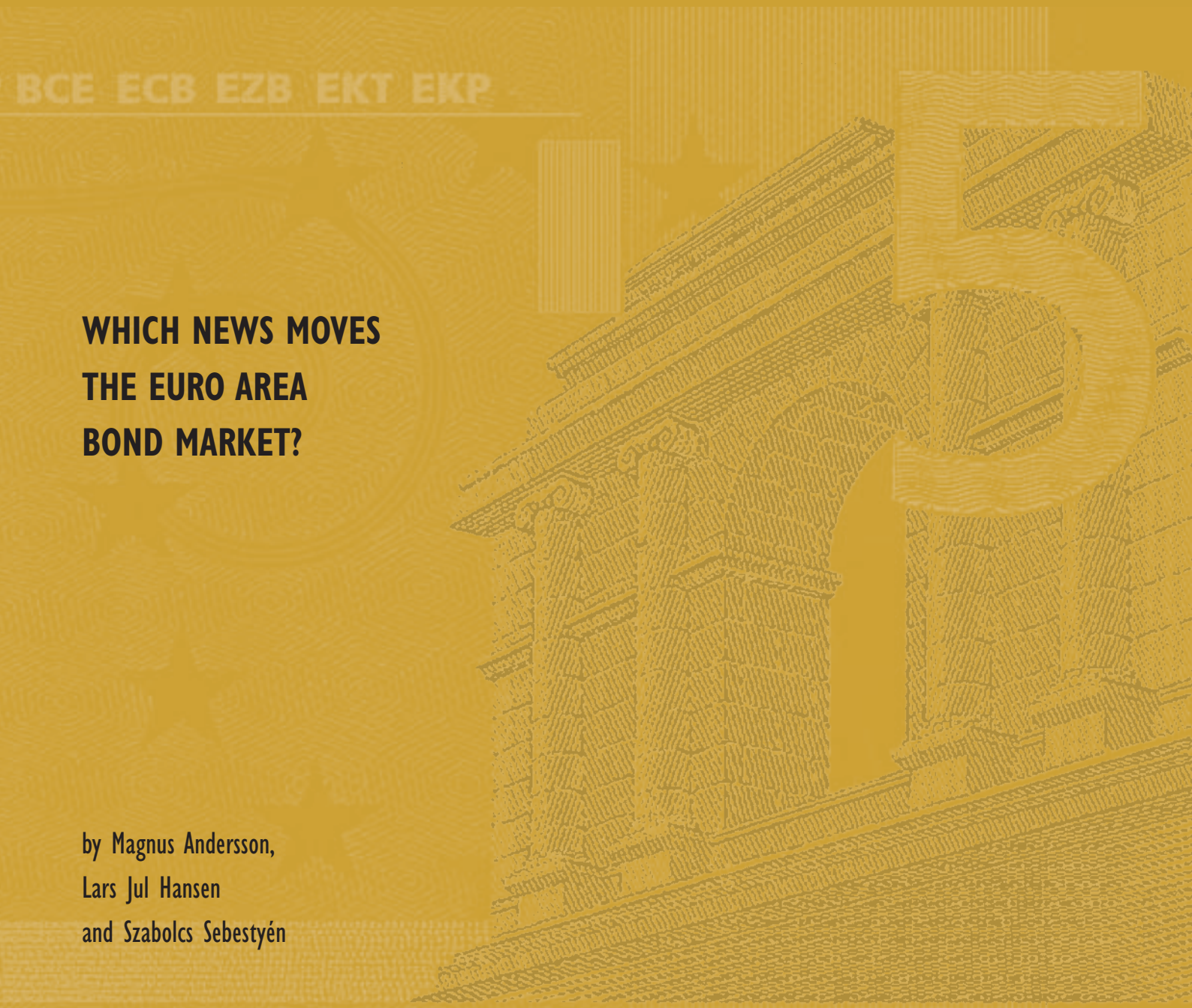
EUROPEAN CENTRAL BANK

WORKING PAPER SERIES
NO 631 / MAY 2006



WHICH NEWS MOVES THE EURO AREA BOND MARKET?

by Magnus Andersson,
Lars Jul Hansen
and Szabolcs Sebestyén

EUROPEAN CENTRAL BANK

WORKING PAPER SERIES
NO 631 / MAY 2006

WHICH NEWS MOVES THE EURO AREA BOND MARKET? [1]

by Magnus Andersson [2],
Lars Jul Hansen [3]
and Szabolcs Sebestyén [4]

In 2006 all ECB publications will feature a motif taken from the €5 banknote.

1 We are grateful for useful discussions with and suggestions from Sven Astheimer, Francesco Drudi, Michael Ehrmann, Michael Flemming, Marcel Fratzscher, Manfred Kremer, Garry Schinasi, and one anonymous referee. We would also like to thank seminar participants from presentations at the International Conference on High Frequency Finance in Konstanz, at the ECB, Danmarks Nationalbank and Sveriges Riksbank for useful comments. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the ECB or Danmarks Nationalbank. Any remaining errors are the authors' responsibility

2 European Central Bank, Postfach 160319, 60066 Frankfurt am Main, Germany; Tel.: +49-69-1344-7410; Fax: +49-69-1344-6514; e-mail: magnus.andersson@ecb.int

3 Danmarks Nationalbank, Havnegade 5, 1093 Copenhagen, Denmark; Tel.: + 45 33 63 67 50; Fax: +45 33 63 71 06; e-mail: ljh@nationalbanken.dk

4 Department of Fundamentos del Análisis Económico, University of Alicante, 03080 San Vicente del Raspeig, Spain; Tel.: +34-96-5903400, ext.: 3339; Fax: +34-96-5903898; e-mail: szabi@merlin.fae.ua.es

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.int

Fax
+49 69 1344 6000

Telex
411 144 ecb d

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

CONTENTS

Abstract

This paper explores a long dataset (1999-2005) of intraday prices on German long-term bond futures and examines market responses to major macroeconomic announcements and ECB monetary policy releases. In general, adjustments in prices are quick and new information is usually incorporated into prices within five minutes of announcements. The volatility adjustment is more long-lasting than that in the conditional mean, and excess volatility can be observed up to 30 minutes after the releases. Overall, German bond markets tend to react more strongly to the surprise component in US macro releases compared to euro area and domestic releases, and the strength of those reactions to US releases has increased over the period considered. The paper also provides evidence that the outcome of German unemployment figures has been known to investors ahead of the pre-scheduled release.

JEL classification: E43, E44, E58.

Key words: Monetary policy, intraday data, macroeconomic announcements.

Non-technical summary

What causes financial market prices to undergo the sometimes strong swings observed during a trading day? The answer to this basic question is of particular interest to anyone monitoring financial markets – from central banks using asset prices to gauge investors' macroeconomic expectations, to fund managers and traders exploring buying and selling opportunities from the prices fluctuating on their computer screens.

As financial assets are inherently forward-looking, only new news should cause revisions to what is currently built into asset prices, thereby immediately affecting prices. The availability of prices at very high frequencies allows for an in-depth analysis of the price discovery process. This in turn enables a "cleaner" analysis of market reactions surrounding major market-moving events compared with standard daily data, where other news during a trading day may blur instantaneous market reactions to events. In addition, the use of high-frequency data makes it possible to depict the dynamic market reactions to the constant flow of information.

This paper examines the effects of macroeconomic data releases and the ECB's monetary policy statements on the German long-term bond market segment of the yield curve. The sample period spans the period January 1999 to December 2005. Given the rather small and relatively stable spreads between government bond yields within the euro area since 1999, German bond prices can be regarded as providing a fairly sound illustration of interest rate developments for the euro area as a whole over the last couple of years.

The paper contributes to the existing literature in a number of ways. First, the paper examines the responses of German long-term bond prices on macroeconomic and monetary policy announcements, a topic which has received little attention in the empirical literature. Second, the combined use of German, French, Italian and aggregate euro area macroeconomic releases, in addition to the 'traditional' US macroeconomic announcements, is novel. Third, the paper identifies some problems related to announcement studies. In particular, evidence is provided that the outcome of the German employment reports is known to investors ahead of the pre-scheduled release. This in turn probably explains why this and previous studies have found no significant impact on financial market prices around the time of the official release. Fourth, a dynamic econometric framework is employed to study the effects of public information on German bond prices. Finally, the paper provides an analysis of the responses of bond futures prices to macroeconomic and monetary surprises in three different monetary policy regimes.

This paper finds that US and to some extent euro area and national macro releases exerts a significant impact on the prices of long-term German government bonds. Overall the announcements have a stronger and more long-lasting impact on volatility than on the level of bond prices. Furthermore, US announcements seem to influence the German bond returns more than euro area, German, French and Italian macro announcements.

There are at least three probable explanations for the strong price sensitivity to US news. First, most aggregate euro area data releases are published after the euro area member states have published their data releases, and so the added informational value of these releases is considered small. Second, the limited response of German bond markets to national releases may also be due to a perception among market participants that the releases do not provide timely and complete information on the macro economy for the euro area. Third, the stronger sensitivity to US news compared with euro area news may also suggest that investors perceive the United States as the main engine for global growth.

By splitting our sample period into three sub-samples, reflecting three different monetary policy regimes (tightening, accommodative and neutral), the paper shows that the impact of public information about US activity and employment on German bond markets has increased over time. A possible explanation may be that in late 2003 and early 2004, US employment data were closely monitored by policymakers owing to growing concerns about the so-called 'jobless recovery'.

With regard to the ECB's monetary policy decisions and statements, the financial market tends to have predicted the outcomes of monetary policy decisions with a high degree of precision so far, possibly due to transparency around the intentions of the ECB. Nonetheless, heightened volatility is observed following both monetary policy decisions and the Introductory Statement read by the President at the Press Conference following the decisions.

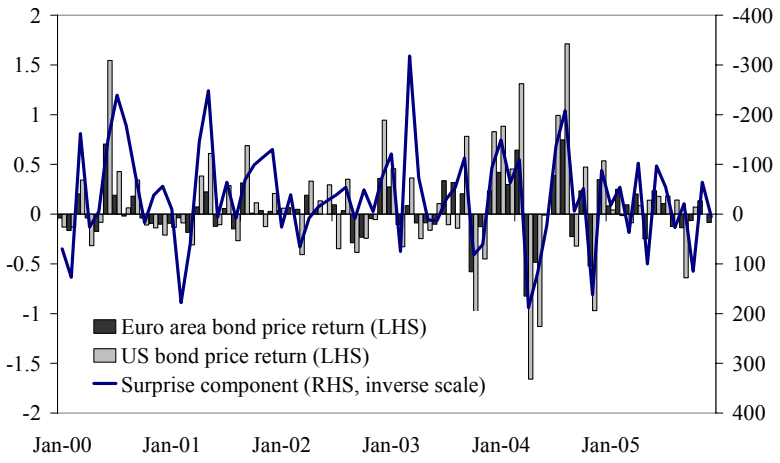
1. Introduction

What causes financial market prices to undergo the sometimes strong swings observed during a trading day? The answer to this basic question is of particular interest to anyone monitoring financial markets – from central banks using asset prices to gauge investors' macroeconomic expectations, to fund managers and traders exploring buying and selling opportunities from the prices fluctuating on their computer screens.

As financial assets are inherently forward-looking, only new news should cause revisions to what is currently built into asset prices, thereby immediately affecting prices. The availability of prices at very high frequencies allows for an in-depth analysis of the price discovery process. This in turn enables a "cleaner" analysis of market reactions surrounding major market-moving events compared with standard daily data, where other news during a trading day may blur instantaneous market reactions to events. In addition, the use of high-frequency data makes it possible to depict the dynamic market reactions to the constant flow of information.

There are two types of events that tend to give rise to strong market reactions – macroeconomic announcements and monetary-policy decisions. As an example of the impact a single macroeconomic release may have on asset prices, Chart 1 shows the intraday returns on US and German bond ten-year futures contracts around the publication of US non-farm payroll releases.[1] The chart also shows the "surprise" component of the non-farm payrolls measured as the difference between the actual and the expected outcome of the release.

Chart 1. Surprise component in US non-farm payroll data releases *(solid line, right-hand scale, inverted)* **and intraday returns** *(15 minutes after and 5 minutes before the release)* **of US** *(grey bars, left-hand scale)* **and German** *(black bars, left-hand scale)* **long-term government bond returns on the release day.** *(Monthly data: January 2000 – December 2005, LHS – in percent, RHS in thousands)*



[1] See also Box 2 published in the May 2004 ECB Monthly Bulletin entitled "The impact of recent employment data releases in the United States on global bond markets".

There is, in general, an inverse relationship: a better than expected outcome of the announcement seems to lead to negative US bond returns (and consequently higher yields). As expected, the reaction was in general stronger when the surprise component was large in absolute terms.

US employment data releases have also had a visible impact on bond returns in Germany. In this respect, it seems that potential changes in market participants' views about the US economic outlook may also have influenced, to some extent, market perceptions about the future course of the German economy. Thus, the chart seems to suggest that bond markets do react to macro announcements and that non-domestic data releases also have a substantial impact on the German bond market.

The purpose of this study is to examine the effects of macroeconomic data releases and the ECB's monetary policy statements on the German long-term bond market segment of the yield curve. The sample period spans the period January 1999 to December 2005. Given the rather small and relatively stable spreads between government bond yields within the euro area since 1999, German bond prices can be regarded as providing a fairly sound illustration of interest rate developments for the euro area as a whole over the last couple of years. The main findings are that German bond markets tend to react more strongly to the surprise component in US macro releases compared to euro area and domestic releases, and the strength of those reactions to US releases has increased over the period considered. The levels of bond prices appear to adjust quickly to new information whereas macro announcements have a stronger and more long-lasting impact on volatility.

The paper contributes to the existing literature in a number of ways. First, the paper examines the responses of German long-term bond prices on macroeconomic and monetary policy announcements, a topic which has received little attention in the empirical literature. Second, the combined use of German, French, Italian and aggregate euro area macroeconomic releases, in addition to the "traditional" US macroeconomic announcements, is novel. Third, the paper identifies some problems related to announcement studies. In particular, evidence is provided that the outcome of the German employment reports in general is known to investors ahead of the pre-scheduled release. This in turn probably explains why this and previous studies have found no significant impact on financial market prices around the time of the official release. Fourth, a dynamic econometric framework is employed to study the effects of public information on German bond prices. Finally, the paper provides an analysis of the responses of bond futures prices to macroeconomic and monetary surprises in three different monetary policy regimes.

The paper is structured as follows: Section 2 discusses the theoretical link between, on the one hand, news in macro and monetary policy announcements and, on the other, movements in long-term bond yields. Section 3 briefly reviews the literature within these fields, while section 4 elaborates on the data used in the study. Summary statistics and the results of the econometric analysis are reported in sections 5 and 6, respectively. Section 7 examines whether the price discovery process for the German bond markets differs depending on the monetary policy stance. Finally, section 8 makes some concluding remarks.

2. Why should macro and monetary policy announcements cause changes in bond yields?

To get an understanding of why macro announcements and monetary policy actions influence financial markets, a closer inspection of the price determination is a natural starting point. Applied to bonds, the price equals the present value of all future cash flows from the asset, discounted at an appropriate discount rate. Hence, the time t price of an n-period government bond B can be written as the discounted sum of all future coupon payments and the face value of the bond:

$$B_n = E\left[\sum_{t=1}^{T} \frac{C_t}{(1+Y)^t} + \frac{FC}{(1+Y)^T}\right] \quad (1)$$

where C denotes coupon payments and FC is the face value of the bond. When new information arrives to the markets, the yield-to-maturity yield Y may change, inversely affecting the price of the bond.

By using two other well known concepts – the Fisher decomposition and the Expectation Hypothesis – a theoretical underpinning for bond market reactions to macro and monetary policy surprises can be inferred. The Fisher decomposition states that interest rate Y on a nominal bond can be decomposed into a real interest rate component and a component for the average inflation expected to prevail over the maturity of the bond (note that these two components may also contain a term premium that investors usually demand for holding longer and thus more risky assets). The former component is often regarded as being closely linked to expectations about economic activity. Consequently, the yield may be expressed as:

$$Y_t^n = E(R^n \mid \Omega_t) + E(\pi^n \mid \Omega_t) \quad (2)$$

where Y_t^n denotes the n-period nominal yield, $E(R^n \mid \Omega_t)$ is the real interest rate expected to prevail over the n periods given the information set Ω at time t, and $E(\pi^n \mid \Omega_t)$ is the expected inflation to prevail over the n periods given the information set Ω at time t. Any changes in bond yields (and bond prices) are thus by definition caused by changes in the information set Ω.

Generally GDP and employment data releases are considered among investors as vital for the future course of the economy and, as a consequence, may lead to swings in bond prices. In terms of the Fisher decomposition, a better than expected GDP growth release could for instance signal an improved outlook for short-term economic growth, putting an upward pressure on the real interest rate component, and maybe also lead to slightly higher inflation expectations as perceived among market participants. Both of these factors, everything else being equal, should then according to Equation 2 lead to higher nominal bond yields (and consequently lower bond prices).

The Expectation Hypothesis, on the other hand, is perhaps the best tool for understanding why monetary policy announcements and statements can affect long-term interest rates. This hypothesis states that long-term bond yields can be seen as a weighted average of current and expected short-term interest rates over the maturity of the bond. As short-term interest rates are usually controlled by the central bank, surprises and/or changes in the perceived monetary policy stance may therefore have an impact also on longer-term

interest rates. Thus, if the central bank raises short-term rates by more than expected, this should therefore normally put upward pressure also on long-term bond yields.

However, the relationship between monetary policy rates and long-term interest rates is not a mechanical one but instead rather complex. The credibility of central banks in safeguarding price stability appears to play a pivotal role, as unexpected changes in monetary policy by a credible central bank may alter the perceptions of growth, inflation and even central bank preferences among financial market participants.

The response on long-term interest rates on changes to monetary policy rates is analysed by Ellingsen and Söderström (2001) in a dynamic macroeconomic model framework. They find a positive relationship between short and long-term rates, if monetary policy reveals information about economic developments. However, if monetary policy actions reveal information about the central bank's policy preferences, short and long-term rates may move in opposite directions. Similarly, Thornton (1998) argues that a tightened monetary policy may lead to lower inflation expectations among market participants. Consequently, monetary policy tightening may lead to overall lower long-term interest rates and thereby create opposite movements in short- and long-term rates.

Further evidence of the complexity of the relation between monetary policy and long-term rate movements can be the behaviour of long-term bond yields in 2004 and 2005, particularly in the United States. In all Committee meetings between May 2004 and end-2005, the Federal Reserve increased the target Federal Funds rate by 25 basis points. The reaction of the long-term rates was however very muted, contrary to past historical experiences, where periods of monetary policy tightening have coincided with increases in long-term bond yields.

Finally it has to be noted that the macro releases and monetary policy announcements are tightly linked and should not be analysed separately, which is why this study includes a large number of announcements together with monetary policy actions undertaken by the ECB.

3. Related literature

3.1 Macro news and bond yields

Overall, the literature about macro announcements and their impact on asset prices is large and spans across asset classes and impacts on various moments of the assets (mainly price and volatility impacts). Numerous studies have analysed the US, euro area, UK and Japanese financial markets. Of greater interest to this study, various approaches have been undertaken to assess the impact of macro announcements on interest rates. Earlier studies relied mainly on daily data. Dwyer and Hafer (1989) for instance examined the reaction of US short and long-term rates to the surprise component in a number of data releases - the money supply figure, the producer price index, the consumer price index, the index of leading indicators, the trade balance and the unemployment rate on interest rates. They found that US interest rates mainly responded to money supply and producer price index surprises.

The more recent literature has moved towards the use of intraday data, which enables a more thorough analysis than data at lower frequencies. Various types of data releases have been tested such as GDP, inflation, consumption, investment, trade and employment. As pointed out in the previous section, the a

priori assumption has been that macro releases signalling a more favourable outlook for economic activity and/or higher than expected inflation should put upward pressure on long-term bond yields and vice versa, everything else being equal.

Two recent papers are more related to our work. First, Balduzzi et al. (2001) examine intraday interest rate data with three-month, two-year, ten-year and 30-year maturities. They test 26 data releases and find that 16 have a significant impact on the ten-year maturity, and 11 on the 30-year maturity. Similarly, Andersen et al. (2005) test, among other things, the immediate impact of a similar sample of macro announcements on 30-year US Treasury bond futures contracts. They find 16 of the macro announcements having a significant impact. Overall, the results in both papers are very similar.[2] The small difference can probably be related to different sample lengths (the former covers the period 1991 – 1995 whereas the latter covers 1992 - 2002).

Apart from triggering some responses in the level of bond prices at the time of the announcements, they may also affect volatility. In fact, as reported by Ederington and Lee (1993), macro announcements seem to be "responsible for most of the observed time-of-day and day-of-the-week volatility patterns in these markets". The authors claim that excess volatility occurs around 15 minutes after the data releases and that part of this may be related to the fact that prices continue to adjust as more details become available of the data release.

As regards announcement studies applied on the euro area bond markets, the focus in these papers have concerned on the impact stemming from US macro announcements. In general the findings support the notion that US data releases indeed not only affect US markets, but also exert a significant impact on the European bond markets. Examples of this can for instance be found in Andersen et al. (2005), who look at the 5-year German futures contracts, and Faust et al. (2003) who conducts a similar study using 10-year German futures contracts.

Ehrmann and Fratzscher (2002) study the impacts of monetary policy and macroeconomic announcements in the euro area and the US on daily changes in euro area and US short-term market rates at 1, 3, 6 and 12 month horizons. They show a high and increasing interdependence between the euro area and the US with euro area rates reacting more strongly to US data releases in comparison with US rate reaction to euro area announcements. The strong influence on euro area bond yields of US data appears to be due to three main factors, according to Goldberg and Leonard (2003). First, the US may be perceived as the engine of global growth, which therefore explains its importance for the global financial markets. Second, it may also be argued that business cycles have become more integrated and globalisation therefore has lead to a higher degree of interdependence between economies. Third, US macro data are typically released earlier than equivalent euro area data. Thus, market participants may therefore draw inferences about the euro area economy from the US data releases. In this respect, only euro area releases that cause investors to revise these inferences should lead to market reactions.

---

[2] The announcements (surprises) that in both papers seem to have a significant impact on long-term US bond yields are: the non-farm payroll, industrial production, new home sales, durable goods orders, the producer price index, the consumer price index, the consumer confidence index, the ISM manufacturing index (formerly NAPM index), housing starts and initial jobless claims.

In addition to the arguments put forward in Goldberg and Leonard (2003), the strong influence of euro area bond yields to US announcements may also be due to the strong observed positive correlations as well as arbitrage relations between US and euro area long-term bond yields (such as interest rate parity). In this respect, it is not clear if the strong observed price sensitivity for euro area bond yields from US macro announcements reflects real economy revisions and/or if it merely mirrors the strong financial integration between the two economies.

3.2 Monetary policy news and bond yields

The impact of monetary policy announcements on financial markets has received considerable attention, although the focus has primarily been on the impacts on the stock and foreign exchange markets.[3] The effect on bond markets has received less attention.

As regards the US, Fleming and Remolona (1997) find a significant increase in bond market intraday volatility following FOMC statement releases made in 1994. Kuttner (2001) uses changes in the Fed Funds Futures as a gauge for monetary policy surprises, and finds that unanticipated rate changes have a considerable effect on 5, 10 and 30-year bond yields. More recent research on bond market reactions includes Andersen et al. (2005), who find a significant impact on 30-year bond volatility following FOMC interest rate surprises. Fleming and Piazzesi (2005) have suggested that the response on the long side of the yield curve following a monetary policy surprise depends on the environment in which FOMC announcements are made. They find that the relation between target rate surprises and bond yields becomes negative when the slope of the curve is particularly steep.

For the euro area, the volatility following ECB Governing Council announcements has been discussed in Bernoth and von Hagen (2003) and Ehrmann and Fratzscher (2002), who study the volatility of money market rates using daily data following Governing Council statements. They both find that volatility generally tends to be higher on these days.

4. Data description

This section describes the characteristics of the German Bond futures, the macro announcement and the monetary policy data used in this study. An empirical examining is also conducted to validate if the expectations used can be deemed as unbiased predictors of the final outcome. Finally, evidence is provided that that the outcome of the German unemployment figure in general has been known to investors ahead of the pre-scheduled release.

4.1 German bond futures

The bond market data consists of five-minute prices of long-term German government bond futures contracts from the beginning of 1999 until the end of December 2005.[4] The eligible delivery bonds are

[3] See for instance Bomfim (2000) or Bentzen et al. (2004) for the impact on stock markets and Faust et al. (2002) or Andersen and Bollerslev (1997, 1998) for the impact on foreign exchange markets.

[4] The data for this study have been purchased from a private company: TickData Inc., which is one of a handful of firms specialising in delivering intraday or tick data.

usually a basket of both non-benchmark and benchmark German governments bonds with a remaining term of between 8.5 and 10.5 years. The collected prices consist of actual trades taking place on the European Exchange (EUREX). The nearest-to-maturity futures contracts are chosen in this study as they normally are the most traded contract and therefore are preferable from a liquidity point of view. The switch to next-maturity contract is utilised through an "auto roll" procedure.[5] This approach compares the daily tick volume for the front and first back-month contracts and rolls to the next contract when the daily tick volume of the back-month contract exceeds the daily tick volume of the current front month contract. This procedure usually results in a switch 3 – 5 days before expiration of the nearest-to-maturity contract.

There are several reasons why German bonds are a preferable object for a study like this. First, they reflect the benchmark status in the long-term segment of the euro area bond market. Second, the corresponding superior liquidity of German long-term bonds ensures that short-term movements in the prices of such bonds are less distorted by pure market noise. Third, bond futures tend to reflect new information faster than the underlying cash instruments (see Upper and Werner (2004). In the same vein, Andersen et al. (2005) also argue that futures markets are to be preferred (over cash markets) owing to quicker price discovery process.

Although data are sometimes available down to "tick-by-tick", most research has tended to look at the changes over short, equally spaced intervals of time. This interval varies among the different studies from five minutes up to one hour. In our study the bond prices are split into five-minute intervals. This length strikes a reasonable balance between market microstructure effects presented in ultra high-frequency and sampling with too long intervals, thereby blurring the potential impact the announcements may have on financial market prices.

4.2 Macro announcements data

The data used to estimate the expected and actual outcome of the macroeconomic data releases have been collected from Bloomberg. The anticipated outcome of the macro releases consists of median expectations of the survey panellists, thereby avoiding giving too large a weight to outlier estimates. In the US, the survey expectations are collected up until the day before the data release, whereas in the euro area, the data are assembled on the Friday before the releases. It should be noted that at the beginning of the sample period, there were generally fewer respondents to the surveys conducted about expectations. Table 1 show all macro announcements and also highlights the distribution of the release days of the 43 macroeconomic announcements used in this study.

As seen in the table, most euro area data macro announcements are released later than the US equivalents. The delayed release of the aggregate euro area statistics is linked to the time needed to compile the statistics from all EMU Member States.

The delayed release of euro area macroeconomic statistics also implies that they may contain less new news as the national releases are already known to the investors at the time of publication. To account for

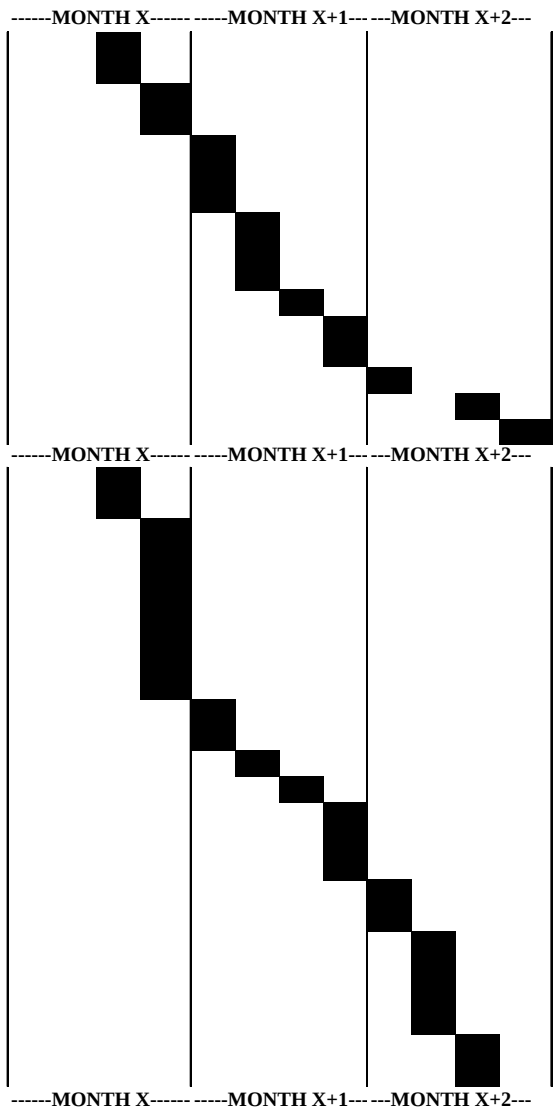
[5] Research by Tick Data Inc. itself suggests that this switching procedure is the most preferable from a liquidity point of view, see http://www.tickdata.com for more info.

this, the most important national German, French and Italian macro releases are also included in this study.

A larger sample of data releases was originally considered, including for instance euro area GDP. However, not all macroeconomic data releases have a sufficiently long time series with reliable survey data. This is especially apparent for various national indicators among euro area countries.

Table 1: Distribution of release days of macroeconomic announcements

Data for Month X	
US data releases	**University of Michigan**
	Philadelphia Fed index
	Consumer confidence
	Chicago PMI
	ISM business confidence
	ISM non-man business confidence
	Nonfarm payroll + Revised for month X-1
	Retail sales
	Producer Price Index
	Consumer Price Index
	Industrial Production
	GDP advance
	Durable goods orders
	Factory orders
	Business inventories
	GDP preliminary
Euro area, German, French and Italian data releases	**ZEW (DE)**
	Business confidence (IFO) (DE)
	Flash HICP (EA)
	CPI (DE)
	Business confidence (FR)
	Business confidence (IT)
	Business climate (EA)
	Unemployment change (DE)
	CPI (IT)
	PMI (EA)
	Consumer confidence (EA)
	CPI (FR)
	HICP (EA)
	M3 (EA)
	Retail sales (EA)
	Unemployment (FR)
	Unemployment rate (EA)
	PPI (EA)
	Industrial Production (IT)
	Industrial Production (FR)
	GDP (IT)
	Industrial Production (DE)
	Industrial Production (EA)
	GDP (FR)



Note: The earliest available release date for the macroeconomic releases has been chosen. This implies that some releases are only preliminary, such as University of Michigan and German CPI. Futhermore the release times are only indicative, as holidays and other events may move publication dates and therefore represent the current typical publication times. US GDP Final is not included - this release is published in month X+3, just as initial jobless claims (US) is not included, as this data release comes weekly on Thursdays with data from Friday the week before.

German GDP is not included, as these announcements are typically published before the German bond markets open, but overall, the dataset covers most of the macroeconomic information that is typically considered important for a fundamental analysis.

The surprise component is measured in terms of a standardised surprise measure (see e.g. Balduzzi et al. (2001)), calculated as:

$$S_{i,t} = \frac{A_{i,t} - E_{i,t}}{\sigma_i} \tag{3}$$

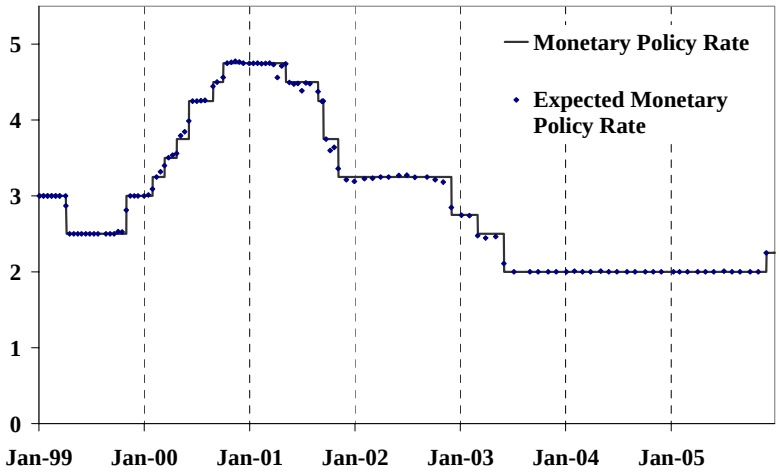
where $A_{i,t}$ and $E_{i,t}$ are the actual and the expected outcome of data release i at time t, respectively, and σ_i is the standard deviation of the forecast error of data release i.

4.3 Monetary policy announcement data

In addition to the 43 macro announcements, the paper also examines the German bond market responses following actual monetary policy decisions by the ECB, the accompanying releases of the Introductory Statements and Monthly Bulletins.

Applied to the ECB's actual monetary policy decisions, the news content of the published decisions can be assessed by comparing actual outcomes of the ECB decisions in terms of the main refinancing rate with the mean of analysts' survey-based expectations collected one week before the Governing Council meetings published by Reuters, see Chart 2 below.[6] From a purely visual inspection, it seems that market participants have been able to anticipate the decisions taken by the ECB, as the surprise component (measured as the difference between the actual outcome and the average ECB watchers' expectations) has been generally rather low.

Chart 2. Actual level of the ECB's main refinancing rate and the average ECB watchers' expectations the day before the Governing Council meetings. *(January 1999 – December 2005; in annual percentages)*



Potential effects from Federal Reserve monetary policy announcements are not examined as until only recently they took place outside the trading hours of German bond futures, leaving no room for intraday analysis.

[6] This choice thus differs with the use of median expectations for macroeconomic announcements. However, the use of median expectations for the ECB monetary policy decisions would give rise to very few non-zero surprises compared with the mean expectations.

4.4 Unbiasedness and efficiency test of the survey data

In order to test for unbiasedness in the expectations data, standard techniques employed in the literature are employed. In line with Balduzzi et al. (2001) and Ehrmann and Fratzscher (2002), simple regressions of the type below are estimated for all data releases:

$$A_{i,t} = c + \beta E_{i,t} + \varepsilon_t \tag{4}$$

Where $A_{i,t}$ and $E_{i,t}$ are defined as in Equation 3. Unbiased market expectations would be expected to yield $c = 0$ and $\beta = 1$. A Wald test is employed to test this joint hypothesis.

The results of the regressions are presented in Table 2 (see Appendix). For the majority of the data releases, the null hypothesis of unbiased expectations cannot be rejected at the 10 percent level, which suggests that the survey expectations are of good quality. However, for a number of data releases this assumption is rejected. For the US, survey expectations for producer prices, retail sales, factory orders, durable goods orders, CPI, non-farm payroll and GDP final are found to be biased predictors of actual outcomes.

Among the aggregate euro area statistics, producer prices, M3 and PMI are found to be biased predictors of the actual outcome, whereas for the national indicators, the null hypothesis of unbiased expectations can be rejected for most surveys of French releases, Italian CPI and German unemployment.

The results are in line with Balduzzi et al. (2001), who also find that survey expectations for some US data releases are biased. There is no significant overlap between those US announcements which they find to be biased and those which we find to be so.

4.5 Distortions to the release of macroeconomic statistics

The arrival of new information on financial markets almost instantaneously leads to price adjustments, if the new information causes market participants to reassess their expectations. When measuring announcement effects by utilising high-frequency data, it is therefore crucial that the announcement times of the macroeconomic releases are correct, as even a slight deviation in such times may lead to incorrect assessment of market reactions following releases.

The actual timing of macroeconomic release may deviate from the pre-announced time for a number of reasons, such as technical mistakes by either the producer of the statistics or news agencies, or deliberate leaks to the media. Clearly if the outcome of an announcement becomes available to investors ahead of the official release time will have an impact on our analysis as the market reaction will then take place earlier. If the release of macroeconomic statistics prior to official release times only takes place infrequently, the overall impact on our results will typically be limited. However, if the macroeconomic statistics systematically are known to investors ahead of official release times, our analysis will clearly be biased.

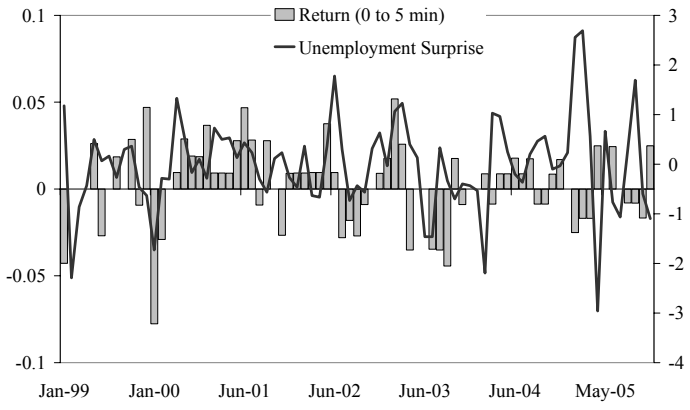
Macroeconomic releases in the US, such as the non-farm payroll statistics published by the Bureau of Labor Statistics are kept under very strict conditions of secrecy until release, in order ensure that new

public information is published at pre-scheduled times. On the day of the publication, reporters receive the statistics at 14:00 (Central European Time), giving them only 30 minutes to analyse the new data under strict control and without any outside contact. At precisely 14:30, phone lines are turned on and the reporters are allowed to send their material for publication. In this case, early releases or leaks appear rather unlikely to occur regularly, although there have been a few rare cases of the statistics becoming available minutes before the pre-announced time.[7] However, these events appear accidental, and do not systematically bias the analysis in this paper.

In the euro area, there is no compelling evidence of macroeconomic statistics being released early or of alleged leakages, with one notable exception, the German unemployment figures. This is an issue which has been described by news agencies [8] but received little attention in the academic literature so far.

If these news reports about presumed leakages are true, it is reasonable to assume that bond markets should have incorporated the latest news in the German unemployment report already prior to the official release, with little or no reaction taking place at the scheduled time. To examine this, Chart 3 shows the German bond market returns in the five-minute interval immediately surrounding the scheduled release times together with the standardised surprise measure. In theory a positive surprise (i.e. more unemployed than expected) should lead to lower yields and higher bond returns. As seen in the chart, the co-movements between the two variables are small. In addition, the econometric results presented later on suggest that the unemployment outcome has no significant impact on the German bond market at the pre-scheduled time. This non-significant price response to German unemployment data is in line with the previous literature. Goldberg and Leonard (2003), for example, find the release of German employment statistics has no significant impact on German bond yields.

Chart 3. Surprise component in German unemployment data releases* *(solid line, right-hand scale)* **and 5-minute returns of German** *(grey bars, left-hand scale)* **long-term government bond futures contract after the release.** *(Monthly data: January 1999 – December 2005, LHS – in percent, RHS - standardised surprise measure)*



** Monthly change in unemployment, seasonally adjusted.*

[7] See "Early Reports On Economy Rattle Markets --- The Internet Isn't to Blame; An Itchy Trigger Finger Makes for Human Error" by Gene Colter and Umberto Torresan, The Wall Street Journal, 7 September 1999.

[8] See "German jobless leaks annoy analysts, investors – and officials" by Andreas Cremer, Bloomberg News, 9 April 2002.

To gather information as to whether the German employment statistics is systematically available to investors ahead of the pre-scheduled announcement time, we collected news reports from Reuters and other market news agencies. The results in Table 3 (see Appendix) show that there is clear evidence that the number of German unemployed workers consistently have been known to investors prior to official releases. These apparent leaks took place prior to all releases in our sample with the exception of a few releases at the beginning of 1999.

There is by contrast no evidence that other German macroeconomic statistics are systematically leaked to the media: leaks only appear to affect the German unemployment figures from the Bundesanstalt für Arbeit. This is to some extent also supported in our later analysis, where some other German data releases are found to have a market impact at official release times.

5. Summary statistics

The following section provides summary statistics for the intraday bond data and the macroeconomic/monetary policy announcement. To pre-empt some of the conclusions, there seems to be a seasonal pattern in the volatility of the intraday bond data, which has to be taken into account in the econometric specification. In addition, visual inspection suggests that US macro announcements have a stronger influence on the volatility of euro area bond markets compared to euro area and national releases.

5.1 Intraday, inter-day and inter-weekly patterns

The intraday 10-year German government bond futures data cover the period from 1 January 1999 to 31 December 2005. The daily trading period spans from 08:00 to 19:00 Central European Time. The five-minute returns (R_t) are calculated as 100 times the log price difference between two consecutive five-minute intervals ($100*ln(p_t / p_{t-1})$), where p_t is the price of the last trade for the nearest-to-delivery futures contract in the current five-minute interval. The initial return of the trading day (08:00-08:05) has been deleted as it largely reflects the adjustment to information accumulated overnight and hence exhibits a spurious excess variability compared to any other five-minute intervals. This results in a sample of 1,781 trading days and a total of 233,269 observations.

The sample mean of returns is equal to 0.0001 which is, given the sample standard deviation of 0.0263, statistically not different from zero. Regarding the range of the returns, the minimum (-0.61) and the maximum (0.57) values do not suggest sharp jumps in the series. However, the returns are obviously not normally distributed, as both the sample skewness (-0.23) and the sample kurtosis (18.07) are highly significant.

Concerning the *intraday* pattern of the returns, Chart 4A plots the average raw returns across the trading day, whereas Chart 4B displays the average absolute returns.

Chart 4A. Trading day average raw returns of 10-year German government futures prices *(January 1999 – December 2005; 5-minute intervals; in percentages)*

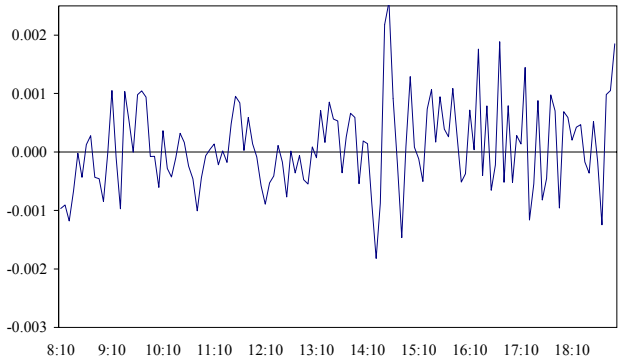
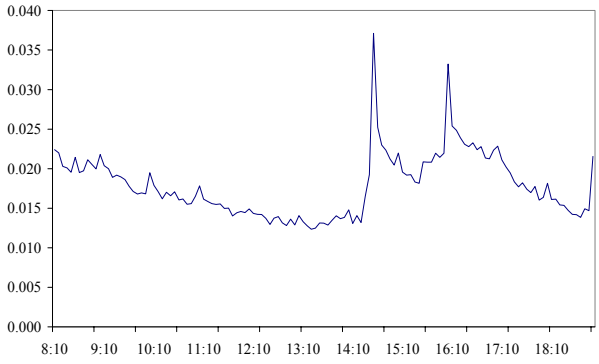


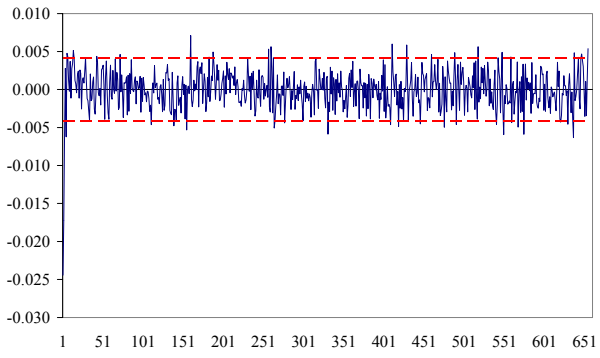
Chart 4B. Trading day average absolute returns of 10-year German government futures prices *(January 1999 – December 2005; 5-minute intervals; in percentages)*



Overall, the average returns are centred around zero, without any systematic and predictable moves. In contrast, return volatility exhibits a regular pattern, suggesting that volatility in general is higher at the opening and closing time of the trading day, with two large spikes at 14:30 and 16:00. These two peaks correspond to the release time of important US macroeconomic variables (for example, non-farm payrolls, GDP, and initial jobless claims) as well as the Introductory Statement following ECB monetary policy decisions, respectively. Hence, there is clear evidence for the presence of strong announcement effects. This is in line with the previous empirical findings in the literature, namely that bond yields seem to display a relatively smooth intraday volatility pattern, but react sharply around monetary policy and macroeconomic releases. [9]

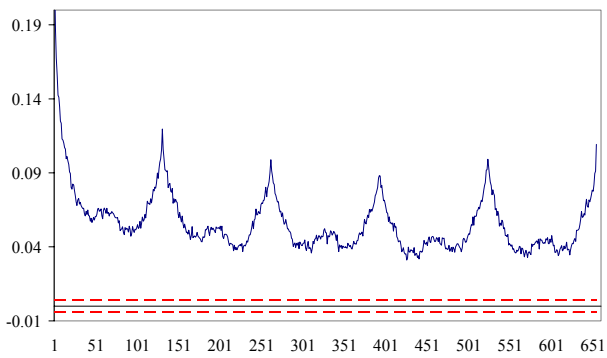
Turning to the dynamic dependencies of the return series, Charts 5A and B plot the autocorrelations of raw and absolute returns, respectively, out to a lag of 655 five-minute intervals, or five trading days.

Chart 5A. Five-day correlogram of raw returns *(January 1999 – December 2005; 5-minute intervals)*



Note: red dashed lines are the Bartlett standard error bands

Chart 5B. Five-day correlogram of absolute returns *(January 1999 – December 2005; 5-minute intervals)*



Note: red dashed lines are the Bartlett standard error bands

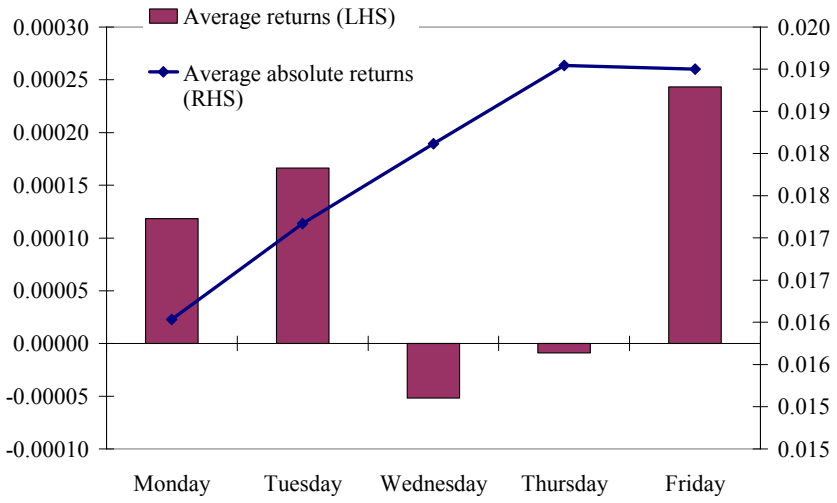
[9] See for example Ederington and Lee (1993), Fleming and Remolona (1999) and Andersen et al. (2000).

As seen in Chart 5A there is a highly significant negative first-order autocorrelation in the return series (probably due to some microstructure effects), but at further lags all the values are small and the series resembles the realisation of that of white noise.

The temporal dependencies of the absolute returns shown in Chart 5B are more interesting, as they display a regular cyclical pattern. The strong periodicity leads to a U-shape in the sample autocorrelation, each occupying one day. For adequate econometric volatility estimation, this *inter-day* pattern has to be controlled for.

Last, several authors have found that asset prices behave differently depending on the day of the week, see Gibbons and Hess (1981). To detect potential *inter-weekly* pattern in the German bond future prices, the average raw and absolute returns have been calculated for each weekday. The result is depicted in Chart 6. No systematic interweekly pattern in the return series can be detected. Volatility, on the other hand, seems to increase over the week. Hence, we can expect that in the econometric model, it is worth including weekday dummies in the conditional variance equation to control for day-of-the-week effects. Some market participants claim that the heightened volatility on Thursdays and Fridays is due to the fact that most data releases are released on these two days with initial jobless claims announced on Thursdays and non-farm payroll numbers on the first Friday of the month.

Chart 6. Weekly pattern of average raw and absolute returns *(January 1999 – December 2005; 5-minute intervals; average return (LHS) and average absolute returns (RHS))*



5.2 Volatility adjustments following macro announcements and ECB decisions

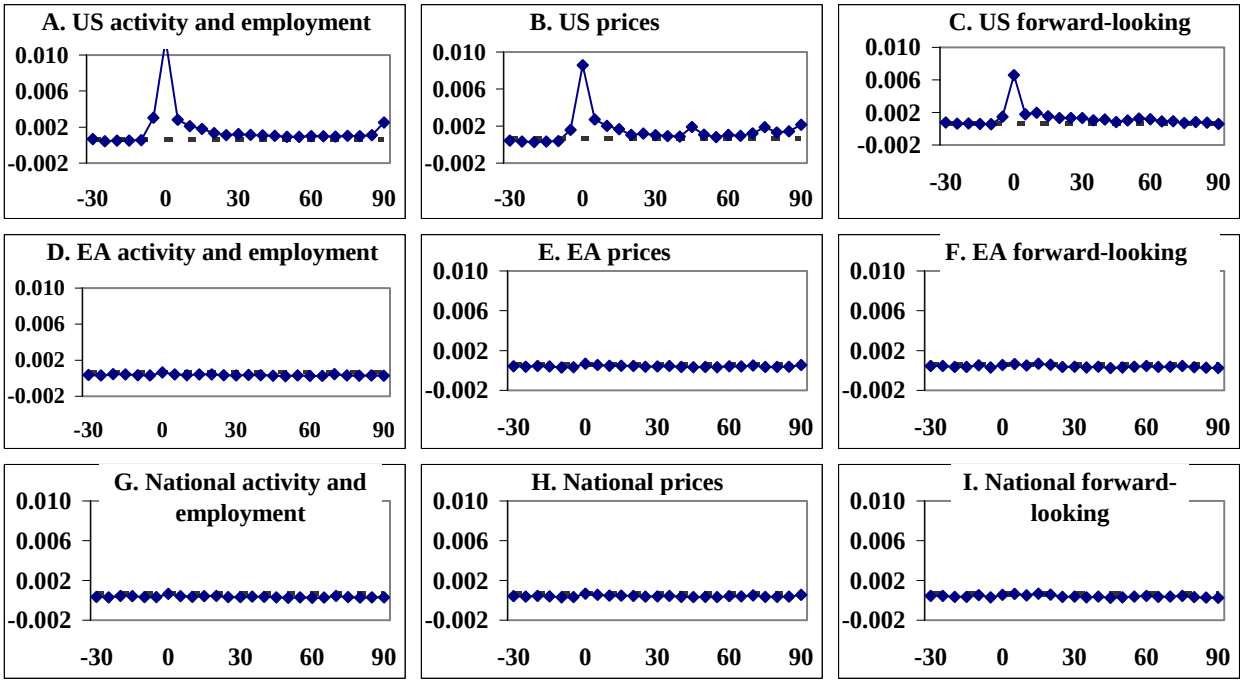
The results derived in subsection 5.1 clearly suggest that volatility spikes during a trading day in the German bond market coincide with important macro and monetary policy announcements. To gauge whether any differences between various classes of macroeconomic releases can be detected, they are grouped into (i) activity and employment, (ii) price and (iii) forward-looking measures (see Table 4).

Table 4. Activity/employment, price and forward-looking data releases for the US, the euro area and Germany/France/Italy

US activity and employment	Euro area activity and employment	National activity and employment
GDP advance	Industrial production	DE unemployment
GDP preliminary	Retail sales	DE industrial production
GDP final	Unemployment	FR industrial production
Industrial production		IT industrial production
Non-farm payroll		FR GDP
Non-farm payroll revised		IT GDP
Initial jobless claims		FR unemployment
Retail sales		
Factory orders		
Durable goods orders		
Business inventories		
US prices	**Euro area prices**	**National prices**
Consumer price index	Flash HICP EA	DE consumer price index
Producer price index	HICP	FR consumer price index
	Producer Price Index	IT consumer price index
	M3	
US forward-looking	**Euro area forward-looking**	**National forward-looking**
University of Michigan Consumer Sentiment Index	Business climate	DE ZEW
ISM manufacturing confidence US	Consumer confidence	DE IFO
ISM non-manufacturing confidence	PMI manufacturing confidence	FR business confidence
Chicago PMI		IT business confidence
Consumer confidence		
Philadelphia Fed index		

In the next step, average 5-minute squared returns surrounding all announcements are computed. Then, the average of these measures for each class is calculated. This is conducted for each 5-minute period spanning between 30 minutes before to 1.5 hours after the releases. The long window is chosen to detect if potential excess volatility at the time of the releases decreases in a gradual or a sharp manner. In order to evaluate whether the volatility for each class differs from adjustments which could be deemed as normal, the volatility on non-announcement days is also calculated (horizontal dotted line). The results are displayed in Charts 7 A – I.

Charts 7 A – I. Average volatility following US, euro area and national activity, price and forward-looking macro releases. *(January 1999 – December 2005; 5-minute intervals; in percentages)*



Note: The solid blue line represents the average squared 5-minute returns around the release time of the US, euro area and national (German, Italian and French) macro announcements. The dotted dark lines correspond to the average squared 5-minute returns on days on which no announcements were published. The X-axis represents the 25 5-minute volatility periods spanning between 30 minute before to 90 minutes after the respective releases.

Two principal features can be inferred from the charts. First, the impact of all classes of US macro releases on the German bond market is much stronger compared to euro area and domestic releases. Second, volatility seems to remain at relatively high levels 20 – 30 minutes after the US announcements. This is contrary to euro area and national releases, where the volatility pattern broadly matches adjustments taking place on normal non-announcement days.

The volatility adjustments following monetary policy decisions and announcements by the ECB are not grouped together but treated separately. The monetary policy decision only reveals the outcome of the actual decision, whereas the Introductory Statements and the publication of the Monthly Bulletin are comprehensive summaries of the Governing Council's assessment of economic developments shaping the euro area economy over the short to medium term. Treating the decisions and publications separately enables us to compute a more adequate measure of benchmark volatility. More specifically, the benchmark volatility is defined as the average squared returns for the same days *and* times but on non-announcement days, thus controlling for the intraday, interday and weekday characteristics of high-frequency data.

The results for the overall sample period are displayed in Chart 8 A-C, where the black solid lines represents the average volatility for the monetary policy decisions, the Introductory Statements and the Monthly Bulletin. Serving as a benchmark for normal volatility, the grey lines in the charts correspond to the volatility on non-announcement days. The filled black circles highlight the 5-minute volatility periods

which significantly exceeds the benchmark volatility (i.e. with a ratio between the two significantly exceeding one).[10]

Chart 8 A. Average volatility surrounding ECB's monetary policy decisions *(January 1999 – December 2005; 5-minute intervals; in percentages)*

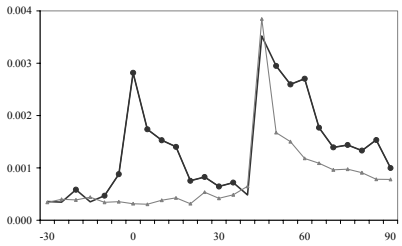


Chart 8 B. Average volatility surrounding the ECB's Introductory Statements releases *(January 1999 – December 2005; 5-minute intervals; in percentages)*

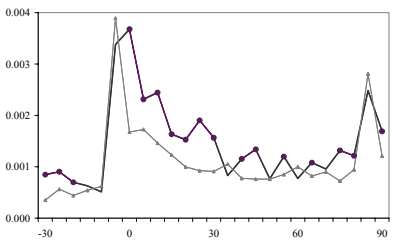
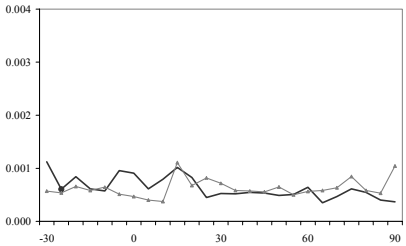


Chart 8 C. Average volatility surrounding ECB Monthly Bulletin *(January 1999 – December 2005; 5-minute intervals; in percentages)*



Note: Solid black lines represent the average squared 5-minute returns around the release time of the monetary policy announcements, the Introductory Statements and the Monthly Bulletin. The grey lines correspond to the average squared 5-minute returns on days and times with no monetary policy announcements. The filled dark circles correspond to the volatility periods in which the average volatility from the three measures significantly exceeds the non-announcements days. The X-axis represents the 25 5-minute volatility periods spanning between 30 minutes before to 90 minutes after the respective releases. Vertical dotted lines correspond to the announcement time.

The immediate market impact of the releases following the announcement of monetary policy decisions by the ECB gives rise to a spike in volatility that significantly exceeds the benchmark (see Chart 8 A, "0" period). Volatility then stays relatively high up to 30 minutes after the release, suggesting that the decisions indeed contain a new news component, and that it takes some time for the markets to calm down. The spikes taking place 45 minutes after the monetary policy decision are probably more related to other news such as some important US macro news and the release of the Introductory Statements (see below).

As shown in Chart 2, the actual decisions seem overall to have been relatively well anticipated among the (mean) investors. There are however still potential explanations for the heightened volatility, even though the ECB seems to have been predictable in its communication about the monetary policy stance. The actual decisions may trigger portfolio adjustments of those individual investors who have deviated from the average. For instance, the amount of trades sharply surges after the decisions, probably reflecting repositioning among "non-mean" investors, with heightened volatility as a result.

Turning to the releases of the Introductory Statements in Chart 8 B, the grey shaded line represents the volatility on the days (Thursdays) when no Introductory Statements was released. As seen, the grey line spikes at the -5 period, which corresponds to 14.30 pm, when some important US macro announcements

[10] It is not straightforward how to decide on the 5-minute interval surrounding the Introductory Statements, i.e. the "zero" window corresponding to the immediate impact of the release. In this respect, the official release time is 14:45 pm., which is the time it is published on the ECB website. However, Introductory Statements are also read by the president at the press conference which starts at 14.30 pm. and is transmitted live via Bloomberg, and reported upon through wire services such as Bloomberg or Reuters. Therefore, a choice of 14.45 pm may be too late for gauging the immediate market reaction (as regards the Monetary policy decisions and the releases of the Monthly Bulletin, such problems do not arise as they are released to the public via press releases and the Internet respectively at dates and times which are known well in advance). Important changes in the ECB monetary policy stance are usually revealed in the second paragraph after the welcome phrase in the statement. By examining the 2005 press conferences in more detail reveals that the President usually starts reading the Introductory Statement some minutes after 14.30 and that it takes on average another 1-2 minutes to get to the end of the second core paragraph. In the calculations below we try to take this feature into account by letting the 5 minute "zero" window cover 14.35 pm. until 14.40 pm.

are released (mainly initial jobless claims and on some occasions also the producer price index). On the Thursdays when the Introductory Statements is not released, volatility then quickly subsides to a relatively low level. However, on days when Introductory Statements are released (black line), volatility remains at high levels for a prolonged time after becoming available to the public. This feature may be linked to the fact that investors may need some time to interpret the statements and accordingly revise the growth and inflation expectations embedded in long-term bond yields.

Concerning the Monthly Bulletin, the volatility response is very muted. A plausible explanation may be that the content of the editorial in the Monthly Bulletin to a large extent coincides with the Introductory Statement and therefore only to a minor extent contains new information for investors.

6. Empirical results

In this section we further investigate the influence macro announcements have on intraday prices in the euro area bond market by utilising a general model, which simultaneously estimates both the level and the volatility of intraday returns on German bonds. In order to capture the time-varying feature of intraday return volatility, a simple semi-parametric model is employed. Part of this procedure has been suggested by Andersen et al. (2003, 2005), and modified by Sebestyén (2005).

Visual inspection of the data shown in the summary statistics section suggested that three important properties of the data must be taken into account in an econometric setup. First, bond returns react sharply to macroeconomic announcements (*announcement effect*). This effect may be present in both the conditional mean and the conditional volatility of the series. Second, the intraday pattern with higher observed volatility in opening and closing sections of the trading days should, together with the inter-day and day-of-the-week effect, also be properly captured in the volatility equation. Third, the conditional heteroscedasticity of daily returns - commonly known to be present in financial time series – should also be appropriately modelled.[11]

The conditional mean of the five-minute German bond futures returns is specified as:

$$R_t = \alpha_0 + \sum_{i=1}^{P} \alpha_i R_{t-i} + \sum_{k=1}^{K} \sum_{j=0}^{R} \alpha_{kj}^{MA} MA_{t-j}^{k} + \sum_{j=0}^{Q} \alpha_j^{MS} MS_{t-j} + \varepsilon_t \qquad (5)$$

where the 5-minute bond returns R_t are modelled as a linear function of: i) $P=2$ values of lagged bond returns, ii) contemporaneous and $R=2$ lagged values of the standardised surprise of the k $(K=43)$ announcements, and iii) contemporaneous and $Q=3$ lagged values of ECB's monetary surprises. Note that this model is able to separate the effects of concurrent announcements. The lag-lengths were suggested by the Akaike and Schwarz information criteria. Moreover, T = 233,269.

Regarding the conditional variance, we model the disturbance term in (6) to be heteroscedastic, and approximate its volatility by the following model:

[11] See Bollerslev et al. (1992) for a good survey of ARCH models.

$$
\begin{aligned}
|\varepsilon_t| &= \beta_0 + \beta_1 \frac{\hat{\sigma}_{d(t)}}{\sqrt{N}} + \\
&+ \left\{ \mu_1 \frac{n}{N_1} + \mu_2 \frac{n^2}{N_2} + \sum_{z=1}^{Z} \left[\phi_z \sin\left(\frac{2\pi z t}{N}\right) + \varphi_z \cos\left(\frac{2\pi z t}{N}\right) \right] + \sum_{i=1}^{D} \gamma_i WD^i_{wd(t)} \right\} + \\
&+ \sum_{k=1}^{K} \sum_{j=0,3,6} \lambda^{MA}_{kj} D^{MA}_{t-j} + \sum_{j=0,3,6} \lambda^{MP}_{j} D^{MP}_{t-j} + \sum_{j=0,3,6} \lambda^{IS}_{j} D^{IS}_{t-j} + u_t
\end{aligned}
\tag{6}
$$

where N denotes the number of 5-minute intervals on a trading day, n is the nth 5-minute interval on a trading day, and $N_1 = \sum_{i=1,N} i = N(N+1)/2$ and $N_2 = \sum_{i=1,N} i^2 = N(N+1)(2N+1)/6$ are normalising constants.

Following Sebestyén (2005) the second term in the volatility equation $\hat{\sigma}_{d(t)}$ - which represents the estimated conditional standard deviation for day *d(t)*, - is approximated by the realised volatility calculated from 30-minute returns, i.e. $\hat{\sigma}_{d(t)} = \left[\sum_{m=1,M} R_m^2\right]^{1/2}$ where R_m is the mth 30-minute return on day *d(t)*.[12] This departs somewhat from estimating a simple GARCH model for daily data, and taking the estimated conditional standard deviations. However, Sebestyén (2005) argues that the realised volatility captures better the intraday price movements and consequently represents a better approximation of the daily volatility than a parametric GARCH model.

The terms in brackets in (6) serve to capture intraday, interday and inter-weekly patterns of the data. The second-order polynomial (i.e., n/N_1 and n^2/N_1) approximates the intraday U-shape intraday pattern of the volatility. The second part with trigonometric terms contains the flexible Fourier form (FFF), introduced by Gallant (1981) and popularised by Andersen and Bollerslev (1997) in high-frequency finance, which was found to be ideal for modelling the cyclical interday pattern across trading days.[13] The tuning parameter Z determines the order of the expansion. Dummies accounting for inter-weekly impacts $WD^i_{wd(t)}$, are also introduced in (6).

Turning to the announcement effects. A general empirical finding is that the adjustment in the conditional variance is much more gradual than in the conditional mean, with the complete response occurring only after one hour. Therefore, more lags are required to capture the whole response pattern. In addition, Rich and Tracy (2003) point out that announcement dummies are a better measure for uncertainty than announcement surprises. This is also supported by empirical findings; both Andersen et al. (2005) and Sebestyén (2005) find that the use of dummies provides a better fit than surprises, while the results are qualitatively similar. Hence, this paper uses announcement dummies to capture the volatility impacts of macroeconomic announcements and of monetary policy.

However, estimating the conditional volatility using many lags makes estimation cumbersome. Andersen and Bollerslev (1998) propose a polynomial decay structure of the volatility response pattern, and they estimate the degree to which an announcement loads into this pattern. Sebestyén (2005), by contrast, use

[12] Calculating daily realised volatility from 5-minute returns results in endogeneity in the conditional variance equation as the returns appear in the right-hand side of the equation. Returns at the 30-minute frequency do not exhibit serial correlation, hence the endogeneity problem no longer exists.

[13] For other de-seasonalisation methods used in the literature, see Dacorogna et al. (2001).

dummy variables to capture the decay effects 15, 30 and 60 minutes after the announcements. His findings suggest that the latter approach is more adequate for the modelling of announcement effects in the conditional variance, as generally 30 minutes is sufficient for the complete volatility adjustment. This seems to be supported by Charts 7 A-I, where after 20-30 minutes, price variability seems to return to its normal level. Thus, in the conditional variance equation three dummy variables are used to capture decay in volatility: the first at the time of the announcement, the second takes on the value one from 5 to 15 minutes after the announcement, and the third equals one from 20 to 30 minutes after the announcement.[14]

In accordance with the results from the summary statistics section, dummies accounting for the monetary policy communications are also included. (D^{MP}) and (D^{IS}) represent dummies for the monetary policy announcements and the Introductory Statement respectively.

The model is estimated by two-step weighted least squares (WLS). In the first step (5) is estimated by ordinary least squares (OLS). Thereafter, (6) is estimated, and the fitted residuals $|\hat{\varepsilon}_t|$, are used to perform a WLS estimate of (5).

The econometric specification outlined above contains many variables and lags and therefore only the most interesting features will be reported here. Starting out with the conditional mean equation, Table 5 in the appendix presents point estimates of $\alpha^{MA}{}_{k,j}$, $j=0$ and $\alpha^{MS}{}_{,j}$, $j=0$ which correspond to the contemporaneous point estimates of the surprises in the most relevant US/euro area/national macro announcements and the ECB's monetary policy decision, respectively, on the euro area bond markets.

Overall, three interesting features can be noted. First, it turns out that many announcements have a significant impact on the German bond markets (24 out of the 43 are significant at the 10 percent level). As shown in the theoretical section above, a better than expected release should result in a negative sign of the surprise component coefficient. Most of the significant estimates indeed results in an expected sign.[15]

Second, US announcements seem to influence the German bond returns *more* than euro area and national macro releases. Both the number of significant variables and the magnitude of the impacts are higher for US variables than for European ones. This result is in line with previous empirical findings; see Goldberg and Leonard (2003) and Sebestyén (2005).

Third, actual and forward looking measures of real economic activity and unemployment releases have a larger impact compared to price announcements. This is also in line with the results of Sebestyén (2005), who also finds that survey data are very important in the price discovery of short-term interest rates.

There are potential reasons for apparent differences in the impact US news has on the euro area economy compared to euro area news. As discussed previously, most aggregate euro area data releases are published after national publications, and so the added informational value of the aggregated euro area

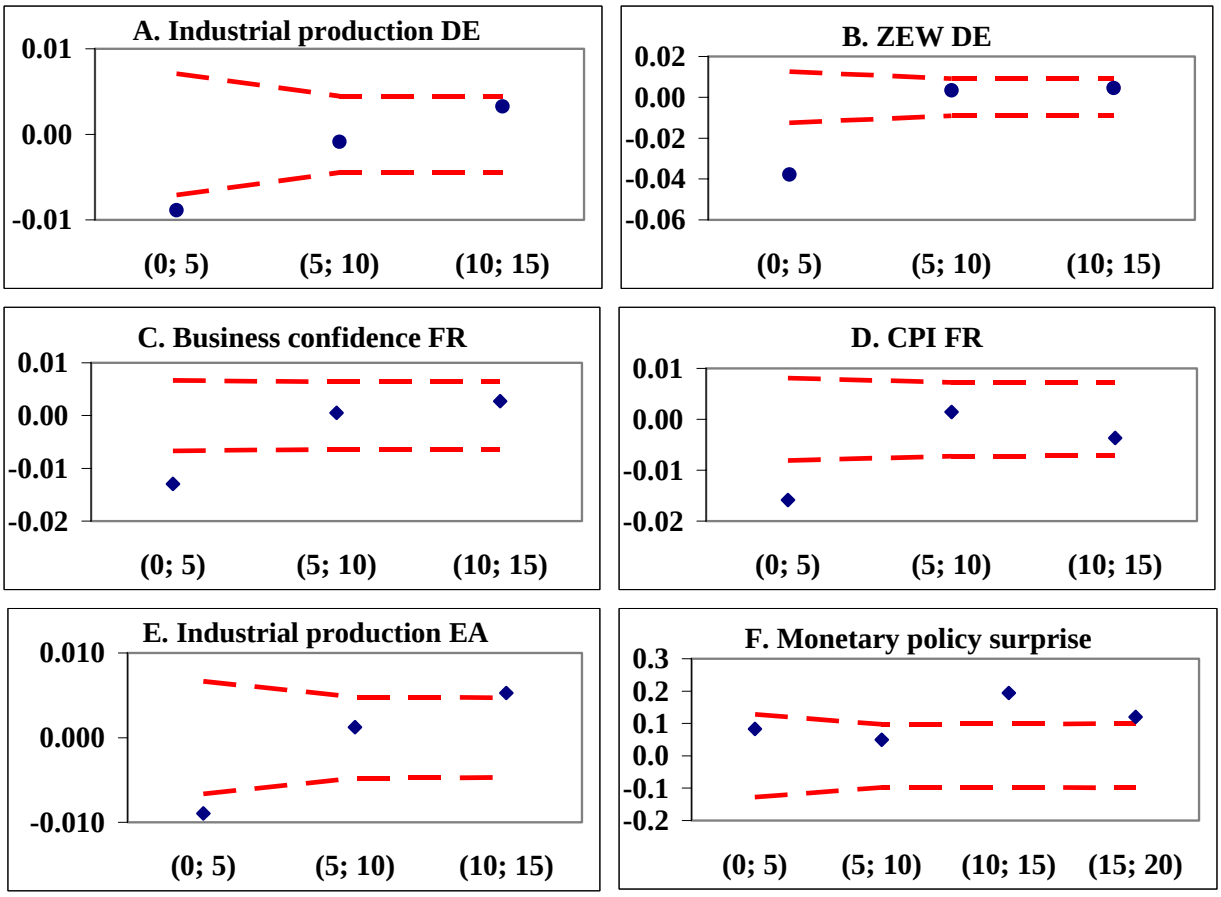
[14] We also allowed for longer adjustment (up to one hour), but the results showed that 30 minutes were sufficient to capture the entire response pattern.

[15] Except for the US initial jobless claims and the unemployment data releases for which a higher than expected number indicates that more people are unemployed than anticipated. Thus for these variables a positive sign would be in line with theory.

releases may be considered small. The limited response on German bond markets to the national releases may also be due to a perception among market participants that they do not provide a timely and complete picture of the macro economy for the euro area as a whole. Finally, the stronger sensitivity to US news compared to euro area news may be linked to investors perception that the United States is the main engine for global growth.

To address the issue of how quickly the German Bond markets incorporates the macro and monetary policy news, Chart 9 A-F displays the estimated coefficients for the most important European variables in the mean equation for the two consecutive 5-minute returns after the announcements. In the Appendix, Chart 10 A – P shows the most important US variables.

Chart 9 A – F. Mean responses of euro area monetary policy and macroeconomic announcements. *(January 1999 – December 2005; 5-minute intervals; in percentages)*



Note: The dots represent the mean responses of German bond futures returns to euro area macroeconomic surprises at the time of the announcement (0;5), ten minutes after (5;10) and fifteen minutes after (10;15). The dashed lines represent standard error bands under the null hypothesis of zero response.

The overall conclusion that can be drawn from this exercise is that there is an immediate jump in the futures prices at the time of the announcement, and little reaction thereafter. This suggests that the price discovery process in the German Bond market is very quick. This result is consistent with previous empirical findings in the literature but for other markets, e.g. Andersen et al. (2003) for exchange rates, and Sebestyén (2005) for short-term euro area interest rates. For the monetary policy surprise (see Chart 9 F), the sign is positive but insignificant.

Regarding the impact on the volatility of futures returns in Equation 6, the effects are more prolonged compared to the influence on the level of bond prices. Table 6 in the Appendix reports on the λ^{MA}, λ^{MP}, and λ^{IS} and estimates which correspond to the volatility response from the macroeconomic surprises, the ECB monetary policy decisions and the volatility induced by the Introductory Statement read by the president at the press conference following the decisions.[16] All except one of the US announcements produce a significant immediate impact on bond volatility (see column "0" in Table 6 in the Appendix). Six of the US releases produce high volatility up to 30 minutes after publications, namely advanced GDP release, industrial production, non-farm payroll, initial jobless claims, the Philadelphia Fed index, and the consumer price index. For the euro area and the national releases, the volatility impact is more muted. Only the euro area industrial production, German industrial production, the ZEW, the IFO, and the French consumer price index releases give rise to elevated volatility at the time of the release.

Both the ECB's monetary policy decisions and the Introductory Statements induce an immediate increase in volatility, especially the latter is higher. Moreover, both influence German bond market volatility significantly up to 30 minutes after the announcements. These results may at first glance seem at odds with Chart 2, which suggested that market participants in general have tended to anticipate well future monetary policy actions by the ECB. However, even though an interest rate decision is in line with market consensus expectations, heightened volatility may still arise. For instance, the event may trigger portfolio adjustments – typically unwinding of profit/loss positions - from investors whose expectations may deviate from the on-average investors.

[16] In the conditional volatility equation, the coefficient for the non-farm payroll includes both the actual and the revised release as the respective influence cannot be separated in the dummy regression approach.

7. Do monetary regimes matter?

The constant estimates from the previous sections may not be completely representative as the impact of macro announcements and monetary policy decisions can change over time. There is no consensus in the literature of how to gauge accurately time varying feature of macro and monetary policy announcements. Ehrmann and Fratzscher (2002) use regression analysis in a rolling window, whereas Andersen et al. (2003) measure the impact of macroeconomic variables in different business cycles. This paper takes a different approach and considers various monetary policy regimes which are of particular interest for the German long-term bond markets given the introduction of the euro in January 1999.

Changes in news sensitivity may occur for several reasons, of which the following four are of most interest. First, policymakers can sometimes signal a preference for one or more macroeconomic indicators as input to their policy decisions for a given period, and thus may lead to increased responses in financial prices to those announcements. Second, a macroeconomic release may behave in an unusual manner at a certain point in the business cycle. Market participants may then perceive, at least temporarily, this variable as being particularly important. For example, employment data for the United States in late 2003 and early 2004 probably fell into both of these categories, given the growing concerns about a so-called jobless recovery. This in turn led to heightened attention being paid to the monthly non-farm payroll and unemployment data.

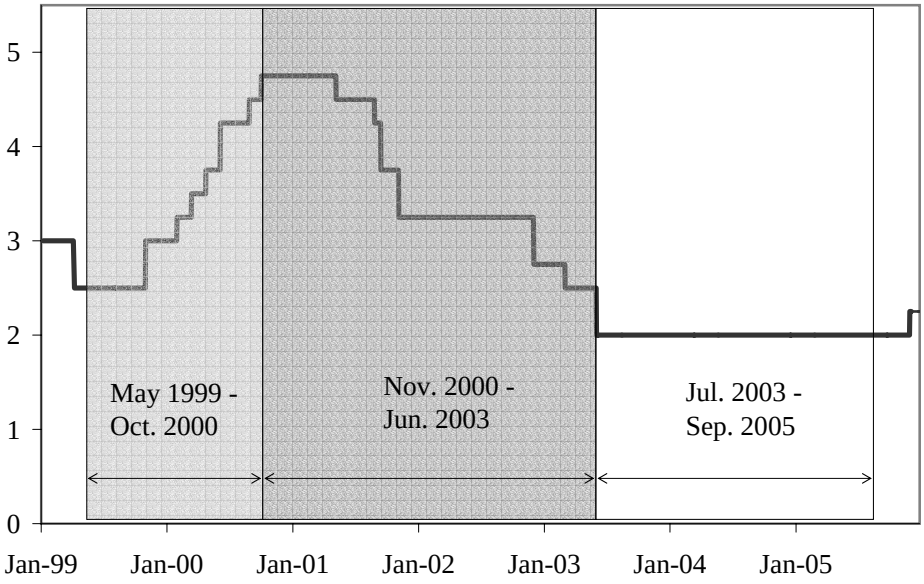
Third, it is reasonable to assume different market reactions depending on the state of the business cycle. For instance, if a turning point of economic activity is expected, but the magnitude of the subsequent up- or downturn is unknown, some forward-looking variables may be monitored more closely by market participants. Fourth and taking a slightly longer perspective, key macroeconomic variables for countries which are growing in importance for the world economy may consequently over time retrieve increased attention. For instance, releases regarding international capital flows and in particular Asian purchases of US securities seem to have become increasingly important for financial markets over the past few years.

It turns out that it is possible to define three different monetary regimes within the sample under consideration. As displayed in Chart 11, shortly after the introduction of the euro the ECB started to tightened monetary policy in order to prevent inflationary pressure building up in the euro area economy. The last in the series of increases in short rates was taken in October 2000, when the ECB increased its key rate by 25 basis points to 4.75%. After seven months without changes, in May 2001 the ECB reduced its key interest rate by 25 basis points, which marked the beginning of a more accommodative monetary policy stance. This lasted until June 2003, when the ECB reduced the minimum bid rate by 50 basis points to 2%. Thereafter, until December 2005 the ECB left its key interest rate unchanged.

Therefore, we define the three monetary regimes in the following manner. The first, a tightening regime, is assumed to start in May 1999 until October 2000 corresponding to the end of the month of the ECB's last decision to increase its key interest rate. The second, an accommodative regime is defined from November 2000 to June 2003, corresponding to the end of the month of the ECB's interest rate reduction in June 2003. Finally, the third, a neutral regime in which short rates have remained unchanged, starts in

July 2003, and lasts until September 2005, when the ECB signalled that it would move to a less accommodative monetary policy stance.[17] The three regimes are depicted in Chart 11 with shaded areas.

Chart 11. Tightening, accommodative and neutral monetary policy regimes in the euro area. *(January 1999 – December 2005; in annual percentages)*



Note: Shaded areas represent the three monetary policy regimes as defined in the main text.

To gauge the price sensitivity across the three monetary policy regimes, the following econometric specification is used:

$$R_t = \alpha_i + \beta_{1i} D_{1t} S_{i,t} + \beta_{2i} D_{2t} S_{i,t} + \beta_{3i} D_{3t} S_{i,t} + \varepsilon_t \qquad (7)$$

where D_{1t}, D_{2t} and D_{3t} represents time dummies controlling for the three monetary regimes, respectively, i.e. they take on the value one in the corresponding monetary regime, and zero otherwise. $S_{i,t}$ represents the *i*th surprise variable.

The shortcoming of this approach is obviously that the length of the three regimes is relatively short (the first 18 months, the second 30 months and the third 27 months) and hence our estimates will suffer from small sample bias. Therefore, quarterly releases are dropped and only those for which there are observations available for almost each month of the corresponding regime are included. It is also noteworthy that expectations for most euro area announcements started in early 2001, which clearly also leads to some problems when comparing results across regimes.

[17] In the Introductory Statement of October, 2005, the ECB used the wording "strong vigilance", which was considered by market participants as clearly hinting the main refinancing rate would increase at the December meeting.

Table 7. Contemporaneous news response coefficients in the first, second and third monetary policy regimes

US Activity and Employment	First regime	Second regime	Third regime
US Industrial Production	-0.0509***	-0.0316***	-0.0200**
US Nonfarm payroll	-0.0605	-0.0383	-0.2070***
US Initial jobless claims	0.0114	0.0114*	0.0277***
US Retail sales	-0.1228*	-0.0466***	-0.0617**
US Factory orders	-0.0252*	-0.0158*	-0.0312***
US Durable goods orders	-0.0437***	-0.0438*	-0.0615*
US Forward-looking			
US University of Michigan consumer Sentiment Index	-0.0387***	-0.0044	-0.0343***
US ISM Manufacturing Confidence US	-0.1510***	-0.0225	-0.0327
US Chicago PMI	-0.0602***	-0.0427***	-0.0180
US Consumer confidence	-0.0242***	-0.0494***	-0.0661***
US Philadelphia Fed index	-0.0252*	-0.0390***	-0.0278*
US ISM Non-Manufacturing Confidence	-0.0028	-0.0659***	-0.0446***
National Activity and Employment			
DE Industrial Production	-0.0128	-0.0159**	-0.0022
FR Industrial production	-0.0055	-0.0267**	-0.0110***
National Forward-looking			
ZEW	n.a.	-0.0362***	-0.0372***
IFO	-0.0378	-0.0223***	-0.0076
FR Business Confidence	n.a.	-0.0155***	-0.0068
IT Business Confidence	n.a.	-0.0128***	-0.0066
National Prices			
FR Consumer Price Index	0.0077	-0.0212***	-0.0069

*Note: ***, **,*, Significant at the 1, 5 and 10 percent level*

Table 7 summarises the contemporaneous news response coefficients in the first, second and third monetary policy regimes. Only the coefficients for the announcements which are significant in the full sample using the regression setup in equations (5) and (7) are shown in the table.

Several interesting features can be observed. First, US activity and employment announcements seem to increase in importance over time, in line with Bernanke et al. (2004). One may argue that this is due to the smaller sample size as it requires a larger t-value to reject the null hypothesis of zero response. However, the t-values for the US announcements in the first regime are generally much smaller than in the other periods, suggesting that during the ECB's tightening cycle, US news played a less important role in the price determination of German bond futures prices compared with the latter two monetary policy regimes. Regarding the magnitude of the estimated significant coefficients, the most interesting characteristics concern the US employment data where the size (in absolute value) of both the non-farm payroll and the initial jobless claims estimates has increased over time. This higher asset price sensitivity to unemployment data in the United States may be linked to market participants concerns about the so-called

'jobless recovery' in the third monetary policy regime. Again note that, in contrast to other variables, a positive sign is expected a priori for initial jobless claims and other unemployment variables.

Second, national announcements seem to have a larger impact on the German bond markets during the ECB's accommodative policy regime than in the neutral period observed between mid-2003 and mid-2005. This extra sensitivity can probably be linked to the state of the business cycle. Over this period, macro announcements may to a larger extent have signalled an increased likelihood of changes in the monetary and fiscal stance compared to the neutral period.

8. Concluding remarks

This paper finds that US and to some extent euro area and national macro releases exert a significant impact on the prices of long-term German government bonds. Overall the announcements have a stronger and more long-lasting impact on volatility than on the level of bond prices.

US announcements seem to influence German bond returns more than euro area, German, French and Italian macro announcements. There are at least three probable explanations for these findings. First, most aggregate euro area data releases are published after the euro area member states have published their data releases, and so the added informational value of the aggregated euro area releases may be considered small. Second, the limited response of German bond markets to national releases may also be due to a perception among market participants that the releases do not provide timely and complete information on the macro economy for the euro area. Third, the stronger sensitivity to US news compared with euro area news may also suggest that investors perceive the United States as the main engine for global growth.

By splitting our sample period into three sub-samples, reflecting three different monetary policy regimes (tightening, accommodative and neutral), the paper shows that the impact of public information about US activity and employment on German bond markets has increased over time. A possible explanation may be that in late 2003 and early 2004, US employment data were closely monitored by policymakers owing to growing concerns about the so-called jobless recovery.

With regard to the ECB's monetary policy decisions and statements, the financial market tends to have predicted the outcomes of monetary policy decisions with a high degree of precision so far, possibly due to transparency around the intentions of the ECB. Nonetheless, heightened volatility is observed following both monetary policy decisions and the Introductory Statement read by the President at the Press Conference following the decisions.

References

Andersen, T.G., and Bollerslev, T., 1997, "Intraday periodicity and volatility persistence in financial markets", Journal of Empirical Finance, 4, 115-158.

Andersen, T.G., and Bollerslev, T., 1998, "Deutsche Mark-Dollar volatility: Intraday activity patterns, macroeconomic announcements, and longer-run dependencies", Journal of Finance, 53 (1), 219-265.

Andersen, T.G., Bollerslev, T., and Cai, J., 2000, "Intraday and interday volatility in the Japanese stock market", Journal of International Financial Markets, Institutions and Money, 10, 107-130.

Andersen, T.G., Bollerslev, T., Diebold, F.X., and Vega, C., 2003, "Micro effects of macro announcements: real-time price discovery in foreign exchange", American Economic Review, 93, 38-62.

Andersen, T.G., Bollerslev, T., Diebold, F.X., and Vega, C., 2005, "Real-time price discovery in stock, bond and foreign exchange markets", NBER Working Paper No. 11312.

Balduzzi P., Elton, E.J., and Green, T.C., 2001, "Economic news and bond prices: Evidence from the US Treasury market", Journal of Financial and Quantitative Analysis, 36, 523-543.

Bentzen, E., Hansen, P., Lunde, A., and Zebedee, A., 2004, "The Greenspan effect on equity markets: an intraday examination of US monetary policy announcements", unpublished manuscript.

Bernanke, B.S., Reinhart, V.R., and Sack, B.P., 2004, "Monetary policy alternatives at the zero bound: an empirical assessment", Finance and Economics Discussion Series of the Federal Reserve Board, September 2004.

Bernoth, K., and von Hagen, J., 2003, "The performance of the Euribor futures markets: efficiency and impact of ECB policy announcements", ZEI Working Paper B27-2003, Bonn.

Bollerslev, T., Chou, R.Y., and Kroner, K.F., 1992, "ARCH modelling in finance: a review of the theory and empirical evidence", Journal of Econometrics, April-May 52(1-2), 5-59.

Bomfim, A., 2000, "Pre-announcement effects, news effects, and volatility: Monetary policy and the stock market", Journal of Banking and Finance, 27(1), 133-151.

Dacorogna, M.M., Gencay, R., Müller, U.A., Olsen, R.B., and Pictet, O.V., 2001, "An introduction to high-frequency finance", Academic Press.

Dwyer, B., and Hafer, R.W., 1989, "Interest rates and economic announcements", Review, Federal Reserve Bank of St. Louis, 71/2, 34-46.

ECB Monthly Bulletin May, 2004, "The impact of recent employment data releases in the United States on global bond markets", 23-24.

Ederington, L.H., and Lee, J.H., 1993, "How markets process information: news releases and volatility", Journal of Finance, September 48(4), 1161-1191.

Ehrmann, M., and Fratzscher, M., 2002, "Interdependence between the euro area and the U.S.: What role for EMU?", International Finance, 6, 309-328.

Ellingsen, T., and Söderström, U., 2001, "Monetary policy and market interest rates", American Economic Review, 91, 1594-1607.

Faust, J., Rogers, J.H., Swanson, E., and Wright, J.H., 2002, "Identifying the effect of monetary policy shocks on exchange rates using high-frequency data", Journal of European Economic Association, 1 (5), 1031-1057.

Faust, J., Rogers, J.H., Wang, S.B., Wright, J.H., 2003, "The high-frequency response of exchange rates and interest rates to macroeconomic announcements", International Finance Discussion papers No. 784., Board of Governors of the Federal Reserve System.

Fleming, M.J, and Piazzesi, M., 2005, "Monetary policy tick-by-tick", unpublished manuscript.

Fleming, M.J., and Remolona, E.M., 1997, "What moves the bond market?", Federal Reserve Bank of New York Economic Policy Review, 31-50.

Fleming, M.J., and Remolona, E.M., 1999, "Price formation and liquidity in the US Treasury market: The response to public information", Journal of Finance, 54 (5), 1901-1915.

Gallant, A.R., 1981, “On the bias in flexible functional forms and an essentially unbiased form: the Fourier flexible form”, Journal of Econometrics, February 15(2), 211-245.

Gibbons, M.R, and Hess, P., 1981, “Day of the week effect and asset returns”, The Journal of Business, Vol 54, No. 4, 579-596.

Goldberg, L.S., and Leonard, D., 2003, “What moves sovereign bond markets? The effects of economic news on U.S and German yields”, Current Issues in Economics and Finance, Vol. 9, No. 9.

Kuttner, K.N., 2001, “Monetary policy surprises and interest rates: evidence from the Fed Funds Futures market”, Journal of Monetary Economics, 47, 523-544.

Rich, R., and Tracy, J., 2003, “Modeling uncertainty: predictive accuracy as a proxy for predictive confidence”, Federal Reserve Bank of New York, Staff Reports No. 161.

Sebestyén, Sz., 2005, “What drives money market rates?”, unpublished manuscript.

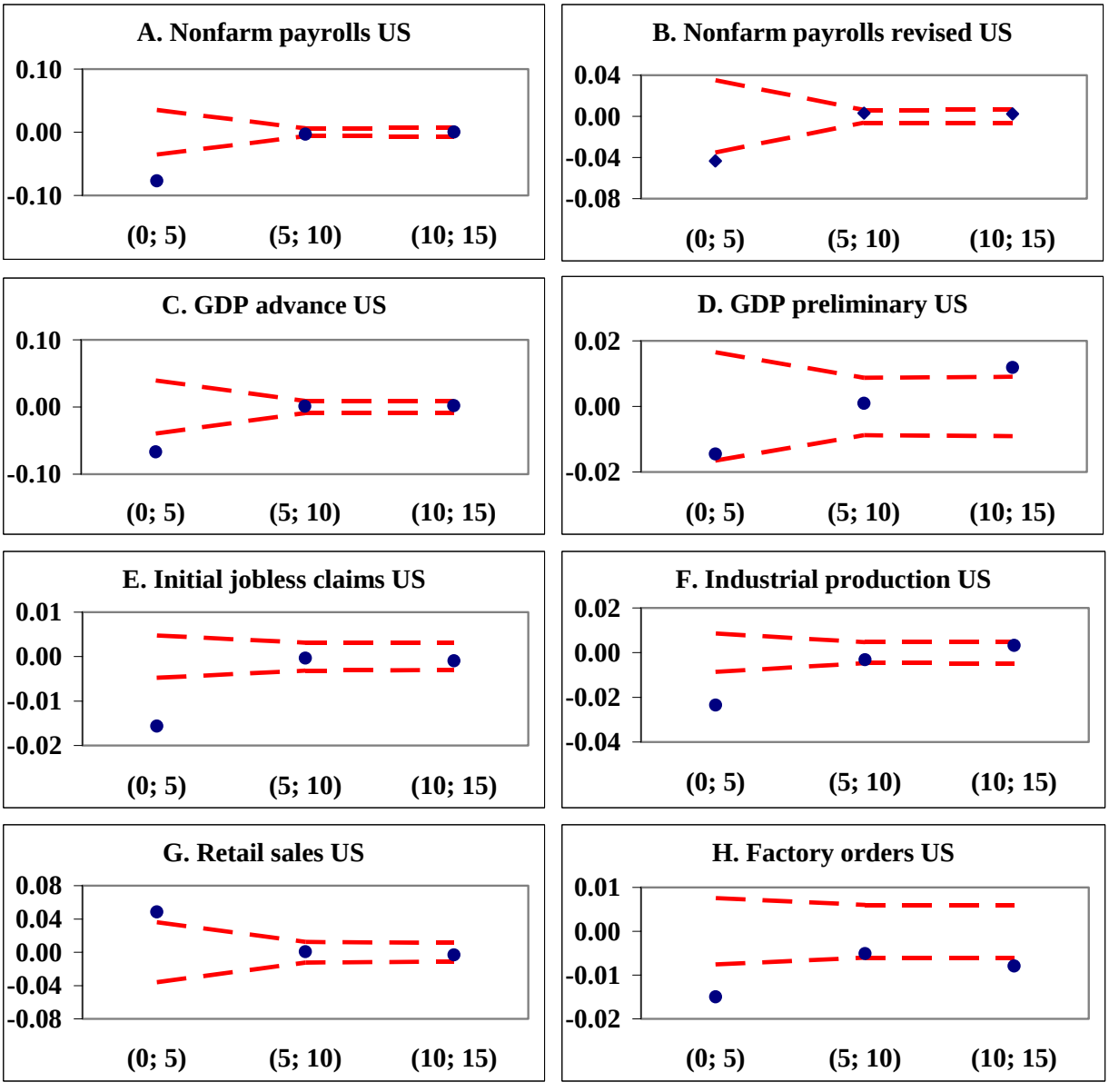
Thornton, D. L., 1998, "Tests of the market's reaction to Federal Funds rate target changes", Federal Reserve Bank of St. Louis Review, 80(6), November/December 1998, pp. 25-36.

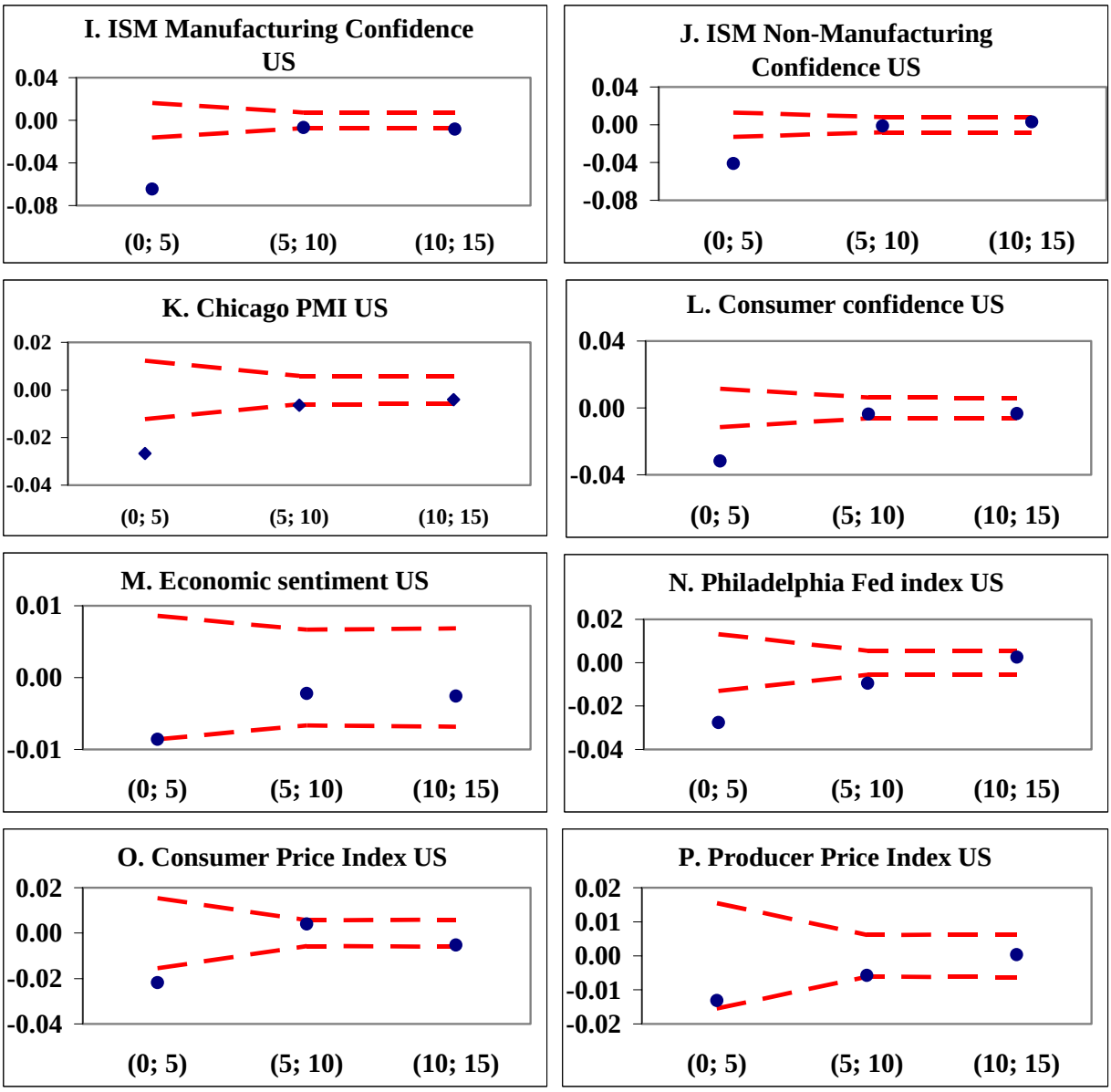
Upper, C., and Werner, T., 2004, “Time-varying information in the bond market and the role of large traders”, unpublished manuscript.

Appendix

Charts

Chart 10 A – P. Mean responses of US macroeconomic announcements. *(January 1997 – July 2005; 5-minute intervals; in percentages)*





Note: The dots represent the mean responses of German bond futures returns to Euro area macroeconomic surprises at the time of the announcement (0;5), ten minutes after (5;10) and fifteen minutes after (10;15). The dashed lines represent standard error bands under the null hypothesis of zero response.

Tables

Table 2. Results of the bias test (see Equation 4)

US Activity and Employment	R2	Constant (St. dev.)		Beta (St. dev.)		No. Obs	Wald test value	(significance)^	^^
US GDP advance	0.792	0.143	(0.340)	0.940	(0.093)	29	0.251	(0.780)	
US GDP preliminary	0.874	0.421	(0.273)	0.925	(0.069)	28	1.253	(0.302)	
US GDP final	0.988	0.099	(0.084)	1.002	(0.021)	28	2.912	(0.072)	*
US Industrial Production	0.677	-0.047	(0.035)	1.142	(0.087)	85	1.606	(0.207)	
US Nonfarm payroll	0.639	-36.160	(14.520)	1.038	(0.086)	85	4.344	(0.016)	**
US Initial jobless claims	0.867	10.050	(7.065)	0.971	(0.020)	369	1.046	(0.352)	
US Retail sales	0.689	-0.054	(0.077)	1.294	(0.095)	85	4.881	(0.010)	***
US Factory orders	0.944	0.047	(0.060)	1.087	(0.029)	85	5.227	(0.007)	***
US Durable goods orders	0.424	0.025	(0.312)	1.555	(0.199)	85	3.973	(0.022)	**
US Business inventories	0.691	0.012	(0.030)	1.094	(0.080)	85	1.438	(0.243)	
Forward-looking US									
US University of Michigan consumer Sentiment Index	0.814	4.918	(4.842)	0.944	(0.051)	80	0.939	(0.395)	
US ISM Manufacturing Confidence US	0.859	0.117	(2.403)	0.999	(0.045)	83	0.025	(0.975)	
US Chicago PMI	0.694	0.738	(3.945)	0.995	(0.073)	85	0.467	(0.628)	
US Consumer confidence	0.947	-0.414	(2.845)	1.004	(0.026)	85	0.022	(0.978)	
US Philadelphia Fed index	0.673	-0.028	(1.187)	0.956	(0.073)	85	0.289	(0.750)	
US ISM Non-Manufacturing Confidence	0.642	6.947	(4.183)	0.888	(0.073)	84	2.364	(0.100)	
US Prices									
US Consumer Price Index	0.765	-0.062	(0.022)	1.250	(0.076)	85	5.487	(0.006)	***
US Producer Price Index	0.683	-0.154	(0.049)	1.856	(0.139)	85	19.224	(0.000)	***
Euro area Activity and Employment									
EA Industrial Production	0.770	0.000	(0.000)	0.900	(0.142)	14	0.377	(0.694)	
EA Retail sales	0.950	0.000	(0.000)	0.996	(0.031)	56	0.430	(0.653)	
EA Unemployment	0.474	-0.001	(0.001)	1.194	(0.178)	52	0.656	(0.523)	
Forward-looking Euro Area									
EA Business Climate	0.991	0.219	(0.606)	0.994	(0.012)	67	0.789	(0.459)	
EA Consumer Confidence	0.926	0.220	(0.550)	1.013	(0.040)	52	0.100	(0.905)	
PMI	0.915	0.000	(0.004)	1.000	(0.041)	57	2.715	(0.075)	*
Euro Area Prices									
Flash HICP EA	0.849	-0.003	(0.001)	1.118	(0.069)	49	1.484	(0.237)	
EA HICP	0.957	0.000	(0.001)	0.985	(0.027)	61	0.177	(0.838)	
EA Producer Price Index	0.831	0.009	(0.004)	0.885	(0.057)	52	4.716	(0.013)	**
EA M3	0.530	0.000	(0.001)	0.769	(0.097)	58	2.866	(0.065)	*
National Activity and Employment									
DE Unemployment	0.599	-4.397	(3.433)	1.363	(0.127)	79	4.152	(0.019)	**
FR Unemployment Change	0.455	-4.297	(2.228)	1.295	(0.157)	84	4.008	(0.022)	**
DE Industrial Production	0.309	-0.295	(0.161)	1.288	(0.215)	82	2.045	(0.136)	
FR Industrial production	0.461	-0.002	(0.001)	1.456	(0.178)	80	4.728	(0.012)	**
IT Industrial production	0.265	-0.003	(0.002)	1.635	(0.473)	35	2.384	(0.108)	
FR GDP	0.787	0.000	(0.001)	0.943	(0.098)	27	1.047	(0.366)	
IT GDP	0.351	0.000	(0.001)	0.800	(0.227)	25	0.732	(0.492)	
Forward-looking National									
ZEW	0.840	3.941	(2.724)	0.910	(0.060)	46	1.161	(0.323)	
IFO	0.931	2.028	(2.766)	0.978	(0.030)	83	0.286	(0.752)	
FR Business confidence	0.988	-5.882	(1.553)	1.056	(0.016)	54	7.935	(0.001)	***
IT Business confidence	0.810	8.471	(5.198)	0.908	(0.055)	65	1.461	(0.240)	
National Prices									
DE Consumer Price Index	0.793	0.000	(0.000)	1.115	(0.065)	79	2.045	(0.136)	
FR Consumer price index	0.694	0.000	(0.000)	1.191	(0.093)	74	4.266	(0.018)	**
IT Consumer Price Index	0.496	0.000	(0.001)	0.693	(0.100)	51	5.430	(0.007)	***

^: Wald-test for constant=0 and beta=1

*^^: ***, **, *, Significant at the 1, 5 and 10 percent level*

Note: Revisions in Non-farm payroll numbers are not included as no expectations are available

Table 3. Selected media reports concerning German unemployment releases (1999 - 2005)

Announcement date	Actual release	Early release / presumed leak	Quote
08 January 1999 09:55	34000	No distortions detected	
09 February 1999 09:53	-59000	No distortions detected	
09 March 1999 10:20	-6000	No distortions detected	
08 April 1999 09:55	-3000	No distortions detected	
07 May 1999 09:50	10000	07 May 1999 09:27	**Only uadjusted numbers leaked.** German unemployment fell in April by 275,383 from a year earlier to 4.145 million, equivalent to 10.7 percent of the workforce, figures obtained by Reuters on Friday ahead of their official release showed.
10 June 1999 10:00	11000	09 June 1999 16:21	**Only unadjusted numbers leaked.** German unemployment fell in May to 3.989 million from 4.145 million the month before on an unadjusted basis, a source familiar with data due to be officially released on Thursday said.
06 July 1999 09:52	15000	06 July 1999 09:02	The source told Reuters the unadjusted number of jobless stood at 3.938 million. The seasonally adjusted jobless number rose by 15,000.
05 August 1999 09:51	1000	01 August 1999 18:52	**Only unadjusted numbers leaked.** In June, a total of 3.94 million people were jobless in Germany in unadjusted terms, compared with 3.99 million in May and 4.15 million in April.
07 September 1999 09:52	4000	07 September 1999 09:06	German unemployment rose by a seasonally-adjusted 4,000 in August, a source told Reuters on Tuesday ahead of the official release of unemployment data by the Federal Labour Office.
05 October 1999 09:55	9000	05 October 1999 09:11	The number of people out of work in Germany in September rose by a seasonally adjusted 9,000 from August, a political source said on Tuesday.
09 November 1999 10:28	-11000	09 November 1999 09:20	Pan-German seasonally-adjusted unemployment fell by 11,000 in October, opposition party sources told Market News International Tuesday.
07 December 1999 10:08	-29000	07 December 1999 09:35	German unemployment fell by 29,000 from the previous month in November on a seasonally adjusted basis, according to sources.
05 January 2000 09:50	-68000	05 January 2000 09:13	German unemployment fell last month by 68,000 from the previous month on a seasonally adjusted basis, sources told Reuters late on Tuesday.
08 February 2000 10:12	-31000	08 February 2000 09:54	**Inaccurate number.** German adjusted unemployment fell in January by 33,000 from the previous month, sources said on Tuesday.
08 March 2000 10:21	-34000	08 March 2000 09:18	German seasonally adjusted unemployment fell in February by 34,000 from the previous month, sources said on Wednesday.
05 April 2000 10:24	8000	05 April 2000 09:10	German seasonally adjusted unemployment rose in March by 8,000 from the previous month, sources said on Wednesday.
09 May 2000 09:55	-8000	09 May 2000 09:21	German unemployment, adjusted for seasonal factors, fell by 8,000 in April from March, sources with access to data due to be released later by the Federal Labour Office said on Tuesday.
08 June 2000 09:55	-32000	08 June 2000 09:01	**Inaccurate number.** The sources also said the number of unemployed on a seasonally adjusted basis fell by 27,000 in May from April.
06 July 2000 09:55	-14000	06 July 2000 14:32	**Only unadjusted numbers leaked.** German unemployment fell by at least 60,000 in June from 3.788 million in May without adjustments for seasonal factors, a trade union official who sits on the Federal Labour Office's board said on Wednesday.
08 August 2000 09:55	-16000	07 August 2000 17:50	**Only unadjusted numbers leaked.** Bild, whose past leaks of jobless data have been accurate, gave no firm adjusted figure for unemployment in July, but said the Federal Labour Office - due to release the figures on Tuesday - would report a fall after June's surprise rise.
06 September 2000 09:55	-19000	06 August 2000 09:05	**Inaccurate number.** German seasonally-adjusted unemployment fell 18,000 from 3.891 million in July, a source told Reuters on Wednesday.
05 October 2000 09:55	-18000	05 October 2000 09:32	Pan-German seasonally-adjusted unemployment fell by 18,000 in September compared to August, informed sources told Market News International Thursday.
07 November 2000 09:50	-25000	07 November 2000 09:23	Following are economists' comments after German seasonally adjusted unemployment fell in October by 25,000 from the previous month, according to data provided by an official source to Reuters.
05 December 2000 09:26	-15000		GERMANY MEDIAN FORECAST - NOV SA UNEMPLOYMENT -20,000 - LEAK -15K.
09 January 2001 09:22	-27000	08 January 2001 17:33	**Only unadjusted number leaked.** German unemployment rose by 163,700 in December from the previous month to around 3.8 million, without adjustment for seasonal factors, the Bild daily said on Monday. The newspaper, which has a good track record in publishing Germany's notoriously leaky jobs figures, gave no figures for seasonally adjusted unemployment.
06 February 2001 09:27	7000		Following are economists' reactions to leaked German January jobless data showing a seasonally adjusted rise of 7,000 from December.
06 March 2001 09:50	3000		German seasonally adjusted unemployment rose by 3,000 in February, sources said on Tuesday, confounding analysts' expectations of a resumption of the downward trend.
04 April 2001 09:50	12000	04 April 2001 08:47	German seasonally adjusted unemployment rose in March by 12,000, a source told Reuters on Wednesday, the third month in a row the adjusted figure has risen.
08 May 2001 09:24	6000		Following are economists' reactions to a report that Germany's unemployment rose 6,000 in April on a seasonally-adjusted basis.
07 June 2001 09:25	18000	07 June 2001 09:16	German unemployment rose in May by 18,000 from the previous month, a source said on Thursday, the fifth month in a row the seasonally adjusted figure has risen.
05 July 2001 09:24	22000	04 July 2001 18:30	Germany's adjusted number of jobless rose 22,000 in June, a source told Reuters on Wednesday.
07 August 2001 09:28	11000		Germany's Federal Labour Office said on Tuesday seasonally adjusted unemployment rose by 11,000 in July, confirming earlier leaks.
05 September 2001 09:33	-2000	05 September 2001 08:18	German unemployment fell by a seasonally-adjusted 2,000 in August, with a rise by 5,000 in western Germany offset by a 7,000 fall in the east, a source said on Wednesday.
09 October 2001 09:03	20000	08 October 2001 18:57	German unemployment rose by a seasonally adjusted 20,000 in September, with a rise of 13,000 in western Germany and a 7,000 increase in the east, largely in line with expectations, a source said on Monday.
06 November 2001 09:26	27000		German adjusted unemployment rose by 27,000 in October, a source said on Tuesday, while the unadjusted figure fell 17,550 in October from 3.725 million to give an unchanged rate of 9.0 percent.
05 December 2001 09:33	17000	05 December 2001 09:28	German seasonally adjusted unemployment rose in November by 17,000 from the previous month, a source told Reuters on Tuesday.

06 February 2002 09:28	31000		German unemployment rose 31,000 in January on a seasonally adjusted basis with the unadjusted unemployment rate up at 10.4 percent from 9.6 percent in December, a source said on Wednesday.
06 March 2002 09:21	1000	06 March 2002 08:50	German unemployment rose 1,000 in February on a seasonally adjusted basis, a deputy head of the Labour Ministry said on Wednesday.
09 April 2002 09:10	-8000		German unemployment, adjusted for seasonal factors, fell in March for the first time since December 2000, sources said on Tuesday.
07 May 2002 09:05	6000	07 May 2002 08:32	Germany's adjusted unemployment rate rose by 6,000 in April, a source told Reuters on Tuesday, above a consensus forecast for a monthly rise of 600.
07 June 2002 09:34	60000	07 June 2002 08:32	Following are economists' reactions to a report that German seasonally adjusted unemployment rose by a higher than expected 60,000 in May.
09 July 2002 09:40	39000	08 July 2002 18:18	**Only unadjusted number leaked.** Germany's headline jobless total rose by an unadjusted 8,000 in June to 3.954 million, mass-circulation Bild newspaper reported on Monday, bad news for Chancellor Gerhard Schroeder ahead of September elections.
07 August 2002 09:02	8000	06 August 2002 19:30	German adjusted unemployment rose by 8,000 in July from the previous month, a source told Reuters on Wednesday, well below most analysts' expectations, but not much consolation for Chancellor Gerhard Schroeder.
05 September 2002 09:19	2000	04 September 2002 17:44	**Only unadjusted number leaked.** Germany's unemployment rate fell to 4,018 million in August, implying a drop of around 29,000 in the month, a source told Reuters on Wednesday.
08 October 2002 09:19	-1000	07 October 2002 18:24	**Only unadjusted number leaked.** The source said that the unadjusted figure was down by nearly 70,000 on the 4.018 million registered in August, bringing the headline figure below four million.
07 November 2002 09:20	22000		West German seasonally adjusted unemployment rose to 2.716 million from 2.689 million, while eastern German unemployment fell to 1.403 million from 1.408 million, the source said.
04 December 2002 09:17	35000	03 December 2002 19:25	German seasonally adjusted unemployment rose in November by 35,000 from the previous month, a source told Reuters on Tuesday.
09 January 2003 09:17	28000		Confirming market expectations of a strong rise, the number of unemployed in Germany rose by a seasonally adjusted 28,000 in December from the November level, a source with access to the official German Labor Office data said Thursday.
05 February 2003 09:17	62000	04 February 2003 20:44	The unemployment total adjusted for seasonal factors rose by 62,000 in January compared with December, the source said.
06 March 2003 09:45	67000	06 March 2003 09:37	The number of unemployed in Germany rose by a seasonally adjusted 67,000 in February from the January level, a source with access to the official German Labor Office data said Thursday.
03 April 2003 09:25	52000	03 April 2003 09:23	German unemployment adjusted for seasonal factors rose by 52,000 in March, a labour office source told Reuters on Thursday.
07 May 2003 09:32	44000	06 May 2003 14:30	**Only unadjusted number leaked.** German headline unemployment, not adjusted for seasonal factors, fell just below 4.5 million in April from 4.608 million in March, a government source told Reuters on Tuesday.
05 June 2003 09:16	-4000		A surprise 4,000 month-on-month decline in German unemployment was caused by government labour market policies rather than any cyclical upturn, a Labour Office source said on Thursday.
08 July 2003 09:24	-33000	08 July 2003 08:17	German unemployment adjusted for seasonal factors fell by 33,000 in June, said a source with knowledge of data to be released by the Federal Labour Office on Tuesday.
06 August 2003 09:27	7000	06 August 2003 08:21	German unemployment adjusted for seasonal factors rose by 7,000 in July to 4.408 million, said a source with knowledge of data to be released by the Federal Labour Office on Wednesday.
04 September 2003 09:25	0	04 September 2003 08:35	German unemployment adjusted for seasonal factors was unchanged in August from July's 4.408 million, said a source with knowledge of data to be released by the Federal Labour Office on Thursday.
09 October 2003 09:14	-14000	09 October 2003 00:35	German unemployment adjusted for seasonal factors fell 14,000 in September, a source with knowledge of the data said on Thursday, attributing the surprising drop to recent labour market reforms.
06 November 2003 09:14	-12000	06 November 2003 00:34	German unemployment fell by 12,000 in seasonally-adjusted terms in October as a result of labour market reforms, an informed source told Reuters on Thursday, a bigger drop than analysts had expected.
04 December 2003 08:59	-18000	04 December 2003 00:41	German unemployment fell by a seasonally adjusted 18,000 in November as measures to get jobless people into training schemes or part-time jobs took effect, a source familiar with data to be released by the Federal Labour Office later on Thursday told Reuters.
08 January 2004 08:53	-21000	08 January 2004 08:16	German unemployment fell by a greater than expected 21,000 in seasonally-adjusted terms in December, a source who has seen data to be released later on Thursday told Reuters.
05 February 2004 09:29	-81000	05 February 2004 08:23	German unemployment fell by 81,000 in seasonally adjusted terms in January, under a new method of calculation that excludes some people on training programmes, but was up more than 20,000 under the old method, a source who has seen the data told Reuters on Thursday.
04 March 2004 09:17	26000	04 March 2004 08:21	German unemployment rose by 26,000 in seasonally adjusted terms in February, a source who has seen the data told Reuters on Thursday.
06 April 2004 09:32	44000	06 April 2004 08:15	German seasonally adjusted unemployment rose by a higher-than-expected 23,000 in April from the previous month, according to a source who has seen data due to be released on Wednesday.
05 May 2004 09:30	23000	05 May 2004 07:06	German seasonally adjusted unemployment rose by a higher-than-expected 23,000 in April from the previous month, according to a source who has seen data due to be released on Wednesday.
08 June 2004 08:17	9000	08 June 2004 07:54	German unemployment rose for a fourth consecutive month in May by a seasonally adjusted 9,000 to 4.374 million, according to a source with knowledge of data due to be released on Tuesday.
06 July 2004 09:25	-1000	06 July 2004 06:01	Germany's seasonally adjusted unemployment total fell by 1,000 in June from May, the first such drop since January, according to a source familiar with the data to be released on Tuesday.
04 August 2004 09:29	11000	04 August 2004 08:11	German unemployment adjusted for seasonal factors rose in July by 11,000 month on month to 4.386 million, a source with knowledge of official data due to be released on Wednesday said.
02 September 2004 09:10	24000	02 September 2004 08:06	German unemployment adjusted for seasonal factors rose in August by 24,000 to 4.414 million, a source with knowledge of official data due to be released on Thursday told Reuters.
05 October 2004 09:27	27000	04 October 2004 17:38	German unemployment adjusted for seasonal factors rose by a bigger-than-expected 27,000 in September, a source with knowledge of official data due to be released on Tuesday told Reuters on Monday.
03 November 2004 09:21	12000	02 November 2004 15:04	German seasonally adjusted unemployment rose in October by 12,000 month-on-month, a source with knowledge of the data told Reuters on Tuesday.

02 December 2004 09:22	7000	02 December 2004 09:18	The number of unemployed people in Germany rose 7,000, in seasonally-adjusted terms, in November from October, a source with access to the official German Labor Agency data told Dow Jones Newswires Thursday.
04 January 2005 09:14	17000	04 January 2005 08:33	The number of Germans out of work rose by a seasonally adjusted 17,000 in December from November, Reuters said, citing unidentified people with knowledge of the figures from the Federal Labor Agency.
02 February 2005 09:07	227000	01 February 2005 18:06	Germany's adjusted jobless total increased by 227,000 in January from the previous month, a Federal Labour Office source told Reuters on Tuesday.
01 March 2005 09:55	161000	28 February 2005 20:00	The source said that unemployment rose by 161,000 in February versus the prior month on an adjusted basis, almost double the amount forecast by economists.
31 March 2005 08:55	92000	30 March 2005 13:29	Germany's seasonally-adjusted jobless total rose by a bigger-than-expected 92,000 in March, a Federal Labour Office source told Reuters on Wednesday.
28 April 2005 09:30	-79000	27 April 2005 16:15	The number of Germans out of work unexpectedly fell on a seasonally adjusted basis in April, the first monthly decline since January 2004, a Labour Office source told Reuters on Wednesday. The adjusted total dropped by 80,000 in April from March, the source said. Economists had been forecasting an adjusted rise of 17,500, according to a Reuters poll.
31 May 2005 09:30	0	30 May 2005 15:04	German unemployment adjusted for seasonal factors was unchanged in May, or slightly better that economists' expectations for a drop of around 10,000, a source familiar with the data told Reuters on Monday. The source said that the unadjusted total, a politically sensitive number in Germanny, fell by 161,000 to 4.807 million.
30 June 2005 09:25	-23000	29 June 2005 20:36	German unemployment adjusted for seasonal factors fell a larger-than-expected 23,000 month on month in June, a source familiar with official Labour Office data said on Wednesday.
28 July 2005 09:55	-42000	27 July 2005 16:33	Unemployment in Germany adjusted for seasonal swings fell by a much-bigger-than-expected 40,000 in July from the previous month, a source with knowledge of the official data told Reuters on Wednesday.
31 August 2005 09:55	-12000	30 August 2005 16:51	Adjusted for seasonal swings, German unemployment fell by a smaller-than-expected 12,000 month-on-month in August, a source with knowledge of the official data due for release on Wednesday told Reuters.
29 September 2005 09:55	39000	28 September 2005 20:26	German unemployment adjusted for seasonal factors rose around 40,000 in September, bucking expectations for a decline, following a statistical change, a source with knowledge of official data said on Wednesday.
02 November 2005 09:55	-36000	01 November 2005 19:08	German unemployment adjusted for seasonal factors fell in October by 36,000, more than double the drop expected, after a statistical blip pushed the total higher in September, a source familiar with the data said on Tuesday.
01 December 2005 09:55	-53000	01 December 2005 08:05	The number of Germans out of work fell by 53,000 month on month in November on a seaonally adjusted basis, a source with knowledge of official data told Reuters on Thursday.
03 January 2006 09:55	-110000	03 January 2006 08:16	The number of Germans out of work fell by 110,000 month on month in December on a seaonally adjusted basis, a far greater drop than expected, a source with knowledge of official data told Reuters on Tuesday.

Note: It has not been possible to identify the exact release times of all media reports. The presumed leaks may have occurred earlier, than the cited release times, as it may have been reported earlier in other news flashes or by other medias.

Source: Factiva and Reuters.

Table 5. Estimated contemporaneous news response coefficients (see Equation 5)

	Euro Area Bond markets, Full Sample		
US Activity and Employment	Beta	t-value	
US GDP advance	-0.0932	-4.2372	***
US GDP preliminary	-0.0167	-1.8293	
US GDP final	-0.0139	-1.0602	
US Industrial Production	-0.0241	-4.7720	***
US Nonfarm payroll	-0.0883	-4.4532	***
US Nonfarm payroll revised	-0.0448	-2.1112	*
US Initial jobless claims	0.0167	-6.4869	***
US Retail sales	-0.0483	-5.2672	***
US Factory orders	-0.0152	3.2264	***
US Durable goods orders	-0.0442	-6.4357	***
US Business inventories	0.0041	0.5793	
US Forward-looking			
US University of Michigan consumer Sentiment Index	-0.0179	-2.9429	***
US ISM Manufacturing Confidence US	-0.0370	-2.9356	***
US Chicago PMI	-0.0315	-4.3873	***
US Consumer confidence	-0.0474	-7.2228	***
US Philadelphia Fed index	-0.0308	-4.0977	***
US ISM Non-Manufacturing Confidence	-0.0447	-7.5728	***
US Prices			
US Consumer Price Index	-0.0195	-1.9816	
US Producer Price Index	-0.0146	-2.0205	*
Euro area Activity and Employment			
EA Industrial Production	-0.0090	-2.6880	**
EA Retail sales	-0.0012	-0.3569	
EA Unemployment	-0.0033	-1.5187	
Euro Area Forward-looking			
EA Business Climate	-0.0027	-0.8143	
EA Consumer Confidence	0.0073	2.7158	**
EA PMI	-0.0046	-1.3433	
Euro Area Prices			
EA Flash HICP	-0.0041	-1.4049	
EA HICP	-0.0011	-0.4646	
EA Producer Price Index	-0.0046	-1.4089	
EA M3	-0.0047	-1.2323	

National Activity and Employment			
DE Industrial Production	-0.0089	2.5047	**
DE Unemployment	-0.0051	-1.1887	
FR GDP	-0.0105	-1.9019	
FR Industrial production	-0.0116	-3.7937	***
FR Unemployment	0.0040	1.1174	
IT GDP	-0.0883	-4.4532	
IT Industrial production	-0.0024	-0.5750	
National Forward-looking			
ZEW	-0.0378	-6.0276	***
IFO	-0.0230	-4.0339	***
FR Business Confidence	-0.0129	-3.8724	***
IT Business Confidence	-0.0070	-2.5521	**
National Prices			
DE Consumer Price Index	-0.0016	-0.6530	
FR Consumer Price Index	-0.0159	-3.9217	***
IT Consumer Price Index	0.0060	1.6290	
ECB			
ECB monetary policy surprise	0.0832	1.3020	

*Note: ***, **,*. Significant at the 1, 5 and 10 percent level*

Table 6. Estimated volatility response coefficients (see Equation 6)

	Minutes after the announcement		
US Activity and Employment	**0**	**15**	**30**
US GDP advance	0.0580***	0.0094***	0.0053*
US GDP preliminary	0.0180***	0.0046*	0.0021
US GDP final	0.0081	-0.0018	0.0005
US Industrial Production	0.0160***	0.0052***	0.0038**
US Nonfarm payroll	0.1159***	0.0256***	0.0076***
US Initial jobless claims	0.0129***	0.0057***	0.0024***
US Retail sales	0.0359***	0.0064***	0.0026
US Factory orders	0.0065*	0.0022	0.0023
US Durable goods orders	0.0209***	0.0062***	0.0025
US Business inventories	0.0178***	0.0054***	0.0006
US Forward-looking			
US University of Michigan consumer Sentiment Index	0.0130***	0.0074***	0.0011
US ISM Manufacturing Confidence US	0.0561***	0.0098***	0.0031
US Chicago PMI	0.0238***	0.0069***	0.0023
US Consumer confidence	0.0185***	0.0054***	0.0026
US Philadelphia Fed index	0.0300***	0.0101***	0.0065***
US ISM Non-Manufacturing Confidence	0.0134***	0.0044**	0.0013
US Prices			
US Consumer Price Index	0.0387***	0.0079***	0.0011
US Producer Price Index	0.0201***	0.0085***	0.0037**
Euro area Activity and Employment			
EA Industrial Production	0.0051**	0.0004	0.0005
EA Retail sales	0.0021	-0.0016	-0.0015
EA Unemployment	-0.0009	-0.0015	0.0000
Euro Area Forward-looking			
EA Business Climate	0.0018	0.0041	0.0019
EA Consumer Confidence	-0.0016	-0.0007	-0.0019
EA PMI	0.0034	0.0001	0.0010
Euro Area Prices			
EA Flash HICP	0.0002	0.0000	-0.0004
EA HICP	-0.0007	-0.0006	0.0000
EA Producer Price Index	0.0041	0.0010	0.0006
EA M3	0.0025	0.0022	0.0029**
National Activity and Employment	**0**	**15**	**30**
GE Industrial Production	0.0072***	-0.0000	0.0009
GE Unemployment	0.0022	0.0003	-0.0015
FR GDP	0.0008	0.0009	-0.0024
FR Industrial production	0.0011	-0.0004	0.0006
FR Unemployment	0.0019	0.0003	-0.0015
IT GDP	0.0017	0.0040	0.0014
IT Industrial production	-0.0014	-0.0009	-0.0011
National Forward-looking			
ZEW	0.0135***	0.0065***	0.0020
IFO	0.0218***	0.0083***	0.0038***
FR Business Confidence	-0.0001	-0.0011	0.0011
IT Business Confidence	0.0002	-0.0000	-0.0013

National Prices			
GE Consumer Price Index	0.0008	-0.0002	-0.0007
FR Consumer Price Index	0.0058*	0.0029*	0.0004
IT Consumer Price Index	-0.0008	0.0004	0.0007
ECB			
ECB monetary policy decision	0.0169***	0.0106***	0.0037***
ECB Introductory Statements	0.0172***	0.0070***	0.0070***

*Note: ***, **,*, Significant at the 1, 5 and 10 percent level The surprises from the non-farm payroll revised numbers are not included in the model as their release time always coincide with that of the new non-farm payroll data, which might lead to multicollinearity problems in the conditional variance equation.*

European Central Bank Working Paper Series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.int)

585 "Are specific skills an obstacle to labor market adjustment? Theory and an application to the EU enlargement" by A. Lamo, J. Messina and E. Wasmer, February 2006.

586 "A method to generate structural impulse-responses for measuring the effects of shocks in structural macro models" by A. Beyer and R. E. A. Farmer, February 2006.

587 "Determinants of business cycle synchronisation across euro area countries" by U. Böwer and C. Guillemineau, February 2006.

588 "Rational inattention, inflation developments and perceptions after the euro cash changeover" by M. Ehrmann, February 2006.

589 "Forecasting economic aggregates by disaggregates" by D. F. Hendry and K. Hubrich, February 2006.

590 "The pecking order of cross-border investment" by C. Daude and M. Fratzscher, February 2006.

591 "Cointegration in panel data with breaks and cross-section dependence" by A. Banerjee and J. L. Carrion-i-Silvestre, February 2006.

592 "Non-linear dynamics in the euro area demand for M1" by A. Calza and A. Zaghini, February 2006.

593 "Robustifying learnability" by R. J. Tetlow and P. von zur Muehlen, February 2006.

594 "The euro's trade effects" by R. Baldwin, comments by J. A. Frankel and J. Melitz, March 2006

595 "Trends and cycles in the euro area: how much heterogeneity and should we worry about it?" by D. Giannone and L. Reichlin, comments by B. E. Sørensen and M. McCarthy, March 2006.

596 "The effects of EMU on structural reforms in labour and product markets" by R. Duval and J. Elmeskov, comments by S. Nickell and J. F. Jimeno, March 2006.

597 "Price setting and inflation persistence: did EMU matter?" by I. Angeloni, L. Aucremanne, M. Ciccarelli, comments by W. T. Dickens and T. Yates, March 2006.

598 "The impact of the euro on financial markets" by L. Cappiello, P. Hördahl, A. Kadareja and S. Manganelli, comments by X. Vives and B. Gerard, March 2006.

599 "What effects is EMU having on the euro area and its Member Countries? An overview" by F. P. Mongelli and J. L. Vega, March 2006.

600 "A speed limit monetary policy rule for the euro area" by L. Stracca, April 2006.

601 "Excess burden and the cost of inefficiency in public services provision" by A. Afonso and V. Gaspar, April 2006.

602 "Job flow dynamics and firing restrictions: evidence from Europe" by J. Messina and G. Vallanti, April 2006.

603 "Estimating multi-country VAR models" by F. Canova and M. Ciccarelli, April 2006.

604 "A dynamic model of settlement" by T. Koeppl, C. Monnet and T. Temzelides, April 2006.

605 "(Un)Predictability and macroeconomic stability" by A. D'Agostino, D. Giannone and P. Surico, April 2006.

606 "Measuring the importance of the uniform nonsynchronization hypothesis" by D. A. Dias, C. Robalo Marques and J. M. C. Santos Silva, April 2006.

607 "Price setting behaviour in the Netherlands: results of a survey" by M. Hoeberichts and A. Stokman, April 2006.

608 "How does information affect the comovement between interest rates and exchange rates?" by M. Sánchez, April 2006.

609 "The elusive welfare economics of price stability as a monetary policy objective: why New Keynesian central bankers should validate core inflation" by W. H. Buiter, April 2006.

610 "Real-time model uncertainty in the United States: the Fed from 1996-2003" by R. J. Tetlow and B. Ironside, April 2006.

611 "Monetary policy, determinacy, and learnability in the open economy" by J. Bullard and E. Schaling, April 2006.

612 "Optimal fiscal and monetary policy in a medium-scale macroeconomic model" by S. Schmitt-Grohé and M. Uribe, April 2006.

613 "Welfare-based monetary policy rules in an estimated DSGE model of the US economy" by M. Juillard, P. Karam, D. Laxton and P. Pesenti, April 2006.

614 "Expenditure switching vs. real exchange rate stabilization: competing objectives for exchange rate policy" by M. B. Devereux and C. Engel, April 2006.

615 "Quantitative goals for monetary policy" by A. Fatás, I. Mihov and A. K. Rose, April 2006.

616 "Global financial transmission of monetary policy shocks" by M. Ehrmann and M. Fratzscher, April 2006.

617 "New survey evidence on the pricing behaviour of Luxembourg firms" by P. Lünnemann and T. Y. Mathä, May 2006.

618 "The patterns and determinants of price setting in the Belgian industry" by D. Cornille and M. Dossche, May 2006.

619 "Cyclical inflation divergence and different labor market institutions in the EMU" by A. Campolmi and E. Faia, May 2006.

620 "Does fiscal policy matter for the trade account? A panel cointegration study" by K. Funke and C. Nickel, May 2006.

621 "Assessing predetermined expectations in the standard sticky-price model: a Bayesian approach" by P. Welz, May 2006.

622 "Short-term forecasts of euro area real GDP growth: an assessment of real-time performance based on vintage data" by M. Diron, May 2006.

623 "Human capital, the structure of production, and growth" by A. Ciccone and E. Papaioannou, May 2006.

624 "Foreign reserves management subject to a policy objective" by J. Coche, M. Koivu, K. Nyholm and V. Poikonen, May 2006.

625 "Sectoral explanations of employment in Europe: the role of services" by A. D'Agostino, R. Serafini and M. Ward-Warmedinger, May 2006.

626 "Financial integration, international portfolio choice and the European Monetary Union" by R. A. De Santis and B. Gérard, May 2006.

627 "Euro area banking sector integration: using hierarchical cluster analysis techniques" by C. Kok Sørensen, J. M. Puigvert Gutiérrez, May 2006.

628 "Long-run money demand in the new EU Member States with exchange rate effects" by C. Dreger, H.-E. Reimers and B. Roffia, May 2006.

629 "A market microstructure analysis of foreign exchange intervention" by P. Vitale, May 2006.

630 "Implications of monetary union for catching-up member states" by M. Sánchez, May 2006.

631 "Which news moves the euro area bond market?" by M. Andersson, L. J. Hansen and S. Sebestyén, May 2006.

ISSN 1561081-0