ECB EURO LIQUIDITY LINES

2021

BANCO DE ESPAÑA
Eurosistema

Documentos de Trabajo
N.º 2125

Silvia Albrizio, Iván Kataryniuk, Luis Molina
and Jan Schäfer

ECB EURO LIQUIDITY LINES

ECB EURO LIQUIDITY LINES [*]

Silvia Albrizio [**]

BANCO DE ESPAÑA

Iván Kataryniuk [***]

BANCO DE ESPAÑA

Luis Molina [****]

BANCO DE ESPAÑA

Jan Schäfer [*****]

CEMFI

(*) We are grateful to Ricardo Reis, Iñaki Aldasoro, Dmitry Khametshin, Javier J. Pérez, Antonio Millaruelo, Maurizio Habib, David Lodge, Arnaud Mehl, Massimo Ferrari, Stephanie Titzck, Roland Beck, the members of the ESCB Workstream on Globalisation, and audiences at the BIS/BoE/ECB/IMF Spillover Conference, the ECB IPA seminar and the Banco de España internal seminar for the useful comments. Thanks to Elisa Sánchez, Enrique Esteban and Mamen Castillo for their availability and data help, and Carlos Moreno Pérez, Begoña Lara y Najat Bazah Lamchanna for the research assistance. The opinions and analysis are the responsibility of the authors, and therefore, do not necessarily coincide with those of the Banco de España nor the Eurosystem.
(**) Email: silvia.albrizio@bde.es.
(***) Email: ivan.kataryniuk@bde.es.
(****) Email: lmolina@bde.es.
(*****) Email: jan.schaefer@cemfi.edu.es. Funding from Spain's State Research Agency through its MarÍa de Maeztu Units of Excellence program (MDM-2016-0684) is gratefully acknowledged.

Documentos de Trabajo. N.º 2125

August 2021

ISSN: 1579-8666 (on line)

Abstract

The use of central bank liquidity lines has gained momentum since the global financial crisis in order to provide liquidity in foreign exchange markets, while at the same time preventing threats to financial stability and negative spillbacks. US dollar swap lines are well studied, but much less is known about the effects of liquidity lines in euros. We use a difference-in-differences strategy to show that the announcement of ECB euro liquidity lines has a direct positive signalling effect since the premium paid by foreign agents to borrow euros in FX markets decreases up to 76 basis points relative to currencies not covered by these facilities. Additionally, the paper provides suggestive evidence that these facilities generate positive spillbacks to the euro area since domestic bank equity prices increase by 6.7% in euro area countries highly exposed via banking linkages to countries whose currencies are targeted by liquidity lines.

Keywords: liquidity facilities, central banks swap and repo lines, spillbacks.

JEL classification: E44, E58, F33, G15.

Resumen

El uso de líneas de liquidez por parte de los bancos centrales ha cobrado impulso desde la crisis financiera mundial, con el fin de proporcionar liquidez en los mercados de divisas, asegurar la estabilidad financiera y evitar efectos indirectos negativos. Mientras que el efecto de las líneas swap en dólares estadounidenses ha recibido mucha atención en la literatura, se sabe mucho menos sobre los efectos de las líneas de liquidez en euros. En este documento se usa una estrategia de diferencias en diferencias para mostrar que el anuncio de una línea de liquidez en euros por parte del Banco Central Europeo con un banco central de fuera del área del euro tiene un efecto directo positivo, ya que la prima pagada en el mercado de divisas para acceder a euros desciende hasta 76 puntos básicos en relación con la prima en monedas no afectadas por el anuncio. Además, el documento proporciona evidencia preliminar de que los anuncios generan efectos indirectos positivos en el área del euro. Así, la cotización bursátil de los bancos de aquellos países del área del euro más vinculados a los países receptores a través de las operaciones de préstamos transfronterizos aumentaría un 6,7 %.

Palabras clave: provisión de liquidez, líneas *swap,* Banco Central Europeo.

Códigos JEL: E44, E58, F33, G15.

Introduction

Central bank swap and repo lines have been used extensively in the last decade to provide liquidity in foreign exchange markets during periods of distress. Their logic is simple. When a swap line is active between a source central bank and a recipient one, the latter can access the source central bank's currency in exchange for its domestic currency at the spot exchange rate, up to a maximum amount and at a fixed interest rate, which is below the market rate. At maturity, the same amount of money is exchanged among the two counterparties at the same fixed spot exchange rate. In this way, the recipient central bank can inject liquidity in the domestic market, preventing market pressure on its own currency (in the case that its currency needs were to be met by private agents) or avoiding to exhaust its own reserves (in the case that the needs were to be met by reserves' sell-off, see Aizenman et al. 2011). In the case of repo lines, the recipient central bank has to pledge assets denominated in the source-country currency as collateral to have access to the currency.

In this *do ut des* agreement, on the one hand, the recipient central bank can support the liquidity needs of its domestic banking system. On the other hand, by reducing foreign liquidity shortage, the source central bank prevents negative spillovers in the form of financial instability. Moreover, it is exempted from bearing credit risk, since the recipient central bank, based on its comparative advantage, takes care of monitoring the institutions accessing the credit. Finally, the transaction does not involve exchange rate risk for any of the two counterparts.[1]

The objective of this paper is to analyze the effect of ECB euro liquidity lines. Just during the Covid-19 pandemic, the ECB has established more than eight new euro liquidity facilities and the euro represents the second most important currency in the international monetary system.[2] In spite of this, the effectiveness of these tools is, to the best of our knowledge, mostly unknown. We provide a description of the deployment of this tool by the ECB, creating a timeline of ECB swap and repo lines announcements based on ECB press releases. We test for the signalling effect of the ECB euro liquidity lines in reducing liquidity tensions and generating positive spillbacks to euro area (EA) countries. We use announcement dates instead of the actual activation of the line for two reasons: first, the announcement is publicly available, and therefore any signalling effect will appear in that date. Second, if these lines serve as a prevention tool, the announcement should be sufficient to provide confidence in the functioning of the foreign exchange swap market and increase liquidity. In fact, as Schnabel and Panetta (2020) underline, these liquidity arrangements do not need to be actually used to be effective.

To test for the effectiveness of ECB euro liquidity lines, following Cetorelli et al. (2020) and Bahaj and Reis (2021), we consider daily deviations of the covered interest parity (CIP)

[1] Bahaj and Reis (2021) provide an in-depth discussion of the swap line mechanisms.

[2] According to the ECB, the euro represents around 38% of the share of global payments at the end of 2020 and around 20% of the share in global holdings of foreign reserves.

before and after the announcement of a euro liquidity line on currencies targeted by the line versus a control, non-targeted group. Similar to Bahaj and Reis (2021), our identification relies on a difference-in differences (DID) strategy. We find that the announcement of euro swap and repo lines reduces the euro funding cost in foreign exchange swap markets by between 51 and 76 basis points as measured by the CIP deviations, depending on the samples of targeted countries considered. Restricting the attention to ECB swap lines, we find that this effect is confirmed but less statistically significant.

Moreover, we provide suggestive evidence on spillbacks of euro liquidity facilities to euro area countries. In this regard, the case of the EA has some particularities that we can exploit. Since banks in different EA jurisdictions can be affected differently depending on their exposures to foreign markets via the domestic banking sector, liquidity arrangements in the EA might also be needed in order to avoid the risk of fragmentation. We capture the cross-country heterogeneous exposure by considering the share of cross-border claims of EA banks towards countries that receive liquidity lines. Using the exposure of the banking sector in EA countries in a DID framework, we estimate the effect of these announcements on the change in Euro Area banks' stock prices. We find that EA countries with the most exposed banking sectors benefit the most from the announcement of the lines since they experience a relative increase of their equity prices of about 6.7% in a four-day window around the announcement. In other words, more exposed banks see their market valuation increased and their profitability expectations improved after the announcement. Overall, the analysis suggests that the signalling effect of central bank liquidity facilities is effective in generating a positive direct effect on foreign FX markets as well as potential spillovers on the source country.

This paper is connected to the economic literature looking at the beneficial effects of swap lines. Several papers have studied how central bank liquidity lines have lubricated both money markets and foreign exchange swap markets in the global financial crisis (GFC) (Carré and Le Maux, 2020; Obstfeld et al., 2009) as well as in the more recent COVID-19 crisis (Aldasoro et al., 2020). Consistent with the central role of the USD in the global financial markets, most of these arrangements have provided liquidity in this currency. Indeed, Fed USD swap lines played an effective lender of last resort function in FX markets by putting a ceiling on deviations from the CIP (Baba and Packer, 2009; Bahaj and Reis, 2021; Moessner and Allen, 2013). This mechanism also worked during the COVID-19 crisis (Bahaj and Reis, 2020a; Cetorelli et al., 2020). In a recent paper, Aizenman et al. (2021) show that trade and banking linkages with the US are positively associated with access to Fed swap and repo lines during the COVID-19 crisis. Fed liquidity facilities announcements during 2020 have led to lower CDS spreads and long-term interest rates in the targeted economies, together with an appreciation of the currency with respect to the USD. Moreover, Bahaj and Reis (2021) find that Fed liquidity lines have a positive spillback effect on the source country by encouraging capital inflows into USD denominated assets. In this way, while the swap

lines started as a byproduct of globalisation in financial markets, since they responded to the liquidity needs of an integrated global financial system, they also proved to be useful to reinforce the international role of the source currency in the international monetary system as well as in international trade. People's Bank of China´s 38 swap lines in less than a decade are a clear example of an alternative use of such tools (Bahaj and Reis, 2020b).

The paper is structured as follows: section 1 provides an overview of the ECB repo and swap lines network across time; section 2 presents the data used in the analysis; section 3 presents the methodology, discusses the results and their robustness; section 4 adds suggestive evidence of the positive spillback effect of these facilities. Section 5 concludes with some considerations on the desirability of a more stable and permanent central bank liquidity network and proposes some lines of future research.

1 ECB liquidity lines

Historically central banks' liquidity lines have been used for three main objectives: (i) defend a peg system (Bordo et al., 2015), (ii) offer a global liquidity backstop (Bahaj and Reis, 2021 among others), (iii) enhance the international use of the domestic currency (Bahaj and Reis, 2020b).

The first objective led to the establishment of the Fed Reciprocal Currency Agreements, i.e. swap lines, in 1962, first with the Bank of France and by the end of the same year with nine other key central banks. Under the Bretton-Woods system, the Fed intervened in forward foreign-exchange markets to reestablish confidence in the USD and to defend its gold peg. At the end of the 90s, this tool was discontinued. The global swap network regained importance as a cooperation tool across central banks only following the September 11th terrorist attack and more extensively in 2007 and 2008 with the Global Financial Crisis (GFC).[3] In this context, central banks' liquidity agreements transformed the Fed into the global lender of last resort, limiting fire sales and helping contain the risk of market contagion.

The G10 central banks contributed to this coordinated effort to expand the USD liquidity provision capacity.[4] By 2013 these temporary bilateral liquidity swap arrangements were converted into a standing agreement with an unspecified withdrawal amount and maturities of approximately seven days or three months. Liquidity provision has been granted in each of the five participating currencies.

Not only did the ECB participate in such network, but between October 2008 and August 2020 it established and/or extended a total of 28 swap and repo lines with 16 foreign counterparts to provide euro liquidity. Counterparts were mostly EU countries outside the EA (Bulgaria, Croatia, Czech Republic, Denmark, Hungary, Poland, Romania, and Sweden),

[3] The evolution of the USD swap lines have been described in McCauley and Schenk (2020), Allen et al. (2010) and Goldberg et al. (2010), among others.

[4] Participating central banks were the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, and the Swiss National Bank.

but since 20 March 2020 also other non-EU countries (Serbia, San Marino, Albania and Republic of North Macedonia).[5]

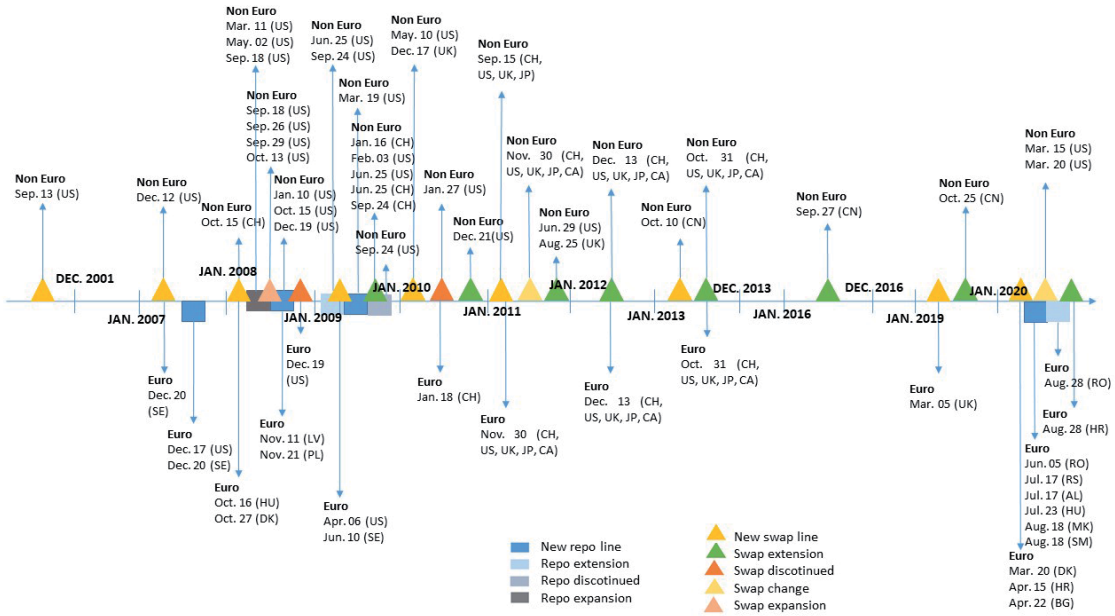
Figure 1 provides a complete picture of all ECB liquidity agreements until August 2020, in euro and in other currencies. Euro lines are highlighted below the timeline and, as the chart shows, they are mainly clustered around crisis episodes. ECB lines announced in collaboration with other central banks to provide liquidity in currencies other than the euro are highlighted above the timeline. Appendix A.3 reports the full timeline of ECB liquidity facilities, specifying additional characteristics of each line. Figure 2 shows the cumulated number of ECB swap and repo lines in euro (blue line) and in other currencies (red line) over time. This comprises announcements about new agreements, as well as extensions and changes in conditions, such as pricing. Both ECB euro and non-euro lines increased during the global financial crisis, predominantly due to the establishment of swap lines with G10 countries. On the contrary, the second spike in the use of euro liquidity lines (blue highlighted) corresponds to the subsequent geographical extension of liquidity lines to EU and non-EU countries during the COVID-19 crisis, mainly in the form of repo lines. Also from this second chart it is clear that the number of these announcements intensifies during crisis episodes, suggesting that the main purpose of ECB liquidity lines has been to provide liquidity in times of distress. Zooming into euro liquidity lines, i.e. lines dedicated to provide euro liquidity and not in other currencies, Figure 3 shows the geographical distribution of the ECB euro liquidity network, where euro swap lines are used to provide liquidity to G10 countries, while euro repo agreements mainly concern countries in the European region outside the Euro Area.

Except for the agreements within the G10 network, most of these facilities are temporary and with a maximum amount of allotment at a fixed rate, which is defined as a spread over the OIS reference date with a minimum floor. Moreover, around 40% of these lines are repo facilities that require adequate collateral in euro-denominated assets and feature a higher lending rate compared to swap lines. Although the ECB liquidity lines have been mainly a liquidity backstop, some of these have also been used in the context of the exchange rate mechanism (ERM II), a peg system to the euro, which is a prerequisite for any EU Member State to join the euro area – as in the case of Bulgaria on 22nd April 2020. Differently from the PBoC, the ECB has not leveraged on euro liquidity facilities to provide incentives for the internationalization of its currency.

With respect to the use of the lines, the available information is scarce. By looking at recipient countries, we have checked that, at least the liquidity lines with the Magyar Nemzeti Bank and the Bank of England have already been used, although in small amounts.

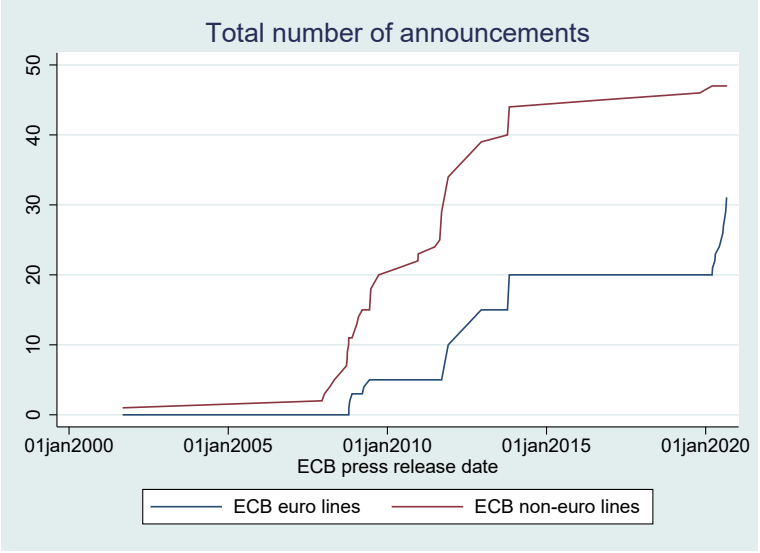
[5]Previous to October 2008, in 2007, the ECB established its first euro swap line with the central bank of Sweden. Since this is an isolated event and it is not present in the ECB press releases, for consistency it is not included in the analysis. Moreover, although our timeline ends in August 2020, the ECB has continued to establishing euro liquidity line to provide euro liquidity during the COVID crisis. The recently established EUREP facility is not included since the respective country-specific announcements are not public.

Figure 1: ECB liquidity facility announcements



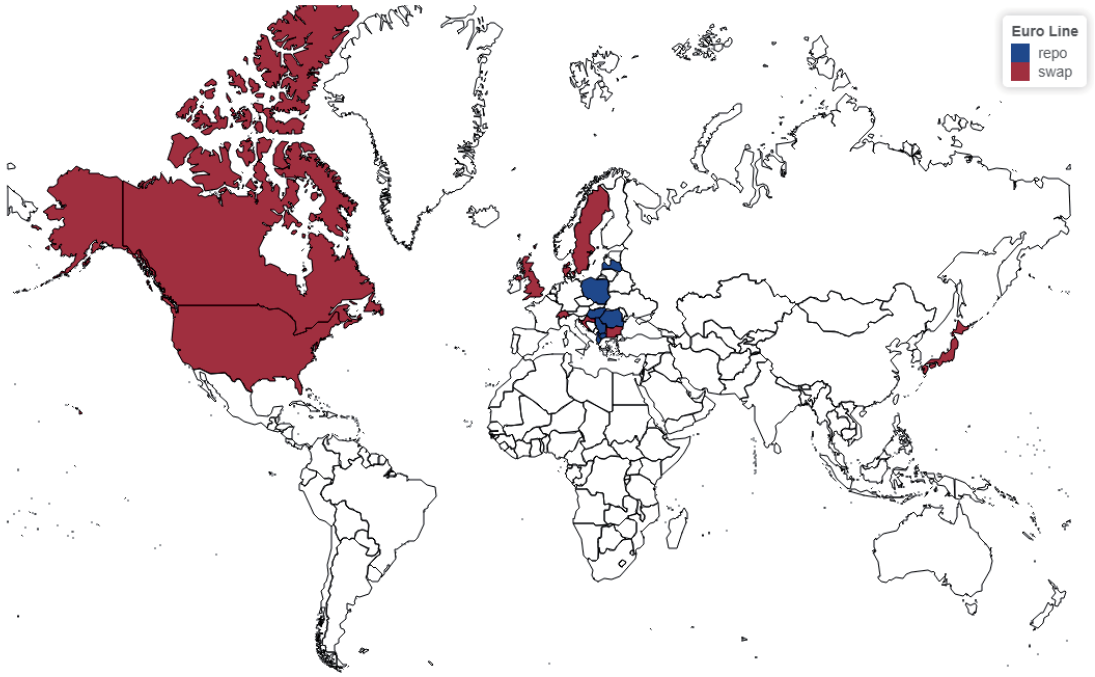
Note: The figure reports the announcements of ECB liquidity facilities. Above the timeline, establishments of lines between the ECB and other central banks for the provision of foreign currencies (such as USD, GBP, CHF, CNY) are reported. Below the timeline, ECB euro liquidity facilities are recorded.

Figure 2: ECB liquidity facility announcements



Note: The figure shows the cumulated sum of ECB liquidity arrangements. The blue line shows euro-providing facilities, while the red indicate non-euro facilities. Events are sourced from the ECB press releases.

Figure 3: Geographical distribution ECB euro liquidity facilities: repo and swap lines



Note: Countries whose central bank has established euro swap lines with the ECB are highlighted in red while countries with euro repo lines are highlighted in blue.

2 Data

For the purpose of this analysis, we consider only euro liquidity lines from 6 October 2008 through 28 August 2020 as reported in the ECB press releases. The sample comprises thirteen currencies targeted by the lines, since we exclude countries targeted by the lines but using the euro as main currency, and four additional currencies never targeted by ECB liquidity lines. The former are Bulgaria, Denmark, Croatia, Hungary, Poland, Serbia, Sweden, United States, Switzerland, Canada, United Kingdom, Japan; while the latter are Norway, Iceland, New Zealand and Singapore.

To test the effectiveness of the ECB euro liquidity line, we first consider the change in the euro funding cost in FX markets. In a frictionless FX market, the covered interest parity (CIP) holds and the implied euro interest rate in the FX market equals the euro money market interest rate. If the CIP does not hold, the FX swap basis spread provides a measure of the premium paid by foreign agents to borrow euros for a specified time period in the FX market compared to the euro money market. In other words, a positive basis represents relatively high costs for euro funding in the FX market. Following Bahaj and Reis (2021), the euro basis is defined as:[6]

$$B_t = ln(F_t) - ln(S_t) - (r_t - r_t^*) \tag{1}$$

[6]Under covered interest parity, the no arbitrage condition $\frac{F_t}{S_t} = \frac{1+r_t}{1+r_t^*}$ holds. Equation (1) follows from taking logs and using the approximation $ln(1+r) \approx r$, valid for small r.

where F_t is the market forward rate of the euro against the rest of the currencies, S_t is the equivalent spot rate, r_t stands for the interest rate of the euro deposits and r_t^* is the interest rate for deposits in each of the foreign currencies considered. We use one-week euro currency deposits when it is possible, and build back some series for some countries using the equivalent interbank interest rate. All data are obtained from Refinitiv databases on a daily frequency. We prefer to use OIS rates, but due to data availability constraints in some cases we use euribor rates instead. Table 8, in the Appendix A.1, shows the main descriptive statistics for CIP deviations. Furthermore, since recipient country idiosyncratic factors may drive the FX basis in times of financial turbulence, we purge the basis from country-specific factors closely related with the occurrence of financial crises, such as sovereign defaults, banking runs or currency crashes.

In other words, in the econometric specification our main dependent variable is defined as the residuals res_{jt} of country-by-country regressions of the basis on country-specific characteristics collected in the vector $\boldsymbol{\Omega_{j,t}}$:

$$basis_{jt} = \alpha_j + \boldsymbol{\beta\Omega_{jt}} + res_{jt} \tag{2}$$

Following Alonso and Molina (2019), $\boldsymbol{\Omega_{jt}}$ includes the following battery of controls at different frequencies, sourced from Refinitiv. In terms of high-frequency data, we construct a volatility measure for the country-specific equity index as the forty-day standard deviation of the daily change of the domestic equity index. We also include the long term yield of sovereign bonds, in local currency when it is possible, or using the EMBI instead. In terms of lower-frequency variables, we include the quarterly change in gross public debt as a percentage of GDP, the annual moving average of the current account balance as a percentage of GDP, countries' short-term external debt as percentage of international reserves, the inflation rate (year on year change of the Consumer Price Index), and the level of Central Bank's International Reserves in billions of USD. Finally, to proxy for the general economic performance and solvency of a country, we include the sovereign credit rating, as defined by Standard and Poor's, transforming its alphanumeric scale linearly, from 21 (AAA ratings) to 12 (BBB-, that is, the investment grade level) and 0 (restricted defaults or selective defaults, RD and SD). Note that this approach is preferable to just control for country characteristics in the DID analysis on the basis since it relies on longer time series, while the DID is just over a 4-day window.

In the last part of the paper, to assess the potential spillback effect on the EA, we consider EA banks' stock prices as a relevant metric, since they capture market valuations and expectations about bank-specific profitability. Low stock prices are usually associated with banks in financial stress: their stock prices decrease to compensate for higher risk, and thus induce investors to hold their stocks. In the context of our analysis, the working hypothesis would be that the announcement of an ECB swap line with a third country outside the euro area reduces the risk of financial turbulence and/or the probability of default of

banks or firms in that concrete market. This in turn, improves the valuation of the highly exposed EA banks, and the stock price should increase. Equity prices are obtained on a daily frequency from Refinitiv, and we use the Datastream aggregate bank equity indices for each country. As in the case of the FX basis, we purge the equity indices from country-specific factors. Since in this last exercise the dependent variable is at the EA country level, we purge for variables that may affect the health of the banking sector of a given EA country. These are the short-term interest rate, defined as the 3-month Treasury Bill interest rate, or the closest maturity when the former is not available; the nominal effective exchange rate deviation, calculated as the difference between the observed nominal effective exchange rate and the exchange rate that would prevail if the real effective exchange rate were consistent with its long term mean, using the IMF nominal and real effective exchange rates; net foreign assets of domestic banks, defined as the difference between domestic banks' claims and liabilities with non-residents over GDP (as defined by the IMF's International Financial Statistics database); the loan-to-deposit ratio, defined as domestic banks' claims on private sector over the sum of deposits (transferable deposits included in Broad Money definition, other deposits included in Broad Money, and deposits excluded from Broad Money), as posted by the IMF's International Financial Statistics database. In Appendix A.1 we summarize the descriptive statistics for the stock market data as well as the banks included in the respective aggregates.

Finally, to construct a measure of EA countries' banking sector exposure to foreign countries we use the BIS Consolidated Banking Statistics on a quarterly basis. In particular, we consider total claims of each EA domestic bank on foreign banking sectors, all maturities, and all instruments and currencies, measured on a guarantor basis. The exposure of the banking sector of EA country j to non-EA country i is calculated as the share of claims on country i over total claims of domestic banks of country j on all countries. For example, Italy's exposure to Bulgaria is proxied by the share of Italian banks' total claims on Bulgarian banks over all cross-border claims of Italian banks. When missing, data are imputed using linear interpolations. The EA country exposure is then calculated as the average exposure towards the countries targeted by a liquidity facility at each announcement. Table 9, Appendix A.1, tabulates the exposure dummy across countries and announcements. Based on this measure, we construct a dummy that allows us to classify EA countries' banking sectors as highly exposed to non-EA countries if the lagged average exposure of EA country j at the announcement t is higher than the 75th percentile of the cross-country distribution at the announcement date t. On the contrary, we defined a EA country banking sector as lightly exposed if its exposure is lower than 75th percentile threshold.

3 Euro funding in FX markets

This section first presents the methodology used to estimate the signalling effect of ECB euro liquidity facilities on the euro funding cost in FX market, as measured by CIP deviations;

second, it reports the results and, finally, it provides evidence of the robustness of the results using a placebo test.

3.1 Methodology

As Bahaj and Reis (2021) explain, this analysis calls for a DID approach for at least two reasons. First, as the authors show, central bank liquidity lines put a ceiling on deviations from covered interest parity; however, these events are sporadic, thus it is more informative to focus on periods of financial stress when the volume of trading in swap contracts increases and the equilibrium is constrained by the FX swap supply curve. Second, potential confounding factors, such as contemporaneous changes in financial regulation, may lead to biased estimates, while comparing the effect with an adequate control group would allow to isolate the effect of the policy.

In our context, the selection of the comparison group for the DID analysis merits some attention. The ECB euro liquidity lines have targeted most of the currencies of central banks in the geographical vicinity of the euro. As such, we do not have a wide comparison group, i.e. currencies with similar characteristics to the treated ones but that have never been targeted by the lines. This is a standard case of multiple periods and groups, where the treatment is staggered over time (Athey and Imbens, 2018; Callaway and Sant'Anna, 2020 among others). However, the treatment is not an absorbing state since we consider announcements and not implementations. Therefore, our identification strategy is as follows: For each announcement date, we compare treated countries, i.e. countries whose currency is targeted by the announcement of an ECB line, with a counterfactual that includes both currencies never targeted by ECB lines as well as currencies that are targeted at previous or future dates. This strategy is similar to Fadlon and Nielsen (2020), where the authors identify the effect of health shocks in labor supply using as control group households targeted on a future date. In other words, we define a currency as treated if it is targeted by the ECB line at time t, but this same currency is considered non-treated in other periods $\tilde{t} \neq t$. This allows us to have an adequate control group, ensuring that the evolution of the outcome would be parallel for the targeted and non-targeted countries without the liquidity line announcement. Nevertheless, this approach could raise concerns that non-targeted countries might be affected by past swap line announcements. In order to reduce this concern, we consider a short window around the announcement to prevent that subsequent announcements could contaminate the current one. Thus, identification relies on the timing of the announcement.[7] Since we have a reduced amount of events, we collapse the panel around these announcements following previous contributions (see Bertrand et al., 2004). Finally, we compute the treatment effect using a two-way fixed effects DID estimator.

More formally, we consider the following set-up, in which y_t^T denotes the mean outcome of the targeted countries at time t and y_t^{NT} is the mean outcome of non-targeted countries,

[7] In the robustness subsection we test for anticipation and we find no such evidence.

and t is the date of the announcement of a liquidity line. We can retrieve the treatment effect β_t by comparing the outcome in t with the outcome in the previous period $(t-1)$, using the DID estimator:

$$\beta_t = (y_t^T - y_t^{NT}) - (y_{t-1}^T - y_{t-1}^{NT}) \tag{3}$$

First, as in Bahaj and Reis (2021), we inspect the distribution of the FX swap basis spread around the facilities' announcements graphically. Specifically, we consider a window spanning two days before and one day after the announcement. In Figure 4, we pool the observations to show the frequency distribution of the basis in this four-day window around the events for treated currencies (left panel) and for non-treated currencies (right panel). A country is considered treated in the window around event t, if its currency is targeted by the ECB liquidity line announced in t, and it will be considered non-treated in the other events $\tilde{t} \neq t$. As shown in Figure 4, the histogram for treated countries suggests a shift to the left. On the contrary, we do not observe such shift in the non-treated group. This graphical inspection suggests that announcements of ECB liquidity lines are associated with a reduction of the cost of euro funding in the FX market.

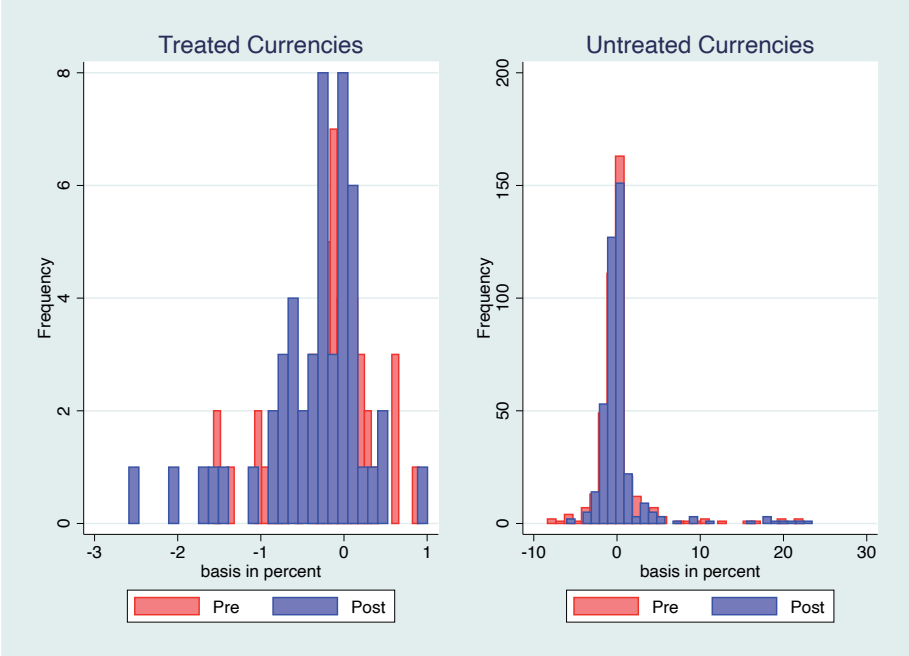


Figure 4: Basis Density Before and After Announcement

Frequency distribution in a 4-day window around the announcement for the countries listed in Section 2. For any announcement, the treated currency/ies is/are going to be the one/s targeted by the announcement, while the non-targeted currencies in the sample are untreated. Post-treatment is defined as the day of treatment and the day after, while pre-treatment is the two days prior to treatment.

Moreover, to further reassert about our grouping strategy, we consider alternative sampling and we purge the basis from country-specific relevant factors, as explained in Section

2, to control for country-specific factors that might contribute to diverging trends between control and treated currencies. In detail, we consider three different samples. Sample I, in line with the strategy by Fadlon and Nielsen (2020), restricts the sample to EU countries plus

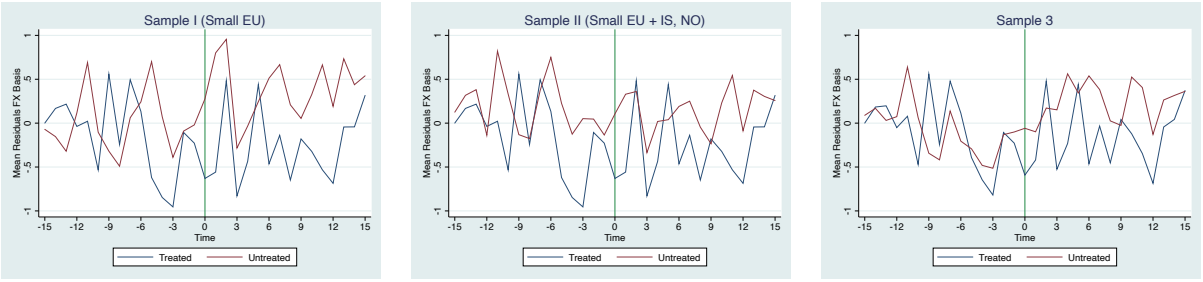


Figure 5: Residuals in Levels: Averaged over Events 2008-2020

The figure shows the average evolution of the variable of interest in the 30-day window around each announcement of an ECB liquidity line for the treated currencies versus non-treated. The variable is defined as the residual obtained from the regression of the FX basis on recipient country s stock market volatility, change in public debt, current account balance, sovereign rating, sovereign yield, short-term debt, reserves and inflation. Each panel of the figure corresponds to a sample, as defined above. For any announcement, the treated currency/ies is/are going to be the one/s corresponding to the announcement, while the rest of the currencies in the sample are used as controls. The events are pooled and the green vertical line indicates the day of the announcement.

Serbia that are targeted at least once during the time span considered (Bulgaria, Denmark, Croatia, Hungary, Poland, Serbia, Sweden). The idea behind this is that these countries have been targeted at least once, so they share similar characteristics under the lens of the ECB. Sample II includes all countries in Sample I, but adds currencies of geographically contiguous countries that have never been targeted (Norway, Iceland). Sample III expands Sample II by considering G10 countries targeted (United States, Switzerland, Canada, United Kingdom, Japan) and additional control countries such as New Zealand and Singapore.

To check whether the parallel pre-trend assumption is supported by the data, Fig. 5 shows the evolution of the residuals of the FX basis in the 15-days pre- and post-announcements of the treated versus the control group. In order to mimic our econometric specification and control for other country-specific factors, we first regress the FX basis on a set of controls as in Eq. (2). We then plot the evolution of the mean of the residuals by treated and non-treated groups. The charts support the credibility of the parallel pre-trend assumption since the FX basis for treated and non-treated evolves very closely in all the three samples, validating our DID strategy combined with the high frequency identification. Additionally, Figure 6 in the Appendix shows the evolution for the basis, which yields a similar picture.

Based on the two pieces of graphical evidence and following Cetorelli et al. (2020), we empirically test for the differential impact of the ECB liquidity lines using a difference-in-differences approach in a four-day window around the announcement. As in the graphical inspection in Figure 4, we exploit variation over two dimensions: the time of the announcement, namely we consider the FX basis daily changes in the two days before the announcement versus the changes on the day of the announcement as well as the following day, and

the treatment versus the control group, i.e. currencies directly targeted by the swap line announcement relative to the rest. Equation (4) specifies this difference-in-differences (DID) framework via a two-way fixed effect approach, where the daily change of the euro basis is regressed over a group variable for treated currencies at time t ($T_{i,t}$), which takes the value of 1 in the four-day interval around the announcement when the economies of concern are targeted by the ECB liquidity line, and zero for the non-targeted currencies; a period dummy ($Post_t$) that equals one on each of the days of the announcements and the following day, while it is zero in the two days before the announcement; as well as the interaction of the two ($T'_{i,t}Post_t$) which captures the effect on the treatment in group i at period t.

Other ECB monetary policy decisions are captured by a dummy corresponding to the date of the ECB monetary policy meetings (mp_t). Moreover, we test additional specifications that add a set of global controls included in a vector (Z_t), i.e. the Global Citi Economic Surprise Index and the EU high-yield spread.[8]

Finally, since we consider a collapsed panel, we include fixed effects to control for permanent unobservables at currency level. Standard errors are robust to heteroskedasticity and autocorrelation. The equation to be estimated is then given by Eq. (4):

$$res_{i,t} = \mu_i + \beta_1 T_{i,t} \times Post_t + \beta_2 T_{i,t} + \beta_3 Post_{i,t} + \beta_4 mp_t + \varphi' Z_t + u_{i,t} \quad (4)$$

The effect of the ECB liquidity line is identified by β_1 which is the group-time average treatment effect defined as the difference of the average treatment effect on the treated and control groups.

There are two additional potential concerns that might affect our DID approach. First, since we have staggered adoption, as De Chaisemartin and d'Haultfoeuille (2020) show, the estimated coefficient of the interaction term (i.e. β_1) is a weighted sum of the average treatment effect (ATE) in each DID event. Given that the DID is actually comparing the evolution of the outcome between consecutive periods across pairs of groups, part of the control group may become and stay treated for two consecutive periods. Thus its treatment effect gets differentiated out by the DID and this may lead to negative weights in the aggregation of the average estimated coefficient. However, our set-up is not subject to such concerns since (i) we consider the announcement of the line, which is not an absorbing state and, as already explained above, (ii) we collapse the panel considering a short window around the announcement. Moreover, since there is a minimum of six days between two announcements targeting different currencies and at least four months between announcements targeting the same currency, the effects of two consecutive events do not overlap.[9] Second, we might capture the effect of other global events. However, the inclusion of the aforementioned global covariates control for other events that could systematically occur in that short time window.

[8] No further global volatility measures are included, since the basis is already regressed on a country-specific measure of stock market volatility.

[9] Furthermore, we drop the only event which is six days apart from the consecutive one.

3.2 Results

Table 1 shows the results for the basis residuals: column (1) and (2) show the results for sample I with two different control sets, columns (3) and (4) show the results for sample II, column (5) and (6) consider the full country sample.

Table 1: Effect of ECB liquidity line announcement

Dependent Variable: FX Basis Residuals

	Sample I		Sample II		Sample III	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated_Post	-0.596*	-0.762**	-0.518	-0.647*	-0.646**	-0.719**
	(0.092)	(0.030)	(0.147)	(0.061)	(0.044)	(0.026)
Treated	-0.408	-0.189	-0.442	-0.227	-0.228	-0.0195
	(0.192)	(0.571)	(0.157)	(0.483)	(0.413)	(0.948)
Post	0.0881	0.175	0.00944	0.0734	0.173	0.179
	(0.632)	(0.413)	(0.960)	(0.717)	(0.227)	(0.207)
MP meetings		-0.621*		-0.530*		-0.505*
		(0.052)		(0.076)		(0.055)
EU high yield		-0.0484***		-0.0502***		-0.0487***
		(0.007)		(0.003)		(0.000)
Surprise index		-0.00347***		-0.00309**		-0.000742
		(0.006)		(0.029)		(0.453)
Observations	220	220	292	292	660	660
R^2	0.092	0.159	0.077	0.123	0.077	0.111
Currency FE	yes	yes	yes	yes	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the two-way fixed effects DID estimation on a collapsed panel which is composed by the four-day window around each ECB euro swap line announcement. Treated is defined as the currency targeted by the line in t, while the control group comprises the countries not targeted by the line announced in t. Sample composition is described in Section 3.

From the table we observe that the euro funding cost decreases in a short window around the announcement by an average of 76 basis points in a sample of small EU countries (note that since the residuals are in percent the effect in the tables is in pp and we need to multiply it by 100 to interpret the effect in basis points). This effect corresponds to about 60% of one standard deviation of the residuals (see Table 8 in the Appendix). The effect is confirmed in sample II although slightly less significant, potentially because Iceland displays higher volatility than the small EU countries. Finally the effect is significant and robust when we include one additional event (euro line with US) and bigger non-EU countries (Sample III).

Taken together, these results underline the regional importance of the ECB euro liquidity network as opposed to the international one by the Fed. As Aizenman et al. (2021)

point out, trade linkages are an important factor behind the establishment of a line and they may also affect the effectiveness of such facilities.

Additionally, we test whether the effect is different according to the type of the line, i.e. swap versus repo. Since repo line announcements are fewer and sometimes they overlap with swap line announcements, in order to maximize the sample size, we restrict our attention to the swap lines by excluding repo lines and contemporaneous swap-repo announcements. We are left with 8 events. Table 2 reports the results for the three samples. The estimates are similar in magnitude, but less statistically significant in the case without controls.

3.3 Robustness

Although our results are robust to the inclusion and exclusion of a battery of global and recipient economy controls and the graphical inspection of pre-trends corroborates our empirical strategy, we further test for anticipation and potential pre-trends. We investigate whether the DID results are robust to a placebo test, in which we artificially move the announcement date three days before the actual event to detect anticipation (in case of a negative and significant effect) as well as to detect non parallel pre-trends. By doing this, we ensure that the window in the placebo test does not include the day of the announcement.

Table 2: Effect of ECB liquidity swap line announcement

Dependent Variable: FX Basis Residuals

	Sample I		Sample II		Sample III	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated_Post	-0.521	-0.713**	-0.444	-0.567*	-0.564*	-0.658**
	(0.143)	(0.040)	(0.211)	(0.088)	(0.057)	(0.035)
Treated	-0.151	0.132	-0.182	0.0392	0.0310	0.313
	(0.579)	(0.680)	(0.501)	(0.896)	(0.890)	(0.262)
Post	0.0864	0.183	0.00955	0.0348	0.163	0.181
	(0.706)	(0.491)	(0.966)	(0.884)	(0.309)	(0.260)
MP meetings		-0.884		-0.955**		-0.658*
		(0.115)		(0.033)		(0.070)
EU high yield		-0.0566**		-0.0473**		-0.0623***
		(0.023)		(0.035)		(0.000)
Surprise index		-0.00377***		-0.00337**		-0.000502
		(0.006)		(0.024)		(0.622)
Observations	172	172	228	228	528	528
R^2	0.094	0.177	0.083	0.136	0.095	0.149
Currency FE	yes	yes	yes	yes	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the two-way fixed effects DID estimation on a collapsed panel which is composed by the four-day window around each ECB euro swap line announcement. Treated is defined as the currency targeted by the line in t, while the control group comprises the countries not targeted by the line announced in t. Sample composition is described in Section 3.

The results for the three samples can be found in Table 5 Appendix A.2. Since the effect is always very far from statistical significant and sometimes even has positive sign, the results indicate no sign of anticipation and it confirms the parallel pre-trends assumption.

We run one additional robustness test on our preferred sample I: Instead of considering the residual as dependent variable we do consider the basis and, in addition to global controls, we include two country-specific covariates that change daily: stock market volatility and sovereign yield. Results are confirmed again under this set-up as shown in Table 4 in Appendix A.2.

Lastly, Appendix B presents alternative evidence from an event study using time-series regressions of the FX basis residuals on the post treatment dummy and a vector of controls. The estimated effect is statistically significant and slightly higher, but of similar magnitude as in the DID approach. The results are thus re-confirmed.

4 Spillbacks

Once the positive signalling effect of the announcement of ECB liquidity lines on euro external financing is quantified, we turn to the euro domestic market and tentatively test for spillbacks. Central bank liquidity line announcements may prevent the materialization of negative spillbacks by instilling confidence in recipient economies and reducing the risk that financial distress may spread into the source country. Therefore, insulation, or, in other words, a null effect on key financial variables in the source countries can already be a sign of spillbacks. However, in the following exercise we test for positive differential effects by exploiting the heterogeneous banking exposure of EA countries towards the countries considered in the treated versus control groups, in a similar fashion to Aizenman et al. (2021). While Aizenman et al. (2021) look at the impact of Fed lines on key financial variables of recipient economies, such as long term interest rates and credit default spreads, we focus on key variables of source countries. We take advantage of the fact that some EA countries have stronger trade and banking ties with some of the countries whose currencies are targeted by ECB lines due to historical or geographical reasons. For instance Italy has strong trade and therefore banking connections with Romania, Austria with Hungary, etc. Therefore, we expect that an ECB announcement of a repo line with Romania will benefit Italy more than Spain, which does not have strong linkages with Romania.

This beneficial effect can materialize through different channels: for instance, the announcement of an ECB swap line by reducing the risk of financial turbulence and/or the probability of default of banks or firms in the recipient economy, may, in turn, reduce the probability of default and consequently the cost of insurance – i.e. the CDS – of euro area banks, particularly of those highly exposed to the third country. Another way to test a positive effect is to consider the stock price and the dividend yield: our working hypothesis is that an announcement of ECB liquidity lines is regarded positively by market participants. Thus, we could observe a relative increase in bank profitability, which in turn should increase

stock prices and reduce the dividend yields of the most exposed banks. Among these testable options we consider the stock price in light of data availability considerations, i.e. it allows us to have a larger sample of EA countries. We expect that, following an ECB liquidity line announcement, the equity price of EA banks most exposed to the countries targeted by the line will increase relatively more than the less exposed banks.

To account for this heterogeneous effect we consider the following two dimensions: time (pre vs. post announcement) and the exposure in terms of cross-border banking flows between EA source countries and non-EA counter-parties. Therefore, our main explanatory variable of interest is the interaction between the dummy capturing the announcement and the following day ($Post_t$) and the lagged exposure variable ($Exp_{j,t-1}$). Furthermore, as in the case of the basis, we first purge the dependent variable for country-specific controls as explained in Section 2. Finally, we use changes and not the levels of the stock price residuals as the dependent variable, due to stationarity concerns.[10] We adjust the specification accordingly:

$$\Delta PriceRes_{j,t} = \mu_j + \beta_1 Post_{j,t} \times EXP_{j,t-1} + \beta_2 Post_{j,t} + \beta_3 EXP_{j,t-1} + \beta_4 mp_t + \boldsymbol{\varphi}' \boldsymbol{Z_t} + u_{j,t} \tag{5}$$

where $\Delta PriceRes_{j,t}$ is the change in the purged average stock price of the banks in EA country j at time t, $EXP_{j,t-1}$ is a dummy equal to one if the average exposure of the EA country j to non-EA countries targeted by the line is higher than the 75th percentile of the exposure distribution at time t, and 0 otherwise. As explained in Section 2, the exposure is defined as the share in portfolio holdings by the banking sector of EA countries. The specification includes country fixed effects. $\boldsymbol{Z_t}$ is a vector of global controls. Standard errors are robust to heteroskedasticity and autocorrelation.

The sample focuses on the ECB lines established with European countries plus Serbia, i.e. sample I of the previous exercise in order to ensure that the effect is not contaminated by liquidity lines in USD or other currencies that may happen at the same time. Figure 7, Appendix A.1, shows the evolution of the change in the stock price in the 30-day window around each announcement. The highly exposed and less exposed countries follow a very close pattern.

According to the results in column 1 of Table 3 the announcement of a ECB euro liquidity line increases EA stock prices for EA countries with a banking sector more exposed to countries whose currencies are targeted by the line. Table 9, Appendix A.1 gives an overview of the EA countries classified as exposed at each announcement. As expected, Italy and Austria are on average more exposed than any other EA countries to ECB liquidity line recipients.

As a robustness check, instead of constructing the exposure dummy based on the 75th percentile of the distribution, we reduce the threshold to the 65th percentile, i.e. the exposure

[10] Unit root tests for the individual time series as well as panel unit root tests suggest that stock prices contain a unit root. This is not surprising, as it is a common feature of financial data.

dummy takes the value of one for countries that have a share of cross-border banking claims towards the targeted country in t above the 65th percentile of the cross-country distribution in t. Table 10, Appendix A.1 reports the dummy value for each country at each announcement and Column 2, Table 3 shows the results. Estimates confirm an increase in banks' equity prices, however, the statistical significance is reduced to one standard deviation. This result points towards the need of strong banking ties to generate a positive and significant spillover effect. In any case, further research is needed to shed light on the different spillback channels that ECB liquidity lines might have.

Table 3: Spillbacks of Announcement to EA banks

Dependent Variable: Change in Stock Price Residuals

	Banking Exp.	
	(1)	(2)
Post × Exp	6.671*	3.564
	(0.05)	(0.21)
Exp	-0.567	0.154
	(0.84)	(0.94)
Post	2.704*	3.440*
	(0.08)	(0.07)
VIX	-0.110	-0.110
	(0.14)	(0.14)
EU high yield	-0.274	-0.227
	(0.41)	(0.51)
MP meetings	2.045	2.247
	(0.28)	(0.28)
Observations	284	284
R^2	0.141	0.130
Controls	full	full
Currency FE	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the two-way fixed effects DID estimation on a collapsed panel which is composed by the four-day window around each ECB euro liquidity line announcement. The exercise focuses on ECB lines towards EU countries to reduce potential overlapping concerns with USD liquidity lines. Exposure (*Exp*) is a dummy that equals one if the share of claims of the banking sector of EA-country j towards the recipient country banking sector of the country targeted by the line in t, is higher than the 75th percentile (first column) or 65th percentile (second column) of the distribution across EA countries at the moment of announcement in t. Lowering the threshold to the 65th percentile reduces significance to 1sd (68%). The EA sample comprises AT, BE, DE, ES, FI, FR, IR, PT, IT.

5 Conclusion

Central bank liquidity lines in times of distress function as a backstop facility, preventing episodes of liquidity shortage to turn into global financial stability problems. In line with the stated policy goal to use such swap lines as a backstop, the ECB has expanded considerably

its network of swap lines during episodes of global financial stress (the global financial crisis and the current COVID-19 crisis).

While previous contributions have focused on the effects of USD liquidity lines, this paper presents original descriptive and empirical evidence for the case of the ECB. Concretely, we show that ECB euro liquidity lines have been effective in decreasing the premium paid by foreign agents to borrow euros in FX markets in a narrow window around the announcement. Furthermore, this paper points towards positive spillbacks to the euro area generated by these facilities in the form of relatively higher bank equity prices, which are often associated with better market valuations of future profitability, in euro area countries highly exposed via banking linkages to countries whose currencies are targeted by liquidity lines.

From our descriptive analysis, we notice that the ECB has provided FX insurance to central banks in its vicinity, mainly non-EA EU countries. Therefore, in contrast with the Fed, its role has been more of a regional lender of last resort than a global one. This difference seems to be driven by the different trade ties of the US and the EU with the rest of the world, as supported by the evidence found in Aizenman et al. (2021) for the US. An unanswered question is then whether these arrangements can also boost the usage of the euro as an international currency, as has been stated in some official speeches (see Schnabel and Panetta, 2020). In general, if these swap lines become a well-established tool (either through permanent arrangements or through temporary but predictable ones), market participants may anticipate that liquidity in euro FX markets will be sufficient and CIP deviations will be small even in times of crisis. As a consequence, liquidity lines may increase the relative attractiveness of trading in euros. These considerations are left for further research.

References

Aizenman, J., H. Ito, and G. K. Pasricha (2021). *Central Bank Swap Arrangements in the COVID-19 Crisis*, Technical Report, National Bureau of Economic Research.

Aizenman, J., Y. Jinjarak, and D. Park (2011). "International Reserves and Swap Lines: Substitutes or Complements?", *International Review of Economics & Finance*, Vol. 20, No. 1, pp. 5–18.

Aldasoro, I., T. Ehlers, P. McGuire, G. von Peter et al. (2020). *Global banks' dollar funding needs and central bank swap lines*, Technical Report, Bank for International Settlements.

Allen, W. A., R. Moessner et al. (2010). *Central bank co-operation and international liquidity in the financial crisis of 2008-9*, Citeseer.

Alonso, I., and L. Molina (2019). "The Sherloc: an EWS-based Index of Vulnerability for Emerging Economies", *Banco de España Working Papers*, No. 1946.

Athey, S., and G. W. Imbens (2018). *Design-Based Analysis in Difference-in-Differences Settings with Staggered Adoption*, Technical Report, National Bureau of Economic Research.

Baba, N., and F. Packer (2009). "Interpreting Deviations from Covered Interest Parity During the Financial Market Turmoil of 2007–08", *Journal of Banking & Finance*, Vol. 33, No. 11, pp. 1953–1962.

Bahaj, S., and R. Reis (2020a). "Central bank swap lines during the covid-19 pandemic", *Covid Economics*, Vol. 2.

Bahaj, S., and R. Reis (2020b). "Jumpstarting an International Currency", *CEPR Discussion Paper No. DP14793*.

Bahaj, S., and R. Reis (2021). "Central Bank Swap Lines", *Review of Economic Studies, forthcoming*.

Bertrand, M., E. Duflo, and S. Mullainathan (2004). "How Much Should We Trust Differences-in-Differences Estimates?", *The Quarterly Journal of Economics*, Vol. 119, No. 1, pp. 249–275.

Bordo, M. D., O. F. Humpage, and A. J. Schwartz (2015). "The evolution of the Federal Reserve swap lines since 1962", *IMF Economic Review*, Vol. 63, No. 2, pp. 353–372.

Callaway, B., and P. H. Sant'Anna (2020). "Difference-in-Differences with Multiple Time Periods", *Journal of Econometrics*.

Carré, E., and L. Le Maux (2020). "The Federal Reserve's Dollar Swap Lines and the European Central Bank during the global financial crisis of 2007–09", *Cambridge Journal of Economics*, Vol. 44, No. 4, pp. 723–747.

Cetorelli, N., L. S. Goldberg, and F. Ravazzolo (2020). "Have the Fed swap lines reduced dollar funding strains during the Covid-19 outbreak?", *Liberty Street Economics*.

De Chaisemartin, C., and X. d'Haultfoeuille (2020). "Two-way fixed effects estimators with heterogeneous treatment effects", *American Economic Review*, Vol. 110, No. 9, pp. 2964–96.

Fadlon, I., and T. H. Nielsen (2020). "Family Labor Supply Responses to Severe Health Shocks: Evidence from Danish Administrative Records", *American Economic Journal: Applied Economics*.

Goldberg, L. S., C. Kennedy, and J. Miu (2010). *Central bank dollar swap lines and overseas dollar funding costs*, Federal Reserve Bank of New York Staff Reports, No. 429.

McCauley, R., and C. R. Schenk (2020). "Central bank swaps then and now: swaps and dollar liquidity in the 1960s", *BIS Working Papers*, No. 851.

Moessner, R., and W. A. Allen (2013). "Central bank swap line effectiveness during the euro area sovereign debt crisis", *Journal of International Money and Finance*, Vol. 35, pp. 167–178.

Obstfeld, M., J. C. Shambaugh, and A. M. Taylor (2009). "Financial instability, reserves, and central bank swap lines in the panic of 2008", *American Economic Review*, Vol. 99, No. 2, pp. 480–86.

Schnabel, I., and F. Panetta (2020). "The provision of euro liquidity through the ECB's swap and repo operations", *ECB Blog*.

Appendix

A.1. Data Sources

Stock Prices are sourced from Datastream (Refinitiv) and are country aggregates from the following banks:

- Germany: Deutsche Bank, Commerzbank, Aareal, Deutsche Pfandbriefbank, Procredit and Umweltbank
- France: BNP, Crédit Agricole, Société Generale, Natixis, Nord CCI, Ille de France, Brie Picardie, and Crédit Foncier
- Italy: Intesa, Unicredit, Generali, BPM, BPER, Finecobank, Monte dei Paschi, Credito Emiliano, Illimity, Sondrio, Profilo, Sistema, Piccolo credito
- Spain: Santander, BBVA, Caixabank, Bankinter, Sabadell, Liberbank and Unicaja
- Belgium: KBC, Banque Nationale de Belgique and KBC Ancora
- Austria: Erste, Raiffeisen, BAWAG Group, Oberbank, BKS, Addiko Bank, and Bank für Tirol und Vorarlberg
- Finland: Nordea and Aktia
- Ireland: Bank of Ireland and Permanent THB
- Portugal: Banco Comercial Portugues

A.2. Regression Tables

Table 4: Effect of ECB liquidity line announcement (Sample I: small EU)

Dependent Variable: FX Basis		
	(1)	(2)
Treated_Post	-0.793**	-0.674*
	(0.036)	(0.051)
Treated	0.482	0.0616
	(0.131)	(0.839)
Post	0.278	0.144
	(0.205)	(0.470)
VIX	-0.00569	
	(0.467)	
EU high yield	-0.0588**	-0.0351
	(0.022)	(0.449)
MP meetings	-0.447	-0.700**
	(0.176)	(0.013)
Surprise index	-0.00355***	-0.00426***
	(0.009)	(0.003)
Stock exchange volatility		-0.240**
		(0.047)
Sovereign yield		0.0358
		(0.754)
Observations	236	220
R^2	0.217	0.177
Currency FE	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the two-way fixed effects DID estimation on a collapsed panel which is composed by the four-day window around each ECB euro swap line announcement. Treated is defined as the currency targeted by the line in t, while the control group comprises the countries not targeted by the line announced in t. Sample composition is described in Section 3.

Table 5: Effect of ECB liquidity line announcement (Placebo)

Dependent Variable: FX Basis Residuals

	Sample I		Sample II		Sample III	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated_Post	-0.102	-0.214	0.0200	-0.0132	0.0922	0.0509
	(0.849)	(0.683)	(0.971)	(0.981)	(0.850)	(0.919)
Treated	0.155	0.298	0.102	0.131	0.176	0.294
	(0.745)	(0.521)	(0.832)	(0.780)	(0.685)	(0.514)
Post	-0.0834	0.0524	-0.205	-0.155	-0.232	-0.162
	(0.647)	(0.761)	(0.358)	(0.518)	(0.161)	(0.333)
MP meetings		-0.406		-0.735**		-0.409
		(0.228)		(0.039)		(0.138)
EU high yield		-0.0357**		-0.0121		-0.0289
		(0.016)		(0.595)		(0.126)
Surprise index		-0.00398***		-0.00401**		-0.000797
		(0.003)		(0.015)		(0.503)
Observations	220	220	292	292	660	660
R^2	0.032	0.084	0.025	0.054	0.023	0.029
Currency FE	yes	yes	yes	yes	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the two-way fixed effects DID estimation on a collapsed panel which is composed by the four-day window around each ECB euro swap line announcement. For the purpose of the placebo exercise, the date of the announcement has been anticipated by 3 days, consequently moving the window ahead of the actual announcement, preventing any overlap with true window. Treated is defined as the currency targeted by the line in t, while the control group comprises the countries not targeted by the line announced in t. Sample composition is described in Section 3.

A.3. Timeline and main features of ECB lines (announcements)

YEAR	DATE	COUNTRY	CB COUNTERPART	EUROFACILITY (Y/N)	TYPE	END DATE	MATURITY	MAX.AMOUNT
2001	13th September	USA	Federal Reserve	No	swap	13-Oct-2001	---	USD 50 bn
	12th December	USA	Federal Reserve	No	swap	---	28 and 35 days	USD 20 bn
2007	17th December	USA	Federal Reserve	Yes	repo	---	28 days	---
	20th December	SWE	Sveriges Riksbank	Yes	swap	---	4 months	EUR 10 bn
	10th January	USA	Federal Reserve	No	repo	---	28 days	USD 10 bn
	11th March	USA	Federal Reserve	No	swap (expansion)	---	28 days	USD 15 bn
	2nd May	USA	Federal Reserve	No	swap (expansion)	---	28 days	USD 25 bn
	18th September	USA	Federal Reserve	No	repo (expansion)	---	28 and 84 days	USD 40 bn
		USA	Federal Reserve	No	swap (expansion)	---	---	USD 40 bn
	26th September	USA	Federal Reserve	No	swap (expansion)	---	7 days	USD 30 bn
	29th September	USA	Federal Reserve	No	swap (expansion)	30-Apr-2009	---	USD 120 bn
	13th October	USA	Federal Reserve	No	swap (expansion)	31-Jan-2009	7, 28 and 84 days	---
2008	15th October	CHE	Swiss National Bank	No	swap	31-Jan-2009	7 days	CHF 25 bn
		USA	Federal Reserve	No	repo	---	7 days	---
	16th October	HUN	Magyar Nemzeti Bank	Yes	swap	---	---	EUR 5 bn
	27th October	DBK	Danmarks Nationalbank	Yes	swap	---	---	EUR 12 bn
	11th November	LVA	Latvijas Banka	Yes	repo	---	---	EUR 1 bn
	21st November	POL	Narodowy Bank Polski	Yes	repo	---	---	EUR 10 bn
	19th December	USA	Federal Reserve	No	repo	31-Mar-2009	7, 28 and 84 days	---
		USA		Yes	swap (discontinued)	---	---	---
	16th January	CHE	Swiss National Bank	No	swap (extension)	30-Apr-2009	7 days	---
	3rd February	USA	Federal Reserve	No	swap (extension)	30-Oct-2009	---	---
	19th March	USA	Federal Reserve	No	repo	1-Jun-2009	7, 28 and 84 days	---
	6th April	USA	Federal Reserve	Yes	swap	30-Oct-2009	---	EUR 80 bn
	10th June	SWE	Sveriges Riksbank	Yes	swap	---	3 months	EUR 3 bn
2009	25th June	USA	Federal Reserve	No	repo (extension)	30-Sep-2009	7 and 84 days	---
				No	swap (extension)	1-Feb-2010	---	---
		CHE	Swiss National Bank	No	swap (extension)	31-Oct-2009	7 days	---
		CHE	Swiss National Bank	No	swap (extension)	31-Jan-2010	7 days	---
	24th September	USA	Federal Reserve	No	repo (discontinued)	---	84 days	---
				No	repo (extension)	31-Jan-2010	7 days	---

Note: swap change refers to changes in the conditions such as pricing.
Sources: ECB Press Releases and internal sources.

YEAR	DATE	COUNTRY	CB COUNTERPART	EUROFACILITY (Y/N)	TYPE	END DATE	MATURITY	MAX.AMOUNT
2010	18th January	CHE	Swiss National Bank	Yes	swap (discontinued)	---	---	---
	27th January	USA	Federal Reserve	No	swap (discontinued)	---	---	---
	10th May	USA	Federal Reserve	No	swap	---	7 and 84 days	---
	17th December	GBR	Bank of England	No	swap	30-Sep-2011	---	GBP 10 bn
	21st December	USA	Federal Reserve	No	swap (extension)	1-Aug-2011	7 days	---
2011	29th June	USA	Federal Reserve	No	swap (extension)	1-Aug-2012	7 days	---
	25th August	GBR	Bank of England	No	swap (extension)	28-Sep-2012	7 days and 3 months	GBP 10 bn
	15th September	CHE	Swiss National Bank	No	repo	1-Mar-2012	3 months	---
		JAP	Bank of Japan	No	repo	1-Mar-2012	3 months	---
		GBR	Bank of England	No	repo	1-Mar-2012	3 months	---
		USA	Federal Reserve	No	repo	1-Mar-2012	3 months	---
	30th November	CHE	Swiss National Bank	Yes	swap	1-Feb-2013	7 days and 3 months	---
		USA	Federal Reserve	Yes	swap	1-Feb-2013	7 days and 3 months	---
		GBR	Bank of England	Yes	swap	1-Feb-2013	7 days and 3 months	---
		JAP	Bank of Japan	Yes	swap	1-Feb-2013	7 days and 3 months	---
		CAN	Bank of Canada	Yes	swap	1-Feb-2013	7 days and 3 months	---
		CHE	Swiss National Bank	No	swap (change)	1-Feb-2013	3 months	---
		JAP	Bank of Japan	No	swap (change)	1-Feb-2013	3 months	---
		GBR	Bank of England	No	swap (change)	1-Feb-2013	3 months	---
		CAN	Bank of Canada	No	swap (change)	1-Feb-2013	3 months	---
		USA	Federal Reserve	No	swap (change)	1-Feb-2013	3 months	---
2012	13th December	CHE	Swiss National Bank	Yes	swap (extension)	1-Feb-2014	7 days and 3 months	---
		USA.	Federal Reserve	Yes	swap (extension)	1-Feb-2014	7 days and 3 months	---
		JAP	Bank of Japan	Yes	swap (extension)	1-Feb-2014	7 days and 3 months	---
		GBR	Bank of England	Yes	swap (extension)	1-Feb-2014	7 days and 3 months	---
		CAN	Bank of Canada	Yes	swap (extension)	1-Feb-2014	7 days and 3 months	---
		CHE	Swiss National Bank	No	swap (extension)	1-Feb-2014	7 days and 3 months	---
		USA	Federal Reserve	No	swap (extension)	1-Feb-2014	7 days and 3 months	---
		JAP	Bank of Japan	No	swap (extension)	1-Feb-2014	7 days and 3 months	---
		GBR	Bank of England	No	swap (extension)	1-Feb-2014	7 days and 3 months	---
		CAN	Bank of Canada	No	swap (extension)	1-Feb-2014	7 days and 3 months	---

Note: swap change refers to changes in the conditions such as pricing.
Sources: ECB Press Releases and internal sources.

YEAR	DATE	COUNTRY	CB COUNTERPART	EUROFACILITY (Y/N)	TYPE	END DATE	MATURITY	MAX.AMOUNT
2013	10th October	CHN	People's Bank of China	No	swap	8-Oct-2016	---	CNY 350bn EUR 45bn
	31st October	CHE	Swiss National Bank	Yes	swap (extension)	---	7 days and 3 months	---
		USA	Federal Reserve	Yes	swap (extension)	---	7 days and 3 months	---
		JAP	Bank of Japan	Yes	swap (extension)	---	7 days and 3 months	---
		GBR	Bank of England	Yes	swap (extension)	---	7 days and 3 months	---
		CAN	Bank of Canada	Yes	swap (extension)	---	7 days and 3 months	---
		CHE	Swiss National Bank	No	swap (extension)	---	7 days and 3 months	---
		USA	Federal Reserve	No	swap (extension)	---	7 days and 3 months	---
		JAP	Bank of Japan	No	swap (extension)	---	7 days and 3 months	---
		GBR	Bank of England	No	swap (extension)	---	7 days and 3 months	---
		CAN	Bank of Canada	No	swap (extension)	---	7 days and 3 months	---
2016	27th September	CHN	People's Bank of China	No	swap (extension)	25-Oct-2019	---	CNY 350bn EUR 45bn
2019	5th March	GBR	Bank of England	Yes	swap	---	7 days	---
	25th October	CHN	People's Bank of China	No	swap (extension)	8-Oct-2022	---	CNY 350bn EUR 45bn
2020	15-Mar-2020	USA	Federal Reserve	No	swap (change)	---	7 days and 84 days	---
		CAN	Bank of Canada	No	swap (change)	---	7 days and 84 days	---
		CHE	Swiss National Bank	No	swap (change)	---	7 days and 84 days	---
	20-Mar-2020	USA	Federal Reserve	No	swap (change)	---	7 days and 84 days	---
		JAP	Bank of Japan	No	swap (change)	---	7 days and 84 days	---
		GBR	Bank of England	No	swap (change)	---	7 days and 84 days	---
		CAN	Bank of Canada	No	swap (change)	---	7 days and 84 days	---
	15-Apr-2020	DNK	Danmarks Nationalbank	Yes	swap	---	6 months	EUR 24 bn
	22-Apr-2020	HRV	Hrvatska Narodna Banka	Yes	swap	31-Dec-2020	3 months	EUR 2 bn
	5-Jun-2020	BGR	Bulgarian National Bank	Yes	swap	31-Dec-2020	3 months	EUR 2 bn
	17-Jul-2020	ROU	Banca Nationala a României	Yes	repo	31-Dec-2020	3 months	EUR 4.5 bn
		SRB	Narodna banka Srbije	Yes	repo	30-Jun-2021	3 months	EUR 1 bn
		ALB	Bank of Albania	Yes	repo	30-Jun-2021	3 months	EUR 0.4 bn
	23-Jul-2020	HUN	Magyar Nemzeti Bank	Yes	repo	30-Jun-2021	3 months	EUR 4 bn
	18-Aug-2020	MKD	Narodna Banka na Republika Severna Makedonija	Yes	repo	30-Jun-2021	3 months	EUR 0.4 bn
		SMR	Banca Centrale della Repubblica di San Marino	Yes	repo	30-Jun-2021	3 months	EUR 0.1 bn
	28-Aug-2020	ROU	Banca Nationala a României	Yes	repo (extension)	30-Jun-2021	3 months	EUR 4.5 bn
		HRV	Hrvatska Narodna Banka	Yes	swap (extension)	30-Jun-2021	3 months	EUR 2 bn

Note: swap change refers to changes in the conditions such as pricing.
Sources: ECB Press Releases and internal sources.

A.4. Additional Tables and Figures

Table 6: Summary Statistics

	Mean		SD		*N*	
Country	Basis	Residuals	Basis	Residuals	Basis	Residuals
AU	-.426	-.018	1.06	1.053	3120	3120
BG	.031	-.009	.787	.73	3120	3120
CA	-.29	-.011	.781	.759	3120	3120
CH	.042	-.002	.552	.543	3120	3120
DK	.123	.004	.452	.444	3120	3120
HR	-.334	.008	1.587	1.253	3120	2817
HU	.678	.012	1.353	1.229	3120	3120
IS	.385	-.107	3.865	2.711	3120	3120
JP	.072	-.005	.625	.622	3120	3120
KR	.863	.066	2.908	2.173	3120	3120
NO	-.185	.012	.798	.794	3120	3120
NZ	-.462	-.003	.97	.925	3120	2337
PL	-.005	.042	1.445	1.422	3120	3120
RS	-.061	.007	2.226	1.85	2397	2397
SE	-.126	-.011	1.473	1.469	3120	3120
SG	-.622	-.053	1.179	1.149	3120	3120
UK	-.15	.009	.46	.445	3120	3120
US	-.405	-.013	.883	.841	3120	3120
ALL	-.048	-.004	1.601	1.277	55437	54351

Unbalanced panel from 1st October 2008 to 15th September 2020.

Table 7: Summary Statistics

Variable	mean	sd	min	max	N
MP meetings	.0393	.194	0	1	55437
Δ Public debt ratio	.598	2.43	-13.52	21.96	55437
CAB	1.758	6.496	-22.1	24.08	55437
External debt ratio	884.6	1717	1.083	11759	54654
Rating	AA-	4	BB-	AAA	55437
Int. reserves	169.8	287.4	2.947	1351	55437
Inflation	1.783	1.954	-2.614	18.58	55437
VIX	19.66	10.12	9.14	82.69	55437
EU high yield	5.262	3.735	2.341	23.61	55437
Surprise index	-4.335	60.44	-304.6	212.4	55437
Sovereign yield	2.764	1.83	-1.108	15.01	55134
Stock exchange volatility	1.013	.714	.243	11.37	55437

Unbalanced panel from 1st October 2008 to 15th September 2020. CAB is the current account balance. International reserves is the level of Central Bank's international reserves in billions of USD. The external debt ratio is measured as a percentage of international reserves.

Table 8: Summary Statistics

	Mean			SD			*N*		
Country	Stock Price	ΔStock Price	ΔResid.	Stock Price	ΔStock Price	ΔResid.	Stock Price	ΔStock Price	ΔResiduals
AT	352.613	-.059	.044	78.417	7.119	8.942	3120	3120	3120
BE	344.007	-.088	.161	115.749	8.076	13.347	3120	3120	3120
DE	148.467	-.074	.032	60.205	3.473	4.344	3120	3120	3120
ES	229.294	-.087	-.041	64.697	4.991	5.098	3120	3120	2588
FI	89.685	-.004	-.003	18.169	1.264	1.474	2861	2860	2860
FR	424.948	-.08	-.041	102.076	8.726	10.891	3120	3120	3120
IR	196.079	-.622	.179	210.718	21.365	14.074	3120	3120	3009
IT	744.254	-.368	.1	270.251	18.551	30.016	3120	3120	2921
PT	33.691	-.041	.008	32.202	.998	.877	3120	3120	2113

Unbalanced panel from 1st October 2008 to 15th September 2020.

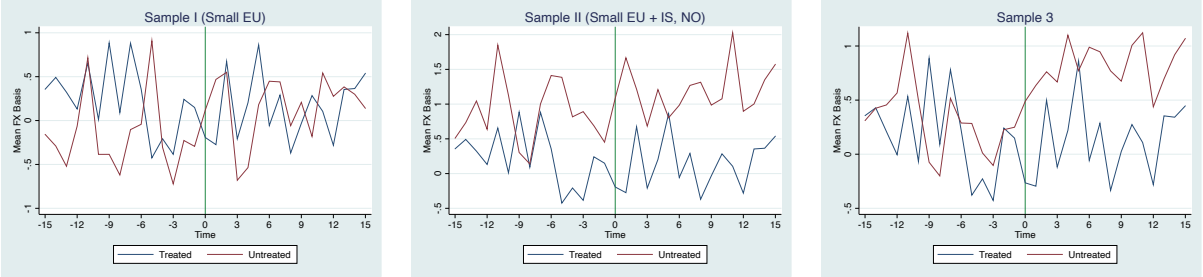
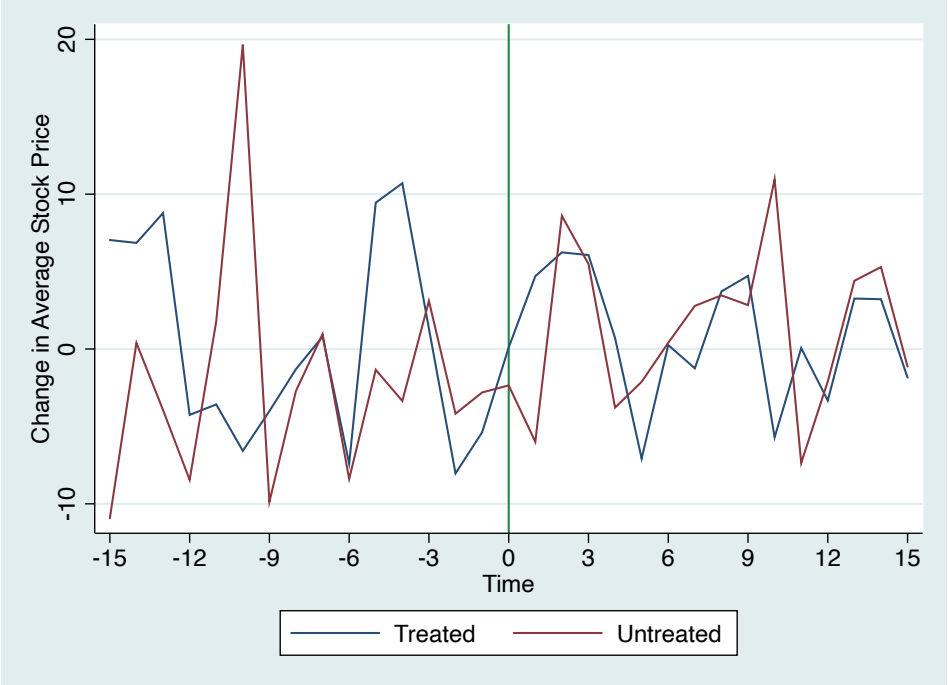


Figure 6: Basis in Levels: Averaged over Events 2008-2020

The figure shows the average evolution of the FX basis in the 30-day window around each announcement of an ECB liquidity line for the treated currencies versus non-treated. Each panel of the figure corresponds to a sample, as defined in Section 3. For any announcement, the treated currency/ies is/are going to be the one/s corresponding to the announcement, while the rest of the currencies in the sample are used as controls.

Figure 7: Pre-trends stock prices



The figure shows the average evolution of the residuals of average bank stock prices in the 30-day window around each announcement of an ECB liquidity line for the treated currencies versus non-treated. The residuals are obtained from regressing the average stock prices on the short term rate, net foreign assets, loan-to-deposit ratio and NEER deviations. Tables 9 indicates the treated and non-treated countries at each announcement considered.

Table 9: Banking exposure dummy by EA country and announcement, 75th percentile threshold

Announcement	AT	BE	DE	ES	FI	FR	IR	IT	PT
16oct2008	1	1	1	1	1	0	0	1	0
27oct2008	1	0	1	1	1	0	1	0	1
21nov2008	1	0	1	1	1	1	0	1	0
10jun2009	1	0	1	1	1	0	1	0	1
20mar2020	1	0	0	0	0	0	1	0	1
15apr2020	1	0	0	0	0	1	0	1	0
22apr2020	1	1	0	0	0	1	0	0	0
05jun2020	1	1	0	0	0	0	0	1	0
17jul2020	1	0	0	0	0	1	0	1	0
28aug2020	1	1	0	0	0	0	0	1	0

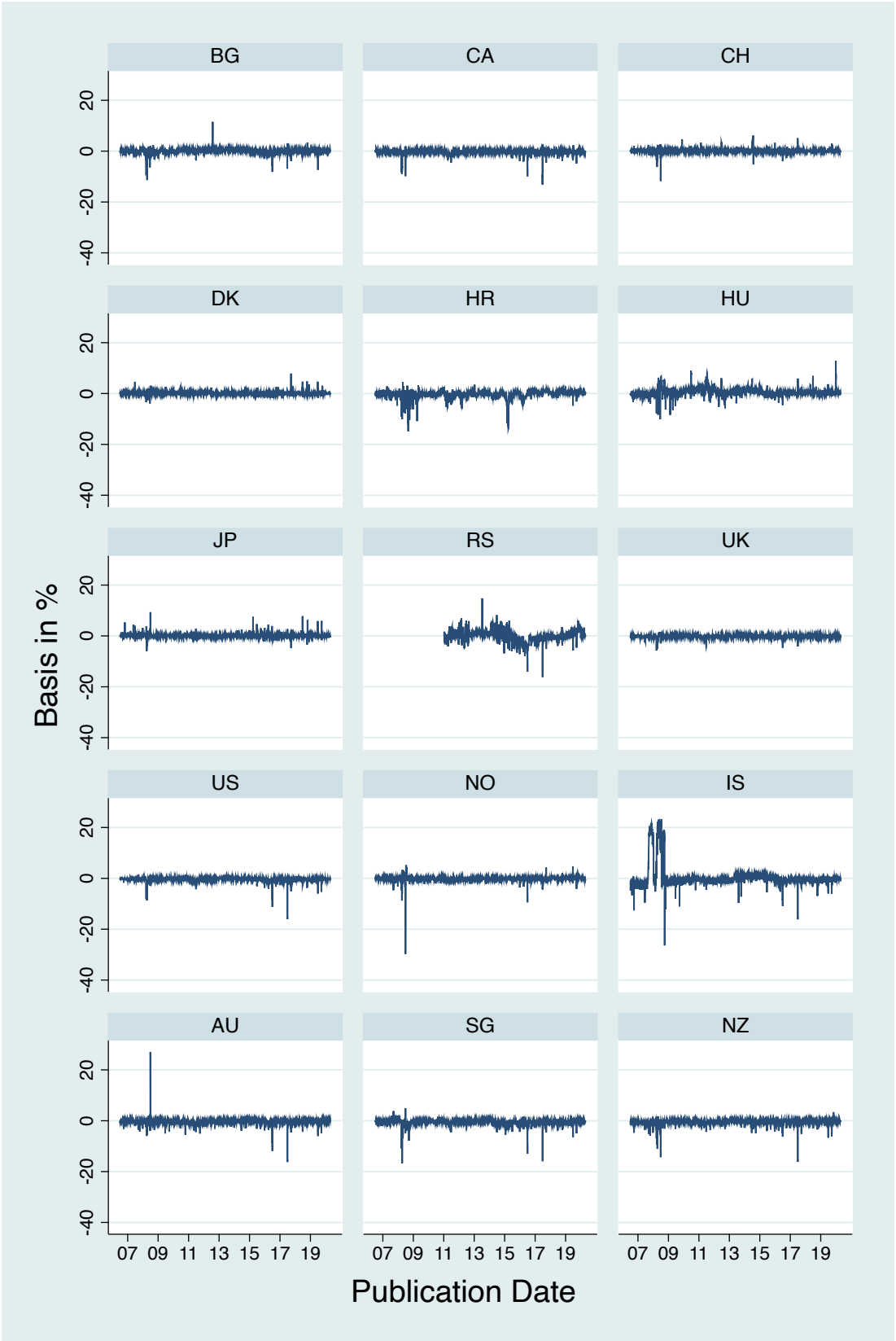
Exposure is defined as the percentage of the banking sector claims of EA country j on non-EA country i over total claims of domestic banks of EA country j globally. If the EA country exposure is higher or equal to the 75th percentile of the cross-country distribution at the announcement date, the exposure dummy takes a value equal to one and zero otherwise

Table 10: Banking exposure dummy by EA country and announcement, 65th percentile threshold

Announcement	AT	BE	DE	ES	FI	FR	IR	IT	PT
16oct2008	1	1	1	1	1	0	0	1	0
27oct2008	1	0	1	1	1	0	1	0	1
21nov2008	1	0	1	1	1	1	0	1	0
10jun2009	1	0	1	1	1	0	1	0	1
20mar2020	1	0	1	0	0	0	1	0	1
15apr2020	1	0	0	0	0	1	1	1	0
22apr2020	1	1	1	0	0	1	0	0	0
05jun2020	1	1	0	1	0	0	0	1	0
17jul2020	1	1	1	1	1	1	1	1	1
28aug2020	1	1	0	0	0	1	0	1	0

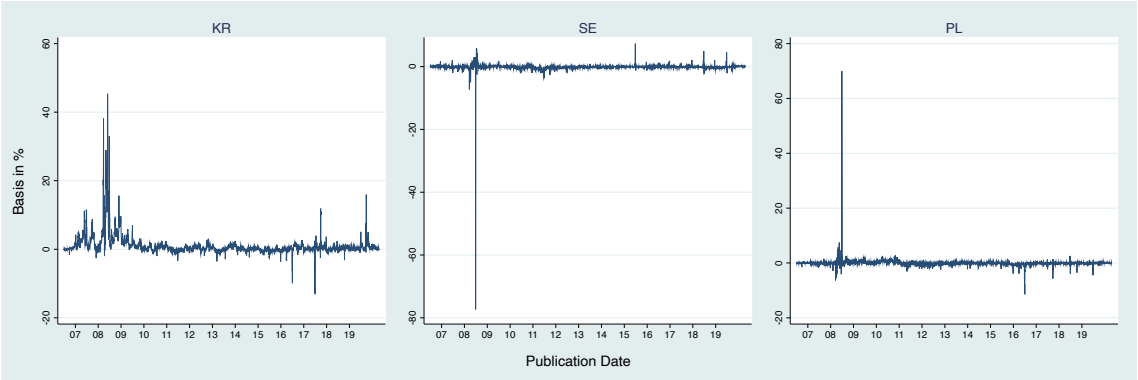
Exposure is defined as the percentage of the banking sector claims of EA country j on non-EA country i over total claims of domestic banks of EA country j globally. If the EA country exposure is higher or equal to the 65th percentile of the cross-country distribution at the announcement date, the exposure dummy takes a value equal to one and zero otherwise

Figure 8: Time Series of CIP Deviations by Country



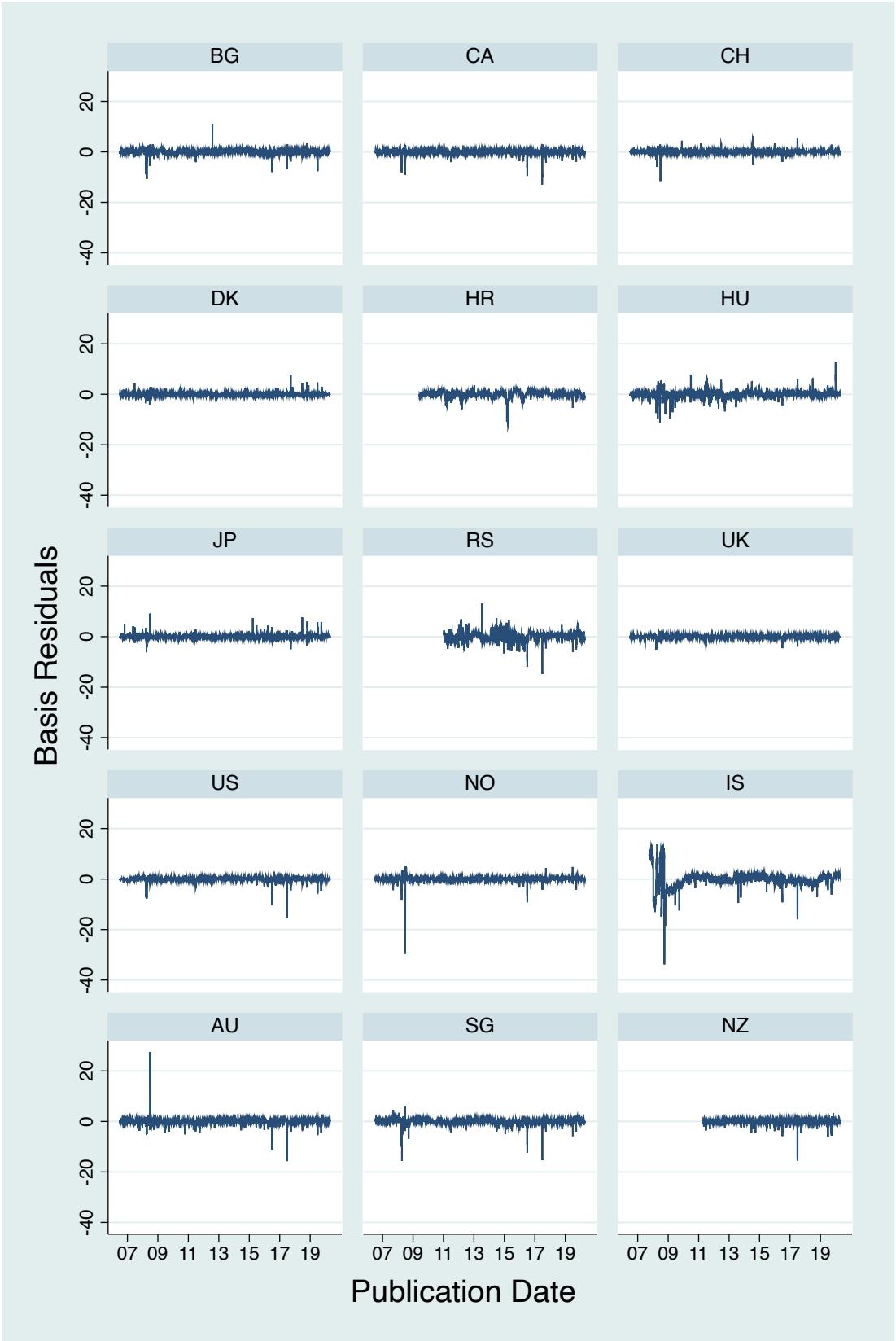
Evolution of the FX Basis over the sample period by country (Part II).

Figure 9: Time Series of CIP Deviations by Country



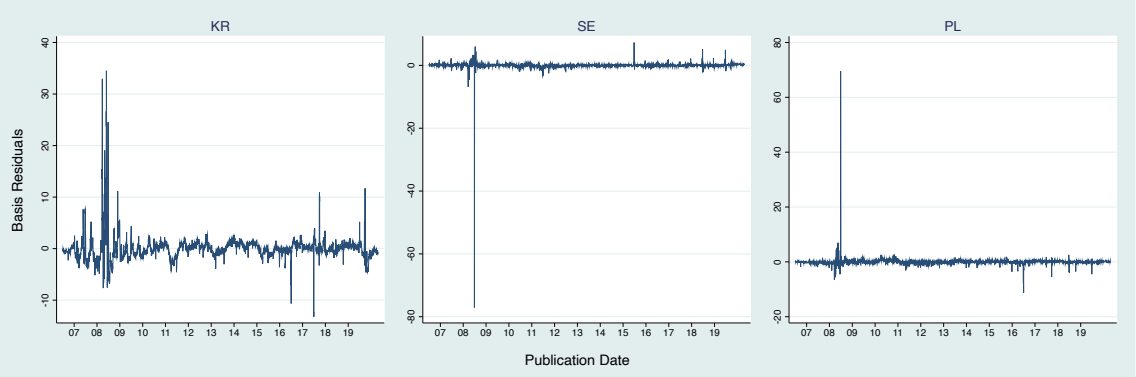
Evolution of the FX Basis over the sample period by country (Part I).

Figure 10: Time Series of Residuals of CIP Deviations by Country



Evolution of the residuals from country-by-country regressions of the FX basis on country-specific characteristics as explained in Section 3 (Part I).

Figure 11: Time Series of Residuals of CIP Deviations by Country



Evolution of the residuals from country-by-country regressions of the FX basis on country-specific characteristics as explained in Section 3 (Part II).

Table 11: Summary Statistics

	Mean				SD				*N*			
Country	Δ Public debt ratio	Int. reserves	External debt ratio	Rating	Δ Public debt ratio	Int. reserves	External debt ratio	Rating (notches)	Δ Public debt ratio	Int. reserves	External debt ratio	Rating
AU	1	44.51	695.258	AAA	1.69	6.98	75.061	0	3120	3120	3120	3120
BG	.17	20.26	63.872	BBB-	1.76	4.68	28.082	1	3120	3120	3120	3120
CA	1.16	72.62	666.178	AAA	3.55	12.75	93.163	0	3120	3120	3120	3120
CH	-.1	496.85	321.16	AAA	.43	247.53	354.413	0	3120	3120	3120	3120
DK	.33	73.14	307.385	AAA	1.19	12.86	91.121	0	3120	3120	3120	3120
HR	1.02	16.3	35.574	BB+	2.29	2.66	13.489	1	3120	3120	3120	3120
HU	.24	37.74	57.439	BBB-	2.84	8.75	8.805	1	3120	3120	3120	3120
IS	.03	5.45	692.366	BBB	5	1.48	640.632	2	3120	3120	3120	3120
JP	1.7	1191.85	190.474	AA-	1.94	93.71	33.812	1	3120	3120	3120	3120
KR	.33	339.45	39.477	A+	.53	53.59	10.795	1	3120	3120	3120	3120
NO	.04	59.59	414.353	AAA	2.94	7.79	70.751	0	3120	3120	3120	3120
NZ	.53	17.95	283.431	AA	1.86	2.49	99.84	0	3120	3120	2337	3120
PL	.17	98.33	49.486	A-	1.52	13.7	11.259	0	3120	3120	3120	3120
RS	.41	12.25	6.383	BB	1.57	1.52	4.575	1	2397	2397	2397	2397
SE	.05	50.68	657.092	AAA	.8	8.76	143.613	0	3120	3120	3120	3120
SG	1.15	250.1	515.254	AAA	2.71	35.83	31.244	0	3120	3120	3120	3120
UK	1.16	115.24	5785.816	AA+	2.3	30.59	2184.606	1	3120	3120	3120	3120
US	1.32	117.7	4788.249	AA+	2.79	17.94	997.977	0	3120	3120	3120	3120
ALL	.6	169.81	884.647	AA-	2.43	287.36	1716.936	4	55437	55437	54654	55437

Unbalanced panel from 1st October 2008 to 15th September 2020. International reserves is the level of Central Bank's international reserves in billions of USD. The external debt ratio is measured as a percentage of international reserves.

Table 12: Summary Statistics

	Mean				SD				*N*			
Country	CAB	Inflation	Sovereign yield	Stock exchange volatility	CAB	Inflation	Sovereign yield	Stock exchange volatility	CAB	Inflation	Sovereign yield	Stock exchange volatility
AU	-3	2.08	3.35	.93	1.671	.78	1.36	.54	3120	3120	3120	3120
BG	-1.04	1.91	2.52	.88	5.663	2.33	1.42	.6	3120	3120	3120	3120
CA	-2.76	1.56	2.13	.94	.714	.83	.77	.79	3120	3120	3120	3120
CH	9.17	-.03	.56	.98	2.542	.74	.92	.56	3120	3120	3120	3120
DK	7.01	1.22	1.4	.86	1.707	.89	1.28	.48	3120	3120	3120	3120
HR	-.59	1.2	4.45	.8	3.55	1.58	1.37	.73	3120	3120	2817	3120
HU	.86	2.73	4.63	1.32	2.355	1.97	1.4	.75	3120	3120	3120	3120
IS	.27	4.15	6.12	1.03	7.195	3.6	1.57	1.25	3120	3120	3120	3120
JP	2.65	.32	.54	1.33	1.174	1.13	.52	.69	3120	3120	3120	3120
KR	4.24	1.8	3.09	1.07	1.812	1.2	1.23	.64	3120	3120	3120	3120
NO	8.86	2.1	2.28	1.31	3.488	.91	.96	.85	3120	3120	3120	3120
NZ	-3.16	1.7	3.68	.64	1.137	1.11	1.39	.35	3120	3120	3120	3120
PL	-2.46	1.99	3.16	1.07	2.331	1.75	.95	.54	3120	3120	3120	3120
RS	-6.09	3.5	4.33	1.02	2.327	3.29	1.52	.6	2397	2397	2397	2397
SE	4.59	.98	1.48	1.13	1.38	1.06	1.13	.65	3120	3120	3120	3120
SG	17.62	1.55	2.11	.89	2.502	2.08	.46	.56	3120	3120	3120	3120
UK	-3.86	2.18	2.06	.99	1.054	1.24	1.05	.6	3120	3120	3120	3120
US	-2.47	1.56	2.4	1.05	.57	1.1	.7	.79	3120	3120	3120	3120
ALL	1.76	1.78	2.76	1.01	6.496	1.95	1.83	.71	55437	55437	55134	55437

Unbalanced panel from 1st October 2008 to 15th September 2020. CAB is the current account balance.

B Time Series Regression

This section presents the results of an event study using fixed effects estimates for Samples I, II and III of the following regression:

$$Res_{jt} = \alpha_j + \beta_1 post_{jt} + \boldsymbol{\beta X_{jt}} + \boldsymbol{\gamma W} + u_{jt} \tag{6}$$

where $post_{jt}$ is the main explanatory variable. It takes the value equal to one in the day of the announcement and in the following day for the treated country and zero otherwise, j indexes country, t time, $\boldsymbol{W}$ are monthly dummies and $\boldsymbol{X_{jt}}$ is a vector of controls. This equation is estimated using fixed effects and heterogeneous robust s.e., however results are robust to using Driscoll-Kraay standard errors.

For the reasons outlined in Section 3, DID is a more demanding method and thus it is not surprising that the effect in the estimates in the event study are slightly higher throughout the samples. Moreover the results are robust and the estimates even slightly higher when we include week × year dummies instead of monthly fixed effects.

Table 13: Event Study

	Sample I		Sample II		Sample III	
	(1) Residuals	(2) Residuals	(3) Residuals	(4) Residuals	(5) Residuals	(6) Residuals
post	-0.863**	-0.850**	-0.898**	-0.890**	-0.833**	-0.856**
	(0.029)	(0.035)	(0.013)	(0.014)	(0.030)	(0.027)
MP meetings	-0.0411	-0.0429	0.0117	0.00930	-0.00163	-0.00144
	(0.442)	(0.411)	(0.846)	(0.874)	(0.951)	(0.957)
EU high yield		-0.0152		-0.00920		0.0784*
		(0.726)		(0.763)		(0.096)
Surprise index		-0.000288		-0.000581		-0.000426
		(0.765)		(0.473)		(0.614)
Observations	11000	11000	14483	14483	29458	29458
R^2	0.047	0.047	0.075	0.075	0.059	0.059
MonthFE	yes	yes	yes	yes	yes	yes
CurrencyFE	yes	yes	yes	yes	yes	yes

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the output of the time series regressions. Post takes the value of 1 on the of the announcement and the day after for the currency targeted by the line in t, and zero otherwise. Sample composition is described in Section 3. The model includes a fixed effect for every month in the sample, as well as currency fixed effects.

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS

2010 ALFREDO GARCÍA-HIERNAUX, MARÍA T. GONZÁLEZ-PÉREZ and DAVID E. GUERRERO: Eurozone prices: a tale of convergence and divergence.

2011 ÁNGEL IVÁN MORENO BERNAL and CARLOS GONZÁLEZ PEDRAZ: Sentiment analysis of the Spanish Financial Stability Report. (There is a Spanish version of this edition with the same number).

2012 MARIAM CAMARERO, MARÍA DOLORES GADEA-RIVAS, ANA GÓMEZ-LOSCOS and CECILIO TAMARIT: External imbalances and recoveries.

2013 JESÚS FERNÁNDEZ-VILLAVERDE, SAMUEL HURTADO and GALO NUÑO: Financial frictions and the wealth distribution.

2014 RODRIGO BARBONE GONZALEZ, DMITRY KHAMETSHIN, JOSÉ-LUIS PEYDRÓ and ANDREA POLO: Hedger of last resort: evidence from Brazilian FX interventions, local credit, and global financial cycles.

2015 DANILO LEIVA-LEON, GABRIEL PEREZ-QUIROS and EYNO ROTS: Real-time weakness of the global economy: a first assessment of the coronavirus crisis.

2016 JAVIER ANDRÉS, ÓSCAR ARCE, JESÚS FERNÁNDEZ-VILLAVERDE and SAMUEL HURTADO: Deciphering the macroeconomic effects of internal devaluations in a monetary union.

2017 JACOPO TIMINI, NICOLA CORTINOVIS and FERNANDO LÓPEZ VICENTE: The heterogeneous effects of trade agreements with labor provisions.

2018 EDDIE GERBA and DANILO LEIVA-LEON: Macro-financial interactions in a changing world.

2019 JAIME MARTÍNEZ-MARTÍN and ELENA RUSTICELLI: Keeping track of global trade in real time.

2020 VICTORIA IVASHINA, LUC LAEVEN and ENRIQUE MORAL-BENITO: Loan types and the bank lending channel.

2021 SERGIO MAYORDOMO, NICOLA PAVANINI and EMANUELE TARANTINO: The impact of alternative forms of bank consolidation on credit supply and financial stability.

2022 ALEX ARMAND, PEDRO CARNEIRO, FEDERICO TAGLIATI and YIMING XIA: Can subsidized employment tackle long-term unemployment? Experimental evidence from North Macedonia.

2023 JACOPO TIMINI and FRANCESCA VIANI: A highway across the Atlantic? Trade and welfare effects of the EU-Mercosur agreement.

2024 CORINNA GHIRELLI, JAVIER J. PÉREZ and ALBERTO URTASUN: Economic policy uncertainty in Latin America: measurement using Spanish newspapers and economic spillovers.

2025 MAR DELGADO-TÉLLEZ, ESTHER GORDO, IVÁN KATARYNIUK and JAVIER J. PÉREZ: The decline in public investment: "social dominance" or too-rigid fiscal rules?

2026 ELVIRA PRADES-ILLANES and PATROCINIO TELLO-CASAS: Spanish regions in Global Value Chains: How important? How different?

2027 PABLO AGUILAR, CORINNA GHIRELLI, MATÍAS PACCE and ALBERTO URTASUN: Can news help measure economic sentiment? An application in COVID-19 times.

2028 EDUARDO GUTIÉRREZ, ENRIQUE MORAL-BENITO, DANIEL OTO-PERALÍAS and ROBERTO RAMOS: The spatial distribution of population in Spain: an anomaly in European perspective.

2029 PABLO BURRIEL, CRISTINA CHECHERITA-WESTPHAL, PASCAL JACQUINOT, MATTHIAS SCHÖN and NIKOLAI STÄHLER: Economic consequences of high public debt: evidence from three large scale DSGE models.

2030 BEATRIZ GONZÁLEZ: Macroeconomics, Firm Dynamics and IPOs.

2031 BRINDUSA ANGHEL, NÚRIA RODRÍGUEZ-PLANAS and ANNA SANZ-DE-GALDEANO: Gender Equality and the Math Gender Gap.

2032 ANDRÉS ALONSO and JOSÉ MANUEL CARBÓ: Machine learning in credit risk: measuring the dilemma between prediction and supervisory cost.

2033 PILAR GARCÍA-PEREA, AITOR LACUESTA and PAU ROLDAN-BLANCO: Raising Markups to Survive: Small Spanish Firms during the Great Recession.

2034 MÁXIMO CAMACHO, MATÍAS PACCE and GABRIEL PÉREZ-QUIRÓS: Spillover Effects in International Business Cycles.

2035 ÁNGEL IVÁN MORENO and TERESA CAMINERO: Application of text mining to the analysis of climate-related disclosures.

2036 EFFROSYNI ADAMOPOULOU and ERNESTO VILLANUEVA: Wage determination and the bite of collective contracts in Italy and Spain: evidence from the metal working industry.

2037 MIKEL BEDAYO, GABRIEL JIMÉNEZ, JOSÉ-LUIS PEYDRÓ and RAQUEL VEGAS: Screening and Loan Origination Time: Lending Standards, Loan Defaults and Bank Failures.

2038 BRINDUSA ANGHEL, PILAR CUADRADO and FEDERICO TAGLIATI: Why cognitive test scores of Spanish adults are so low? The role of schooling and socioeconomic background

2039 CHRISTOPH ALBERT, ANDREA CAGGESE and BEATRIZ GONZÁLEZ: The Short- and Long-run Employment Impact of COVID-19 through the Effects of Real and Financial Shocks on New Firms.

2040 GABRIEL JIMÉNEZ, DAVID MARTÍNEZ-MIERA and JOSÉ-LUIS PEYDRÓ: Who Truly Bears (Bank) Taxes? Evidence from Only Shifting Statutory Incidence.

2041 FELIX HOLUB, LAURA HOSPIDO and ULRICH J. WAGNER: Urban air pollution and sick leaves: evidence from social security data.

2042 NÉLIDA DÍAZ SOBRINO, CORINNA GHIRELLI, SAMUEL HURTADO, JAVIER J. PÉREZ and ALBERTO URTASUN: The narrative about the economy as a shadow forecast: an analysis using Banco de España quarterly reports.

2043 NEZIH GUNER, JAVIER LÓPEZ-SEGOVIA and ROBERTO RAMOS: Reforming the individual income tax in Spain.

2101 DARÍO SERRANO-PUENTE: Optimal progressivity of personal income tax: a general equilibrium evaluation for Spain.

2102 SANDRA GARCÍA-URIBE, HANNES MUELLER and CARLOS SANZ: Economic uncertainty and divisive politics: evidence from the *Dos Españas*.

2103 IVÁN KATARYNIUK, VÍCTOR MORA-BAJÉN and JAVIER J. PÉREZ: EMU deepening and sovereign debt spreads: using political space to achieve policy space.

2104 DARÍO SERRANO-PUENTE: Are we moving towards an energy-efficient low-carbon economy? An input-output LMDI decomposition of CO_2 emissions for Spain and the EU28.

2105 ANDRÉS ALONSO and JOSÉ MANUEL CARBÓ: Understanding the performance of machine learning models to predict credit default: a novel approach for supervisory evaluation.

2106 JAVIER ANDRÉS, ÓSCAR ARCE and PABLO BURRIEL: Market polarization and the Phillips curve.

2107 JUAN de LUCIO and JUAN S. MORA-SANGUINETTI: New dimensions of regulatory complexity and their economic cost. An analysis using text mining.

2108 DANILO LEIVA-LEON and LUIS UZEDA: Endogenous time variation in vector autoregressions.

2109 CORINNA GHIRELLI, ANDREA GONZÁLEZ, JOSÉ LUIS HERRERA and SAMUEL HURTADO: Weather, mobility and the evolution of the Covid-19 pandemic.

2110 KLODIANA ISTREFI, FLORENS ODENDAHL and GIULIA SESTIERI: Fed communication on financial stability concerns and monetary policy decisions: revelations from speeches.

2111 YUNUS AKSOY, HENRIQUE S. BASSO and CAROLYN ST AUBYN: Time Variation in Lifecycle Consumption and Income.

2112 JENNIFER PEÑA and ELVIRA PRADES: Price setting in Chile: micro evidence from consumer on-line prices during the social outbreak and Covid-19.

2113 NEZIH GUNER, YULIYA A. KULIKOVA and ARNAU VALLADARES-ESTEBAN: Does the added worker effect matter?

2114 RODOLFO G. CAMPOS and JACOPO TIMINI: Unequal trade, unequal gains: the heterogeneous impact of MERCOSUR.

2115 JAVIER QUINTANA: Import competition, regional divergence, and the rise of the skilled city.

2116 PATRICK MACNAMARA, MYROSLAV PIDKUYKO and RAFFAELE ROSSI: Marginal Tax Changes with Risky Investment.

2117 RODOLFO G. CAMPOS, JACOPO TIMINI and ELENA VIDAL: Structural gravity and trade agreements: does the measurement of domestic trade matter?

2118 ALESSANDRO MELCARNE, JUAN S. MORA-SANGUINETTI and ROK SPRUK: Democracy, technocracy and economic growth: evidence from 20 century Spain.

2119 ÁNGEL ESTRADA and DANIEL SANTABÁRBARA: Recycling carbon tax revenues in Spain. Environmental and economic assessment of selected green reforms.

2120 ALEJANDRO FERNÁNDEZ-CEREZO, BEATRIZ GONZÁLEZ, MARIO IZQUIERDO and ENRIQUE MORAL-BENITO: Firm-level heterogeneity in the impact of the COVID-19 pandemic.

2121 EDUARDO GUTIÉRREZ and CÉSAR MARTÍN MACHUCA: The effect of tariffs on Spanish goods exports.

2122 JACOPO TIMINI: Revisiting the 'Cobden-Chevalier network' trade and welfare effects.

2123 ALEJANDRO BUESA, JAVIER J. PÉREZ and DANIEL SANTABÁRBARA: Awareness of pandemics and the impact of COVID-19.

2124 ALICIA AGUILAR and DIEGO TORRES: The impact of COVID-19 on analysts' sentiment about the banking sector.

2125 SILVIA ALBRIZIO, IVÁN KATARYNIUK, LUIS MOLINA and JAN SCHÄFER: ECB euro liquidity lines.