

Do European Central Bank Announcements Influence Stock Prices and Exchange Rates?

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Abstract

This article examines how European Central Bank (ECB) communications with markets influence stock prices and exchange rates in the Euro area. European countries introduced common currency, the euro, in 1999 and an integrated monetary policy has been implemented. Monetary policy became difficult as each country has its own economic conditions and variety of market participants; however, heavy dependence on monetary policy occurs as the fiscal condition of each country is very severe. At present, ECB policy announcements effectively impact future interest rates, stock prices, and exchange rates via future interest rates. However, impacts on stock prices and exchange rates have not been significant. The time span of the policy is short. Moreover, unexpected shocks in unemployment data cause significant movement in exchange rates.

JEL classification numbers: E52, E58, F31

Keywords: Central bank; communication; ECB; Euro; exchange rate; stock price

1 Introduction

This article examines the impact of the European Central Bank (ECB) monetary policy announcements on stock prices and exchange rates in the Euro area. The goal of European Economic and Monetary Union (EMU), which was established in 1992, was to complete the task at the start of stage 3 of the currency unification process. Eleven countries introduced the euro while still using their national currency (e.g., the German marc). The successful adoption of the euro occurred not only because of careful preparation but also because of economic convergence attained by macroeconomic policies since the early 1990s. These policies could have achieved several economic conditions, including inflation. After the introduction of the euro in 1999, the Euro area sometimes experienced severe economic conditions. First, the Euro area was influenced significantly by

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contagion from the U.S. subprime problem with other area countries in 1998. Next, large public deficits and debt, as in Greece, lowered output and huge financial market tensions hit growth in the Euro area.

The ECB and national central banks together made the Euro area into the Eurosystem. The main mission of the Eurosystem is to maintain price stability. The ECB thinks that price stability contributes to the achievement of good economic performance and employment, which has been a serious issue in some European countries. The ECB's governing council has defined price stability as a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) at below 2%.

The ECB homepage notes that the ECB emphasizes transparency, which means that the central bank provides the general public and the markets with all relevant information about its strategy, assessments and policy decisions as well as its procedures in an open, clear and timely manner. Transparency can help the public understand the monetary policy and makes the policy more effective.

It cannot be denied that communication with markets for central banks is very important in the conduct of adequate and effective monetary policy. The ECB publicly announces monetary policy, which helps the markets understand the policy and moreover makes the policy more predictable. Appropriate monetary policy with the use of announcements is generally expected to improve performance by establishing efficient and accurate expectations; however, this approach may sometimes dampen the economy or even cause financial market turmoil. Moreover, central banks should understand the transmission mechanism of monetary policy to have a desirable effect. However, the transmission mechanism should be examined for long, changeable and uncertain lags, so it is difficult to manage it.

[1] found that monetary policy has huge, rapid, and significant effects on output and inflation. [2] showed that monetary policy was stabilized when the economy was more effective after the 1980s by responding to inflation expectations. [3] showed that the regional effects of monetary policy were dampened during the Volcker-Greenspan era. [4] found that as much as half of the variability in output was caused by monetary policy shocks.

However, in spite of its importance, little attention has been paid to monetary policy, especially financial market communication with central banks. Recently, some studies have been published about the case of the United States; however, such studies for the other countries and areas cases have just begun to appear.

This does not mean that market communication relative to monetary policy has not been discussed at all. The relationship between central bank transparency and the effectiveness of monetary policy has been disputed for the case of the United States. For example, [5] showed that central banks with large transparency contribute to decreases in inflation and interest rates. [6] showed that transparency of the central banks' forecasting procedures causes output stabilization. Like these studies of central bank transparency, most studies have indicated that greater transparency has a desirable effect that lowers inflation expectations and also lowers long-term nominal interest rates.

Moreover, studies that have focused on central bank communication have begun to appear recently. Most of these studies have shown the importance of policy communication with markets. [7] showed that the important news for market participants are announcements by the Fed but the information about the Fed's future policies. [8] showed that ambiguous messages from central banks have temporary effects on the increasing volatility of some economic variables and change interest rates away from the expected levels. [9] showed

that financial market participants have systematically misunderstood the ECB's monetary policy, namely the interest rate rule, and understanding of monetary policy that pertains to inflation has become more accurate. [10] showed that central bank communication with financial markets influences inflation rates and has a large role in the transmission of monetary policy to output production. [11] showed that short-term interest rates rise if the central bank communicates when economic conditions are not good. However, few studies have been presented, as only a short time has passed since this field was first developed.

The impact of monetary policy can lead to movements of asset prices. [12] demonstrated that a tightening of interest rates driven by monetary policy has a negative effect on stock prices and that the Fed responds to movements in stock prices. Also, [13] and [14] showed that a commodity price index is not necessary to solve the price puzzle. However, few studies have analyzed the relationship between central bank communications and stock prices. This situation does not seem unnatural in spite of the fact that the goals of many central banks do not include adoption of exchange rates and stock prices; however, the movements of these variables are not and should not be ignored by central banks. These asset prices exert a large influence on the economy.

Also, it appears that the relationship between market communication and exchange rate has not been fully discussed as with the case of stock prices. [15], [16] and [17] showed that the U.S. dollar exchange rate responds to the difference between what the central bank does and what the financial market participants expects the central bank do. On the other hand, such studies have recently started to appear. [18] showed that efforts to talk up the Euro have generally not been successful for the Euro area. [19] also found no significant reaction for the case of the ECB. [20] also showed that exchange rates have been impacted by the conduct of monetary policy in Japan.

This article employs empirical methods to examine how central bank (i.e., ECB) announcements influence exchange rates and stock prices in the Euro area. Section 2 presents a theoretical view to support the empirical analyses. In section 3, empirical analyses are conducted to examine the relationship between the ECB's announcements and financial markets, especially stock prices and exchange rates. The empirical results also are analyzed in this section. Finally, this article ends with a brief summary.

2 Theoretical Analyses

2.1 ECB's Monetary Policy Decisions

The ECB's governing council has sole responsibility for monetary policy in the Euro area. The Council decided that 11 EU states had fulfilled the convergence criteria and would adopt the euro on 1 January 1999. The euro was introduced as the single currency of the Euro area. In 1999, ECB began to do jobs and make monetary policy decisions. The governing council of ECB usually meets twice a month to make decisions. At its first meeting in each month, the council examines the economic and monetary situation and makes policy decisions. Table 1 shows 1999 policy decision. Only the cases in which changes occurred are listed in the Table 1.

Table 1: Monetary policy decisions by the ECB

Date	Interest Rate on Main Refinancing Operations	Interest Rate on Marginal Lending Facility	Interest Rate Deposit Facility	Longer-Term Refinancing Operations
8 Apr. 1999	↓	↓	↓	
21 Oct. 1999				*
4 Nov. 1999	↑	↑	↑	
20 Jan. 2000				*
3 Feb. 2000	↑	↑	↑	
27 Apr. 2000	↑	↑	↑	
8 Jun. 2000	↑	↑	↑	*
21 Jun. 2000				*
31 Aug. 2000	↑	↑	↑	
5 Oct. 2000	↑	↑	↑	
4 Jan. 2001				*
10 May 2001	↓	↓	↓	
30 Aug. 2001	↓	↓	↓	
17 Sept. 2001	↓	↓	↓	
8 Nov. 2001	↓	↓	↓	
8 Nov. 2001	↓	↓	↓	
5 Dec. 2002	↓	↓	↓	
6 March 2003	↓	↓	↓	
5 June 2003	↓	↓	↓	
1 Dec. 2005	↑	↑	↑	
2 March 2006	↑	↑	↑	
8 June 2006	↑	↑	↑	
3 Aug. 2006	↑	↑	↑	
5 Oct. 2006	↑	↑	↑	
7 Dec. 2006	↑	↑	↑	
8 March 2007	↑	↑	↑	
6 June 2007	↑	↑	↑	
3 July 2008	↑	↑	↑	
8 Oct. 2008	↓	↓	↓	
6 Nov. 2008	↓	↓	↓	
4 Dec. 2008	↓	↓	↓	
15 Jan. 2009	↓			
5 March 2009	↓	↓	↓	
2 April 2009	↓	↓	↓	
7 May 2009	↓	↓		
7 April 2011	↑	↑	↑	
7 July 2001	↑	↑	↑	
3 Nov. 2011	↓	↓	↓	
8 Dec. 2011	↓	↓	↓	
5 July 2012	↓	↓	↓	
2 May 2013	↓	↓		
7 Nov. 2013	↓	↓		

Note: ↑ denotes an increase and ↓ denotes a decrease.

Although the minutes of the meetings are not published, the policy decision is expressed at a press conference held shortly after the first meeting of the month. This study uses these announcements as market communication.

2.2 Theoretical Model for Empirical Study

This study investigates the relationship between the ECB's monetary policy announcements and stock prices/exchange rates in the Euro area. These relationships are important topics for several reasons. From the perspective of monetary policymakers, the response of asset prices to central bank policy is one of the most important key factors in examinations of the effect of monetary policy on the economy, which constitutes an understanding of the policy transmission mechanism [21]. To achieve sound economic performance, it is important to conduct monetary policy more adequately and efficiently. To analyze the communication of central banks with financial markets concretely, stock prices and exchange rates are regressed by interest rates and announcement days. Dummy variables are used for announcement days. The basic equations for estimation are as shown in (1) and (2).

$$STOCK = a + bINTEREST/FINTEREST + cPOLICY \quad (1)$$

$$EXCHNAGE = a + bINTEREST/FINTEREST + cPOLICY \quad (2)$$

STOCK means stock prices and EXCHANGE means exchange rates. INTEREST and FINTEREST denote interbank interest rate and interbank future interest rate respectively. POLICY denotes the day when the monetary policy was implemented. The Euro area has suffered serious economic conditions since the introduction of the euro, so the ECB has tried to overcome this situation as shown in Table 1. Also, it should be noted that exports are a driving force that boost the economy of the Euro area, so depreciation of the euro is in general the preferable technique by which policymakers can promote exports. However, too much depreciation of the euro sometimes promotes inflation. The ECB is tasked to control the inflation rate.

After the Lehman shock occurred in 2008, a large amount of capital has flowed into the Japanese yen and Swiss franc (instead of the euro and the U.S. dollar) in spite of the fact that the Japanese economy has not been in good circumstances. Unexpected, complex, and large movements have been ongoing in international financial markets, so one might conclude that it is difficult for policymakers to overcome recession and promote economic growth.

Moreover, this study focuses on the difference between the real value and the market participants' expectations. The difference sometimes influences markets and is strongly related to communication.

Some studies, especially recent ones, have examined the relationship between monetary policy and expectations of some economic variables for the case of the United States. [22] proposed ways to adopt monetary policy in the forecasts of interest rates for the United States. [23], [24], [25] and [26] suggested that the federal future rates are a suitable forecast of the Federal Open Market Committee's (U.S.) target. The current futures contract is well-suited to the evaluation of monetary policy shocks because the underlying 3-month interbank rate closely traces the policy rate, such that it moves to the extent that there is a policy surprise [21, 27].

This article examines the basic equations as shown in (3) and (4). *DIFFERENCE in MARKET EXPECTATIONS* denotes the difference between the real value and the expected ones.

$$STOCK = a + b(DIFFERENCE \text{ in } MARKET \text{ EXPECTATIONS}) \quad (3)$$

$$EXCHANGE = a + b(DIFFERENCE \text{ in } MARKET \text{ EXPECTATIONS}) \quad (4)$$

3 Empirical Analyses

3.1 Relationship between Asset Prices and Monetary Policy

The sample period is from 2000 to 2013. The euro was first introduced in 1999. Daily data are used for estimations of equations (1) and (2). Two interest rates are used for estimation. One is the 3-month interbank interest rate and the other is the 3-month future interest rate in London. Stock price is the end-of-day DAX Average (Germany). DAX is one of the most famous and widely used stock price indices in Germany. Exchange rate is the end of the day's London interbank spot exchange rate (euro/U.S. dollar). POLICY is a dummy variable, which sets to one or zero when monetary policy change occurs. All of the data are from NIKKEI Financial QUEST. The results are shown in Table 2.

Table 2: Monetary policy to stock price/exchange rate: OLS (Ordinary Least Squared)

	STOCK		EXCHANGE	
C	5320.018	14225.92	1.3396	-3.5458
(prob.)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
INTEREST	62,1519		-0.0482	
(prob.)	(0.0000)		(0.0000)	
FINTEREST		-89.7526		0.0488
(prob.)		(0.0000)		(0.0000)
POLICY	58.9947	49.8927	-0.0200	-0.0239
(prob.)	(0.6372)	(0.6880)	(0.4447)	(0.3622)
Adj.R2	0.0129	0.0250	0.1509	0.1479
F-Statistic	24.8284	49.7056	336.5034	328.6773
(prob.)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
D. W.	0.0064	0.0065	0.0024	0.0028

Table 2 shows the results regressed by GMM (generalized method of moments). One problem in equations that use the OLS method is the existence of unobservable specific effects and also lagged dependent variables. This problem can be overcome with the use of the GMM, which is often used for this purpose. This method requires a decision on which variables to use as instrumental variables. In this equation, the lagged values of the dependent variables are used as instrumental variables (see Table 3).

Table 3: Monetary policy to stock price/exchange rate: GMM

	STOCK		EXCHANGE	
C	2225.869 (0.7280)	-293149.9 (0.6707)	1.8974 (0.0487)	47.5249 (0.5372)
INTEREST	-2680.028 (0.6102)		0.4453 (0.5504)	
FINTEREST		2942.482 (0.6653)		-0.4566 (0.5495)
POLICY	876078.4	1034540 (0.6675)	-157.7746 (0.5083)	-156.9895 (0.5067)
Adj.R2	0.81279	0.8510	0.8098	0.8021
J-Statistic	0.0000	0.0000	0.0000	0.0000
D. W.	2.0268	2.0262	2.0269	2.0264

It is difficult to understand the results; however, only FINTERST significantly influences STOCK and EXCHANGE. Future interest rates impact stock prices and exchange rates. However, monetary policy announcements do not directly influence stock prices and exchange rates.

It is necessary to examine whether or not monetary policy has impacts on interest rates or future interest rate. The empirical estimation is as shown in (5).

$$INTEREST = a + bINTEREST(-1) + cPOLICY \quad (5)$$

$$FINTEREST = a + BFINTEREST(-1) + cPOLICY \quad (6)$$

The results are shown in Table 4.

Table 4: Market interest rate effect

	INTEREST	FINTEREST
C	-0.0012 (0.0313)	0.0560 (0.4103)
INTEREST(-1)	1.0002 (0.0000)	
FINTEREST(-1)		0.9994 (0.0000)
POLICY	-0.0049 (0.0740)	0.0253 (0.0083)
Adj.R2	0.9985	0.9981
F-Statistic (prob.)	12805582 (0.0000)	1027288 (0.0000)
D.W.	1.3510	2.5414

The results are clear. Monetary policy announcements influence future interest rates. Monetary policy announcements impact stock prices and exchange rates through future interest rates.

Moreover, vector autoregression (VAR) estimates are conducted to check the effects of monetary policy on time period and direction [17, 28]. [17] denied the conclusion based on much of the VAR results that only a small portion of the variance of output can be

explained by monetary policy shocks. The results of the regression are shown in Tables 5 and 6 and the impulse responses are illustrated in Figures 1 and 2.

Table 5: VAR estimation: INTEREST

	POLICY	INTEREST	STOCK	EXCHANGE
POLICY(-1)	-0.0150 (-0.9219)	-0.0280 (-10.8919)	8.7150 (0.8781)	-0.0010 (-0.8889)
POLICY(-2)	-0.0225 (-1.3681)	0.0028 (1.1092)	-30.2943 (-3.0087)	-0.0005 (-0.4758)
INTEREST(-1)	-0.2935 (-2.9943)	1.3038 (84.1299)	-21.5562 (-0.3606)	-0.0075 (-1.0225)
INTEREST(-2)	0.2963 (3.0231)	-0.3039 (-19.6096)	19.9889 (0.3344)	0.0074 (1.0104)
STOCK (-1)	1.47E-05 (0.5693)	6.58E-06 (1.5515)	0.9563 (58.4772)	2.90E-08 (0.0143)
STOCK (-2)	-1.22E-05 (-0.4531)	-3.61E-06 (-0.8512)	0.0413 (2.5280)	-1.18E-07 (-0.0581)
EXCHANGE (-1)	0.1259 (0.5783)	-0.0255 (-0.7428)	56.6489 (0.4265)	1.0035 (61.1753)
EXCHANGE (-2)	-0.1335 (-0.6131)	0.0247 (0.7174)	-58.2110 (-0.4383)	-0.0047 (-0.2866)
C	-0.0004 (-0.0241)	-0.0152 (-5.6471)	18.4497 (1.7675)	0.0021 (1.6519)
Adj.R2	0.0030	0.9998	0.9938	0.9981
F-Statistic	2.4336	3769876	75932.11	256187.8
Akaike AIC	-1.6517	-5.3406	11.1744	-6.8237

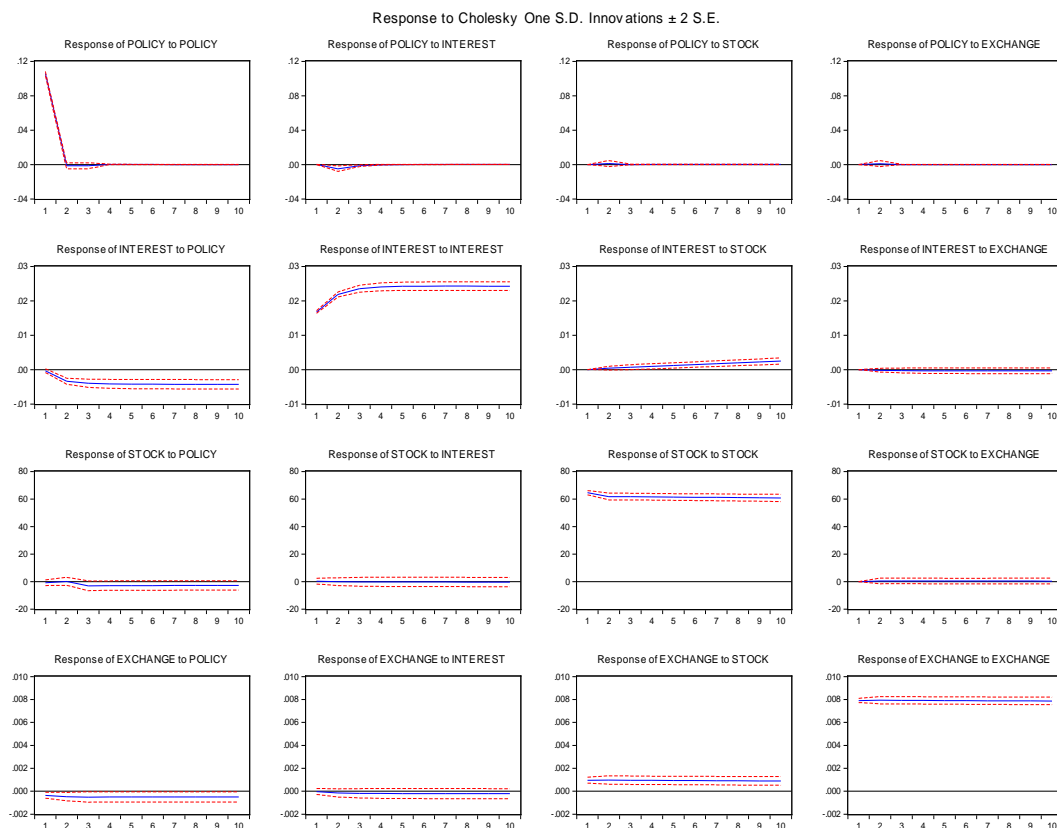


Figure 1: Impulse response: INTEREST.

Table 6: VAR estimation: FINTEREST

	POLICY	FINTEREST	STOCK	EXCHANGE
POLICY (-1)	-0.0136 (-0.8367)	0.0038 (0.4158)	8.1620 (0.8224)	-0.0010 (-0.8328)
POLICY (-2)	-0.0134 (-0.8250)	0.0120 (1.3112)	-29.7350 (-3.0013)	-0.0003 (-0.3192)
FINTEREST (-1)	0.0242 (0.8801)	0.7223 (46.3477)	21.8641 (1.3008)	-0.0016 (-0.7903)
FINTEREST (-2)	-0.0268 (-0.9717)	0.2755 (17.6529)	-20.2878 (-1.2072)	0.0016 (0.8181)
STOCK (-1)	1.47E-05 (0.5465)	-8.14E-05 ()	0.9556 ()	4.78E-09 ()
STOCK (-2)	-1.34E-05 (-0.4975)	7.61E-05 (5.0045)	0.0410 (2.5050)	-1.36E-07 (-0.0672)
EXCHANGE (-1)	0.1274 (0.5846)	0.2264 (1.8359)	57.5389 (0.4334)	1.0039 (61.1939)
EXCHANGE (-2)	-0.1360 (-0.6238)	-0.2204 (-1.7875)	-59.0368 (-0.4445)	-0.0049 (-0.3016)
C	0.2611 (2.0729)	0.1116 (1.5669)	-139.8962 (-1.8233)	-0.0035 (-0.3786)
Adj.R2	0.0005	0.9983	0.9938	0.9981
F-Statistic	1.2530	279649.9	75956.95	12925.88
Akaike AIC	-1.6344	-2.7890	11.1740	-6.8234

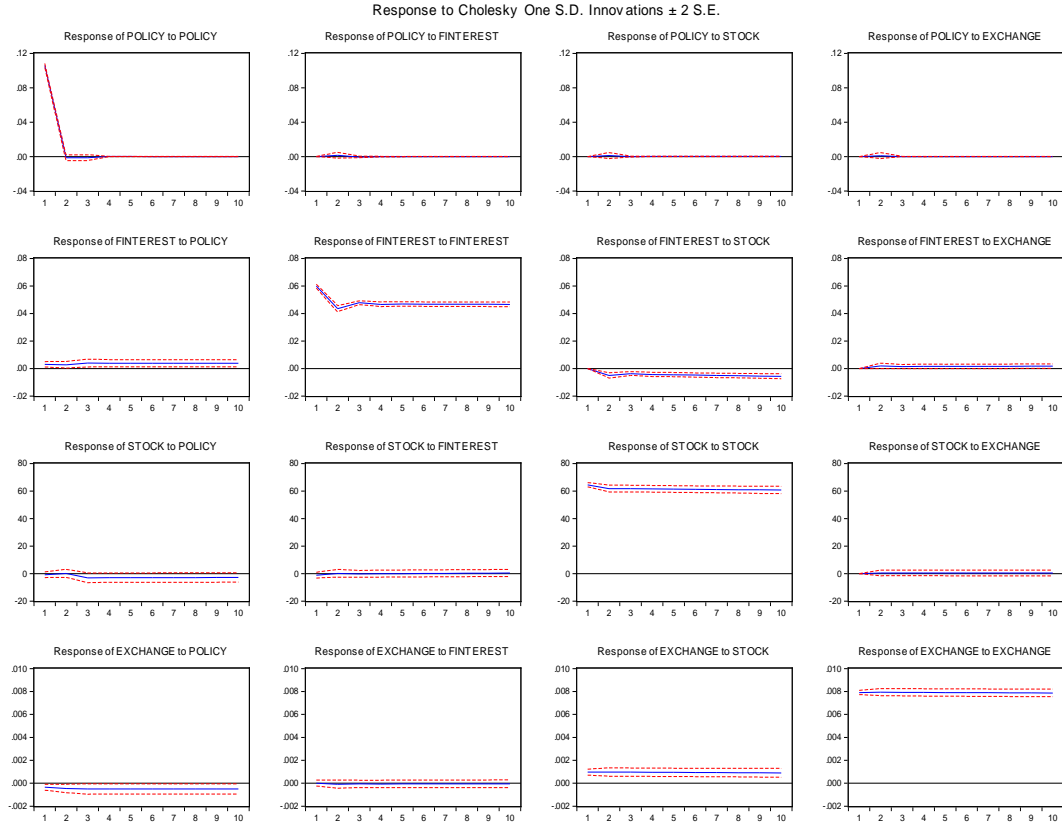


Figure 2: Impulse response: FINTEREST.

The results show that the effects of monetary policy on stock prices and exchange rates exist for only a short period. [29] found that ECB communication drives maturities greater than four months. Compared to this, the period is short. In this case, much more drastic policies may be preferable.

Finally, the effects of macroeconomic news announcements on stock prices and exchange rates on the Euro area also are analyzed. [30] examined the effects of macroeconomic news announcements from the Fed and the ECB on exchange rates. [31] examined the effects of monetary policy actions from macroeconomic news announcements by the Fed and ECB on domestic stock prices. However, few studies have examined case of the Euro area. One reason may be that only a short time has passed since the introduction of the euro. The present study focuses on the responsiveness of exchange rates and stock prices to macroeconomic surprises. The following equation is regressed as shown in (7) and (8).

$$STOCK = a + bMacroNewst \quad (5)$$

$$EXCHANGE = a + bMacroNewst \quad (6)$$

MacroNews is defined as follows: $MacroNewst = Realt - Expected[t, \Omega, t-1]$. Real means the real data announced publicly by government organizations and Expected means the data of market expectations formed by information Ω . t means time. (CPI-ECPI), (UNEMPLOYMENT - EUMUNEMPLOYMENT) and (INTEREST - EINTEREST) are used as explanatory variables. E means expectation. CPI, UNEMPLOYMENT and

INTEREST denote HICP, unemployment rate and future interbank (3-month) interest rate respectively. The data are from the yearly OECD Economic Outlook. Quarterly data from International Financial Statistics (IMF) are used for estimation.

The results are shown in Table 7.

Table 7: News announcements and economic variables

	STOCK	EXCHANGE
C	5412.871 (0.0000)	1.1905 (0.0000)
CPI-ECPI	179.9403 (0.2288)	-0.0597 (0.0514)
UNEMPLOYMENT – EUMUNEMPLOYMENT	-169.7479 (0.3723)	0.2393 (0.0000)
INTEREST – EINTEREST	-90.6376 (0.5888)	0.0400 (0.2435)
Adj.R2	-0.0018	0.2227
F-Statistic (prob.)	0.8975 (0.4438)	16.9523 (0.0000)
D.W.	0.0795	0.1686

Finally, the VAR analysis uses EXCHANGE, STOCK, (CPI-ECPI), (UNEMPLOYMENT – EUMUNEMPLOYMENT), (INTEREST – EINTEREST) is performed. The results are shown in Table 8 and Figure 3.

Table 8: VAR analysis of impacts of economic news and its expectation

	EXCHANGE	STOCK	CPI-ECPI	UNEMPLOYMENT -EUMUNEMPLOYMENT	INTEREST -EINTEREST
EXCHANGE(-1)	0.9723 (12.2338)	155.2255 (0.3313)	1.2642 (1.5937)	-0.2334 (-0.5062)	1.9577 (3.4429)
EXCHANGE(-2)	-0.0034 (-0.0435)	-95.3857 (-0.2056)	-1.5686 (-1.9973)	0.4466 (0.9783)	-2.0905 (-3.7134)
STOCK(-1)	1.35E-06 (0.1006)	0.9191 (11.6499)	3.94E-05 (0.2947)	4.55E-05 (0.5852)	-4.54E-05 (-0.4745)
STOCK(-2)	-4.18E-06 (-0.3097)	0.0517 (0.6500)	-2.26E-05 (-0.1675)	-8.29E-05 (-1.0582)	8.13E-05 (0.8416)
CPI(-1)-ECPI(-1)	-0.0084 (-1.1015)	-24.9251 (-0.5498)	0.8097 (10.5504)	0.0674 (1.5107)	0.0262 (0.4774)
CPI(-2)-ECPI(-2)	0.0107 (1.4056)	28.9308 (0.6414)	-0.1571 (-2.0579)	-0.0356 (-0.8034)	0.0095 (0.1749)
UNEMPLOYMENT(-1)- EUNEMPLOYMENT(-1)	-0.0056 (-0.3179)	-69.4614 (-0.6589)	0.2076 (1.1632)	0.7959 (7.6712)	0.1794 (1.4028)
UNEMPLOYMENT(-2)- EUNEMPLOYMENT(-2)	0.0142 (0.8147)	54.1996 (0.5250)	-0.0025 (-0.0143)	0.0172 (0.1702)	-0.1460 (-1.1657)
INTEREST(-1)- EINTEREST(-1)	-0.0097 (-0.6966)	-97.6840 (-1.1877)	0.1620 (1.1639)	0.0511 (0.6315)	0.9332 (9.3487)
INTEREST(-2)- EINTEREST(-2)	0.0046 (0.3281)	-5.4590 (-0.0660)	-0.1477 (-1.0551)	0.0667 (0.8205)	-0.2100 (-2.0930)
C	0.0525 (1.9455)	78.1441 (0.4911)	0.2765 (1.0267)	-0.0048 (-0.0309)	-0.0864 (-0.4478)
Adj.R2	0.9599	0.9269	0.5480	0.7249	0.5957
F-Statistic	424.9381	225.5379	22.4643	47.6585	27.0806
Akaike AIC	-3.6523	13.7112	0.9489	-0.1358	0.2831

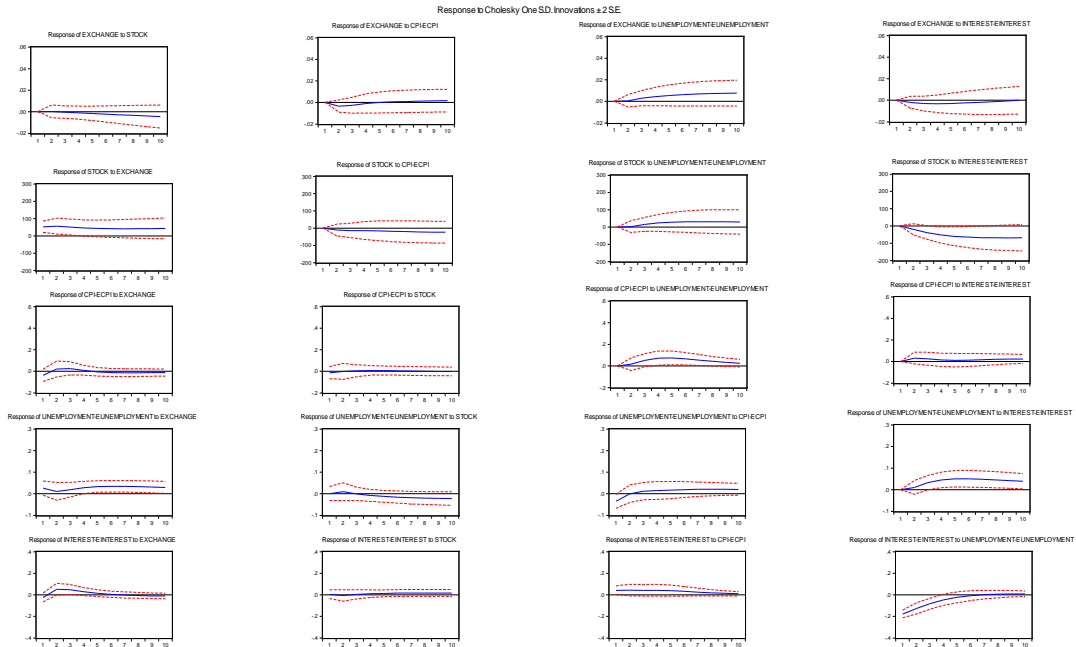


Figure 3: Impulse response function.

The results are interesting. The shock that resulted from the increase in unemployment rate caused depreciation of the euro. However, other shocks (i.e., CPI and interest rates shocks) do not influence stock prices and exchange rates. The direction of the relationship between unemployment and stock prices is positive as expected; however, it is not significant. The shock from the rising unemployment caused depreciation of the euro.

4 Conclusions

This article first examined the impact of ECB announcements on stock prices and exchange rates. Communication by central banks can be an important and powerful measure as it has the power to move markets and to help achieve central banks' potential macroeconomic objectives sometimes without costs. The empirical results show that the policy announcement (i.e., communication) has desirable effects on exchange rates and stock prices through future interest rates. However, most macroeconomic news shocks do not have any desirable impact on stock prices and exchange rates except the case of unemployment news on exchange rates. The findings indicate that the ECB's policy has been effective in general.

There are still some problems. Interest rates and market-based measures of monetary policy news respond simultaneously to all news, not just to news in monetary policy announcements [32, 33]. This suggests that much shorter period data should be used for further analysis. Other foreign exchange markets instead of London should be considered if the data availability problem is solved. The effectiveness of monetary policy sometimes depends on the circumstances of markets and the economy. Boom and recession periods should be separated as the time span increases. The expansion or division of the sample period and other central bank cases would be necessary for a full analysis. Moreover, it

would be interesting to focus on market structure or systems [34]. Further study is needed.

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