Ágnes Csermely–András Rezessy: The theory and practice of interest rate smoothing

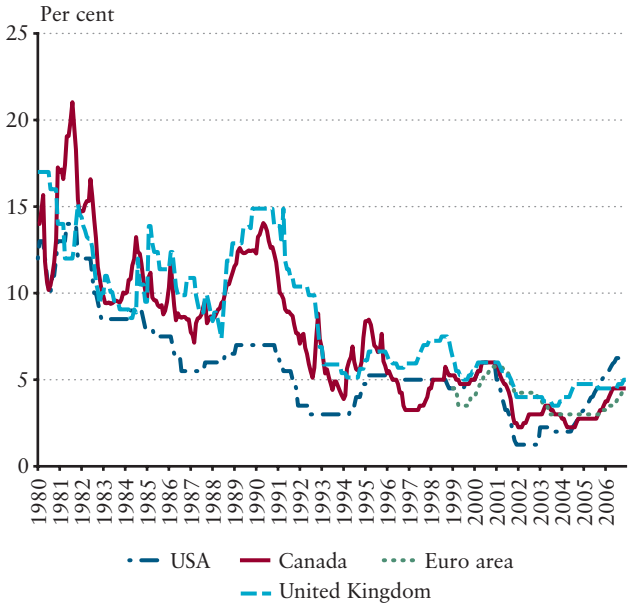
The interest rate policy of the Magyar Nemzeti Bank typically consists of taking several smaller steps in one direction. Other central banks follow similar practices. Their interest rate policy actions are characterised by gradual changes: in other words, they avoid sudden, major changes in interest rates and are wary of reversing interest rate cycles too frequently. This study will present the theoretical background of the practice of such interest rate smoothing, the motivations of central banks as revealed by their communication, and some important considerations for Hungarian monetary policy.

INTRODUCTION

International monetary policy practice shows that central banks attempt to avoid extreme interest rate changes. Looking at the past tendencies in the key interest rates of major central banks (Chart 1), it is apparent that prime rates – especially in the past decade and a half – have been fairly stable over the short term, while interest rate changes have been gradual over the long term, and that central banks have aimed to change the direction of the interest rate cycles as seldom as possible. While the Federal Reserve (Fed), which serves as the American central bank, has always followed this kind of strategy in the past, the Bank of England and the central bank of Canada, for example, only adopted this type of behaviour in the past decade and a half. Today, changes of 25 basis points have become prevalent, but from time to time, when economic developments feature a sudden reversal, a larger interest rate change is also possible. As Table 1 illustrates larger steps were taken more frequently to cut interest rates which suggest that the growth of the economy is more often affected by unpredictable events of great importance (e.g. the capital markets crisis, 9/11).

Chart 1

Changes in central bank prime rates



Sources: International Financial Statistics, Bank of England.

The statistical properties of the interest rate series also reflect the gradual approach taken by central banks. In most countries, the autocorrelation of central bank interest rates is considerable. This suggests that at any given time the interest rate will be affected by the interest rate of the previous period. Another interesting fact is that after an interest rate change in a particular direction, the interest rate is 3-4 times

Table 1

Statistical characteristics of central bank rates (1996-2006)

	Interest autocorrelation	Probability of a cycle reversal[1]	Average interest rate hike	Average interest rate cut
Federal Reserve	0.98	0.17	0.30	0.38
Bank of England	0.98	0.19	0.25	0.29
Bank of Canada	0.98	0.24	0.30	0.33
ECB (1999–2006)	0.98	0.18	0.31	0.39

Sources: International Financial Statistics, Bank of England.

[1] This indicator is the ratio of interest rate changes that reverse a cycle compared to all interest rate changes.

more likely to change in the same direction, rather than in the opposite direction. This indicates that central banks attempt to avoid reversals in the interest rate cycle.

THEORETICAL CONSIDERATIONS OF INTEREST RATE SMOOTHING

The theoretical literature identifies four major reasons for gradual changes in interest rates, in other words interest rate smoothing (see for example Bernanke, 2004; Blinder, 2005; Rudebusch, 2006).

1. Macroeconomic uncertainty requires a more cautious and a gradual approach to interest rate policy.

2. Interest rate smoothing and less frequent reversals in interest rate cycles help make monetary policy more understandable and underscore the competence of the central bank.

3. Interest rate smoothing contributes to financial stability.

4. As expectations regarding future interest rate changes have an impact on the decisions that economic agents make today, the economy may be stabilised with the help of smaller, but more lasting interest rate changes.

The most important reason for interest rate smoothing is macroeconomic uncertainty. Economic data are inaccurate, data revisions are frequent, and the available analytical tools are not sufficient to identify the economic shocks that drive the behaviour of economic agents in 'real time'. On the other hand, monetary decision makers do not know in advance the impact of an interest rate change on other macroeconomic variables such as, for example, the exchange rate and the price of assets, and therefore constant learning is required until the optimal degree of monetary restriction or relaxation can be determined. A seminal study by Brainard (1967) demonstrated that if a decision maker is unsure about the model that describes the economy and the impact its decision will have on the economy, then – under certain parameter restrictions – the optimal decision is to take smaller steps in response to the information received, compared to when circumstances are not uncertain.[2]

It is important to note, however, that uncertainty does not always justify a gradual change. If the uncertainty concerns the persistence of inflation, for example, an optimal policy would tend to take more aggressive steps than in the absence of uncertainty. The reason is that this is how the central bank reduces uncertainty about inflation in the future (Söderström, 2000). In addition, increased inflation persistence may indicate that market players are not fully convinced by the central bank's commitment to price stability. The later the central bank responds, the higher the real costs the central bank will incur when it attempts to re-establish its credibility.

The second advantage of interest rate smoothing is that it helps to reduce the frequency of cycle reversals. If cycle reversals are too frequent, communication becomes more difficult and public opinion may call into question the competence of the central bank.[3] Frequent changes in interest rate cycles are also undesirable if we wish to understand how the economy operates (see, for example, Ellison, 2006), as they prevent the central bank and other market participants from learning about the monetary transmission mechanism.

The third advantage of interest rate smoothing is that it enables monetary policy to have a stronger impact on interest rate expectations and on long-term yields. Interest rate policy affects economic activity – including decisions to invest, consume and save – primarily by way of long-term interest rates rather than the prime rate. The relationship between the two is based on the expectation hypothesis of the yield curve according to which long-term yields are an average of short-term yields that are expected in the future. Therefore, if an interest rate change is considered to be long-lasting or if additional changes are expected in the future, long-term yields will change to a greater extent because the interest rate change is understood as the first step in an interest rate cycle.

The impact on long-term interest rates may lead to a more favourable economic trajectory via two channels.

One is based on the assumption that interest smoothing can achieve the desired macroeconomic effect via lower fluctuation in the prime rate. This is because different shocks often change inflation in opposite directions. In such cases, a monetary policy featuring interest rate smoothing does not have to complete interest rate cycles on the basis of newly received information; however, long-term interest rates undergo the necessary changes. Smaller fluctuations in short-term interest rates are of value primarily for the purpose of stability. Banks' funds usually have shorter terms than their placements. Therefore, a gradual change in short-term interest rates has a stabilising effect on banks' profits because it enables them to adapt to changes in their financing costs (Cukierman, 1991).

[2] This consequence of uncertainty, and the fact that uncertainty requires gradual action, was later also demonstrated in a different model framework. Martin (1999) had similar results in the new Keynesian model framework. Martin adds that those parameter values in respect of which Brainard's results are not valid do not appear to be realistic on the basis of empirical evidence.

[3] According to Meyer (2004), for example, this consideration was of key importance for Greenspan, the previous chairman of the Fed.

According to the second consideration, described by Woodford (1998), it is not interest rate smoothing but the long-term nature of changing of interest rates that matters. Due to forward expectations, inflation and output do not depend on current monetary conditions alone, but also on future monetary policy action. Therefore, a more favourable result will be achieved if the central bank is capable of influencing long-term interest rate expectations as well. If market players expect the currently optimal interest conditions to be lasting, a smaller initial interest rate change may be sufficient to stabilise the economy.

However, the central bank can only influence expectations if it is credibly committed to an interest rate trajectory. This means that the central bank cannot re-optimise its policy at each moment, as it must take into account its past decisions (history-dependent). Accordingly, a commitment may narrow the central bank's options over the short run, but overall the central bank will be more successful in stabilising the economy, because expectations can be managed more effectively.

MODELLING THE CENTRAL BANK'S ACTIONS: IS INTEREST RATE SMOOTHING INTENTIONAL?

If we wish to model the actions of the central bank, it is important to decide why interest rate smoothing occurs and whether or not it is intentional. If the central bank's actions are influenced by financial stability considerations, after a larger shock the central bank will execute only a portion of the necessary interest rate change and finish up – provided that the central bank's outlook is not modified by new information – later, in several smaller steps. If the central bank's objective is to influence expectations and to formulate a persistent interest rate trajectory (à la Woodford), the central bank will respond to a shock immediately, but will take into account its previous commitments when determining the optimal approach. Therefore, interest rate smoothing is not a result of future action, but rather of past action. Finally, some people believe that interest rate smoothing is not intentional but is caused by the dynamics of the economic variables and/or uncertainty as described by Brainard and a constant learning process about economic processes. In this approach the central bank, in every one of its decisions, immediately changes the interest rate to what is considered to be the optimal level at the time. However, the unfolding of macroeconomic processes and a better knowledge of their nature results in a more persistent interest rate trajectory.

Empirical studies of the central bank's interest rate smoothing are generally based on the logic of financial stability: a new argument is added to the central bank's traditional loss function[4] to penalise interest rate fluctuations. The logic of estimating the central bank's so-called reaction functions or the interest rate rules is similar. These studies are based on the primary hypothesis that the central bank adapts to the fundamentally justifiable interest rate level only gradually. Most often the fundamental interest rate is a function of inflation and the output gap (in the literature this is referred to as the 'Taylor rule'). The actual change in the interest rate can be estimated on the basis of a partial adjustment equation, as a function of the fundamental interest rate and the lagged interest rate. The coefficient of the lagged interest rate *(ρ)* was regarded as the parameter of interest rate smoothing. Most of these studies were written to describe the actions of the Fed and resulted in a rather high smoothing parameter of approximately 0.7-0.9.[5] Hidi (2006) performed similar calculations in respect of Hungary, the results of which indicated a similar level of interest rate persistence (0.6-0.8).

The above approach was widely criticised, because in practice the high autocorrelation of interest rates can be caused by several factors in addition to intentional smoothing. Rudebusch (2002 and 2006), for example, called attention to the fact that the results are similar if the central bank, when making its decision, takes into account criteria other than growth and inflation and for a longer period of time (e.g. stability considerations). Rudebush also proposes an alternative method for measuring intentionality on the basis of money market information. If the central bank's gradual changes were intentional, forward yields would be easy to predict. In the case of the USA, the prime interest rate cannot be predicted with sufficient certainty for a period longer than 3 months; consequently, interest rate smoothing is not intentional in the interpretation based on money markets.

With regard to the Bank of England, Goodhart (2004) also came to the conclusion that smoothing is not intentional. In the study he estimated the reaction function of the Bank of England and found that the central bank does not react to current inflation, but to a deviation from the target of the inflation forecast, that is, $\tilde{\pi}_{t+2}$. In this approach, interest rate changes do not exhibit smoothing. However, we must underline that in most cases the central bank's forecasting practice contains smoothing. As forecasters face the same uncertainty as decision makers when evaluating freshly received macroeconomic variables, they too only gradually incorporate the impact of new information into their forecasts.

[4] The most popular form of the central bank's loss function can be expressed as the discounted present value of the square sum of the deviation from the inflation target and the fluctuation in the output gap. In certain models this corresponds to the welfare function of the representative household.

[5] See Amato and Laubach, 1999, Clarida et al., 2000.

The latest method of modelling the central bank's behaviour is based on estimates by the so-called stochastic dynamic general equilibrium models.[6] These models do not assume the central bank's target function which penalises interest rate volatility and but do take into account the persistence of shocks to the economy. Nevertheless, the estimated parameter of the lagged interest rate in the central bank's target function is high. In this model framework the welfare impact is primarily caused by the 'Woodford' channel that pertains to the predictability of future interest rates.

INTEREST RATE SMOOTHING AND COMMUNICATION BY CENTRAL BANKS

In the previous chapter we have seen that empirical approaches cannot accurately grasp the motivation behind the generally observed interest rate smoothing behaviour of central banks. Therefore, in this chapter we will examine communication by central banks in order to explore the assumptions behind gradual interest rate changes. This study will only focus on tools that guide longer-term interest expectations and will not analyse communication aimed at smoothing market interest rates over the very short term.[7]

The direct statements of central bank chairmen are not equivocal. In an earlier study Bernanke, the current chairman of the Fed, claimed that American monetary policy smoothes interest rates intentionally (Bernanke, 2004). However, according to Poole, another member of the Fed's decision-making body, future interest rate changes are based almost exclusively on newly received information, that is, if interest rate changes are gradual, it is not because of intentional interest rate smoothing (Poole, 2003). Similarly to Poole, King, the chairman of the Bank of England, claims that the central bank always makes a new decision in light of new information (King, 2006). Goodhart, a former member of the decision-making body of the Bank of England, denies having regularly voted together with his colleagues on smaller steps than were necessary to attain the inflation target (Goodhart, 2004). Despite this statement, we have found evidence of intentional interest rate smoothing in the minutes of the Bank of England. The minutes of the interest rate decision often point out that uncertainty requires cautious measures in monetary policy. In one case, the minutes specifically state that although a 50 basis point increase would have been necessary due to the inflation forecast, yet they decided to take several smaller steps due to the uncertainty and to the danger of sending the wrong message by changing the size of a step.

In addition to the statements made by central bank officials, the forward communication of central banks may also yield information about expectations concerning future interest rates and therefore about the assumptions that underlie interest rate smoothing. In the inflation targeting system, one of the key tasks of monetary policy is to influence expectations; therefore, the practice of each inflation targeting central bank has forward components. An accepted tool for orienting interest rate expectations is the so-called fan chart[8] which, in addition to the basic trajectory of inflation forecast, also indicates the uncertainty faced by decision makers in respect of future developments in inflation and growth. The fan chart sends a message about future interest rate changes: if the likelihood of inflation in excess of the target is high, monetary tightening can be expected. At the same time, it also demonstrates the 'Brainard' uncertainty: decision makers need additional information and learning to be able to formulate a more accurate picture of the future trajectory of the economy and to determine the appropriate monetary policy.

A policy bias or code words regarding the nature of future interest rate changes may fulfil a similar function. This type of forward communication is also exercised by non-inflation targeting central banks as well. Similarly to the fan chart, the policy bias is generally preceded by enumeration and evaluation of the risk factors impacting inflation ('verbal fan chart'), as a result of which the direction of future interest rate changes is determined. In this communication framework, the policy gradualism is also motivated by learning and uncertainty, which highlights that the commitment to the bias is always contingent.

Some inflation targeting central banks only use the fan chart (e.g. the Bank of England), while others help interpret the fan chart by making direct references to the direction, or perhaps the pace, of expected interest rate changes. The central bank may help calibrate expected interest rate changes if the inflation forecast and/or the fan chart are based on the assumption that the prime rate will follow the trajectory set by forward market rates. In this case, the fan chart and/or the bias can be evaluated by comparing them to the interest rate changes that are expected by the market, which allows much more freedom in fine-tuning expectations.

The practice of inflation targeting banks that also publish an interest rate trajectory which is considered acceptable by the central bank (so-called endogenous interest rate

[6] See e.g. Smets and Wouters, 2003.

[7] The most widespread type of short-term tool is verbal intervention, used by several central banks, which attempts to orient money market expectations about future interest rate changes especially between interest decision sessions. In these cases, the purpose of communication is to help the markets evaluate the events that occur between sessions and the responses of the central bank to these events. In respect of verbal intervention see Pintér et al., 2006.

[8] This interpretation of the fan chart is possible only if the inflation forecast and the inflation report reflects the assessment of the Monetary Council.

trajectory) in respect of the time period for which a forecast is made (e.g. the central banks of New Zealand, Norway, Sweden and Iceland) represents a higher level of orienting interest rate expectations. These interest rate trajectories are generally 'smooth' and change monetary conditions in slow, gradual cycles. The Norwegian central bank has been most specific in what it regards as a 'good' interest trajectory.[9]

1. The interest rate should be set with a view to stabilising inflation close to the target over the medium term. The horizon will depend on the disturbances to which the economy is exposed and the effects on the prospects for the inflation path and the real economy.

2. The interest rate path should provide a reasonable balance between the path for inflation and the path for capacity utilisation.

3. Interest rate developments should result in acceptable developments in inflation and output also under alternative, albeit not unrealistic assumptions concerning the economic situation and the functioning of the economy.

4. Interest rate adjustments should normally be gradual and consistent with the Bank's previous response pattern.

5. As a cross-check for interest rate setting, it should be possible to explain any substantial and systematic deviations from simple monetary policy rules.

Criterion 4 clearly states the need to change the interest rate gradually. At the same time, based on Criterion 2, it is clear that the future developments in inflation and the output gap must also be taken into account when determining the interest rate trajectory, therefore the persistence of macro variables enhances the gradual changing of interest rates. Criterion 5 also enhances interest rate smoothing because the endogenous interest rate trajectory is also compared to the Taylor-type rules, which contain explicit interest rate smoothing.

Finally, we would like to note that sometimes central banks are also expected to ensure a low volatility of interest rates. For example, according to the definition by the New Zealand central bank, the objective of monetary policy is to ensure the stability of prices in general and to avoid unnecessary fluctuations in output, interest rates and the exchange rate.

Overall, on the basis of the forward communication of central banks, gradual interest rate changes are based primarily on the 'Brainard' uncertainty, i.e. continuous learning about economic processes, while at the same time the intention to moderate interest rate volatility sometimes appears to be genuinely beneficial. However, we do not have any information as to whether it is based on the 'Woodford' type persistent interest rate policy or considerations related to financial stability.

INTEREST RATE SMOOTHING IN HUNGARY

In this chapter, we examine the interest rate policy of the Magyar Nemzeti Bank in the period after inflation targeting was introduced. First, we wish to describe the past 6 years in respect of the gradualism in interest rate changes and the prevalence of smoothing the prime rate. We then examine the motivation behind keeping interest rate changes gradual on the basis of the central bank's forward looking communication.

The extent of interest rate changes made by the Hungarian central bank and the changes in interest rate cycles are greatly determined by the structural characteristics of the Hungarian economy:

1. Transitional economies experience more frequent and greater shocks than developed economies (Benczúr and Rátfai, 2005), while the mechanisms that facilitate smooth adjustment of the economy are weaker (large share of liquidity constrained households, weak automatic stabilisers in the budget).

2. The Hungarian economy has a long history of inflation, and due to the legacy of high inflation expectations, interest rate smoothing may have been constrained by weaker credibility of the central bank's disinflationary policy.

3. The MNB, similarly to central banks in other transitional economies, has faced high macroeconomic uncertainty. Due to the short span of the available data series and the structural changes in the economy, the uncertainty of models describing the economy is greater than usual.

4. The exchange rate plays an important role in monetary policy, because the most important real effect of monetary policy action comes through the exchange rate channel.

[9] These criteria are always listed in the Norwegian report on inflation as a framed message within the section that describes the Monetary Council's interest rate trajectory.

Table 2

Autocorrelation of the central bank's interest rates and the likelihood of cycle reversals in small inflation targeting economies (1999–September 2007)

	Autocorrelation of interest rates	Likelihood of cycle reversals
New Zealand	0.98	0.13
Chile	0.96	0.33
Israel	0.98	0.12
Hungary (2001–September 2007)	0.96	0.17

Sources: Central bank websites.

The first two criteria, the extent of shocks and the issue of credibility, point towards lower scale interest rate smoothing, while Criterion 3 supports interest rate smoothing on the basis of the Brainard logic. The importance of the exchange rate is not unequivocal for interest rate smoothing. On the one hand, for inflation processes, only permanent changes in the exchange rate count; and the central bank must only respond to permanent changes in the risk premium. Because – ex ante – it is very difficult to say how permanent exchange rate changes will be, the key role of the exchange rate may provide an incentive for a gradual monetary policy reaction. Smaller changes in the interest rate may also moderate exchange rate and interest rate speculation. This is because money market players with considerable market weight can build speculative positions if the central bank reacts to exchange rate fluctuations quickly and with considerable interest rate changes. On the other hand, however, we can also argue for a more aggressive response to the exchange rate. If on the basis of their past experience market players expect exchange rate changes to be lasting, this may enhance the pass-through of exchange rate changes to inflation. Consequently, the central bank will be able to moderate the tightness of exchange rate management only gradually as market players learn to live with exchange rate fluctuations. This is the assumption behind the fact that in small, open, inflation targeting countries a decrease in the exchange rate pass-through parameter has become an important indicator of the central bank's credibility.

Due to the specific aspects of the Hungarian economy, small, open and less developed countries provide a better basis for comparison than large, developed countries. We selected three countries that are leaders in the practice of inflation targeting and have extensive experience in this respect (New Zealand, Chile and Israel). According to Table 2, the autocorrelation of the interest rates in these countries are somewhat lower than in large, developed countries. In respect of the likelihood of cycle reversals, results are only partially comparable because we do not have available a time series of the same length as in the case of developed countries. Overall, in these countries cycle reversals are not more frequent.

Another indicator of the importance of interest rate smoothing is the average size of interest rate changes. Table 3 shows that in small inflation targeting countries, the average extent of interest rate change is somewhat larger than in more developed countries (Table 1). It should be underlined that the asymmetry in this case is the opposite. While the central banks of developed countries make faster and more resolute interest rate correction moves downward, small countries tend to do the same in an upward direction. A higher-than-average increase in interest rate may be explained by an outstanding interest rate hike or a series of hikes due to a sudden weakening in exchange rates or a crisis-like situation. However, in quiet periods the normal extent of

Table 3

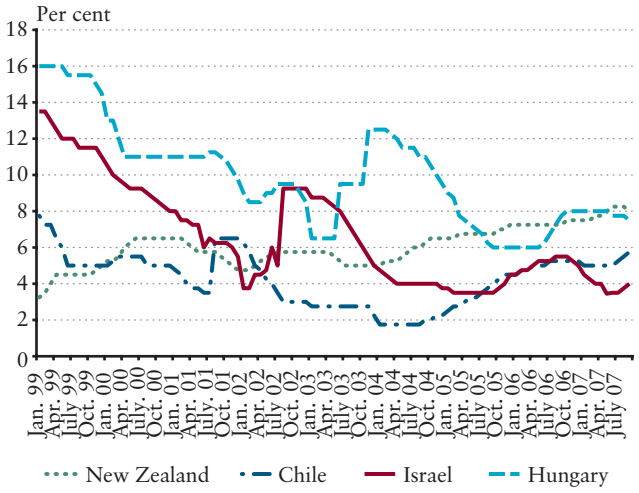
Extent of interest rate changes by the central banks of small inflation targeting economies (1999–September 2007)

	Average interest rate change	Interest rate hike		Interest rate cut	
		average	mode	average	mode
New Zealand	0.27	0.28	0.25	-0.25	-0.25
Chile	0.42	0.39	0.25	-0.44	-0.25
Israel	0.40	0.60	0.25	-0.35	-0.25
Hungary	0.56	0.90	0.50	-0.44	-0.50

Sources: Central bank websites.

Chart 2

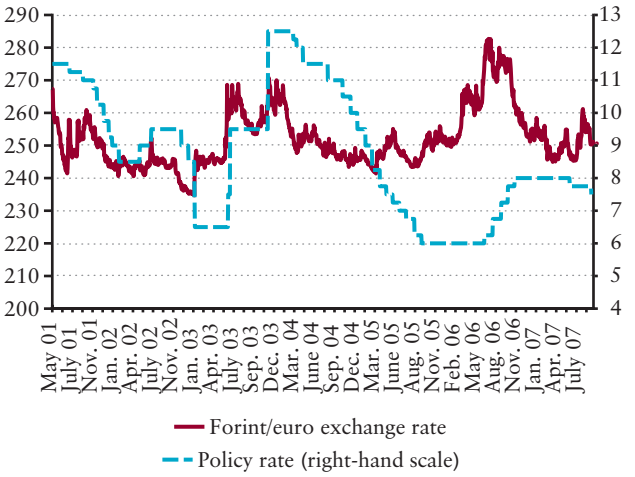
Changes in central bank prime rates in the small economies under review (1999-2007)



Sources: Central bank websites.

Chart 3

Changes in the central bank's prime rate and the exchange rate 2001-2007



Source: MNB.

interest rate change, similarly to developed countries, is 25 basis points[10] (see Chart 2).

During the past 6 years the persistence of the Hungarian prime rate has been rather similar to that of peer countries. The largest changes in the interest rate occurred in 2003 in response to a speculative attack against the exchange rate band and in relation to the exchange rate drops in the course of the year. This is in line with the experience of other small, open countries and the conclusions of the theoretical literature according to which the optimal response to a weakening of the central bank's credibility is a firm reaction by the central bank, and smoothing of interest rates is not an option (Söderstorm, 2000). At the same time, for the MNB the normal step was also larger. While in the other small countries the typical extent of the change was 25 basis points, in Hungary it was 50 basis points.

In the first years after inflation targeting was introduced, the lessening of exchange rate fluctuations played a key role in the interest rate policy of the MNB. Up until 2001-2003 the central bank attempted to orient short-term exchange rate expectations by announcing exchange rate comfort zones which were compatible with the attainment of the inflation target. Starting from 2004, the central bank no longer commented directly on changes in the exchange rate, but the effect of exchange rate changes that proved to be long-term were incorporated into inflation forecasts and therefore interest rate policy was indirectly impacted.[11]

An increase in the central bank's exchange rate tolerance created an opportunity for a more extensive smoothing of interest rates. This change is also apparent in yield and exchange rate volatility changes. The fluctuation of the exchange rate grew, the fluctuation of short-term yields fell

Table 4

Exchange rate and interest rate volatility*

	Exchange rate	3 months	6 months	1 year	3 year	5 year
2001–Sep. 2007	0.46	0.35	0.36	0.37	0.37	0.30
2001–2002	0.39	0.36	0.35	0.34	0.33	0.27
2004–Sep. 2007	0.47	0.24	0.26	0.30	0.31	0.27

** Average of 90 day volatilities.*

Source: MNB.

[10] The optimal extent of exchange rate changes is also affected by the frequency of interest rate decisions. International practice is not uniform in this respect. The European Central Bank has a rate-setting meeting every month, while the central banks of other developed countries typically meet less often (the Fed: 8 meetings, the Swedish central bank: 6 meetings). In less developed countries, the Monetary Councils meet more often; in Chile and Israel interest rate decision meetings are held on a monthly basis similarly to Hungary, in New Zealand, however, there are only 8 such meetings.

[11] In addition, when the exchange rate was close to the edge of the band, the announcements started to include statements related to the risk premium due to the direct management of the exchange rate.

considerably, but there was no significant change in the behaviour of the time series over longer horizons. This indicates that the reason for the changed tendency of interest rate changes is not only a change in the nature of the shocks, but stronger interest rate smoothing activity by the central bank as well.

In the period since inflation targeting was introduced there were two longer interest rate reduction periods which were followed by two shorter interest rate hike periods. Currently, the market is expecting interest rate cuts again. The reasons behind the gradual changes in the interest rate can be further explained by the central bank's forward communication. Over the past six years, most interest rate changes were preceded by an indication by the central bank, either in the form of a fan chart or a policy bias. However, there were periods when in the series of interest rate changes of a particular direction were motivated by a series of shocks of the same direction.

As to forward looking communication, the past six years can be broken down into two periods. The first one lasted until the end of 2003 during which time the MNB published its inflation forecast on a quarterly basis. The fan chart in the forecast reflected the risk perceptions of the Monetary Council, and in connection with the fan chart the Council also formulated a policy bias in respect of the direction of interest rate changes. In those decision-making sessions where there were no inflation report publications, the Council only provided an uninformative statement on the rate decision.

Between the middle of 2001 and the end of 2003, 10 inflation reports and related statements were published. On six of these occasions the direction of interest rate change indicated by the Council and the actual interest rate changes until the next report were of the same direction. In the rest of the cases the exchange rate change, which is not listed among the risks in the conditional forecast prepared by the MNB, altered the intended direction of monetary policy.

From 2004, the inflation report was issued as a staff report and the Monetary Council did not provide a regular policy bias related to the fan chart. At the same time, the announcements issued by the Monetary Council became more substantive, giving a detailed description of the Council's assessment of economic processes.

In this period, we can only compare the skewness of the fan chart and the interest rate changes which were made in the following quarter. During this period, the skewness of the fan chart and the direction of the interest rate change was in harmony for 9 out of the 15 inflation reports.[12] There must have been a series of surprises that caused such conflicting messages in 2005. During this period, international risk premiums fell considerably, and stronger competition in the product market and the persistently low level of core inflation may have contributed to the series of interest rate cuts.

On the other hand, in 2004 and starting from the end of 2006, there was a foreseeable discrepancy between the fan chart and the forthcoming interest rate changes. Both of these were related to the fact that the market harboured different expectations regarding the simultaneous change in interest rates and the exchange rate than was indicated in the assumptions of the inflation report with respect to the interest rate and exchange rate, which were fixed at the previous month's level.

In 2004, while preparing the inflation forecast, the staff did not take into account that entry into the EU will result in considerable disinflation due to increasingly strong competition; therefore it forecasted higher inflation than eventually occurred. At the same time, considerable strengthening of the forint resulted in a significant tightening in monetary conditions and therefore there was no need for additional interest rate hikes. Starting from 2004, the Monetary Council did not provide a policy bias, but reference was made to the expected interest rate trajectory in the form of 'code words.' The typical message of the period was a reference to the need for 'cautious' interest policy: the fragility of consolidation and the macroeconomic imbalance justified only a gradual decline in interest rates. In the first half of 2004, market players in fact priced in steeper interest rate cuts than actually happened, and the message of the central bank helped the market learn about the interest rate smoothing behaviour of the central bank.

At the end of 2006, the situation was similar to the beginning of 2004: while the inflation fan charts indicated an upside risk, the market planned for an interest rate cut. This was in line with the Council's opinion that, due to an improvement in macroeconomic equilibrium, the interest premium expected from investments in forint would gradually fall and consequently the monetary conditions of a disinflation trajectory may be ensured even if the prime rate is lower. The Council also indicated this to market players in the form of an interest rate policy bias. However, these assumptions – which were proven ex post – did not find their way into the

[12] We interpreted the fan chart as an indicator of interest rate hike/interest rate cut if compared to the target the fan chart was oblique, that is, the probability of a higher/lower inflation than the target was higher/lower.

fan chart, which was based on the technical assumption of a fixed interest rate and exchange rate. Nevertheless, the fan chart provided useful information for the market in respect of the expected interest rate change. The upside risk to the baseline scenario may have indicated to the market that the interest rate decline will be much slower than expected.

CONCLUSIONS

In summary, in the past six years the uncertainty related to the nature and course of the shocks and the impact of monetary decisions on the economy called for gradual interest rate changes by the MNB, and this is primarily what caused the interest rate cycles which were observed. In addition to continuous learning about economic processes, the projected interest rate trajectory was most often altered by changes in the exchange rate.

Despite the uncertainty and the unforeseeable shocks, inflation forecasts and the Monetary Council's interest rate indications helped form interest rate expectations. The fan chart indicated the risk factors which influenced the decisions of the Monetary Council, facilitating the learning process amongst market participants. At the same time, however, when there was a significant discrepancy between the exchange rate and the interest rate trajectory expected by the market on the one hand and the presupposed fixed interest rate and fixed exchange rate in the inflation report on the other hand, the information content of the fan chart's message regarding the interest rate was significantly reduced. In such cases, the Monetary Council's forward communication regarding expected developments in the exchange rate and the interest rate trajectory is of key importance.

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