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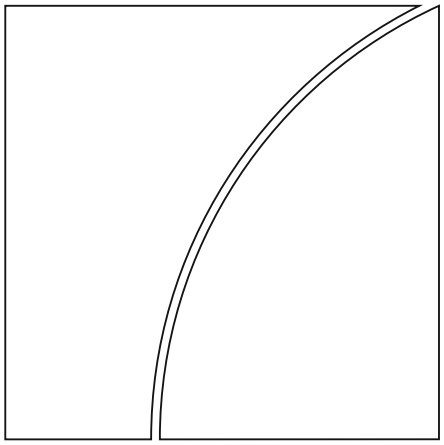

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by Boris Hofmann, Anamaria Illes, Marco Lombardi and Paul Mizen

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The impact of unconventional monetary policies on retail lending and deposit rates in the euro area[1]

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Abstract

This paper investigates the overall effect of the European Central Bank's (ECB's) unconventional monetary policies (UMPs) implemented since 2008 on euro area bank retail lending and deposit rates offered to households and non-financial corporations. To do so, we use an analytical approach that combines the estimation of the cumulative effects of UMP on key money and capital market rates via daily event study analysis with monthly retail rate pass-through estimation. In counterfactual simulations, we quantify the full effect of the ECB's UMPs implemented since 2008 on retail lending and deposit rates and systematically explore differences in their effects over time and across euro area countries. Our results show that the ECB's UMPs – particularly the measures launched since 2012 – significantly lowered retail lending and deposit rates in Germany, France, Spain and in particular in Italy. The impact on banks' intermediation margins through retail lending-deposit rate spreads turns out to be not clear-cut, with significant compressions prevailing only in Germany and Italy.

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1. Introduction

This paper assesses the overall effects of the unconventional monetary policies (UMPs) implemented by the European Central Bank (ECB) since 2008 on bank retail lending and deposit rates offered to households and non-financial corporations in the major euro area countries (France, Germany, Italy and Spain).[2] To do so, we adopt a two-step analytical approach. In the first step we measure the cumulative impact of UMP announcements on key money and capital market rates at the daily frequency. In the second step, we estimate interest rate pass-through models at the monthly frequency to assess the effects of changes in key money and capital market rates on bank lending and deposit rates (which are only available at monthly frequency). Based on the estimated models, we assess the pass-through of the cumulative UMP impact via benchmark money and capital market rates (as established in the first step) to bank lending and deposit rates through a *counterfactual scenario without UMP.* This approach allows us to quantify the overall effect of the ECB's UMP over time and across countries. The analysis shows that UMP considerably lowered banks' retail lending and deposit rates, mainly through the OMT announcement in 2012 and the launch of large-scale asset purchases starting mid-2014. The effects are found to be heterogeneous over the major euro area countries.

Our focus on bank retail rates is motivated by the fact that the euro area's financial system is more bank-reliant than that of the United States (i.e. a larger share of financial intermediation is provided by banks as opposed to capital markets) as can be seen from Graph 1. Bank credit accounts for a significantly larger share of total debt and bank deposits for a much larger share of financial assets of the private non-financial sector. The importance of bank finance means that bank lending and deposit rates play a critical part in the euro area monetary transmission process (Illes *et al.* (2019)).

Our paper complements previous papers that have focused on the impact of specific UMPs (e.g. Altavilla *et al.* (2019), Boeckx *et al.* (2020)) by documenting the *overall impact* on bank retail of *all* UMPs launched by the ECB since 2008, and how the effects of the different measures have varied over time. As such, this is the first paper to our knowledge

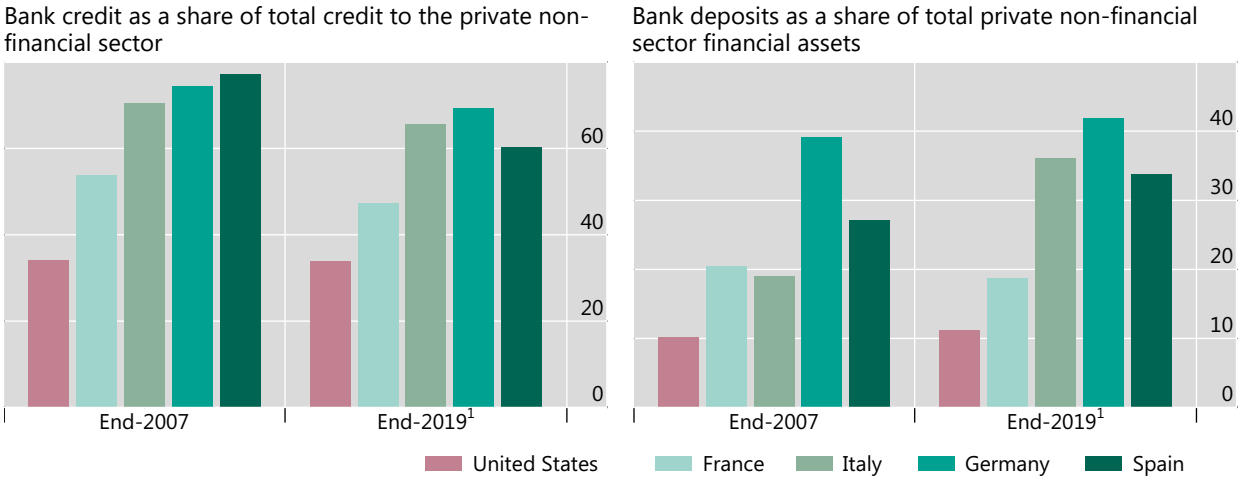
[2] This paper does not cover the impact of unconventional monetary policy measures that were launched in 2020 in response to the Covid-19 pandemic, which is ongoing at the time of writing.

providing an overall empirical assessment of the effects of the ECB's UMP since the GFC, from the perspective of retail loan and deposit market pricing.[3]

Moreover, we document the differential impact of the ECB's UMP through retail interest rates *across the major euro area countries*. The euro area is a heterogeneous currency area and the Great Financial Crisis (GFC) and the subsequent euro area sovereign debt crisis had a varied impact, with the southern countries being more strongly affected than the northern ones. The ECB's UMP measures were in part aimed at offsetting mixed crisis effects, which we would expect to be reflected in a varied impact of the measures across countries. Another contribution of our paper is therefore to assess whether the ECB's UMP has indeed been transmitted in such a heterogeneous way. In this way, our paper also complements previous studies on the heterogeneity in the transmission of certain UMP measures to output and prices (Burriel and Galesi (2018)).

Importance of bank intermediation in the euro area

In per cent — Graph 1



[1] For the euro area countries, Q3 2019 data.

Sources: ECB; Federal Reserve; Datastream; BIS.

In addition, by analysing the effect of UMP on both retail lending and deposit rates, we can also assess the impact of these measures on the retail lending-deposit rate spreads. There is an ongoing debate about potential adverse effects of UMP on bank profitability through the compression of banks' net interest margins, which may have adverse effects

[3] For a comprehensive review of the ECB's strategy and policy actions over this period including detailed analyses, see Rostagno *et al.* (2019).

on credit supply (Borio *et al.* (2017), Brunnermeier and Koby (2019), Kumhof and Wang (2019), Altavilla *et al.* (2019), Goodhart and Kabiri (2019)). We contribute to this debate by assessing the impact of the ECB's UMP on intermediation margins through lending-deposit rate spreads across the euro area countries.

Our main findings are as follows. First, the ECB's UMP was effective in reducing lending and deposit rates in all the major euro area countries in an economically and statistically significant way.

Second, the bulk of these effects was achieved since 2012, reflecting the effects of the Outright Monetary Transactions (OMT) announcement and the introduction of large-scale asset purchases since mid-2014.

Third, the effects of the ECB's measures varied considerably across the four largest euro area economies. They lowered lending rates in Germany, France and Spain by 100-200 basis points, while deposit rates in the three countries were reduced by 50-150 basis points. Italian lending and deposit rates were pushed down by roughly 250-450 basis points and about 150-250 basis points respectively. These differences across countries reflect (i) that the ECB's measures had a particularly large lowering effect on bank bond yields in Italy and, albeit to a lesser extent, in Spain; and (ii) that retail rates in Italy, Germany and France are mainly linked to bank bond yields rather than EURIBOR rates while in Spain it is the other way round. Overall, this suggests that the ECB measures were more effective in the countries most affected by financial and economic stress over the period, in particular Italy.

Fourth, we find that the ECB's UMP did not have a clear-cut impact on banks' intermediation margins through retail lending-deposit rate spreads. Statistically significant reductions of spreads obtain only in Germany and Italy. German banks' loan-deposit spreads would have been 50–150 basis points higher in 2019 had there been no ECB UMP. Italian banks' intermediation margins were reduced by 100–250 basis points.

Related literature

Our paper contributes to various strands of the literature. First, we contribute to the literature analysing the impact of UMP on money and capital markets through event-study analysis. Event studies have been used in a number of papers in order to evaluate UMPs in the United States and the United Kingdom, where quantitative easing (QE) was in operation much earlier than in the euro area, e.g. Gagnon *et al.* (2011), Krishnamurthy and Vissing-Jorgensen (2011) and D'Amico and King (2013) for the United States and Joyce *et al.* (2011) and Kapetanios *et al.* (2012) for the United Kingdom. A number of studies also explore the high-frequency financial market impact of the ECB's unconventional measures. Szcerbowicz (2015) analyses the impact of all ECB UMPs up to 2012, including the various liquidity-providing measures, the covered bond purchase programmes, the SMP and the OMT. Eser and Schwab (2013) and Ghysels *et al.* (2014) analyse the impact of the SMP on euro area countries' sovereign bond yields. Fratzscher *et al.* (2016) and Krishnamurty *et al*. (2017) analyse the market impact of the ECB's long-term liquidity provisions as well as those of the SMP and the OMT. Andrade *et al.* (2016) explore the announcement and implementation impact of the APP. Ambler and Rumler (2019) consider the effect of UMP on inflation expectations, finding that euro area announcements operate on real rates in part via inflation expectations as well as through nominal yields. We focus on the overall effect of the ECB's UMP measures on benchmark money market and capital market rates and on how the effectiveness of the measures has varied over time and across countries.

Second, we contribute to the literature on the pass-through of monetary policy to retail lending and deposit rates. The pass-through of policy rates to retail rates has been studied extensively in the literature, concluding that pass-through is often incomplete and sluggish, see e.g. Borio and Fritz (1995), Mojon (2000), Hofmann and Mizen (2004), Gambacorta (2008). A number of studies have assessed whether monetary policy pass-through has changed after the GFC, finding that pass-through has weakened particularly in peripheral euro area countries due to widening risk spreads (e.g. Hristov *et al.* (2014), Darracq-Paries *et al.* (2014), Holton *et al.* (2015), von Borstel *et al.* (2016), Illes *et al.* (2019)). Altavilla *et al.* (2019) show that the decline in pass-through was linked to a deterioration in bank balance sheets and that the launch of the ECB's asset purchase programme in mid-2014 helped to restore policy pass-through. Our focus is instead on

the quantitative pass-through of the ECB's UMP to retail rates at the individual euro area country level.

Finally, the paper also adds to the literature on the potential adverse side effects of UMP through banks' profitability. Borio *et al.* (2017) suggest that the compression of retail rates may weaken bank profitability through the compression of net interest margins, potentially depressing credit supply. Brunnermeier and Koby (2019) and Kumhof and Wang (2019) show conceptually how the negative effect of lower rates on banks' net interest margins may give rise to a "reversal interest rate" level at which accommodative monetary policy becomes contractionary. The empirical relevance of this effect remains controversial. Altavilla *et al.* (2018) find no systematic link between interest rates and bank profitability in the euro area, but they establish a negative effect of prolonged low rates. But Goodhart and Kabiri (2019) do find a systematic link between euro area interest rates and bank profits. We assess quantitatively how the pass-through of the ECB's UMP since 2008 has affected banks' intermediation margins through a compression of lending-deposit rate spreads.

The remainder of the paper is organised as follows. In Section 2, we present a brief chronology of the UMP measures implemented by the ECB over the period 2008-19 and review how they would, from a conceptual point of view, be expected to affect the retail rates offered by banks. Section 3 presents the data. This is followed by the empirical analysis in Section 4. Section 5 concludes.

2. The ECB's unconventional monetary policy and bank retail rates

Before delving into the empirical analysis, this section provides a chronology of the ECB's unconventional monetary policy measures between 2008 and 2019 and discusses the channels through which they might have affected bank retail rates.

2.1 The ECB's unconventional monetary policy 2008–19: A short chronology

The ECB's UMP can be broadly divided in two phases: (1) the period of the GFC and the subsequent euro are sovereign debt crisis from 2008 to 2012, characterised by long-term large-scale liquidity provision to banks and targeted asset purchase programmes; and (2)

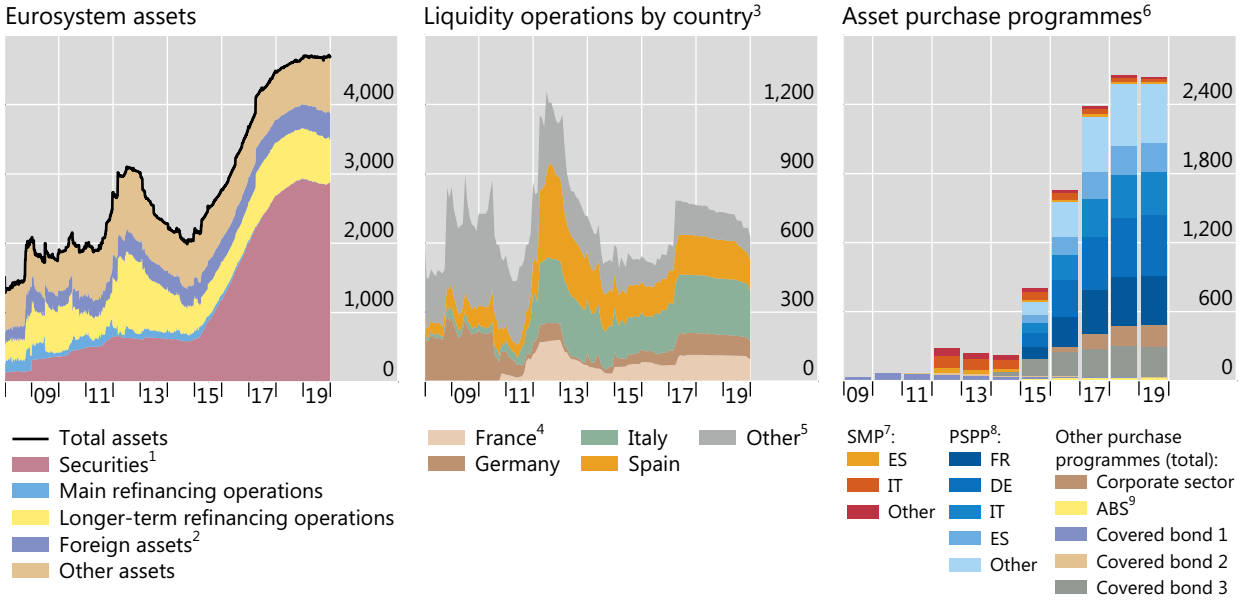
the period of persistent low inflation and stagnation from 2013 to 2019, characterised by forward guidance, negative deposit rates and eventually large-scale asset purchases.[4]

First phase: GFC and European Debt Crisis 2008–12

In the first phase of ECB UMP, between 2008 and 2012, the size of the Eurosystem's balance sheet roughly doubled to about 3 trillion euros. This rise was mainly driven by lending to euro area MFIs, which increased from approximately 500 billion euros in 2007 to more than 1,100 billion by the end of 2012, mainly through the various longer-term refinancing operations (LTROs) launched since October 2008 (Graph 2, left-hand panel).

Eurosystem balance sheet

In billions of euros — Graph 2



[1] Securities of euro area residents and general government debt. [2] Includes all foreign currency claims to both residents and non-residents of the euro area. [3] Includes all liquidity operations provided by the ECB for the selected countries. [4] France data starting October 2010. [5] Other includes France up to and including September 2010. [6] Outstanding amounts. [7] Securities market programme. [8] Public sector purchase programme. [9] Asset-backed securities.

Sources: ECB; Datastream; national data; authors' calculations.

The country uptake of the liquidity operations reflects the different phases of financial sector stress in the euro area, which affected different countries at different times (Graph 2, centre panel). Between 2008 and 2010, banks outside the large four euro area countries were the main borrowers in the Eurosystem's liquidity operations, in particular Greek and Irish banks, reflecting the banking strains in these countries. Since 2011,

[4] For a more detailed chronology and discussion of the ECB's UMP, see Rostagno *et al.* (2019).

Spanish and Italian banks were the main takers of Eurosystem liquidity, reflecting the spreading of the euro area sovereign debt crisis to these economies.

The ECB also launched targeted asset purchase programmes over this period, which were, however, relatively small in terms of their balance sheet impact. Specifically, the ECB launched two covered bond purchased programmes (CBPPs), with a total announced size of 100 billion euros, and, in response to the outbreak of the euro area sovereign debt crisis, the Securities Market Programme (SMP). By the end of 2012, the total asset holdings under the SMP amounted to more than 200 billion euros, approximately half of which were Italian government bonds (Graph 2, right-hand panel).

In September 2012, the ECB announced the Open Market Transactions (OMT), a bond-buying programme that would allow the ECB to intervene in unlimited ways in case of need. While the programme was never activated, it effectively put an end to the strains in euro area sovereign bond markets. Its success was reflected in narrowing sovereign spreads against the German benchmark. This measure is the perfect example of why, for this type of policy measure, methods such as event studies are necessary to determine the effects as there were no measurable quantitative interventions to evaluate the effectiveness of the policy. Indeed, the announcements themselves were the key policy instrument.

Second phase: Persistent low inflation and economic stagnation 2013–19

The second phase of the ECB's UMP between 2013 and 2019 was characterised by both unconventional interest rate and balance sheet policies. The ECB adopted forward guidance on policy rates in 2013, which was reinforced in early 2014. The Eurosystem's balance sheet initially shrank during this period as banks' liquidity situations improved and conditions in euro area sovereign bond markets normalised. Until mid-2014, Eurosystem assets fell by one third to about € 2 trillion, mainly as a consequence of expiring LTROs.

In June 2014, the ECB introduced a package of UMP measures, which included the introduction of a negative deposit facility rate and targeted longer-term refinancing operations (TLTROs). The package also included a third covered bond purchase programme (CBPP3) and an asset-backed securities purchase programme (ABSPP). In January 2015, the ECB launched the expanded asset purchase programme (APP), adding

to the existing purchase programmes the Public Sector Purchase programme (PSPP), featuring large-scale purchases of investment-grade securities issued by euro area governments and agencies and European institutions in the secondary market. In March 2016, a corporate sector purchase programme (CSPP) involving purchases of investment-grade euro-denominated bonds issued by non-financial corporations was added to the APP. In the wake of these measures, the size of the Eurosystem's balance sheet increased to more than 4.5 trillion euros by the end of 2019. This expansion was driven mainly by the large-scale asset purchases under the APP. By December 2019, the Eurosystem's asset purchases totalled about 2.6 trillion euros, mainly through the PSPP (Graph 2, right-hand panel).

Against the background of improving macroeconomic conditions, the ECB started to taper asset purchases in December 2016, ending its net purchases at the end of 2018. In early 2019, the outlook darkened again, inducing the ECB to adjust forward guidance on policy rates and to launch new targeted long-term refinancing operations (TLTRO-III) in March 2019. In September 2019, the ECB further cut its deposit facility rate to –0.5% and restarted net asset purchases under the APP.

2.2 Transmission channels of UMP to bank retail rates

The ECB's UMP measures are transmitted to bank retail rates through a number of channels. The first chain in the transmission is the effect on benchmark money and capital market rates. Large-scale liquidity provision reduces liquidity risks, but also the chance that these will morph into credit risk. That way, the measures reduce credit risk premia in wholesale money and capital market rates for banks. At the same time, the measures may also reduce sovereign yields as banks engage in a carry trade operation, borrowing cheaply from the central bank and obtaining the yields offered on sovereign bonds in return (Acharya and Steffen (2015)). More generally, given the strong sovereign-bank nexus in the euro area, lowering the credit risk of banks through liquidity provision would tend to lower sovereign credit risk, dampening down sovereign bond yields.[5]

Large-scale asset purchases also impact benchmark money market rates and capital market rates, in particular through stock, duration and credit premium channels

[5] For a review of the various channels of the sovereign-bank nexus in the euro area, see Bellia *et al.* (2019).

(Krishnamurty and Vissing-Jorgenson (2011)) as well as through a signalling channel (Eggertson and Woodford (2003)). Through these channels, bond purchases lower interest rates by driving down term premia, credit risk premia or the expected level of future policy rates. In the case of the euro area, bond purchases also work through a sovereign credit risk channel and redenomination risk channel, i.e. the risk of euro area breakup and redenomination of debt into new currencies (Krishnamurty *et al*. (2017)). Given the strong sovereign-bank nexus mentioned before, the credit risk spreads for banks would also be lowered by such asset purchases.

The second chain in transmission is the pass-through of the initial impact on benchmark money and capital market rates to retail lending and deposit rates offered to households and non-financial corporations. If banks set retail lending and deposit rates as a mark-up/mark-down over the benchmark money and capital market rates that determine their funding or opportunity costs (Freixas and Rochet (1997), Illes *et al.* (2019)), a reduction in the latter will translate directly into lower retail rates. This will occur with a delay due to the sluggishness of retail rate adjustment, reflecting the adjustment costs faced by banks (e.g. Hofmann and Mizen (2004)).

3. Data

In the empirical analysis, we use data at daily and monthly frequencies. The analysis of announcement effects on benchmark money and capital market rates is based on daily data. The analysis of the subsequent pass-through to retail lending and deposits rates uses monthly data.

For short- and long-term benchmark money market rates, we use daily three-month and 12-month EURIBOR rates. There are no historical data that systematically track the yield of both secured and unsecured bonds issued by banks. As an approximation, we assume, following Illes *et al.* (2019), that banks are able to issue bonds at a cost equal to the interest rate swap rate plus a mark-up representing the industry risk amounting to the credit default swap (CDS) rate for the banking sector in each country. To calculate the financial CDS we use a simple average over the CDS of selected representative financial institutions in each country. For the long-term bank bond yield, we use the five-year interest rate swap plus the five-year financial CDS and the one-year interest rate swap

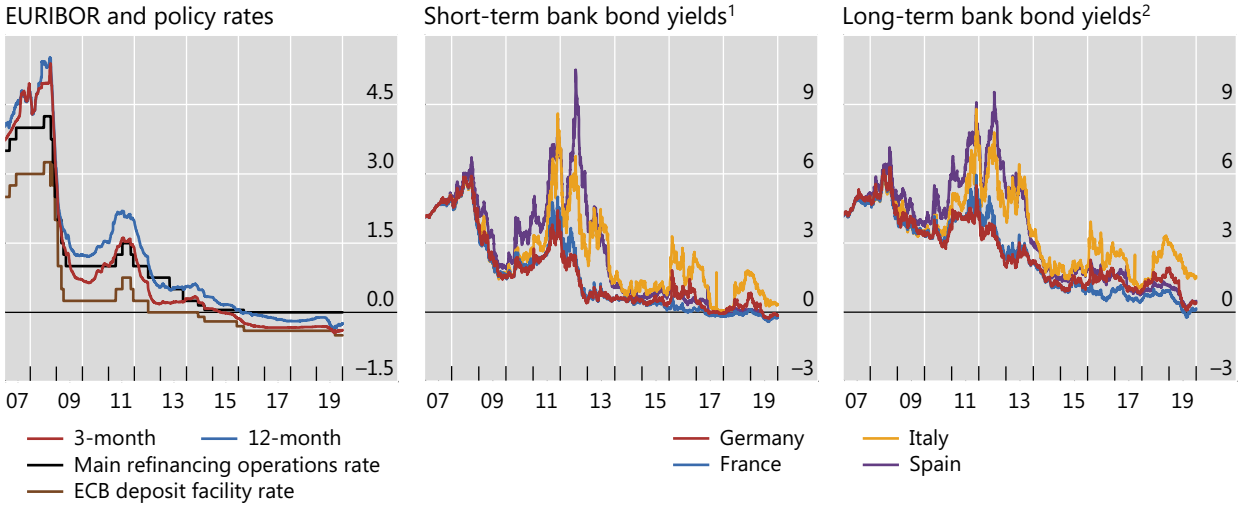
plus the one-year financial CDS for the short-term bank bond yield. The data are collected over the period 2007–19 from Bloomberg and Markit.

The evolution of the daily short- and long-term EURIBOR rates and of the daily short- and long-term (proxy) bank bond yields is shown in Graph 3. The charts show how EURIBOR rates dropped sharply relative to policy rates after the ECB's large-scale liquidity provisions launched end-2018 (Graph 3, left-hand panel). After the rate hike interlude of 2010–11, they fell in tandem with the MRO and even dropped below zero in 2015, when the ECB's deposit rate moved deeper into negative territory.

EURIBOR rates and bank bond yields

In per cent

Graph 3



[1] Calculated as the one-year interest rate swap plus the one-year financial CDS for selected banks in each country. [2] Calculated as the five-year interest rate swap plus the five-year financial CDS for selected banks in each country.

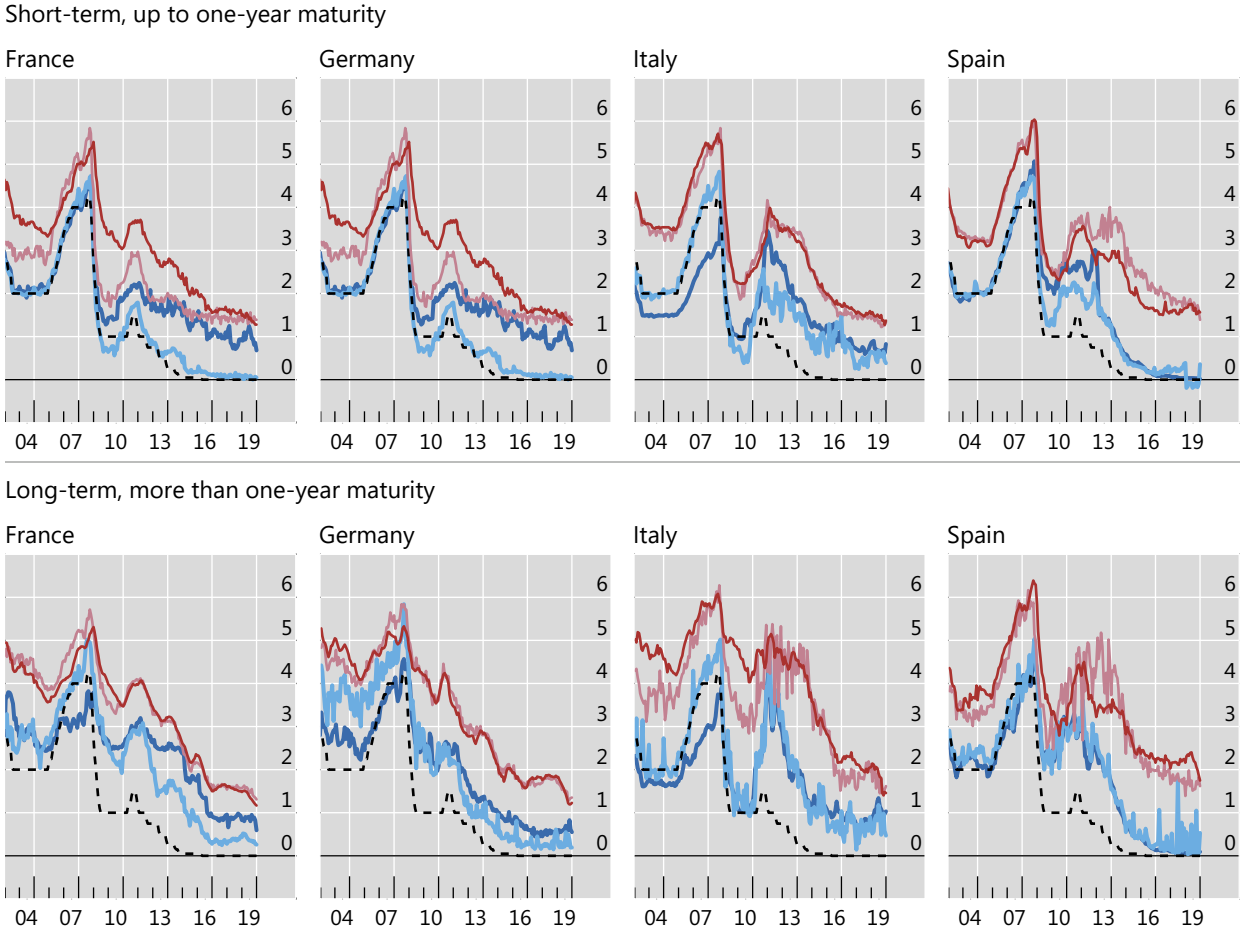
Sources: Barclays; Bloomberg; Markit; authors' calculations.

Our proxies for short- and long-term bank bond yields in the four major euro area countries display a somewhat different pattern (Graph 3, centre and right-hand panel). These rates fell steeply in the wake of the policy rate cuts and the launch of the ECB liquidity package in October 2008. They then rose again sharply between 2010 and 2012, when the euro area sovereign debt crisis intensified, particularly in Italy and Spain, the countries that were at the epicentre of the crisis. Since the second half of 2012, in the wake of the launch of OMT, bank bond yields fell steadily to levels well below those seen before the outbreak of the GFC.

In the analysis of the pass-through of the announcement effects on benchmark EURIBOR rates and bank bond yields to retail markets, we use monthly data for retail lending and deposit rates offered to household and non-financial corporations. Specifically, we use lending/deposit rates on new short- and long-term loans/deposits to households and non-financial corporations from the ECB's MFI interest rates statistics.

Retail lending rates and deposit rates[1]

In per cent — Graph 4



[1] For lending rates of households, new loans for house purchase excluding revolving loans and overdrafts, convenience and extended credit card debt; for lending rates of non-financial corporations, new loans other than revolving loans and overdrafts, convenience and extended credit card debt. For deposit rates of households, new deposits from households; for non-financial corporations, new deposits from non-financial corporations.

Sources: European Central Bank; Bloomberg; IHS Markit; national data.

The evolution of the retail lending and deposit rates for the four largest euro area countries, together with the MRO rate, is displayed in Graph 4. The charts show that these rates also fell steeply in tandem with policy rates in the wake of the GFC. Between 2010 and 2012, retail rates moved up and large and persistent 'wedges' emerged between

these rates and policy rates, particularly in Italy and Spain. These wedges then shrank significantly since 2013.

4. Empirical analysis

The empirical analysis of the effects of the ECB's UMP proceeds in two steps. We first assess the impact of UMP on EURIBOR rates and bank bond yields using an 'event study' approach. In the second step of the analysis, we estimate interest rate pass-through models at the monthly frequency to assess the effects of UMP on bank retail rates.

4.1 UMP announcement effects

The appeal of event studies lies in their ability to account for different policies in a unified framework. The underlying assumption behind event studies is that the full impact of an UMP measure unfolds immediately after the announcement, i.e. that financial markets immediately and fully price in the effects. This means that the effects are assumed to work through a combination of a signalling effect steering expectations, and a stock effect, e.g. the impact from the expected reduction in bond supply brought about by the asset purchase programme, rather than a flow effect, i.e. the impact on financial markets of the actual implementation of the measure in later periods. This assumption is in line with the evidence that the stock effects of asset purchase programmes are large while the flow effects are relatively small (see e.g. D'Amico and King (2013)).

In the following, we assess the announcement effects of the ECB's UMP measures since 2008. Table 1 reports the ECB's major announcements of UMP measures between 2008 and 2019, taken from Szczerbowicz (2015) and Krishnamurty *et al.* (2017) for the period 2008–12 and based on our own classification for the period 2013–19. For the latter period we focus, in order to ensure consistency with the previous years' approach, on major UMP news, in the form of either policy announcements or of speeches by the ECB president.

Major ECB UMP news Table 1

2008	Oct 8	Fixed rate full allotment (FRFA) for main refinancing operations and corridor of the standing facilities reduced to 100 basis points
	Oct 13	FRFA for U.S. dollar funding
	Oct 15	1) Expansion of collateral that can be used for refinancing operations and 2) FRFA for longer-term refinancing operations (LTROs)
2009	May 7	1) Introduction of new longer-term refinancing operations (LTRO) with a maturity of one year with FRFA and 2) a new covered bond purchase programme (CBPP1)
2010	May 10	1) New Securities Market Programme (SMP) and 2) reactivation of FRFA for LTROs and U.S. dollar funding
2011	Aug 7	Reactivation of SMP
	Oct 6	1) New covered bond purchase programme (CBPP2) and 2) introduction of two new one-year LTROs
	Dec 1	ECB President Mario Draghi's speech at the European Parliament mentioning the importance of European Union and hinting at potential additional aid
	Dec 8	1) Introduction of two new LTROs with maturity of three years and 2) other measures to support lending and money market activity
	Dec 21	First three-year LTRO operation
2012	Feb 29	Second three-year LTRO operation
	Jul 5	Deposit facility rate (DFR) cut to zero
	Jul 26	ECB President Mario Draghi's speech in London stating that the ECB was ready to do "whatever it takes" to preserve the euro
	Aug 2	Possibility of Outright Monetary Transactions (OMT) mentioned
	Sep 6	1) Details of technical features of the OMT Programme and 2) changes in the collateral used in the monetary operations
2013	Jul 4	Forward guidance on policy rates
2014	Jan 9	Reinforcement of forward guidance on policy rates
	Jun 5	1) DFR cut to –0.1% (negative rates), 2) introduction of new targeted LTROs (TLTROs) and 3) preparations for a new asset backed securities purchase programme (ABSPP)
	Aug 22	ECB President Mario Draghi's speech in Jackson Hole highlighting the decline in euro area inflation expectations and the resolve of the Governing Council to use all available instruments needed to preserve price stability in the euro area
	Sep 4	1) DFR cut to –0.2%, 2) changes to the use of collateral for monetary operations and 3) introduction of a new covered bond purchase programme (CBPP3) and the new ABSPP
	Oct 2	Details of the CBPP3 and the ABSPP
2015	Jan 22	Expanded asset purchase programme (APP) including a public sector securities purchase programme (PSPP)
	Mar 5	Details of the PSPP
	Mar 9	First implementation of the PSPP
	Sept 3	Increase of the issue share limit for the PSPP
	Oct 22	Hint at more asset purchases
	Dec 3	1) DFR cut to –0.3% and 2) extension of the APP
2016	Jan 21	Hint at more monetary easing
	Mar 10	1) DFR cut to –0.4%, 2) expansion of the APP, 3) introduction of a new corporate sector purchase programme (CSPP) and 4) announcement of new TLTROs (TLTRO-II)
	Apr 21	Details of the CSPP
	Oct 20	Hint at extension of the APP
	Dec 8	Tapering of purchases under the APP
2017	Jun 27	ECB President Mario Draghi's speech in Sintra mentioning a strengthening and broadening of the recovery
	Oct 26	Further tapering of purchases under the APP

2018	Mar 8	Drop of reference to readiness to increase asset purchases if needed
	Jun 14	Further tapering and extension of APP, forward guidance on policy rates
	Dec 13	Forward guidance on reinvestment of principal payments from maturing securities
2019	Mar 7	Forward guidance on policy rates, launch of new TLTROs (TLTRO-III)
	Apr 10	Readiness to adjust all instruments
	Jun 6	Forward guidance on policy rates, details of TLTROs
	Jul 25	Need for highly accommodative monetary policy for prolonged period of time
	Sep 19	1) DFR cut to –0.5%, 2) new net purchases under the APP, 3) change in modalities of TLTROs and 4) two-tier system for reserve remuneration

We assess changes in three-month and the 12-month EURIBOR rates as well as in short- and long-term bank bond yields around these major announcement dates. We focus on the change in these interest rates in a two day window around the UMP events. The results for changes over a one-day window are qualitatively similar but quantitatively smaller, suggesting that some adjustment occur with a delay so that the impact is better captured through the two-day window.[6]

In order to estimate the announcements effects, we generate dummy variables $D_{i,t}^{UMP}$ which take the value of 1 on the two days around each announcement, and zero elsewhere. In order to ensure that the announcement dummies do not pick up the effects of conventional monetary policy measures, we include the surprise in the change in the MRO rate as a control variable. In addition, we also control for other important news that came out around the same time. To this end, we collect a set of additional controls, including surprises in key macro variables such as GDP, consumer prices, industrial production and business and consumer confidence in the euro area as whole as well as in the four major euro area countries and in the United States (see Annex-Table 1 for a complete list). The surprises are constructed as the standardised difference between the released data and their expected values according to Reuters surveys in the week prior to the release.

The announcement effects are thus estimated by running the following regression:

$$\Delta i_{t+1,t-1} = i_{t+1} - i_{t-1} = \alpha + \sum_{i=1}^{m} \beta_i D_{i,t}^{UMP} + \theta MRO_t^{surprise} + \sum_{j=1}^{n} \gamma_j Z_{t,j}^{surprise} + u_t \quad (1)$$

where $i_{t+1} - i_{t-1}$ is the two-day change in the respective interest rate. The individual announcement effects are given by the β_i coefficients. $MRO_t^{surprise}$ denotes the surprise

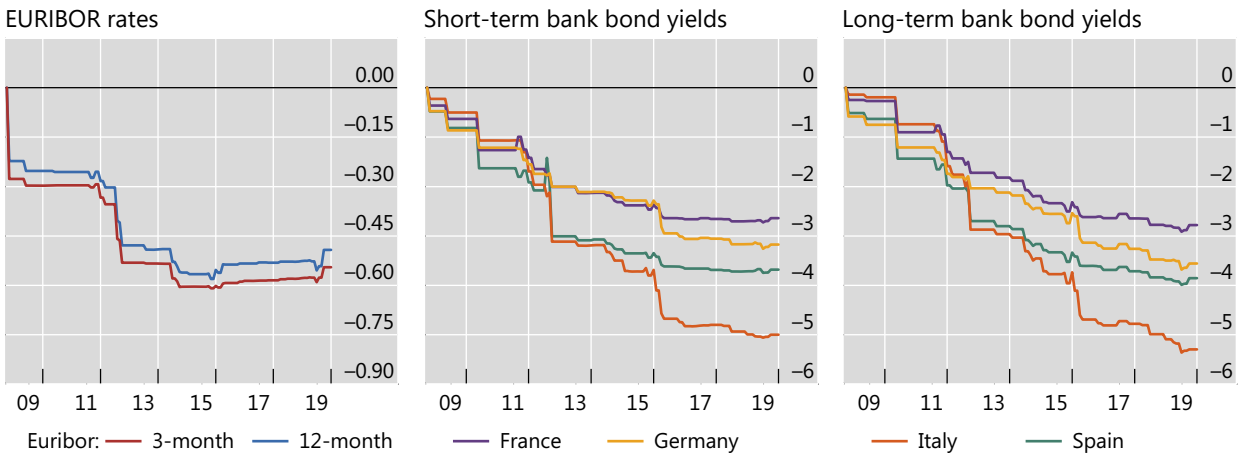
6 The results are available upon request.

in the change in the MRO rate, $Z_{t,j}^{surprise}$ the set of macroeconomic surprise controls entering the regressions.

We plot the cumulated estimated announcement effects in Graph 5, aggregated at the monthly frequency, which is the way the effects enter the pass-through analysis in the following section. The panels reveal that the effects over time as well as the overall quantitative impact on EURIBOR rates and bank bond yields differ starkly, a fact that would be hard to appreciate from a large table of announcement effects which we instead report in the Appendix (Annex Table 2). The overall impact of UMP on EURIBOR rates was relatively limited, with an overall reduction of about 0.5 percentage points (Graph 5, left-hand panel). The largest reductions are linked to the large-scale liquidity provisions announced in October 2008 and the reduction of the deposit facility rate to zero in July 2012. However, and bearing in mind that EURIBOR rates had already been considerably reduced by policy rates cuts over this period, it is perhaps not surprising to find little additional impact from UMP announcements.

Cumulative UMP announcement effects[1]

Percentage points, cumulative from September 2008 Graph 5



The dashed vertical line denotes December 2016, which is the start of the normalisation period for the euro area.

[1] Announcement effects of two-day window based on key monetary policy events on 08 Oct 2008, 13 Oct 2008, 15 Oct 2008, 07 May 2009, 10 May 2010, 08 Aug 2011, 06 Oct 2011, 01 Dec 2011, 08 Dec 2011, 21 Dec 2011, 29 Feb 2012, 05 Jul 2012, 26 Jul 2012, 02 Aug 2012, 06 Sep 2012, 04 Jul 2013, 09 Jan 2014, 05 Jun 2014, 22 Aug 2014, 04 Sep 2014, 02 Oct 2014, 22 Jan 2015, 05 Mar 2015, 09 Mar 2015, 03 Sep 2015, 22 Oct 2015, 03 Dec 2015, 21 Jan 2016, 10 Mar 2016, 21 Apr 2016, 20 Oct 2016, 08 Dec 2016, 27 Jun 2017, 26 Oct 2017, 08 Mar 2018, 14 Jun 2018, 13 Dec 2018, 07 Mar 2019, 10 Apr 2019, 06 Jun 2019, 18 Jun 2019, 25 Jul 2019, 12 Sep 2019.

Sources: ECB; Bloomberg; Datastream; Markit; BIS calculations.

The announcement impacts on bank bond yields, in contrast, were rather large, although they also differed markedly over time and across countries (Graph 5, centre and right-hand panels). While short- and long-term bank bond yields fell in total by less than 3

percentage points in France and by 3-3.5 percentage points in Germany, they dropped by almost 4 percentage points in Spain and by more than 5 percentage points in Italy. These results suggest that the ECB's measures impacted Italy and Spain more than Germany or France, or put differently, they had stronger effect on those countries that were most affected by financial stress and economic weakness over the period. The reductions in bank bond yields are mainly due to the announcement of OMT in 2012 as well as announcements related to the APP since mid-2014.

4.2 The pass-through of UMPs to bank lending and deposit rates

Having established the cumulative impact of key unconventional policy announcements on benchmark money and capital market rates, we now turn to estimating the wider pass-through of the ECB's unconventional measures to bank retail lending and deposit rates.

To this end, we estimate monthly pass-through models which relate bank lending and deposit rates to the rates we have examined in the previous section. More precisely, we link for each of the four major euro area economies short-term lending and deposit rates to the three-month EURIBOR rate and the one-year bank bond yields and long-term lending and deposit rates to the 12-month EURIBOR and the five-year bank bond yields. The implicit assumption is that short-term retail rates are priced off short-term bank funding or opportunity costs while long-term retail rates are priced off long-term bank funding or opportunity costs.

In formal terms, we estimate the following autoregressive distributive lag (ARDL) models:

$$r_t = \alpha + \sum_{i=1}^{m} \rho_i r_{t-i} + \sum_{j=0}^{n} \beta_j m_{t-j} + \sum_{k=0}^{p} \kappa_j b_{t-k} + \varepsilon_t \qquad (2)$$

where, for each of the four countries under investigation, r_t is the short- or long-term target rate (i.e. household and non-financial corporations lending and deposit rates), m_t is the short- or long-term EURIBOR rate and b_t is the short- or long-term bank bond yield. The lag orders of the regressors are determined based on the Akaike information criterion (AIC).[7]

[7] The results turned out to be robust to the use of alternative lag selection criteria, such as the Schwarz-Bayes criterion. The model fit was, however, better with the Akaike criterion.

In order to enhance the efficiency of the estimation, we estimate the pass-through equations jointly by means of Seemingly Unrelated Regressions (SUR). By estimating pass-through in system form, we can in the simulation of the effects of UMP also calculate the impact on bank intermediation margins by just adding the lending-deposit rate spread as an identity to the system.

Tables 3 summarise the results of the estimation of the ARDL models. We report the estimates of the long-run pass-through of the EURIBOR rates and of the bank bond yields, calculated as the long-run multiplier for each variable. The significance level of the long-run multipliers is indicated by asterisks. The table suggests the following main findings.

First, there is evidence of an economically and statistically significant pass-through of benchmark money and capital rates to both short- and long-run retail lending and deposit rates in all four countries. The estimates indicate significant and in many cases even complete long-run pass-through of changes in EURIBOR rates and bank bond yields to lending and deposit rates.

Second, there are some notable differences in pass-through across different types of lending and deposit rate, and across countries. In particular, short-term retail rates in Germany, France and Spain are mainly driven by the EURIBOR rate, while in Italy the bank bond yield tends to be the main driver. On the other hand, for long-term retail rates we find that in most cases bank bond yields are the main driving force in Germany, France and Italy, while in Spain the EURIBOR rate tends to be more important.

Based on the estimated pass-through equations, we can quantify the overall effect of the ECB's UMP measures on retail lending and deposit rates through counterfactual simulations. The counterfactual is that of no UMP and hence no reduction in EURIBOR rates and bank bond yields through the UMP measures. Specifically, we construct a counterfactual path for the lending and deposit rates by simulating counterfactual values for EURIBOR rates and bank bond yields using the estimated pass-through equations (2).

Long-run pass-through to retail rates Table 3

Short-term retail rates				
Lending rates				
	Households		**Non-financial corporations**	
	EURIBOR	Bank bond yield	EURIBOR	Bank bond yield
Germany	0.563***	0.226***	0.593***	0.238**
France	0.455**	0.372**	0.743***	0.016
Italy	0.209*	0.664***	0.345**	0.672***
Spain	0.616***	0.193***	0.490***	0.271***
Deposit rates				
	Households		**Non-financial corporations**	
	EURIBOR	Bank bond yield	EURIBOR	Bank bond yield
Germany	0.677***	0.091	0.818***	-0.050
France	0.514***	0.115	0.700***	0.125**
Italy	0.129	0.490***	0.481***	0.269***
Spain	0.537***	0.395***	0.610***	0.227***
Long-term retail rates				
Lending rates				
	Households		**Non-financial corporations**	
	EURIBOR	Bank bond yield	EURIBOR	Bank bond yield
Germany	0.151	0.623***	0.336**	0.568***
France	0.310***	0.556***	0.343***	0.483***
Italy	0.273*	0.890***	0.414***	0.508***
Spain	0.627***	0.161***	0.364***	0.090***
Deposit rates				
	Households		**Non-financial corporations**	
	EURIBOR	Bank bond yield	EURIBOR	Bank bond yield
Germany	0.412***	0.380***	0.734***	0.240***
France	0.119	0.500***	0.475***	0.424***
Italy	0.231*	0.531***	0.458***	0.477***
Spain	0.601***	0.324***	0.526***	0.314***

Note: Long-run multipliers derived from the SUR estimation of the pass –through equations (2). */**/*** denotes significance at the 10%/5%/1% level

The counterfactual values for the EURIBOR rates and bank bond yields are obtained by adding to the actual values the estimated cumulative impact of UMP announcements, as estimated in the previous section and shown in Graph 5. We then use the estimated pass-through equations to simulate counterfactual values of the various retail rates as well as of the bank intermediation margins given by the spread of the lending rates over the

deposit rates. We derive standard errors for the counterfactual paths based on Monte Carlo simulations of the estimated models.

Graphs 6 and 7 display the actual and the counterfactual evolution of short-and long-term retail lending and deposit rates. The distance between the actual value (red lines) and the counterfactual estimate (black lines), as well as its 95% confidence bands, is to be interpreted as the contribution of unconventional policies. The counterfactual paths are above the actual paths, reflecting that retail rates would have been higher in the absence of UMP.

Three main observations stand out. First, in all four countries the simulations suggest that the ECB's UMP has brought about an economically and statistically significant reduction in retail lending and deposit rates. Second, the bulk of the expansionary effects of UMP is registered after 2011, reflecting the effects of the OMT announcement and the large-scale asset purchases implemented since 2014 on bank bond yields. Third, there is a sizeable quantitative difference in the impact of UMP across the euro area countries. The ECB measures lowered German, French and Spanish lending rates by roughly 100-200 basis points and deposit rates by 50-150 basis points. Italian lending and deposit rates were pushed down by roughly 250-450 basis points and about 150-250 basis points respectively.

More specifically, the simulations suggest that the UMP measures lowered short-term loan rates by roughly 1 percentage point or even less in Germany, France and Spain, and by about 250-350 basis points in Italy (Graph 6). The impact on short-term deposit rates was generally smaller than that on lending rates. In France and Germany, the reduction amounted to about 50 basis points, while in Italy to roughly 150-200 basis points. In Spain, short-term deposit rates were lowered by around 100 basis points.

Somewhat larger effects are obtained for long-term lending and deposit rates (Graph 7). Long-term loan rates in France and Germany were lowered by 150 and 200 basis points respectively, while those in Italy were driven down by 350-450 basis points. In Spain, long-term lending rates were reduced only by about 100 basis points. Again, the impact of UMP on long-term deposits rate was smaller than or as large as that on long-term loan rates. French and German long-term deposit rates were lowered by about 150 and 100

basis points respectively, those in Italy by 150-250 basis points, and the Spanish ones by roughly 100 basis points.

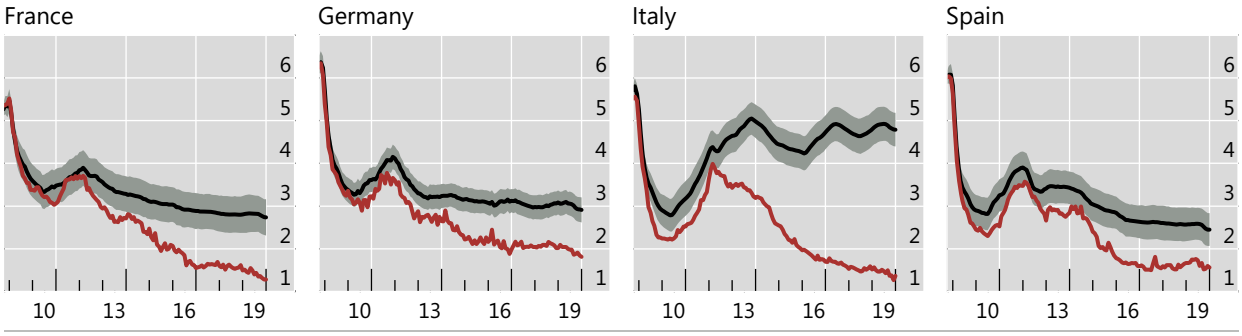
These differences across countries can be explained by the cumulative differences that emerged in the event study analysis and the estimated impacts from the pass-through equations. The larger effect on Italian retail rates results from two factors. First, from the larger cumulative effects of the UMP measures on Italian bank bond yields we have seen in the event study analysis. And, second, from the larger weight of these bond yields in the pricing of Italian loans and deposits as estimated in the pass- through equations. This combines to a larger overall impact on Italian retail rates. In Spain, the cumulative impact of the UMP announcements on bank bond yields was also somewhat larger than in France and Germany. However, the weight of bank bond yields relative to EURIBOR rates in the pricing of retail rates is smaller in Spain than in France and Germany, so that the larger cumulative announcement effects on these yields do not translate into larger reductions in lending and deposit rates in the counterfactual simulations. Instead, the overall effect of the UMP measures turns out to be similar to that in Germany and France or even smaller.

Also the differential quantitative effects we found for lending and deposit rates can be understood from the differences in the estimated pass-through relationships. Loan rates were generally estimated to be relatively more responsive than deposit rates to changes in bank bond yields than to EURIBOR rates, which translates into a larger cumulative impacts for the UMP measures. The exception to this pattern is Spain, where deposit and loan rates were both mainly responsive to EURIBOR rates, translating into similar cumulative reductions over time.

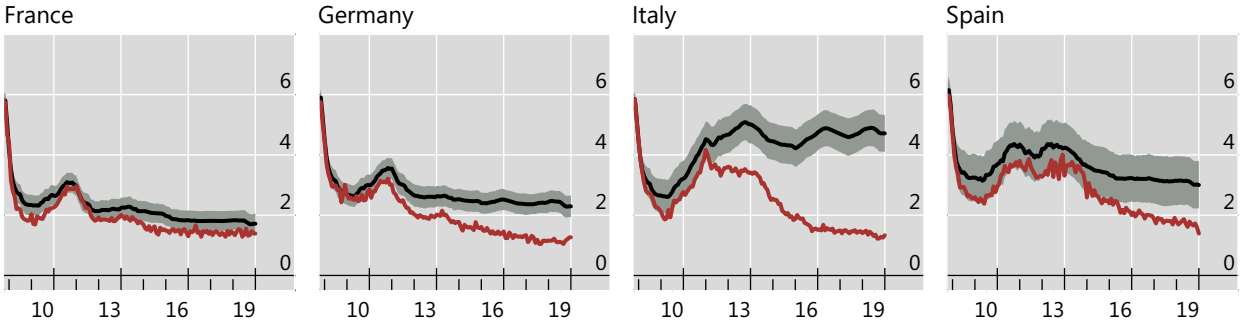
Actual and counterfactual short-term retail lending and deposit rates

Maturity up to one year, in per cent — Graph 6

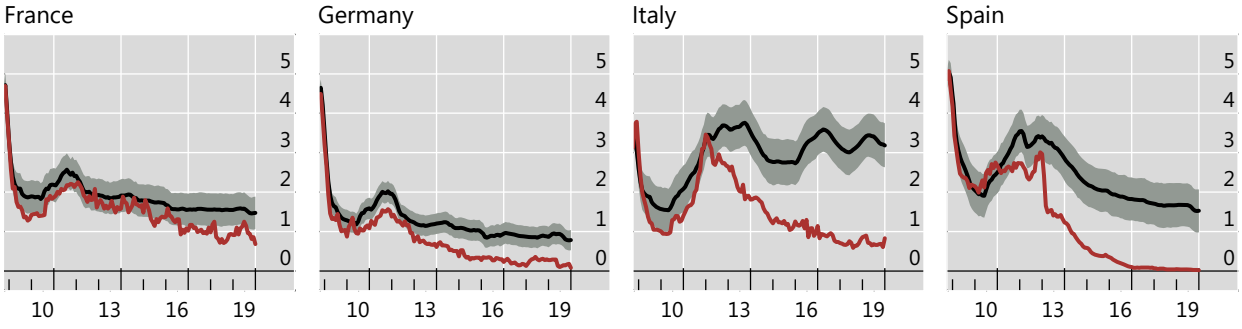
Loan rates: household loans for house purchases



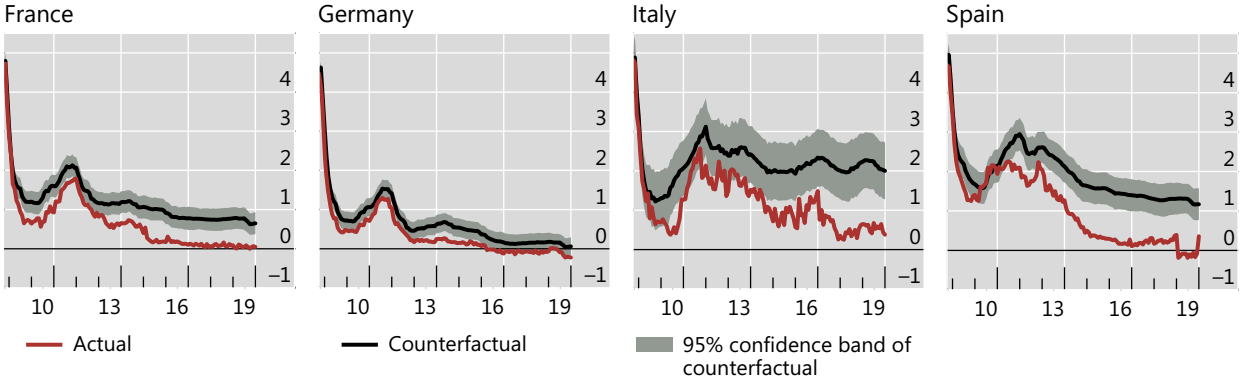
Loan rates: non-financial corporations



Deposit rates: households

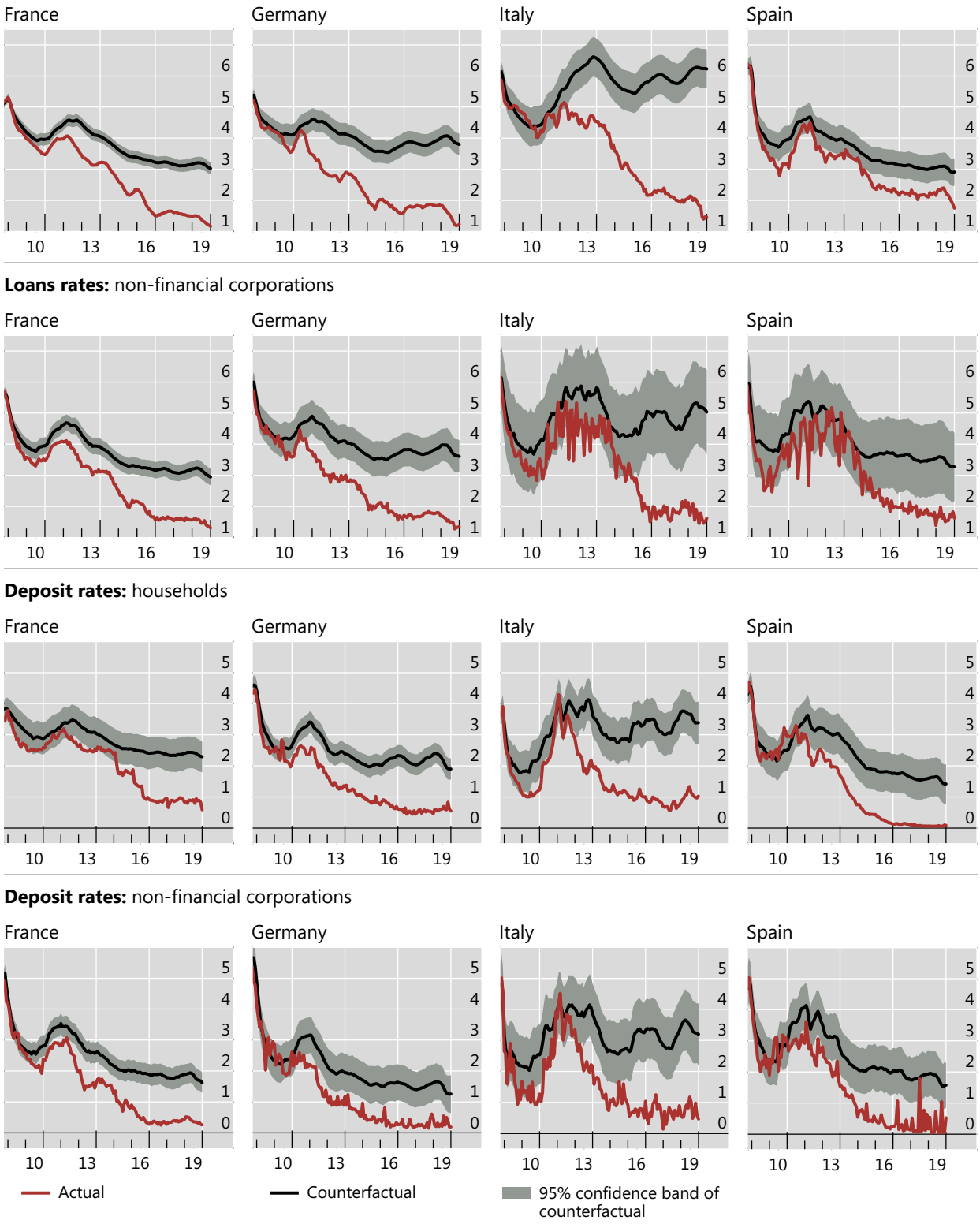


Deposit rates: non-financial corporations



Actual and counterfactual long-term retail lending and deposit rates

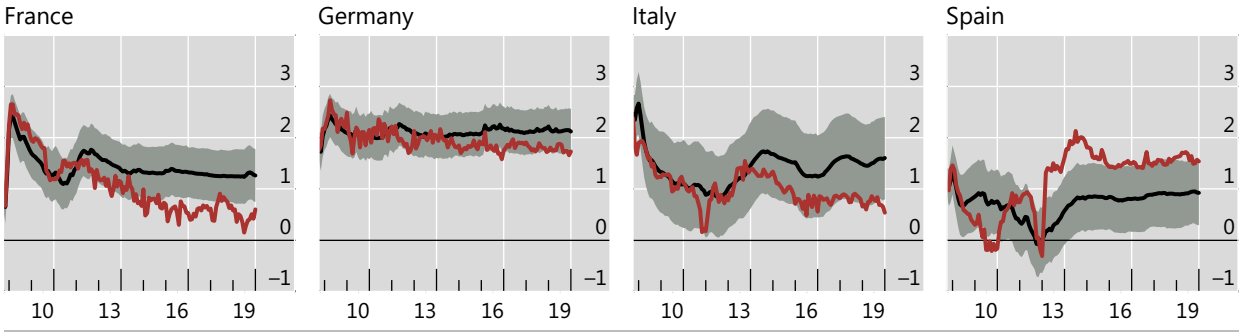
Maturity more than one year, in per cent — Graph 7



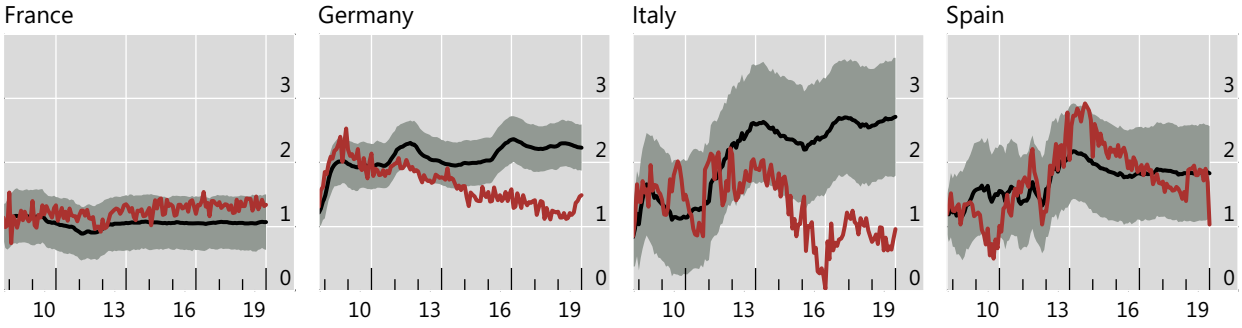
Actual and counterfactual retail lending-deposit rate spreads

In percentage points — Graph 8

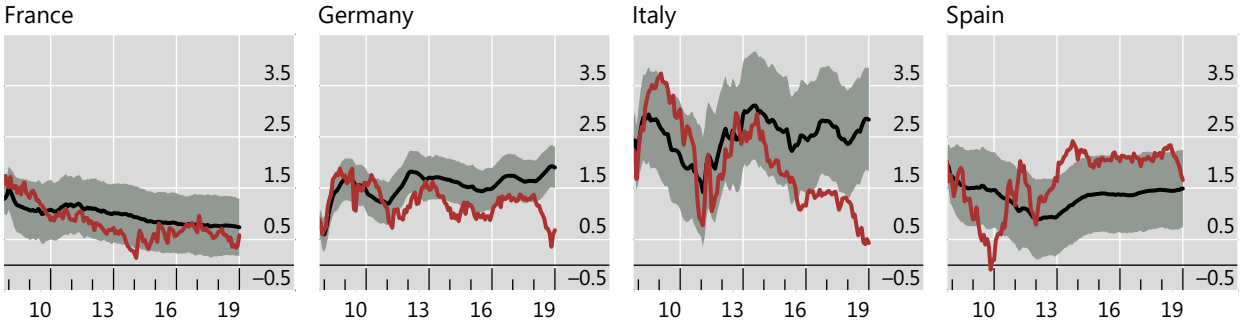
Maturity up to one year: households



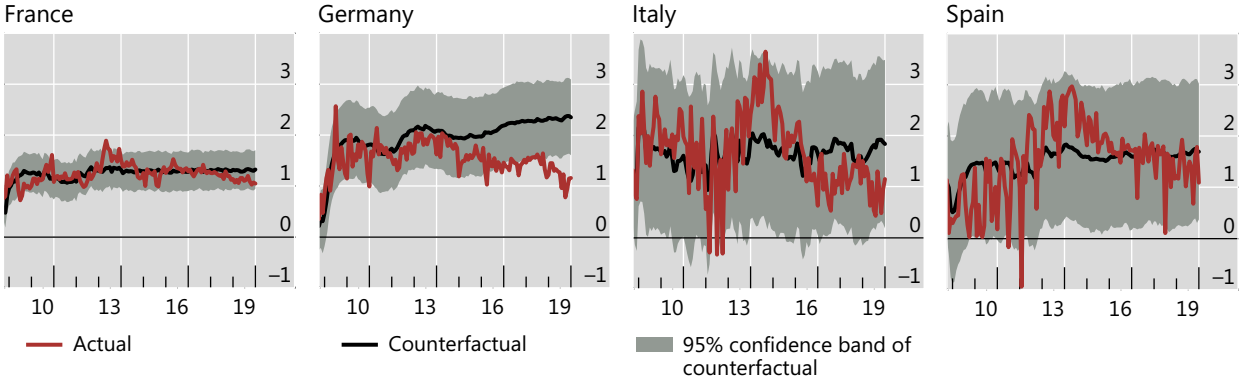
Maturity up to one year: non-financial corporations



Maturity more than one year: households



Maturity more than one year: non-financial corporations



The quantitatively different effects of UMP on loan and deposit rates implies that banks' intermediation margins were also affected by these measures through their impact on retail lending-deposit rate spreads. In order to assess whether this effect was statistically significant, we also simulated the impact of UMP on the lending-deposit rate spreads for each maturity (short and long) and each sector (household and non-financial corporations). Graph 8 displays the actual and the counterfactual evolution of the spreads. The distance between the actual value (red lines) and the counterfactual estimate (black lines), as well as its 95% confidence bands, reflects again the contribution of unconventional policies.

The results suggest that statistically significant reductions of lending-deposit rate spreads obtain only in Germany and Italy. German spreads would have been 50–150 basis points higher in 2019 had there been no ECB UMP. Italian spreads were reduced by up to 100–250 basis points. We generally do not observe a significant impact on French spreads, except for short-term intermediation margins for the household sector, which were compressed by about 50 basis points. In Spain, by contrast, some spreads even rose slightly but mostly not in statistically significant way through UMP at least for some time, reflecting the larger cumulative impact of the measures on deposit rates as compared to lending rates.

5. Conclusions

We document the overall impact of the ECB's entire UMP since 2008 on retail lending and deposit rates in the individual euro area countries. To this end, we use an analytical strategy that combines the cumulative effects of UMP via event study analysis with pass-through estimation to quantify the overall impact of the UMP measures in counterfactual simulations. As such, this is the first paper to assess the overall effect of the ECB's UMP on retail lending and deposit rates, as well as on the implied bank intermediation margins, and to systematically explore differences across countries.

Our findings yield four main insights. First, the ECB's UMP was effective in reducing euro area retail rates in an economically and statistically significant way. Second, the bulk of these effects was registered after 2011 in the wake of the OMT announcement in 2012 and the adoption of large-scale asset purchases after mid-2014. Liquidity programmes

and other asset purchase programmes generally had smaller effects. Third, across the four major euro area countries, the effects of the ECB's measures varied considerably. The ECB measures reduced German, French and Spanish lending rates by roughly 1-2 percentage points, while deposit rates were lowered by 50-150 basis points. Italian lending and deposit rates were pushed down by roughly 250-450 basis points and about 150-250 basis points respectively. This suggests that the measures were indeed most effective where economic and financial stress was most pronounced, namely in Italy. Fourth, the impact of the measures on euro area banks' intermediation margins through retail lending-deposit rate spreads is not clear-cut, with significant compressions prevailing only in Germany and Italy.

A number of caveats are in order to qualify our results. First, it is important to bear in mind that the estimated effects presented here reflect only the effects of the ECB's UMP, not those of the entire range of monetary policy measures implemented by the ECB over the period. In particular, our analysis does not capture the effects of lower policy rates, which offered additional monetary policy easing besides the effects we have estimated. Second, our estimates should be seen as representing a lower bound of the effects of the ECB's UMP, because our event study does not capture all possible anticipation effects ahead of the announcements and possible additional channels through which the measures might affect lending rates, such as e.g. implementation effects or wider confidence effects. Such effects might have further lowered lending rates, but they are hard if not impossible to capture empirically. Third, we do not assess whether the reductions in lending rates were also effective in stimulating credit and the real economy. These effects have been analysed elsewhere with different empirical approaches (Boeckx *et al*. (2017, 2019), Burriel and Galesi (2018)). The findings of this complementary literature suggest that positive effects on credit, output and prices have been achieved. Our findings suggest that the effectiveness of the measures in lowering loan and deposit rates in particular in crisis-stricken countries was probably an important channel of transmission.

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Control variables used in the event study Table A1

Euro area	**Spain**
Consumer confidence indicator	Harmonised consumer price index, yearly changes
Harmonised consumer prices, monthly changes	Real gross domestic product, quarterly changes
Economic sentiment indicator	Real retail sales, yearly changes
Real gross domestic product, quarterly changes	Unemployment rate
Industrial production, monthly changes	**United States**
ECB Main Refinancing Operations rate	Chicago Business Barometer
France	Conference Board consumer confidence
Consumer prices, yearly changes	Consumer prices index, urban consumers, monthly changes
Real gross domestic product, quarterly changes	Federal Funds target rate – upper bound
Industrial production, monthly changes	Real gross domestic product, quarterly changes
Germany	Gross domestic product price index, quarterly changes
Consumer prices, monthly changes	Building (housing) starts
Expectations of economic growth	Initial jobless claims
Business climate	ISM Manufacturing PMI
Industrial production, monthly changes	University of Michigan consumer sentiment
Unemployment rate	Unemployment rate
Italy	Employees on non-farm payrolls, monthly net changes
Business confidence manufacturing sector	
Harmonised consumer prices, yearly changes	
Real gross domestic product, quarterly changes	
Industrial product, monthly changes	

Detailed event study results — Table A2

		EURIBOR rates		Short-term bank bond yields				Long-term bank bond yields			
		3-month	12-month	France	Germany	Italy	Spain	France	Germany	Italy	Spain
2008	Oct 8	0.013	0.018	-0.022	**-0.094**	-0.043	**-0.071**	-0.007	**-0.138**	0.034	0.005
	Oct 13	**-0.144**	**-0.129**	**-0.182**	**-0.143**	**-0.150**	**-0.259**	**-0.200**	**-0.413**	**-0.202**	**-0.317**
	Oct 15	**-0.147**	**-0.111**	**-0.158**	**-0.238**	-0.032	**-0.148**	**-0.040**	**-0.032**	0.030	**-0.200**
2009	May 7	**-0.020**	**-0.030**	**-0.270**	**-0.386**	**-0.275**	**-0.334**	**-0.022**	**-0.165**	**-0.053**	**-0.118**
2010	May 10	0.001	-0.003	**-0.630**	**-0.356**	**-0.569**	**-0.819**	**-0.629**	**-0.457**	**-0.546**	**-0.805**
2011	Aug 8	**-0.007**	**-0.018**	0.268	**-0.022**	0.007	**-0.174**	0.134	**-0.105**	**-0.133**	**-0.215**
	Oct 6	0.010	0.018	**-0.258**	**-0.222**	**-0.243**	0.125	**-0.180**	**-0.153**	**-0.220**	0.098
	Dec 1	-0.002	0.001	**-0.414**	**-0.270**	**-0.572**	**-0.456**	**-0.542**	**-0.368**	**-0.597**	**-0.545**
	Dec 8	**-0.033**	**-0.027**	0.440	0.355	0.501	0.444	0.400	0.312	0.442	0.348
	Dec 21	**-0.006**	**-0.003**	**-0.191**	**-0.176**	**-0.319**	**-0.222**	**-0.213**	**-0.225**	**-0.342**	**-0.230**
2012	Feb 29	**-0.020**	**-0.019**	**-0.229**	**-0.190**	**-0.271**	**-0.166**	**-0.131**	**-0.063**	**-0.170**	**-0.063**
	Jul 5	**-0.094**	**-0.087**	0.190	0.209	0.463	0.300	0.147	0.175	0.400	0.163
	Jul 26	**-0.011**	**-0.014**	**-0.324**	**-0.246**	**-0.696**	0.363	**-0.277**	**-0.228**	**-0.642**	**-0.146**
	Aug 2	**-0.004**	**-0.005**	0.017	0.046	0.075	**-0.504**	0.063	0.069	0.112	**-0.080**
	Sep 6	-0.068	**-0.070**	**-0.242**	**-0.269**	**-0.990**	-1.089	**-0.224**	**-0.244**	**-0.986**	**-0.596**
2013	Jul 4	**-0.003**	**-0.013**	**-0.124**	**-0.109**	**-0.084**	**-0.079**	**-0.099**	**-0.085**	**-0.089**	**-0.100**
2014	Jan 9	-0.001	0.002	0.002	0.002	0.012	0.019	**-0.064**	**-0.058**	**-0.074**	**-0.060**
	Jun 5	**-0.045**	**-0.039**	**-0.054**	-0.013	**-0.140**	**-0.085**	**-0.188**	**-0.169**	**-0.274**	**-0.220**
	Aug 22	**-0.009**	**-0.014**	**-0.028**	**-0.017**	**-0.060**	**-0.027**	**-0.059**	**-0.057**	**-0.074**	**-0.050**
	Sep 4	-0.017	-0.017	**-0.081**	**-0.086**	**-0.111**	**-0.075**	**-0.069**	-0.059	**-0.114**	**-0.070**
	Oct 2	0.001	-0.002	**-0.022**	0.004	-0.004	**-0.016**	0.007	0.029	0.041	0.035
2015	Jan 22	0.001	**-0.004**	**-0.066**	**-0.060**	**-0.209**	**-0.080**	**-0.123**	**-0.111**	**-0.258**	**-0.125**
	Mar 5	0.002	0.004	**-0.037**	**-0.029**	**-0.068**	**-0.037**	-0.003	0.008	**-0.039**	-0.011
	Mar 9	**-0.002**	**-0.004**	0.036	0.027	0.060	0.038	**-0.019**	**-0.016**	**-0.022**	**-0.032**
	Sep 3	0.002	0.001	0.010	0.001	0.067	0.009	**-0.047**	**-0.042**	0.027	**-0.051**
	Oct 22	-0.007	**-0.016**	**-0.094**	**-0.102**	**-0.149**	**-0.098**	**-0.116**	**-0.150**	**-0.208**	**-0.141**
	Dec 3	0.007	0.027	0.099	0.102	0.110	0.091	0.187	0.207	0.218	0.188
2016	Jan 21	**-0.005**	**-0.009**	**-0.071**	**-0.076**	**-0.412**	**-0.072**	**-0.103**	**-0.065**	**-0.369**	**-0.083**
	Mar 10	0.012	0.025	**-0.158**	**-0.461**	**-0.467**	**-0.161**	**-0.163**	**-0.442**	**-0.492**	**-0.184**
	Apr 21	0.001	0.000	**-0.047**	**-0.127**	**-0.109**	**-0.036**	**-0.034**	**-0.091**	**-0.091**	-0.006
	Oct 20	0.004	0.003	**-0.006**	**-0.070**	**-0.068**	-0.008	0.008	**-0.059**	**-0.075**	**-0.008**
	Dec 8	0.002	0.000	**-0.013**	**-0.049**	**-0.082**	**-0.037**	**-0.031**	**-0.059**	**-0.045**	**-0.069**
2017	Jun 27	0.001	**0.004**	**0.021**	**0.024**	0.017	0.002	**0.084**	**0.088**	**0.086**	**0.057**
	Oct 26	0.001	-0.001	-0.019	-0.016	0.007	-0.025	-0.088	-0.094	-0.052	-0.086
2018	Mar 8	**0.003**	**0.004**	-0.005	-0.019	-0.017	-0.010	-0.007	-0.034	-0.028	-0.021
2018	Jun 14	**0.002**	0.000	-0.043	-0.093	-0.116	-0.026	-0.124	-0.185	-0.185	-0.104
	Dec 13	0.002	0.003	0.009	0.005	-0.059	0.009	-0.023	-0.018	-0.101	-0.038
2019	Mar 7	**0.002**	0.001	-0.001	**0.034**	-0.037	**0.008**	-0.033	**0.016**	-0.060	-0.029
	Apr 10	-0.001	-0.003	**0.016**	-0.027	-0.007	**0.032**	-0.007	-0.031	-0.027	-0.013

Event study results coefficients (continued) Table A2

Jun 6	**0.003**	**0.005**	-0.001	-0.017	**0.072**	-0.005	-0.023	-0.040	-0.060	-0.016
Jun 18	-0.017	-0.033	-0.041	-0.085	-0.093	-0.070	-0.057	-0.129	-0.127	-0.054
Jul 25	**0.013**	**0.013**	**0.027**	**0.035**	0.017	0.006	**0.035**	**0.038**	**0.038**	0.020
Sep 12	**0.032**	**0.049**	**0.060**	**0.048**	**0.039**	**0.062**	**0.101**	**0.083**	**0.031**	**0.115**

Results reported in the table are the βi obtained from the following specification: $\Delta i_{t+1,t-1} = i_{t+1} - i_{t-1} = \alpha + \sum_{i=1}^{m} \beta_i D_{i,t}^{UMP} + \theta MRO_t^{surprise} + \sum_{j=1}^{n} \gamma_j Z_{t,j}^{surprise} + u_t$. Bolded coefficients represent correct expected sign and significance at the 5% level.

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