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Ben Lockwood (Head of the Department of Economics, University of Warwick) and Michael Ward (Head of the Department of Economics, Monash University)

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Impacts of ECB Unconventional Monetary Policy on Eurozone sovereign risk: A Cross-Country Analysis

Anya Dobson

Abstract

This paper investigates the impact of ECB Unconventional Monetary Policy announcements on the 10-year sovereign bond yields of eleven Euro area countries. This paper uses event study methodology to examine expansionary UMP announcements between 1st January 2007 and 31st December 2021. Consistent with the literature, I find significant negative announcement effects on sovereign yields collectively examining all programmes. Differences in the magnitude and significance of individual country reactions are closely related to their solvency status. This is persistent for the most recent programmes in response to the Covid-19 pandemic which extends the scope of current literature. This paper also incorporates intraday analysis to more closely examine the determinants of announcement effects on their respective dates.

JEL Classification: G21, G28, E58, F45

Key Words: Monetary Policy, ECB, government bond yields, Covid-19

1   Introduction

Unconventional Monetary Policy (UMP) was recently popularised during the Global Financial Crisis as 'conventional' policy became limited by the constraint of the 'zero lower bound'. For major central banks, this prevented sufficient reductions in the policy rate required to alleviate the recession. Instead, policymakers resorted to UMP to more directly influence market expectations and asset prices. This involved targeted asset purchases (QE), altering long term lending conditions and enhanced communication via 'forward guidance'. UMP facilitates the meeting of inflation and output mandates by directly influencing the yield curve. For example, despite the Federal Funds Rate being at the zero lower bound between 2008 and 2011, unconventional measures succeeded in significantly reducing medium and longer-term rates Swanson and Williams (2014).

Since initiation, UMP has become a major component of central bank policy, especially in response to macroeconomic shocks. UMP has been the ECB's primary policy tool since surpassing the 'zero lower bound' in 2014. This was seen during the Covid-19 pandemic, which was the largest macroeconomic crisis in the last 40 years Ludvigson et al. (2020). They opted to leave the policy rate unchanged, solely adopting unconventional measures.

As new policy is highly scrutinized by market participants, to measure the short-term impact of UMP the literature examines the 'announcement effect', the induced daily or intraday change in asset prices on the announcement date. This is motivated by empirical difficulties in measuring the exogenous effect of asset purchases or enhanced communication. This financial impact acts as a proxy for determining the real economic effects, on which there is no clear consensus in the literature. This is because UMP is a relatively novel phenomenon, adopted due to extreme circumstances rather than on intellectual foundations Joyce et al. (2012).

The 'announcement effect' is mainly evaluated for sovereign bond yields which are a proxy for country default risk premia. Low and stable sovereign bond yields are crucial for economic stability, particularly during recessions which incur substantial fiscal costs. For example, the Covid-19 pandemic caused the Euro Area budget deficit to increase from 0.6% to 8% between 2019 and 2020 Aguilar et al. (2020). This is particularly detrimental

for Eurozone countries as governments rely more on borrowing via financial markets within the monetary union. If a recession increases sovereign yields, this potentially creates an effective binding constraint on acquiring more debt for fiscal stimulus Jäger and Grigoriadis (2017). UMP mitigates this scenario by inducing negative announcement effects on sovereign yields. This result is significant for several major central bank policies since the Bank of Japan was first to initiate Quantitative Easing in 2001.

If consistent results are found for the ECB, UMP directly improves government financing conditions. Thus, they can avoid providing state monetary financing and maintain their position as an independent central bank Moessner (2015).

Following the event study methodology of Fendel and Neugebauer (2020) who analysed UMP between 2007 and 2017, this paper extends the examined time frame until December 2021. This provides more comprehensive analysis since initiation. There is particular focus on more recent programmes under the ECB's negative interest rate policy, including those responding to the Covid-19 pandemic.

Moreover, I incorporate analysis using intraday data. As intraday data is unavailable for non-announcement dates, I do not measure the announcement effect. Instead, I focus on the determinants of yields, separately analysing the press release and subsequent press conference.

2   Literature Review

Bernanke (2004) provided early evidence on the link between UMP and sovereign yields considering announcements altering the relative supply of US Treasuries and Bank of Japan QE policies since 2001. For both countries, comparing event study analysis to an estimated term structure model, longer term yields were significantly lower in the presence of unconventional measures. However, considering the small sample size of announcements, this is insufficient evidence to affirm UMP's long term impact for a range of central bank policies.

The literature significantly expanded after the Global Financial Crisis, when the need for

UMP escalated as policy rates were cut. UMP was launched by the Bank of England, ECB and the Federal Reserve, with all initial programmes exhibiting negative announcement effects. There was a significant reduction of up to 100 basis points for both US and UK 10-year sovereign yields under QE Gagnon et al. (2011). This was also evident for the ECB's Securities Market Programme, but not consistent for all EU countries as some yields continued to rise post announcement Eser and Schwaab (2016). This is because the programme only involved large scale purchases of Greek, Irish and Portuguese sovereign bonds to restore the functioning of these markets.

For the ECB's subsequent programmes directly addressing more countries, the literature distinguishes between the impact on core and periphery countries with an amplified reaction consistently found for the latter. This categorisation is based on a country's 10-year yield as a measure of its solvency status. In this paper, it is less than 3% on average for core countries and vice versa for periphery Fendel and Neugebauer (2020).

For example, regarding the Outright Monetary Transactions Programme which pledged to additionally intervene in secondary markets, Altavilla et al. (2015) found significant negative effects across the yield curve. These were greatest for 2 and 10 year Italian and Spanish yields but insignificant for France and Germany. Krishnamurthy et al. (2018) deconstructed this larger periphery effect, finding a 37% average reduction in the default risk premium for Italy, Spain and Portugal. This supports the 'default risk channel' which suggests more fiscally constrained countries are greater beneficiaries of UMP due to a larger decrease in their risk premia Krishnamurthy and Vissing-Jorgensen (2011). Fendel and Neugebauer (2020) also argue that a higher initial yield spread to Germany acts as a separate channel contributing to the 'announcement effect'. They prove this by showing the interaction term between the yield spread and the event dummy variable is highly significant. This is robust for their inclusion of announcements expanding Longer-Term Refinancing Operations, aimed at improving Eurozone bank liquidity.

Focussing on core countries, the literature reconciles small positive announcement effects with the 'portfolio balancing channel'. Investors with improved expectations acquire more risk post announcement by switching from core to periphery bonds Krishnamurthy and Vissing-Jorgensen (2011). For example, despite presenting consistent results for Spain

and Italy, Briciu and Lisi (2015) found a significant rise in German yields in response to SMP and OMT. For OMT, Fratzscher et al. (2016) corroborated this for 3 other core countries.

Similar trends were found for the Asset Purchase Programme which extended the scope of asset purchases by including Asset Backed Securities (ABSPP) and covered bonds (CSPP). It reduced the EU 10 year term structure by up to 50 basis points, with effects doubling in magnitude for Italy and Spain Altavilla et al. (2015). The lack of diminishing effects for APP proves UMP's efficacy even in a non-crisis period and under a negative policy rate. However, programme-specific results do not provide a general analysis of UMP since 2007. For example, Altavilla et al. (2015) only examine 3 months of data and Urbschat and Watzka (2020) examine 2 years.

UMP is often shown to cause cross-country spread convergence, as under Szczerbowicz (2018). Analysing a larger time frame from 2008 and 2017, Ambler and Rumler (2019) found consistent results considering the weighted average of EU yields. The use of such dependent variables omits distinct country effects by excluding each country's contribution to spread convergence, motivating this paper's focus on individual country yield levels.

Regarding Covid-19 targeted programmes, only announcements up to June 2020 have been examined. For announcement selection, the literature differs in its inclusion of the ECB's initial response on 12th March 2020. This did not introduce any new programmes, but expanded APP and TLTRO III. This caused positive announcement effects with significant increases in 10 year sovereign term premia of 8/11 countries sampled Moessner and de Haan (2022). This surprising reaction was because the ECB failed to meet expectations by cutting the policy rate. Their response was initially interpreted as the opposite to Draghi's 'whatever it takes' attitude during the sovereign debt crisis, casting doubt over the ECB's future proactivity ECB (2012).

Corradin et al. (2021) analysed the Pandemic Emergency Programme which included purchases of all assets eligible under APP on a larger scale. Announcements induced positive effects for France and Germany, but negatively influenced Italian and Spanish

yields under a two day window. By contrast, Fendel et al. (2021) found consistently significant positive effects for UMP announcements until June 2020. This may be due to the inclusion of the March 12th announcement in their specification, or their sole use of a one day window. This paper uses both window specifications to eliminate this ambiguity.

Despite finding similar results for periphery countries to Corradin et al. (2021), the literature produces contradictory results for core countries. Rebucci et al. (2020) found PEPP's initiation significantly reduced German sovereign yields which was confirmed for a panel of 25 other EU countries Klose and Tillmann (2020). However, they omit further country-specific analysis.

For intraday results, this paper uses a high frequency dataset of European asset prices and indices ECB (2022a). This has addressed a clear gap in the literature on intraday analysis, evaluating the two distinct releases of information which form monetary policy decisions. This includes the initial announcement and subsequent press conference. Altavilla et al. (2019) focus on monetary policy surprises, which are more significant during the press conference window where there is scope for discussion. This evidence that markets react differently during these two stages motivates their separate analysis.

3 Data

Daily data on financial variables are obtained from Bloomberg, using 'close prices' from January 1, 2007 to December 31st, 2021. All data is in index form. My dependent variable is each country's existing 10 year sovereign yield. Observations differ slightly by country due to factors such as national holidays and absence of 10 year bonds on the curve. I use the 10 year maturity which is most commonly adopted as a benchmark Falagiarda and Reitz (2015).

For intraday data, due to limited data availability I construct a simplified regression for 28 announcements between 2014 and 2021. I use the EA-MPD database for data on 10 year yields, Stoxx50 and the EURUSD exchange rate ECB (2022a). For Vstoxx and VIX indices, I use futures prices from 'First Rate Data' FirstRateData (2022).

For announcement dates and their content, I use official ECB press releases ECB (2022b). I believe this is the most objective and efficient method of announcement selection compared to others in the literature, such as via news databases and machine learning. Examining daily data on 10 year sovereign yields, on separating core and periphery countries in Table 1 and 2, higher means and standard deviation are evident for periphery yields. This is reflected in their time series in Figure 1, as on average they tend to peak during periods of macroeconomic stress, which may explain the larger announcement effects observed. By contrast, core yields have shown a persistent downwards trend over time. The reaction to the Covid-19 shock in Figure 2 is evident with a rise in sovereign yields for all countries during March 2020. As in previous crises, this is more pronounced for the periphery.

Table 1: Summary statistics: Core country yields

Variable	Obs	Mean	Std. Dev.	Min	Max
y_DE	3833	1.46	1.55	-.86	4.68
y_FR	3834	1.86	1.54	-.438	4.84
y_NL	3834	1.68	1.60	-.645	4.85
y_AU	3834	1.80	1.63	-.475	4.92
y_FI	3834	1.70	1.57	-.47	4.87
y_BE	3834	2.03	1.70	-.43	5.86

Table 2: Summary statistics: Periphery country yields

Variable	Obs	Mean	Std. Dev.	Min	Max
y_ES	3833	2.88	1.88	-.02	7.62
y_IT	3834	3.15	1.60	.46	7.26
y_IR	3307	2.65	2.76	-.33	14.08
y_GR	3829	7.80	6.69	.55	37.10
y_PT	3831	4.09	3.13	-.06	17.40

This data is non-stationary and integrated order 1 according to the augmented Dickey-Fuller Test, hence I take first differences to generate stationarity. I use Newey West standard errors for daily data and robust standard errors for intraday data to control for heteroscedasticity and autocorrelation.

Analysing intraday summary statistics listed in the appendix, periphery countries Italy and Spain also show higher average variation considering their median change around the press release window compared to core countries France and Germany. Comparing the two windows, larger means and standard deviation are evident for all countries

during the press conference. Yields may be more responsive as further information is provided on new measures. However, this window is larger which increases the risk that such changes are influenced by other factors.

Figure 1: **Mean 10 year yields and Programme Initiation Dates (2007 - 2021)**

Figure 2: **10 year sovereign yields (2020)**

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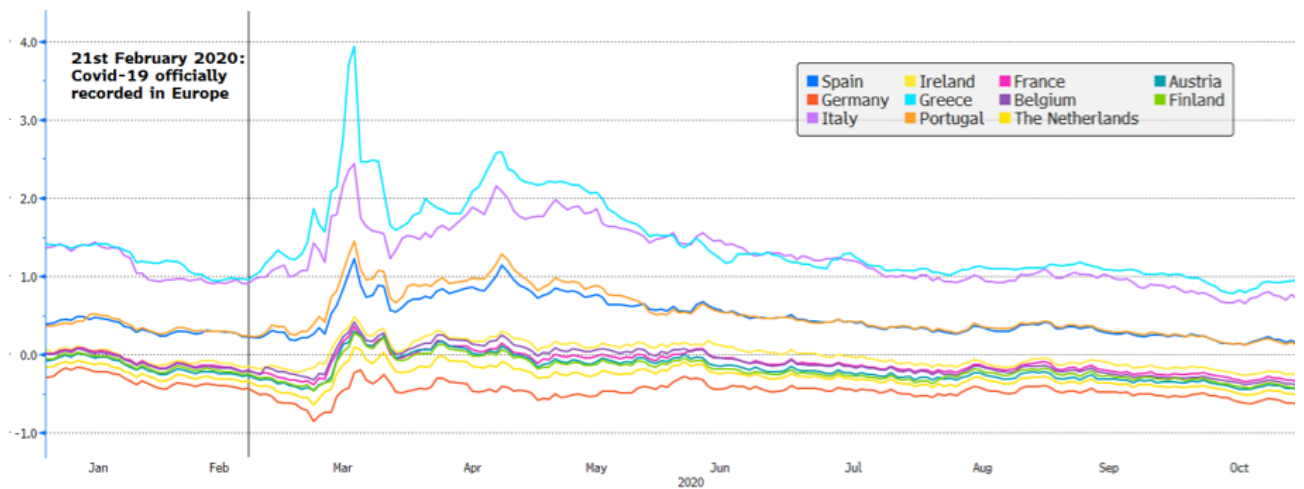
I follow Falagiarda and Reitz (2015) by comparing the standard deviation of daily yield changes on Event and Non-Event days in Figure 3, where 'Event' refers to an announcement date. Higher volatility is observed for all countries compared to Non-Event days with a larger discrepancy found for the periphery. This highlights the persistent influence of UMP announcements on sovereign yield movements.

Figure 3: **Standard Deviation of daily change in 10 year yields (2007 - 2021)**
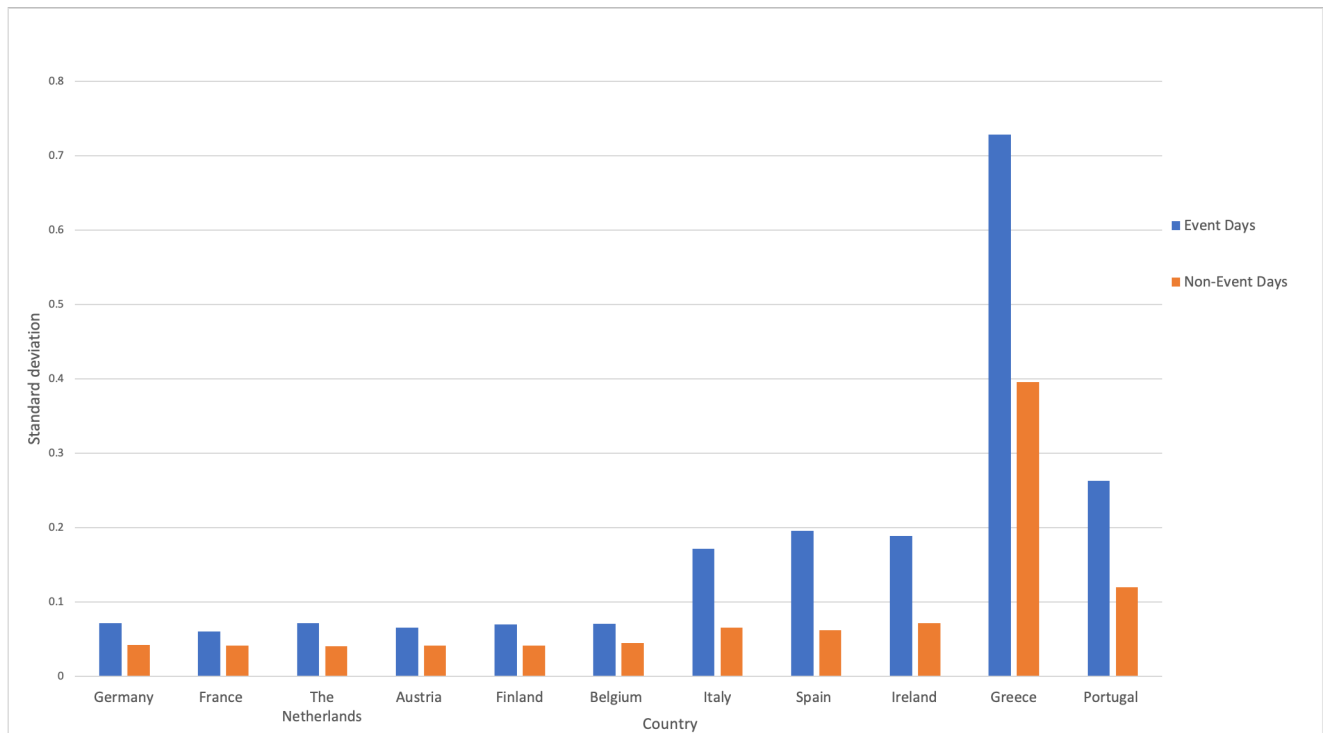
4 Methodology

This paper uses event study methodology. This method facilitates analysing market reactions to a range of economic and financial events. It has emerged as the most common method to evaluate UMP's short term impact on financial asset prices since adopted by Kuttner (2001) . Assuming efficient markets, the announcement effect is swiftly reflected during the event window as new information is incorporated into asset returns.

This window is based on the announcement's date and time, initially set to one day Glick and Leduc (2012). This allows time for market participants to comprehend policy changes whilst being sufficiently narrow to avoid contamination with other market news Hosono et al. (2014). The market's ability to react under this short time frame has been proven in the literature Neely (2015). I also present results using a two-day window. Although this poses a greater risk of contamination, results have been shown to be highly sensitive to this change in specification. For example, Joyce et al. (2020) find effects are halved comparing a two to one-day window for UK QE announcements.

The correct announcement selection is crucial in generating accurate and representative results. I analyse the content of each ECB press release from 2007 to 2021. I solely include announcements introducing new or supplementary measures, satisfying the surprise element of the event study Neely (2015). This reduces the possibility of the market anticipating their content and reacting prior to the event window. I include announcements of a continuation of asset purchases, as these can generate positive surprises if programmes are expected to end Fendel and Neugebauer (2020). I exclude announcements solely disclosing technical details which are unlikely to provide any novel information to the market.

4.1 Daily analysis

For daily data, my baseline regression is as follows:

$$\triangle y_t = \alpha + \beta \triangle y_{t-1} + \gamma event_t + \delta \triangle X_t + \epsilon_t \tag{1}$$

With t = 1, …, T denoting daily observations for each variable, $\epsilon_t \, (0, \sigma^2)$ as the error term and α as the constant.

My dependent variable is the first difference of each country's current 10 year sovereign yield measured in percentage points. My independent variable is the event dummy which takes the value 1 on the announcement date and 0 otherwise. I follow Urbschat and Watzka (2020) accounting for present day yields' dependency on previous day levels by including a one lag estimator.

The vector X_t incorporates six control variables. I use each country's benchmark stock market index as investors' assessment of their economic prospects. I control for the relationship between exchange rate changes and interest rates by including the Euro Dollar spot exchange rate and 10-year forward US Treasury Inflation Protected Securities yields Fendel and Neugebauer (2020). The CESI index is included for euro area macroeconomic news. This gives a measure of surprise by taking the difference between actual news releases and Bloomberg median survey expectations Boesler (2013). Thus, an increase in this index implies a positive surprise to market expectations. The daily change in 3-month Euribor futures effectively predicts the ECB policy rate Bernoth and Hagen (2004). Thus, it accounts for monetary surprises by controlling for the response of yields to changing futures rates Kuttner (2001). I employ the VIX index which projects stock market price volatility based on S&P 500 index options. As volatility is a common risk measure, this represents investor risk aversion which is often heightened during periods of financial instability Szczerbowicz (2018). In further specifications, I split the time period at March 2020 into two 'Pre-Covid' and 'Covid' periods to more closely examine programmes introduced during the pandemic.

4.2   Intraday analysis

Intraday analysis is based on the structure of ECB announcements using OLS regressions. The initial announcement of measures occurs at 13:45 CET followed by a press conference discussing the new policy at 14:30 CET which usually lasts one hour. For the 'Press Release Window', I take the change in the median quote for all variables between

13:25-13:35 and 14:00-14:10. I use the same method for the 'Press Conference Window' between 14:15-14:25 and 15:40-15:50. An illustration of the event windows is in the appendix.

The specification is as follows:

$$y_t = \alpha + \beta STOXX50 + \gamma EURUSD + \delta VSTOXX + \mu VIX + \epsilon \tag{2}$$

$\epsilon\,(0, \sigma^2)$ is the error term and α is the constant. Due to data availability, I analyse 4 countries' respective 10 year sovereign yields (Germany, France, Italy and Spain). I use the Stoxx50, comprised of the 50 largest stocks in the Eurozone as a proxy for country indices. I use the EURUSD exchange rate as under my baseline specification. For VIX and Vstoxx indices I use continuous futures. Vstoxx futures are a proxy for CESI, measuring investor sentiment towards Europe using Stoxx50 options prices. Coefficient estimates provide insight into the determinants of yields on the announcement date.

5 Empirical limitations

Considering the assumptions required under event study methodology, my results investigate correlation, not causality between UMP announcements and sovereign yields. Deriving causality would imply the correct announcement selection which is inevitably subjective Ambler and Rumler (2019). It also suggests that UMP announcements are the only determinants of yields during the event window. This is an unrealistic prospect given other news such as economic data is simultaneously released by the ECB. However, my inclusion of control variables for macroeconomic news and previous trends in asset prices reduces omitted variable bias.

Another limitation is endogeneity. Monetary policy is guided by economic and financial circumstances, implying market conditions may influence policy decisions. For example, stock market changes were proven to be an explicit determinant of US monetary policy by Rigobon and Sack (2003). More specifically, endogeneity is likely if UMP was introduced to mitigate rising sovereign yields which is often observed prior to policy

changes. If such yield developments motivate new measures, it creates reverse causality.

Potential endogeneity was seen in March 2020 when investors expected the ECB to mitigate spread divergence. Following Lagarde's response that the ECB is 'not here to close spreads' the Italian-German 10 year spread reached a 9 month high MarketWatch (2020). It is possible this market reaction was a key driver of PEPP introduced one week later. Investors interpreted spread convergence as an unofficial component of the ECB's mandate.

I solely analyse high frequency daily and intraday data. The consensus of the literature states this sufficiently limits endogeneity. ECB policy decisions are unlikely to be determined by changes in asset prices on or within the same day Haitsma et al. (2016).

6 Results

6.1 Daily results: One day window

	(1) DE	(2) FR	(3) NL	(4) AU	(5) FI	(6) BE	(7) ES	(8) IT	(9) IR	(10) GR	(11) PT
$Event_t$	0.012	0.008	0.005	0.001	0.003	-0.002	-0.040	-0.034	-0.038	-0.161	-0.063*
	(0.009)	(0.010)	(0.008)	(0.008)	(0.008)	(0.011)	(0.027)	(0.029)	(0.030)	(0.105)	(0.036)
Stock	8.28e-05***	9.88e-05***	0.0016***	0.0001***	0.0002***	5.61e-05	-8.68e-05***	-5.41e-05***	-1.51e-05	-0.0015***	-0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.0000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2nd diff	0.015	0.041*	0.024	0.070***	0.023	0.153***	0.129***	0.065***	0.294***	0.083***	0.173***
	(0.020)	(0.023)	(0.020)	(0.027)	(0.023)	(0.038)	(0.028)	(0.022)	(0.049)	(0.041)	(0.042)
Future	-0.195***	-0.216***	-0.174***	-0.209***	-0.190***	-0.204***	-0.309***	-0.298***	-0.285**	-0.714*	-0.342*
	(0.056)	(0.061)	(0.055)	(0.058)	(0.055)	(0.061)	(0.083)	(0.091)	(0.130)	(0.434)	(0.181)
CESI	0.000***	0.000***	0.000***	0.001***	0.000***	0.000***	0.001***	0.000***	0.001***	-0.000	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
VIX	-0.000	0.001	0.000	-0.000	-0.000	0.000	-0.000	0.001	0.001	0.009**	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.005)	(0.001)
Exchange	0.781***	0.391***	0.724***	0.294**	0.666***	-0.073	-0.675***	-0.469**	-0.497*	-0.908	-0.197
	(0.139)	(0.128)	(0.127)	(0.133)	(0.135)	(0.151)	(0.206)	(0.236)	(0.274)	(1.215)	(0.292)
Forward	0.301***	0.233***	0.232***	0.222***	0.240***	0.191***	0.155***	0.126***	0.102**	-0.258	0.146***
	(0.035)	(0.030)	(0.033)	(0.030)	(0.033)	(0.031)	(0.043)	(0.045)	(0.044)	(0.308)	(0.056)
Obs	3407	3450	3450	3273	3334	3450	3443	3411	2944	3247	3447

$^{*}\ p < 0.10,\ ^{**}p < 0.05\ ^{***}p < 0.01$
Newey West standard errors in parentheses

Table 3: Results under a one day event window

Table 3 provides results for my baseline specification using a one day event window. There is heterogeneity in the 'announcement effect' between core and periphery countries with a positive effect for core, and negative, larger effect for periphery. However, this effect is only weakly significant for Portugal. This implies that yields either do not react to UMP, or a change in event window is required to capture this reaction.

By contrast, stock market coefficients show the same sign pattern, but with high significance. Given a stock market increase signals an improvement in a country's economic prospects, one would expect this to negatively influence sovereign yields. This contradicts the positive coefficients found for core countries. However, this may be an indirect transmission of the 'portfolio balancing channel'. A stock market improvement may have a greater propensity to improve investor sentiment towards periphery countries if they already trust core's economic prospects, reducing the perceived risk of periphery bonds. This theory is supported by EU economic sentiment indicators, as UMP actually worsened investors' short term economic expectations for core countries Galariotis et al. (2016). Thus, investors may switch from core to periphery bonds to achieve superior returns, explaining the sign pattern. The significance of the 'portfolio rebalancing channel' has been proven in the literature, such as by examining investors'

stock of bond holdings during APP Albertazzi et al. (2021). They proved that announcements induced investors to acquire more credit risk.

Comparing results for stock coefficients and announcement effects on sovereign yields, the higher significance of the former may be associated with the differences between equity and bond trading Fendel and Neugebauer (2020). As bonds are traded over the counter, trades are often executed over a longer time frame. This contrasts to equities where electronic platforms such as Xetra substantially reduce market frictions, implying time lags preventing same day yield reactions may not apply.

6.2   Daily results: Two day window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	DE	FR	The NE	AU	FI	BE	ES	IT	IR	GR	PT
Stock	8.29e-05***	9.90e-05***	0.0016***	0.0001***	0.0002***	5.55e-05	-8.91e-05***	-5.45e-05***	-1.50e-05	-0.0015***	-0.0003***
	(0.0000)	(0.000)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)
$Event_t$	-0.002	-0.014*	-0.004	-0.006	-0.004	-0.019***	-0.032**	-0.027**	-0.017	-0.033	-0.026
	(0.009)	(0.007)	(0.008)	(0.008)	(0.009)	(0.007)	(0.014)	(0.012)	(0.014)	(0.034)	(0.016)
Observations	3407	3450	3450	3273	3334	3450	3443	3411	2944	3247	3447

* $p < 0.10$, $^{**}p < 0.05$ $^{***}p < 0.01$

Newey West standard errors in parentheses

Table 4: Stock market coefficients and 'announcement effects' under two day window

To investigate potential delayed reactions, I present results under a two day window in table 4. This specification generates more significant and consistently negative announcement effects. This supports the theory that bonds may be subject to trading lags.

Periphery yields exhibit larger announcement effects compared to core which is consistent with the literature. This was expected considering this paper's inclusion of more recent programmes, as Covid-19 caused a disproportionately large increase in periphery sovereign risk. For example, the positive elasticity of credit spreads to Covid-19 was 10-15 times larger for Portugal compared to Germany due to Portugal's lower fiscal capacity. This was in spite of similar infection rates Augustin et al. (2022). Overall, this suggests UMP's 'default risk channel' was significant. Regarding stock coefficients, the sign pattern for core and periphery is sustained with high significance implying the 'portfolio balancing channel' is persistent via stock market developments.

6.3   Covid-19 programme analysis

To examine Covid-19 targeted programmes, I present results before and after March 2020 when new measures were introduced. I solely use a two day window due to a lack of significance for same day results.

March 12th announcement: debate on inclusion in announcement sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	dy_DE	dy_FR	dy_NL	dy_AU	dy_FI	dy_BE	dy_ES	dy_IT	dy_IR	dy_GR	dy_PT
$Event_t$	0.184***	0.110***	0.190***	0.207***	0.2547***	0.107***	0.076***	0.045	0.077***	0.120**	0.044*
	(0.010)	(0.012)	(0.010)	(0.011)	(0.011)	(0.014)	(0.028)	(0.036)	(0.024)	(0.093)	(0.026)

$^*\,p < 0.10,\ ^{**}p < 0.05\ ^{***}p < 0.01$

Newey West standard errors in parentheses

Table 5: Announcement effects for March 12th announcement under a two day window

As previously stated, the first announcement during the pandemic was on March 12th when no new programmes were introduced. For this reason, there is debate in the literature over its inclusion in the announcement selection. Having isolated the March 12th announcement, I find significant positive announcement effects consistent with the literature for all countries except Italy. This is supported by intraday analysis as the highest ever median increase in 10 year French and Italian yields was recorded over the press release window.

On average, announcement effects are nearly double in magnitude for core countries compared to periphery at 17.5 basis points. This contradicts UMP typically causing amplified periphery effects. Lagarde's requirement of an 'ambitious and collective fiscal response' during the press conference may have driven these results ECB (2020). As core countries were expected to bear the majority of the pandemic's future financing burden, it potentially increased their perceived sovereign risk Fendel et al. (2021).

Considering the anomalous reaction and this announcement's omission of Covid-19 targeted programmes, I choose to exclude it from the 'Covid period' specification.

Comparison: 'Pre-Covid' and 'Covid' periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	dy_DE	dy_FR	dy_NL	dy_AU	dy_FI	dy_BE	dy_ES	dy_IT	dy_IR	dy_GR	dy_PT
Event_t	-0.001	-0.013*	-0.004	-0.007	-0.006	-0.020***	-0.035**	-0.029**	-0.016	-0.049	-0.028
	(0.008)	(0.007)	(0.007)	(0.006)	(0.008)	(0.007)	(0.016)	(0.013)	(0.016)	(0.037)	(0.019)
Observations	3407	3450	3450	3273	3334	3450	3443	3411	2944	3247	3447

* $p < 0.10$, $^{**}p < 0.05$ $^{***}p < 0.01$

Newey West standard errors in parentheses

Table 6: Pre-Covid period announcement effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	dy_DE	dy_FR	dy_NL	dy_AU	dy_FI	dy_BE	dy_ES	dy_IT	dy_IR	dy_GR	dy_PT
Event$_t$	-0.039	-0.039	-0.032	-0.032	-0.032	-0.035*	-0.034*	-0.026	-0.034*	0.028	-0.025*
	(0.032)	(0.024)	(0.029)	(0.028)	(0.026)	(0.019)	(0.020)	(0.017)	(0.017)	(0.051)	(0.013)

* $p < 0.10$, $^{**}p < 0.05$ $^{***}p < 0.01$

Newey West standard errors in parentheses

Table 7: Covid period announcement effects

Consistent with the entire time period, for the Covid period in table 7 I find negative announcement effects for all countries except Greece. Delatte and Guillaume (2020) additionally find this atypical result for Greece. PEPP's initiation had a positive and significant effect on Greek spreads against Germany because of its stricter conditions on Greece compared other EA members. Their private securities still remained ineligible for ECB purchase. This is confirmed solely examining PEPP's initiation, as Greek yields increased significantly by 29.3 basis points.

For countries exhibiting negative announcement effects, there is less heterogeneity in its magnitude between core and periphery countries compared to the Pre-Covid period. Contrasting to prior evidence, the average effect for core countries is slightly larger than periphery. This suggests the ECB was more effective in uniformly improving investor expectations for Eurozone countries during Covid-19. One reason may be the symmetry of the shock across countries, as governments imposed common measures restricting economic activity to combat the virus. For example, measuring cumulative abnormal EU CDS spreads, Italy's first national lockdown caused a significant increase in their sovereign default risk Andrieș et al. (2021).

As the pandemic was the first major exogenous shock in the history of UMP, this differed

to previous crises endogenous to the financial sector VoxEU (2020). As a result, investors' greater wariness of similar future shocks may have induced higher risk aversion. If this reduced previous bias towards periphery investments, it explains the more similar results to core countries. Historic records were made for metrics proxying risk aversion in March 2020. For example, the VIX increased by approximately 500% between January and March with a similar rise in the Eurozone-specific VSTOXX index. Heightened doubt over economic policy was reflected in the EPU index which quadrupled during this period Baker et al. (2020). With a collapse in confidence and record market volatility, despite subsequent recovery in these indices, elevated risk aversion may have been persistent.

During the Covid period, the 'announcement effect' is slightly less significant, at the 10% level for 4 countries. This upholds the findings of Wei and Han (2021). They suggest the pandemic weakened the transmission of monetary policy to financial markets considering metrics including the 10 year sovereign yields of 37 countries. Unanticipated announcements potentially reduced investor receptiveness to policy. For example, PEPP was initiated on an ad-hoc basis. Moreover, the reduction in financial activity due to measures such as social distancing and national lockdowns may have played a role Sharif et al. (2020). This paper generates more significant results than Wei and Han (2021) . This implies UMP was more effective post April 2020 when their analysis ends. As investors adjusted to the successive policy changes, they became more responsive, facilitated by the gradual adaptation towards conducting business under a 'pandemic environment'. This is assuring to policymakers by suggesting the transmission of UMP to financial markets was somewhat restored following the initial shock.

6.4   Intraday analysis

I now present results using intraday data.

Initial Press Release

	(1)	(2)	(3)	(4)
	DE10Y	ES10Y	IT10Y	FR10Y
STOXX50	0.923	-3.814*	-9.271**	-2.860**
	(0.910)	(1.920)	(3.763)	(1.137)
VIX	2.379	2.661	6.055	2.728
	(1.611)	(1.704)	(3.888)	(2.163)
VSTOXX	1.133	-1.530	-6.385	-0.751
	(1.367)	(2.503)	(4.490)	(1.778)
EURUSD	2.856***	1.912	-1.233	1.445
	(0.832)	(1.730)	(3.519)	(1.108)
Constant	-0.086	-0.836	-2.348*	-0.412
	(0.387)	(0.651)	(1.136)	(0.494)
Observations	28	28	28	28

$^{*}\ p < 0.10,\ ^{**}p < 0.05\ ^{***}p < 0.01$
Robust standard errors in parentheses

Table 8: Results under Press Release window

Examining the ECB's initial Press Release, the only consistently significant coefficient is for the Stoxx50 index. A positive change in the Stoxx50 should improve expectations and contribute to the negative 'announcement effect'. Coefficients are largest for periphery countries Spain and Italy. This corroborates the 'portfolio rebalancing channel' by suggesting such changes induced the most positive investment in periphery bonds. Thus, this channel is significant for reactions immediately following the press release and at daily frequencies.

The Stoxx50 includes companies from all the countries examined. It is the most relevant economic indicator for France and Germany, mainly consisting of stocks from these countries. However, there is no significant influence on German yields. This suggests the index is a broader indicator of Eurozone economic performance. Investors focus more on the implications for periphery countries in their immediate reaction to announcements.

Press Conference

Results for the press conference give no significant results. These are included in the appendix.

7   Robustness checks

This paper presents several robustness checks, with motivation and results included in the appendix:

1. **Diminishing Effects**: Do announcements excluding programme initiations generate significant announcement effects?

2. **Conventional Policy**: Influence of changes in the policy rate on announcement effects

3. **Stock market indices**: Justification of their inclusion as control variables

8   Conclusion

In conclusion, ECB Unconventional Monetary Policy generates significant negative announcement effects over a two day window since its initiation during the Global Financial Crisis until 2021. The greater significance compared to a one day window is likely attributed to the potential lags associated with bond trading. This is supported by highly significant stock market reactions on the same day where trades are subject to less market frictions Fendel and Neugebauer (2020).

Although ECB policy is aimed at the collective Euro area, this paper affirms that heterogeneous country reactions should not be ignored. Between 2007 and 2021 and during the Pre-Covid period, periphery yields react more to UMP announcements with a higher significance, aligned with the literature. This benefits policymakers by implying additional monetary support for these countries is not required to maintain favourable government financing conditions. However, the discrepancy in magnitude between core

and periphery reactions diminishes for Covid-19 targeted programmes, marking a change in investors' assessment of these two country groups. The pandemic's parallel timing and common restrictions may have contributed to similar cross-country economic impacts. Moreover, higher investor risk aversion may have reduced preferences towards periphery bonds.

The significant negative announcement effects for Covid-targeted programmes highlight UMP's flexibility in counteracting an economic shock unprecedented in scale. Despite results showing lower significance compared to pre-Covid, the ECB's response was arguably sufficient. This is because in contrast to previous crises, UMP was accompanied by a sizeable joint fiscal response. For example, 'Next Generation EU', a €750 billion fiscal package, was seen as the largest ever progression towards a fiscal union. Preliminary evidence shows its initiation also caused significant negative announcement effects and reduced EU sovereign spreads. Havlik et al. (2022).

The next question for policymakers and a useful extension would be to analyse how sovereign yields will respond to the eventual unwinding of UMP as economies recover from the pandemic. Although a shock effect on market expectations was desirable for expansionary UMP to counteract spread divergence, the ECB will want to minimise market volatility when removing stimulus Jones (2022). If yields are equally responsive to contractionary measures and generate the opposite positive announcement effect, this could adversely impact future solvency ratings. This may pose particular issues for periphery countries if their reaction is disproportionately large, consistent with the majority of UMP programmes. Therefore, the ECB should formulate an appropriate 'exit strategy' when communicating these measures to the market.

Similar to daily results, stock coefficients are significant at intraday frequencies under the Press Release window. Stock market developments and their economic implications are important contributors to heterogeneous core and periphery effects. A future extension would be to explicitly examine intraday announcement effects with data on non-announcement dates, reducing endogeneity. This would determine whether the lack of significance at daily frequencies masks a higher frequency reaction at the time of announcements. Moreover, comparing results for the Press Release and Press Conference

windows will provide insight into the optimal method of UMP communication.

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