NORBERT KISS M.

THE EFFECTS OF MACROECONOMIC NEWS ON MONEY MARKETS

The views expressed are those of the authors and
do not necessarily reflect those of the Magyar Nemzeti Bank.

Written by Norbert Kiss M.

CONTENTS

1. SUMMARY

This paper examines the effects of the announcement of different macroeconomic data on the forint/euro exchange rate and government securities yields. It focuses on establishing whether there is a significant correlation between the size or direction of exchange rate and yield movements and the announcement of macroeconomic data and their news value. The study is based on an analysis of the statistical characteristics of movements following the announcement of data as well as on regression calculations and hypothesis tests.

The absolute magnitude of data published has only a slight effect on money markets, whereas the deviation of data from expectations and the surprise element of the information they carry have a significant impact. The reason for this is that expectations relating to new data and the information they provide are constantly being built into market prices and exchange rates. Thus, when the next announcement is made the exchange rate and yields are primarily moved by the surprise components of the data and the extent of surprise they cause. The main direction of the exchange rate and yield movements is determined by expectations on the general state of the economy, and is affected by publication of specific data only temporarily and to a small extent. A permanent shift usually only takes place when several pieces of data reinforce one another and often only following analysis and evaluation of such data, resulting in a time gap after announcement of the actual data. As a result in most cases, correlation between the announcement of macroeconomic data and market yields and the exchange rate can only be observed for a short period of time, as the effect of the announcement is priced out and the exchange rate and yields return to a level justified by the combined effect of other factors defining the economic environment.

The forint/euro exchange rate reacts more sensitively than the average to new information related to the consumer price index, GDP growth and the current account balance. Exchange rate movements were explained by the unexpected component of new data in a significant number of cases. Similarly, a close statistical correlation can be found between the news value of the above three types of data and yield movements. The announcement of new data has an especially significant effect on long-term yields. Publication of other types of data, however, shows no significant correlation with exchange rate and yield movements.

2. INTRODUCTION

In their investment decisions, foreign strategic investors attach special importance to macroeconomic developments and the state of the economy. Improving or worsening fundamentals can significantly influence whether investors' confidence in a country's currency, government securities and other investment opportunities strengthens or weakens. Essentially, this confidence determines the price at which investors are willing to invest in a country, which is then reflected in the value of the domestic currency, government securities yields, etc.

Based on the above, we can assume that if investors pay close attention to data on the state of the economy, they may re-evaluate their earlier opinion as a result of new information or rearrange their portfolios, causing changes in money markets as well.

The aim of this analysis is to examine how the announcement of various macroeconomic data have affected the forint/euro exchange rate and government securities yields in the period since band widening on 4 May 2001, and to determine whether or not there is a significant correlation between the extent and direction of movements in the exchange rate and yields and the announcement of certain data types.

The study is composed of two main parts: the first part examines the effect of announcements on the exchange rate, while the second part looks at the effect on yields. The structure of the two parts is similar: each begins with a description of the data under review, followed by a comparison of announcement and non-announcement days. The effect of the announcement of different types of data is then examined one by one. In the case of the exchange rate, both intra-day and daily changes are taken into account. In the case of yields, however, the lack of intra-day data allowed only a restricted analysis. The following part provides an analysis of how the difference between expectations and actual data are related in the case of data where analysts' expectations are known. The final section presents a sensitivity analysis based on past experience using certain refinements (e.g. applying intra-day data and eliminating outliers).

3. THE EFFECTS OF MACROECONOMIC NEWS ON THE EXCHANGE RATE

3.1 DATABASE

This paper examines the effects of macroeconomic news on the forint/euro exchange rate following band widening. The database under review contains data for the period from 4 May 2001 to 28 November 2003, including the official daily forint/euro exchange rates during this period (fixing at 11 a.m.), intra-day two-minute exchange rate data for a part of the period and certain characteristics of the announcements examined.

3.1.1 Forint/euro exchange rate

In order to analyse daily exchange rate movements, the official foreign exchange rate of the MNB was used, which is set every day at 11 a.m. As far as intra-day exchange rate data are concerned, two types of two-minute data published by Reuters were used. Base values of an informational nature supplied by Reuters information service were available from 24 July 2001, while actual trading offers from Reuters D2000 trading system were used from 7 November 2001. The latter type of information has more advantages and consequently, where available Reuters D2000 data were used and the aforementioned 'informative' base exchange rates were only used when these data were unavailable. In the case of intra-day data, the average of bid and ask exchange rates was used for the purpose of our analysis. As such data were only available for a certain part of the period under review, intra-day exchange rate movements could not be studied after every announcement.

3.1.2 Announcements

At first, it appeared that the impact of announcements of the following macroeconomic data were worth studying: the consumer price index, the industrial producer price index, GDP growth, the current account balance, industrial output growth, employment and unemployment and the public sector deficit. Most of these data are published monthly, with the exception of GDP growth, which is released quarterly. There are also differences in the time of day when these data are published (see Table 1). In the case of certain variables, preliminary and final data are also published (e.g. gross domestic product, industrial output growth and the current account balance). Here, the announcement of preliminary data was considered more important as it undoubtedly had more information value.

In addition to the above mentioned macroeconomic data, the effects of the publication of the Quarterly Report on Inflation published by the MNB and the Reuters poll also seemed worthy of examination. When discussing Reuters polls, regular monthly surveys (generally published in the middle or at the end of a given month, between the 15th and the 25th) were to a certain extent separated from one-off polls relating to a specific event (e.g. band widening, policy rate decisions) often offering forecasts on only one or a few variables instead of all the usual parameters.

In cases where sufficient data are available based on Reuters polls, the news value of a certain announcement can be defined as the difference between the average of expectations in a Reuters poll for a certain period and the actual values. Accordingly, in the case of the consumer price index, GDP growth, the current account balance, industrial output growth and the public sector deficit, the impact of the difference between the forecast and actual values on the exchange rate was also analysed (since GDP data are published quarterly and Reuters polls contain monthly GDP expectations, publication of expectations immediately preceding the quarterly figure was considered relevant).

Table 1

Characteristics of the data under review

Announcement	Number of announced data in the period	Frequency of announcement	Release Time	Published by
Consumer price index	31	Monthly	9:00	CSO
Industrial producer price index	30	Monthly	9:00	CSO
GDP	10	Quarterly	9:00	CSO
Current account balance	30	Monthly	8:30	MNB
Industrial output	31	Monthly	9:00	CSO
Unemployment rate	31	Monthly	9:00	CSO
Public sector deficit	31	Monthly	Varied	Min. of Finance
Report on Inflation	10	Quarterly	14:00	MNB
Reuters regular poll	31	Monthly	Varied	Reuters
Reuters one-off poll	15	Varied	Varied	Reuters

3.1.3 Exchange rate movements

Exchange rate movements were calculated on the basis of the following formula:[1]

$$\Delta s_t = -100 \times (\ln s_t - \ln s_{t-1})$$

In the case of daily exchange rate movements, since the official daily official exchange rate of the MNB set at 11 a.m. is considered as a starting point, exchange rate movements following announcements should naturally be examined from the point of view of when

---

[1] Multiplication with a minus sign was used for the sake of simplicity as this way movements acquire positive values in the case of strengthening and negative ones in the case of weakening.

the announcement takes place on a given day with regard to the 11 a.m. fixing. In the case of announcements preceding fixing, exchange rate movements between the given day and the preceding day were studied, while in the case of publications following 11 a.m. (Quarterly Report on Inflation, Reuters poll) the effect of data can only be felt in the exchange rate on the following day. In this respect, the change between the given day and the following day is important.

As far as intra-day exchange rate data are concerned, movements in the few hours following the announcement are most notable. Accordingly, our study focuses mainly on this period.

3.2 COMPARISON OF ANNOUNCEMENT AND NON-ANNOUNCEMENT DAYS

When analysing the effects of announcements on the exchange rate, in order to compare announcement and non-announcement days, it is worthwhile to examine exchange rate movements on days without events of significant importance to the exchange rate. Non-announcement days are days when none of the aforementioned data were published, no policy rate change was made and no measures were taken by the MNB. Accordingly, the day of band widening and band shifting, for example, was also excluded from these data. The fact that the Monetary Council (MC) left interest rates unchanged was also considered a policy rate decision: days when the MC held a meeting were treated as announcement days, as meetings of the MC itself were considered a kind of piece of news (please note that examination of the effect of policy rate moves is not a subject of this study and, as a result, the effects of MC meetings are not analysed here in detail). Thus, a group was set up for days when no 'shocks' affected the exchange rate, and it was only influenced by natural market developments. If we assume that announcements (and central bank measures) have an impact on exchange rate movements, it could be expected that the two groups exhibit differing statistical characteristics (see Table 2 and Chart 1).

There are certain dangers not to be overlooked when evaluating the data received. As far as classification is concerned, there is undoubtedly no clear line according to which the two groups can be separated. From a certain point of view, it was arbitrarily decided what macro data announcements were to be included in our study. If the announcement time of more, fewer or different data was observed, the group of non-announcement days would also look different, naturally affecting the statistical characteristics of the group. In order to avoid this, those types of macro data were selected that were assumed worthwhile for the purpose of our analysis both on an intuitive basis and in light of the relevant literature.

Another possible source of error is that, for example, a monetary policy measure is treated as a factor having an automatic effect on the exchange rate, although there are events where it is not clear whether they should be included in the category of 'natural market developments' or reclassified into the group of extraordinary events. (An example for this could be the Argentinean-Turkish crisis in July 2001, which most certainly had an effect on the forint exchange rate as well.)

Table 2

Statistical characteristics of exchange rate movements

	All days	Non-announcement days	Announcement days
Number of observations	642	379	263
Average* (%)	0.0013	−0.0092	0.0165
Average absolute movements (%)	0.3377	0.3212	0.3614
Median (%)	0.0237	0.0080	0.0509
Standard deviation (%)	0.554	0.504	0.619
Standard deviation of absolute movement (%)	0.439	0.388	0.502
Standard error (%)	0.0218	0.0259	0.0382
Kurtosis	15.01	7.35	19.08
Skewness	−1.79	−1.05	−2.34
Range (%)	7.04	4.95	7.04
Minimum (%)	−4.64	−2.91	−4.64
Maximum (%)	2.40	2.04	2.40

* Negative values indicate depreciation, while positive ones indicate appreciation.

There are only a few small differences in the statistical characteristics of the distribution curve (see Table 2 and Chart 1). The average shows the highest deviation from zero on announcement days, and the standard deviation is also the lowest in this case, but the dif-

Chart 1

Distribution of exchange rate movements*[2]
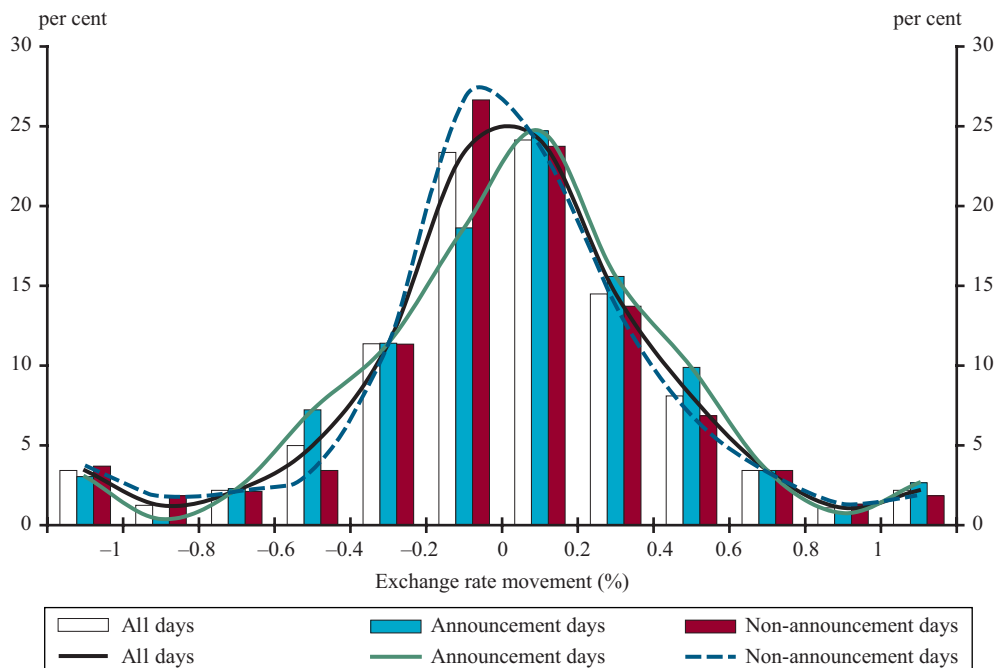
* Negative values indicate depreciation, while positive ones indicate appreciation.

[2] The x-axis indicates maximum threshold values.

ference is not significant. The same applies to absolute movements: the average and the standard deviation are the highest on these days, but the difference is not significant. Each distribution is slightly skewed and shows a right-hand side asymmetry, most markedly appearing on announcement days. Non-announcement days have the highest kurtosis: the number of cases around the central tendencies (that is, exchange rate movements close to zero) is highest in this case. The distribution of announcement days is wider and flatter: here there are more cases deviating from the average. In both groups, the number of outliers is relatively high, which is a typical phenomenon in the case of the distribution of such data.

Despite low deviations, the distributions can practically be considered identical: there are no significant differences as far as the main characteristics (expected value, standard deviation) are concerned.

3.3 EFFECTS OF THE ANNOUNCEMENT OF CERTAIN DATA

As the group of announcement days is not overly homogenous, significantly more information can be gained than in the previous comparison if exchange rate movements following the announcement of certain data are examined on a case-by-case basis. When comparing the characteristics of exchange rate movements following a given announce-

Table 3

Main characteristics of exchange rate movements following announcements

(data in percentages)*

Announcement	Average movement	Standard deviation	Average absolute movement	Standard deviation of absolute movement	Largest strengthening	Largest weakening
Consumer price index	0.1474	0.6854	0.4029	0.5738	2.4018	–2.3341
Industrial producer price index	–0.0778	0.3745	0.3060	0.2294	0.4914	–1.1489
GDP	0.0713	0.4378	0.2943	0.3180	1.1522	–0.2491
Current account balance	0.0936	0.3640	0.3274	0.1846	0.5973	–0.6010
Industrial output	0.1047	0.5873	0.3731	0.4655	2.3507	–1.3215
Unemployment rate	–0.1505	0.4813	0.3285	0.3836	0.4309	–2.1111
Public sector deficit	0.009	0.4924	0.3414	0.3608	1.0914	–1.5510
Report on Inflation	0.1063	0.3807	0.3153	0.2167	0.6511	–0.4942
Reuters poll	0.0515	0.4504	0.3108	0.3300	2.0830	–0.7775
Regular	0.0326	0.3308	0.2663	0.1989	0.6220	–0.7775
One-off	0.0893	0.6443	0.3997	0.5026	2.0830	–0.5368
Monetary Council meeting	0.0727	0.9148	0.4648	0.7912	2.4018	–4.6408
Policy rate change	0.0078	1.1827	0.7161	0.9425	2.4018	–3.7754
Non-announcement day	–0.0092	0.5033	0.3212	0.3875	2.0369	–2.9132

* Negative values indicate depreciation, while positive ones indicate appreciation.

ment (see Table 3) to movements occurring on the days when no announcement was made, the most marked difference is shown in the case of MC meetings and actual policy rate changes. In addition to this, the characteristics of the consumer price index, the one-off Reuters polls and industrial output are most notable.

Appendix 1 describes the effect of publication of certain data by announcements. Changes in the daily official exchange rate, as well as average absolute movements based on two-minute data a few hours around the time of the announcement are shown.

3.3.1 Consumer price index

The consumer price index is one of the most important and best known indices, to which analysts usually attach special importance, as changes in inflation primarily determine the direction of monetary policy in a monetary regime using inflation targeting. The average exchange rate movement was highest when the consumer price index was announced; and the standard deviation of exchange rate movements was also highest in this period. The same applies to average absolute movements and standard deviation. Following announcement of the consumer price index, the size of the exchange rate movement fell most frequently (4 times out of 31) beyond the 95% confidence interval of the exchange rate movement on non-announcement days (see Appendix, Chart 28).

The correlation between the announcement and the exchange rate can be shown more clearly with the help of two-minute intra-day exchange rate data. On days when the consumer price index was published, an exceptionally greater average exchange rate movement was observed near the time of the announcement than at other times during the day (see Appendix, Chart 29). The greatest average exchange rate movement was experienced in the minutes directly following the announcement, while one-quarter of an hour before and after the announcement the exchange rate changed on average to a greater extent than in the period thereafter. We determined, therefore, that the consumer price index had an impact on the exchange rate.

3.3.2 Industrial producer price index

The industrial producer price index is of lesser significance than the consumer price index, and its announcement is surrounded by more modest expectations. The value of exchange rate movements following announcements of the industrial producer price index is relatively narrow, in a range of +/–0.5 per cent, there are no outliers (one figure falls outside of the 95% confidence interval) and the standard deviation is one of the lowest (see Appendix, Chart 30). The average absolute movements are of middle value, while their standard deviation is low.

Intra-day data seem to reinforce the above: there are no correlations suggesting that announcement of the industrial producer price index had a significant effect on the exchange rate. Movements around the time of announcement are not larger than at other times and there are only a few moments in time when the average exchange rate movements are somewhat larger, but these are not related to announcements (see Appendix, Chart 31).

3.3.3 GDP growth rate

From the point of view of economic developments, the GDP growth rate is of special significance as it provides important information regarding the state of the economy.[3] It is interesting to note that in most cases we can observe minimal movements in daily figures: it seems that the exchange rate hardly reacted to the announcements (see Appendix, Chart 32) and, except for in one case, exchange rate movements did not exceed half per cent. Nor are the average movements and standard deviation outstanding. Daily movements show that announcement of GDP figures does not have a considerable impact on the exchange rate.

In contrast with this, intra-day two-minute exchange rate movements suggest that the announcement of this data does have an effect on the exchange rate (see Appendix, Chart 33). We see the largest average movements shortly after announcement, and there are significant movements even during a broader time interval following the announcement (for approximately one-half an hours afterwards). We can say, therefore, that there is a correlation between the announcement of GDP and exchange rate movements.

3.3.4 Current account balance

Average exchange rate movements do not deviate significantly from zero following announcements of the current account balance. The standard deviation of the values is relatively low, and there are no outliers: there was not one movement falling outside the 95% confidence interval (see Appendix, Chart 34). Average absolute movements are practically identical with the average of non-announcement days, and their standard deviation is the lowest.

On the basis of two-minute figures, the largest movements took place directly following the announcements on these days (see Appendix, Chart 35).[4] In addition, even 30 minutes following the announcement (that is around 9 a.m.) there is a 'peak' that could be explained by the fact that although deals are made earlier, trading really begins around 9 a.m., although this is only an assumption.[5] Thus, the results obtained based on intra-day data show that the current account balance figures can have an impact on the exchange rate.

3.3.5 Industrial output

Exchange rate movements show a relatively high standard deviation on days following the announcement of industrial output figures. The average movement is 0.1 per cent, a value taking a middle position among the news in terms of the size of its impact. We can find

---

[3] As far as the publication of GDP figures is concerned, due to the brevity of the time interval under review and to the quarterly frequency of the publication, we have a rather small number of figures at our disposal (altogether ten) on the basis of which no far-reaching conclusions can be drawn.

[4] As current account balance figures are announced at 8.30 a.m. and the intra-day exchange rates figures are also available from this point in time, we cannot examine the movements preceding the announcement in this case.

[5] Our assumption is confirmed by the fact that when this figure is published at 8.30 a.m., it is only 7.30 a.m. in London and thus it comes out before their opening time. This leads us to suggest that it would be more reasonable to set the time of the publication at 9 a.m. instead.

significant movements both in the positive and in the negative direction (see Appendix, Chart 36). The indices of absolute movements also belong in the category of high values.

As regards intra-day movements, we can see that there are somewhat larger movements around the announcements than at other times in this case as well. The difference between these and earlier movements (e.g. when the consumer price index was announced) is that the gap is much smaller and the effect is 'drawn out' for about half an hour following the announcement (see Appendix, Chart 37). Although in our view the effect of the announcement is indeed reflected in the exchange rate, it is not too strong on the whole.

3.3.6 Employment and unemployment

Both daily and intra-day figures suggest that publication of employment data does not move the exchange rate to a great extent – it has practically no impact. Although the average movement is large, the characteristics of absolute movements are only average. The standard deviation of daily movements is not too high, and there are no movements falling outside the confidence interval (see Appendix, Chart 38). Exchange rate movements are relatively even in the period following the announcement, there are a few outliers, but these clearly have no correlation with the announcement (see Appendix, Chart 39). Based on the above, we do not think it probable that this type of data has a close connection to the exchange rate.

3.3.7 Public sector deficit

The average of exchange rate movements following publication of the public sector deficit is minimal, but this is mainly due to the fact that larger movements balance each other out. This is also shown by the higher-than-average value of the standard deviation and the description of movements of certain days (see Appendix, Chart 43). Movements falling outside the 95% confidence interval were found in three cases, but apart from this, the value of the movements mostly remained within a narrow range. The indices of absolute movements also belong to the middle of the range.

Publication of public sector deficit figures does not occur at a standard point in time, and as a result we were unable to examine the impact of this announcement with the help of two-minute data.

3.3.8 Quarterly Report on Inflation

Our findings for GDP also apply to the report on inflation. Accordingly, due to the small number of observations, it is difficult to draw any conclusions. In addition to this, as the Quarterly Report on Inflation is of a more complex nature, it cannot be as easily compared to market expectations: it is more difficult to evaluate the report as good or bad. And while the contents of the previous types of data can practically be summed up in one figure, allowing the market to process the information value very quickly, the same cannot be said about analysing the effect of the Quarterly Report on Inflation. In any case,

outlier values were not found in a positive or negative direction; and the size of daily exchange rate movements remains in a relatively narrow range (see Appendix, Chart 40).

Intra-day figures also confirm the assumption that there is no strong correlation between this announcement and exchange rate movements, at least as regards the effect of inflation projections. If there is any, it does not appear within a short period of time (see Appendix, Chart 41). In our view, this result is not surprising since as mentioned earlier the information content of the Report is too complex by its very nature to be immediately processed by the market and built into prices.

3.3.9 Reuters poll

Reuters surveys macro-analysts once a month, around the middle of the month, regarding their expectations for the most important macro variables and also conducts one-off polls from time to time. The results of these polls can significantly guide and/or influence market expectations. For the regular polls, average exchange rate movements are rather small, similar to the size of the standard deviation. Movements following one-off polls have higher average values and their standard deviation is particularly high, although an exceptionally large movement occurred only in May 2001, but clearly not as a result of the poll. Essentially, the same applies to the characteristics of absolute movements.

As regards the precise time of publication of the Reuters poll, we had no data at our disposal that would have allowed us to examine two-minute exchange rate movements in relation to the time of intra-day publications as we had done before. Thus, on the whole, we cannot draw clear conclusions on what effect the Reuters poll had.

3.4 DEVIATION FROM EXPECTATIONS

As regards the data under review, it seems justified to assume that the exchange rate is not necessarily affected by the actual value of the variable in question: it is more influenced by its deviation from the expected value, that is the news value of the data. In case of variables for which Reuters regularly publishes analysts' forecasts, the news value of an announcement can be defined as the deviation of the actual value for the given period from the average of the estimates given in the poll. Based on Reuters polls of analysts, we have sufficient information on the consumer price index, gross domestic product and industrial output growth, the current account balance and public sector deficit for the purpose of our study. The value of error is the difference between the actual and the estimate, i.e. in the case of a negative figure, the values are smaller than expected by analysts (a favourable development in the case of the consumer price index and unfavourable in the case of the other four types of data), while in the case of a positive figure, the actual value is higher than expected.

It is debatable what exchange rate and yield movements are considered consistent with the unexpected component of data. On the one hand, it seems logical that as a result of favourable news the exchange rate strengthens and yields fall: positive news triggers favourable money market developments. On the other hand, the opposite trend could

also apply based on the logic of inflation targeting. Better-than-expected news, especial-ly lower inflation, suggests that the central bank may respond to positive developments by monetary policy easing, which in turn leads to depreciation of the exchange rate. In the opposite case, however, when news is unfavourable, monetary policy tightening and a consequent strengthening of the exchange rate can be expected. In our view, the first case is more probable. The latter possibility is viable in the case of the combined effect of several types of data and over the longer term. In addition, in Hungary the system of inflation targeting does not have such a long history as is the case in other countries where this effect can be felt more strongly.

Table 4

Statistical characteristics of analyst expectation errors

Data	Average error	Average absolute error	Standard deviation	Standard error	t statistics
Consumer price index (%)	−0.084	0.183	0.219	−0.039	−2.12*
GDP (%)	−0.178	0.286	0.334	−0.105	−1.68
Current account balance (EUR millions)	6	150	182	33	0.18
Industrial output (%)	−0.289	0.715	0.921	−0.052	−1.74
Public sector deficit (HUF billions)	−19	37	43	8	−2.28*

* The expected value deviates from zero at 95% confidence level.

3.4.1 Regression between exchange rate movements and expectation errors

The following equation is an attempt to describe the correlation between expectation errors and exchange rate movements:

$$\Delta s_t = a_0 + a_1 x_t + v_t \, ,$$

where Δs_t is the logarithm exchange rate movement on day t (fixing/previous day fixing), x_t is the difference between actual and estimated data on day t, and v_t is the error component.

Results arrived at on the basis of regression estimation (see Table 5) can be interpreted in general terms as follows:

a_0: The measure of the exchange rate movement belonging to the 0 expectation error (the figure exactly matching expectations) based on the regression equation;

a_1: If the deviation of actual data from expectations is one unit (percentage point; million euros; billion forints) higher or lower, the exchange rate is likely to change by this number of units (percentage) on the basis of the regression equation;

t and F statistics: Parameters testing the accuracy of the regression parameter and the regression equation (zero hypothesis: $a_1=0$; i.e. there is no correlation between the criteria);

p value: The level of significance at which the zero hypothesis is just about acceptable (in this case the smaller its value, the greater the correlation between the criteria);

R^2: indicates the closeness of the criteria: the percentage of the exchange rate movement variance explained by the expectation.

Table 5

Characteristics of regressions between expectation errors and exchange rate movements

Data	a_0 (Constant)	a_1 (Coefficient)	t statistics	F statistics	p value	R^2
Consumer price index	−0.084	−0.751	1.33	1.76	19%	0.06
GDP	−0.045	−0.654	−1.63	2.66	14%	0.25
Current account balance	0.097	0.048	1.28	1.64	21%	0.06
Industrial output	0.109	0.014	0.11	0.01	90%	0.00
Public sector deficit	−0.031	0.000	−0.17	0.03	86%	0.00

It is true for each criteria that both the t test testing the coefficient and the F test testing the model show that even at the 95% and 90% confidence levels we cannot accept the assumption that there is a real regression between the criteria. This is most markedly observable in the case of industrial output and the public sector deficit that practically cannot be accepted at any confidence level, while in the case of the consumer price index, GDP and the current account balance the p value, the level of significance at which the assumption is just about acceptable, is at least below 20% or near this value (although this still signifies a weak correlation).

3.4.2 Consumer price index

As regards the frequency distribution of expectation errors relating to the consumer price index (see Table 6), the occurrence frequency of negative values is greater, while the distribution is quite near the normal value, it is slightly skewed to the left with a small negative expectation value.

In the diagram showing the correlation between the error and the exchange rate movement (Chart 2 – X-axis: the error value; Y-axis: the related exchange rate movement), the points are most dense in the first quarter indicating that inflation was mostly overestimat-

Table 6

Characteristics of consumer price index expectation errors

| Deviation from expectations (%)	< −0.3	−0.3	−0.2	−0.1	0	0.1	0.2	0.3	> 0.3
Number of cases	2	3	6	7	5	4	2	1	1
Average exchange rate movement* (%)	0.53	0.07	0.58	−0.15	0.04	0.25	−0.29	0.31	−0.05

* Negative values indicate depreciation, while positive ones represent appreciation.

ed, and this had a favourable effect on the exchange rate. In the second and fourth quarter there are a great number of points around the axes suggesting that small errors are connected to minor exchange rate movements. There is one case where a small negative error (better-than-expected data) is connected to a large negative exchange rate movement, but this was a piece of data from July 2001 when depreciation was caused by an unfavourable international situation (the Argentinean-Turkish crisis).

On the basis of the regression equation, one percentage point of surprise inflation leads to a 0.7512 per cent depreciation of the exchange rate on average, while a figure satisfying expectations results in a 0.0847 per cent appreciation. Although the regression line satisfies logical expectations (its steepness is negative and it crosses the axes near the origin), on the basis of the statistical tests carried out, the regression equation cannot be accepted even at a 90% confidence level. The determination coefficient is rather low and as we can see in the Chart, there are some points placed very far from the line. Accordingly, the correlation between the expectation errors and the exchange rate movements is weak.

Chart 2

Consumer price index expectation errors and exchange rate movements

$y = -0.7512x + 0.0847$
$R^2 = 0.0575$

Expectation error (percentage point)

Unfavourable   Favourable
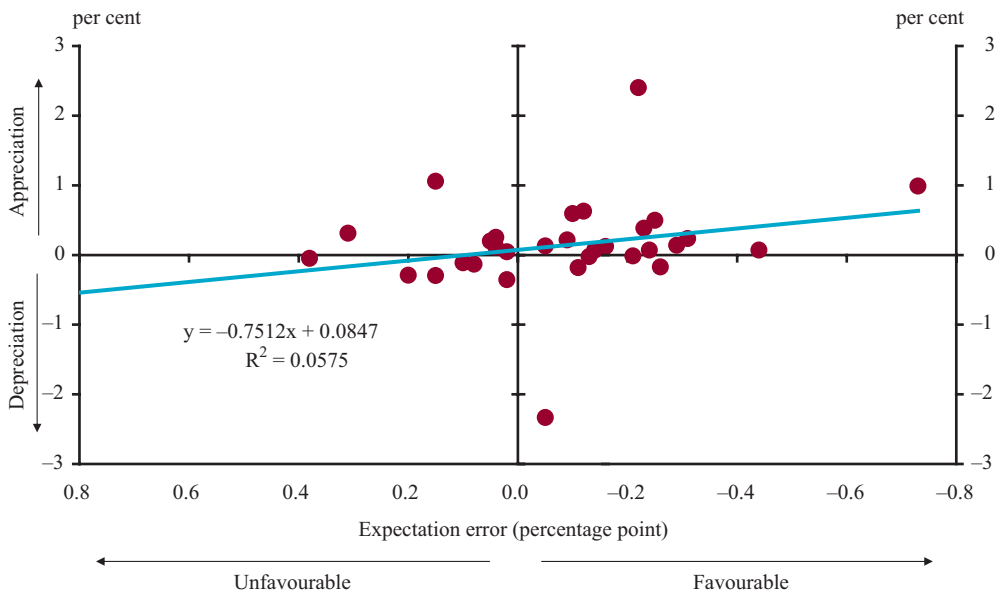
3.4.3 Growth rate of gross domestic product

As we have relatively little data at our disposal, it is difficult to draw conclusions in this respect. We can only establish that the exchange rate weakened more often than it strengthened, and that the size of the movements is also relatively small (as we saw ear-

Table 7

Characteristics of GDP expectation errors

Deviation from expectations (%)	< –0.3	–0.3	–0.2	–0.1	0	0.1	0.2	0.3	> 0.3
Number of cases	3	0	2	1	0	2	2	0	0
Average exchange rate movement* (%)	1.04	-	–0.03	–0.08	-	0.26	–0.48	-	-

** Negative values indicate depreciation, while positive ones indicate appreciation.*

lier, the only large movement that took place was not necessarily a result of the announcement). Based on expectation errors, growth was underestimated more frequently than it was overestimated (see Table 7), and due to the small number of elements it is difficult to make any meaningful statements about the distribution.

Apart from one exception, we can see that the size of the error does not significantly influence the extent of the movement, let alone its direction. Logically, one would expect that an error with a positive value (favourable data) correlates more to a positive (strengthening) exchange rate movement, while an error with a negative value (unfavourable data) relates more to a negative exchange rate movement (weakening). In this case, however, the points are distributed relatively evenly throughout the four quarters.

The direction of the regression line does not coincide with what would logically be justified: it suggests strengthening in the case of unfavourable data, while it indicates weakening in the case of favourable developments (according to the equation, a growth rate one percentage point higher than expected causes a 0.6543 per cent depreciation). This

Chart 3

GDP expectation errors and exchange rate movements

$$y = -0.6543x - 0.0451$$
$$R^2 = 0.2497$$
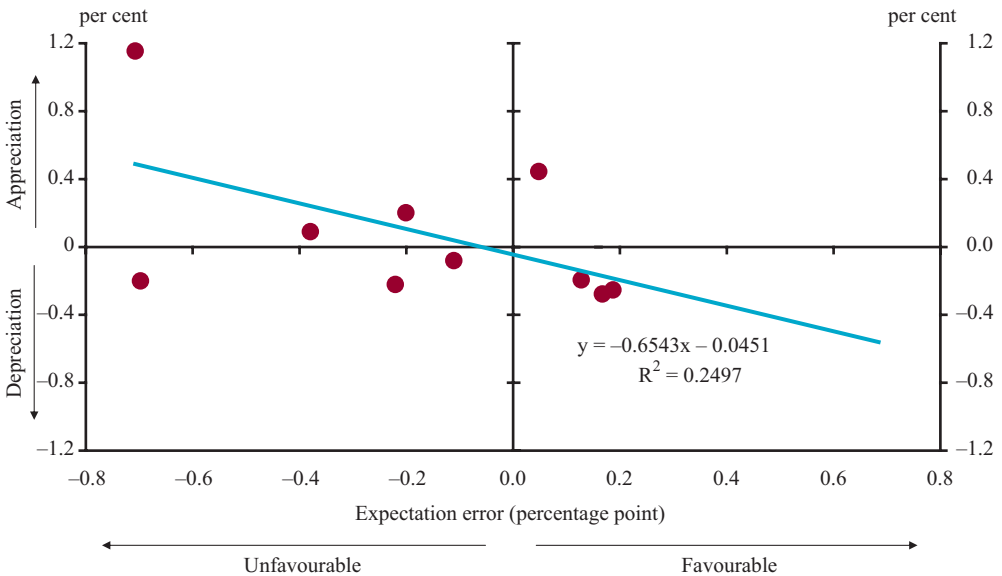
strange result may be explained by two possible factors. On the one hand, due to the limited data, it is possible that even one outlier (May 2003) can significantly distort the calculation. On the other hand, too many other factors may also play a role in daily exchange rate movements and, as a result, the movements do not show the effect of the announcement in a well-defined way. In addition, statistical tests indicate that the regression is false, and that there is no real correlation between the criteria.

3.4.4 Current account balance

Expectation errors show a distribution skewed slightly to the left, and the group means of a given range do not indicate a correlation with the expectation error.

Table 8

Characteristics of current account expectation errors

Deviation from expectations (EUR millions)	< –300	–300	–200	–100	0	100	200	300	> 300
Number of cases	0	1	5	8	5	4	5	0	2
Average exchange rate movement* (%)	–	–0.60	0.09	0.00	0.17	0.23	0.24	–	0.00

Negative values indicate depreciation, while positive ones represent appreciation.

As expected, the regression line has a positive steepness in this case as well, although the distribution of the points is very large: many points can be found quite far from the line

Chart 4

Current account balance expectation errors and exchange rate movements

$$y = 0.0482x + 0.0965$$
$$R^2 = 0.0563$$
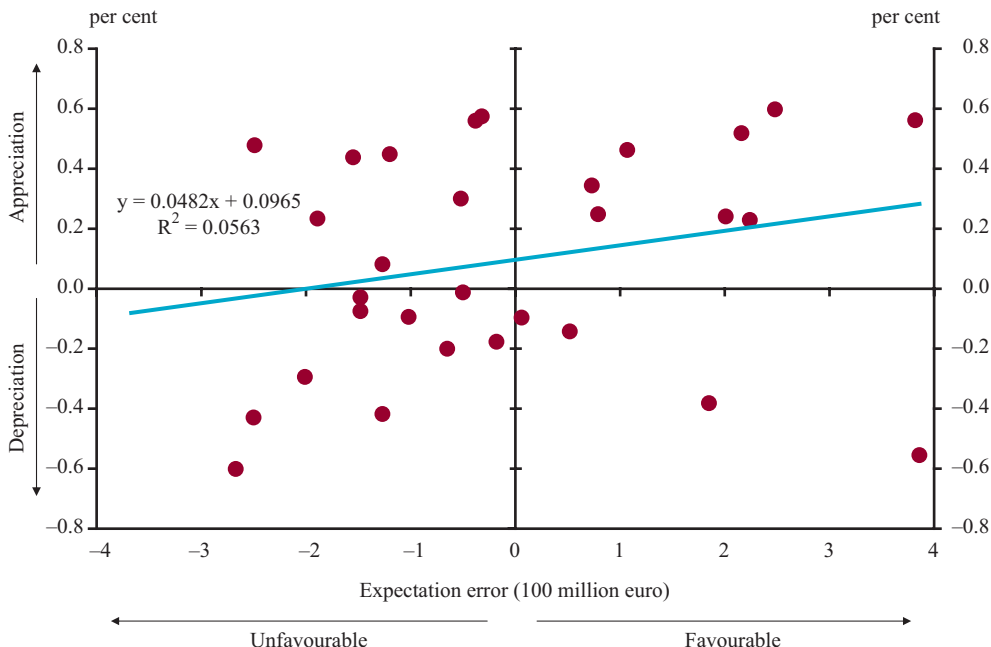
and many of them are not even in the proper quarter (see Chart 4). The value of the determination coefficient is low and the regression equation cannot be accepted even on the basis of the statistical tests.

3.4.5 Industrial output growth

As regards industrial output expectations, the deviation between expectations and actual data is significantly higher than in the two preceding cases. This may suggest that, as analysts expectations do not estimate this type of data too accurately, its guiding role is not significant either and thus the news value of the deviation between the estimate and the factual data is not notable.

Table 9

Characteristics of industrial output expectation errors

Deviation from expectations (%)	< −1.5	−1.5	−1	−0.5	0	0.5	1	1.5	> 1.5
Number of cases	2	0	6	9	6	5	1	1	1
Average exchange rate movement* (%)	0.03	–	0.00	0.20	−0.21	0.59	0.44	−0.25	−0.53

* Negative values indicate depreciation, while positive ones indicate appreciation.

Compared to the size of expectation errors, the size of exchange rate movements is not too significant: the majority of the points can be found around the origin. The value pairs are most dense in the first quarter (unfavourable data - exchange rate

Chart 5

Industrial output expectation errors and exchange rate movements

$$y = 0.0137x - 0.1087$$
$$R^2 = 0.0005$$
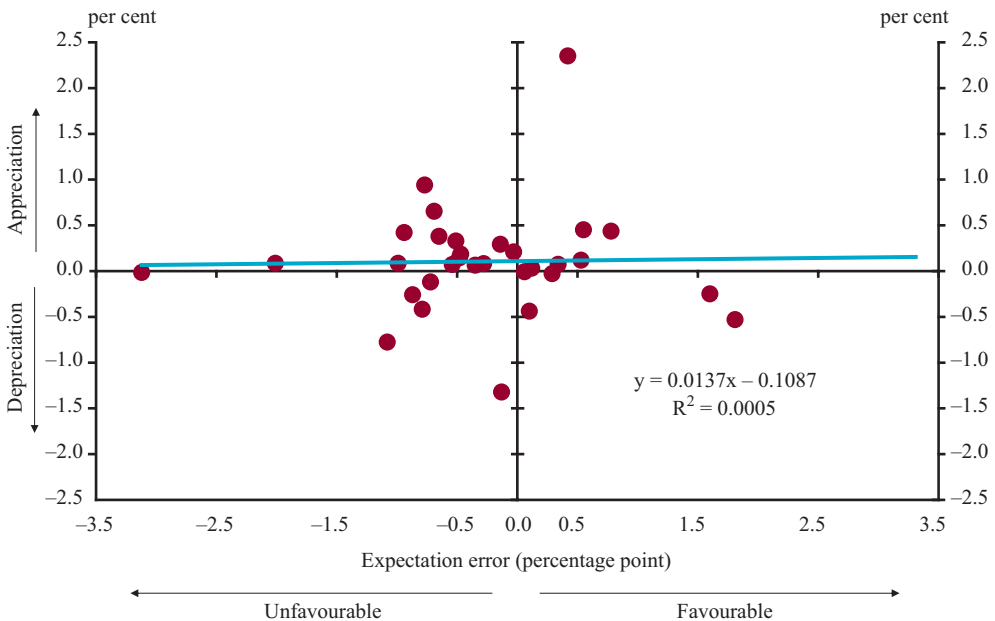
strengthening) and least dense in the fourth quarter (favourable data – exchange rate weakening).

Both the position of the regression line and the value of the determination coefficient (which is practically zero) suggest that in the case of industrial output there is no correlation between expectation errors and exchange rate movements. According to the regression line, a one percentage point error causes just slightly more than a one hundredth percentage point exchange rate movement. The value of the t and F tests, as well as the p value arrived at on the basis of such, also indicate a lack of correlation in this respect. We found it probable that the fact of the announcement has an effect on the exchange rate, but we found no correlation between the announcement and the deviation from expectations. This suggests that the significance of expectations is not considerable: this type of data is evaluated more on the basis of its relation to earlier data and trends than its connection to expectations.

3.4.6 Public sector deficit

As regards the deficit, most analysts were mistaken in the negative direction, although in most cases their mistake was minimal. Surprisingly, unfavourable news was connected more often to group means of exchange rate weakening, while favourable news was associated with exchange rate strengthening.
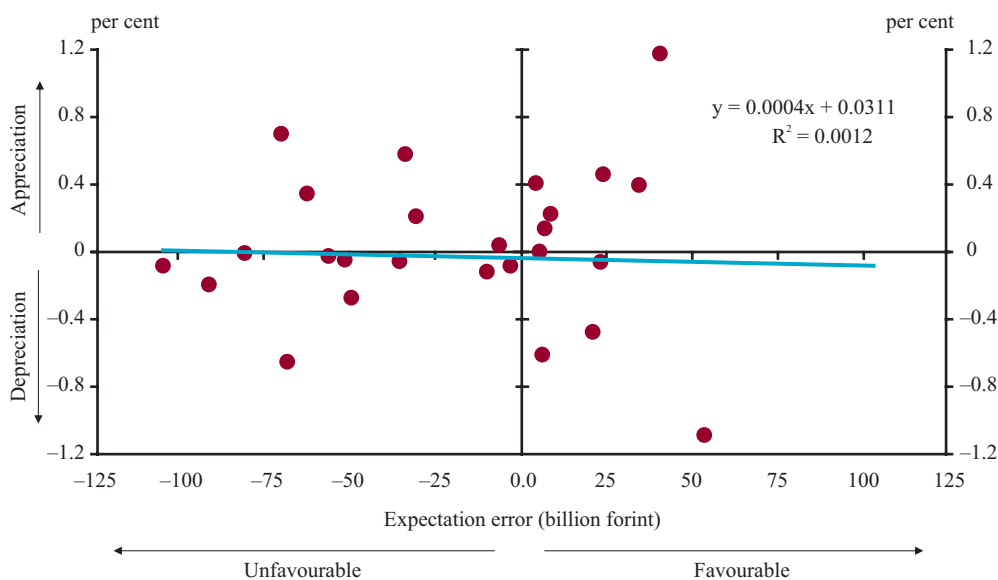
The regression line is practically horizontal, and it is almost identical with the x-axis (that is the unexpected component essentially does not cause an exchange rate movement) and the points can be found evenly throughout the four quarters (see Chart 6). Both the value of the determination coefficient and the statistical tests show that there is no difference whatsoever between the deviation from expectations and exchange rate movements. A possible reason for this is that a great amount of information is published regarding the public sector deficit (the deficit estimates of the Ministry of Finance, announcements on expected measures or tax revenue, changes in regulations) which has a continuous effect on expectations. As a result of this, the effect of the announcement of this type of data is not concentrated.

Table 10

Characteristics of public sector deficit expectation errors

Deviation from expectations (HUF billions)	< –60	–60	–40	–20	0	20	40	60	> 60
Number of cases	3	5	3	1	9	3	2	1	0
Average exchange rate movement* (%)	–0.09	0.06	0.08	0.2	–0.17	–0.02	0.73	–1	–

* Negative values indicate depreciation, while positive ones represent appreciation.

Chart 6

Public sector deficit expectation errors and exchange rate movements

per cent   per cent

$$y = 0.0004x + 0.0311$$
$$R^2 = 0.0012$$

Appreciation

Depreciation

Expectation error (billion forint)

Unfavourable   Favourable

3.4.7 Response to positive and negative errors

Thus far we have not examined whether exchange rate movements responding to news are symmetrical in the sense that they deviate in the positive or negative direction from expectations. We can, however, assume that exchange rate movements are not necessarily independent of the fact that expectations were proven false in either a favourable or unfavourable direction. It is possible that exchange rates react more sensitively to certain types of news, and to examine this we looked at exchange rate movements following different types of news (see Table 11). Except for the public sector deficit, relatively significant differences can be seen between group means.

In the case of the consumer price index, a negative error, i.e. announcement of a lower-than-expected inflation rate, resulted in a greater-than-average change than a higher-than-

Table 11

Exchange rate movement as an effect of positive and negative errors* (%)

	Favourable news		Unfavourable news	
	Piece	Average	Piece	Average
Consumer price index	19	0.20	12	0.06
GDP	4	–0.05	6	0.16
Current account balance	12	0.17	18	0.04
Industrial output	11	0.20	20	0.05
Public sector deficit	12	–0.08	15	0.02

Negative values indicate depreciation, while positive ones indicate appreciation.

expected inflation figure. At the same time, positive errors (higher-than-expected, i.e. unfavourable, inflation figure) also led to positive average movements (appreciation).

The result we arrived at regarding GDP is definitely surprising: data below expectations strengthened the exchange rate on average, while data above expectations weakened it. In the case of unfavourable news, this could be explained by the appearance of one large positive exchange rate movement distorting the average. In the case of favourable news the value is low enough to mainly signify exclusively that it has no effect on the exchange rate.

The data on the current account balance are similar to what we have seen in the case of the consumer price index. Favourable news resulted in greater strengthening, while the average was positive even following unfavourable news.

As regards industrial output, responses to unfavourable errors balance each other out quite evenly, and only one value distorts the average even in the case of a favourable deviation. In connection with the public sector deficit we found no correlation: favourable news resulted in weakening on average, while unfavourable news was met with strengthening.

3.4.8 Response to large and small errors

Large error was defined as follows: the upper 30% of expectations aligned according to the absolute extent of the error. In order to eliminate the offsetting effect of potentially large negative and positive movements, we calculated the average on the basis of the absolute movements as well, since in this case it is the extent of movement that is essential (see Table 12). In certain cases we may see significant differences between the exchange rate movements taking place in response to small and large errors. Large errors in estimating the consumer price index and GDP seemed to have influenced exchange rates much more than low deviations, and the exchange rate showed a stronger reaction to large errors than to small ones; the difference is also more significant for GDP. On the basis of the values of the average movement, we can say that the exchange rate movements following the low deviations

Table 12

Exchange rate movement as an effect of large and small errors (%)

Extent of deviation	Large			Small		
	Piece	Average movement	Average absolute movement	Piece	Average movement	Average absolute movement
Consumer price index	11	0.44	0.48	20	−0.02	0.36
GDP	3	0.35	0.47	7	−0.05	0.22
Current account balance	10	0.07	0.46	20	0.10	0.30
Industrial output	11	−0.03	0.38	20	0.18	0.37
Public sector deficit	9	−0.10	0.32	18	0.02	0.36

* Negative values indicate depreciation, while positive ones indicate appreciation.

practically cancel each other out, while movements following large errors deviate more strongly from zero. In the case of current account balance data, this difference is only clear with regard to absolute movements, where it is very well defined. On the basis of the industrial output data received, the expectation errors do not have an influence on these either: the group means of absolute movements are practically equal and a higher average deviation was detected in the case of small errors, while a close to zero value was observed for large errors, which is logically unjustifiable. In the case of public sector deficit, the data obtained show that the exchange rate does not react differently to large and small errors.

3.5 SENSITIVITY TEST, REFINEMENTS

So far, we have drawn our conclusions by considering all announcement days, mainly on the basis of daily exchange rate movements. Our analysis shows, however, that there are certain days when other factors also influenced the exchange rate and these are outliers from a certain aspect, having different characteristics than the days when the exchange rate suffered no other shocks. On the other hand, intra-day exchange rate movements showed a significantly closer correlation with the announcements than the daily changes. This is why in this section a sensitivity test is carried out relating to the fact whether we obtain different results after certain refinements. There are two methods of finding correlations.

With the help of two-minute data, we examined the changes between the exchange rate before the announcement and at a certain time following the announcement. We carried out this survey in the following intervals: the exchange rate immediately before the announcement – the exchange rate within 2, 10, 30, 60 and 120 minute periods following the announcement. By using narrow intervals, we can eliminate the effect of other events.

In addition, we identified the days falling far from the regression line, i.e. the outliers, and checked whether any other important events took place on those days which could have had a stronger influence on the exchange rate than the news itself. Should there be such an event, we removed the day in question from the sample and carried out the test again after elimination of the outliers.

The advantage of these methods is that with the refinements we can obtain a more accurate picture of the effects, while the drawback is that intra-day exchange rates are not available for the entire examined period and that the elimination contains a certain level of arbitrary elements, since in some cases it may be a question of judgement what to consider an outlier and which element to eliminate from the sample.

3.5.1 Using two-minute data

3.5.1.1 Calculation of the regression

The regression method described above is used for defining the correlation between expectation errors and exchange rate movements, but when defining the exchange rate movement,

Table 13

**Characteristics of regressions between consumer price index expectation errors and exchange rate movements**

Period	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value	R^2
2 minutes	−0.009	−0.412	−4.94	24.46	0.01%	0.48
10 minutes	0.013	−0.483	−3.82	14.58	0.01%	0.36
30 minutes	0.036	−0.434	−2.31	5.36	3%	0.17
60 minutes	0.029	−0.394	−2.11	4.48	4%	0.14
120 minutes	−0.008	−0.104	−0.50	0.26	61%	0.01

instead of the movement between the two fixings we considered the movement within the 2, 10, 30, 60 and 120 minute periods following the announcement (see Tables 13, 14, 15 and 16).

On the basis of the results relating to the consumer price index, the exchange rate reacted to the announcement of the data very quickly. The narrower the interval, the closer correlations can be found and, as time passes, the determination coefficient gradually decreases, while the p value increases. This is consistent with our earlier finding that the largest absolute movements take place immediately after the announcement in the case of the consumer price index. There is an excess exchange rate movement most

Chart 7

Regression between consumer price index expectation errors and exchange rate movements*

$$y = 0.4121x - 0.0092$$
$$R^2 = 0.4847$$
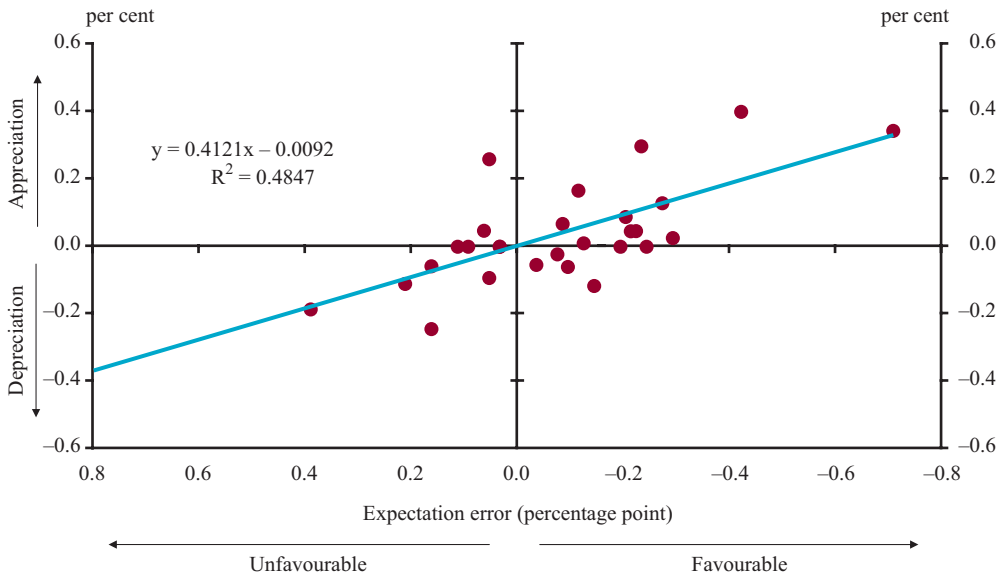
* Exchange rate movement within 2 minutes following announcement.

probably due to lively trading following announcement, which is priced out within a few hours. Up to the 60 minute interval the t and F statistics show that the regression model may be accepted at a 95% confidence level, indicating a significant improvement compared to the regression of the daily movements. The determination coefficient, showing the closeness of the correlation, also increased due to the refinements. Almost passing the origin, the regression line follows the logically expected direction, should we assume a correlation between the two criteria and, in addition, most of the points are close to the line (see Chart 7).[6] On the basis of the regression equation, one per cent higher-than-expected inflation data is followed by an average 0.4121 per cent appreciation of the exchange rate, while in the case of data meeting expectations the rate practically does not change.

In the case of GDP data, the process is reversed compared to the consumer price index. The information is built into the exchange rate more slowly and the more time passes the more it reflects the effect of the announcement and the closer the correlation is, which means that the effect on the exchange rate persists later as well. The closest correlation was found within 120 minutes following announcement. On the basis of the regression model, a one percentage point higher-than-expected growth rate results in almost half a per cent strengthening of the exchange rate on average. At the same time, even when the data meet the expectations, the equation shows a slight, 0.06 per cent appreciation. In this case, contrary to daily movements experienced earlier, the direction of the regression line (positive skewness) coincides with the logically justifiable direction. In addition, the direction of the exchange rate movements meets the trend marked by the expectation error; unfavourable data were followed by depreciation, while favourable data were followed by appreciation (see Chart 8; it is also true, however, that in this case the examined sample is very small).

Table 14

**Characteristics of regressions between GDP expectation errors and exchange rate movements**

Period	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value	R^2
2 minutes	−0.023	−0.028	−0.51	0.26	62%	0.04
10 minutes	0.021	0.071	1.05	1.01	32%	0.14
30 minutes	0.017	0.306	1.96	3.85	9%	0.35
60 minutes	0.001	0.270	1.5	2.25	17%	0.24
120 minutes	0.060	0.481	3.25	10.61	1%	0.60

The current account balance outturn does not show a close correlation with the immediate exchange rate movement, while later there is a gradually strengthening correlation. The correlation is the closest after 30 or 60 minutes, when the regression equation is accepted at a more than 99% confidence level, but the p value is not too high even afterwards. Most of the points can be found in adequate quarters and fit well the regres-

---

[6] We showed the best fitting line in the case of each macro data.

Chart 8

Regression between GDP expectation errors and exchange rate movements*

$y = 0.4806x + 0.0596$
$R^2 = 0.6027$
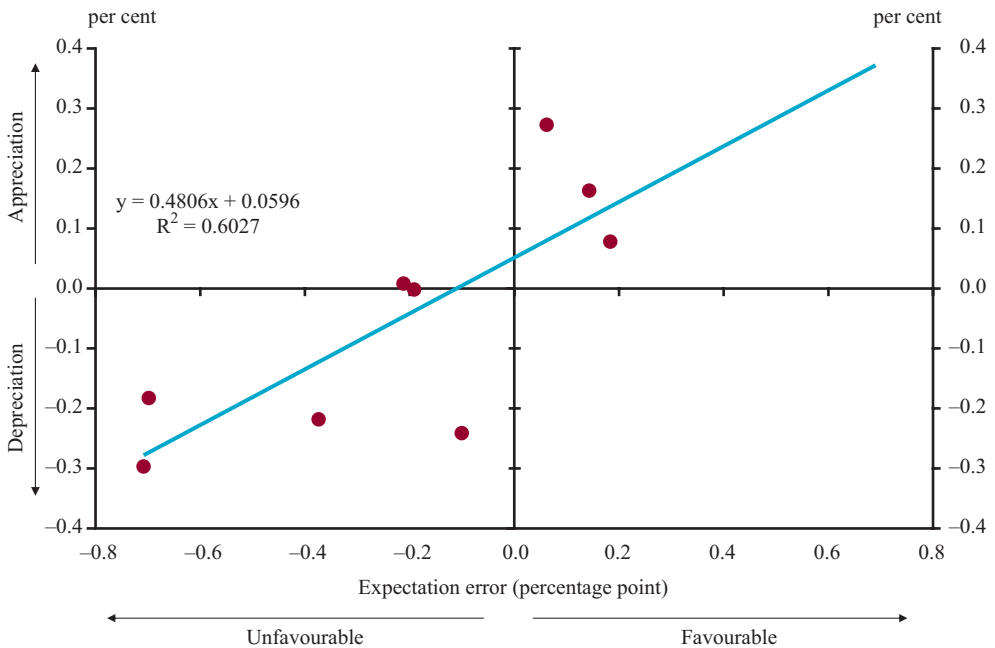
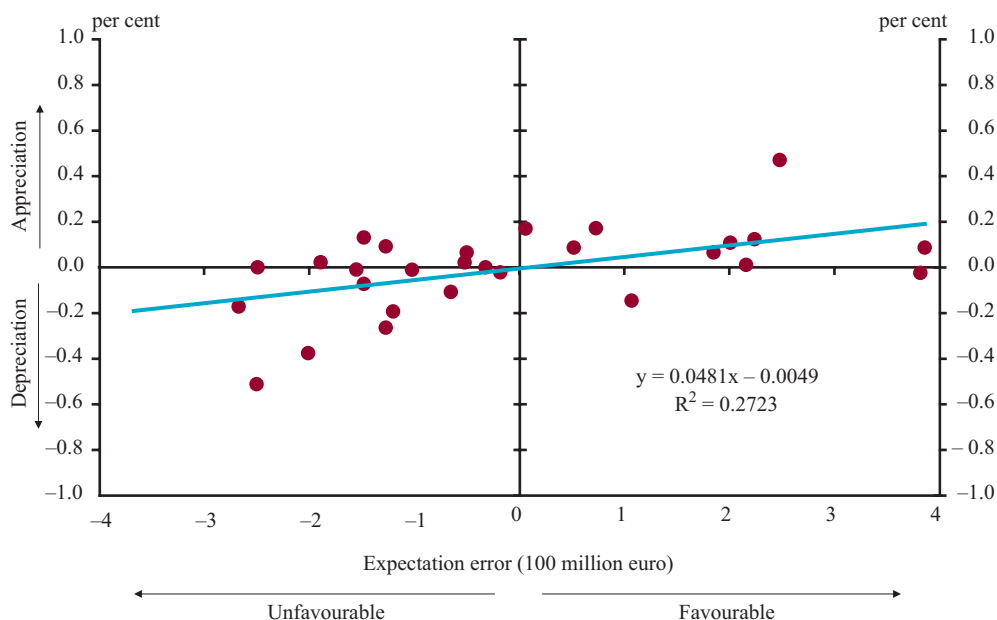** Exchange rate movements within 120 minutes following announcement.*

sion line, with the exception of only a few points that fall relatively far from it (see Chart 9). At the same time, the surprise component causes a smaller-than-expected change: a 100 million euro better-than-expected current account balance data results in half a per cent appreciation on average.

In the case of industrial output, the refinements did not substantially modify the result, but confirmed our earlier finding. Exchange rate movements within the examined peri-

Table 15

Characteristics of regressions between current account balance expectation errors and exchange rate movements

Period	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value	R^2
2 minutes	−0.139	0.009	−1.18	1.41	24%	0.06
10 minutes	0.067	0.013	1.73	2.99	10%	0.10
30 minutes	−0.005	0.048	3.12	9.78	0.5%	0.27
60 minutes	0.028	0.051	3.06	9.38	0.5%	0.27
120 minutes	0.040	0.032	1.61	2.61	12%	0.09

Chart 9

Regression between current account balance expectation errors and exchange rate movements*

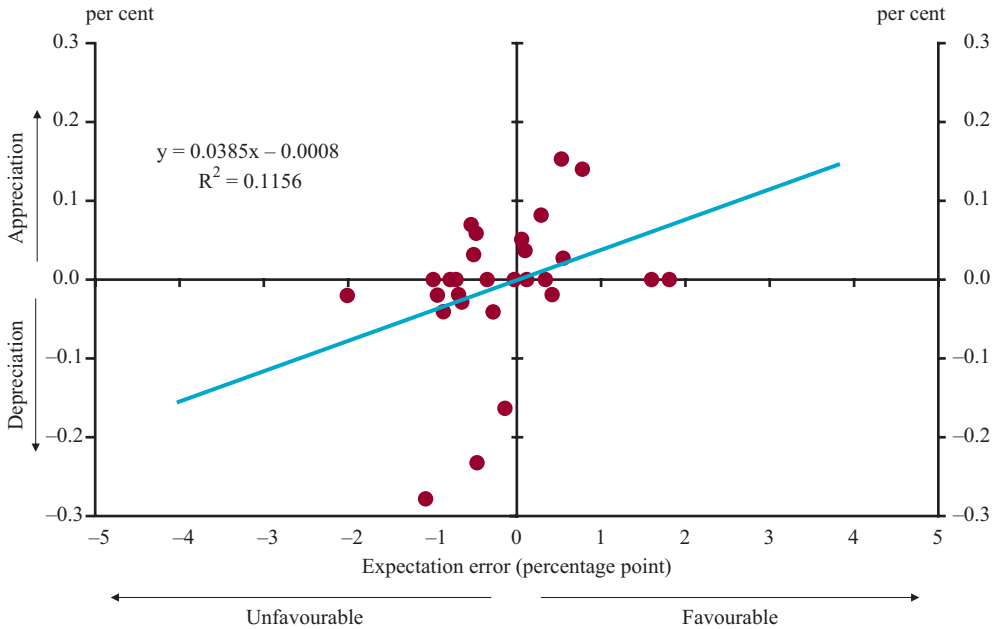* Exchange rate movements within 30 minutes following announcement.

od do not correlate with the expectation error. We only found a correlation in one case (exchange rate movement within 10 minutes of the announcement), but even then relatively many points fall far from the regression line. On the basis of the values of the regression equations and the determination coefficient, the industrial output expectation error and exchange rate movement may be regarded as practically independent of each other, exhibiting no correlation.

Table 16

Characteristics of regressions between industrial output expectation errors and exchange rate movements

Period	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value	R^2
2 minutes	0.001	0.001	0.20	0.04	84%	0.00
10 minutes	0.001	0.038	1.84	3.40	8%	0.11
30 minutes	0.001	0.005	0.14	0.02	88%	0.01
60 minutes	0.029	–0.006	–0.14	0.02	88%	0.01
120 minutes	0.019	–0.002	0.05	0.00	96%	0.00

Chart 10

Regression between industrial output expectation errors and exchange rate movements

$$y = 0.0385x - 0.0008$$
$$R^2 = 0.1156$$

* Exchange rate movement within 10 minutes following announcement.

3.5.1.2 Response to positive and negative errors

There is a tendency in the case of each of these indicators that the reaction of exchange rates differs depending on the fact whether there is favourable or unfavourable news. Favourable news was mainly followed by a strengthening of the exchange rate, while unfavourable news was followed by a weakening of the exchange rate in the period after the announcement. After refinement, the differences can be seen more clearly than in the case of daily exchange rate movements. The deviation is the highest in the case of GDP,

Table 17

Exchange rate movement as an effect of positive and negative errors* (%)

	Consumer price index		GDP		Current account balance		Industrial output	
	Favourable	Unfavourable	Favourable	Unfavourable	Favourable	Unfavourable	Favourable	Unfavourable
2 minutes	0.07	−0.03	−0.01	−0.02	−0.03	0.00	0.01	−0.00
10 minutes	0.12	−0.03	0.04	−0.01	0.03	−0.01	0.04	−0.04
30 minutes	0.15	−0.03	0.10	−0.13	0.10	−0.08	0.00	−0.02
60 minutes	0.07	−0.09	0.11	−0.14	0.16	−0.06	−0.04	−0.02
120 minutes	0.03	−0.04	0.18	−0.16	0.12	−0.01	0.01	−0.03

* Negative values indicate depreciation, while positive ones represent appreciation.

while it is very low in the case of industrial output data. There is a clear tendency, similarly to the case of GDP, that the effects caused by the data tend to strengthen gradually with time, with the deviation highest after 120 minutes, while in the case of inflation data there is an opposite trend. In the case of the current account balance, similarly to the regression line, the correlation is highest after 30 and 60 minutes. The results confirm our earlier finding that expectation errors have an effect on exchange rates in the case of the consumer price index, GDP data and the current account balance, while in the case of the industrial output this is not the case.

3.5.1.3 Response to large and small errors

Our earlier findings are also valid in this context: in the case of the industrial output there is no essential difference between the groups, while in the case of the consumer price index and GDP there is. As regards average movements, the exchange rate reacted to larger expectation errors more strongly, as announcements with greater surprise value were accompanied by larger exchange rate movements, while exchange rate movements following small errors cancelled each other out. The same effect is shown by the fact that, apart from a few exceptions, absolute movements are larger in the case of larger errors. In the case of current account balance data, only absolute movements show a significant difference. Similarly to the favourable-unfavourable groups, in the case of the consumer price index the difference between the two groups disappears by the end of the period, while in the case of GDP it becomes even more well defined and in the case of the current account balance it appears most strongly in the 30 and 60 minute period. This result is consistent with what we would have expected by intuition.

Table 18

Exchange rate movement as an effect of large and small errors* (%)

	Consumer price index		GDP		Current account balance		Industrial output	
	Small	Large	Small	Large	Small	Large	Small	Large
2 minutes	−0.01	0.10	−0.02	−0.02	0.00	−0.03	0.00	0.00
10 minutes	0.01	0.15	0.01	0.00	0.01	−0.01	0.00	−0.02
30 minutes	0.05	0.14	−0.01	−0.13	0.00	−0.02	0.00	−0.03
60 minutes	−0.01	0.05	−0.02	−0.13	0.02	0.03	−0.03	−0.02
120 minutes	0.00	0.00	0.05	−0.24	0.02	0.06	0.00	−0.06

* Negative values indicate depreciation, while positive ones represent appreciation.

Table 19

Absolute exchange rate movement as an effect of large and small errors* (%)

	Consumer price index		GDP		Current account balance		Industrial output	
	Small	Large	Small	Large	Small	Large	Small	Large
2 minutes	0.06	0.14	0.02	0.06	0.02	0.04	0.02	0.01
10 minutes	0.09	0.19	0.04	0.05	0.05	0.05	0.05	0.06
30 minutes	0.12	0.19	0.12	0.15	0.09	0.18	0.11	0.11
60 minutes	0.16	0.15	0.14	0.13	0.09	0.16	0.12	0.14
120 minutes	0.17	0.17	0.13	0.24	0.14	0.16	0.14	0.17

* Negative values indicate depreciation, while positive ones represent appreciation.

THE EFFECTS OF MACROECONOMIC NEWS ON THE EXCHANGE RATE

3.5.2 Eliminating outliers

3.5.2.1 Regression calculation

Another potential method to eliminate the effect of other factors from the exchange rate movements is to identify the outliers when more important events influenced the money market processes more strongly and when the exchange rate movement was not related to macro news. These days were taken out of the sample and then the regression parameters were again calculated for the new data series (see Table 20).

Table 20

Characteristics of regressions created by eliminating outliers

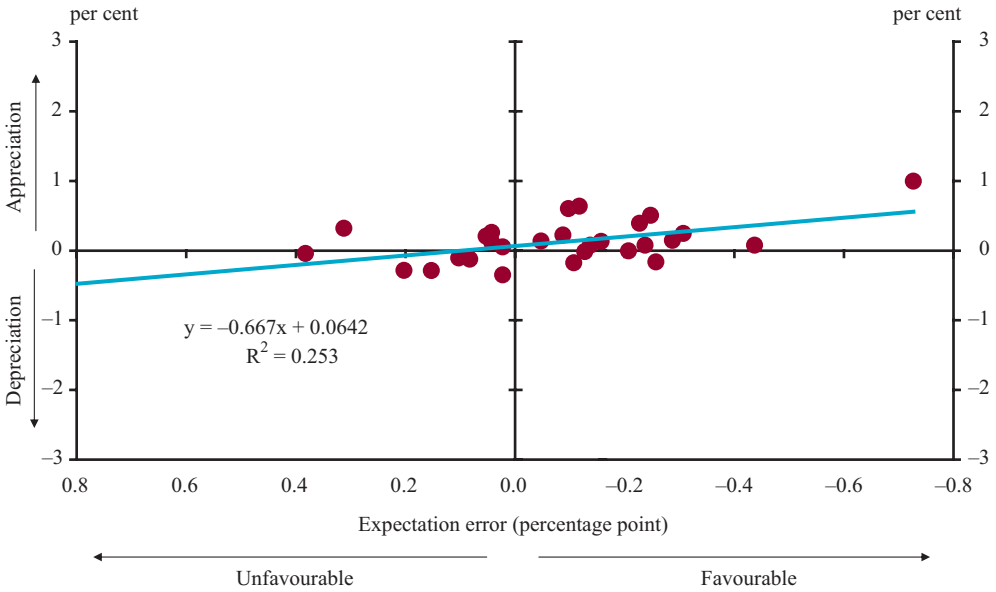| Data	a_0 (Constant)	a_1 (Coefficient)	t statistics	F statistics	p value	R^2
Consumer price index	0.064	−0.667	−2.96	8.82	0.6%	0.25
GDP	0.035	0.189	0.51	0.26	62%	0.05
Current account balance	0.163	0.110	3.15	9.97	0.4%	0.28
Industrial output	0.037	−0.047	−0.58	0.33	56%	0.01
Public sector deficit	0.127	0.002	1.25	1.56	22%	0.06

We believe that in respect of consumer price index announcement dates, the loss of confidence in emerging markets resulting from the Turkish-Argentinean crisis caused the devaluation on 11 July 2001 (actual inflation data was practically in line with expectations). The data for 15 February 2002 was also removed, because on that day the exchange rate rose following a comment by the Prime Minister ('the forint will appreciate by 3%-4% per year until the date of joining monetary union'), and 11 June 2003 was eliminated as well, because the 100-basis-point interest rate increase of the previous day had an effect then. The regression calculated this way may be accepted at a 99% confidence level, while 25% of the deviations from expectations are explained by the variance of the exchange rate movement. On the basis of the regression equation, one per cent surprise inflation results in an average 0.667 per cent depreciation. In this case most of the points are close enough to the regression line (see Chart 11).

We found justification for three of the GDP announcement days to be removed from the original sample. Apart from GDP, on 3 December 2002 data relating to the current account balance and the public sector deficit were also announced, and both were weaker than expected which may also have influenced the exchange rate. On 4 March 2003, the forint weakened due to regional contagion as an effect of the Czech and Polish government crises. The exchange rate started to weaken again on 30 May 2003, probably because news of an impending band shift may have leaked out. The regression line is now of the right direction, but the correlation is rather weak and therefore the regression cannot be accepted on the basis of the tests. (In this case, it was also a problem that even originally we had little data, which was further decreased due to the elimination and therefore it is questionable whether it makes sense at all to fit a regression for seven data.)
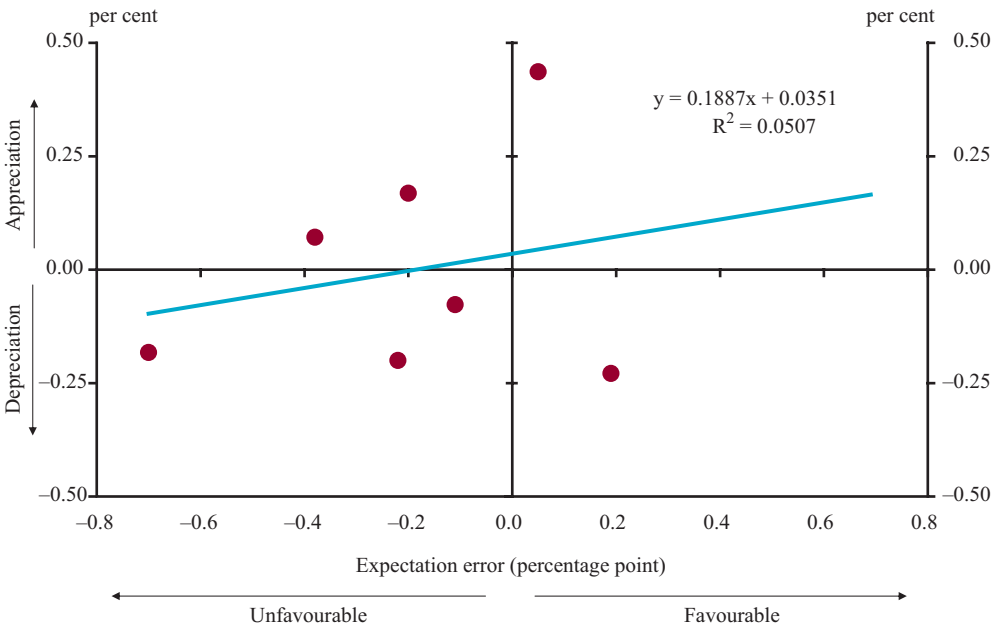
Chart 11

Consumer price index expectation errors and exchange rate movements after eliminating outliers

per cent   per cent

$$y = -0.667x + 0.0642$$
$$R^2 = 0.253$$

Appreciation

Depreciation

Expectation error (percentage point)

Unfavourable   Favourable

Chart 12

GDP expectation errors and exchange rates after eliminating outliers

per cent   per cent

$$y = 0.1887x + 0.0351$$
$$R^2 = 0.0507$$

Appreciation

Depreciation

Expectation error (percentage point)

Unfavourable   Favourable

In the case of the current account balance, there were two pieces of data that were out of alignment and we found explanatory events as well. On 4 February 2002, the favourable current account balance did not have any effect, because the zloty weakened significantly at that time, dragging down the forint as well. On 3 May 2002, the data was better than expected, but the joint effect of the strengthening of the euro against the dollar and the weakening of the zloty still caused depreciation of the exchange rate. After eliminating these two data the regression equation significantly improved, and the determination coefficient increased. On the basis of tests we may accept the correlation among the criteria at a 99% confidence level, that is, a 100 million euro more favourable-than-expected current account balance results in an average of 0.1096 per cent appreciation.

Chart 13

Current account balance expectation errors and the exchange rate after eliminating outliers
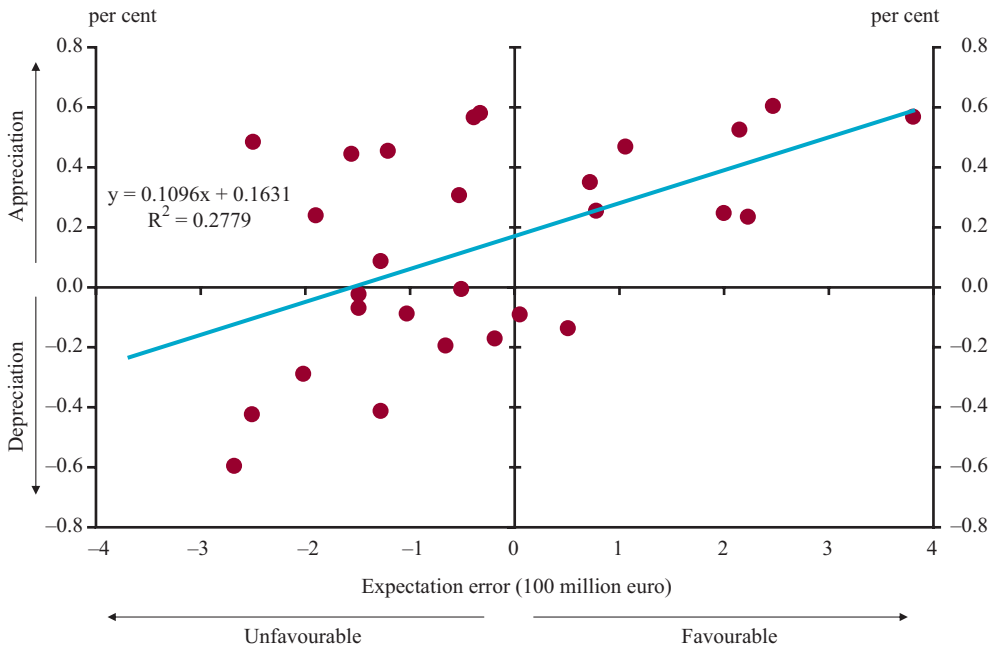
The four dates eliminated in the case of industrial output and the justifications: 8 May 2001 - was too close to the widening of the band; 6 June 2001 - foreign exchange liberalisation was announced a day before; 6 July 2001 - signs of crisis in Argentina and Turkey; 6 May 2003 - high volatility following the shift of the band. The elimination practically did not change the results, the regression line being horizontal and the determination coefficient very low, so on the basis of the test we have to accept the fact that there is no correlation between the data.

Chart 14

**Industrial output expectation errors and exchange rates after eliminating outliers**
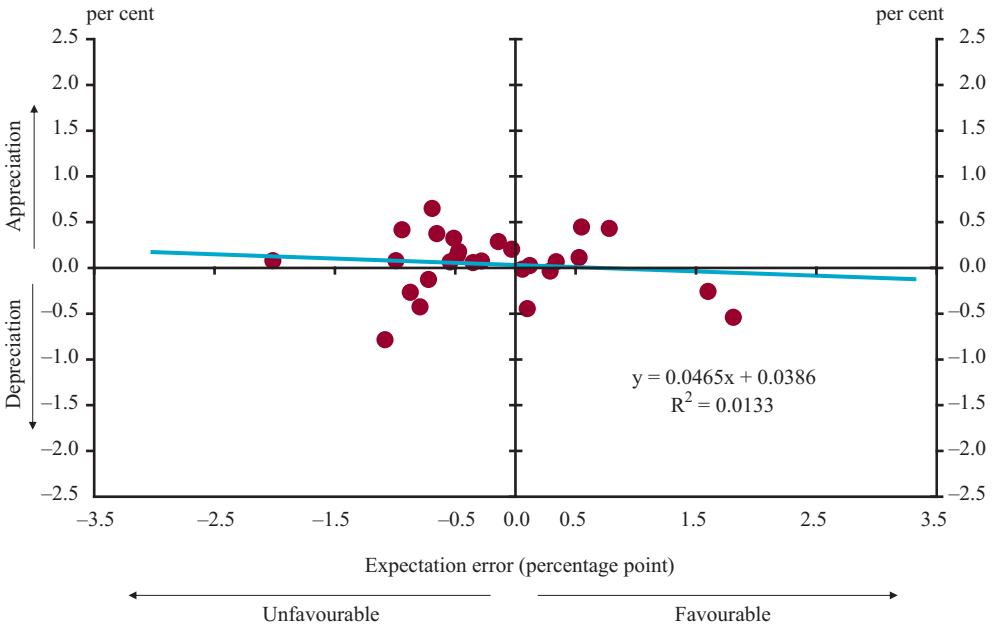
The elimination did not substantially change the basic conclusions in the case of public sector deficit data either. We took two data out of the original sample (13 July 2001 – Argentinean-Turkish crisis; 3 June 2003 – shift of the band), which resulted in a slight improvement, but the determination coefficient is still low and on the basis of the tests this regression is out of the question.

Although on the basis of the total sample the daily movement in the exchange rate did not show a significant correlation with any of the macroeconomic data, after the refinements a correlation was shown with the consumer price index, GDP and the current account balance. In the case of public sector deficit, we did not have the same experience and on the basis of our experiences the state of the budget does not seem to have an effect on the exchange rate. This result looks surprising for such important data, but we are of the opinion that this may be explained by the differences in announcing the data. Compared to the rest of the data, the public sector deficit information is much more dispersed: there is no standard date of announcement (it also occurred that this data was announced after the closing of the market), in the newspapers and other media the information relating to the central budget is published continuously, and therefore the full picture is composed of numerous little pieces. Consequently, the effect also appears in a dispersed manner: the information is gradually built into the exchange rate, with each piece of news or Ministry of Finance announcement adding to the change.

Chart 15

Public sector deficit expectation errors and exchange rates after eliminating outliers

$$y = 0.0022x - 0.1268$$
$$R^2 = 0.0636$$

Expectation error (billion forint)

Unfavourable   Favourable
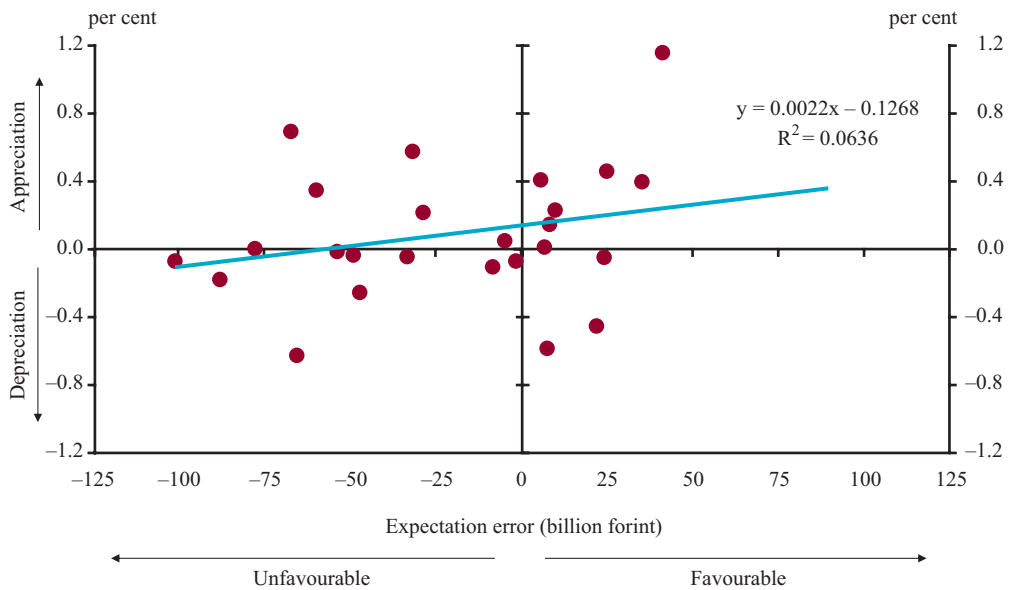
3.5.2.2 Response to positive and negative errors

After eliminating the outliers, the difference between the group means grew in the case of the consumer price index and, therefore, the group mean resulting from the unfavourable news turns negative. In the case of GDP, the group mean is of the expected sign, contrary to the experiences taking the total sample into consideration. There is larger exchange rate movement in the case of favourable news in both cases. The difference between the group mean data of the current account balance grew, but we still obtain a positive group mean for unfavourable news as well. The situation is similar in the case of the public sector deficit: the favourable news were followed by a greater strengthening, but the group mean of the unfavourable news is, though only slightly, positive. The outturn for industrial output remains inconsistent with the rest of the data, showing the contrary effect to what we would expect.

Table 21

Exchange rate movement as an effect of positive and negative errors after eliminating outliers* (%)

	Favourable news		Unfavourable news	
	Piece	Average	Piece	Average
Consumer price index	17	0.22	11	−0.03
GDP	2	0.10	5	−0.04
Current account balance	10	0.29	18	0.04
Industrial output	10	−0.01	17	0.08
Public sector deficit	10	0.15	15	0.02

* Negative values indicate depreciation, while positive ones represent appreciation.

3.5.2.3 Response to large and small errors

The deviation can be most clearly seen in the case of the consumer price index data considering both the average and the absolute average movements. In the case of the current account balance and industrial output data, the deviation is the clearest when looking at the differing extent of the absolute movements. In the case of GDP and public sector deficit data, we see the opposite of the logically justifiable result.

Table 22

Exchange rate movement due to large and small errors after eliminating outliers* (%)

Extent of deviation	Large			Small		
	Piece	**Average movement**	**Average absolute movement**	**Piece**	**Average movement**	**Average absolute movement**
Consumer price index	10	0.25	0.29	18	0.05	0.21
GDP	2	–0.05	0.13	5	0.02	0.22
Current account balance	9	0.14	0.43	19	0.13	0.26
Industrial output	9	–0.13	0.36	18	0.14	0.20
Public sector deficit	8	0.01	0.23	17	0.11	0.29

* Negative values indicate depreciation, while positive ones mean appreciation.

Elimination of the outliers of the sample most notably changed the results relating to the consumer price index and the current account balance, in both cases improving the indices and showing a better correlation with the exchange rate. In the case of the other three data we did not find a spectacular improvement.

4. THE EFFECTS OF MACROECONOMIC NEWS ON YIELDS

4.1 DATABASE

In our analysis, we used the benchmark yields of the Government Debt Management Agency, published daily at 2:30 p.m., for defining the yield changes. Currently, the Government Debt Management Agency determines benchmark yields for seven durations – three-month, six-month, twelve-month, as well as three-year, five-year, ten-year and fifteen-year durations. For the sake of transparency, we think it is reasonable to only use certain indices that meet the following requirements: they help cover the yield curve, examine the various periods separately and comprise several yield changes and show their average. With the help of the principal component analysis[7] we determined a variable, comprising the daily changes in three-month, six-month and twelve-month yields expressed in basis points (short-term yield movement), and another variable, comprising the changes of three-year, five-year and ten-year yields (long-term yield movement).[8]

No intra-day data were available with regard to the yields, therefore, we cannot analyse the short periods following the announcement in such a way as in the case of exchange rates. This means that it is also more difficult to evaluate the result, as several factors influence the daily fluctuation of yields apart from the news and too may factors play a role in daily movements. Also, similarly to our experience of examining the exchange rate movements, we were able to find better correlations if examining only the period of a few hours after announcements.

4.2 COMPARISON OF ANNOUNCEMENT AND NON-ANNOUNCEMENT DAYS

Classification of days into announcement and non-announcement days took place as described before. The statistical characteristics of the two groups differ only slightly from each other in the case of both short-term and long-term yield movements (see Table 23, and Charts 16 and 17). There is no significant deviation between the average yield movements, and the distribution is essentially the same. The values show more standard deviation on announcement days, and the largest increase and decline in yields is also related to announcement days. The differences are more significant between the scatter ratios of short-term yield movements, showing stronger variation of the short end of the yield curve.

---

[7] See the description of the method in Appendix 2.
[8] Fifteen-year benchmark was first set on 13 December 2001, therefore it is not available during the whole examined period and was not taken into consideration when determining the variable.


Table 23

Statistical characteristics of yield movements

|	Short-term			Long-term		
	All days	Non-announcement days	Announcement days	All days	Non-announcement days	Announcement days
Number of observations	642	379	263	642	379	263
Average (bp)	0.21	0.42	–0.09	0.15	0.02	0.33
Average absolute movement (bp)	6.20	5.10	7.78	6.40	6	6.96
Median (bp)	–0.68	–0.68	–0.34	–0.29	–0.44	0.1
Standard deviation (bp)	14.09	9.11	19.12	10.62	8.85	12.75
Standard deviation of absolute movement (bp)	12.65	4.56	17.42	8.04	6.5	10.65
Standard error (bp)	0.56	0.46	1.18	0.42	0.45	0.78
Kurtosis	47.67	12.91	33	18.28	7.57	18.69
Skewness	1.13	2.14	0.8	1.95	1.41	2.05
Range (bp)	288	93	288	148	86	148
Minimum (bp)	–132	–32	–132	–53	–24	–53
Maximum (bp)	156	61	156	95	62	95

Chart 16

Distribution of short-term yield movements
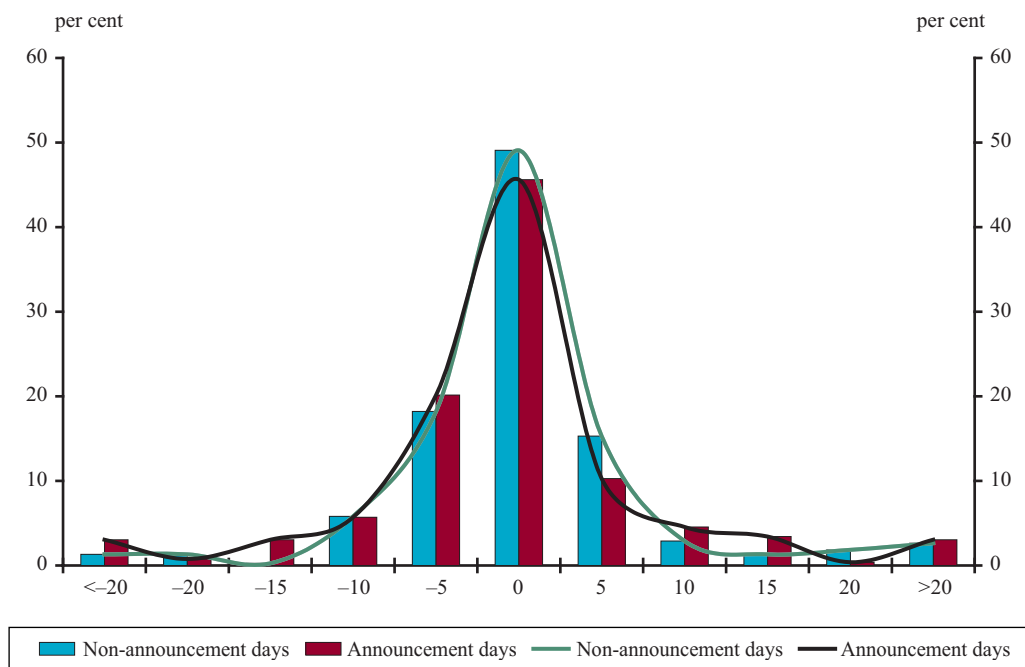
Chart 17

Distribution of long-term yield movements
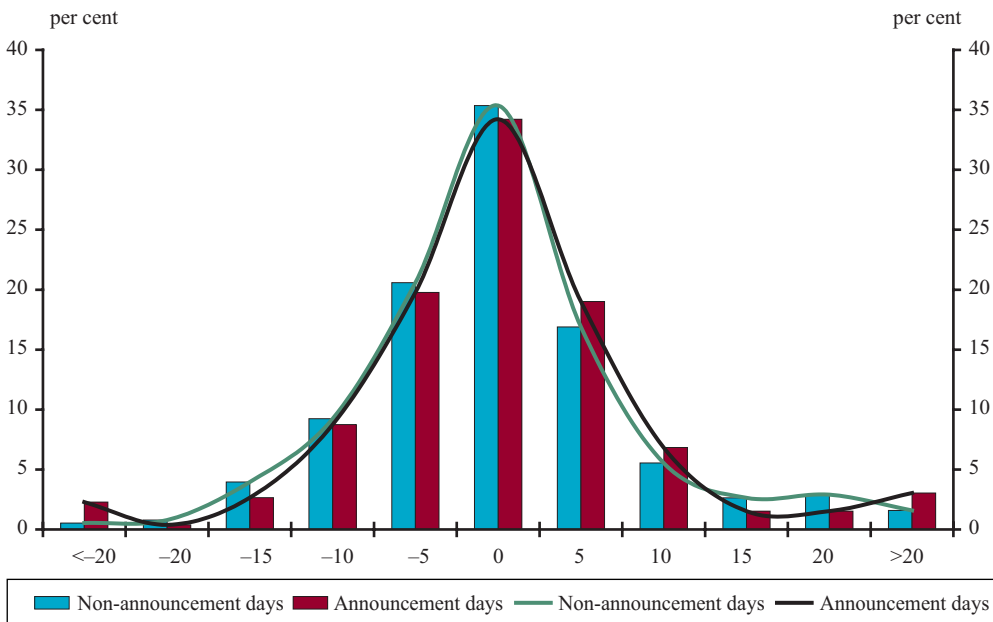
The distribution curve is very similar to this in the case of both short and long-term movements, the most important difference being the higher frequency of outliers experienced on announcement days. The distribution of announcement days is more even in the case of both short and long-term yields, and more spread out in the case of long-term yields, but the difference is not considerable. On the whole, the differences between the two examples are not considered significant, the similarity being even stronger than in the case of exchange rates.

4.3 THE EFFECT OF THE ANNOUNCEMENT OF CERTAIN DATA

It is clear from the characteristics of the yield movements following the various announcements (see Table 24) that the higher standard deviation and the higher proportion of extremely large movements on announcement days were primarily caused by yield movements after the policy rate decision and not by the announcement of macro data. While the standard deviation of movements after the policy rate moves is higher by several order of magnitude than the standard deviation on non-announcement days (or on all days), we did not find outliers concerning the movements following the announcement of the macro data, which would refer to the fact that the announcement actually influenced the yields. The characteristics of the movements following announcements are not very different from those on non-announcement days.

Table 24

Characteristics of yield movements following announcements *(data in basis points)*

Announcement	Short-term				Long-term			
	Movement		Absolute movement		Movement		Absolute movement	
	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Consumer price index	–2.10	7.56	5.51	5.57	–0.61	9.64	6.68	6.96
Producer price index	1.61	15.47	6.57	14.09	3.69	17.85	7.33	16.69
GDP	3.54	9.48	5.75	8.18	1.59	7.02	5.80	3.83
Current account balance	–0.23	7.43	4.79	5.68	1.00	8.80	6.12	6.40
Industrial output	–2.04	8.32	5.71	6.37	–2.78	6.75	5.75	4.48
Unemployment rate	3.50	13.38	6.17	12.37	1.60	8.04	5.80	5.79
Public sector deficit	0.85	9.11	5.98	6.92	2.66	8.46	6.30	6.25
Report on Inflation	–5.59	14.43	9.31	12.10	2.09	7.42	5.95	4.54
Reuters poll	3.59	16.98	7.53	15.63	–0.76	12.93	7.32	10.67
Meeting of the Monetary Council	–1.97	33.46	14.18	30.37	–0.67	17.27	9.45	14.47
Policy rate change	–3.64	61.95	35.92	50.61	2.79	30.9	20.64	23.16
Non-announcement day	0.42	9.11	5.10	7.56	0.02	8.85	6.00	6.50

We conducted a hypothesis test of each announcement in order to confirm the above statement relating to the fact whether the yield movements following announcements significantly differ from yield movements on non-announcement days. As a zero hypothesis, we assumed that the average yield movements following the various announcements do not significantly differ from the average yield movements on non-announcement days. This assumption was accepted at a 95% confidence level, almost without exceptions (see Table 25).[9]

As a further possibility, we examined whether it was possible to fit a regression function on the yield movements with the help of dummy variables. The value of the dummy variable was regarded as 1, if the given macro data was announced, and as 0, if not. On the

Table 25

Empirical t-statistics of the hypothesis test

Announcement	t-statistics short-term	t-statistics long-term
Consumer price index	–1.72	–0.34
Producer price index	0.4	1.09
GDP	1.03	0.69
Current account balance	–0.45	0.57
Industrial output	–1.54	–2.13*
Employment vs. unemployment	1.24	1.01
Public sector deficit	0.24	1.64
Report on Inflation	–1.31	0.85
Reuters poll	1.21	–0.41

* Differs from the non-announcement day average at a 95% confidence level.

[9] The significant deviation in the case of the only exception, the effect of industrial production on long-term yields, is not caused by the announcement itself either, but by the fact that the time of the announcement coincided several times with the events strongly influencing the yields (see the section on eliminating outliers).

basis of the characteristics of the regression estimates we find (see Table 26) that we can-not set up a regression equation on any of the macro data to be accepted at a 95% con-fidence level.

Table 26

Characteristics of the regression between announcements and yield movements

Data	Yield	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value
Consumer price index	Short-term	0.261	−2.990	−0.85	0.71	40%
	Long-term	−0.022	−0.343	−0.15	0.02	88%
Producer price index	Short-term	0.11	−0.014	0.00	0.00	99%
	Long-term	−0.17	2.781	1.23	1.51	22%
GDP	Short-term	0.061	3.116	0.52	0.27	60%
	Long-term	−0.062	1.035	0.27	0.08	78%
Current account balance	Short-term	0.23	−0.561	−0.21	0.04	83%
	Long-term	0.191	−1.024	−0.50	0.25	61%
Industrial output	Short-term	0.303	−3.871	−1.09	1.20	27%
	Long-term	0.124	−3.286	−1.47	2.17	14%
Employment vs. unemployment	Short-term	−0.051	3.541	0.99	0.97	32%
	Long-term	−0.128	1.723	0.76	0.58	44%
Public sector deficit	Short-term	0.174	0.662	0.25	0.06	79%
	Long-term	0.026	2.641	1.35	1.82	18%
Report on Inflation	Short-term	0.201	−5.764	−0.93	0.86	35%
	Long-term	−0.073	2.160	0.55	0.30	58%
Reuters poll	Short-term	−0.134	3.491	1.17	1.37	24%
	Long-term	0.032	−0.973	−0.52	0.27	60%

The results show that the fact of the announcement did not have an effect on either the short-term or the long-term yields in the case of any of the data (nevertheless, we should not disregard the possibility that the lack of correlation may be due to the fact that the data were not exact enough – lack of intra-day yields).

4.4 DEVIATION FROM EXPECTATIONS

Since, according to our experience, the fact of the announcement of macroeconomic news does not characteristically influence the yields, we examine below whether we can discover a similar correlation between the surprise value of news and yield movements to what we experienced in the case of the exchange rate. The following equation was used to describe the connection with the help of a regression equation:

$$\Delta r_t = a_0 + a_1 x_t + v_t,$$

where Δr_t is the yield movement on day t, x_t is the difference between the actual and the estimated data on day t, v_t is the adjustment for errors (see Table 27).

Table 27
Characteristics of regressions between expectation errors and yield movements

| Data	Yield	a_0 (Constant)	a_1 (Coefficient)	t statistics	F statistics	p value	R^2
Consumer price index	Short-term	−0.588	10.121	1.92	3.68	6%	0.11
	Long-term	2.259	26.007	4.68	21.88	1%	0.43
GDP	Short-term	0.983	−8.410	3.46	12.01	1%	0.6
	Long-term	−3.227	−16.810	−4.19	17.57	1%	0.69
Current account balance	Short-term	−0.314	−1.303	−1.83	3.23	8%	0.10
	Long-term	0.830	−2.704	−3.52	12.30	0.1%	0.30
Industrial output	Short-term	−4.041	−1.771	0.76	0.57	45%	0.02
	Long-term	−3.259	−0.355	−0.25	0.06	80%	0.00
Public sector deficit	Short-term	1.410	−0.031	−0.79	0.63	43%	0.02
	Long-term	2.041	−0.060	−1.62	2.64	11%	0.09

As in the case of the exchange rate movements, it is found that there is a clear relationship between the surprise value of the consumer price index, GDP and the current account balance versus yield movements, while the unexpected components of industrial output and the public sector deficit do not provide a good explanation for yield movements.

4.4.1 Consumer price index

The relationship between the expectation error of the consumer price index and short-term yield movements may be accepted at a 90% confidence level, while the relationship between the consumer price index expectation error and long-term yield movements may be accepted at a 95% confidence level. The surprise value of the news is more closely connected with the long-term yields, which is also shown by the higher value of the determination coefficient. It is true for both types of yields that most of the value pairs are found in logically reasonable quarters (favourable news - decrease of yield; unfavourable news - increase of yield), although there are points falling far from the regression line (see Charts 18 and 19). On the basis of the regression, if the inflation datum is one percentage point better than the expectations, short-term yields decline by an average of 10 and long-term yields by 26 basis points.

Chart 18

Consumer price index expectation errors and short-term yield movement

basis point   basis point

$$y = 10.121x - 0.5881$$
$$R^2 = 0.1161$$

Expectation error (percentage point)

Unfavourable   Favourable
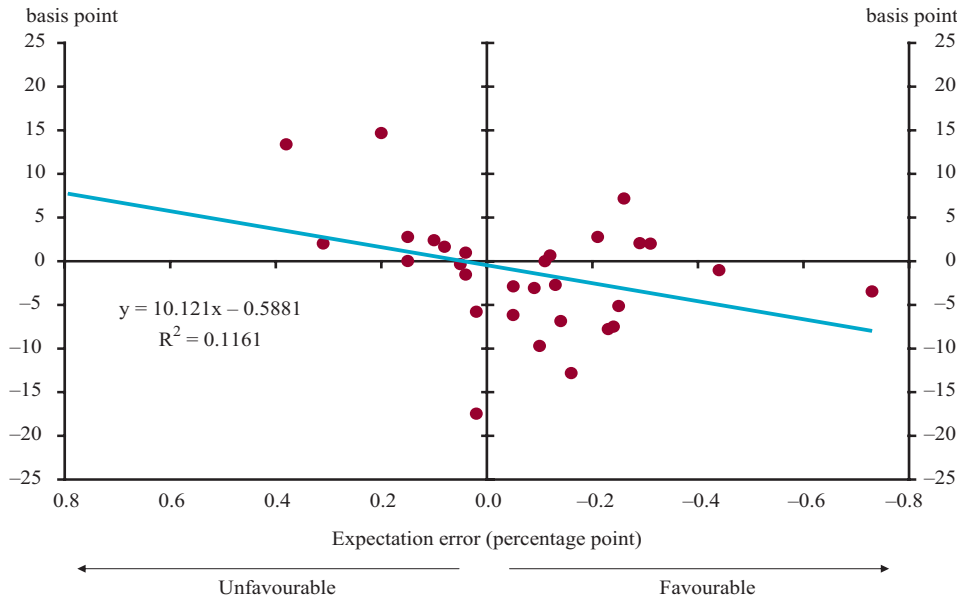
Chart 19

Consumer price index expectation errors and long-term yield movement

basis point   basis point

$$y = 26.007x + 2.2591$$
$$R^2 = 0.4388$$

Expectation error (percentage point)
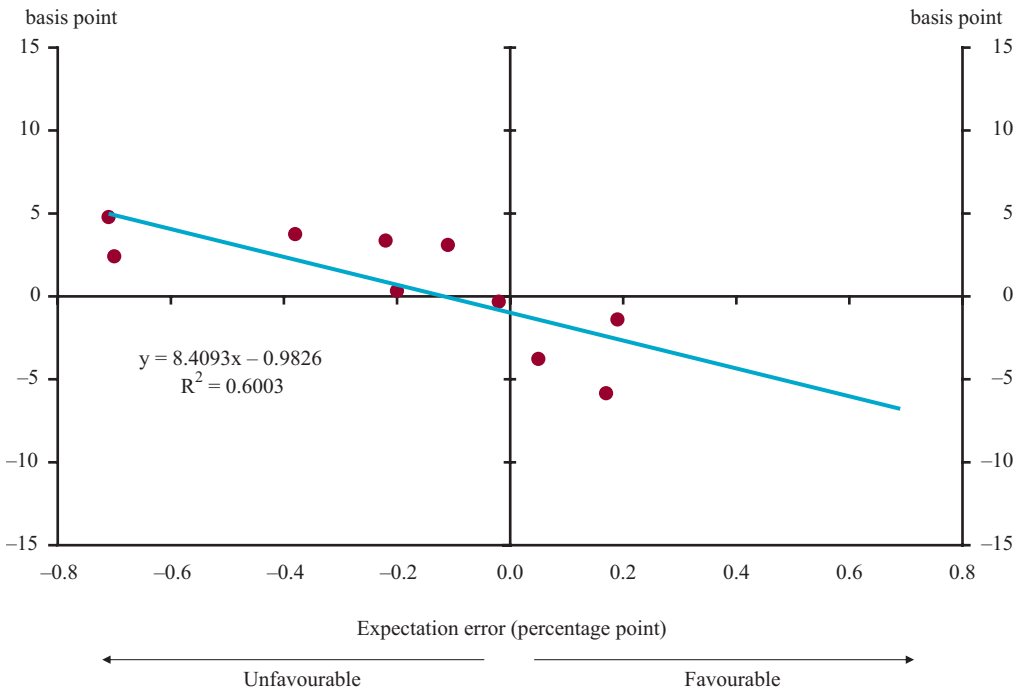
Unfavourable   Favourable
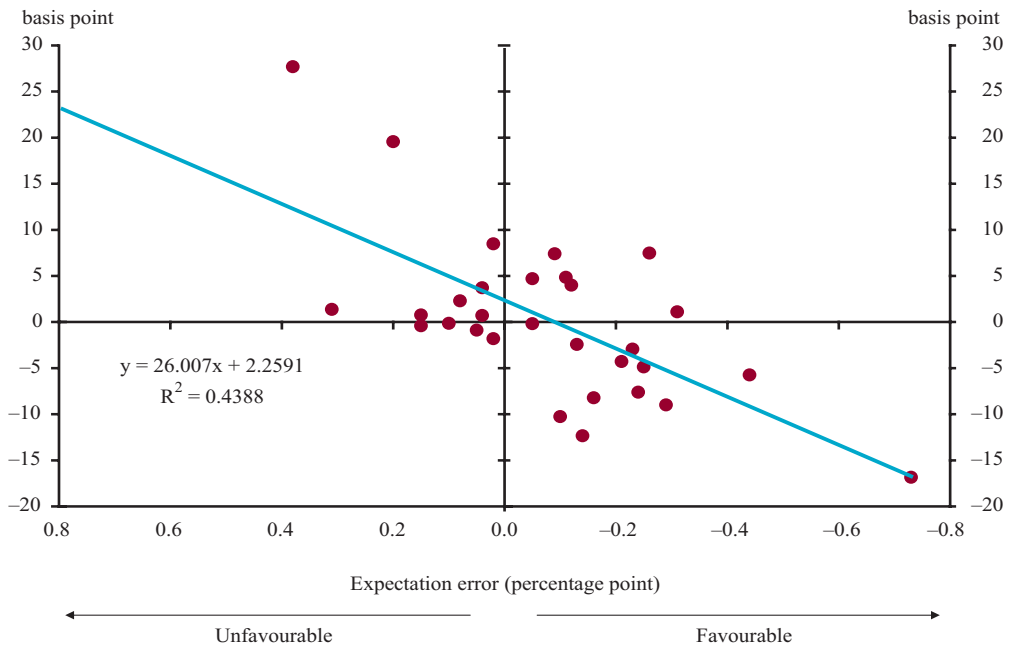
4.4.2 Growth rate of gross domestic product

The regression between GDP expectation errors and yields seems to be very strong in the case of both short and long-term yields, which is supported by both the statistical tests and the high value of the determination coefficient. Similarly to the consumer price index data, there is a closer relationship with long-term yields here as well. Due to a one percentage point higher-than-expected growth rate, an 8-basis-point decline in short-term yields and a 16-basis-point decline in long-term yields can be observed on the basis of the regression equation. At the same time we must note again that although the points fit the regression line quite well and each point is located in the 'relevant' quarter (see Charts 20 and 21), there are very few observations available. Therefore, even one more datum may significantly modify the results. In the case of a sample with more elements we would have found more exceptions.
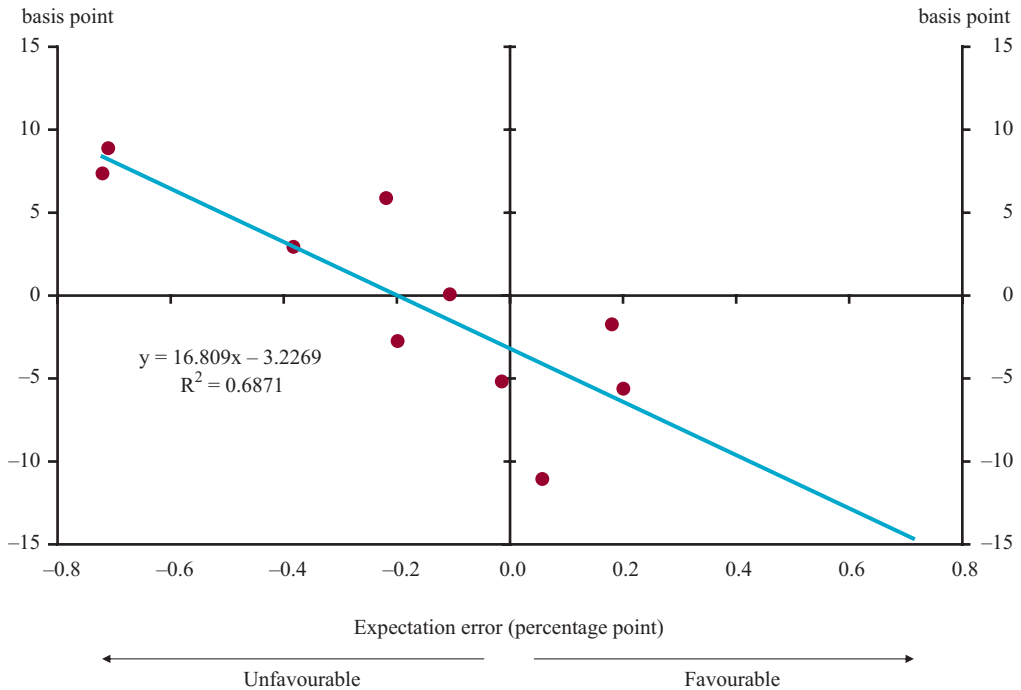
Chart 20

GDP expectation errors and short-term yield movements

$$y = 8.4093x - 0.9826$$
$$R^2 = 0.6003$$

Expectation error (percentage point)

Unfavourable   Favourable

Chart 21

GDP expectation errors and long-term yield movements

basis point   basis point

$$y = 16.809x - 3.2269$$
$$R^2 = 0.6871$$

Expectation error (percentage point)

Unfavourable   Favourable

4.4.3 Current account balance

The deviation of current account balance from the expectations shows a closer corre-lation with long-term yields. Favourable news-decline in yields and unfavourable news-increase in yields value pairs are characteristic of most of the data. When this is not the case, we observe only a slight yield movement. The value of the determination coeffi-cient is relatively high (the deviation gives an explanation to 30% of the variance analy-sis of the long-term yield movement), and the regression equation may be accepted on the basis of the t and F test. There is only a weaker connection with short-term yields. Deviation from expectations causes less movement, an error of hundred million euros on average causes a 1.3 and a 2.7 basis point change in short and long-term yields, respectively.
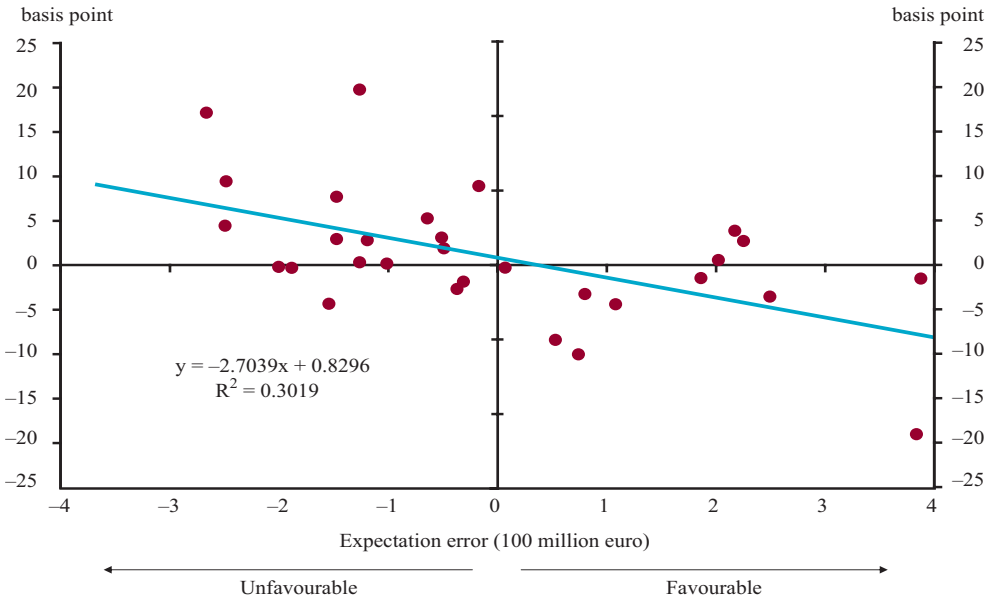
Chart 22

Current account balance expectation errors and short-term yield movements

$$y = -1.3033x - 0.3143$$
$$R^2 = 0.0986$$

Expectation error (100 million euro)

Unfavourable   Favourable
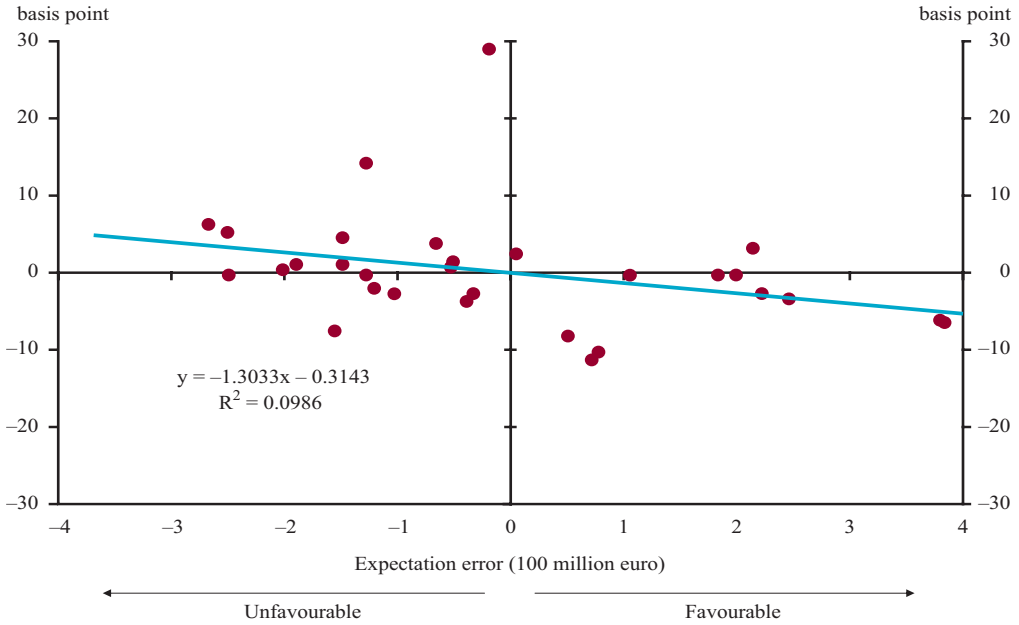
Chart 23

Current account balance expectation errors and long-term yield movements

$$y = -2.7039x + 0.8296$$
$$R^2 = 0.3019$$

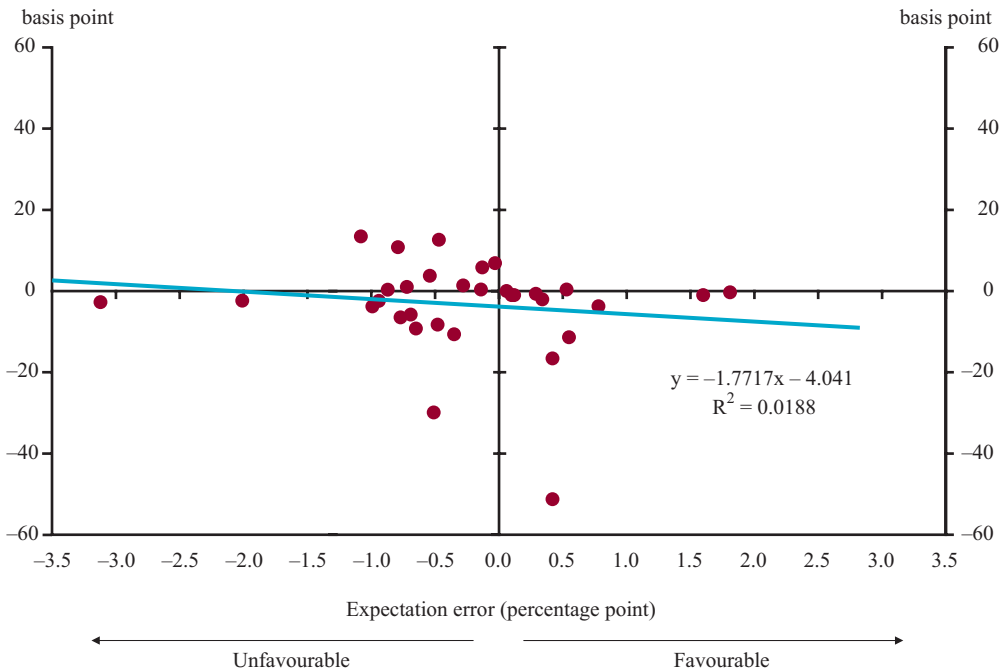Expectation error (100 million euro)

Unfavourable   Favourable
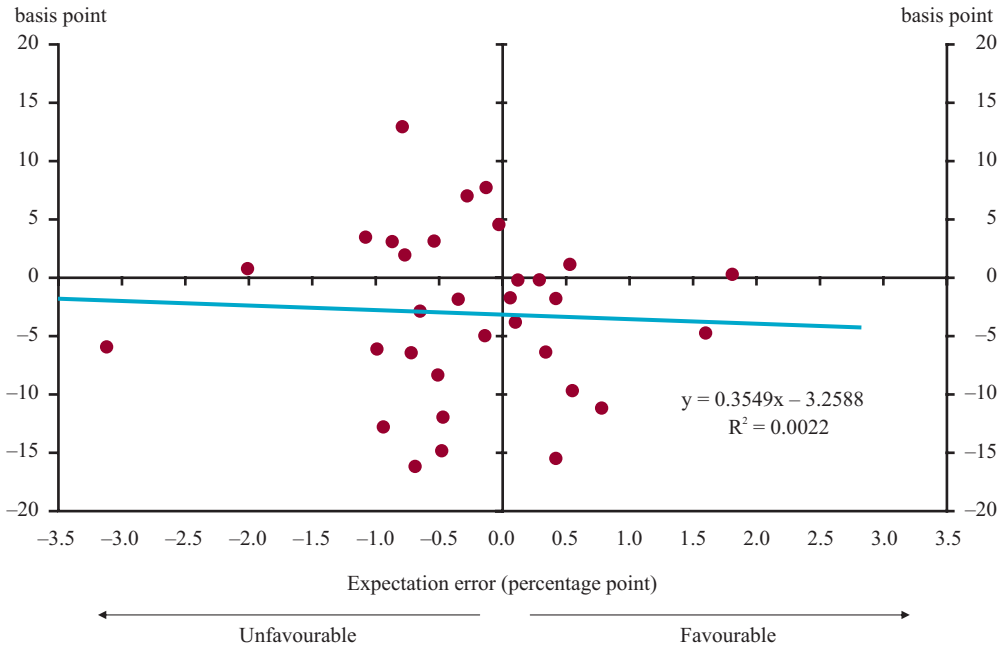
4.4.4 Growth rate of industrial output

The regression line placed on the industrial output expectation errors and yield movements following announcements is almost horizontal, that is, no trends can be discovered among the data. The value of the determination coefficient is practically zero, and on the basis of the values of the t and F tests referring to the regression we also have to dismiss the assumption that the expectation errors of industrial output influence yield movements.

Chart 24

**Industrial output expectation errors and short-term yield movements**

$$y = -1.7717x - 4.041$$
$$R^2 = 0.0188$$

Expectation error (percentage point)

Unfavourable   Favourable

Chart 25

Industrial output expectation errors and long-term yield movements

basis point   basis point

y = 0.3549x − 3.2588

$R^2 = 0.0022$

Expectation error (percentage point)

Unfavourable   Favourable

4.4.5 Public sector deficit

The regression line does not seem to fit in the case of either short or long-term yields, as relatively few points are on the line and a lot are far from it. The points are not condensed in any of the quarters, and are relatively evenly distributed. The value of the determination coefficient is relatively low and on the basis of the statistical tests we cannot accept the similarity. The long-term yield has a closer correlation with the deviation, but even this cannot be considered significant.
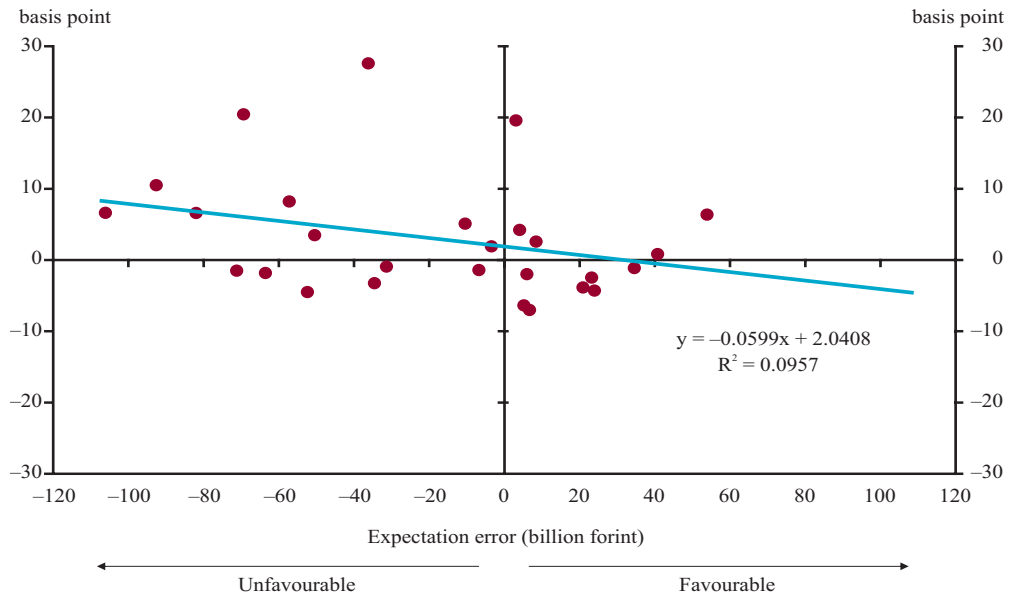
Chart 26

Public sector deficit expectation errors and short-term yield movement

$$y = -0.0309x + 1.4104$$
$$R^2 = 0.0246$$

Expectation error (billion forint)

Unfavourable Favourable
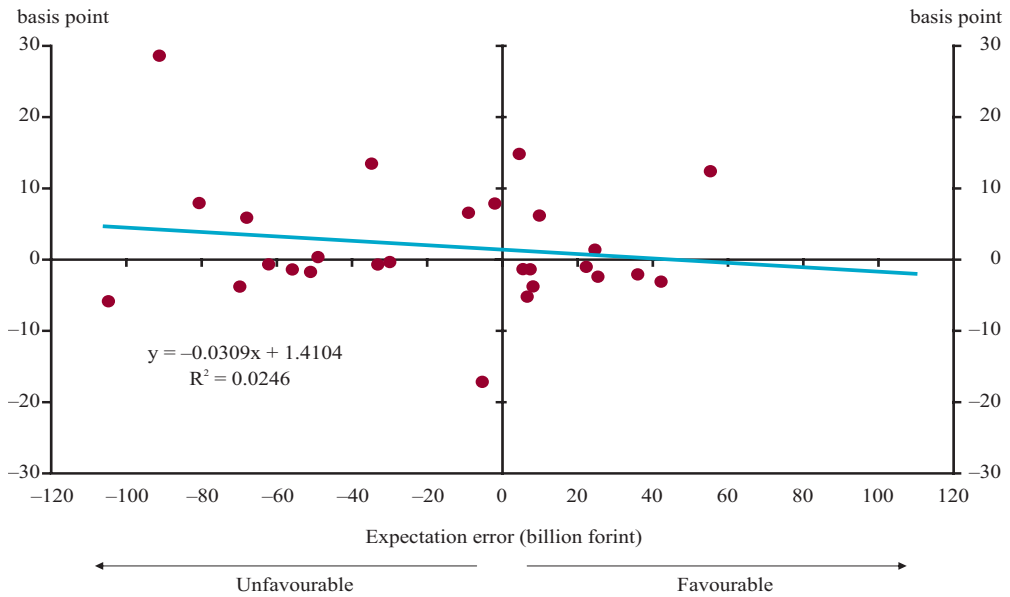
Chart 27

Public sector deficit expectation errors and long-term yield movement

$$y = -0.0599x + 2.0408$$
$$R^2 = 0.0957$$

Expectation error (billion forint)

Unfavourable Favourable

4.4.6 Response to positive and negative errors

When fitting the regression line we have already found that in the case of some macro data the points were mostly concentrated in two quarters, that is, the yields characteristically reacted to the favourable or unfavourable news in differing directions. The favourable news following announcement of the consumer price index, GDP and the current account balance – that is, lower-than-expected inflation, higher-than-expected growth or the lower-than-expected deficit – were followed by a decline in yields, while higher inflation, slower growth and a larger deficit were accompanied by a rise in yields. The size of the average movement is higher after the favourable news in four out of six cases, the average reaction given to the unfavourable news being the largest in the combination of consumer price index or current account balance and long-term yield. Following announcement of industrial output data, a negative average is calculated for average yield movements, while following public sector deficit data, a positive average may be calculated. The rules observed in the case of the other macroeconomic data do not apply.

Table 28

Yield movements as an effect of positive and negative errors *(basis points)*

	Yield	Favourable news	Unfavourable news
Consumer price index	Short-term	–4.08	1.07
	Long-term	–4.22	5.11
GDP	Short-term	–3.67	2.96
	Long-term	–6.14	3.96
Current account balance	Short-term	–4.04	2.30
	Long-term	–4.71	4.8
Industrial output	Short-term	–3.41	–1.27
	Long-term	–3.47	–2.38
Public sector deficit	Short-term	1.2	2.6
	Long-term	0.6	5.2

4.4.7 Response to large and small errors

As regards industrial output, we cannot find a correlation between the expectation error and the extent of the yield movement. In the case of the rest of the data, there were larger movements in yields for larger expectation errors (an exception is the impact of the current account balance on short-term yields). The difference, in terms of yields, is clearer for long-term yields, or in terms of announcements, for the consumer price index.

Table 29

Yield movement as an effect of large and small errors *(basis points)*

	Yield	Large			Small		
		Piece	Average movement	Average absolute movement	Piece	Average movement	Average absolute movement
Consumer price index	Short-term	11	−1.94	6.79	20	−2.17	4.77
	Long-term	11	−3.13	9.97	20	0.78	4.87
GDP	Short-term	3	3.65	3.65	7	−0.70	2.97
	Long-term	3	6.68	6.68	7	−2.45	4.57
Current account balance	Short-term	10	−0.81	3.51	20	0.05	5.42
	Long-term	10	1.47	7.51	20	0.74	5.43
Industrial output	Short-term	11	0.15	4.33	20	−3.23	6.45
	Long-term	11	−1.65	5.75	20	−3.38	5.74
Public sector deficit	Short-term	9	4.60	7.6	18	0.67	4.90
	Long-term	9	5.71	7.43	18	1.86	5.45

4.5 SENSITIVITY TEST, REFINEMENTS

As there are no two-minute data available for yields, the results may only be improved by eliminating the outliers. Naturally, in this case we eliminated those days from the sample, which we have already listed when carrying out the elimination in the case of exchange rates.

4.5.1 Calculation of regression

With regard to the consumer price index, there is no essential change compared to the data calculated on the basis of the original data. The data referring to the connection between GDP data and long-term yields did not essentially change, while the results relating to short-term yields show a lower correlation than in the original case. The situation is similar in the case of the current account balance: the data after the changes show a higher correlation with long-term yields than with short-term yields. Despite the refinements, industrial output does not show any relationship with yield changes. The only case when we may clearly talk about improvement is the public sector deficit: there is a high-

Table 30

Characteristics of regressions created by eliminating outliers

Data	Yield	a_0 (constant)	a_1 (coefficient)	t statistics	F statistics	p value	R^2
Consumer price index	Short-term	−0.614	9.857	1.78	3.17	9%	0.10
	Long-term	2.390	26.817	4.29	18.47	0.1%	0.45
GDP	Short-term	−0.121	−6.305	−1.88	3.55	12%	0.41
	Long-term	−4.072	−20.294	−3.44	11.83	2%	0.70
Current account balance	Short-term	−0.326	−1.278	−1.51	2.32	14%	0.08
	Long-term	0.353	−3.177	−3.62	13.13	0.1%	0.33
Industrial output	Short-term	−1.670	−0.562	−0.27	0.07	79%	0.00
	Long-term	−3.351	−0.500	−0.29	0.08	77%	0.00
Public sector deficit	Short-term	−0.337	−0.062	−1.62	2.62	12%	0.10
	Long-term	0.457	−0.085	−2.39	5.75	3%	0.20

er correlation than previously in the case of both long and short-term yields, and there is a significant correlation with long-term yields.

4.5.2 Response to positive and negative errors

In the case of three types of data (consumer price index, GDP growth and current account balance), we obtained suitable results even before elimination, which did not change after elimination. The fact that favourable news was in general followed by a decline in yields, while unfavourable news was followed by a rise in yields indicates that the news has an effect on the government securities market. In the case of industrial output, the picture did not change despite the refinements: no correlation is found between the news and the yields. The refinements changed the results in one case - after taking out two data, in the case of public sector deficit there is a tendency that, as a reaction to bad news, yields tend to increase, while in the case of good news there is a decline. Where this tendency applies at all, the difference is clearer in the case of long-term yields.

Table 31

Yield change as an effect of positive and negative errors, by eliminating the outliers

	Yield	Favourable news	Unfavourable news
Consumer price index	Short-term	−3.03	0.91
	Long-term	−3.52	5.99
GDP	Short-term	−2.58	2.59
	Long-term	−8.39	3.21
Current account balance	Short-term	−4.09	2.30
	Long-term	−5.25	4.80
Industrial output	Short-term	−2.09	−1.29
	Long-term	−3.64	−3.02
Public sector deficit	Short-term	−1.27	2.60
	Long-term	−1.91	5.19

4.5.3 Response to large and small errors

The modification of the sample did not change our earlier findings in any of the cases. The only change is the fact that in the case of industrial output data it became applicable that as a response to a larger expectation error there is a bigger average absolute movement, but the difference is rather small. The differences are clearer in the case of long-term yields again.

Table 32

Yield change as an effect of large and small errors, by eliminating the outliers

	Yield	Large			Small		
		Piece	Average movement	Average absolute movement	Piece	Average movement	Average absolute movement
Consumer price index	Short-term	10	0.18	5.16	18	−2.40	4.98
	Long-term	10	−0.94	8.46	18	0.56	5.11
GDP	Short-term	2	3.08	3.08	5	0.33	2.39
	Long-term	2	6.18	6.18	5	−2.61	5.16
Current account balance	Short-term	9	−0.14	3.14	19	0.09	5.67
	Long-term	9	1.86	8.11	19	0.89	5.62
Industrial output	Short-term	9	1.21	4.26	18	−2.99	5.92
	Long-term	9	−1.58	6.15	18	−4.08	5.84
Public sector deficit	Short-term	8	3.62	7.55	17	−0.16	4.62
	Long-term	8	5.63	6.98	17	0.81	4.37

Elimination of the outliers of the sample primarily caused a change in the results relating to the public sector deficit, resulting in better indices at the regression calculations and clearer differences between the yield movements following the various types of news. In the case of the other data, the same trends can be observed as in the case of taking the total sample into consideration.

5. CONCLUSIONS

In this paper, we attempted to determine whether there is a correlation between the announcement of macroeconomic data and the forint/euro exchange rate or yields in the government securities market. Based on the findings, the examined data may be classified into three clearly separate groups.

The first group consists of announcements of the consumer price index, GDP growth and the current account balance, which have a clear effect on the money market. The announcement of these data resulted in larger movements in both the forint/euro exchange rate and in yields in the government securities market than experienced on other days. Apart from the fact that the money market is clearly more sensitive to these announcements, exchange rate and yield movements primarily show a significant correlation with the unexpected component of these data, that is, even if the absolute value of the data is not significant, its deviation from the expectations of the analysts is significant from the point of view of the money market processes. The movements of the exchange rates and the yields caused by the surprise value of the data can be suitably described by the regression equations.

In the case of the exchange rate, the effect of the new information is primarily manifested in the few hours following announcement. Within a one-day period the correlation was not significant any longer, the effect is priced out and the exchange rate moves to a level justified by other factors. By eliminating days when other important events influenced the exchange rate aside from the announcement, the correlation remained for the one-day periods as well.

Contrary to this, the information content of new data had a more lasting effect on the yields, the correlation being traceable with regard to one-day movements as well. The close correlation is not significantly modified by eliminating the outliers from the sample. The announcement of the data have a more significant effect on long-term yields: on the one hand, there is a closer correlation with the unexpected component of the data, and on the other hand, a similar surprise causes larger movements in long-term yields than in short-term yields.

Apart from the fact that the deviation from expectations provides a good explanation of exchange rate and government securities yield movements in the period following the announcement of the consumer price index, GDP and the current account balance, we also found that both the direction and the extent of the deviation influence the direction and the extent of exchange rate and yield movements well. In the hours following the

announcements, the exchange rate reacted to favourable news by strengthening and to unfavourable news by weakening, while yields characteristically declined on days with the favourable announcements and rose when unfavourable inflation and growth reports were published. The data with greater surprise value move the forint exchange rate and government securities yields more vigorously, while the data meeting expectations result in less vigorous movements.

A potential interpretation of these findings is the fact that since in part of the examined period (especially during 2002), the Magyar Nemzeti Bank successfully communicated the desirable width of the band in order to reach the targeted inflation level, exchange rate expectations were mainly determined by this communication, therefore, the macro data were only able to affect the exchange rates for a short period. However, the desired level of yields was not so clearly articulated and this is why the information content of the new data is more strongly reflected in yields. The closer correlation with long-term yields may refer to the fact that the market did not expect the Bank to immediately (or shortly) react to data differing from expectations, but with regard to the longer-term expectations of monetary conditions the data had a more significant effect.

The second group consists of industrial output and the public sector deficit, where no similar correlation was found and the relationship with the surprise value of the new information was not significant. The reason for this may be the fact that information on the government budget is published continuously between the analysts' surveys and the announcements of the data as well, therefore, the effect of new information does not appear in a concentrated way at the time of the announcement. In the case of industrial output, the projections of analysts in most cases significantly differ from the facts, and therefore, expectations do not have a relevant orientation role and this is why no correlation can be observed.

There are no analyst expectations regarding the other data (producer price index, unemployment, etc.) which would enable us to examine the relationship with their deviation from expectations, and the announcement of data itself does not have a significant effect on the exchange rate and yields.

6. REFERENCES

Almeida, Alvaro; Goodhart, Charles; Payne, Richard (1988): The effects of macroeconomic news on high frequency exchange rate behaviour; Journal of Financial and Quantitative Analysis; 33; 383-408.

Ederington, Louis H.; Lee, Jae Ha (1995): The short-run dynamics of the price adjustment to new information; Journal of Financial and Quantitative Analysis; 30; 117-134.

Edison, Hali J. (1997): The reaction of exchange rates and interest rates to news releases; International Journal of Finance and Economics; 2; 87-100.

Hardouvelis, Gikas A. (1988): Economic news, exchange rates and interest rates; Journal of International Money and Finance; 2; 23-25.

APPENDIX 1: EXCHANGE RATE MOVEMENTS FOLLOWING ANNOUNCEMENT OF CERTAIN MACRO DATA

Chart 28

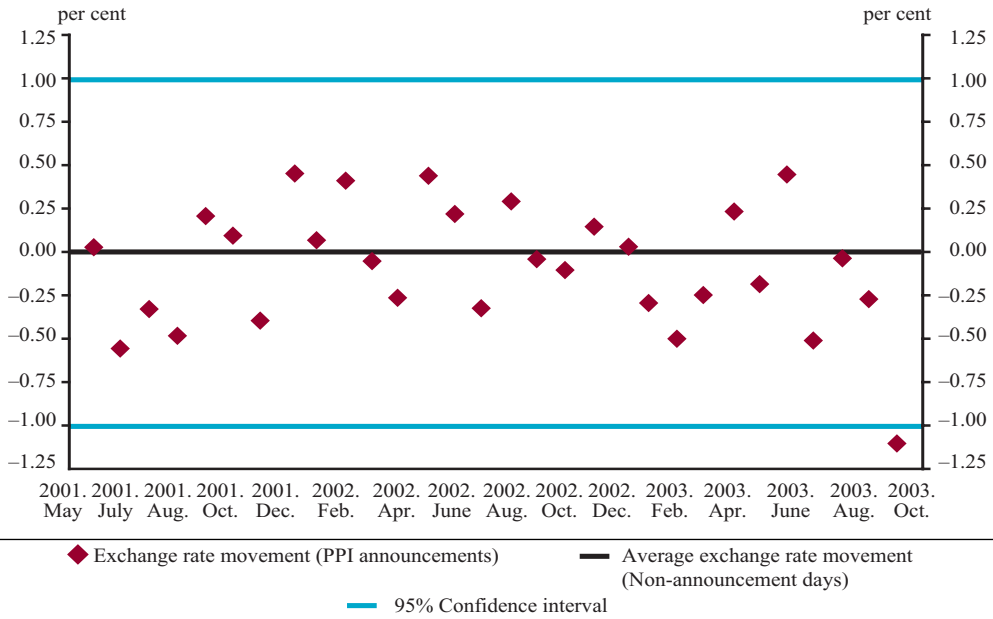**Exchange rate movements following announcement of the consumer price index**

Legend:
- ◆ Exchange rate movement (CPI announcements)
- — Average exchange rate movement (Non-announcement days)
- — 95% Confidence interval
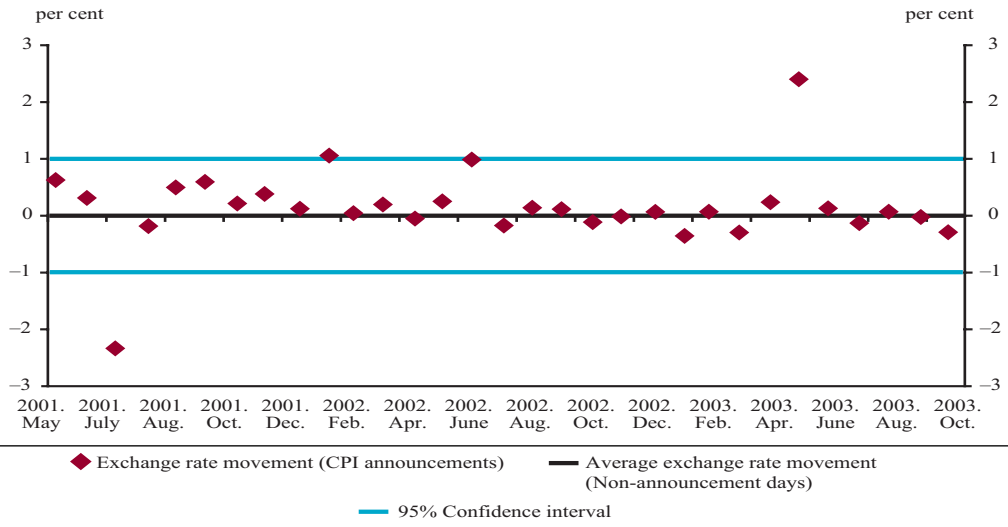
Chart 29

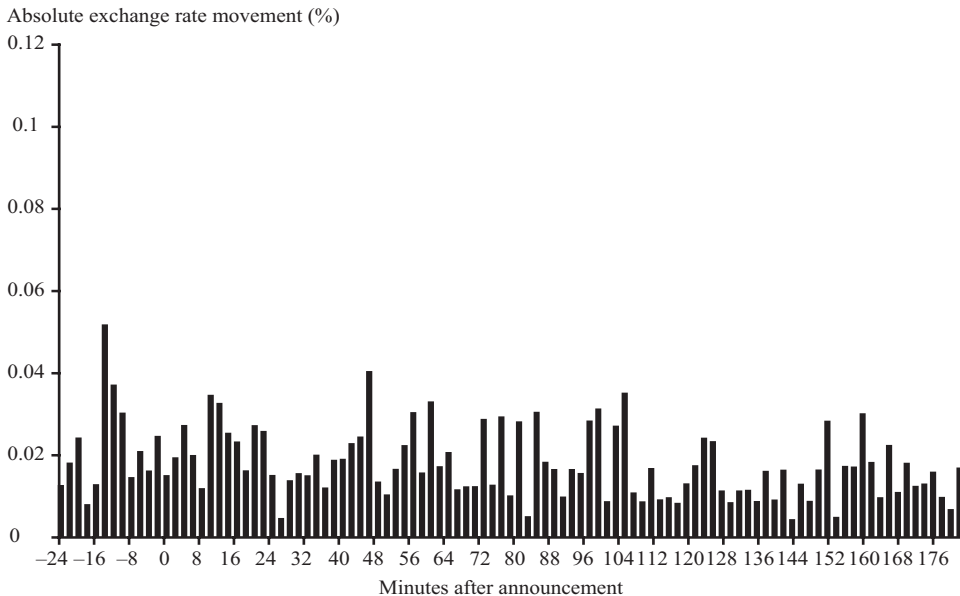**Average absolute exchange rate movement following announcement of the consumer price index** *(two-minute data)*
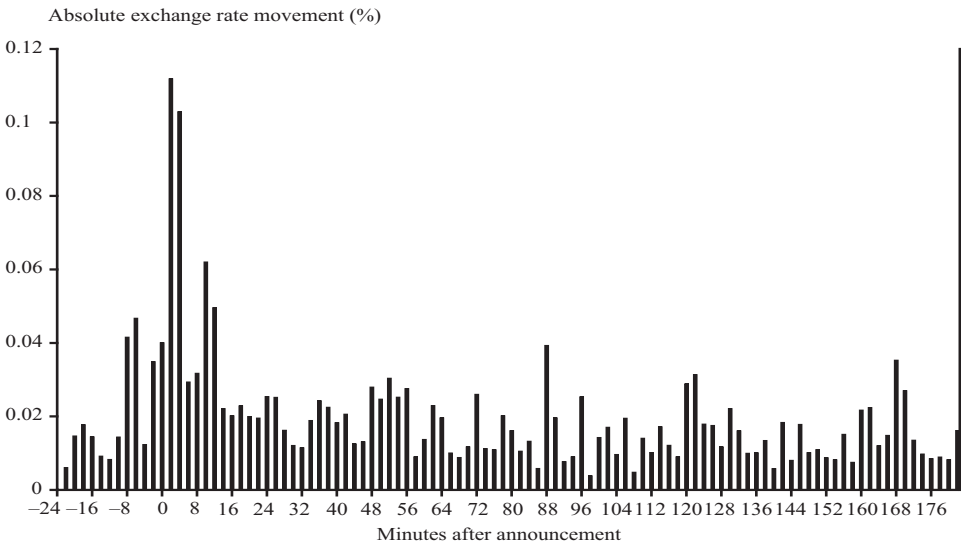
Chart 30

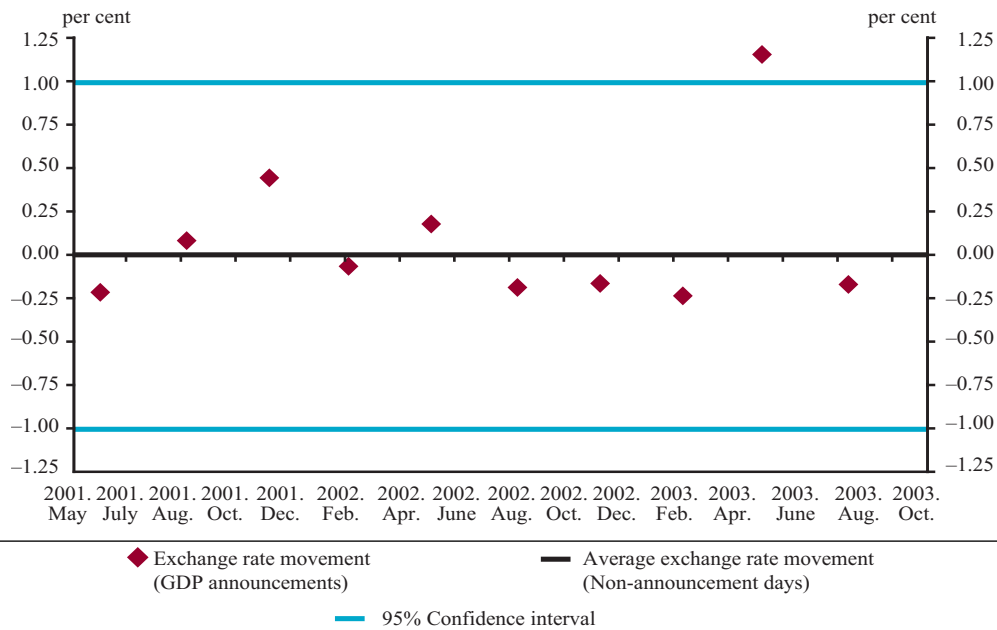**Exchange rate movements following announcement of the producer price index**

Legend:
- ◆ Exchange rate movement (PPI announcements)
- Average exchange rate movement (Non-announcement days)
- 95% Confidence interval

Chart 31

Average absolute exchange rate movement following announcement of the producer price index *(two-minute data)*

Chart 32

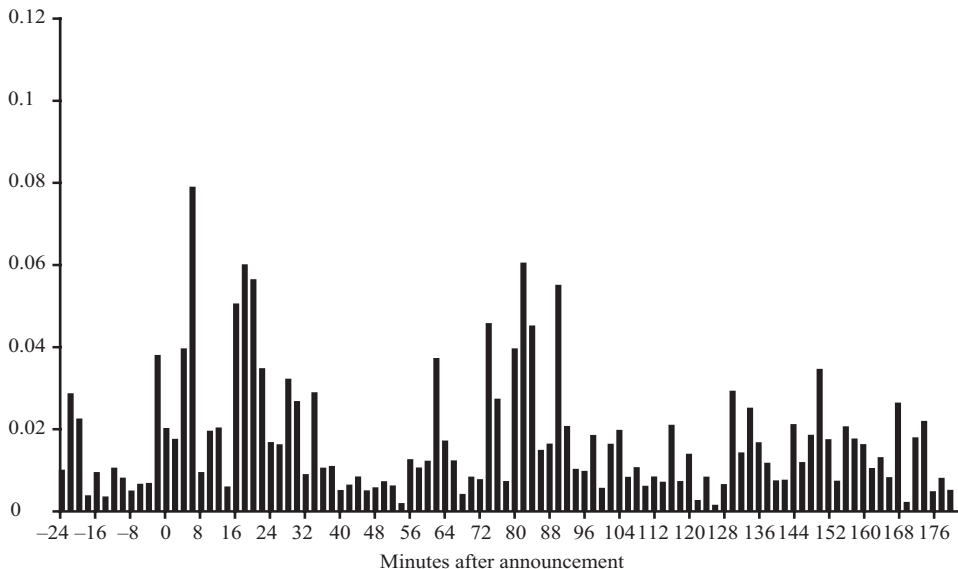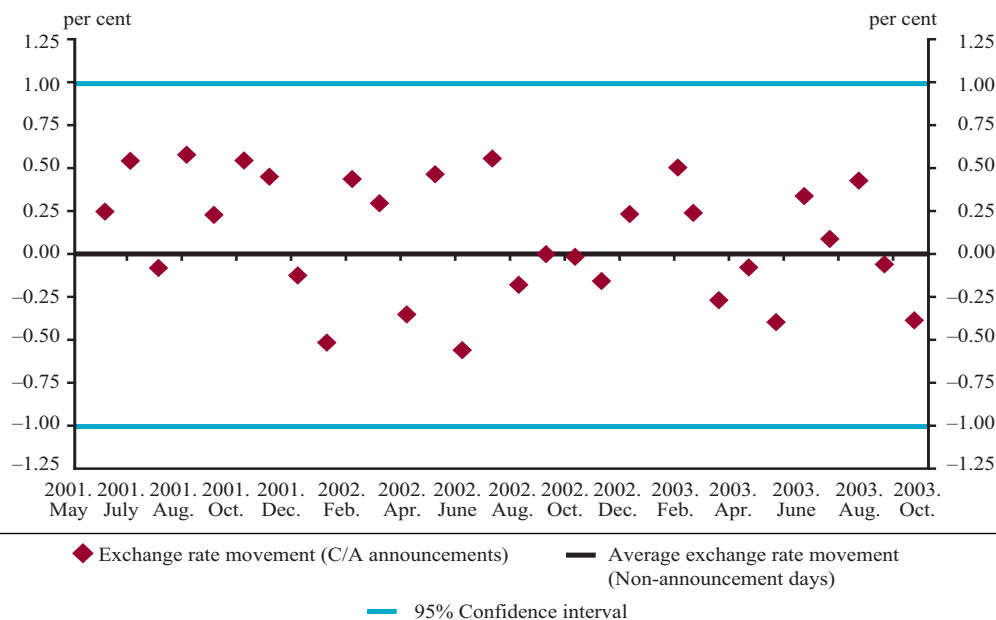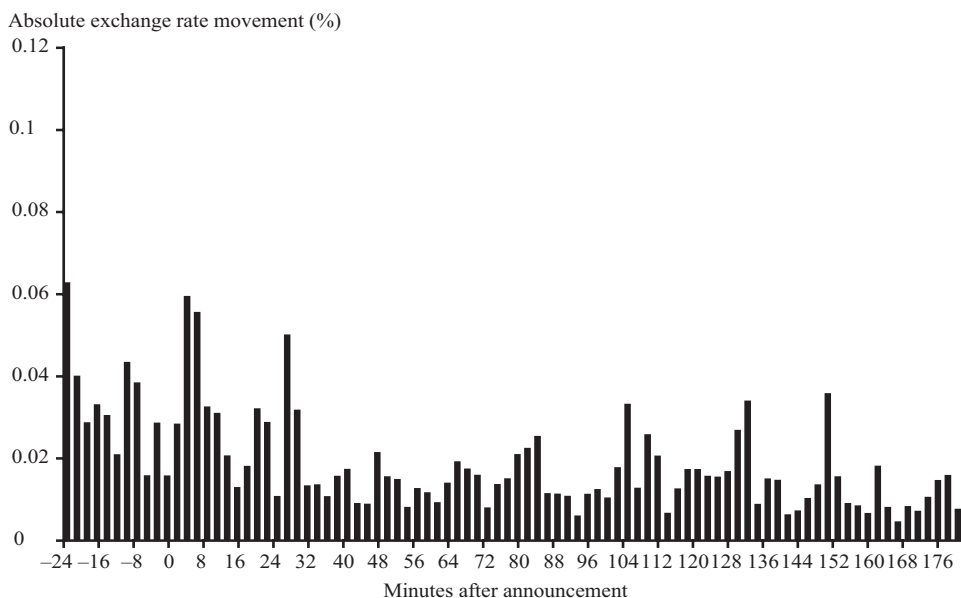**Exchange rate movements following announcement of GDP**

per cent   per cent

| | 2001. May | 2001. July | 2001. Aug. | 2001. Oct. | 2001. Dec. | 2002. Feb. | 2002. Apr. | 2002. June | 2002. Aug. | 2002. Oct. | 2002. Dec. | 2003. Feb. | 2003. Apr. | 2003. June | 2003. Aug. | 2003. Oct. |

◆ Exchange rate movement   ▬ Average exchange rate movement
   (GDP announcements)   (Non-announcement days)

▬ 95% Confidence interval

Chart 33

Average absolute exchange rate movement following announcement of GDP

(two-minute data)

Absolute exchange rate movement (%)

Minutes after announcement

Chart 34

Exchange rate movement following announcement of the current account balance

per cent

1.25	1.25
1.00	1.00
0.75	0.75
0.50	0.50
0.25	0.25
0.00	0.00
–0.25	–0.25
–0.50	–0.50
–0.75	–0.75
–1.00	–1.00
–1.25	–1.25

2001. 2001. 2001. 2001. 2001. 2002. 2002. 2002. 2002. 2002. 2002. 2003. 2003. 2003. 2003. 2003.
May July Aug. Oct. Dec. Feb. Apr. June Aug. Oct. Dec. Feb. Apr. June Aug. Oct.

◆ Exchange rate movement (C/A announcements)   ▬ Average exchange rate movement
(Non-announcement days)

▬ 95% Confidence interval

Chart 35

**Average absolute exchange rate movement following announcement
of the current account balance** *(two-minute data)*
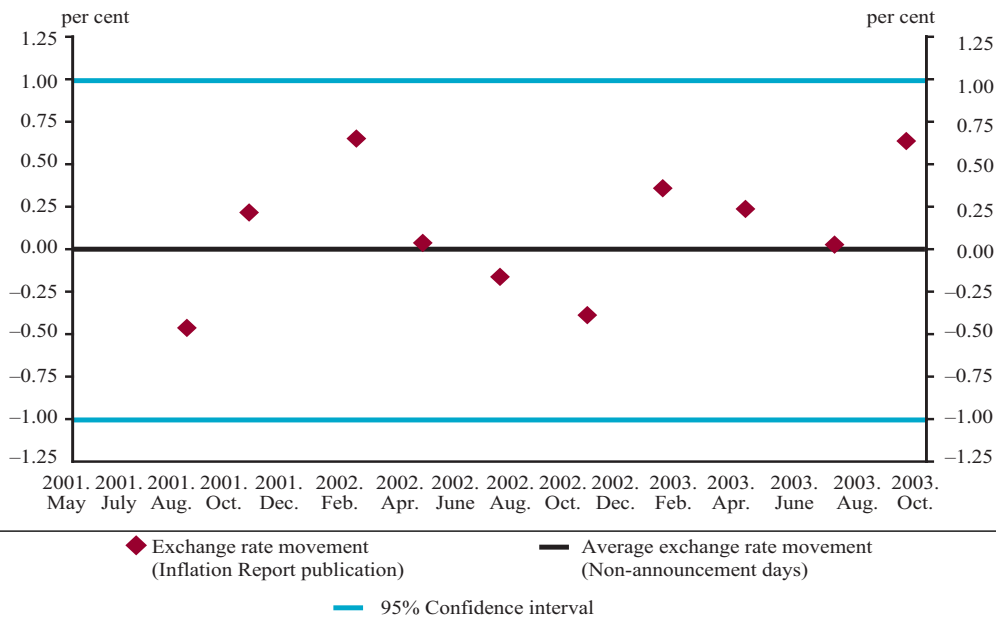
Absolute exchange rate movement (%)

0.12	
0.1	
0.08	
0.06	
0.04	
0.02	
0	

–24 –16 –8 0 8 16 24 32 40 48 56 64 72 80 88 96 104 112 120 128 136 144 152 160 168 176
Minutes after announcement

Chart 36

Exchange rate movement following announcement of industrial output

◆ Exchange rate movement (IP announcements)	▬ Average exchange rate movement (Non-announcement days)
▬ 95% Confidence interval	
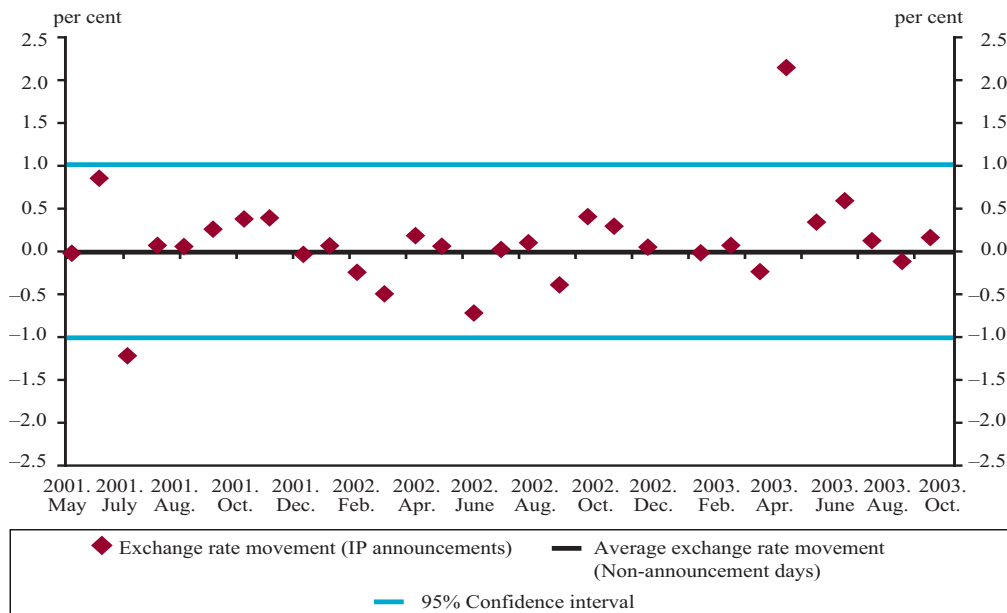
Chart 37

Average absolute exchange rate movement following the announcement of industrial output *(two-minute data)*
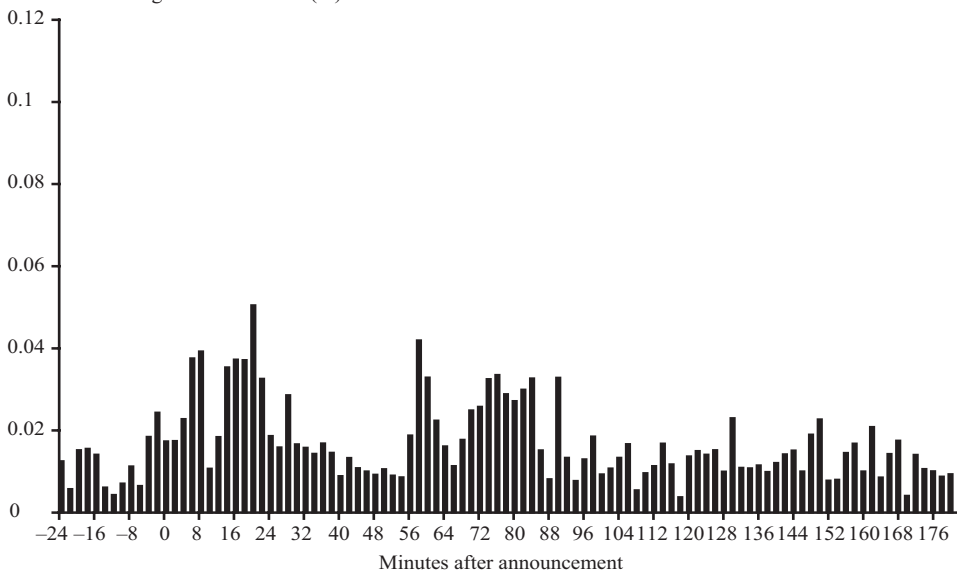
Chart 38

Exchange rate movement following the announcement of employment vs. unemployment
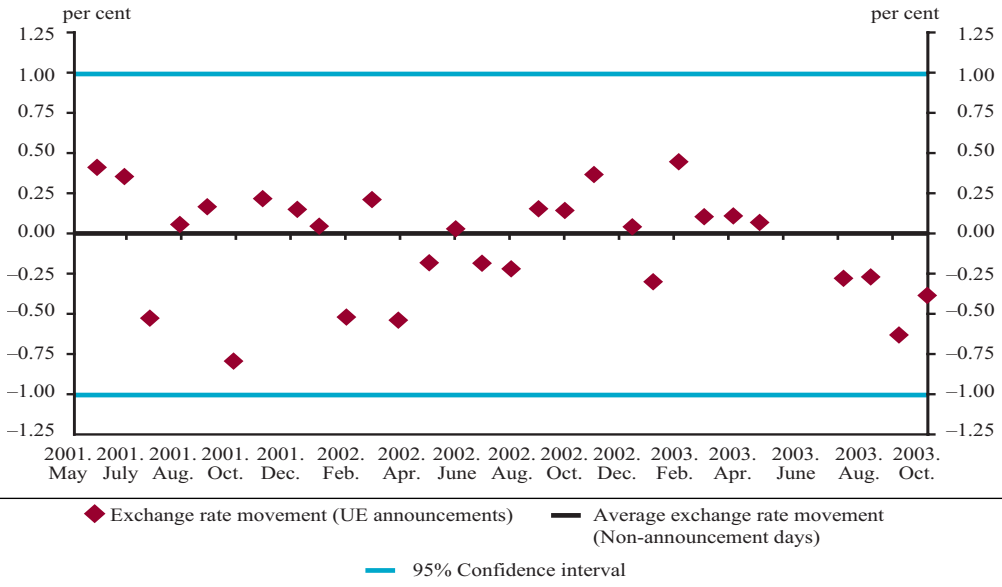
Chart 39

Average absolute exchange rate movement following the announcement of employment vs. unemployment *(two-minute data)*
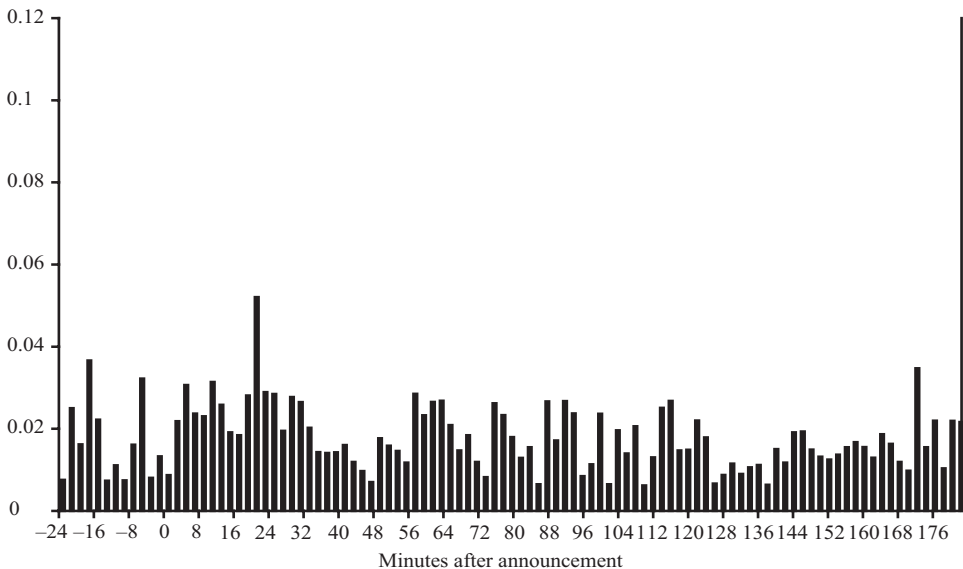
Chart 40

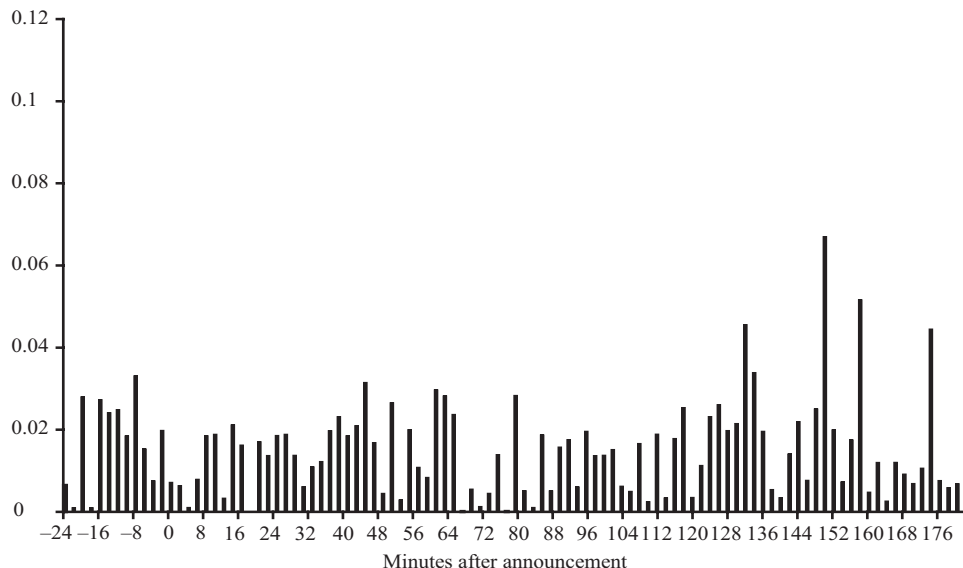**Exchange rate movement following publication of the Report on Inflation**

per cent   per cent

◆ Exchange rate movement
(Inflation Report publication)

— Average exchange rate movement
(Non-announcement days)

— 95% Confidence interval

Chart 41

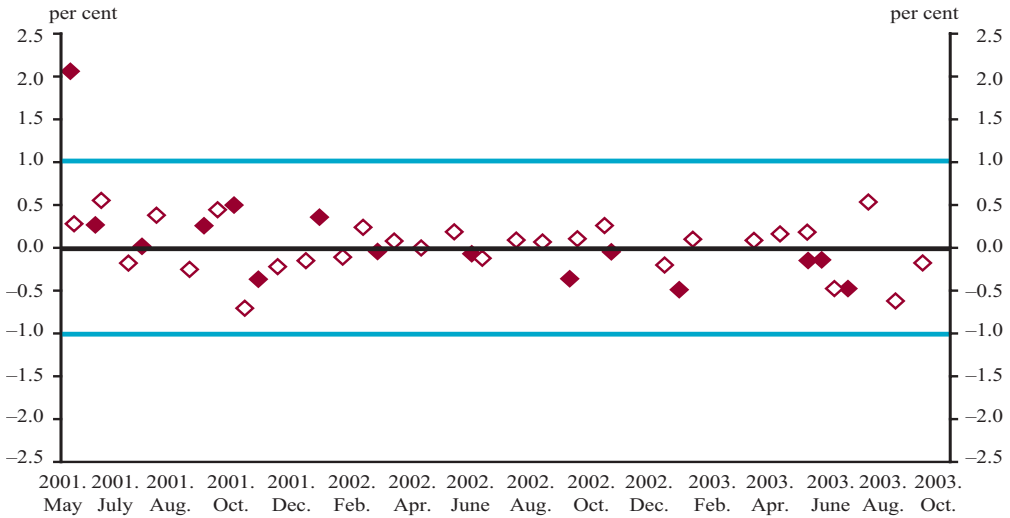**Average absolute exchange rate movement following the publication of the Report on Inflation** *(two-minute data)*
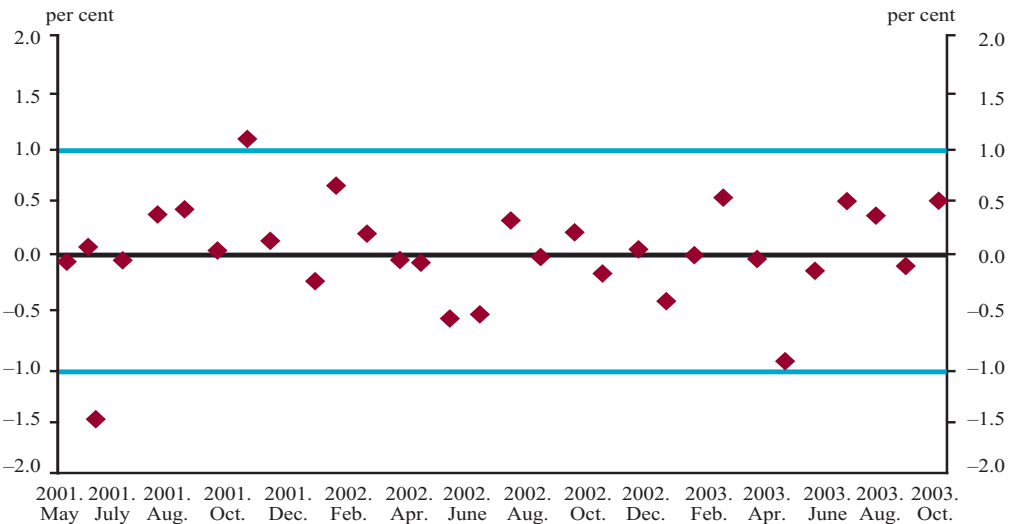
Absolute exchange rate movement (%)

Minutes after announcement

Chart 42

Exchange rate movement following the announcement of Reuters poll

Legend:
- ◆ Exchange rate movement (Non-ordinary Reuters poll)   ◇ Exchange rate movement (Monthly Reuters poll)
- ▬ Average exchange rate movement (Non-announcement days)   ▬ 95% Confidence interval

Chart 43

Exchange rate movement following the announcement of public sector deficit

Legend:
- ◆ Exchange rate movement (Public sector deficit announcement)   ▬ Average exchange rate movement (Non-announcement days)
- ▬ 95% Confidence interval

APPENDIX 2: PRINCIPAL COMPONENT ANALYSIS

With the principal component analysis the information content of several variables may be condensed into one index. We would like to get an answer to the question what linear combination of the variables explains best the movements of all the indices.

The three-month, six-month, twelve-month and the three-year, five-year and ten-year benchmark yields were used for the analysis.

Let $X = (X_1, X_2,...X_n)$ be the vector containing the daily movements of the above mentioned yields. We are looking for a C vector, where $PC_j=X*C$, and where PC_j is a combination of the above-mentioned yield movements showing the development of the yield time series in the best possible way. We worked with altogether two composite indices (PC_j) and within each of these composite indices we summarised the daily movements of three yields of various durations. The short-term yield summarises the movements of three-month, six-month and twelve-month benchmark yields, while the long-term yield summarises the benchmark yields of three-year, five-year and ten-year yields. Before starting the calculations all the data series were normalised in order to avoid the problem of the most volatile data series to dominate the estimation.

In order to get the values of the C vector, a maximisation task has to be solved with the stipulation that the total of weights should be one. In our case this is the own vector belonging to the highest own value of the X`*X matrix. With the help of the weights obtained from the own vector the value of the composite indices may be calculated.

The resulting composite indices are then homogenised so that their standard deviation equals the weighted average standard deviation of their components.