Estimating the immediate impact of monetary policy shocks on the exchange rate and other asset prices in Hungary

András Rezessy

Magyar Nemzeti Bank

2005

Abstract

The paper applies the method of identification through heteroskedasticity as described by Rigobon and Sack (2004) to estimate the immediate impact of Hungarian monetary policy on the forint exchange rate vis-à-vis the euro, on spot and forward government bond yields and on the index of the Budapest Stock Exchange. The results obtained are in line with the intuition. There is evidence of a significant negative impact on the exchange rate in one day i.e. an increase in the policy rate leads to an appreciation of the domestic currency. The effect increases markedly when the estimation is carried out with a two-day window suggesting the inefficiency of markets in incorporating monetary policy decisions in asset prices in a short period of time. Monetary policy affects spot yields positively, but the effect gradually dies out as the horizon gets longer. This can be explained with the impact on forward yields, as the results suggest a positive impact on short-term and a negative impact on long-term forwards meaning that a surprise change in the policy rate leads to a rotation of the forward curve. The negative impact on long-term forwards is higher in two days, enough to make the impact on long-term spot yields slightly negative. However, the method does not provide interpretable results for the stock exchange index.

I. Introduction

Monetary policy exerts its influence on the economy through several channels, two major of which are the exchange rate and interest rates. In understanding the transmission mechanism of monetary policy, it is necessary first to get a picture how the central bank's decisions affect these rates.

Theory does not provide an unambiguous answer how monetary policy affects the exchange rate. The traditional view maintains that an increase in the domestic interest rate makes domestic debt more attractive to foreign investors and generates demand for the domestic currency. However, there can be several factors that might complicate this relationship, some of which can even lead to a 'perverse' opposite relationship. Blanchard (2004) and Stiglitz (1999) point out that – under certain circumstances depending among others on the level of indebtedness and share of foreign financing in a country – a large increase in the domestic interest rate might result in an increase of default risk thus reducing the attractiveness of domestic debt which can lead to a weakening of the currency. In addition, Garber and Spencer (1995) describe how the dynamic hedging activity in options markets can lead to a 'perverse' effect of monetary policy on the spot exchange rate.

This paper applies the method identification through heteroskedasticity as described by Rigobon and Sack (2004) to investigate how the interest rate decisions of the Central Bank of Hungary affected the exchange rate of the forint throughout the first three years following the widening of the exchange rate band in the middle of 2001. The paper also examines the impact of monetary policy on spot and forward government bond yields and on the stock exchange index.

The paper is structured as follows. Section 2 presents the theoretical considerations of identifying the impact of monetary policy and provides a brief description of the estimation method applied here. Section 3 presents the baseline results obtained with the heteroskedasticity-based method, compares those with the event study method and checks the robustness of the baseline results. Finally, Section 4 concludes.

II. Identifying the immediate impact of monetary policy shocks

Estimating the response of asset prices to monetary policy steps is complicated by the issue of endogeneity of the variables. The two variables are simultaneously determined, i.e. the central bank reacts to changes in asset prices while asset prices themselves are also influenced by monetary policy decisions. Another source of endogeneity is the presence of factors that affect both variables e.g. macroeconomic news, changes in the risk premia etc. In the presence of endogeneity, the standard ordinary least squares (OLS) estimation method gives biased estimates and this necessitates the use of other techniques.

One way to identify the response of asset prices to monetary policy commonly used in the literature is the event study method. The main idea here is to use institutional knowledge to consider only certain periods when changes in the asset price are dominated by news about monetary policy. In practice, this usually implies running an OLS regression on days of policy decisions of the central bank. This method was first used to estimate the impact of monetary policy on money market yields by Cook and Hahn (1989) in the case of US. An application of the event study method for Hungarian data is provided by Pintér and Wenhardt (2004) who find a significant impact of monetary policy shocks on forward yields up to a 3-year horizon.

Rigobon (2003) and Rigobon and Sack (2004), however, point out that the strict assumption of the event study method – i.e. that the only important source of innovations in a carefully selected subsample of all observations is news about monetary policy – may not be satisfied even in a short window of one day and the estimates obtained may be biased. They propose an alternative identification method which makes less stringent assumptions about the heteroskedasticity present in the data. Their heteroskedasticity-based estimation method can thus lead to consistent estimates even in cases when the event study method suffers from a bias.

Rigobon and Sack (2004) consider the following two-equation system to model the simultaneous relationship of monetary policy and the price of a given asset:

$$\Delta i_t = \beta \Delta s_t + \gamma z_t + \varepsilon_t \qquad (1)$$

$$\Delta s_t = \alpha \Delta i_t + z_t + \eta_t , \qquad (2)$$

where the first equation is a monetary policy reaction function and the second one is an asset price equation. Δi_t is the change in the short-term interest rate, Δs_t is the change in the price of the given asset and z_t is a vector of common shocks. ε_t is the monetary policy shock while η_t is a shock to the asset price. The parameter of interest here is α which measures the reaction of the asset price to changes in the policy variable.

It can be shown that running an OLS regression on (2) will yield an unbiased estimate only if the variance of the monetary policy shock σ_ε is infinitely large in the limit relative to the variance of the asset price shock σ_η and to the variance of the common shock σ_z. The event study method assumes that this holds if one considers only a certain subset of all observations, e.g. days of monetary policy decisions. Though in many cases this might be a plausible assumption, it may not always be the case.

On the other hand, the heteroskedasticity-based estimator considers two subsets of observations: policy dates – which can be defined as days of monetary policy decisions – and non-policy dates – which can be defined as preceding days – and assumes that the variance of the monetary policy shock increases from non-policy dates to policy dates, while there is no systematic change in the variances of the other shocks from one subset to the other. Thus the method does not assume that only monetary shocks matter on policy dates, but rather that the relative importance of monetary shocks with respect to the other shocks increases between the two subsets.

The event study method assumes that the OLS estimate is unbiased if one considers only days of policy decisions. However, in the presence of strong common shocks, for example, this assumption may not be satisfied. In contrast, the heteroskedasticity-based method does not assume unbiasedness on policy days; instead it estimates α from the change in the bias that occurs between the two subsamples.

Assuming the above-mentioned structure of heteroskedasticity and that the parameters α and β are stable across the two subsets, Rigobon and Sack (2004) show that the difference of the covariance matrices of Δs_t and Δi_t calculated for the two subsamples ($\Delta\Omega$) can be written as:

$$\Delta\Omega = \Omega^{P} - \Omega^{NP} = \lambda\begin{bmatrix} 1 & \alpha \\ \alpha & \alpha^{2} \end{bmatrix}, \qquad (3)$$

where:

$$\lambda = \frac{\sigma_{\varepsilon}^{P} - \sigma_{\varepsilon}^{NP}}{(1-\alpha\beta)^{2}}. \qquad (4)$$

Thus, $\Delta\Omega$ is a function of α and a parameter λ, which measures the shift in the monetary policy shock from non-policy dates to policy dates. From this, one can impose three restrictions on the change in the covariance matrix to obtain α.

The estimation can be implemented in two different ways: through an instrumental variables (IV) interpretation or with generalised method of moments (GMM). Though the IV approach is easier to implement, it considers only one of the three possible restrictions. Therefore this estimation method leads to multiple estimates. The GMM approach, on the other hand, takes into account all three restrictions at the same time and provides more efficient estimates. Another useful feature of this approach is that it is possible to test the assumptions of the model. Since there are three restrictions and only two parameters are estimated (α and λ), the system is overidentified and the standard test of overidentifying restrictions can be applied for this purpose.

This paper applies the heteroskedasticity-based method to estimate the immediate response of asset prices to monetary policy shocks. I also compare the results with those of the event study method to find out whether the latter ones contain any bias.

III. Results

III. 1. Data

The paper analyses the impact of monetary policy on the exchange rate of the forint vis-à-vis the euro, on spot government bond yields with maturities of 1, 5 and 10 years, on forward yields with the same maturities and on the index of the Budapest Stock Exchange (BUX). The spot yields are the benchmark yields published daily by the Government Debt Management Agency Ltd., while the forward yields are estimates made by the MNB using the yield-curve estimation method developed by Svensson (1994). The data are represented as first differences of daily observations, with the exchange rate and the stock index treated as logarithmic differences. Thus, what is measured here is the impact of monetary policy in one day[1].

Policy dates include days of rate-setting meetings of the Monetary Council of the Central Bank of Hungary, while non-policy dates are the preceding working days. Because of the variations in the timing of the variables, the data series are corrected in a way that the observations for policy dates contain the information from the central bank's decisions. The sample covers the period August, 2001 – November, 2004 and contains 160 observations. The sample includes the regular meetings of the Monetary Council, which took place every second week until July, 2004 and once every month since then, and also includes four irregular meetings.

As it is usual in the literature, monetary policy shocks are interpreted as unanticipated moves of the central bank, which take financial markets as a surprise.[2] This is captured by the change in the three-month yield, as it is assumed to change only as much as the central bank's move represents a surprise to the market. Approximating the surprise element of policy rate changes with three-month yields also has the advantage that they are less likely to be influenced by the uncertainty regarding the timing of the central bank's action. It is worth noting that with this approach, keeping the central bank's policy rate unchanged can also represent a surprise to the market which would then be reflected in a change in the short-term yield.

---

[1] The section examining the robustness of the results presents estimations with a two-day window. One could perform the estimation for longer windows measuring the effect of monetary policy on a longer horizon. However, there is a tradeoff here as in a longer estimation window it is less likely that the importance of policy shocks changes sufficiently for the model's assumptions to be satisfied.

The time-frame of the measured effect is not exactly one day, because different variables are recorded at different hours of the day and the timing of the publication of the central bank's interest rate decision varies in the sample. For instance, the exchange rate and the benchmark yields are collected around 15-30 after the publication of the central bank's decision in a large part of the sample, while forward yields are collected the following morning except in the case of irregular meetings of the Monetary Council.

[2] See Vonnák (2005) for a discussion on the importance of focussing on the surprise element of the central bank's actions in analysing the transmission mechanism of monetary policy.

Since the estimation method is based on the change in the variance/covariance structure of the data from one subsample to the other, it is worth analysing this structure. As can be seen in Table 1, the variance of the policy rate is more than twice as high on policy dates as on non-policy dates, which is in line with the assumption that the importance of monetary policy shocks is higher on policy dates.

Table 1: Variances of the variables and their covariances with the policy rate

	Variances		Covariances with policy rate (*10^{-3})	
	Non-policy	Policy	Non-policy	Policy
Policy rate	0.1408	0.3302	n.a.	n.a.
HUF/EUR	0.4693	0.6554	0.4	-0.1
1Y BM	0.2027	0.2733	0.3	0.8
5Y BM	0.1739	0.1589	0.2	0.4
10Y BM	0.1078	0.1072	0.1	0.2
1Y FW	0.1983	0.2851	0.2	0.6
5Y FW	0.1911	0.1613	0.0	-0.2
10Y FW	0.2782	0.2296	0.1	-0.3
BUX	1.0742	1.4127	-0.1	-0.7

The covariance structure of the exchange rate shows a positive co-movement with the policy rate on non-policy dates – suggesting that a rise in the short-term interest rate is associated with a depreciation of the forint – whereas the relationship is slightly negative on policy dates[3]. The positive relationship on non-policy dates can be the result of common shocks such as changes in the risk premia or macroeconomic news, which are likely to affect the exchange rate and the short-term interest rate in the same direction. On policy dates, however, when the importance of monetary shocks increases substantially while other shocks are still present, the co-movement becomes slightly negative, which may imply that monetary policy affects the exchange rate negatively. From this covariance structure, one would expect a negative coefficient for the estimate of α in the case of the exchange rate.

This change in the covariances is also visible on the scatter plots of the two variables for the two subsamples. The positive relationship is clearly visible on non-policy dates, while there is a much less discernible direction on policy dates.

Each observation plotted on the graphs can be interpreted as an intersection of the asset price curve and the monetary policy reaction function curve. These intersects are moving because shocks are continuously hitting both curves. If it is almost exclusively the monetary policy curve that is being hit by monetary shocks while the asset price curve is stable and there are no common shocks – that is the assumptions of the event study method are fulfilled – the intersects will be close to the asset price curve. However, the apparently strong role of common shocks in the case of the exchange rate suggests that this may not hold on policy dates and the slope coefficient α estimated with OLS for this subsample will be biased.

[3] A rise in the value of the exchange rate variable represents a depreciation of the forint against the euro.

Figure 1: Scatter plot of the exchange rate and the policy rate on non-policy dates

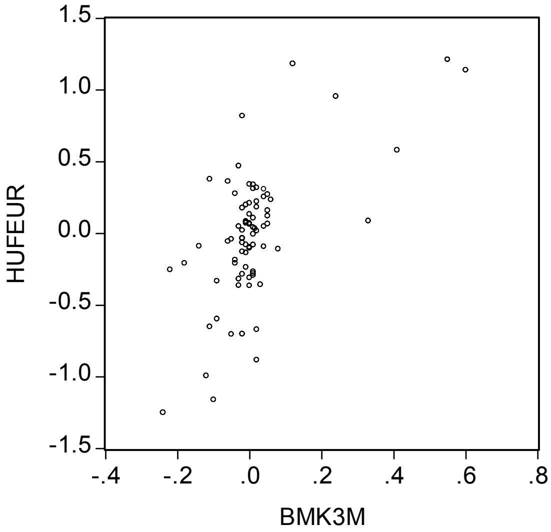
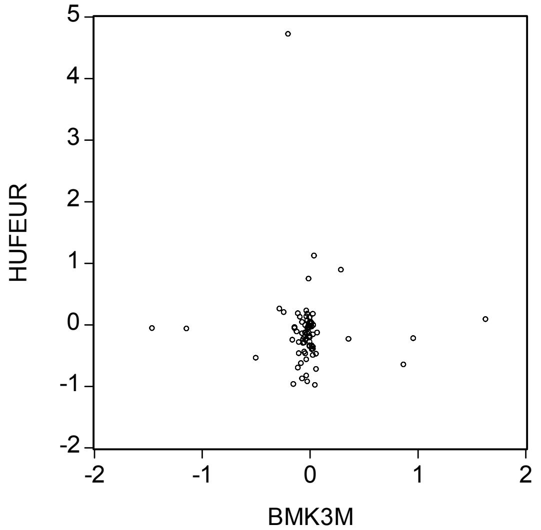


Figure 2: Scatter plot of the exchange rate and the policy rate on policy dates



On the other hand, given that there is a substantial increase in monetary policy shocks between the two subsamples, the cloud of the intersections of the two curves will be rotated towards the monetary policy curve from non-policy dates to policy dates. As mentioned earlier, the heteroskedasticity-based method estimates α from the change in the size of the bias, which in this context appears as the rotation of the cloud of realisations. Thus, the covariance structure of the exchange rate suggests that the heteroskedasticity-based method may provide a better estimate of α than the event study method in the case of the exchange rate and also that the difference between the two may be substantial.

The covariances of the benchmark yields with the policy rate show a positive co-movement on non-policy dates which increases on policy dates. This may suggest some role of certain common shocks which push the two variables in the same direction even on non-policy dates. It also suggests that, contrary to the case of the exchange rate, monetary policy might affect the 1-year benchmark yield positively. The covariances of the benchmark yields at longer horizons show a similar structure. Based on this covariance structure, one would expect a much smaller difference between the two estimation methods for the benchmark yields.

Figure 3: Scatter plot of the 1-year benchmark rate and the policy rate on non-policy dates

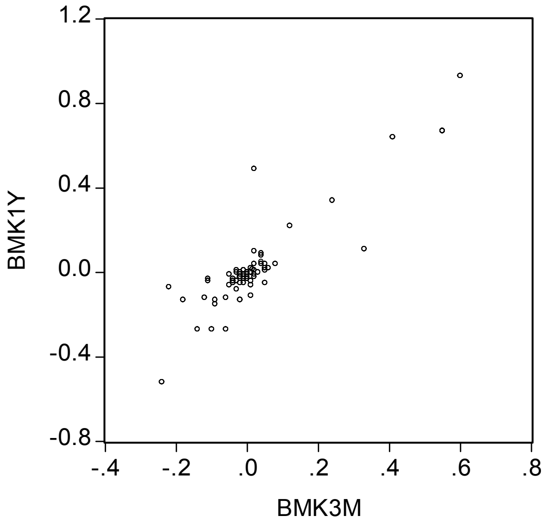
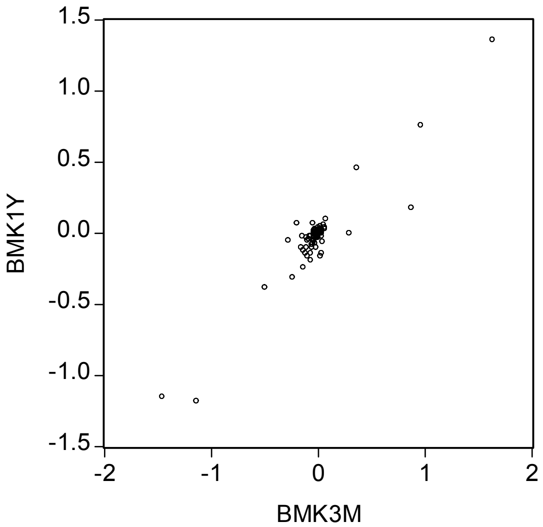


Figure 4: Scatter plot of the 1-year benchmark rate and the policy rate on policy dates



Regarding the forward yields, one can find a structure similar to that of the benchmark yields at the short horizon, while the covariance structure of the 5 and 10 year forward yields are more similar to that of the exchange rate. The BUX index shows a negative co-movement for both subsamples which increases substantially for the policy dates.

III. 2. Results of the heteroskedasticity-based method

The paper applies both ways of implementation of the heteroskedasticity-based estimation method: the IV and the GMM approach. The instrument for the IV estimation is based on the policy rate[4]. The IV estimation can be carried out with a standard single-equation two-stage least squares (TSLS) method. In this case, the asset price variable is regressed on the policy rate separately for each variable using the relevant instrument. Alternatively, the estimation can be carried out in a system including all the individual asset price equations using three-stage least squares (3SLS). The latter one is usually preferred as it is more efficient. However, the coefficients obtained with the two IV methods are almost identical and the improvement in efficiency is marginal, therefore only the 3SLS results are reported here. Since the efficiency gain from estimating in system is neglectable as compared to single equations in the case of the IV method, the GMM method is carried out only in single equations.

As can be seen in Table 2, the coefficients are significant with both methods except in the case of the BUX index. The coefficients obtained with IV and GMM are close for all variables except for the stock exchange index. This is important because the two estimations should yield asymptotically equal results provided that the assumptions of the model are satisfied. The overidentifying restrictions are in line with the fact that only the BUX shows strongly different coefficients with IV and GMM. The significant test statistic for the BUX index implies that the model's assumptions are not satisfied in this case, while the overidentifying restrictions cannot be rejected for any of the other variables.

Table 2: The results of the instrumental variables and generalised method of moments estimations

	IV		GMM		
	Coefficient	Std. Error	Coefficient	Std. Error	Overid. restr.
hufeur	-0.60*	0.28	-0.54*	0.21	1.93
bmk1y	0.66*	0.05	0.70*	0.05	3.05
bmk5y	0.21*	0.06	0.26*	0.04	1.75
bmk10y	0.10*	0.04	0.11*	0.03	0.07
fw1y	0.48*	0.09	0.55*	0.08	2.25
fw5y	-0.24*	0.08	-0.25*	0.08	2.92
fw10y	-0.50*	0.12	-0.39*	0.12	2.56
bux	-0.68	0.56	-20.10*	9.41	12.65*

* significant at 5% level

[4] More precisely, the instrument equals the policy rate with a positive sign on policy dates and with a negative sign on non-policy dates. The IV estimation can also be carried out with an instrument obtained with a similar transformation of the asset price variables. The coefficients thus obtained are not significantly different from the ones reported here (except for the ten-year forward yields), though they show much higher standard errors.

The heteroskedasticity-based method shows a negative coefficient for the exchange rate. It implies that a 50 basis-point surprise rate hike results in an immediate 0.27-0.30 percent appreciation of the forint. Thus, the results show no evidence of the presence of a 'perverse' effect of monetary policy on the exchange rate, the direction of the impact is in line with the classic intuition.

Considering benchmark yields, the results indicate that monetary policy has a positive impact on spot government bond yields. A 50 basis-point surprise increase of the central bank's policy rate leads to a 33-35 basis-point rise in the 1-year benchmark yield and this effect reduces to around 10 and 5 basis points for the 5 and 10-year yields respectively. This is in line with the intuition and implies that monetary policy can affect short-term yields – with a positive sign – but has a much more limited impact on long-term yields. The effect of monetary policy almost dies out at the ten-year horizon. The structure of the impact of monetary policy on forward yields helps explain this phenomenon.

The estimated impact of monetary policy on the 1-year forward yield is close to that on the 1-year benchmark yield; it is only slightly below the latter one. On the other hand, an unexpected 50 basis-point rate-hike results in a 12 basis-point fall in the 5-year, and a 20-25 basis-point fall in the 10-year forward yield. In other words, monetary policy affects the short end of the forward yield curve positively and has a negative impact on the longer end of the curve, which increases with maturity. Thus, the results suggest that an unanticipated change in the policy rate leads to a rotation of the forward curve.

According to the expectation hypothesis of the term structure, spot yields can be interpreted as averages of the forward yields calculated until the relevant maturities. Therefore the fact that monetary policy affects the short and on the long end of the forward curve in the opposite directions can explain why the impact of monetary policy dies out gradually on spot yields as the maturity increases.

It is interesting to investigate what can be the reasons behind the negative impact on forward yields. As these yields can be interpreted as the market's expectations for the future short-term interest rates, the results indicate that a surprise central bank rate-hike leads to an increase in the short-term horizon and a decrease in the long-term horizon of the expected path of interest rates. A possible explanation of this can be that a surprise increase in the policy rate may signal a reinforced commitment of the central bank to its mandate of achieving and maintaining price stability on the long-run with the help of higher interest rates temporarily in the short-run.

As mentioned earlier, the highly significant overidentifying test statistic for the BUX implies that the model's assumptions are not satisfied in this case and therefore these results are not interpretable. The reasons for this can be that the parameters α, β or the shocks to the BUX index or the common shocks show instability between the two subsamples.

III. 3. Comparison of the event study and the heteroskedasticity-based methods

Rigobon and Sack (2004) also construct a hypothesis test with which it is possible to test whether the results obtained with the event study method are biased. Table 3 compares the results of the GMM and event study methods and presents the biasedness tests[5].

Table 3: Comparison of the event study and the heteroskedasticity-based methods

	Event study		**GMM**		**Biasedness test**
	Coefficient	Std. Error	Coefficient	Std. Error	
hufeur	-0.09	0.22	-0.54*	0.21	-38.36*
bmk1y	0.78*	0.03	0.70*	0.05	4.98*
bmk5y	0.35*	0.04	0.26*	0.04	14.74*
bmk10y	0.19*	0.03	0.11*	0.03	54.85*
fw1y	0.53*	0.08	0.55*	0.08	0.25
fw5y	-0.19*	0.05	-0.25*	0.08	0.79
fw10y	-0.30*	0.08	-0.39*	0.12	0.79
bux	-0.65	0.48	-20.10*	9.41	4.28*

A quick comparison of the coefficient estimates reveals that the two methods give similar results for spot and forward yields. The event study approach produces significant coefficients for these variables just as the GMM, and the differences between the coefficients are usually at the second decimal. On the other hand, the event study method fails to give a significant coefficient for the exchange rate, as the parameter obtained is strongly below the GMM estimate in absolute value. This difference in the size of bias for the exchange rate and for interest rates can be explained with the different covariance structures as outlined in section III.1.

The GMM-based result shows that the unbiased coefficient is strongly negative for the exchange rate. However, there was indication of a strong presence of common shocks which presumably push the policy rate and the exchange rate in the same direction thereby reducing the negative impact of monetary policy even on policy dates. As the event study method ignores this issue, the result obtained with this approach is biased upwards and thus it gets close to zero. The biasedness test provides strong evidence that the event study approach gives a biased result in the case of the exchange rate.

In the case of the benchmark yields, the tests indicate that the event study results are biased, though they are quantitatively closer to the GMM coefficients than in the case of the exchange rate. The event study estimates exceed the GMM values for all the benchmark variables which can again be the result of common shocks ignored by the former method.

Finally, forward yields represent the only asset class, where the biasedness tests cannot reject the hypothesis that the event study method provides unbiased estimates. For long-term forward yields – as their coefficients are negative similarly to that of the exchange rate – the event study results are smaller in absolute value than the GMM results, but the size of the bias is small therefore the coefficients remain significant. It is worth noting that in this case, the event study approach is more efficient than the heteroskedasticity-based method.

[5] The biasedness tests comparing the event study and the IV estimates mainly lead to the same conclusions and therefore they are not reported.

III. 4. Robustness

There are several aspects from which the robustness of these results can be checked. The stability of the coefficients in time is assessed by performing the estimations on a smaller time-frame: from August, 2001 until December 2002. The reason why this subperiod is especially interesting is that it excludes the year 2003, in which Hungarian financial markets experienced several episodes of extreme turbulence. The results for the spot and forward yields obtained for this period are very similar to the baseline estimation, however there is a slightly positive but insignificant coefficient for the exchange rate. This could imply that only the large changes in the policy rate – which were associated with the turbulent episodes of 2003 – have had a significant impact on the exchange rate. However, caution is necessary when interpreting these results as the methods applied are asymptotic estimations and therefore require large samples. The fact that the sample is much smaller may explain some of the differences as compared to the baseline estimation.

Table 4: Results for the period August, 2001- December, 2002

	3SLS		GMM		
	Coefficient	Std. Error	Coefficient	Std. Error	Overid. restr.
hufeur	0.32	0.34	0.10	0.11	5.29*
bmk1y	0.94*	0.06	1.03*	0.02	6.63*
bmk5y	0.34*	0.05	0.33*	0.03	3.76
bmk10y	0.17*	0.04	0.16*	0.02	1.33
fw1y	0.77*	0.11	0.83*	0.06	6.49*
fw5y	0.02	0.09	0.04	0.04	4.49*
fw10y	-0.14	0.20	-0.13	0.07	1.20

To investigate the importance of large moves in the policy rate, the estimation is also implemented on the entire sample with the exclusion of these observations[6]. The coefficients for the benchmark and forward yields are similar to the baseline estimation, however the assumptions of the model are not satisfied in many cases. The reason for this is that the exclusion of the largest monetary policy steps renders the rise in the variance of policy shocks insufficient to reach identification which is evidenced by the insignificant λ coefficients[7]. On the other hand, the model's assumptions are satisfied for the exchange rate and both heteroskedasticity-based methods give a negative coefficient larger than the baseline results. While the coefficient obtained with 3SLS is insignificant, the GMM result is weakly significant providing weak evidence that small monetary policy steps can also have an impact on the exchange rate, which in fact may be greater than the impact of large steps.

[6] The excluded observations are days on which the central bank changed the base rate by at least 100 basispoints.

[7] In contrast, the λ coefficients in the baseline estimation are significant for all the variables (except for the BUX index) in line with the intuition.

Table 5: Results for the entire sample excluding large changes in the policy rate

	3SLS		**GMM**		
	Coefficient	Std. Error	Coefficient	Std. Error	Overid. restr.
hufeur	-0.81	0.94	-1.01	0.59	0.62
bmk1y	0.42	0.24	0.77	0.09	4.66*
bmk5y	-0.24	0.34	0.37	0.05	8.09*
bmk10y	-0.06	0.20	0.10	0.07	2.10
fw1y	0.03	0.41	-0.58	0.79	0.11
fw5y	0.23	0.32	-0.20	0.21	11.12*
fw10y	-1.03	0.58	0.03	0.20	4.97*

Finally, I also check whether the results change when the estimation is carried out with a two-day data window. The results for short-run yields – both spot and forward – are not substantially different, though they are slightly lower. However, the negative impact of monetary policy on long-term forward yields is considerably higher in two days than in one day which is enough to make the impact even on spot long-term yields slightly negative.

Table 6: Results obtained with a two-day data window

	3SLS		**GMM**		
	Coefficient	Std. Error	Coefficient	Std. Error	Overid. restr.
hufeur	-2.51*	0.58	-2.08*	0.29	0.85
bmk1y	0.53*	0.10	0.50*	0.08	0.13
bmk5y	-0.18	0.12	-0.01	0.05	2.86
bmk10y	-0.22*	0.09	-0.12*	0.03	2.23
fw1y	0.41*	0.15	0.33*	0.08	0.06
fw5y	-0.47*	0.12	-0.36*	0.05	6.78*
fw10y	-0.71*	0.18	-0.64*	0.15	1.76

There is also a marked difference for the exchange rate, as the coefficients obtained for two days are around four times higher. This large difference can be interpreted as a failure of the model to provide stable coefficients. Another and perhaps more realistic explanation can be the inefficiency of financial markets as it takes time for market participants to fully adjust to monetary policy shocks.[8] The very low overidentifying test statistics for the exchange rate and short-term yields also support the validity of these estimations.

[8] It is important to note, however, that the data for the exchange rate and benchmark yields are collected some 15-30 minutes after the publication of the central bank's decision in a large part of the sample. Thus, what the results show is that markets fail to incorporate fully the innovation from the central bank's decision in the exchange rate in such a short time-frame.

IV. Conclusion

The paper estimates the immediate impact of Hungarian monetary policy on the forint exchange rate vis-à-vis the euro, on spot and forward government bond yields and on the index of the Budapest Stock Exchange. The endogeneity problem – which stems from the simultaneous relationship of monetary policy and asset prices and from the presence of common shocks – is treated with the method of identification through heteroskedasticity as described by Rigobon and Sack (2004).

Being a small and open economy, the exchange rate plays an important role in the monetary transmission mechanism in Hungary and as a result the central bank needs to know how its decisions affect the exchange rate. Theory does not give an unambiguous answer about the direction of this effect. While the traditional view supports a negative impact of monetary policy, several authors emphasise the possibility of a 'perverse' opposite effect. The results obtained with the heteroskedasticity-based method support the validity of the traditional view for Hungary for the period 2001-2004. There is evidence of a significant negative impact on the exchange rate in one day suggesting that a 50 basis-point surprise increase in the policy rate causes 0.3 percent appreciation. This negative effect increases by around four times when the estimation is carried out with a two-day window suggesting the inefficiency of markets in incorporating monetary policy decisions in asset prices in a short period of time.

The results provide evidence that monetary policy affects spot yields positively, but this effect gradually dies out as the horizon gets longer. This can be explained with the impact on forward yields, as the results suggest a positive impact on short-term and a negative impact on long-term forwards implying that a surprise change in the policy rate leads to a rotation of the forward curve. The negative impact on long-term forwards is higher in two days, enough to make the impact on long-term spot yields slightly negative. However, the method does not provide interpretable results for the stock exchange index.

The paper also shows that the event study method – often used in the literature to estimate the impact of monetary policy – does not provide a valid result in the case of the exchange rate. This can be explained with the strong positive correlation – possibly the result of common shocks – visible on non-policy dates. Ignoring that this can influence the co-movement of the variables also on policy dates, the event study method overestimates the effect and gives a coefficient close to zero. The biasedness of the event study method is less of a problem for spot yields, and there is no evidence that this method would be biased in the case of the forward yields.

To assess the stability of the results, the estimation is also carried out in a shorter period running until the end of 2002 excluding the year 2003 which saw many periods of extreme turbulence often associated with large changes in the policy rate. The coefficients for the yields are similar to the baseline results, while the coefficient for the exchange rate is not significant and positive. However, the shortness of the sample is a problem here as the asymptotic method used requires large samples. The importance of the large monetary policy steps is investigated in an alternative estimation on the entire sample excluding the large changes in the policy rate. This provides weak evidence that small monetary policy steps can also influence the exchange rate negatively.

References

Blanchard, O. (2004), "Fiscal Dominance and Inflation Targeting: Lessons from Brazil", *NBER Working Paper*, No. 10389.

Cook, T. and Hahn, T. (1989), "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s", *Journal of Monetary Economics*, Volume 24, Pages 331-351.

Garber, P. M. and Spencer, M. G. (1995), "Foreign Exchange Hedging and the Interest Rate Defence", *IMF Staff Papers*, Volume 42, No. 3, Pages 490-516.

Hamilton, J. D. (1994), *Time Series Analysis*, Princeton University Press, Princeton.

Pintér, K. and Wenhardt, T. (2004), "A jegybanki kamatdöntések előrejelezhetősége és hatása a hozamokra" (The Predictability of the Central Bank's Interest Rate Decisions and their Impact on Yields), *MNB Working Paper*, No. 2004/31, (available only in Hungarian).

Rigobon, R. (2003), "Identification through Heteroskedasticity", *Review of Economics and Statistics*, Volume 85, No. 4., Pages 777-792.

Rigobon, R. and Sack, B. (2004), "The Impact of Monetary Policy on Asset Prices", *Journal of Monetary Economics*, Volume 51, Issue 8, Pages 1553-1575.

Svensson, L. E. O. (1994), "Estimating and interpreting forward interest rates: Sweden 1992-94", *IMF Working Paper*, No. 114, September.

Stiglitz, J. E. (1999), "Interest Rates, Risk, and Imperfect Markets: Puzzles and Policies", *Oxford Review of Economic Policy*, Volume 15, Issue 2, Pages 59-76.

Vonnák, B. (2005), "Estimating the Effect of Hungarian Monetary Policy within a Structural VAR Framework", *MNB Working Paper*, No. 2005/1.