household sector has high FX debt, amounting to 25% of GDP at the end of 2008, which – considering the fact that household income is generated mostly in HUF – does represent an exchange rate exposure. In addition, although the direct exchange rate risk of the banking sector is low, the exchange rate has a significant indirect impact on this sector via credit risks, because of unhedged household and domestic corporate FX loans.

### Stylized facts

Similarly to several other countries in the region, household indebtedness grew rapidly in the previous decade, primarily owing to a considerable rise in the FX loans of households, extended mainly by domestic credit institutions and other financial intermediaries (see Chart 1). Concurrently, the

**Chart 1****Household loans broken down by foreign currencies**

ratio of households' FX assets to GDP remained unchanged, as a result of which the FX exposure of households increased considerably. In parallel with the increase in the household FX loan portfolio, the ratio of debt service to disposable income also showed an increase.

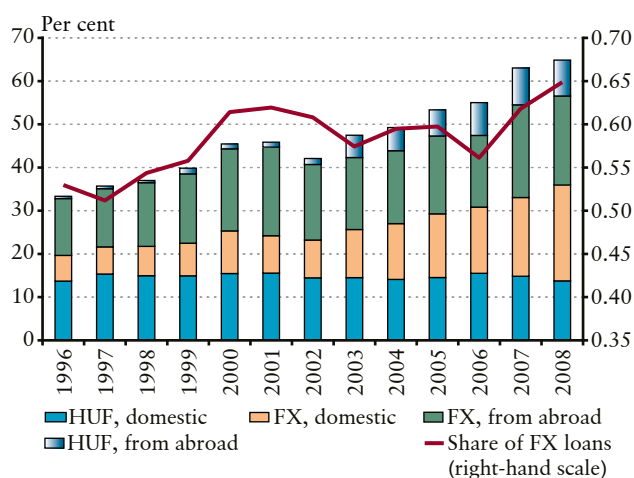
**Corporate sector**

Both corporate indebtedness and, within that, the share of FX loans have also increased in recent decades, but not as markedly as in the case of household loans. The share of FX loans within total corporate loans was already high, at over 50% by the second half of the 1990s, rising to 65% by the end of 2008 (Chart 2). In contrast to the household sector, it was not only loans from domestic credit institutions and

financial intermediaries, but also loans directly from foreign institutions along with derivative transactions for hedging or speculative purposes that played an important role in the FX exposure of the corporate sector. Concerning FX loans, a strong increase was observed in FX loans extended by domestic banks and financial intermediaries, while the ratio of FX loans from abroad to GDP did not increase significantly. In contrast to household FX loans, corporate loans do not necessarily represent FX exposure thanks to export revenues and may even serve the purposes of natural hedging.

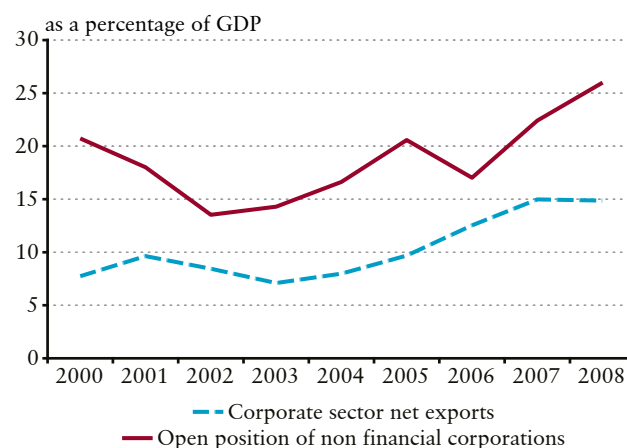
In Hungary, no major exposure is observed when comparing the FX position stated in the balance sheet of companies with net exports on an aggregate level. In recent years, an increase in the open position has been accompanied by an increase in net corporate exports (See Chart 3), in line with the expansion of foreign trade. An international comparison of corporate FX debt and exports shows a similar picture (See Chart 4). Although the FX debt-to-GDP ratio of the Hungarian corporate sector is significant, the debt-to-exports ratio is much lower than in some countries affected by the financial crises of the 1990s. In principle, this may also prove that in Hungary high corporate FX debt is attributable to the high export revenues of the corporate sector.

Due to the heterogeneity of companies, an aggregate comparison does not unequivocally reflect whether FX debt does in fact relate to companies that generate export

**Chart 2****Indebtedness of the non-financial corporate sector (domestic and foreign loans\* as a percentage of GDP)**

Source: MNB.

\* Foreign loans also include shareholder loans.

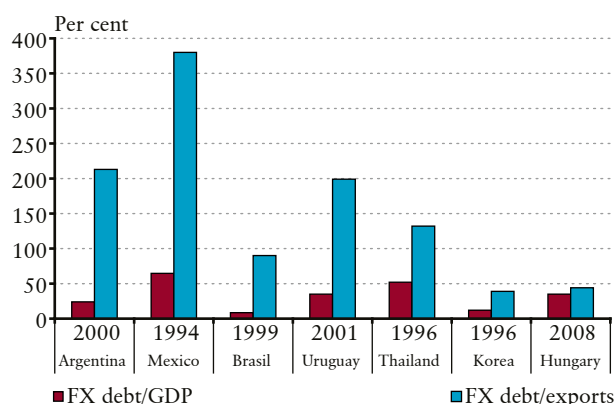
**Chart 3****Net position of the corporate sector and net corporate exports\***

\* The chart illustrates the loans of the non-financial corporate sector taken out from other domestic monetary institutions and from other financial intermediaries and from foreign institutions (including shareholder's loans). Net corporate exports was defined as exports less imports for purposes other than consumption.

Source: MNB.

Chart 4

(Foreign and domestic) corporate FX debt as a percentage of GDP and exports



Source: IMF, MNB.

revenues. However, a few stylized facts concerning corporate-level exposure indicate that, in spite of a high export ratio, there is no natural hedge behind a significant portion of corporate FX loans.

A questionnaire-based survey conducted in the corporate sector showed sizeable unhedged currency exposure (Bodnár, 2009). Using a sample of hundreds of small and large companies, the questionnaire also included questions on the FX composition of revenues, expenditures and balance sheet items of companies (stock-flow exposure). The survey revealed that there is no natural hedge behind approximately 50% of the FX loans of the non-financial corporate sector.

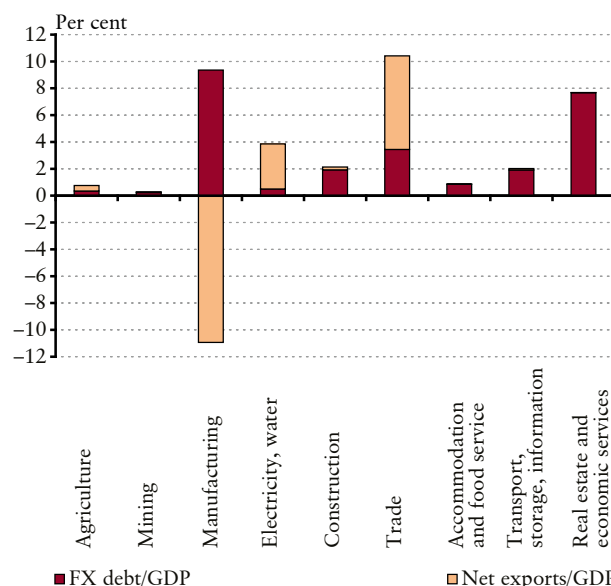
Although we do not have detailed data on the total FX position of certain sectors, comparing foreign and domestic FX loans with the net exports of the sectors, we can conclude that it is not only sectors generating FX revenues that incur FX debts (See Chart 5).<sup>2</sup>

Except the manufacturing industry, all the other sectors are either net importers or neutral, including several sectors with relatively high FX debt compared with their sectoral added values. Based on the FX exposure-to-total GDP ratio, the marked FX exposure of the *real estates and economic*

Chart 5

Sectoral FX loans and net exports as a percentage of total GDP

(December 2008)



\* FX loans include the foreign and domestic FX bank loans of the various sectors, but do not include FDI-related loans. Net exports only include exported and imported goods, but not service exports and imports. Nor have imports for consumption purposes been excluded. Net exports have a negative sign, i.e. net importing sectors take up positive figures.

services sector with no net exports may lead to vulnerability.<sup>3</sup> In addition, there may be significant balance sheet effects in the construction industry and in trade.<sup>4</sup>

Overall, although aggregate FX exposure is not very significant, for certain sectors and corporate groups depreciation may significantly deteriorate the companies' balance sheets.

### Banking sector

The direct FX exposure of the banking sector is low, but changes in the exchange rate may still have an indirect impact on the credit supply of banks through various channels. Although the vulnerability of the banking sector also stems from the FX loans of the private sector, we should still analyse the impact of the exchange rate on the banking sector as a separate channel. One reason is

<sup>2</sup> We wish to note that, in addition to the foreign and domestic FX bank loans of the various sectors, FX deposits, derivatives, non-bank loans taken out from domestic financial enterprises and the export and import of services should also be taken into account to be able to compute total FX exposure accurately, however, for the time being, there are no data available on their sectoral distribution.

<sup>3</sup> This sector also includes office projects where rent is often agreed in a foreign currency. However, considering the fact that the majority of office lessees operate in the market services sector, this does not provide full protection against exchange rate fluctuations.

<sup>4</sup> In the chemical industry and the petroleum refining sector the majority of FX debts relate to MOL, however, the revenues of the company – in spite of negative net exports – moves with the exchange rate due to MOL's pricing power, and thus, FX exposure is unlikely to be significant. As the chart shows the transportation and warehousing sectors are also vulnerable, but in their case exported services, that are not included in the chart may modify the picture significantly.

that the impact of the exchange rate on banks' lending capacity depends not only on the existing FX loan portfolio, but also on the capital and liquidity constraints faced by the banking sector itself. Furthermore, an important feature of the lending channel is that the credit squeeze is general, affecting all debtors, not only those with FX loans.

In accordance with this, in Hungary the exchange rate affects the balance sheets of economic agents through three different, albeit interdependent channels. The balance sheet effects in turn alter the consumption/investment/loan decisions of those agents, which also has an impact on economic growth.

### **1) The household balance sheet channel and the exchange rate**

a) Exchange rate depreciation increases the HUF value of the monthly instalments of FX loans, which reduces disposable income and, indirectly, consumption (income effect).

b) A (permanent) depreciation increases the HUF value of total debt, i.e. it reduces net wealth (wealth effect). In fact, we are not talking about two separate effects, as the wealth effect equals the sum of future repayments changes, i.e. that of future income effects. The reason why it should still be highlighted is that as the consumption effect depends on exchange rate expectations, i.e. the extent to which households consider an income shock to be permanent: if households expect permanent or continuous weakening, they consequently smooth their consumption to a lesser extent and generate precautionary savings. If the loan defaults, wealth is lost irrespective of expectations, i.e. the wealth effect is stronger.

### **2) The corporate balance sheet channel and the exchange rate**

Similarly to household loans, the depreciation of the exchange rate increases the HUF value of companies' FX debt, but unlike the FX debt of households, corporate FX debt does not necessarily mean FX exposure. One key issue in relation to the impact of corporate FX lending is the availability of a natural hedge for FX loans, i.e. the manner in which exchange rate movements – with the expected future revenues taken into account – affect the profit outlook and the value of companies.

For companies with revenues only in HUF and FX debts, depreciation leads to lower profits and lower corporate value. Net FX debt can, however, also reduce the positive impact of higher export revenues, even in the case of companies whose FX debts are fully hedged with export revenues.

### **3) Credit supply channel of banks and the exchange rate**

Weakening of the exchange rate influences the balance sheet of banks through several channels – not independently of the FX debt of the private sector –, and, consequently also affects the credit supply of banks and growth.

Despite a take-off in FX lending, the total open FX position of the Hungarian banking sector, excluding banks with active operations abroad, has been low and stable over the past years, and thus the exchange rate has a more indirect effect on the banking sector through the following channels.<sup>5</sup>

#### *a) Capital adequacy*

In accordance with banking regulations, the risks assumed by banks must be limited by their capital. This is reflected by the so-called capital adequacy ratio (CAR), which is, to put it simply, the ratio of a bank's capital to its risk-weighted assets. Depreciation of the exchange rate exerts an impact on CAR through various channels. Due to changes in the HUF value of FX loans, it increases risk-weighted total assets, i.e. the denominator of the capital adequacy ratio. This effect may be partially offset if certain components of the bank's capital are also denominated in FX (the numerator of CAR also changes). In addition, depreciation increases the default risk (more precisely the expected loan losses) of households and companies with FX loans, but with no natural hedge. If the profit of the bank cannot cover the increased loan losses, this will reduce its capital. If the capital adequacy ratio of banks falls below a critical level, they may decide to respond to this by reducing their lending activity. This is driven, in part, by the regulation, but it is also in the interest of banks to ensure that risks reflected by CAR do not exceed a certain level.

#### *b) Liquidity*

Due to the maturity and currency mismatches of FX assets and liabilities, depreciation leads to a deterioration of the liquidity position of banks, which may result in a decrease in credit supply.

<sup>5</sup> In several emerging countries, banks run direct exchange rate risks, i.e. they use part of their foreign currency resources for lending in the local currency, thus the exchange rate directly reduces the bank's value (e.g., Turkey, 2000–2001).

- In the Hungarian banking sector as a whole, FX assets are covered only partly by foreign and parent bank FX liabilities; while banks hedge the difference mainly with short-term FX swaps. Consequently, during the weakening of the exchange rate in early 2009, it was the renewal of short-term currency swaps and the meeting of margin calls that primarily generated significant liquidity demand in the Hungarian banking sector. Since then, banks have accumulated larger liquidity buffers and the instruments introduced by the MNB are likely to be able to handle potential disturbances in the operation of the swap market. All these developments have significantly improved the ability of the banking sector to withstand the shocks caused by sudden depreciation in the exchange rate. Consequently, we do not think that the effect of this channel will have to be reckoned with in the near future.
- However, over the longer term, the need to lower funding risk and exposure to external financing, and the preservation or reduction of the high loan-to-deposit ratio in the banking sector may lead to restraints in credit supply. The loan-to-deposit ratio reflects the reliance of banks on external funds, and as such, it may also be considered one of the indicators of liquidity risk. The loan-to-deposit ratio of the Hungarian banking sector is high by international standards, suggesting that banks would face a severe shortage of funds if international resources dried up. The crisis motivated Hungarian banks to modify their financing structure. Most banks have set the objective of reducing the share of market funds, i.e. the loan-to-deposit ratio. As the share of FX loans is significantly higher than that of FX deposits for most banks, depreciation of the nominal exchange rate directly increases the loan-to-deposit ratio, which may be offset by banks by reducing their lending activity.

Consequently, if there are *effective* liquidity and/or capital constraints, exchange rate depreciation reduces the ability of banks to lend. It is important to emphasize that the credit squeeze not only hits FX debtors, but also has a more general impact. Moreover, experience shows that banks tend to first restrain their corporate lending usually with shorter maturity and a lower margin, even if the underlying reason for reduction is losses suffered on household loans.

#### *c) Deterioration of debtors' creditworthiness*

In addition to the above reasons, banks may also restrain their credit supply as a result of the deteriorating creditworthiness of borrowers. In the case of companies whose exchange rate exposure is high, depreciation reduces creditworthiness and increases the cost of external financing due to the fall in the company's net worth, and also weakens

the willingness of banks to lend to such companies. (As discussed earlier, this is often the primary channel of third-generation crisis models.) Similarly, a decline in net wealth also undermines the creditworthiness of households. Thus, depreciation may shift the credit supply curve even if banks do not face liquidity or capital constraints. The direction of the shift in the supply curve, however, is not conclusive and may vary from sector to sector: e.g. in the case of companies in the exporting sector depreciation may reduce credit risks, while in the case of those providing market services it may increase credit risks.

#### **Summary of the various effects**

Summarising the various channels, we can conclude that the contraction triggered by balance sheet effects is a non-linear function of the size of depreciation: the larger the depreciation is, the higher the probability that the banking sector and FX debtors will not have sufficient buffers to absorb the shock and that constraints become binding. With regard to the contractionary effect, we can identify at least three phases:

- A significant increase in the ratio of non-performing loans may lead to a banking crisis, where negative output impacts could be immense.
- However, if there are effective liquidity and capital constraints, the reduction in credit supply due to the exchange rate change could offset the positive impact of depreciation on growth before the solvency of banks falls to a critical level.
- The effect on the consumption of households and the profitability and assets of companies with unhedged FX loans may undermine the positive effect of the exchange rate even without banks' constraints becoming effective and before a default on loans; obviously, in this case the contractionary effect is much lower than in the previous cases.

In addition to the extent of depreciation, contraction associated with balance sheet effects also depends on the initial liquidity constraints/capital position of the banking sector: the closer the banking sector is to the minimum required capital adequacy ratio, and the more severe the liquidity constraints are, the lower the size of exchange rate depreciation required to noticeably influence credit supply. It is important to note that – in view of the existing credit, swap, etc. positions – one of the major factors influencing the constraints imposed by banks over the short term is the level of the exchange rate. The role of liquidity problems typically becomes truly significant during global financial

turbulences, and therefore, the credit supply channel can be particularly strong during periods of financial crises.

In addition, if weakening is fast and substantial, the self-generating processes leading to even weaker exchange rates – highly emphasised in financial literature – are also relevant in Hungary. Such processes result in a much larger depreciation than the initial exchange rate shock and lead to the overshooting of the exchange rate.

- If the exchange rate weakens to a level at which it significantly increases the stability risks of the banking sector, the higher probability of a banking crisis materialises in even higher risk premiums, which in turn weakens the exchange rate further, and further increases the probability of a banking crisis, etc.
- Likewise, if – in response to domestic actors' losing their confidence in the forint and the banking sector – HUF is converted to foreign currencies, this will put further pressure on the exchange rate and amplify the impact of exchange rate weakening. In a more severe case, conversion is performed in cash, i.e. it reduces the deposit of banks, aggravating the liquidity position of the banking sector even further.

## ESTIMATION OF THE EFFECT OF BALANCE-SHEET CHANNELS AND CONCLUSIONS

In addition to presenting simple stylised facts, we used our existing models to conduct partial simulations assessing the importance of balance-sheet channels. We examined the effect of exchange rate shocks of varying magnitudes. Our results provide a rough estimate of how the contractionary effect of the balance-sheet channels modifies our former view of the impact of the exchange rate on the real economy, which is captured by the MNB's quarterly projection model (QPM).

Regarding households' FX loans, we relied on the consumption function of the QPM model and estimated how loan repayments increased by exchange rate depreciation can affect the disposable income of households and, indirectly, consumption and GDP.

As regards the corporate sector, we relied on survey-based and sectoral analysis-based information in respect of the extent to which FX loans were hedged, and estimated the effect of depreciation on the profitability and capital investments of unhedged companies and, through this, on GDP. We used two methods. In the QPM model, we interpreted the effect of changes in the exchange rate as a

profit shock. In the investment model, which also takes into account balance-sheet effects, we captured the effect of higher loan repayments on investments through changes in the cash flow. The two methods led to results of a similar magnitude.

Finally, on the basis of individual banking data and stress tests, published in the November 2009 Report on Financial Stability, we also analysed the effects exerted through banks' balance sheets. First, we estimated the impact of an exchange rate shock on credit supply as a result of capital adequacy and loan/deposit constraints becoming effective. Then, using a simple VAR model, we gave an estimate on the effect on the real economy of the squeeze in credit supply calculated in this manner. The calculations were made on the basis of September 2009 data, i.e. the results reflect the situation of the banking sector prevailing at that time.

On the basis of our partial model calculations, we can conclude that the contractionary effects of a weaker exchange rate depend significantly on how the depreciation affects the lending capacity of the banking sector. If we only take into account the effect of the exchange rate on the balance sheets of the private sector, then the competitiveness effect is stronger. However, the impact of depreciation on household income and the profitability of companies with FX debts and no natural hedge absorbs approximately 50% of the expansionary effect stemming from improved competitiveness. By contrast, if depreciation also reduces banks' credit supply, then the sign of the effect of the exchange rate on the real economy becomes uncertain. According to our credit supply estimate, despite considerable improvement in recent months, based on September 2009 data of the banking sector, the capital and liquidity constraints of the banking sector are still stretched to the extent that even a minor (approx. 10%) weakening of the exchange rate could force the banking sector to adjust. Although our results vary within a wide range, if the banking sector were to respond to the shock only by cutting back its lending activities, and credit supply limits were effective, on the whole, due to the contraction of credit supply, the overall effect of a depreciation could be contractionary in the first two years. Contractionary effects would likely be stronger than expansionary effects if depreciation is larger.

We would like to emphasize that our results involve considerable uncertainty. On the one hand, we assumed rather simplified banking behaviour, whereby banks' only response to shocks is to cut back their credit supply, an assumption which overestimates the actual effect. A likely alternative reaction is a capital increase, in respect of which

the behaviour of parent banks is critical. Loan/deposit constraints may be eased by aggressive deposit collection. On the other hand, the real effects of the reduction of credit supply may remain lower than our estimates if credit supply limits are not effective, for example because companies and households lower their credit demand anyway as a result of the shocks they suffer. In addition, some companies (typically large, export-oriented or foreign-owned companies) may also raise funds from other sources instead of relying on domestic bank loans, while better-capitalised banks may easily snatch up the customers of banks restraining credit supply.

In summary, in the current situation balance sheets are vulnerable enough for the contractionary effects to eliminate most of the stimulating impact of exchange rate depreciation. The likely outcome of this is that the ability of a potential nominal depreciation to ease a recession will be rather limited in the future.

The credit supply effect of the exchange rate should, at least in such a strong form, be considered a temporary phenomenon associated with the crisis. In parallel with consolidation of the global financial environment and improvement in the capital position and profit prospects of the banking sector, the credit supply channel is also expected to attenuate. This is supported by the latest, better-than-expected data on the profitability and capital position of the banking sector at end 2009.

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