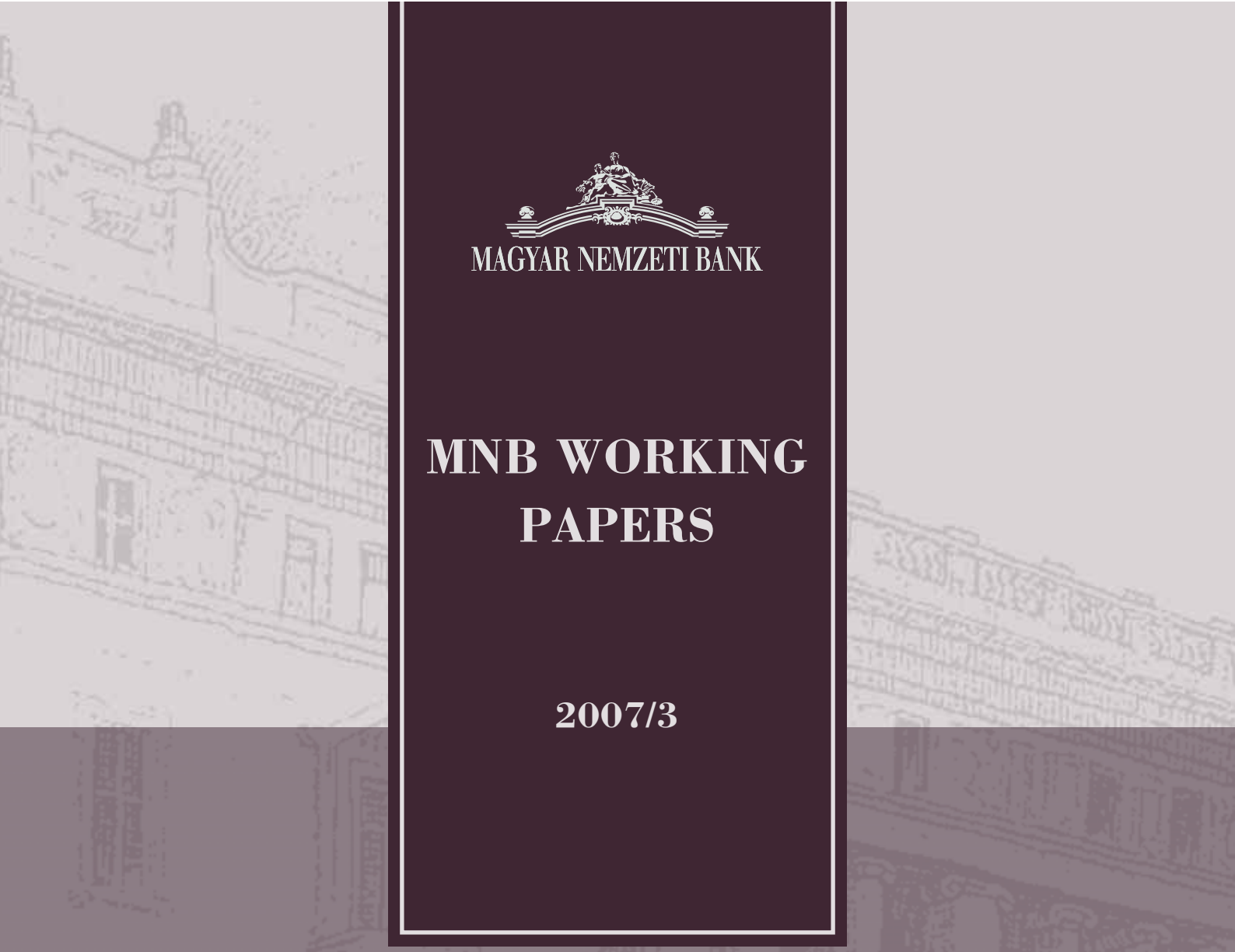

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The Hungarian Monetary Transmission Mechanism: an Assessment

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The Hungarian Monetary Transmission Mechanism: an Assessment*

(A magyar monetáris transzmissziós mechanizmus – összefoglalás)

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Contents

Abstract

This paper attempts to aggregate and summarise fresh results concerning the monetary transmission mechanism in Hungary. Within a research project at the MNB nine studies have been published investigating the channels through which Hungarian monetary policy affects the economy. We create a framework for synthesising particular results based on Mishkin's (1996) classification. We analyse how aggregate demand is affected through those channels. Our conclusion is that during the past ten years monetary policy did exert a measurable influence on real activity and prices. The dominance of the exchange rate channel explains why prices respond faster and output responds more mildly than in closed developed economies like the U.S. or the euro area. We expect that after adopting the euro the absence of exchange rate will be compensated by the fact that the interest rate channel will work through foreign demand as well. Therefore, no significant asymmetries can be expected inside the euro area in terms of monetary transmission.

Keywords: monetary transmission mechanism, monetary policy shock, exchange rate channel.
JEL classification: E44, E52, E58.

Összefoglalás

Jelen tanulmány megkísérli összefoglalni legfrissebb eredményeinket a magyarországi transzmissziós mechanizmusról. Az MNB kutatási projektjének keretében kilenc dolgozat jelent meg, melyek a monetáris politikának a gazdaságra gyakorolt hatását vizsgálták. Mishkin (1996) tanulmányára támaszkodva bemutatunk egy modellkeretet, melyben lehetségessé válik a részeredmények szintézise. Az összkép alapján arra a következtetésre jutunk, hogy az elmúlt 10 évben a monetáris politika kimutatható hatást gyakorolt a reálgazdaságra és az árakra. Az árfolyamcsatorna meghatározó szerepével magyarázzuk, miért reagálnak az árak gyorsabban, a kibocsátás pedig kisebb mértékben egy kamatlépésre, mint zárt és fejlett gazdaságokban. Bemutatjuk azt is, hogy az euro bevezetése esetén az árfolyamcsatorna megszűnését a kamatcsatorna kiszélesedése ellensúlyozza, így nem várható, hogy Magyarország aszimmetrikusan reagál majd a közös monetáris politikára.

1. Introduction

From the central bank's point of view, the transmission of monetary policy to the economy is of particular interest among various topics of macroeconomics. Without being aware of the monetary transmission mechanism (MTM) it is not possible to conduct good policy. In Hungary, our knowledge so far has been based mainly on intuitive understanding of the structural features of the economy instead of evidence from quantitative research.

In the beginning of 2004 a comprehensive research project was launched at the Magyar Nemzeti Bank. The aim of the project was to provide quantitative results about the Hungarian monetary transmission mechanism in order to form an overall picture. The focus of the project was empirical. We investigated first of all those areas where the most up-to-date econometric methods could be applied.

The sample used for estimations typically covered the period between 1995 and 2004. In some cases, when the higher frequency or the existence of panel data endowed us with enough observations, the sample was even shorter. The identification of the effect of monetary policy has been particularly challenging due to the fact that during this period the main driving force behind macroeconomic fluctuation came from the supply side, not from demand. Being aware of this difficulty, we have tried to apply techniques that are capable of disentangling monetary policy from other sources of shocks.

This paper aims to create a synthetic view from particular results. During 2004 and 2006 nine papers were published within the project as either an MNB study or an MNB working paper. The synthesis basically relies on those studies, but other research results are also considered as long as they concern the transmission mechanism.

There are some aspects that make our synthesis challenging. The first difficulty to overcome is that the particular estimates were based on various sample periods. Despite this, we will treat the underlying studies as if they referred to the same sample, which is typically the decade between 1995 and 2004. The second problem is that the definition of monetary policy differs across estimations. Some papers consider the effect of an interest rate change, while other authors have investigated only those changes that were not an endogenous reaction of monetary policy to some economic shocks. Taking into account their limited comparability, we try to create a qualitative synthesis which is consistent with all individual findings.

In the assessment of the overall picture we focus on two particular issues that are of primary interest. The first one is about the effectiveness of monetary policy. Having an open capital market with a predominant presence of foreign investors, interest rates and the exchange rate are strongly influenced by the risk preferences and risk assessment of international players. It was sometimes not obvious whether there is an autonomous monetary policy in Hungary that implements a policy in line with its targets, or the interest and exchange rates are driven by international and other factors. Hence, we first posed the question, whether it is possible to detect any significant effect of monetary policy on key variables.

The second question we try to answer is whether the exchange rate channel dominates the transmission mechanism. Hungarian monetary policy has paid special attention to exchange rate movements and expectations. The belief was that this is the most, if not the only effective channel of transmission. It was observed that tradable goods prices followed closely exchange rate movements, influencing incomes, wages and other prices. Should this picture alter significantly, there might be consequences for monetary policy strategy.

In order to be able to address the above-mentioned issues we need a comprehensive view of the transmission mechanism. We try to synthesise particular results using a scheme that focuses on two stages of transmission mechanism. At the first stage monetary policy impulses are transmitted by special markets to agents who make decisions about purchasing and production. To describe the first stage we rely on Mishkin's (1996) classification of different channels of transmission mechanism. He distinguishes between the interest rate, the exchange rate, other asset price and credit channels. Each mechanism is based on a particular theory of the effect of monetary policy. We add the expectation channel to the analysis, a mechanism that relates to the transparency and credibility of the monetary policy objective and strategy.

Several studies have addressed explicitly this first step within the MTM project. Horváth et al. (2004) (henceforth HKN) investigated how commercial bank rates follow the policy rate. Rezessy (2005) presented estimates of the pass-through to government bond yields and equity prices. Kiss and Vadas (2005) provide information about the Hungarian housing market. HKN (2006) posed the question whether credit supply of banks is affected by monetary policy.

The first stage includes the behaviour of the exchange rate as well. Unfortunately, the empirical literature has so far provided mainly puzzling results regarding the effect of monetary policy. Although these puzzles were interesting from a scientific point of view, they were of less practical importance regarding large, closed economic entities like the U.S. or the euro area. Hungary is a small open economy and the exchange rate has played a central role in formulating and communicating monetary policy. Hence, we allocated more resources to this issue than is usual in the literature of monetary transmission mechanism. Whereas Rezessy (2005) and Karádi (2005) investigated the short-term reaction of the exchange rate using high frequency data from the very recent period, Vonnák (2005) obtained estimates for a longer horizon.

After commercial bank interest rates and asset prices have accumulated all the information about the stance of monetary policy, economic agents on the goods market make their purchase decisions. At this second stage we analyse the behaviour of aggregate demand with special regard to private consumption, investment decisions and foreign trade.

Finally, we give a brief overview about how relative price changes disappear in the long run and what role the labour market plays in this procedure. We can consider this as the third stage of the transmission process. Despite its obvious importance, we cannot have a deep insight as we have no specific research focusing on this area.

The structure of the paper is the following. In section 2 we present the overall picture and put it into an international context highlighting the special features of Hungarian MTM. Section 3 classifies particular results using Mishkin's (1996) approach. In section 4 we investigate aggregate demand. In section 5 we review our knowledge of medium-run effects, including the labour market and the non-tradable sector. Section 6 concludes and, based on Orbán and Szalai (2005), tries to assess future trends.

2. The overall picture

The most important aspect of the transmission mechanism is the way monetary policy can influence inflation and output. Central banks usually have the primary goal of maintaining price stability. The volatility of output is also of significant concern. In this section we present a bird's eye view of the effect of a Hungarian monetary policy shock. We compare our results for inflation and output with findings for other countries. In the subsequent sections we go beyond the overall picture and try to describe the mechanism in more detail and to explain the special features of Hungarian MTM.

We investigate the behaviour of output and prices after an unexpected monetary tightening. According to Vonnák (2005), a typical monetary policy shock can be characterised as a 30-40 basis point interest rate hike, coupled with a 0.6-0.8 per cent exchange rate appreciation. Both changes are transitory, the variables return to the baseline after 3-4 years.

The response of Hungarian consumer prices to the shock is shown in Figure 1 borrowed from Jakab et al. (2006; henceforth JVV). There is substantial similarity between the three impulse response functions, each of them coming from a model estimated on Hungarian data. Consumer prices react to monetary tightening by a quick drop. The lower price level seems to persist for several years. In terms of yearly inflation rate, which is the target variable in Hungary, this means that the effect of monetary policy is the largest within the first two years, the peak being somewhere at the end of the first year.

This shape of price response is somewhat different from those found in closed, developed economies like the U.S. or the Euro area. Most SVAR estimates[1] show a slight increase during the first year and prices typically begin to fall only later, but then the decline lasts for several years. Accordingly, the annual inflation rate is higher at the beginning, but later falls below the baseline persistently. This stands in clear contrast with the Hungarian price dynamics.

The response of Hungarian output is not as clear-cut as in the case of prices. While two models in JVV show a slight decline in real activity after the contractionary shock, SVAR estimates using time series of GDP rather suggest a small although not significant increase. The reason for this is that, within the same framework, significantly higher household consumption is detected, which offsets the decline in investments. It should be noted, however, that using the same methodology with industrial production data instead of GDP Vonnák (2005) estimated a significant drop in industrial output, and the magnitude was even higher than those found by the other two models in JVV. We conclude therefore that the Hungarian GDP drops somewhat after the contraction.

Estimates for the U.S. and the Euro area show a more pronounced output response. Although there are some studies that could not find a significant effect of monetary policy[2], most results indicate a clear slowdown of the economy after an unexpected monetary tightening. The consensus view fits the basic features of a neo-Keynesian economy with sticky prices: after the monetary policy action volumes react more quickly to the changes of demand and output returns to its natural level only when price adjustment takes place, that is GDP response leads price response.

In the case of Hungary the same neo-Keynesian explanation alone is not able to explain fully what happens after a monetary policy shock. The response of output is moderate. The reaction of prices is instantaneous and does not lag behind that of output gap. For Hungary some alternative description of the transmission mechanism is needed. In the following sections we try to identify the special features of Hungarian MTM relying mainly on our fresh results.

[1] For examples see Christiano et al. (1998) and Angeloni et al. (2003).
[2] Uhlig (2005) is such an example.

3. The channels of monetary transmission

The mechanism through which monetary policy affects the economy can be divided into two steps. In the first step monetary policy influences market interest rates, the exchange rate, asset prices, credit supply of the banking sector and the expectations through its policy rate and communication. Economic agents extract signals transmitted by those markets and make decisions concerning their demand for goods and production. The second stage of MTM consists of the reaction of demand, as well as the adjustment process of the supply side and labour market.

In this section we classify the results that relate to the first stage of MTM relying on Mishkin (1996) who distinguishes between interest rate, exchange rate, asset price and credit channels. This framework provides a convenient way of separating distinct mechanisms of monetary transmission. Another advantage is that Mishkin's categories are widely used when talking about the effect of monetary policy. However, the framework also has some shortcomings. These channels cannot be regarded as a model-based, complete decomposition of the whole effect. For example, we augment Mishkin's classification scheme with the expectation channel. Another problem is that in some cases separating these channels is very difficult. Nonetheless, we found this framework to be a useful tool for arranging the results of our research on various aspects of the transmission mechanism.

3.1. INTEREST RATE CHANNEL

The first stage of the interest rate channel is the mechanism through which policy rate passes through to commercial bank rates, that is to corporate and household deposit and loan rates. The second stage is when households and firms make their consumption and investment decisions in face of new interest rate conditions. We summarise here our findings concerning the first stage, which is far simpler than the second.

Monetary policy has the power to determine the very short end of the yield curve by providing or absorbing liquidity with a maturity ranging typically from overnight to two weeks or one month. The rate set by the central bank is the (opportunity) cost of having excess liquidity for commercial banks, and therefore influences money market interest rates of the same maturity very quickly and effectively. In Hungary during the past ten years a short-term deposit rate acted as a policy instrument. Until 1997 its maturity was one month, since then the policy rate has been the two-week deposit rate.

According to the expectation hypothesis, longer maturities are linked to the policy rate through expectations about future development of short-term rates. For example, if an interest rate hike by the central bank is expected to be temporary, longer-term interest rates will not be affected to the extent that short-term rates change. On the contrary, if the market expects higher rates will remain for a longer period, long-term yields increase more, thereby monetary policy may be more effective.

An important feature of most of our research is that typically 3-month money market or T-bill rates are used as policy rate instead of the central bank's deposit interest rate. The reason for this is twofold. On the one hand, for higher frequency estimation (monthly or more frequent) the policy rate sometimes does not reflect the frequent change in monetary policy stance. On the other hand, we can consider 3-month interest rates as embedding more information than the policy rate, since it contains expectations about its movement in the very near future. If, for example, the Monetary Council leaves the base rate unchanged according to market expectations, but at the same time releases a statement containing tightening bias, 3-month market rates will rise and this reflects a genuine monetary tightening correctly, even in the absence of any immediate interest rate move. Nonetheless, at monthly or quarterly frequency the policy rate co-moves with 3-month market rates closely, as it is shown in Figure 2.

For government bond yields and T-bill rates Rezessy (2005) estimated the immediate effect of an unexpected interest rate move on the yield curve. He found significant impact all along the entire curve. Even the 10-year benchmark yield increases by 10 basis points after a 100 basis point surprise policy rate hike on the same day. The one year ahead forward interest rate increased by half a percentage point, but beginning with the 5-year horizon, a significant decrease was detected. As long as forward rates reflect interest rate expectations, the reaction of forward rates can be interpreted, since half of the unexpected move is expected to be maintained one year later, and to die out completely by the fifth year.

Although the pass-through from short to longer maturities is found to be satisfactory, it is not necessary for an effective interest rate channel because in Hungary the maturity of loans and deposits are typically shorter than in developed countries. In some cases, such as corporate loans, even if the maturity is longer, the interest rate is linked to the 3-month interbank rate, rendering it essentially a short-term debt with frequent re-pricing.

HKN (2004) investigate the connection between short-term money market rate and commercial bank rates. They detect relatively fast pass through with the adjustment of corporate loan rates being the fastest and most complete, but even the most slowly and least completely reacting consumption loan rates absorb 80 per cent of short-term interest rate moves.

From our point of view, the relevant finding of these papers is that this first stage of the interest rate channel performs well; it depends on the household and corporate sectors whether interest rate movements exert any direct influence on aggregate demand. As we will see in section 4, the interest rate channel may be effective through mainly investment decisions.

3.2. EXCHANGE RATE CHANNEL

The first, and perhaps empirically the most challenging step of the exchange rate channel is the reaction of the exchange rate to interest rate movements. A very simple and in theoretical modelling widely used assumption is uncovered interest rate parity (UIP). Within the UIP framework, risk neutral agents demand excess yield on assets that compensate them for the expected loss caused by depreciation:

$$i_t = i_t^* + E_t s_{t+1} - s_t, \tag{1}$$

where i denotes one period yield, s is the domestic currency (forint) value of the foreign currency (euro) and * stands for foreign variable.

As in Dornbusch's (1976) model, an unexpected interest rate increase with flat foreign rates causes the spot exchange rate to appreciate and/or the expected future rate to weaken. Unfortunately, statistical methods have failed to detect this mechanism.[3] The estimated relationship between interest rate and exchange rate was just the opposite, that is appreciation was more frequently coupled with positive interest rate differential.

One possible explanation is the presence of time-varying risk preferences. When the right-hand side of (1) is augmented with a risk premium term, the relationship alters in a way that investors require compensation not only for an expected depreciation, but also for holding domestic assets at all. The latter term can represent, for instance, an exchange rate risk premium if investors are risk averse.

$$i_t = i_t^* + E_t s_{t+1} - s_t + rp_t. \tag{1'}$$

It is easy to see that an increase in risk premium *(rp)* can lead to higher domestic interest rates, to a spot depreciation or can be offset by an appreciation in the future. If risk premium shocks dominate autonomous monetary policy, the observed co-movement between interest rate and exchange rate will be the opposite of the pure UIP case.

For Hungary the model containing time-varying risk premium is certainly the relevant one. During the past decade, since foreign portfolio investors appeared on forint markets, several episodes were recorded when it was obvious that changing risk assessment and preferences caused large swings in the exchange rate. Monetary policy tried to partially neutralise those shocks, otherwise they would have caused undesired movements in consumer prices.

The presence of shocks to risk premium renders measuring the effect of monetary policy on the exchange rate difficult. Relying purely on the correlation between interest rate and exchange rate would lead to a perverse effect, monetary tightening would seem to weaken the currency. Distinguishing between two types of 'financial' shock, monetary policy and risk premium shocks, is therefore crucial. Unfortunately, due to its limited relevance for developed economies, this problem has not received much attention in the empirical literature.

[3] For a survey see MacDonald and Taylor (1992).

Three of our research papers dealt explicitly with the reaction of exchange rate to monetary policy. Rezessy (2005) estimated the immediate impact of monetary policy shocks on the exchange rate. He used daily data starting in the middle of 2001 when the intervention band of the forint was widened and the inflation targeting regime was introduced. His identification strategy exploited the fact that on rate-setting meetings of the Monetary Council monetary policy shocks are typically larger than on other days. He detected a significant effect with the expected sign on the first day, and an even larger effect on the day after a rate-setting meeting.

For a longer period, beginning in 1995, Vonnák (2005) estimated the dynamic effect of monetary policy shocks on industrial production, consumer prices, short-term interest rate and nominal exchange rate. It is important to note that the response of the exchange rate was in one case part of the identifying assumptions, therefore it cannot be considered as being purely estimated. One identification strategy there assumed that out of all the possible shocks that have only delayed effect on output, monetary policy shock is the only one producing negative correlation between the interest rate and exchange rate (higher interest rates with appreciation). The other identification scheme, however, did not involve any presumption about the exchange rate; it was based instead on some historical evidence about Hungarian monetary policy. The exchange rate response was in each case almost identical, and despite the different data set, comparable to Rezessy's (2005) results. We are therefore quite certain that during the past 5-10 years monetary policy has been able to influence the exchange rate. An unexpected 25 basis point rate hike on average appreciates the exchange rate almost immediately by 0.5-1 per cent.

Karádi (2005) introduced a more sophisticated model of monetary policy and exchange rate. In his set-up there are two channels for affecting the exchange rate by the central bank: one is the traditional interest rate policy, the second is influencing exchange rate expectations. The relevance of his model is obvious from the characteristics of the Hungarian monetary policy in the past. During the crawling peg regime the preannounced rate of depreciation anchored expectations. Even later, in the first two years of inflation targeting, a range of exchange rate considered to be consistent with the inflation target was usually announced.

From (1) it is obvious that with full control over exchange rate expectations it is possible to manage the spot exchange rate without changing the policy rate. With constant foreign and domestic interest rates, a one per cent change of expected future exchange rate will move the spot rate by the same amount in the same direction. It is therefore possible to tighten monetary conditions simply by announcing a credible exchange rate target which is stronger than previously expected. Something similar happened after the widening of the intervention band in May 2001. The measure itself was a clear message for the markets that the MNB would like to see a more appreciated exchange rate in order to bring down inflation. As a consequence, the forint appreciated by 10 per cent within two months without any policy rate hike.

The second step in the exchange rate channel is the relationship between domestic prices and the exchange rate. This link is traditionally viewed as the most important one in Hungary. Monetary policy strategies have been based on the role of the exchange rate. Being a small open economy, the consensus view has been that exchange rate movements are tracked closely by tradable goods prices and affect the tradable sector strongly. Hence, the level of the exchange rate, not the interest rate was considered as a proper representation of the monetary policy stance. Although this link of the MTM belongs rather to the second stage, here we review briefly the most important findings for Hungary.

There is a branch of papers in the literature investigating how exchange rate changes pass through to domestic nominal variables. From our point of view, most of the results are only partly informative, since we restrict our attention to exchange rate movements that are generated by monetary policy. Pass-through coefficient estimates are usually not conditioned to a specific shock, therefore they can be considered as an average across all possible sources of shocks with weights proportional to the importance, or frequency of that particular shock, as is stressed in Bouakez and Rebei (2005).

In order to highlight this issue let us consider the case of changing risk premium again. In several cases Hungarian monetary policy has been successful in preventing the real economy from being affected by risk premium shocks. It achieved this by quickly countering exchange rate movements induced by sudden shifts in risk assessment of foreign investors. As a result, these shocks have had virtually no effect on output and prices. In contrast with this, autonomous monetary policy had a persistent effect on the exchange rate, and therefore consumer prices also reacted in the medium term. Intuitively, after an exchange rate change economic agents are more or less aware of the nature of the shock, and they reset their prices only if they do not expect the exchange rate to return to its previous level quickly.

To our knowledge, only two papers have attempted so far to estimate the Hungarian exchange rate pass-through or describe its main features. Darvas (2001) applied an equilibrium real exchange rate framework. He modelled price and exchange rate dynamics in a two-equation system, and estimated time-varying parameters for Hungary, the Czech Republic, Poland and Slovenia. He found that long-run exchange rate pass-through was high in Hungary during the years of the crawling peg regime, compared to the other three countries.

Jakab and Kovács (2003) investigate the role of expectations, goods market and labour market in the exchange rate pass-through. Simulating with the Hungarian block of the NIGEM model, they conclude that during the first 1-2 years after an exchange rate movement the pass-through mainly depends on the pricing elasticity in relation to cost changes and the role expectations play in price and wage-setting. From the third year onwards the mark-up elasticity becomes dominant. Labour market characteristics, namely the elasticity of wages in relation to unemployment and productivity are important only in the longer run, roughly after 5 years following the shock.

Our project has not included any research with the sole aim of obtaining fresh estimates for the pass-through. Nevertheless, for the understanding of consumption and investment decisions, JVV could not escape from dealing with the pass-through of monetary policy induced exchange rate movements. Using information of three empirical macromodels they concluded that pass-through to tradable goods prices is immediate and almost complete, but it is slow to prices of non-tradable goods. The pass-through to overall consumer prices seems to be gradual.

Finally, Kovács (2005) gives a very informative insight into the effect of exchange rate depreciations on the real economy using the experiences of the austerity package of finance minister Lajos Bokros in 1995. One central element of that package was the surprise devaluation of the forint by 9%, which serves as an excellent example for investigating some aspects of the exchange rate channel. His main conclusions concerning the external equilibrium were the following: (1) the profitability of the corporate sector was not significantly affected by the devaluation; (2) the position of the household sector deteriorated because of the negative income effect of the surprise inflation; (3) the success of the package hinged primarily on the fiscal policy, especially on the fact that inflating the expenditure side of the budget was not followed by a correction, so there was a persistent improvement in real terms on the expenditure side.

It is in order here to mention the role of intermediate goods in transmitting exchange rate changes. McCallum and Nelson (2001) present an open-economy model in which imports are treated not as finished goods but rather as raw-material inputs to domestic production. Hence, exchange rate movements affect production costs directly through the price of intermediate goods. They show that their model produced a relationship between exchange rate and inflation that is closer to empirical evidence.

We have only little empirical evidence concerning how exchange rate pass-through works through production costs. Although our project has not covered the supply side, we can invoke some other studies. As Tóth and Vincze (1998) report, as the two most important reasons for changing their prices, Hungarian companies in a survey refer to changes in 'fuel, raw material, accessories price' or in 'the exchange rate'. On the other hand, demand and productivity are ranked among least important determinants of pricing. This observation suggests that the cost channel may be relevant in Hungary.

Kovács (2005) demonstrates that firms' profit did not significantly improve after the depreciation in 1995-1996. The reason is that, while surprise inflation decreased real wages, material related expenses grew considerably at the same time, rendering the total effect nearly neutral. The neutralizing role of material costs was particularly important for firms producing for export. After the nominal appreciation in 2001-2002 a similar story but with opposite sign can be read from firm level data. Kovács (2005) makes the general statement that in Hungary the corporate sector's profitability is mainly determined by foreign trade partners' business cycle and the role of real exchange rate is negligible.

3.3. ASSET PRICE CHANNEL

According to monetarist as well as Keynesian theories, asset prices decline after a monetary contraction. A higher interest rate results in higher yield expected from bonds experiencing a decrease in their prices. Stock prices also fall. The loss of property value can be also important, as households' consumption spending might be affected through house equity withdrawal.

Mishkin (1996) explains the asset price channel focusing on the stock prices. The first example he cites is Tobin's q theory of investment (Tobin, 1969). When equities are cheap relative to the replacement cost of capital, firms do not want to issue new equities in order to buy investment goods, therefore investments decline. The second channel works through households' consumption. Lower equity prices reduce households' wealth and they consume less.

In Hungary there are at least two reasons for considering stock price channel as irrelevant. Firstly, there is no empirical evidence that monetary policy affects stock prices. We have estimates only for the instantaneous impact of monetary policy decisions on the Hungarian stock market index (BUX). Rezessy (2005) found no effect which is in contrast with Rigobon, Roberto and Brian Sack (2004) who detected a significant decrease in major U.S. stock market indices after an unexpected tightening. Taking into account the ability of stock markets to absorb news quickly, it is hard to imagine that monetary policy shocks have only a delayed effect on equity prices.

Secondly, shares play a minor role in Hungarian households' financial wealth. Typically they amounted roughly to 10 per cent of all financial assets during the past ten years. The same is true for other securities, like government bonds. Their amount has never exceeded ten per cent of total assets. Even households' financial wealth itself is not as large as in more developed countries. At the end of 2004 total financial assets excluding items that are not supposed to play a role in the asset price channel (cash, deposits, insurance technical reserves) amounted to 40 per cent of annual GDP (see Figure 3).

Housing wealth may play a more important role in the asset price channel, as its market value is more than three times larger than households' financial assets. Kiss and Vadas (2005) estimated the effect of an interest rate increase on house prices. They then fed the results into the consumption function of the MNB's quarterly projection model.[4] It is important to emphasise that they obtained an estimate that combines the asset price channel with the credit channel, as the consumption function cannot distinguish between the two mechanisms. They detected a significant effect of interest rates on private consumption and housing investments through house prices. However, if we compare this to other macro level estimates, as with JVV or Vonnák (2005), and take into account the relative size of the interest rate shock[5], we can conclude that even the housing market is incapable of explaining the effect of monetary policy.

3.4. CREDIT CHANNEL

The role of credit supply in magnifying the effect of monetary policy is discussed in detail in, among others, Bernanke et al. (1995). The basic idea is that monetary tightening leads to a higher external finance premium stemming from imperfections on the credit market, such as the principal-agent problem. They argue that the conventional cost-of-capital effect fails to explain the size, timing and the composition of the observed response of spending on durable goods. The additional mechanism, called credit channel, should not be imagined as a stand-alone mechanism, but rather as an amplifier of the conventional way the interest rate exerts its effect. It works in the same direction: a monetary contraction not only reduces demand for durables, it also decreases loan supply.

The authors distinguish between bank lending channel and balance sheet channel. The former concept rests on the assumption that a monetary contraction drains loanable funds from the banking sector. Commercial banks can raise new funds only at a higher price by issuing certificates of deposits or equity. The balance sheet channel is related to the financial accelerator phenomenon. Changes in interest rates affect the net worth of a firm through its cash-flow and the value of collateral. Higher interest rates thus lead to lower net worth and a higher external finance premium.

Stylised facts about the Hungarian economy suggest that even if there exists a credit channel, its contribution to the transmission mechanism may not be highly significant. A large part of commercial banks as well as the non-financial corporate sector is owned by large foreign companies. Loans from the parent company are available for numbers of domestic firms at normal price, even if the monetary policy is tight in Hungary, since either these loans are in fact internal financing at firm level or the cost of raising additional funds from external sources is not affected by Hungarian monetary policy. The same argument but to a limited extent also applies to Hungarian commercial banks owned mainly by foreign banks.

[4] A non-technical summary of the model is available on the MNB's website (Jakab et al., 2004).

[5] Kiss and Vadas (2005) assumed a permanent 1 percentage point increase in interest rate and they got 0.3 and 1 per cent deviation of consumption and housing investments from the baseline. In JVV a much smaller interest rate shock (0.4 of a percentage point increase in the first quarter, shrinking to 0.1 by the end of the year) resulted in a 0.1-0.2 per cent response of GDP components.

Regarding the estimation, Kashyap and Stein (1995) argue that the easiest way to test for the existence of a credit channel is to use cross-section estimates. In this way one can identify a credit supply effect that is independent of the demand side. The idea is that certain banks and firms, typically the smaller ones suffer more from higher external premium. HKN (2006) tested whether the existence of cross-bank asymmetries in lending activity can be rejected in Hungary. They estimated several credit supply equations on a panel of 25 commercial banks during the period 1995 to 2004. They related banks' ability to raise new funds to their size, liquidity, capitalization and foreign ownership. In the regression they also controlled for GDP growth, inflation, exchange rate and foreign interest rate. Using several specifications they could not reject the null hypothesis that the effect of the monetary policy is magnified by the bank lending channel.

As for the balance sheet channel, we have no research at hand dedicated exclusively to that phenomenon. However, there is some indirect evidence. Kátay and Wolf (2004) estimated an investment equation on a large panel of non-financial firms. In their specification the investment depended on the user cost of capital, sales revenues and the cash-flow. They found that the latter had significantly non-zero effect on investment spending. Although there may exist several channels through which cash-flow can influence investments, one plausible candidate is the external finance premium, that is the balance sheet channel.

Taking into account the ownership structure of the Hungarian banking and corporate sector, as well as the results of HKN (2006) and Kátay and Wolf (2004) we arrive at the conclusion that, although empirical evidence points towards the existence of the credit channel, for structural reasons we do not consider it to be a crucial ingredient in the transmission mechanism.

3.5. EXPECTATIONS

In a simple model with a Taylor-type monetary policy rule the long-term or steady-state inflation is determined by the target of the central bank. Forward looking and rational agents in this model-world anchor their interest rate expectations to the known policy rule and their long-run inflation expectations to the known target. If a shock occurs, monetary policy responds to it according its rule and no one doubts that all the variables, including inflation will return to the steady-state value. As a consequence of forward-lookingness, the effect of the shock is also mitigated by public expectations. Similarly, if the central bank changes its target and announces it, expectations may help the interest rate policy achieve the new goal, as long as perfect credibility is assumed. In the model-world the expectation channel has more to do with the policy rule than with policy shocks.

In the real world it is usually the case that either the target is not explicit or is not believed by the public (credibility problem). The central bank may want to signal that its target is below or above the current or forecasted level of inflation. It can do this by communication or in the absence of credibility, by demonstrative, unexpected changes of its instruments. Monetary policy shocks can be thus useful for sending messages about the preference of monetary policy and for gaining credibility, for signalling commitment. In reality, and particularly when policy preferences are changing, the expectation channel is related more to monetary policy surprises than systematic policy.

The role of monetary policy in coordinating expectations is most obvious in price and wage-setting, the two mechanisms that play a crucial role in neo-Keynesian theories of monetary transmission. The higher the credibility of monetary policy, the lower the real cost of disinflation, that is the sacrifice ratio depends heavily on the expectation channel. With more flexible nominal wages, production can be adjusted to changes in real demand without major changes in employment; therefore the short-run supply curve is more vertical than in the rigid-wage case.

An important example of the way expectations determine price setting is the so-called Taylor hypothesis. Taylor (2000) investigates the observed low pass-through of cost shocks to consumer prices. He relates the phenomenon to the low inflation and low nominal volatility environment, arguing that when setting their prices producers do not follow closely input prices, as changes in the latter are expected to be short-lived due to the nominal stability established by the monetary policy.

Expectations also play role in some of the previously analysed channels, especially in the response of asset prices including the exchange rate. The way interest rate steps affect the entire yield curve is determined mainly by what market participants think of the future course and the effectiveness of monetary policy. The reaction of exchange rate as well as other asset prices is also crucially dominated by the assessment of monetary policy.

Unfortunately, we have limited knowledge about price and wage setting in Hungary and how it has changed over time. As for pricing behaviour, Tóth and Vincze (1998) and Tóth (2004) report the results of a survey in which Hungarian private companies were asked about their pricing practice in 1998 and 2001. In 1998 the typical frequency of price reviews was lower in Hungary than what was found in the UK by a similar survey reported in Hall et al. (1997). In an environment of higher inflation one would expect more frequent re-optimising of prices, yet, whereas a typical Hungarian firm reviewed them quarterly in the UK respondents chose monthly frequency. Another counterintuitive result was that in the 2001 Hungarian survey the pattern became more similar to the UK pricing practice, despite the fact that Hungarian inflation had been decreasing between 1998 and 2001, even if not very dramatically (from 14-15% to 10%). The relatively rare price reviewing in Hungary can be justified by the costs of gathering information, as is argued in Mankiw and Reis (2002). Anyway, firms' responses regarding the reasons for price changing suggest that costs are more important than expectations.

We know even less about the Hungarian labour market. Pula, (2005) gives a comprehensive description of the flexibility of the Hungarian labour market. He claims that in Hungary the bargaining power of trade unions and employees are weak compared to other EU members. On the other hand, JVV found that nominal wages are rigid. After a monetary policy shock, it takes at least one year before nominal wages are modified according to the new path of prices. Putting these two observations together, a plausible reason for wage stickiness is the backward-looking nature of wage setting. An alternative explanation can be that the disinflationary monetary policy had not enough credibility; thus economic agents expected the former level of inflation to remain.

Some results related to other channels bear information about expectations. One possible explanation of the findings of Rezessy (2005), namely that long-term forward interest rates decrease after an unexpected rate hike, is that market participants believed in the success of monetary policy. Interest rate policy served to some extent as a channel for signalling long-term monetary policy preferences.

Karádi's (2005) exchange rate model incorporates public expectations about central bank exchange rate preference. His results show that communication was effective in coordinating market participants' exchange rate expectations and it helped exert influence on the spot rate, too. These two examples highlight the importance of expectations of agents on financial markets.

Although this channel is the most difficult one from the econometrician's point of view and we do not have specific results, we have the overall impression that while financial markets were supportive and expectations made policy more effective, the expectations of price and wage setters have not been anchored by the goals of monetary policy. Nevertheless, this is quite natural considering that the monetary policy in our sample period can be best characterised as shifting gradually from a more external-position-oriented regime towards a price-stability-oriented one, and gaining credibility for the new objectives takes time.

4. Demand

In basic models of MTM, production is affected by monetary policy mainly through the demand channel, as is explained in Ireland (2005). According to the neo-Keynesian view, changes in demand first influence output with prices adjusting only with some delay. The mechanism is the following: tighter (looser) monetary policy reduces (expands) demand for real goods, to which firms first respond by temporarily decreasing (increasing) their output, as re-pricing is costly and thus can be made only later. Lower demand without price adjustment results in output level and marginal costs lower (higher) than natural. As time goes by, firms cut (lift) their prices according to the altered environment. Lower (higher) prices stimulate (calm down) demand and production will return to its natural level. This mechanism can be labelled as the output gap, or demand channel.

As for Hungary, there is some empirical evidence of such a neo-Keynesian pattern in the demand channel. Tóth and Vincze (1998) digest the results of a survey conducted among Hungarian private companies in 1998. Tóth (2004) evaluates how the picture has changed relying on a 2001 survey. One of the questions in both surveys was the ordering of possible responses to a change in demand. Firms typically ranked steps like adjusting hours worked and employment or changing capacity before re-pricing. Their finding is in accordance with the result of a similar survey in the UK in 1995 (Hall et al., 1997).

In this section we review what we have learned about the behaviour of some key components of aggregate demand, namely, consumption, investment and net export. For this section JVV is our starting point. Using three different macromodels they show that a significant effect of monetary policy can be detected first of all in the case of investments. In the following we survey the relevant literature and check how their findings fit existing evidence. At the end of the section we connect the demand components to the individual channels of the transmission.

4.1. CONSUMPTION

Investigating the transmission mechanism within an SVAR framework, Angeloni et al. (2003) found that while in the U.S. households' consumption dominates the response of output to monetary policy shocks, in the euro area the contribution of investments is more important. Nevertheless, the sign of impulse responses are intuitive in both economies, namely, after an unexpected tightening both consumption and investment drop.

In contrast with the euro area and the U.S., JVV demonstrated that in Hungary there is no empirical evidence of lower consumption after a monetary contraction, and one model even shows rising consumption. This finding may appear to be counterintuitive, especially when one takes into account the results of Kiss and Vadas (2005) who detected a significant consumption effect of monetary policy through the housing market.

Nevertheless, there are some empirical studies as well as theoretical ones that suggest this type of consumption response is plausible. Theoretically, one important reason can be that appreciation of the currency increases the wealth of households. Households then may spend their excess revenue stemming from the higher purchasing power of their wealth to either tradable or non-tradable goods, depending on the income elasticities of both. Benczúr (2003) shows in a two-sector dynamic growth model how a nominal appreciation can stimulate consumption.

Van Els et al. (2001) compare the main characteristics of MTM in eurozone members using country models. In four out of the twelve countries, consumption is above the baseline during a couple of years after a tightening monetary shock. In Belgium and Italy the authors attribute rising consumption to the net creditorship of households. In the case of Finland their explanation is in line with Benczúr (2003), claiming that the pure exchange rate channel dominates. In the German model prices fall faster than nominal wages, raising real wages and thereby consumer spending.

JVV explain the reaction of consumption by the stickiness of nominal wages and relatively quick exchange rate pass-through. Their argument is that tradable prices respond to monetary policy quickly because they track exchange rate movements closely. Since the short-term reaction of non-tradable prices is virtually neutral, overall price level declines already during the first year. In contrast with prices, nominal wages remain unchanged for at least one year, meaning that real wages rise. The income effect offsets other mechanisms, such as asset price changes.

The nominal stickiness of wages can be the consequence of either infrequent re-setting or backward-lookingness. The latter explanation seems to be the more relevant one for Hungary, since in a high inflation environment economic agents are inclined to rely on the last period's inflation rate when setting prices and wages.

It is important to stress that the empirical evidence of this kind of consumption response is not particularly strong. The identification of the effect of monetary policy is complicated by the fact that the appreciation of the forint after the widening of the intervention band coincided with several fiscal measures aimed at stimulating private consumption. Since the band widening in 2001 can be regarded as probably the biggest unexpected monetary tightening during the past ten years[6], statistical methods that do not control for fiscal policy may fail to separate the two effects. Nevertheless, the way JVV explained why consumption does not fall after monetary contraction is in line with Jakab and Vadas (2001) who found that wages are far the most important explanatory variable for consumption, while they could not detect any significant role for interest rates.

To sum up and putting these findings into Mishkin's framework we can conclude that there are no signs that after a monetary tightening private consumption falls in Hungary. The reason is the relatively quick exchange rate pass-through and the slower nominal wage adjustment. Our interpretation is that the exchange rate channel offsets interest rate, asset price and other channels in relation to the behaviour of Hungarian households.

4.2. INVESTMENTS

JVV found that the reaction of investment spending is the most robust ingredient of the demand effect of unexpected monetary policy. Hence, to form an overall picture about the monetary transmission mechanism, it is crucial that we understand the mechanism through which firms' investment decisions are affected.

Kátay and Wolf (2004, henceforth KW) give us a deeper insight into the investment behaviour of Hungarian firms. They estimated an investment function using a large number of observations of firm level balance sheet data obtained from the APEH database. The main advantage of their approach over aggregate time series techniques is the high degree of freedom from cross-section.

Most importantly, they found a significant and quick reaction of investments to changes in user cost, which reinforces the finding of JVV. Obviously, there are serious limitations of translating KW's result to the macro level. The first problem comes from the cross section heterogeneity. The obtained impulse response is valid at an aggregate level only as long as there is no considerable heterogeneity between firms with regard to their investment function, particularly the user cost elasticity.

The second challenge is the missing link between the instrument of monetary policy (in Hungary this is the two-week deposit rate) and the user cost. The specification they used relates investments to the user cost, which consists of expected return on equity and bank lending rates among others. Obviously, monetary policy has no direct control over all these factors. In order to assess the impact of monetary policy on investments, we need to know the relationship between policy rate and user cost, but, unfortunately, we have no empirical evidence.

The third difficulty to overcome is that they estimated only one dynamic equation in which investment spending is explained by the user cost, sales and cash flow. Even if we treat user cost as exogenous, which is a questionable assumption in itself, cash flow and sales depend apparently on past investments; therefore, for the calculation of the dynamic effect of user cost additional relationships would be necessary.

Finally, monetary policy can affect firms' cash flow and sales through channels other than investments. The adequate exercise would be therefore to simulate the effect of the policy instrument on user cost, cash flow and sales, calculate the response of investments to these variables, taking into account that lagged investment changes also influence cash flow and output. The simulated firm level behaviour needs then a proper aggregation technique.

[6] Actually, one of the identification schemes of Vonnák (2005) was based on that assumption and proved to be equivalent to a completely different characterisation of monetary policy.

Using the same database as KW, Reiff (2006) estimated on the firm level an investment model for the Hungarian corporate sector in which firms face three types of adjustment costs: the standard convex cost, a fixed cost and an irreversibility cost. Using the estimated model he was then able to analyse at both aggregate and firm level how investments respond to a so-called profitability shock. In line with KW and JVV, he finds that firms react immediately by reducing investment spending after profitability falls. His findings are informative also from the MTM point of view, as there are substantial similarities between monetary policy and profitability shocks, and he solves the aggregation problem as well.

Despite all the shortcomings mentioned above and the limited comparability of the three models, the high degree of similarity between impulse responses from micro- and macroestimates make us believe that those results reinforce each other and – similarly to the euro area – investments are key ingredients of the demand effect of monetary policy. As we will show in the next subsection, the demand for investment goods may help keep foreign trade balanced, despite a strong exchange rate response.

It is noteworthy to mention that although the cost-of-capital channel is usually counted to the classical interest rate channel, the role of exchange rate in investment decisions may be important, as JVV emphasise. Since investment goods are typically tradables, their price moves closely together with the exchange rate. The cost of capital includes the (expected) inflation of investment goods in a way that declining prices mean higher costs as postponing investment spending pays-off. Their conclusion is that although the existing evidence is insufficient to separate exchange-rate effect from direct interest rate effect, the response of investments is likely to be affected through both channels.

4.3. NET EXPORTS

The third main component of output investigated by JVV is net exports. The results from the three models they used were less conclusive than for private consumption and investments, and the authors concluded that they could not detect any significant effect of monetary policy. Only one model predicted considerable deteriorating of the trade balance after an unexpected monetary tightening, the other two suggested rather a balanced path but with substantial uncertainty.

Looking at exports and imports separately it becomes obvious that while the models indicate a similar response of exports, it is the reaction of imports that is responsible for diverging results. All three models predict a sizable drop in exports after a monetary tightening. Export prices also decline quickly, suggesting that the export sector reacts flexibly to changes in demand. The lack of price stickiness can be understood taking into account the strong competition on international goods markets.

There is, however, much less agreement among models on how imports react to monetary policy. According to the quarterly projection model of the MNB, imports rise after a tightening. In contrast, the other two models used in the paper referred to predict declining imports, which can explain the rather balanced net export response they obtained.

There might be several plausible explanations for the insignificant net export response, and the ambiguous import response. According to Kim (2001), after an appreciation expenditure switching results in less export and more import, due to the change in their relative price. The observed behaviour of Hungarian consumption itself would imply higher import demand, at least according to two models used in JVV. On the other hand, contractionary monetary policy may reduce imports through lowering domestic demand, that is through income absorption. In Hungary the significant drop in investments and exports may easily offset the additional import effect of higher consumption, because of their high import content.

To conclude, foreign trade is probably affected by monetary policy in several ways. First of all, exchange rate changes cause quick response of exports both in volumes and prices. Secondly, changes in investments and consumption, as well as exports, influence imports. It seems that the import demand from investments and exports dominate imports; therefore the income absorption effect offsets expenditure switching, implying that no significant net export reaction can be detected by econometric methods.

4.4. HOW DO INDIVIDUAL CHANNELS OF TRANSMISSION INFLUENCE DEMAND FOR REAL GOODS?

In this subsection we combine the findings on particular channels of transmission with those regarding demand. Of course, not all channels can be associated with all components of demand; for example, we have no idea how credit supply asymmetries could affect net exports. In other cases, even if the relationship exists, the interpretation is not straightforward.

This is especially true for the exchange rate channel with regard to consumption and investments. There are also cases that are not covered by our research project; sometimes it is not possible to identify through which channel a certain component of demand was affected. Nevertheless, using this scheme we can rank the importance of particular mechanisms.

Taking into account the high sensitivity of private investments to monetary policy, the interest rate channel may play an important role in the transmission mechanism. Nevertheless, it is not possible to disentangle it from other channels. JVV explain how exchange rate appreciation can lead to the same reaction through the user cost of capital. Similarly, we cannot exclude the possibility that credit supply also contributes. On the other hand, asset price channel seems not to influence the investment behaviour.

In the case of consumption the exchange rate channel was identified as the main reason for the insignificant response. Through the income effect it can offset the interest rate and credit channel. Asset prices are not found to be able to explain consumption behaviour.

The role of the exchange rate is trivial in the case of net exports. Although we could not detect any significant effect of monetary policy on the trade balance, the quick reaction of export and import prices highlights the dominance of the exchange rate channel in short-run price development.

We can conclude that the exchange rate channel dominates the short-run output and price effect of monetary policy. Due to the openness of the Hungarian economy, consumer prices react more quickly than in the U.S. or the euro area, while the change in output is smaller due to the lack of households' consumption response. Nevertheless, the significant reaction of investments suggests that the interest rate channel may not be negligible in Hungary.

5. Nominal adjustment in the medium run

Changes in aggregate demand affect various sectors differently. In the medium run relative prices adjust mainly because the labour market transmits monetary policy impulses between sectors. As for Hungary, we expect that tradable price changes spread over the entire economy, including non-tradable goods' prices. In this section we present what we know about the medium-run effects of monetary policy. Since we have not conducted specific research in this topic, we rely on some other studies outside of the MTM project and present some fresh estimates.

The most important observation is that although exchange rate and tradable prices dominate the short-run effect of monetary policy, consumer prices remain at a lower level, even when the exchange rate returns to its initial value. Since tradable prices follow exchange rate movements closely, this indicates some price adjustment of non-tradable goods.

Indeed, SVAR estimates[7] show that non-tradable prices, approximated by the price index of market services respond slowly to monetary policy (see figure 4). The adjustment of goods prices not directly affected by the exchange rate seems to prolong the immediate reaction of tradable prices.

One possible explanation of relative price adjustment is based on the labour market. If wages equate between sectors, demand shocks to some sectors spill over to the rest of the economy. In our case the fall in exports and investments after a monetary contraction may exert downward pressure on employment and wages in the entire economy. Lower wages allow producers in sectors not directly affected by lower demand to cut their prices. The relevance of the labour market in the medium run is demonstrated in Jakab and Kovács (2003) who found that, several years after an exchange rate shock, pass-through in Hungary depends on labour market developments.

In JVV wage responses to a monetary policy shock are shown. Nominal wages tend to react only one year after the shock occurs, which is not an extremely sticky style of wage-setting, but taking into account the relatively quick exchange rate pass-through to consumer prices, it results in significant changes in real wages.

Figure 5 presents impulse responses from an SVAR similar to the previous one used to estimate tradable and non-tradable price response.[8] As in JVV, nominal wages decline slower than consumer prices after a monetary contraction. Real wages, therefore, increase significantly for two years. On the other hand, employment drops quickly and begins to return to the baseline as early as in the second year. Probably it is the higher unemployment rate that promotes the nominal wages to adjust. According to the SVAR estimates, firms respond to higher wage costs first by cutting jobs. Lower employment then pushes wages down allowing firms to keep prices low even 3-4 years after the monetary shock.

[7] The estimation was based on Vonnák (2005). Similarly to the SVAR estimation strategy introduced in JVV, I augmented the 4-variable benchmark monthly VAR (industrial production, CPI, 3-month T-bill rate, exchange rate, sample 1995:m1-2004:m12) with industrial goods and market services sub-indices. For identification of monetary policy shocks I used sign restriction as in Vonnák (2005). The results are comparable to those of the paper referred to.

[8] In this case a VAR model of quarterly GDP, CPI, short-term interest rate, nominal exchange rate, employment and nominal wages in the private sector was estimated. The identification was the same as in the previous SVAR.

6. Conclusion and forward-looking remarks

In this paper we reviewed the fresh results of nine studies made under the umbrella of the Hungarian MTM project. Relying on other studies as well, we created a synthesis from particular findings.

Our overall picture about how monetary policy works in Hungary can be summarised as follows: consumer prices are affected immediately in the first year after monetary policy has increased its policy rate. The response is persistent; the price level remains lower for several years. On the other hand, output reacts only marginally. The reason for this on the demand side may be that while investment drops significantly after a monetary tightening, consumption seems to offset more or less the demand effect of decreasing investment spending.

The output and price dynamics differ significantly from that found for large, developed economies. Empirical estimates for U.S. and euro area monetary transmission mechanism suggest that in those economies output reacts first and significantly, and consumer prices are adjusted only with substantial lag.

We attribute the difference first of all to the central role the exchange rate plays in the Hungarian monetary transmission mechanism, and mainly for two reasons. First, due to openness, exchange rate movements pass through to tradable goods' prices quickly. Second, the output response is mitigated by the fact that because of the short-run nominal wage rigidity and the quick exchange rate pass-through, the income effect offsets the interest rate effect on consumption, resulting in a fairly insensitive reaction.

Being an EU member country, Hungary is expected to adopt the common European currency as soon as it meets the Maastricht criteria. With the adoption of the euro, the most important channel of transmission will disappear. This raises the question whether it is optimal for Hungary to join the eurozone, running the risk that the economy will remain without effective monetary policy that could smooth shocks.

Orbán and Szalai (2005) point out that after euro adoption the scope of the interest rate channel will broaden for at least two reasons. First, common monetary policy shocks in the euro area will influence the Hungarian economy through foreign demand, which is now an exogenous factor for monetary policy. Second, the ECB's interest rate policy directly affects the interest rate burden on euro-denominated loans. They conclude that the differences between Hungarian MTM and those of present eurozone member countries will not be so important that an asymmetric response to common monetary policy and a real divergence in the euro area could be expected.

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Figures

Figure 1

CPI responses to an unexpected rate hike

(NEM and 5GAP model simulations from JVV, SVAR estimates from Vonnák 2005)

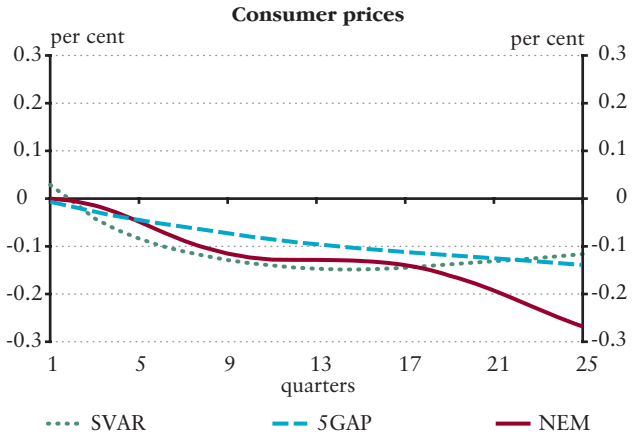


Figure 2

3-month money market, T-bill rates and the policy rate

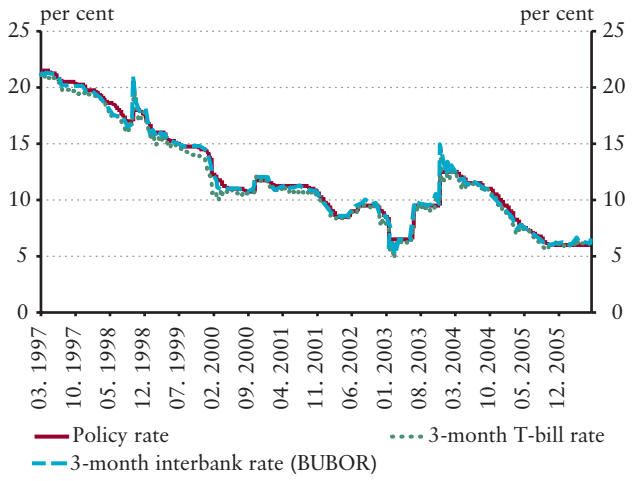


Figure 2

Households' wealth as a percentage of GDP

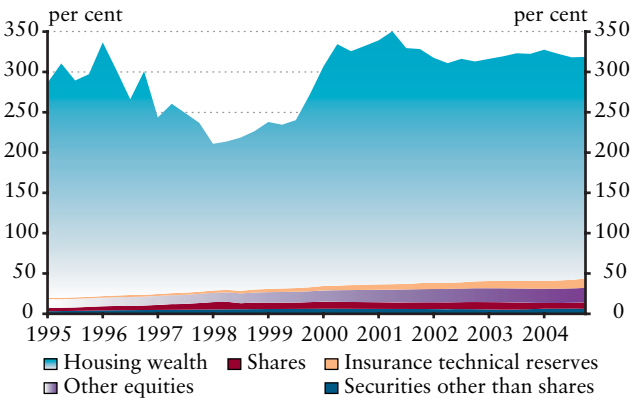
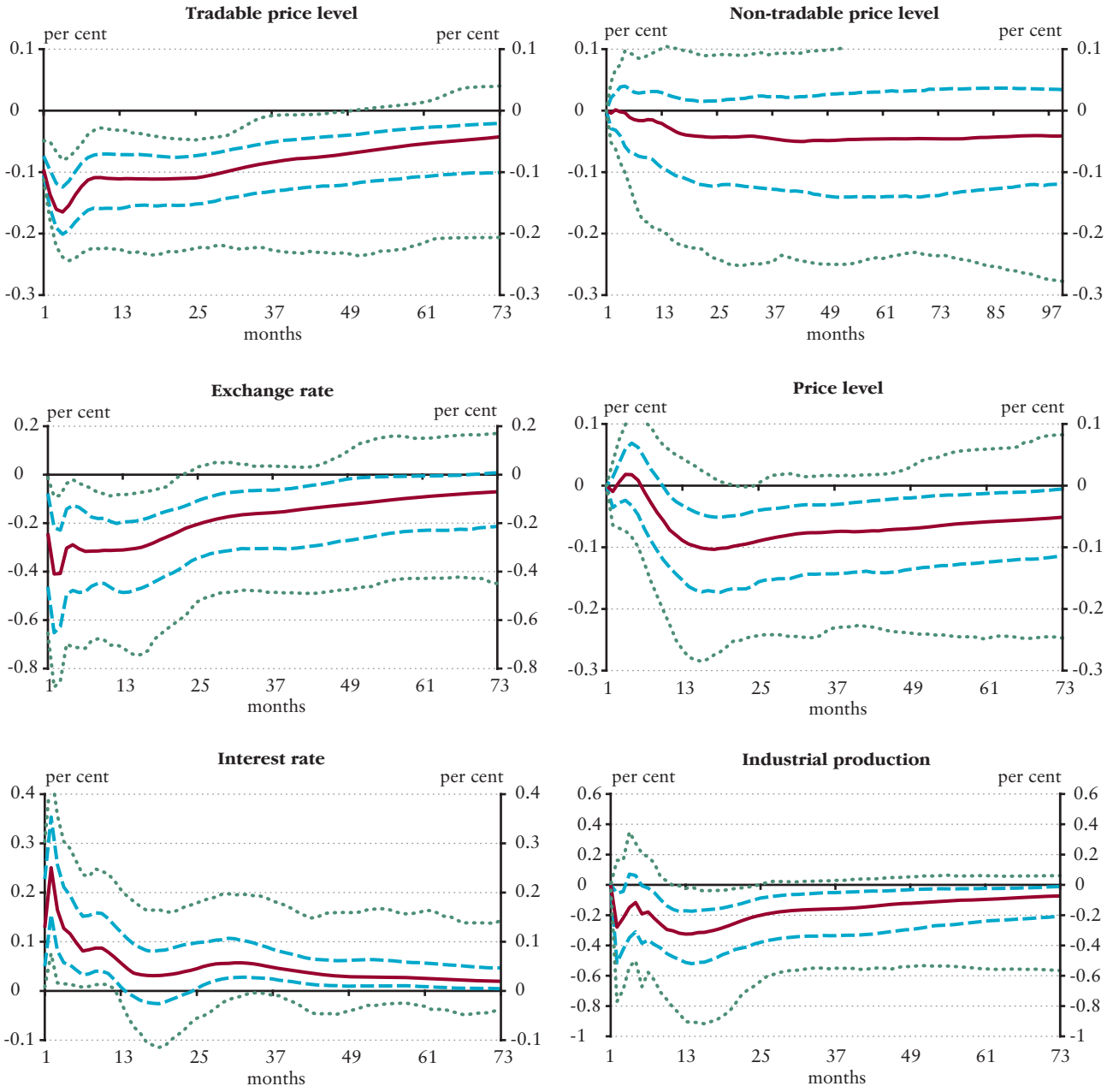


Figure 4

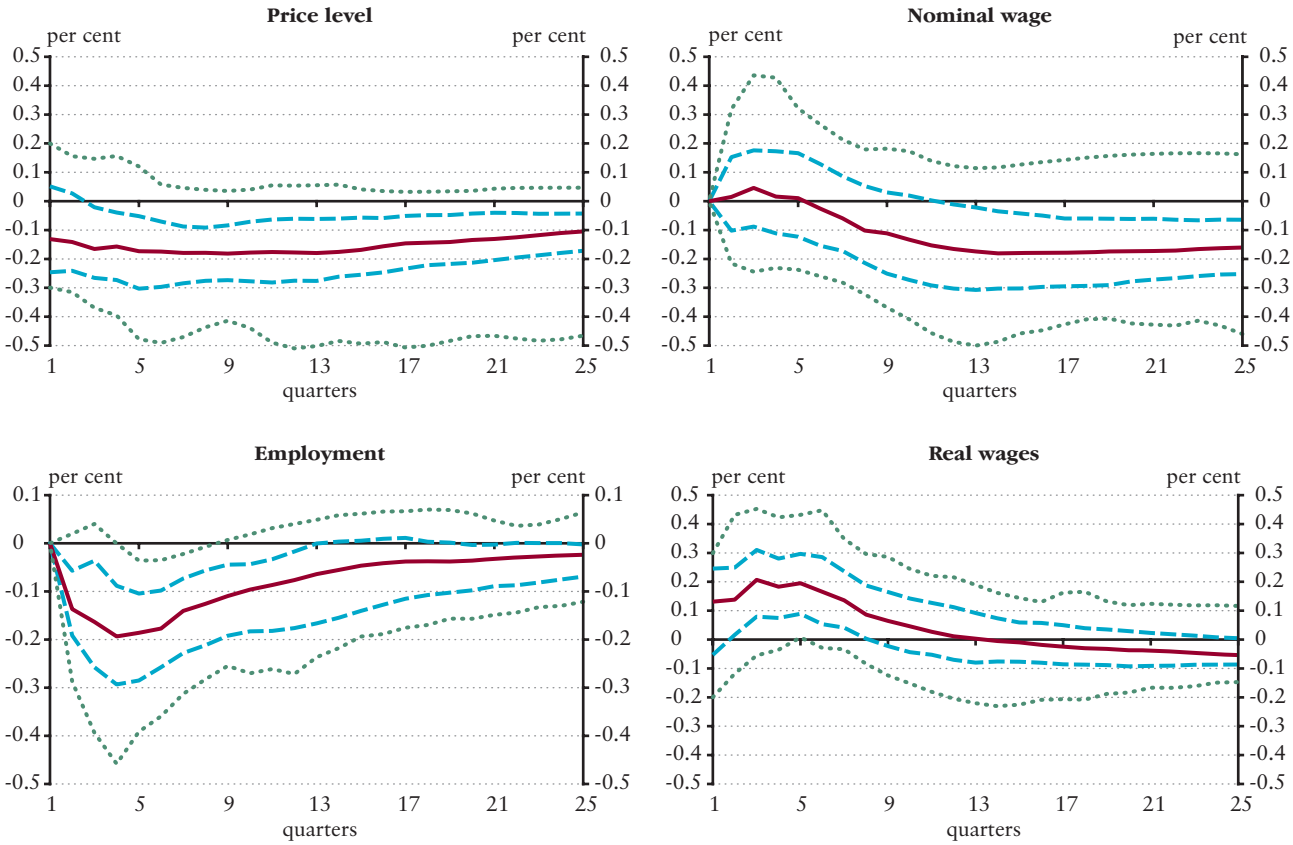
Response of tradable and non-tradable goods prices to an unexpected rate hike
(SVAR estimates)



The median estimates and the middle 68 and 95 percent of the Bayesian posterior distributions.

Figure 5

Response of employment and private sector wages to an unexpected rate hike
(SVAR estimates)



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