Financial market reactions to interest rate announcements and macroeconomic data releases[1]

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Reactions of financial prices to news contain information about market beliefs and expectations. This article looks at reactions of a selection of UK interest rate, equity and exchange rate contracts to macroeconomic data releases and interest rate changes before and after the Bank of England was granted operational independence in May 1997. We find some differences in the nature of the reactions in the two periods, and attempt to draw out the implications for market perceptions of monetary policy.

Introduction

At 11.00 am on 6 May 1997 the new UK government announced that it had granted the Bank of England operational independence with respect to the implementation of monetary policy, subject to an RPIX inflation target of $2^1/_2$% per year. This change was designed to improve the credibility and transparency of the monetary policy process. The Bank of England's aims were stated clearly, and the voting record and discussions of the members of the Monetary Policy Committee (MPC) were to be published shortly after interest rate decisions had been made.

Our aim in this study is to investigate whether there has been a systematic change since Bank independence in the way that market participants incorporate information from monetary policy announcements, and from other important macroeconomic data announcements, into financial prices. We use intra-day price data (rather than daily data, which are sometimes used in this context) because markets receive many different pieces of news throughout the trading day, and so the impact of a particular announcement may be obscured by using daily price series. We therefore concentrate on the minutes immediately preceding and following these announcements.

Our study uses high-frequency data on short and long-term LIFFE interest rate futures contracts,[2] on the LIFFE FTSE 100 stock index futures contract, and on the dollar/sterling and Deutsche Mark/sterling exchange rates. We monitor the behaviour of these financial prices around the times of interest rate announcements and key macroeconomic data releases over two periods: from January 1994 to 6 May 1997 (pre Bank independence), and from 7 May 1997 to June 1999 (post Bank independence).

The impact of news on financial prices

The reaction of financial prices to news should be determined by the extent to which the news changes market perceptions about the future payoff of the relevant security. For example, an announcement that changes expectations about long-term economic growth and inflation should, other things being equal, have some effect on the values of long-term assets. The announcement of Bank independence caused UK 20-year bond yields to fall by around 40 basis points on the day.

If the aims of monetary policy are clear and it is possible to predict interest rate decisions accurately using publicly available macroeconomic data, then the interest rate decisions themselves will usually be less newsworthy and so will, on the whole, provoke little reaction in financial prices. News will, however, be conveyed in macroeconomic data releases. Over a period when the monetary policy process becomes more transparent, the reaction to these macroeconomic announcements could therefore increase while the reaction to interest rate decisions declines.

But monetary policy will never be completely devoid of news. This is because the process of converting raw, publicly available data into an interest rate decision can never be a mechanical one. Many judgments must be made before a policy stance can be taken. To the extent that the people making those judgments, and the analysis on which they are based, 'add value' to the raw data, the decision may contain useful news for the market and hence cause market agents to revise asset prices on the release of the decision. In that case, increased transparency could allow more information to be extracted from the interest rate decision, and hence may provoke reactions that are large relative to reactions to other macroeconomic data releases.

In summary, any improvement in the transparency of monetary policy might bring about a change in the way that both interest rate decisions and other macroeconomic announcements are incorporated into securities prices. And it is possible that changes in the reactions to these two types of announcements may be in opposite directions.

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[1] Based on a forthcoming *Bank of England Working Paper*, 'Assessing the impact of macroeconomic news announcements on securities prices over different monetary policy regimes'.
[2] Since futures prices are linked by a no-arbitrage condition to the value of the underlying asset, movements in futures contracts should mirror movements in the underlying asset.

Previous work

There is a considerable body of work that focuses on the impact of macroeconomic news announcements on securities prices. Many of the studies investigate the impact of macroeconomic news announcements on foreign exchange rates (see Almeida, Goodhart and Payne (1998), Andersen and Bollerslev (1998) or Kim (1998)), while others look at the impact of macroeconomic announcements on equity prices (see Mitchell and Mulherin (1994)), bond prices (see Fleming and Remolona (1997) or Jones *et al* (1994)), or on market interest rates (see Becker *et al* (1996) or Thornton (1998)).

Two studies of this kind are of particular relevance to our current work. The first, by Ederington and Lee (1995), looks at the impact of US macroeconomic news announcements on high-frequency data for T-bond, eurodollar and dollar/Deutsche Mark futures contracts. Their methodology compares the average behaviour of security prices around the times of the announcements with the average behaviour of the same securities in equivalent periods when no announcements were made. We use a similar approach in this paper. Ederington and Lee (1995) focus on price behaviour from 2 minutes before the announcement to 10 minutes after. They find that the measurable price reaction begins within the first 10 seconds after the announcement and is complete after another 40 to 50 seconds. Hence they implicitly establish that the optimal time frame in which to assess reactions is considerably shorter than a day.

The second study of relevance to our work is by ap Gwilym *et al* (1998), who also employ the Ederington and Lee (1995) methodology. In their work, ap Gwilym *et al* look at the impact of UK scheduled macroeconomic news announcements on LIFFE FTSE 100 and short sterling futures contracts. We also examine the reaction of these two contracts to macroeconomic announcements. ap Gwilym *et al* investigate the impact of nine different announcement types, finding that RPI, PPI and PSBR announcements have a significant impact on FTSE 100 contracts, and that RPI, PPI, labour market statistics and retail sales announcements have a significant impact on short sterling contracts. Looking at the behaviour of announcement relative to non-announcement days over a 12-minute window around the announcements, they find less price volatility than was found in equivalent US studies in the 2 minutes prior to announcements, and a sharp reaction which peaked in the first 90 seconds, and which remained significantly higher for another 5 to 6 minutes. In our empirical work we use all the macroeconomic announcement types that ap Gwilym *et al* find to be significant, and expand the set to include monetary policy related announcements.

While the studies cited above all use high-frequency data, there are two studies that use daily data to address issues of monetary policy transparency as seen by market participants. Haldane and Read (1999) look at the response of the UK yield curve to official interest rate changes, using daily data from January 1984 to May 1997 (the start of the Bank independence period). They conclude that the response of the UK yield curve to a 1% change in official interest rates fell following the adoption of inflation targeting in October 1992, particularly at maturities up to two years. In a related study, Joyce and Read (1999) look at the reaction of UK bond prices to RPI announcements from January 1982 to April 1997. They find that over the inflation-targeting period beginning in October 1992 bond prices became less responsive to RPI announcements, and they interpret this as a sign of improved monetary policy credibility.

Data

Price data

In our study we use tick-by-tick price data for five different assets for the period from the start of 1994 to the middle of 1999. We use data provided by LIFFE for short sterling, long gilt and FTSE 100 futures contracts, and data provided by Olsen Associates for the dollar/sterling and Deutsche Mark/sterling exchange rates.[1]

There are always a number of futures contracts with different maturities available at any one time. We have generally used data for the most heavily traded LIFFE contract in our analysis, switching when the most heavily traded contract changes. The switch tends to occur around four weeks before maturity for long gilt contracts, and at maturity for FTSE 100 contracts. For short sterling, the nearest to maturity contract is used at all times.

Macroeconomic announcement data

We calculate the reaction of the financial prices described above to a variety of macroeconomic news announcements relating to: interest rate changes (pre Bank independence); MPC interest rate changes (post Bank independence);[2] RPI/RPIX; PPI input/output; average earnings; unemployment; GDP (preliminary, revised and final); industrial production; retail sales; PSBR (and subsequently PSNCR); M0; M4; consumer credit; current account; global visible trade; ex-EU visible trade; CIPM index; CBI distributive trades survey; CIPS services survey; and CBI industrial trends survey.[3] The announcements reach the market at the official announcement time, which is generally 9.30 am for macroeconomic data releases and is currently 12.00 pm for interest rate decisions.

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(1) We use Deutsche Mark/sterling up to 31 December 1998, and euro/sterling thereafter.
(2) We do not include the MPC's 'no change' decisions in our set of announcements, since no equivalent is available in the pre Bank independence era. We analyse these no change decisions in the fuller *Working Paper* version of this article.
(3) See Brooke, Danton and Moessner (1999) for a study of the most 'important' UK macroeconomic news announcements for UK financial markets.

## Analysing the pattern of price reactions

In our empirical analysis we monitor the pattern of price reactions by calculating returns for each one-minute window from 10 minutes before announcements to 60 minutes after. We make similar calculations for a control sample of days when no macroeconomic announcements occur, which we refer to as 'non-announcement' days. The returns are used to calculate mean absolute returns (a measure of volatility) and mean cumulative absolute returns over the same period. We compare the mean absolute returns series for announcement and non-announcement days and test for differences between the two. We also subtract the mean cumulative absolute returns on non-announcement days from the mean cumulative absolute returns on announcement days to produce mean cumulative absolute abnormal returns (CAARs). Any systematic difference in the behaviour of the asset prices on announcement and non-announcement days can be used as a measure of the 'abnormal' behaviour that occurs around these announcements. To determine whether a pre-defined set of announcements has a larger or smaller impact upon asset prices following Bank independence, we compare the abnormal behaviour in the pre-independence period with that in the post-independence period.

To illustrate the kind of impact that macroeconomic data releases typically have on securities prices, we plot in Chart 1 the mean absolute return for one-minute windows from 10 minutes before announcements to 60 minutes after, for the LIFFE short sterling contract. The chart shows the average reaction of this contract to all the macroeconomic announcements in our data set over the full sample period from 1994 to 1999. It is clear that these announcements have a pronounced impact upon contract volatility immediately following the announcement. This volatility remains higher than on non-announcement days for approximately 50 minutes, and is very much higher in the first 5 minutes or so. We apply a non-parametric test (the Kruskal-Wallis test[1]) to determine whether or not this higher volatility is significantly higher in a statistical sense. We use this non-parametric test rather than a parametric equivalent so that our results are not unduly influenced by outliers. The results show that volatility following macroeconomic announcements relative to volatility on non-announcement days is significantly higher at the 99% level of confidence for each of the 22 one-minute windows following these announcements. The question that we wish to consider, however, is whether volatility in the post Bank independence period is significantly different from volatility in the pre Bank independence period.

Empirical results

We begin our analysis by separating the announcement of interest rate changes from the other macroeconomic announcements, applying the generic term 'macroeconomic announcements' to this second set. Charts 2 to 11 show the mean CAARs in the pre and post-independence periods for

Chart 1
Mean absolute returns for the LIFFE short sterling contract following macroeconomic announcements
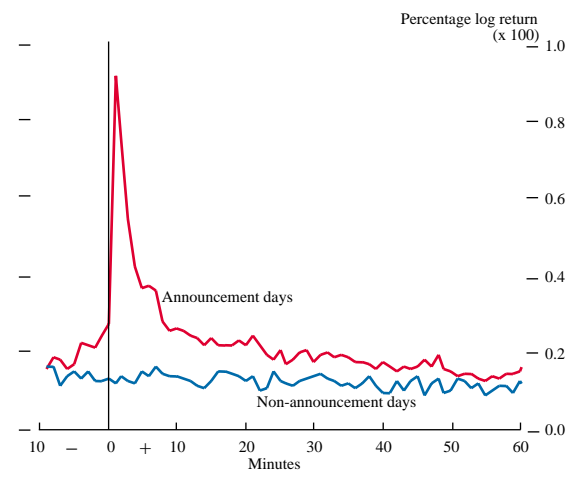
macroeconomic data releases and for announcements of interest rate changes. The line labelled 'Before BI' shows the mean CAARs in the pre-independence period, while the series labelled 'Since BI' shows the mean CAARs in the post-independence period. Table A gives the results of tests of the difference between the mean CAARs in the pre and post-independence periods after 5, 15 and 60 minutes. This is a test for significant differences at 5, 15 and 60 minutes in the data represented by the two lines plotted on the chart.
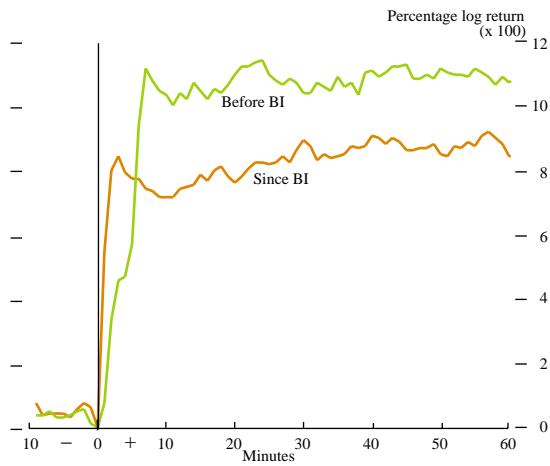
Interest rate announcements

Charts 2, 3 and 4 show that for each of the futures contracts, the *immediate* reaction to interest rate announcements in the post Bank independence period is higher than in the pre Bank independence period. This finding is consistent with the fact that the timing of interest rate announcements was known in advance post independence, whereas between 1994 and 1997 the timing was at the Bank of England's discretion. One would expect a much quicker reaction to an event whose timing was completely anticipated than to one where there was some uncertainty. However, when we look beyond the initial period we can see that after approximately 10 minutes the reaction is lower for the two interest rate contracts and approximately the same for the equity index contract.

For the exchange rates, Charts 5 and 6 show that the immediate reaction is also greater in the post Bank independence period than in the pre Bank independence period. But after approximately 30 minutes, the total impact of the interest rate announcements is very similar in both periods. These results suggest that for the period considered here, the overall impact of Bank independence on the different markets was either to reduce the reaction to interest rate changes, or to have little noticeable impact.

The test statistics in Panel A of Table A indicate that for the 5 minutes following the interest rate announcements, the increase in volatility in the interest rate contracts is

Chart 2
Short sterling cumulative abnormal returns following interest rate announcements

Percentage log return (x 100)

Chart 3
Long gilt cumulative abnormal returns following interest rate announcements

Percentage log return (x 100)
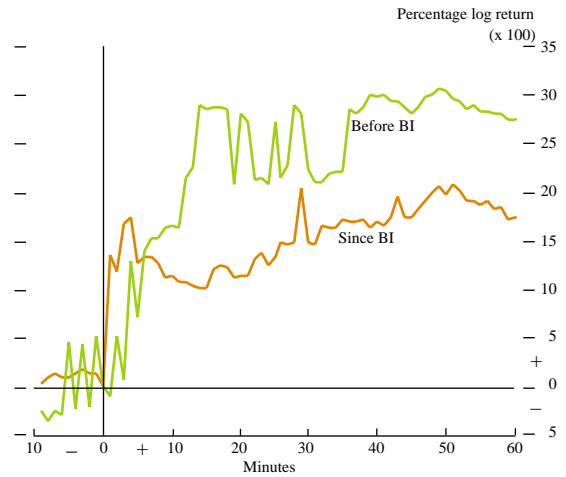
Chart 4
FTSE 100 cumulative abnormal returns following interest rate announcements

Percentage log return (x 100)
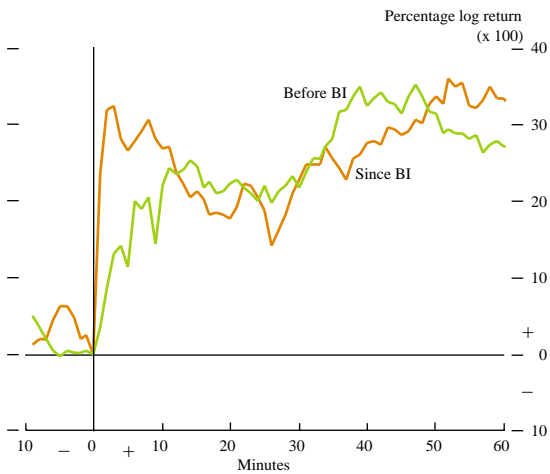
Chart 5
DM/£ cumulative abnormal returns following interest rate announcements

Percentage log return (x 100)
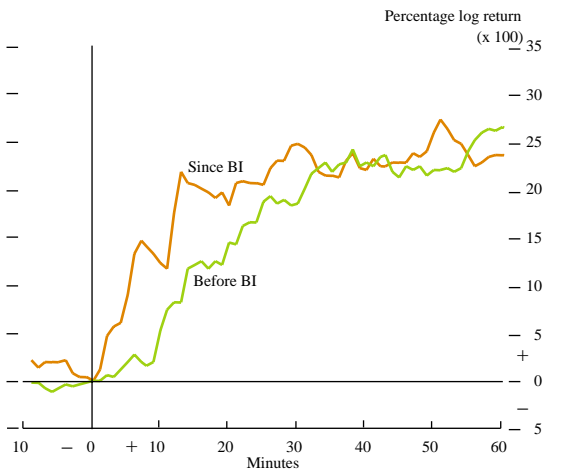
Chart 6
$/£ cumulative abnormal returns following interest rate announcements

Percentage log return (x 100)

Chart 7
Short sterling cumulative abnormal returns following macroeconomic announcements

Percentage log return (x 100)
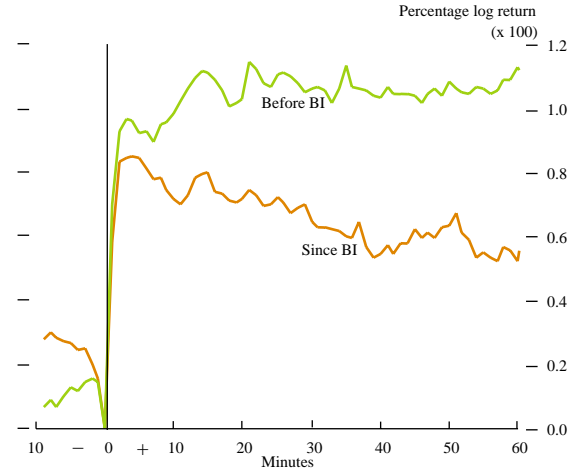
Chart 8
Long gilt cumulative abnormal returns following macroeconomic announcements
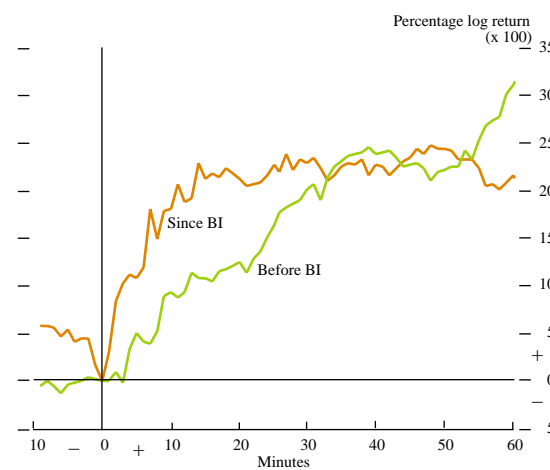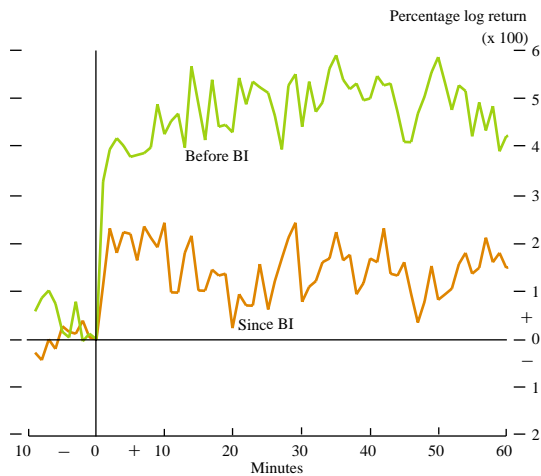

Chart 9
FTSE 100 cumulative abnormal returns following macroeconomic announcements

Chart 10
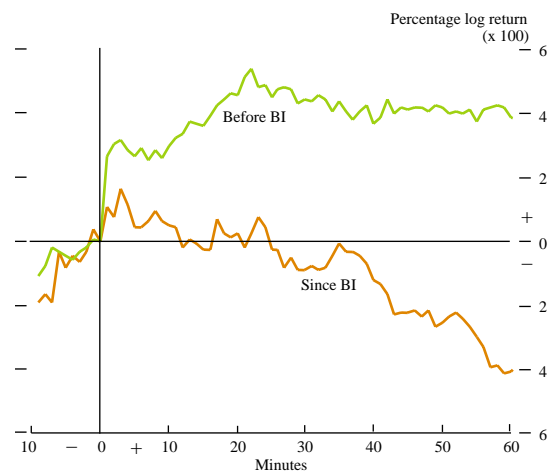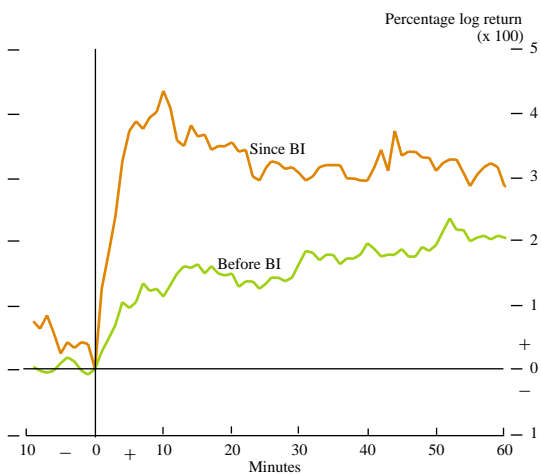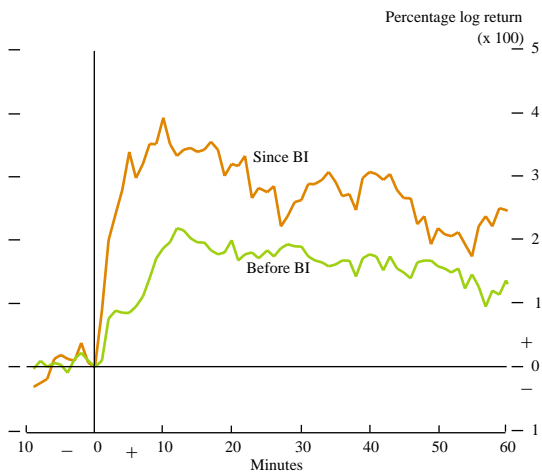**DM/£ cumulative abnormal returns following macroeconomic announcements**

Chart 11
$/£ cumulative abnormal returns following macroeconomic announcements

statistically significant. However, this is not true for the FTSE 100 contract or for the exchange rates. Looking further ahead, we also provide test statistics for the difference in volatility between the two periods after both 15 and 60 minutes. The non-parametric test indicates that none of these observed differences is significant. But the analysis covers a small sample, which raises the chance of a test for a significant difference being rejected. Moreover, May 1997 to June 1999 was a period when the market had to learn about the MPC's reaction function. This learning process was complicated by the fact that membership of the Committee changed substantially during its first year, with one member standing down and four new members joining. So, given these changes, it is encouraging that Chart 2 is indicative of a reduction in the market reaction to an interest rate change in the hour after the announcement of a decision.

Table A
Abnormal reactions to announcements post versus pre Bank independence

Announcement type	Mins.	Short sterling	Long gilt	FTSE 100	DM/£	$/£
Panel A						
Interest rate changes	5	2.06 (a)	5.58 (a)	15.23	4.76	5.81
	15	-2.61	-18.45	-3.45	8.28	11.60
	60	-2.29	-10.24	6.30	-2.90	-9.10
Panel B						
Macroeconomic data	5	-0.08 (b)	-1.58 (b)	-2.19 (b)	2.74 (b)	2.52 (b)
announcements	15	-0.31 (a)	-3.90	-3.87 (b)	1.99	1.43
	60	-0.60	-2.74 (b)	-7.90 (b)	0.80	1.10

Notes: The figures represent the CAARs in the post-BI period minus the CAARs in the pre-BI period, for 5, 15 and 60 minutes following the announcements. The test uses rankings determined by the ratios of the cumulative absolute returns following individual announcements to the mean absolute returns on either pre-BI or post-BI non-announcement days.

(a) Significant at the 95% level of confidence.
(b) Significant at the 99% level of confidence.

Macroeconomic announcements

Charts 7, 8 and 9 show the reaction of the three LIFFE contracts to the set of macroeconomic announcements. The post Bank independence reactions are lower than the pre Bank independence reactions at all the horizons considered.

This is in sharp contrast to the results for the exchange rates, which are shown in Charts 10 and 11. There appears to have been a clear post Bank independence increase in reactions in the foreign exchange (FX) market following macroeconomic announcements at all horizons. The differences between the two sets of results are puzzling. They suggest at face value that there has been an upward shift in the perceived importance of macroeconomic data to FX markets relative to other markets.

These results are supported by the test statistics presented in Panel B of Table A for the 5-minute period following the announcements. It is also clear that for the long gilt and FTSE 100 contracts there is still significantly lower volatility 60 minutes after the announcements (and after 15 minutes for the short sterling contract).

Conclusions

The empirical results discussed above do not yield simple definitive conclusions about whether monetary policy is now better understood by financial market participants as a result of Bank independence. The total (cumulative) reaction of the LIFFE contracts and exchange rates to interest rate decisions appears either unchanged or lower in the post Bank independence period, depending on the market observed. This supports the idea that the news content of monetary policy announcements has fallen. However, while the total reaction supports this view, the immediate reaction in the first 5 minutes is larger in all of the markets studied here. With respect to interest rate decisions, it appears that

the news contained in the decisions is incorporated into financial prices more quickly than in the pre Bank independence era. One possible explanation for this is that pre-positioning in the financial markets ahead of the decision has become more sophisticated since Bank independence, with the publication of a clear, unambiguous timetable for the announcement of interest rate decisions.

Looking at exchange rate responses, there is evidence to support the idea that FX market agents now pay more attention to macroeconomic data announcements. This evidence appears to suggest that the underlying economic data have become more important in these markets relative to the key monetary policy announcement.

A different picture emerges when we consider the impact on the LIFFE contracts of the same set of non monetary policy related announcements. For the short sterling and long gilt contracts these reactions are lower in the post Bank independence period. Since the total impact of interest rate announcements is also lower following May 1997, it is difficult to make any clear statements about the relative importance of monetary policy for LIFFE fixed-income market participants. We can say that all announcements now appear to have a lower impact upon the two interest rate contracts that we consider. Finally, there is a significant decline in FTSE 100 volatility around the set of macroeconomic announcements.

The empirical analysis presented here is based on a relatively short sample, including a period when the markets will have been learning about the new monetary policy framework. The results can only be suggestive rather than the basis for firm conclusions. Nevertheless, there is some evidence that interest rate announcements have become less important for some financial markets, and no more important for others, since May 1997.

Appendix

The differences in the mean absolute returns and mean number of trades between announcement and non-announcement days are tested using a non-parametric statistic.[1] The non-parametric test we use is the Kruskal-Wallis test which is given by:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{j} \frac{S_j^2}{m_j} - 3(N+1)$$ **(1)**

where J is the number of series (here $J = 2$, representing announcement and non-announcement series); N is the total number of observations from both series combined; m_j is the number of observations from series j; and S_j is the rank sum for series j. This test statistic is distributed $\chi^2(J-1)$ under the null hypothesis of equal medians.

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(1) We also calculate a parametric test for the difference in these means, but given the highly non-normal nature of the data we prefer to use and report the non-parametric statistic in expression **(1)**. The parametric results are available on request from the authors.

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