

RESEARCH ARTICLE

Effectiveness of European Central Bank Monetary Policy Announcements

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Abstract

The European Central Bank is the main regulator and shaper of monetary policy in the Eurozone. It is, therefore, very interesting to examine to what extent her measures and announcements have an impact on the various economic figures. This investigation covers the period from March 2020 to December 2022. Using the event analysis methodology based on non-standard returns to study the impact of various ECB announcements on government bonds, it is found that significant market reactions occurred. These reactions are more intense for announcements of important monetary policies and less intense for publications of already available information.

Keywords: Efficiency, Monetary Policy, Central Bank, Fact Analysis.

1. Introduction

The purpose of this paper is to analyze the effectiveness of the ECB's monetary policy instruments, as well as their practical application to achieve its objectives. We look at the specific measures the ECB took at key dates in 2020-2022 and check their impact on some financial figures. Another aspect of the ECB's operation, its inflation forecasting ability, is also under scrutiny. We also estimate the effect of policy announcements and their communication with the market in general on euro area government bond yields using the standard event study model developed in the works of Ray Ball and Philip Brown (1968) and Fama, Fisher, Jensen and Roll (1969).

2. The Strategy of the European Central Bank and its Role in the Eurozone

In general, the Treaties do not specify the definition of price stability, with the result that the Governing Council (Board) of the ECB implements the directive based on the contents of the ECB's monetary policy strategy. Setting monetary policy to achieve such a

qualitative target is more easily achieved by using certain, more precise, quantitative targets. The Board believes that price stability is presented in the economy in the form of low, stable inflation and considers optimal to achieve its goals a level close to, but below 2% in the medium term, providing at the same time a margin of safety against the occurrence of deflation.

3. Means of Conducting Monetary Policy

3.1 Conventional Tools

The central bank's conventional tools or contractual policies work mainly through the change in the ECB's policy rates. These are: The main refinancing rate which provides most of the liquidity in the banking system and is also used for open market operations which are a non-contractual instrument, the deposit facility rate provided to banks for their deposits with the ECB and the marginal lending facility rate at which banks are offered overnight credit.

Through them, the levels of various interest rates in the economy such as deposits and consumer, housing and business loans are affected. These interest rates

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directly affect important figures such as the reward of deposits, the cost of borrowing and investments, the exchange rate of the euro and the valuations of various assets, subsequently changing the decisions for consumption, investments and transactions. Thus, the desired values of the Central Bank's target variables such as the inflation rate, the level of demand and the level of employment can be achieved.

3.2 Unconventional Tools

Conventional tools were the ECB's main monetary policy instruments from its inception until the 2007 financial crisis, during which their use to address the eurozone debt crisis brought policy rates to such low levels that the further reduction becomes particularly risky, but also inefficient. As a result, the ECB had to resort to unconventional measures to achieve its goals, implementing asset purchase and targeted funding programs for banking institutions.

The hallmark of such measures is that the ECB actively uses its balance sheet to influence outside of short-term interest rates and asset prices as well as broader market conditions through large-scale liquidity support for banks and large-scale interventions in financial markets. In addition, forward guidance is used to inform the public about various aspects of the future course of the ECB's policies in order to moderate the market's reactions to them. Although the use of non-conventional policies is controversial, analyzing how they are exercised and their impact is important, as they are now a very large part of the ECB's operation.

3.2.1 Long Term Facilities

Long-term facilities aim to reduce the cost of long-term financing for financial institutions by providing liquidity to central banks at a lower interest rate than other sources of capital. The aim is to reduce the general level of interest rates to encourage credit to households and businesses and to promote demand and new investment. They were implemented in the form of temporary long-term refinancing operations (TLTROs) and played an important role in improving bank financing conditions.

3.2.2 Asset Purchases

As part of asset purchases, central banks buy a wide range of such items from private securities to government bonds, which usually form the main part of the programs. Such programs are now a characteristic part of the operation of modern central banks.

Similarly to conventional instruments, the main

objective is to change interest rates, but the way of achieving it shows significant differences. This tool aims to affect market interest rates more directly than a change in policy rates, and as most programs contain purchases of mainly government securities, they are particularly aimed at affecting the risk-free interest rate.

Such programs are implemented either with a quantity objective, buying up to a limited amount of items at any price (quantitative easing), or with a price objective, buying any quantity up to a limited price.

3.2.3 Forward Guidance

Forward guidance refers to informing the market about the direction of monetary policy that the ECB intends to follow. When it uses it, it announces its policy rate targets, how it uses its other tools and its commitment to those targets. These commitments may be of a "temporal" nature, placing limitations on the minimum duration of a policy, or of a "conditional" nature, committing it to maintaining the policy as long as the financial conditions it has set last. Conditions constrain policy change as long as selected variables, such as inflation or employment, show values above or below a selected value. Combined with the rest of its communication methods, guidance is the tool with the biggest impact on asset prices especially near the dates of important ECB publications.

4. Fact Study

The extent of the effects of announcements on selected economic aggregates is assessed by applying the fact study methodology to analyze the influence of ECB announcements and decisions on government bond yields in the Eurozone.

4.1 Methodology of Fact Study

The event study attempts to analyze the statistical significance of the relationship between changes in the levels or trends of economic quantities upon the occurrence of an event. Among the various approaches applied in event studies, this paper uses the abnormal returns methodology, which was developed in the studies of Ray Ball and Philip Brown (1968) and Fama, Fisher, Jensen and Roll (1969). In this approach the question is whether the variables of interest at the date of the events or a period of time around it show unusual magnitudes compared to the data before the corresponding date. In hypothesis testing it is customary to use standard, two-sided statistical tests with the null hypothesis stating that the event had no effect on the selected variable. It can be expressed

numerically as the average value of how much the variable deviates from the estimated value based on the data before the event is zero. The alternative hypothesis is that the control value is nonzero, so the event had a statistically significant effect.

4.2 Variables of Interest

The following variables are used for the market model:

Dependent variable: $R(i,t) = (1 + R_{(EU,t)})^{(1/365)} - 1$

$R_{(EU,t)}$ = nominal current annual interest rate on 10-year Eurozone government bonds on day t .

Market indicator: $R_{(m,t)} = \ln(S50_t / S50_{(t-1)})$

$S50_t$ = closing price of STOXX50 index on day t .

As t is defined the day of an observation around a specific event where a value of 0 is the day of the event, i.e. of each announcement. The estimation period is different per event and depends on the distance of its date from the previous event of the sample lasting up to 57 days before the date of the event until the day before the event. The event period is the day of the event up to 7 days after it.

Table 1. Categorized set of announcements on the ECB website from 1 March 2020 to 31 December 2022. Announcements of monetary policy decisions are underlined.

Date/ Category	Event
March 12, 2020 Press Release	The Governing Council decided on a comprehensive package of monetary policy measures for its programs (LTRO, TLTRO III and APP) and kept the key ECB interest rates on hold. ECB announces easing of conditions for targeted long-term refinancing operations (TLTRO III). The ECB announces measures to support banks' liquidity conditions and money market activity.
March 15, 2020 Press Release	A large group of central banks announces a concerted action to strengthen liquidity provision through US dollar standing liquidity swaps.
March 18, 2020 Policy Decision	ECB announces €750 billion Pandemic Emergency Purchase Program (PEPP).
March 20, 2020 Press Release	Press Release The ECB and Danmarks Nationalbank reactivate the swap line to provide euro liquidity. Continued concerted action by central banks to further strengthen the supply of US dollar liquidity.
April 7, 2020 Press Release	The ECB announces a package of temporary collateral relaxation measures.
April 15, 2020 Press Release	Press Release ECB and Hrvatska narodna banka set up swap line to provide euro liquidity.
April 22, 2020 Press Release	The ECB and the Bulgarian National Bank have established a swap line to provide liquidity in euros. The ECB is taking steps to mitigate the impact of potential rating downgrades on collateral availability.
April 30, 2020 Policy Decision	The Governing Council decided on a comprehensive package of monetary policy measures for its programs (TLTRO III, PELTRO, PEPP and APP) and kept the key ECB interest rates on hold. The ECB is adjusting its targeted lending operations to further support the real economy. The ECB announces new emergency long-term refinancing operations for the pandemonium.
June 4, 2020 Policy Decision	The Governing Council decided on a comprehensive package of monetary policy measures for its programs (PEPP and APP) and kept the key ECB interest rates on hold.
June 5, 2020 Press Release	The ECB and the National Bank of Romania have established a line of repurchase agreements to provide liquidity in euros.

4.3 Total Events

The set of selected events consists of the announcements posted on the website of the European Central Bank from March 2020 until the end of 2022.

The announcements have been categorized into Policy Decisions and Press Releases. The contents of the policy decision announcements include the ECB Governing Council's monetary policy decisions on purchases under the PEPP and APP programmes, financing under PELTRO and TLTRO III and changes in key interest rate levels.

The contents of press releases are more varied. They contain announcements about the ECB's future cooperation with various international financial institutions, usually to maintain liquidity, minor changes in its programs and often include information on monetary developments within the eurozone.

Below is table 1 with all the included announcements. The date of announcement, the type of announcement and a description of its contents are included. The number of events is sixty-one (61) and includes twenty-four (24) Policy Announcements and thirty-seven (37) Press Releases.

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June 10, 2020 Press Release	The ECB publishes an amendment to the indicative calendar for the maintenance periods of foreign exchange reserves in 2020. The ECB publishes indicative calendars for the regular auctions and maintenance periods of the Eurosystem's foreign exchange reserves for 2021.
June 19, 2020 Press Release	The ECB and other major central banks will reduce the frequency of 7-day transactions in US dollars.
June 25, 2020 Press Release	The repo facility for Eurosystem central banks is introduced as a precautionary support to address the pandemic-related liquidity needs of the euro outside the euro area.
July 16, 2020 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for the purchases within the PEPP and APP and the provision of liquidity and for the maintenance of the key ECB interest rates.
July 17, 2020 Press Release	The ECB and the Bank of Albania have established a line of repurchase agreements to provide liquidity in euros. The ECB and the National Bank of Serbia have established a line of repurchase agreements to provide liquidity in euros.
July 23, 2020 Press Release	ECB and Magyar Nemzeti Bank set up line of repurchase agreements to provide euro liquidity
August 18, 2020 Press Release	The ECB and the National Bank of the Republic of North Macedonia have created a line of repurchase agreements to provide liquidity in euros. The ECB and the National Bank of San Marino have established a line of repurchase agreements to provide liquidity in euros.
August 28, 2020 Press Release	The ECB extends euro liquidity lines with the central banks of Croatia and Romania.
September 10, 2020 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for the purchases within the PEPP and APP and the provision of liquidity and for the maintenance of the key ECB interest rates.
September 17, 2020 Press Release	The Governing Council of the ECB has decided that it agrees with banking supervision that there are "exceptional circumstances" that allow certain central bank risks to be excluded from the leverage ratio.
September 22, 2020 Press Release	The ECB will accept bonds linked to sustainability as collateral.
September 28, 2020 Press Release	The ECB amends the monetary policy implementation guidelines.
October 7, 2020 Press Release	The ECB publishes summary of feedback on the public consultation on the €STR compound interest rates.
October 29, 2020 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for the purchases within the PEPP and APP and the provision of liquidity and for the maintenance of the key ECB interest rates.
December 10, 2020 Policy Decision & Press Release	The Governing Council of the ECB announced the monetary policy decisions on the purchases within the PEPP and APP, financing within the TLTRO III and PELTRO and on the maintenance of key interest rates.
January 21, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions on purchases within PEPP and APP, financing within TLTRO III and on the maintenance of key interest rates.
January 29, 2021 Press Release	The ECB publishes a press release on monetary developments in the eurozone.
February 4, 2021 Press Release	The ECB extends bilateral liquidity lines in euros with non-euro area central banks.
March 11, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions on purchases within PEPP and APP, financing within TLTRO III and on the maintenance of key interest rates.
March 18, 2021 Press Release	The ECB starts publishing average short-term euro interest rates (€STR) on 15 April 2021
April 22, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions on purchases within PEPP and APP, financing within TLTRO III and on the maintenance of key interest rates.
April 23, 2021 Press Release	The ECB and other major central banks have decided to suspend 84-day liquidity operations in US dollars.
June 10, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions on purchases within PEPP and APP, financing within TLTRO III and on the maintenance of key interest rates.
June 18, 2021 Press Release	ECB Governing Council Confirms Exceptional Circumstances Still Justify Leverage Ratio Easing

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June 20, 2021 Press Release	The first face-to-face meeting since March 2020 took place for an in-depth discussion on the ECB's strategy review.
July 8, 2021 Press Release	The Governing Council of the ECB approves its new monetary policy strategy. The ECB presents an action plan for including climate change in its monetary policy strategy.
July 22, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
July 23, 2021 Press Release	The ECB publishes indicative calendars for the regular auctions and maintenance periods of the Eurosystem's foreign exchange reserves in 2022.
July 27, 2021 Press Release	The ECB publishes a press release on monetary developments in the eurozone.
September 9, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
October 28, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
December 16, 2021 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
February 3, 2022 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
March 10, 2022 Policy Decision	The Governing Council of the ECB announced its monetary policy decisions on purchases under PEPP and APP, financing under TLTRO III and on the maintenance of repo lines and key interest rates.
March 24, 2022 Policy Decision	Policy Decision The ECB announces a timetable for the phase-out of temporary collateral relief measures due to the pandemic.
March 28, 2022 Press Release	ECB agrees euro liquidity lines with non-euro area central banks until 15 January 2023
April 14, 2022 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the maintenance of key interest rates.
June 9, 2022 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions on purchases within PEPP and APP, financing within TLTRO III and on maintaining key interest rates with the intention of raising them in July.
June 15, 2022 Press Release	Statement after the extraordinary meeting of the Governing Council of the ECB.
July 18, 2022 Press Release	The ECB publishes indicative calendars for the regular auctions and maintenance periods of the Eurosystem's foreign exchange reserves for 2023.
July 21, 2022 Policy Decision & Press Release	The Governing Council of the ECB announced the monetary policy decisions for the purchases within the PEPP and APP, the financing within the TLTRO III and for the increase in the key interest rates. The Governing Council approved the Transmission Protection Instrument (TPI) to support the effective transmission of monetary policy.
September 8, 2022 Policy Decision & Press Release	The Governing Council of the ECB announced the monetary policy decisions for the purchases within the PEPP and APP, the financing within the TLTRO III and for the increase in the key interest rates. The ECB temporarily removes the 0% interest rate ceiling for government deposits.
September 27, 2022 Press Release	The ECB publishes a press release on monetary developments in the eurozone.
October 26, 2022 Press Release	The ECB publishes a press release on monetary developments in the eurozone.
October 27, 2022 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the increase in key interest rates. The ECB is adjusting its targeted lending operations to help restore price stability in the medium term.
October 28, 2022 Press Release	The ECB lays down transitional provisions for minimum reserve requirements after the introduction of the euro in Croatia.
November 28, 2022 Press Release	The ECB publishes a press release on monetary developments in the eurozone.
December 15, 2022 Policy Decision	The Governing Council of the ECB announced the monetary policy decisions for purchases within PEPP and APP, financing within TLTRO III and for the increase in key interest rates. The ECB extends liquidity lines with non-euro area central banks until January 15, 2024.

Source: <https://www.ecb.europa.eu/press/pr/activities/mopo/html/index.en.html>

5. Analysis of Results

The presentation of the results is divided into three parts. First, an analysis is made exclusively of the results of the announcements regarding monetary policy decisions. Second, only the results of press release publications are analysed. Third, an analysis is made including both categories. In each part, the analysis is further divided into: analysis by event, analysis of all events per moment of the event period, and analysis of all events over the entire event period.

5.1 Announcements of Monetary Policy Decisions

The following analysis includes the announcements regarding decisions of the Board of Directors for changes in the monetary policy of the ECB. The set of events consists of twenty-four (24) announcements. The shortest time distance between events is seven (7) observations and therefore constitutes the selected duration of the event period (EP) for each event.

5.1.1 Per Event Throughout the Event Period

Below is the table of t-tests for the cumulative, standardized and unstandardized, abnormal returns per

Table 2. Detailed table of hypothesis tests for CAR and CSAR by event for monetary policy decisions. Statistical significance at levels below 10%, 5% and 1% is indicated by *, ** and *** respectively.

Date	EP		t test			Patell test	
18/3/2020	57	0,64%	8,0334	***	21,9275	7,9808	***
30/4/2020	29	-0,04%	-1,3138	-	-3,5930	-1,3071	-
4/6/2020	23	-0,26%	-6,9917	***	-18,8683	-7,2012	***
16/7/2020	30	-0,27%	-19,6482	***	-54,4531	-19,5919	***
10/9/2020	40	-0,05%	-2,3056	**	-6,2267	-2,2943	**
29/10/2020	35	-0,18%	-7,4852	***	-20,0237	-7,1313	***
10/12/2020	30	-0,14%	-4,1273	***	-11,4443	-4,1713	***
21/1/2021	26	0,10%	3,8410	***	10,3465	3,7590	***
11/3/2021	35	0,22%	11,4130	***	31,7227	11,4700	***
22/4/2021	28	0,15%	6,1778	***	16,9754	6,2179	***
10/6/2021	34	-0,08%	-3,9817	***	-11,0328	-3,9626	***
22/7/2021	30	-0,33%	-24,8398	***	-68,4348	-24,7188	***
9/9/2021	35	0,17%	7,7709	***	21,0705	7,5017	***
28/10/2021	35	0,20%	3,8555	***	10,7240	3,8595	***
16/12/2021	34	-0,03%	-0,6909	-	-1,8877	-0,6833	-
3/2/2022	33	0,64%	17,4235	***	47,7130	16,9016	***
10/3/2022	25	0,22%	12,8181	***	35,1639	12,2627	***
24/3/2022	10	0,18%	8,1225	***	21,4354	8,1660	***
14/4/2022	15	0,23%	18,6947	***	49,4004	18,2236	***
9/6/2022	38	0,52%	16,2867	***	44,2899	15,7469	***
21/6/2022	8	-0,08%	-3,1527	**	-8,0435	-3,1435	***
8/9/2022	57	0,34%	22,5500	***	62,6574	22,7329	***
27/10/2022	35	0,07%	4,6345	***	12,7708	4,6529	***
15/12/2022	35	0,18%	8,9388	***	24,1652	8,2151	***

event for the entire event period. The first column is the date of the event, i.e. the announcement, i.e. time 0. The second column is the extent of the Evaluation Period measured in observed days. As the variables include only weekday observations, the calendar span is longer than the Estimation Period. The third column is the cumulative abnormal return of the events in the event period. The fourth column is its control variable using a t-test with EP-2 degrees of freedom. Columns five and six are the corresponding information as columns three and four but for the standardized abnormal returns.

In checking the CARs it appears that most communications reject the null hypothesis of interest. In 20 events, the null hypothesis is rejected with statistical significance below 1%, in 2 events it is rejected with statistical significance below 5%, and in 2 events it is not rejected. In CSAR control the results look similar. In 21 events, the null hypothesis is rejected with statistical significance below 1%, in one event it is rejected with statistical significance below 5%, and in two events it is not rejected. Based on these values, we can conclude that monetary policy

Table 3. Detailed hypothesis testing matrix for AR and SAR by event for monetary policy decisions. Statistical significance at 10%, 5% and 1% levels is indicated by *, ** and *** respectively.

Estimation Moment	AR	t test		SAR	Patell test	
0	0,0122%	1,6323	-	0,8541	1,2758	-
1	0,0120%	1,7791	*	0,9725	1,2048	-
2	0,0106%	1,5441	-	0,7945	1,1176	-
3	0,0118%	1,5974	-	0,9619	1,1783	-
4	0,0120%	1,7976	*	0,9661	1,1394	-
5	0,0148%	1,9846	*	1,3412	1,5340	-
6	0,0138%	2,0274	*	1,3046	1,5672	-
7	0,0135%	1,9222	*	1,3032	1,4692	-

decision announcements had an impact on returns throughout the analysis period.

5.1.2 Per Event Period Moment for all Events

Below is the table of t-tests for the mean standardized and unstandardized abnormal returns of the events by time in the event period. The first column is the relative moment in time with respect to the date of the event, i.e. the announcement at time 0. The second column is the average non-normal AR return of the events at the relevant moment. The third column is the AR control variable using a t-test with 22 degrees of freedom. Columns four and five are the corresponding information as columns two and three but for the average standardized abnormal SAR returns.

In checking the ARs it appears that most communications reject the null hypothesis of interest. At 5 moments, the null hypothesis is rejected with statistical significance below 10% while at three moments it is not rejected. In the SAR control it appears that the null hypothesis is not rejected at any time of the event period with the lowest statistical significance observed at time 6 with 13.07%. Based on these, it appears that announcements in this category did not create a significant impact on returns within individual days of the event period.

5.1.3 Event Total Throughout the Event Period

With a CAR value of 0.1005% the control variable is set to t 1.8690 with a p-value of 7.44% and with a SAR value of 8.5981 the control variable is set to t 1.3470 with a p-value of 19.11%. Based on the above values, we can conclude that on average,

5.2.1 Per Event

Table 4. Detailed hypothesis testing table for AR and standardized AR by event for publication of type sheets. Statistical significance at 10%, 5% and 1% levels is indicated by *, ** and *** respectively.

Date	EP	AR	t test		SAR	Patell test	
12/3/2020	57	0,03%	0,8784	-	0,6230	0,9352	-
15/3/2020	3	0,06%	1,8016	-	1,3581	2,0387	**

considering all the events in the category across the event period, they did not create a significant impact on returns within the event period. It should be noted that since most events had a strictly positive or strictly negative impact, aggregation may result in weakened controls.

5.2 Press Releases

The following analysis includes announcements that are press release publications. The set of events consists of thirty-seven (37) announcements. Due to the high frequency of this class of announcements, the event period is set to one day, the event date to separate event periods and isolate the effects of different announcements. For this reason no analysis is performed for the set of events of the category per moment of the event period as it consists of only 1 moment. The lower importance of this category is expected as it includes publications of widely available financial data and more easily predictable announcements.

In checking the ARs it appears that most announcements do not reject the null hypothesis of interest. In one event the null hypothesis is rejected with statistical significance below 5% while in 36 events it is not rejected. In SAR control the results look quite similar. In one event, the null hypothesis is rejected with statistical significance below 1%, in two events it is rejected with statistical significance below 5%, and in 34 events it is not rejected. Based on these, we can conclude that individual press release announcements mostly did not generate abnormal returns during the analysis period.

20/3/2020	5	-0,01%	-0,1780	-	-0,1479	-0,2220	-
7/4/2020	12	0,01%	0,3339	-	0,3196	0,4798	-
15/4/2020	4	-0,02%	-0,5012	-	-0,1673	-0,2511	-
22/4/2020	5	0,03%	0,9019	-	0,7715	1,1582	-
5/6/2020	30	-0,03%	-0,8357	-	-0,7897	-1,1854	-
10/6/2020	3	0,02%	0,4975	-	0,4105	0,6163	-
19/6/2020	7	-0,01%	-0,4438	-	-0,4109	-0,6168	-
25/6/2020	4	0,00%	0,0200	-	0,0173	0,0259	-
14/7/2020	13	-0,01%	-0,2041	-	-0,1893	-0,2841	-
23/7/2020	7	-0,01%	-0,3184	-	-0,2977	-0,4469	-
18/8/2020	18	0,01%	0,2520	-	0,2446	0,3672	-
28/8/2020	8	0,02%	0,5095	-	0,4730	0,7100	-
17/9/2020	14	-0,02%	-0,4832	-	-0,4606	-0,6914	-
22/9/2020	3	0,00%	-0,0735	-	-0,0525	-0,0789	-
28/9/2020	4	-0,01%	-0,2799	-	-0,0921	-0,1382	-
7/10/2020	7	0,01%	0,2539	-	0,2350	0,3528	-
10/12/2020	46	-0,03%	-0,8683	-	-0,8584	-1,2886	-
29/1/2021	32	0,01%	0,4220	-	0,3849	0,5779	-
4/2/2021	4	0,01%	0,4579	-	0,4047	0,6075	-
18/3/2021	30	0,02%	0,7268	-	0,7139	1,0717	-
23/4/2021	24	0,01%	0,2648	-	0,2589	0,3887	-
18/6/2021	39	0,00%	-0,0803	-	-0,0742	-0,1113	-
20/6/2021	3	-0,13%	-3,9758	-	-0,1518	-0,2279	-
8/7/2021	14	-0,03%	-0,8240	-	-0,6716	-1,0081	-
23/7/2021	11	-0,02%	-0,5807	-	-0,5378	-0,8073	-
27/7/2021	3	-0,01%	-0,2547	-	-0,1321	-0,1984	-
28/3/2022	3	0,00%	0,0377	-	0,0264	0,0396	-
15/6/2022	55	0,08%	2,6336	**	2,5739	3,8639	***
18/7/2022	23	-0,01%	-0,4123	-	-0,4000	-0,6005	-
21/7/2022	3	0,01%	0,2538	-	0,2044	0,3069	-
8/9/2022	35	0,05%	1,4617	-	1,4389	2,1600	**
27/9/2022	13	0,03%	0,9326	-	0,8986	1,3489	-
26/10/2022	21	0,00%	-0,0821	-	-0,0801	-0,1203	-
28/10/2022	3	0,00%	-0,0933	-	-0,0762	-0,1144	-
28/11/2022	21	-0,01%	-0,2344	-	-0,2222	-0,3335	-

5.2.2 For Set of Facts

With an AR value of 0.0016% the control variable is set to t 0.3150 with a p -value of 75.46% and with a SAR value of 0.2250 the control variable is set to t 1.3685 with a p -value of 17.96%. Based on the above values, we can conclude that considering all the events of the category, there was no significant change in returns due to press release announcements in the analysis period.

5.3 Announcements of Policy Decisions and Press Releases

In the analysis below, both categories of announcements are included, with a total of sixty

one (61) announcements. As some announcements of different categories coincide on the same date, the total number of event dates is less than the number of announcements. In checking the ARs it appears that most announcements do not reject the null hypothesis of interest. In 2 events the null hypothesis is rejected with statistical significance below 10% while in 57 events it is not rejected. In SAR control the results look quite similar. In one event, the null hypothesis is rejected with statistical significance below 1%, in one event it is rejected with statistical significance below 5%, and in 57 events it is not rejected. Based on these, we can conclude that individual announcements mostly did not generate abnormal returns during the analysis period.

5.3.1 Per Event

Table 5. Detailed hypothesis testing table for AR and standardized AR by event for publications of policy decisions and formularies. Statistical significance at 10%, 5% and 1% levels is indicated by *, ** and *** respectively. Dates of announcements of policy decisions are highlighted in bold.

Date	EP	AR	t test		SAR	Patell test	
12/3/2020	57	0,03%	1,0308	-	0,73	1,1187	-
15/3/2020	3	0,06%	2,1142	-	1,59	2,4386	**
18/3/2020	3	0,04%	1,5877	-	1,09	1,6729	-
20/3/2020	3	-0,02%	-0,8260	-	-0,65	-1,0007	-
7/4/2020	12	0,01%	0,3918	-	0,38	0,5740	-
15/4/2020	4	-0,02%	-0,5881	-	-0,20	-0,3004	-
22/4/2020	5	0,03%	1,0584	-	0,91	1,3854	-
30/4/2020	6	-0,05%	-1,7568	-	-1,17	-1,7843	-
4/6/2020	23	-0,03%	-0,9595	-	-0,94	-1,4346	-
5/6/2020	3	0,01%	0,1962	-	0,16	0,2401	-
10/6/2020	3	0,02%	0,5838	-	0,48	0,7372	-
19/6/2020	7	-0,01%	-0,5208	-	-0,48	-0,7378	-
25/6/2020	4	0,00%	0,0235	-	0,02	0,0310	-
14/7/2020	13	-0,01%	-0,2395	-	-0,22	-0,3399	-
16/7/2020	3	-0,01%	-0,2471	-	-0,19	-0,2921	-
23/7/2020	5	-0,01%	-0,2415	-	-0,22	-0,3369	-
18/8/2020	18	0,01%	0,2957	-	0,29	0,4393	-
28/8/2020	8	0,02%	0,5979	-	0,56	0,8493	-
10/9/2020	9	0,00%	0,0235	-	0,02	0,0339	-
17/9/2020	5	-0,02%	-0,7897	-	-0,47	-0,7260	-
22/9/2020	3	0,00%	-0,0862	-	-0,06	-0,0943	-
28/9/2020	4	-0,01%	-0,3285	-	-0,11	-0,1654	-
7/10/2020	7	0,01%	0,2980	-	0,28	0,4220	-
29/10/2020	16	-0,01%	-0,2501	-	-0,24	-0,3703	-
10/12/2020	30	-0,02%	-0,7350	-	-0,72	-1,1007	-
21/1/2021	26	0,03%	0,9404	-	0,92	1,4099	-
29/1/2021	6	0,01%	0,2161	-	0,16	0,2488	-
4/2/2021	4	0,01%	0,5373	-	0,47	0,7267	-
11/3/2021	25	0,01%	0,2573	-	0,25	0,3840	-
18/3/2021	5	0,02%	0,6309	-	0,55	0,8385	-
22/4/2021	23	0,01%	0,3236	-	0,31	0,4701	-
23/4/2021	3	0,00%	0,0174	-	0,02	0,0230	-
10/6/2021	33	-0,01%	-0,4487	-	-0,44	-0,6763	-
18/6/2021	6	-0,02%	-0,7933	-	-0,21	-0,3285	-
20/6/2021	3	-0,13%	-4,6656	-	-0,18	-0,2726	-
8/7/2021	14	-0,03%	-0,9669	-	-0,79	-1,2059	-
22/7/2021	10	-0,01%	-0,5411	-	-0,51	-0,7748	-
23/7/2021	3	-0,01%	-0,2606	-	-0,22	-0,3419	-
27/7/2021	3	-0,01%	-0,2989	-	-0,16	-0,2373	-
9/9/2021	32	0,02%	0,5887	-	0,58	0,8870	-
28/10/2021	35	0,03%	1,0496	-	1,03	1,5820	-
16/12/2021	34	-0,02%	-0,5620	-	-0,55	-0,8395	-
3/2/2022	33	0,05%	1,9258	*	1,83	2,7986	-
10/3/2022	25	0,02%	0,7922	-	0,76	1,1631	-

24/3/2022	10	0,01%	0,4794	-	0,46	0,6977	-
28/3/2022	3	0,00%	0,0442	-	0,03	0,0474	-
14/4/2022	13	0,02%	0,7426	-	0,71	1,0862	-
9/6/2022	38	0,05%	1,6804	-	1,63	2,4912	-
15/6/2022	4	-0,01%	-0,5029	-	-0,23	-0,3496	-
21/6/2022	4	0,00%	0,1654	-	0,15	0,2226	-
18/7/2022	19	-0,01%	-0,3326	-	-0,32	-0,4904	-
21/7/2022	3	0,01%	0,2978	-	0,24	0,3671	-
8/9/2022	35	0,05%	1,7154	*	1,69	2,5837	***
27/9/2022	13	0,03%	1,0944	-	1,05	1,6136	-
26/10/2022	21	0,00%	-0,0963	-	-0,09	-0,1439	-
27/10/2022	3	0,00%	-0,1677	-	-0,09	-0,1353	-
28/10/2022	3	0,00%	-0,1095	-	-0,09	-0,1368	-
28/11/2022	21	-0,01%	-0,2751	-	-0,26	-0,3989	-
15/12/2022	13	0,01%	0,5277	-	0,28	0,4326	-

5.3.2 For Set of Facts

With an AR value of 0.0021% the control variable is set to t 0.608 with a p-value of 54.56% and with a SAR value of 0.2242 the control variable is set to t 1.9694 with a p-value of 5.37%. Relative to the analysis of press release announcements, an improvement in statistical significance is observed in both tests, highlighting the impact of policy announcements. Based on the above values, we can conclude that considering all the facts, there was no significant change in returns due to announcements in the analysis period.

6. Conclusion

From the above analysis it follows that the operation of the ECB in the period after 2020 has been partially effective. Key rate cuts and the initiation and extension of liquidity programs proved successful in creating a downward trend in interest rates starting in the first 3 months of 2020 and throughout the rest of the year. It is however difficult to isolate the result from the effects of improved market estimates over the same period. At the same time, it managed to weaken the discrepancies that appeared in the figures within the eurozone countries. Analyzing the price level around important dates becomes difficult as inflation consists of monthly observations. In terms of its predictive power, inflation forecasts during the crisis in both the short and long term were consistently slightly overestimated before the onset of high inflation in early 2021 and consistently underestimated thereafter. More generally, the intensity of the effects of policy decisions and the accuracy of forecasts started at high levels, but started to decline in early 2022.

A fact study analysis of the impact of the 61 ECB announcements on 10-year eurozone government

bond yields over the same period was also conducted. The standard event study model developed in the work of Ray Ball and Philip Brown (1968) and Fama, Fisher, Jensen, and Roll (1969) was used. For the analysis, announcements were separated into categories, dividing them into two sets of 24 monetary policy releases and 37 press release releases based on the assessment that policy decisions will have a greater impact on the market. Based on these, three analyses, one for each category and one combined, were conducted.

Regarding monetary policy announcements, the results of the analysis show that the ECB's decisions had effects on government bonds consistently throughout the period. Although the abnormal returns on individual days within a week of the relevant announcements did not show values to reject the null hypothesis, the cumulative results of the event periods showed statistically significant control values for 22 of the 24 announcements. Based on these, it appears that the market was affected by almost all policy changes in a relatively slow manner, without particularly sharp daily changes. This fact may be due to the inefficient transmission of new information, market uncertainty about the efficiency of specific policies, or other factors that reduced the flexibility of the variables of interest in general, but this is a topic outside the scope of this paper.

Regarding the press release announcements, the results of the analysis highlight that the information provided by the ECB had minimal effects on government bonds throughout the period. The abnormal odds showed no values for rejecting the null hypothesis, showing non-statistically significant control values for the majority of announcements. We can conclude that the contents

within the press releases it published, namely the economic analyzes of monetary developments in the eurozone, the announcements of smaller scale measures and the collaborations with financial institutions during the crisis did not include new and substantial information on the bond market. This result was expected as publications in this category often consist of reviews of already widely available data.

The combined analysis of the two categories shows similar results to the analysis of press release publications. It should be noted that the previous results are particularly affected by the design of the chosen methodology and in particular the use of one-day event periods. Although avoiding overlapping event periods is essential to isolate the effects of different announcements, it is possible that overall market reactions are not captured in an environment that, as seen through the analysis of monetary policy announcements, requires some period of time for to assimilate the information and to show a significant change in the magnitudes of the variables.

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