

# Non-bank liquidity provision to firms: Fund runs and central bank interventions\*

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## Abstract

We study the determinants of the liquidity dry-up in the commercial paper market in March 2020 and the role of central bank interventions in reviving the market. We show that the dry-up was driven by money market funds (MMFs) - the key investors in the commercial paper market - that faced investor outflows. Using security-level fund holdings, we establish that the liquidity crisis in MMFs affected corporate funding: non-financial companies were less likely to issue commercial paper if their commercial paper was held by funds experiencing larger investor outflows. We show that the revival of the market was driven by the ECB's intervention in the European non-financial commercial paper market leading to better terms and conditions for eligible firms.

**Keywords:** Commercial paper; money market funds; central bank intervention; asset purchases; COVID-19

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\*The views expressed do not necessarily reflect those of the European Central Bank.

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# 1 Introduction

Covid-19 triggered substantial declines in corporate revenues, thus impeding corporate cash flows and generating a high demand for cash. Firms required access to cash in order to maintain their day-to-day operations, such as paying salaries. For large firms in the euro area, a significant proportion of these liquidity needs is traditionally met through the commercial paper market, with more than 80% (approximately 85 billion euros) of the euro area's short-term market debt being commercial paper. However, this market experienced a near total standstill during the Covid-19 crisis in March 2020.

In this paper, we (i) document the liquidity crunch experienced in European commercial paper markets in March 2020, (ii) demonstrate that the standstill was, at least partially, driven by distressed money market funds – the primary investors in European commercial paper, and (iii) find that the ECB's Pandemic Emergency Purchase Programme (PEPP) contributed significantly to the recovery of commercial paper markets.

Collectively, our findings first of all suggest that stress in the non-bank sector can spill over into the real economy, and that the composition of the investor base plays a critical role in firms' access to short-term market credit during downturns. Additionally, we show that central bank interventions in short-term credit market can help stabilizing these markets. Uncovering these mechanisms is vital, especially given the marked increase in non-bank financial intermediation in the euro area after the 2008-2009 financial crisis. In today's market, approximately half of the outstanding commercial paper is held by money market funds, and non-financial commercial paper constitutes roughly a third of total investments made by money market funds – a notably large share.

We begin by documenting the liquidity crunch in European commercial paper markets. In the final two weeks of March 2020, the weekly number of non-financial commercial paper issuances sharply fell from approximately 175 to 50 (Figure 2a). Correspondingly, the aggregate weekly volume issued plummeted from around 8 billion EUR to just below 2 billion EUR (Figure 2b). This contraction resulted in a 13% decrease in the total outstanding amount of non-financial euro area commercial paper (Figure 1) during this two-week period, as firms were no longer able to rollover their maturing short-term debt.

Having documented the freeze in commercial paper issuance, we next turn our attention to analyzing the mechanisms driving these events. Money market funds are the most significant buyers of non-financial commercial paper. In fact, at the close of 2019, almost 60% of all outstanding non-financial Euro area commercial paper was held by euro area money market funds. For comparison, the second largest group of investors were investment funds, which held a notably lower share of 13%.

During the COVID-19 crisis in March 2020, money market funds experienced large outflows due to the increased cash demand from fund investors. Combined with the dominant investor status of these funds in commercial paper markets this resulted in a reduced demand for non-financial commercial paper, subsequently putting pressure on firms reliant on these short-term markets for day-to-day liquidity needs.

To demonstrate that liquidity strains in money market funds had a direct impact on non-financial commercial paper issuance, we make use of the cross-sectional heterogeneity in fund outflows in March 2020 and detailed security-level information on fund holdings. Our main empirical specification compares the changes in outstanding commercial paper from the same issuer at multiple money market funds (i.e., following a Khwaja and Mian (2008) type of setup). In this way, we ensure that our results cannot be attributed to firm-specific shocks to the demand for short-term credit that likely surfaced during the initial weeks of the COVID-19 pandemic.

Our analysis shows that the dominant investor status of money market funds had a direct impact on commercial paper markets. Funds experiencing outflows reduced their exposure to the same firms more than other funds did. In other words, there was a direct spillover of the stress experienced by money market funds to the firms relying on these funds to buy their commercial paper. Additionally, firms were not able to switch to other buyers of commercial paper in order to satisfy their short-term demand for credit. It also implies that (short-term) debt markets are not frictionless, given that, during times of market stress, the composition of investors has a significant impact on a firm's access to commercial paper.

We subsequently examine whether the reduction in short-term credit supply by money market funds varies based on firm characteristics. When controlling for firms' demand for short-term credit, our findings indicate that the contraction in credit supply by money mar-

ket funds is less severe for larger firms and for firms that are less exposed to the COVID-19 crisis. This suggests a 'flight to safety' effect, where during times of financial stress, money market funds are more likely to continue their lending to larger, less crisis-exposed firms, thus maintaining a relative level of safety in their portfolios.

Next, we turn our attention to the recovery in commercial paper markets and analyze whether and how the ECB's asset purchases affected this recovery. Commercial paper issuances started to pick up again end of March and early April, after the start of the implementation of the ECB's Pandemic Emergency Purchase Programme (PEPP) on March 26. In contrast with previous purchase programmes, the maturity of the purchased corporate debt under PEPP can be below 365 days, allowing the ECB for the first time to buy commercial paper of eligible issuers.

We identify the impact of the PEPP by comparing the issuance behaviour of firms that issue eligible commercial paper to the behaviour of firms that issue non-eligible commercial paper in a difference-in-differences setup around the introduction of the PEPP. The key identifying assumption underlying our analysis is that, conditional on a host of control variables, non-eligible commercial paper provides a good counterfactual for the issuance characteristics (volume, maturity, and yields) of eligible paper in the absence of the PEPP.

The main threat to our identifying assumption is that the issuance behavior of eligible and non-eligible firms contain different time trends, which cannot be differenced out in a difference-in-differences setup. To limit this threat, we provide several pieces of evidence of parallel trends in issuance behaviour of both groups before the introduction of PEPP. Most importantly, we show that issuing volumes are on a similar downward trend for both the eligible and non-eligible sample during the first weeks of March (i.e., at the onset of the COVID-19 crisis). This indicates that any difference in issuance behaviour that we observe post-PEPP is unlikely to be caused by differential reactions to COVID-19, as this type of reaction should already be there during the first weeks of the pandemic as well.

First, we analyse actual amounts issued and the conditions of the commercial paper issuances before and after the introduction of the PEPP. We find that firms issuing eligible commercial paper increased outstanding amounts by around 20% over the first four weeks after the start of PEPP, compared to a decrease in outstanding amounts by 30% for firms

issuing non-eligible commercial paper, while both groups followed a similar trend in the pre-PEPP period. This indicates that the revival in commercial paper issuance in April 2020 was driven by the ECB's commercial paper purchases.

Second, we show that PEPP not only allowed eligible firms to issue more than non-eligible firms, but also led to better terms and conditions. We find that eligible firms substituted their maturing short-term commercial paper with longer-term commercial paper issuances, while the opposite is true for non-eligible firms. More specifically, after the start of commercial paper purchases by the ECB, eligible firms increased the maturity at issuance by around 70%, relative to non-eligible firms. At the same time, eligible firms managed to issue at a lower yield relative to non-eligible firms.

Overall, our paper indicates that the stark connection between money market funds and the issuer of commercial paper has adverse externalities in crisis times. We show that the rapid decline in commercial paper issuance was at least partly driven by distressed money market funds. Put differently, frictions in money market funds create segmentation in the commercial paper market, and thus affect the liquidity constraints that non-financial firms face. The central bank intervention with the PEPP alleviated these constraints and supported the recovery of commercial paper markets.

Our paper is related to several strands of literature. First, we contribute to the literature on commercial paper markets by providing evidence on the importance of money market funds for the functioning of commercial paper markets. Using detailed, security-level information on commercial paper holdings we show how liquidity shocks to money market funds can spill over to non-financial firms via commercial paper markets.

Earlier work shows that, for large firms, commercial paper constitutes an important part of firms' short-term funding instruments (Colla, Ippolito, and Li (2013)), that firms use commercial paper to provide start-up financing for capital investment (Kahl, Shivdasani, and Wang (2015)), and that firms systematically reduce their outstanding short-term debt on quarterly and annual disclosure dates (Klingler, Syrstad, and Vuillemeys (2021)). Most closely related to our work is Lugo (2021), who argues that demand by money market funds for commercial paper affects firms' use of short-term debt. We document strong ties between funds and firms through commercial paper holdings and study the direct spill over effects

from large outflows in money market funds to commercial paper issuers. We also document how central bank interventions in commercial paper markets can alleviate these spillover effects.

Second, our paper relates to a broader strand of papers investigating the behavior of money market, investment, and mutual funds during crisis times. For example, Kacperczyk and Schnabl (2013) document that money market funds suffer runs because of their risk taking and reduce their holdings of (financial) commercial paper radically in crisis times. More recently, several papers investigated how investment funds and in particular mutual funds fared during the COVID-19 crisis (e.g., Breckenfelder and Hoerova (2021), Falato, Goldstein, and Hortaçsu (2021), Haddad, Moreira, and Muir (2020), Jiang et al. (forthcoming), Ma, Xiao, and Zeng (2020) and Pastor and Vorsatz (2020)). Most closely related to our paper is Falato, Goldstein, and Hortaçsu (2021), who document major outflows from corporate bond funds in the US during the COVID-19 crisis and show that corporate funds holding bonds that were bought by the Federal Reserve recovered more quickly. Also related is Zhu (2021). He focusses on bond holdings of mutual funds over the business cycle, documents that holder of a firm's existing bonds are more likely to invest in additional new issuances from the same firm, and shows that strong bondholder flows predict a higher probability that a firm will issue new bonds. In contrast, our focus lies on money market funds, commercial paper markets and the ECBs PEPP programme. Additionally, we provide a security-level analysis on the impact of fund outflows on commercial paper issuances, and their terms and conditions.

Third, our paper contributes to a nascent literature on the impact of central bank purchases in commercial paper markets. While the ECB did not focus on commercial paper before the March 2020 crisis, the Federal Reserve intervened successfully in the commercial paper market already during the financial crisis between 2008 and 2010 via a Commercial Paper Funding Facility (CPFF). Adrian, Marchioni, and Kimbrough (2011) provide a detailed overview of the operational details of the CPFF and documents its usage and effectiveness. In March 2020, the Federal Reserve re-introduced the CPFF. Boyarchenko, Crump, and Kovner (2020) document that the 2020 CPFF supported market functioning and provided a liquidity backstop for the commercial paper market. We are the first to focus on the impact of the ECB's purchases in commercial paper markets.

More broadly, our paper also relates to the literature on central bank interventions in corporate bond markets. For example, several papers show that the ECB's Corporate Sector Purchase Program (CSPP) from 2016 increased bond issuance but reduced the demand for bank loans by bond issuers (Arce, Mayordomo, and Gimeno (2021), Grosse-Rueschkamp, Streitz, and Steffen (2019) and Todorov (2020)). As a result, banks increase their lending to other (smaller) corporations (Ertan, Kleymenova, and Tuijn (2020)). We differ from these papers by focussing on commercial paper, an asset class that has received limited attention in this context.

The remainder of the paper is organized as follows. In Section 2, we provide institutional details on the European commercial paper market and the Pandemic Emergency Purchase Program. In Section 3, we describe the data we use. In Section 3, we outline our empirical strategy. In Section 5, we present the results. Section 6 concludes.

## **2 Institutional background**

This Section gives first an overview over the commercial paper market in Europe and how commercial paper was affected by the March 2020 crisis. Second, we review the goals of the ECB's intervention in the commercial paper market. We end with a summary of the timeline of key ECB policy interventions in March 2020.

### **2.1 Commercial paper markets in Europe**

Non-financial corporations have become more active in the commercial paper market in recent years to manage their short-term cash needs. The upper panel of Figure 3 depicts the evolution of the importance of the commercial paper market for euro area firms between the first quarter of 2017 and the third quarter of 2020. At the end of 2019, commercial paper accounted for more than more than 80% (approximately 85 billion euros) of outstanding market-based short-term debt, or about 5% of total outstanding market-based debt issued by euro area non-financial corporations.

The lower panel of Figure 3 illustrates the importance of money market funds for euro-denominated commercial paper markets. Between 2017 and the end of 2019, money market

funds held 45 to 50 % of total outstanding commercial paper. This dropped to below 35 % in the second quarter of 2020.

## **2.2 Pandemic Emergency Purchase Programme (PEPP)**

The World Health Organization declared the COVID-19 outbreak as a public health emergency of international concern on January 31, 2020, and as a global pandemic in the second week of March. Simultaneously, the associated financial market turmoil also reached the commercial paper market.

The March 2020 liquidity crisis prompted the ECB to intervene in the non-financial commercial paper market. The goals were three-fold (de Guindos and Schnabel (2020)): (i) ensuring monetary policy transmission through commercial paper to firms through easing the financing conditions for short-term liquidity needs of non-financial companies, (ii) restoring demand for commercial paper by private sector counterparties, and (iii) incentivising firms to issue commercial paper, thereby reducing their dependence on bank-based finance. The idea was that non-financial corporations would expand their short-term market-based borrowing as banks were reluctant to lend. More market-based funding by some firms would also free up lending capacities of banks that would benefit other firms with for which banks play a more important role.

The intervention in the commercial paper market was significant: During the first two months of the programme, net purchases of commercial paper under PEPP amounted to approx. 35 billion euro, of which 81 % was bought on primary markets. For comparison, net purchases of corporate bonds over that same period were less than one third of this amount (10.5 billion euro), which illustrates the importance of the commercial paper purchases for the corporate sector part of PEPP in the initial phase of the crisis.<sup>1</sup>

Regarding the purchases of private sector securities, an important difference with the existing corporate sector purchase programme (CSPP) was the inclusion of non-financial commercial paper in the PEPP. Commercial paper must adhere to several requirements to be eligible for purchase under the PEPP. Commercial paper eligible for purchase under the CSPP should be accepted as collateral for ECB's liquidity-provision operations. Eligible

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<sup>1</sup>Purchases of public bonds over that period amounted to 186.6 billion euro



paper must be issued in euro and their credit rating must be investment grade. Additionally, the issuer must be established in the euro area and the issuer, or its parent may not be a credit institution.

The eligibility criteria for commercial paper purchases by the Eurosystem are similar to those of other securities: a security needs to: a) be investment grade (i.e. have a minimum credit assessment of at least BBB-); b) be issued by a private or public sector entity residing in the euro area; c) be denominated in EUR; d) have a yield greater than the deposit facility rate (DFR); e) have a maximum residual maturity of 30 years and 264 days and a minimum residual maturity of 28 days; and f) the issuer cannot be a credit institutions, the issuer does not have any parent undertaking, which is a credit institution, and/or the issuer is not an asset management vehicle or national asset management and divestment fund established to support financial sector restructuring or resolution. In the case of commercial paper, however, many issuers of commercial paper did not fulfil the requirements because their paperwork was not in-line with the requirements, at the beginning of the purchases. That some issuers were with incomplete paperwork did not reflect a difference in the riskiness of the issuer but was due to non-standardized formalities/issuance procedures. This difference is helpful for our identification strategy when comparing eligible vs non-eligible issuers.

The timeline of ECB interventions to counter the escalating financial market tensions looked as follows: On March 12, the ECB announced the expansion of the existing Asset Purchase Programme (APP). On March 18, the ECB announced the Pandemic Emergency Purchase Programme (PEPP), with an initial envelope of 750 billion EUR envelope (extension by an additional 600 billion EUR on June 4). A key difference of PEPP from the existing APP was that purchases were conducted in a flexible manner, which allows for fluctuations in the distribution of purchase flows over time, across asset classes and among jurisdictions. On March 25, the legal documentation of the PEPP was published. First purchases were conducted on March 26, 2020.

### 3 Data and sample construction

The goal of our analysis is to understand whether and how stress in money market funds spilled over to commercial paper markets, and which role the ECB’s Pandemic Purchase Programme (PEPP) played in the recovery of commercial paper markets. To do so, we combine data on commercial paper issuances, fund flows, fund holdings of commercial paper and firm balance sheet and P&L info.

We start by selecting all euro area non-financial firms that have euro-denominated commercial paper outstanding between January 1, 2020 and May 31, 2020. We extract this information from the ECB’s Centralised Securities Database (CSDB). The CSDB is a security-by-security level Eurosystem database that contains data on instruments and issuers including issuance volume, maturity and issuance date, security type (e.g., zero coupon), currency, ratings, and issuer information (location, issuer organization).

Next, we match these issuances with the commercial paper held by money market funds. We collect fund holdings data from the Thomson Reuter Lipper Database. We retrieve fund-level data on outflows, performance, and ISIN-level portfolio holdings. Fund flow information, total net assets (TNA) and trading prices, are available at daily frequency. ISIN-level fund holdings information is available at monthly frequency. We observe the portfolio holdings at market valuation and as shares of the fund’s total holding. Lipper sources the portfolio holdings directly from the fund management companies. Unavailable fund holdings are typically linked to non-disclosure agreements and embargo periods. We compute daily net fund flows variable as is standard in the literature (see, e.g., Falato, Goldstein, and Hortaçsu (2021), for a recent example):

$$flows_{i,t} = (TNA_{i,t} - (1 + r_{i,t}) * TNA_{i,t-1}) / TNA_{i,t-1}, \quad (1)$$

where  $TNA_{i,t}$  is total net assets of fund  $i$  at day  $t$  and  $r_{i,t}$  is the fund’s daily return. We analyze flows on a fund-share level.

For each money market fund, we calculate the net fund flow between February 28, 2020, and March 31, 2020. Additionally, we calculate a weighted fund flow at the firm level, using the share of outstanding commercial paper of a firm that is held by a money market fund

on February 28, 2020 as weights. In other words, for each firm  $f$ , the firm-level fund flow captures the fund flow between end of February and end of March of all funds that were holding firm  $f$ 's commercial paper at the end of February.

Next, we collect information on each firms' outstanding euro-denominated commercial paper at the end of February 2020, and its issuances between February 28, 2020, and May 31, 2020. This information is extracted from the CSDB database. For each isin-level issuance, we collect information on the volume issued, issue date, maturity, and interest rate. We further enrich the CSDB data information on whether the issuance appears in the list of assets that are eligible to us as collateral in transactions with the ECB<sup>2</sup>. Euro-denominated commercial paper issued by non-financial firms established in the euro area that can be used as collateral in transactions with the ECB is in principle eligible for PEPP. Finally, we download firm-specific balance sheet and P&L information from Bureau van Dijk's Orbis database. For each firm, we collect information on its total assets, leverage, and cash holdings for the accounting year 2019.

Summary statistics on all isin-level variables can be found in panel A of Table 1. Panel B of that table includes summary statistics on all firm-level variables used in our analysis.

## 4 Empirical setup

To address whether outflows from money market funds affected commercial paper issuances during March 2020, we run the following regression specification:

$$\text{Log}(\text{amountoutstanding})_{i,f,t} = \alpha + \beta \times \text{NegativeFundflow}_i \times \text{Post}_t + \delta_{f,t} + \gamma_i + \varepsilon_f, \quad (2)$$

The regressions includes data from two points in time:  $t$  is either February 28, 2020 or March 31, 2020.  $\text{Log}(\text{amount outstanding})_{i,f,t}$  is the outstanding amount of commercial paper of firm  $f$  held by fund  $i$  at time  $t$ .  $\text{Negative Fundflow}_i$  is a dummy equal to one if the fund flow for fund  $i$  was negative between February 28, 2020 and March 31, 2020.  $\delta_{f,t}$  denotes a firm-time fixed effect,  $\gamma_i$  represents a fund fixed effect.

<sup>2</sup>see <https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html>

This setup with firm-time fixed effects allows us to analyze how differences in fund flows between funds affect their commercial paper holdings of the exact same firm. In this way, we ensure that our estimates of  $\beta$  are not affected by firm-specific demand for short-term credit. In additional tests, we also interact the *Negative Fundflow<sub>i</sub>* dummy with firm-specific characteristics to analyse the heterogeneous impact of fund flows across firms.

Next, we study whether being exposed to funds with negative flows also implies a reduction in outstanding commercial paper at the firm-level (as opposed to at the firm-fund level in equation 2). In this way, we can track whether firms exposed to a negative shock from one or more funds could still find alternative buyers for their commercial paper (e.g. funds that did not experience a negative shock or other investors such as banks, insurance companies etc.). For each firm  $f$  the firm-level fund flow captures the weighted fund flow between end of February and end of March of all funds that were holding firm  $f$ 's commercial paper at the end of February. We then run the following specification at the firm-level:

$$Y_f = \alpha + \beta \times \text{NegativeFundflow}_f + \delta \times X_f + \varepsilon_f, \quad (3)$$

where  $Y_f$  is an outcome variable reflecting either a dummy variable equal to one if a firm managed to fully rollover all commercial paper maturing between February 28, 2020, and March 31, 2020, or the growth in outstanding commercial paper over the same time period. *Negative Fundflow<sub>f</sub>* is a weighted average of the fund flow over the same period of all funds that were holding firm  $f$ 's commercial paper at the end of January 2020 (see section 3).  $X_f$  denotes a set of firm-level control variables, including the logarithm of a firm's total assets, its leverage ratio, and its return on assets, all for the accounting year 2019. In our most stringent specification, we also include fixed effects that control for how severely a firm's sector was exposed to the Covid-19 crisis. To do so, we group sectors in 5 buckets: (i) essential and fully active sectors, (ii) active but teleworking sectors, (iii) partly essential and partly active, (iv) non-essential and partly active, and (v) closed. The classification is based on Fana et al. (2020).

The next question we address is whether the ECB's Pandemic Purchase Programme (PEPP) affected the recovery of commercial paper markets that took place from April 2020

onwards.<sup>3</sup> To do so, we use a difference-in-differences framework in which we compare the issuance of eligible and non-eligible commercial paper before and after the introduction of the PEPP. As described in section 2, commercial paper must meet several criteria to be eligible for purchase by the ECB under the PEPP. Comparing the issuance of these eligible bonds with the issuance of non-eligible bonds should thus give us an estimate of the impact of the PEPP. As such, we estimate the following baseline specification:

$$Y_{i,t,f} = \alpha + \beta \times Post_t \times Eligible_{i,t,f} + \delta \times Post_t + \gamma_f + \varepsilon_{i,t,f}, \quad (4)$$

where  $Y_{i,t,f}$  is an outcome variable reflecting either the logarithm of the volume of commercial paper issued via security  $i$  (isin-level) by firm  $f$  at day  $t$ , the log of the maturity of that issuance or the yield of that issuance.  $Eligible_{i,t,f}$  is a dummy equal to one if the commercial paper is eligible under the PEPP programme,  $post_t$  is a dummy equal to one from March 26, 2020, onwards, and  $\gamma$  is a firm fixed effect. In the most conservative setup, we replace the post dummy with a week fixed effect. To limit the influence of confounding events, we use a relatively short window of 4 weeks before and 4 weeks after the implementation date of the PEPP (March 26, 2020). Standard errors are clustered at the firm level.

The key identifying assumption underlying our analysis is that, conditional on firm and time fixed effects, non-eligible commercial paper provides a good counterfactual for the issuance characteristics (volume, maturity, and yields) of eligible paper in the absence of the PEPP. In that case, the estimate of  $\beta$  in regression 4 gives the causal impact of the PEPP on commercial paper characteristics.

The main threat to this assumption is that the issuance behavior of eligible and non-eligible firms contain different time trends, which cannot be differenced out in a difference-in-differences setup. Figures 5 and 6 indicate that this is unlikely to be the case: for both the eligible and non-eligible sample, the volume of outstanding commercial paper (Figure 5) and accordingly the volume of weekly issuances (Figure 6) evolve in a very similar way before the introduction of the PEPP. Importantly, this also holds in the first weeks of March, when issuance volumes start to deteriorate. The fact that volumes are on a similar down-

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<sup>3</sup>see, e.g., Figure 1, which shows a strong recovery of the amount of outstanding commercial paper from April 2020 onwards.

ward trend for both the eligible and non-eligible sample indicates that any differences in issuance behaviour that we observe post-PEPP are unlikely to be caused by differential reactions to COVID-19, as this type of reaction should already be there during the first weeks of the pandemic as well.

## 5 Results

Following several lock downs across Europe in early March 2020, conditions in commercial paper markets in Europe started to deteriorate from mid-March onwards. While the total amount of outstanding commercial paper for non-financial companies had been growing steadily since the start of the year, it dropped by more than 13% between March 16 and March 26 (Figure 1), as firms could no longer rollover their maturing short-term debt.

The number of non-financial companies able to issue commercial paper dropped even more strongly over that same period. In the week of March 9 to 13, 88 firms issued commercial paper. This dropped to only 38 firms in the last week of March, or a reduction of almost 60%. Unsurprisingly, the number of issuances dropped from around 175 a week in early March to around 50 in the last week of March (Figure 2a). Correspondingly, total weekly issuance volumes dropped from more than 8 billion EUR to below 2 billion EUR (Figure 2b).

After the introduction of the ECBs Pandemic Emergency Purchase Programme (PEPP), issuance volumes rebounded from April onwards. By the end of April, the number of weekly issuances hovered around 150, while the aggregate weekly issuance volumes were back above 8 billion EUR.

In what follows, we analyze what is driving the sharp decrease in commercial paper issuances, and whether and how the PEPP affected the recovery. Our results indicate that severe stress in money market funds spilled over to the commercial paper market, driving the liquidity dry-up in this market. PEPP helped in alleviating these liquidity issues in commercial paper markets by buying non-financial commercial paper.

## 5.1 Fund flows and commercial paper issuances

In this section, we relate the drop in commercial paper issuance in March 2020 (as documented in Figure 2a and 2b) to outflows experienced by money market funds during that same period.

Money market funds were pivotal for the liquidity dry-up in commercial paper markets for at least two reasons. First, money market funds are key investors in European commercial paper. For example, European money market funds were holding almost 60% of all outstanding, euro-denominated non-financial commercial paper at the end of 2019. For comparison, the second largest holding sector was the investment fund sector at that point in time, but with a significantly lower holding share of 13%.

Second, European money market funds experienced severe stress at the start of the COVID-19 crisis, suffering large outflows during the second half of March 2020. Figure 4 documents aggregate net fund flows between the end of January 2020 and the end of June 2020, relative to January 30. While money market funds initially experienced an inflow in February and early March 2020, they faced an aggregate outflow of around 4% by the end of March.<sup>4</sup>

The outflows from money market funds (i.e., a reduction in their liabilities) must be matched by a reduction on the asset side of the fund. Funds can either reduce their cash buffers, sell securities, or stop rolling over maturing securities. If funds choose the latter option this could potentially lead to liquidity problems for firms, given the fact that commercial paper by construction tends to be very short-term paper, and thus must be rolled over frequently. Additionally, Zhu (2021) shows that (mutual) funds that hold a firm's existing bonds have a high propensity to acquire additional new issuances from the same firm, indicating that it might be difficult for commercial paper issuers to switch to new investors (especially during crisis periods).

Table 2 directly links the outflows from money market funds to the issuance of commercial paper. It shows the regression results for specification 2. The dependent variable is the logarithm of the amount of commercial paper issued by a firm  $f$  that is being held by fund

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<sup>4</sup>The inflow in February and early March is likely due to investors switching from (long-term) investment funds to more liquid money market funds. See e.g., Breckenfelder and Hoerova (2021) for more on outflow in investment fund around the COVID-19 crisis.

$i$ , either at February 28, 2020 or at March 31, 2020. The explanatory variable of interest is the interaction between *Negative flow*, a dummy equal to one if the fund flow for fund  $i$  was negative between February 28, 2020 and March 31, 2020, and the *Post* dummy, which is equal to one for all March 31 observations.

The point estimate for the coefficient on the interaction term of -0.227 in column 1 of Table 2 implies that funds facing outflows in March 2020 reduced their commercial paper exposure to the average firm with 22.7 % between the end of February and the end of March. In column 2, we add firm-time fixed effects to the specification. This ensures that our main coefficient is not affected by firm-level changes in the demand for commercial paper over time. Effectively, we are comparing the holdings of two or more funds of the commercial paper of the same firm, and analyze how these holdings evolve between February 28 and March 31, 2020. The point estimate on the interaction term is now -0.16, and still statistically and economically significant. Finally, in column 3 we also include fund fixed effects, to control of any fund-specific characteristics that could affect their commercial paper holdings. The estimates for this specification imply that funds reduced their commercial paper exposure to the average firm with around 13%. Overall, the analysis in Table 2 points at strong spillovers from outflows in money market funds to issuance behaviour of non-financial firms.

Next, we examine whether this reduction in short-term credit supply of funds to firms is stronger for some firm types than for others. We keep using a setup with firm-time fixed effects to control for the impact of demand for short-term credit. To capture heterogeneity across firms, we interact our *Negative flow* and *Post* dummy with a set of firm characteristics. In particular, we analyse interactions with firm size (measured by total assets), leverage, profitability (measured by return on assets), financial risk (measured by interest coverage ratio). For all these characteristics, we create a dummy variable equal to one when the firm is the highest tercile of the distribution of that characteristic. Additionally, we also create a dummy variable capturing whether the firm operates in a industry that was hit hard by the Covid-19 crisis.<sup>5</sup>

The results in table 3 indicate that the reduction in commercial paper held by funds hit

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<sup>5</sup>We use the classification from Fana et al. (2020) and define a Covid sector in case a sector is defined as non-essential and with many closures (category 5 of the classification) such as hotels, restaurants, etc.



by an outflow is significantly higher for firms that were particularly exposed to the Covid-19 crisis and for small firms. While firms with a low Covid-exposure experience a relative reduction in commercial paper held by funds that face an outflow of -8.5%, this further drops to close to 24% for firms heavily exposed to Covid (column 1 of Table 3). Similarly, we don't find a significant relative reduction in funds' holdings of large firms, while funds faced by outflows do reduce their exposure to the average small firm with around 20%. Other firm-specific characteristics are not taken into account by money market funds when reducing their commercial paper exposures in March 2020. The stronger reduction in exposure to small and covid-hit firms suggests a flight-to-safety of the money market funds.

The next question that arises is whether firms that experience a reduction in demand for their short term debt by their go-to funds can compensate this by selling their debt to other funds or other investors. To test this, we analyse the changes in outstanding commercial paper at the firm level (as opposed to at the firm-fund level in the above analysis). Table 4 shows the result for estimating equation 3. In the first three columns of this table, we regress a rollover dummy on a firm-level *Negative flow* dummy. The former is equal to one if a firm is able to rollover its maturing commercial paper between February 29, 2020 and March 31, 2020. The *Negative flow* dummy is equal to 1 if the average weighted net fund flows of all funds that hold commercial paper of a firm on February 28, 2020 was negative between February 28 and March 31, 2020.

Column 1 of Table 4 shows that firms borrowing from funds facing a negative flow are 30 percent less likely to rollover their outstanding commercial paper in March 2020. Adding a number of firm-level control variables and either covid-sector (column 2) or covid-sector-country fixed effects (column 3) do not materially change this result, as we still get a rollover probability that is 28 percent lower for firms exposed to funds that face outflows.<sup>6</sup> Similarly, columns 4 to 6 show that the results also hold when using the firm-level growth in outstanding commercial paper as dependent variable. The growth rate for firms borrowing from funds that face outflows has growth rates that are between 38 and 50 percent lower than other firms.

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<sup>6</sup>The covidsector fixed effect groups sectors in 5 buckets: (i) essential and fully active sectors, (ii) active but teleworking sectors, (iii) partly essential and partly active, (iv) non-essential and partly active, and (v) closed.

## 5.2 PEPP and commercial paper issuances

The Pandemic Emergency Purchase Programme was announced by the ECB on the evening of March 18, 2020, and launched on March 26, 2020. Part of the programme was aimed at commercial paper markets, allowing the ECB to buy commercial paper of non-financial companies.

Figure 1 shows that a few days after the implementation of the programme, commercial paper issuance by non-financial firms rebounded, leading to a gradual increase in the total amount of outstanding commercial paper. By end of April, outstanding commercial paper volumes were again at the level of mid-March. This is a first indication that PEPP revived the commercial paper market.

To analyze whether this rebound in commercial paper issuance was effectively driven by the ECB's purchase programme, we make use of the fact that the ECB was only allowed to buy eligible commercial paper. Commercial paper is eligible when it fulfils several criteria, such as being issued in euro, being of high credit quality and not being issued by a financial institution. If the rebound in commercial paper markets is driven by PEPP purchases, we would expect to see a particularly strong increase in the issuance of eligible paper.

Figure 5 compares the evolution of the outstanding amount of eligible and non-eligible commercial paper. Eligible outstanding commercial paper is defined as the amount of commercial paper outstanding from firms that ex-ante, i.e., before the introduction of PEPP, issued eligible commercial paper. The figure shows that, before the introduction of PEPP, the stock of commercial paper from eligible and non-eligible firms was evolving in a fairly similar way, steadily growing until mid-March, and decreasing in both groups from mid-March onwards. However, once the PEPP programme is activated, outstanding stocks of eligible paper quickly rebounded and reached pre-pandemic levels by the end of April, while non-eligible stocks low.

In Table 5 we study the impact of a eligibility status on commercial paper issuance at the firm level. We use a similar setup as in Table 4, but add an eligibility dummy as explanatory variable and not only focus on what happens in March 2020, but also in April and May 2020. The dependent variable in each regression is a rollover dummy. In columns 1 and 3, this dummy is equal to one if a firm is able to rollover its maturing commercial paper

between February 29 and March 31, 2020. In columns 2 and 4, we look at the rolling over of commercial paper that matured in April 2020, while column 5 focusses on April and May. The eligibility dummy is equal to one if the firm issues commercial paper that fulfills the requirements to be eligible under the PEPP.

The results in column 1 and 3 of Table 5 show that eligibility status had no impact on whether commercial paper could be rolled-over in March 2020. This makes sense, as the PEPP programme only became active on March 26, and only really took off in April. Instead, and as shown in Table 3, the fund flow indicator plays a crucial role during this month: firms exposed to firms with negative fund flows are less likely to rollover their maturing commercial paper.

Columns 2, 4 and 5 however show a different picture for April and May 2020, i.e. once PEPP is activated. During these months, eligibility status positively and significantly affects firms' rollover probability. Eligible firms are between 34 and 42 percent more likely to fully rollover their maturing commercial paper.

The first two columns of Table 6 further confirm that PEPP had a positive impact on the issuance volume of eligible commercial paper. In this table, we focus on commercial paper at the issuance level (isin-level) during the 4 weeks before and the 4 weeks after the introduction of the PEPP. The dependent variable in column 1 and 2 is the log of the amount issued. The variable of interest is the interaction term between the eligibility dummy and the post dummy, which is equal to one after the introduction of PEPP. Column 1 shows that, relative to the amount issued by non-eligible firms, the amount of eligible commercial paper being issued is on average 47% higher after the introduction of PEPP. This estimate rises to 51% once we consider firm fixed effects.

Figure 6 illustrates this difference in issuance behaviour by plotting the aggregate weekly issuance volumes for eligible and non-eligible firms. While issuances of both groups evolve in a similar way before the introduction of PEPP, with issuance volumes in both groups hovering around 4 billion EUR a week before the drop in mid-March, we see a much stronger pick-up of issuance volumes for eligible firms after the introduction of PEPP.

One might be worried that eligible firms have specific characteristics that make it easier for them to access commercial paper markets in crisis times, apart from being eligible

for PEPP. There are at least two reasons, however, why this is unlikely. First, commercial paper markets started showing signs of stress already in mid-March, approximately two weeks before the implementation of PEPP. As evident from figures 5 and 6, both eligible and non-eligible firms issued commercial paper at a very similar pace. The similar issuance behaviour of eligible and non-eligible firms in the pre-PEPP period is also reassuring for the parallel trend assumption of our difference-in-differences analysis. Second, when comparing balance sheet characteristics such as firm leverage and cash holdings, there is no significant difference between eligible and non-eligible firms (ADD Table that compares firm characteristics).

Eligible firms not only are able to issue once PEPP is introduced, but they also manage to increase the maturity of their issuances. Column 3 of Table 6 indicate that, while the maturity of non-eligible issuances decreased by 39.3% after the introduction of PEPP, the maturity of eligible issuances increases by 30.3% ( $-39.3 + 69.5$ ). Put differently, relative to the non-eligible issuances, the maturity for eligible issuances increased with 69.5%. Column 4 confirms these results when week and firm fixed effects are added to the specification in column 3.

Table 7 describes the impact of PEPP on the yield at issuance for the full sample and for different maturity buckets. We split up the sample in four maturity buckets: below 1 month, 1 to 3 months, 3 to 6 months and above 6 months. The table indicates that yields especially went down for eligible commercial paper between 1 and 6 months. The non-result for the below 1 month category is not a surprise, as PEPP purchases need to have a maturity of at least 28 days. The bulk of the issuances is in the 1 to 3 months bucket, so it is no surprise to see a strong impact there: eligible issuers in this bucket see a relative decline in their short-term funding cost of 13.8 basis points.

## 6 Conclusion

The commercial paper market came to an almost complete standstill during the Covid-19 crisis in March 2020. In the last two weeks of March 2020 the aggregate weekly volume issued by non-financial euro area commercial paper dropped from about 8 bn. EUR to below 2 bn. EUR. This had direct effects on firms relying on short-term market funding for their day-to-day operations. In the euro area, more than 80% of short-term market debt is commercial paper.

We show that the standstill was at least partly driven by distressed money market funds. Liquidity strains in money market funds caused a reduction in demand for non-financial commercial paper, thereby putting pressure on firms relying on these short-term markets for day-to-day liquidity needs.

We also document the role of the ECB's Pandemic Emergency Purchase Programme (PEPP) in the recovery of commercial paper markets. Our analysis indicates that the revival in commercial paper issuance in April and May 2020 was driven by PEPP purchases. PEPP not only allowed firms to issue more commercial paper, but also led to better terms and conditions. Last, we show that firms became less sensitive to outflows in money market funds through the PEPP.

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## Figures and Tables

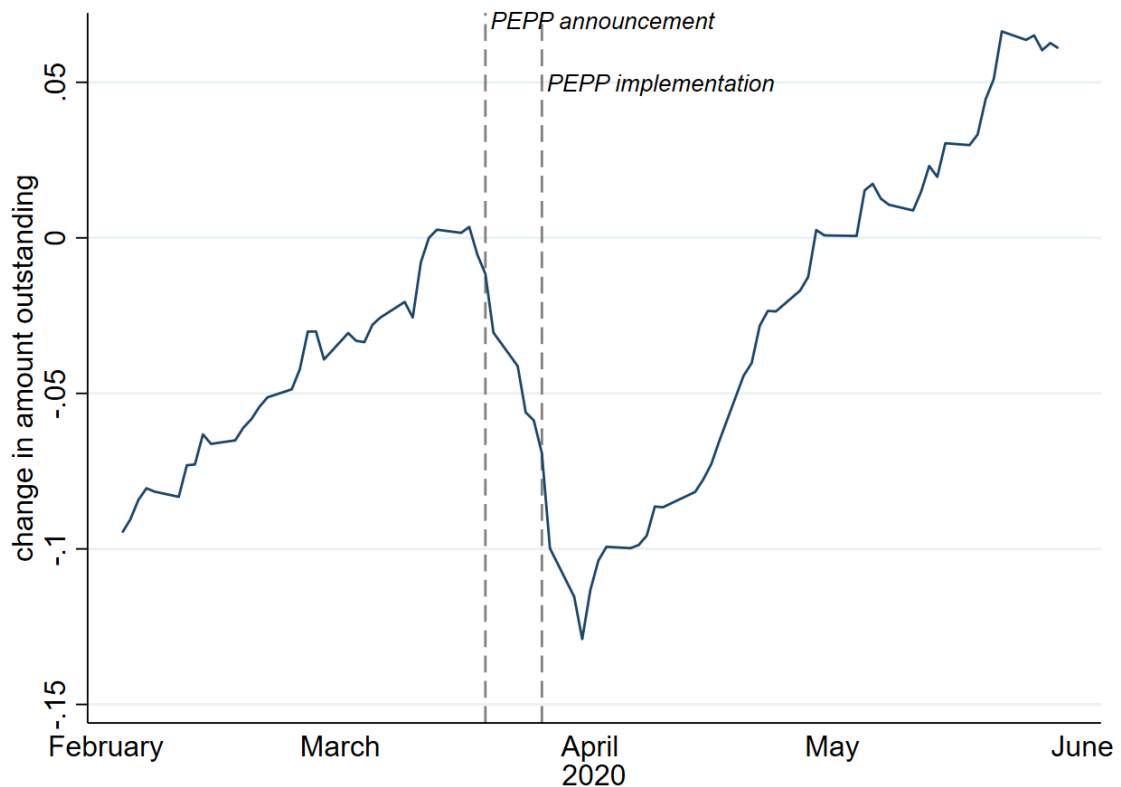
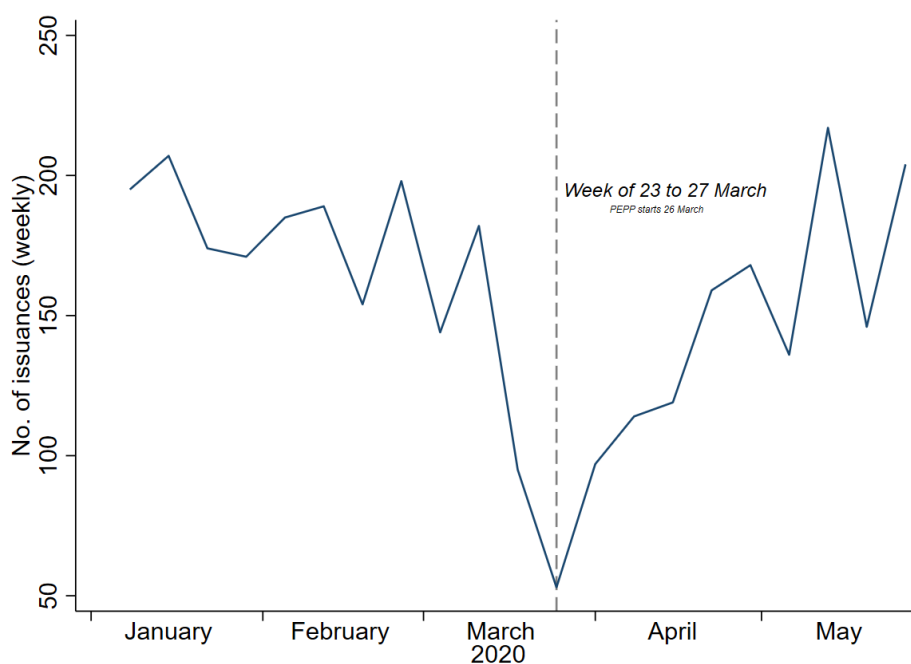
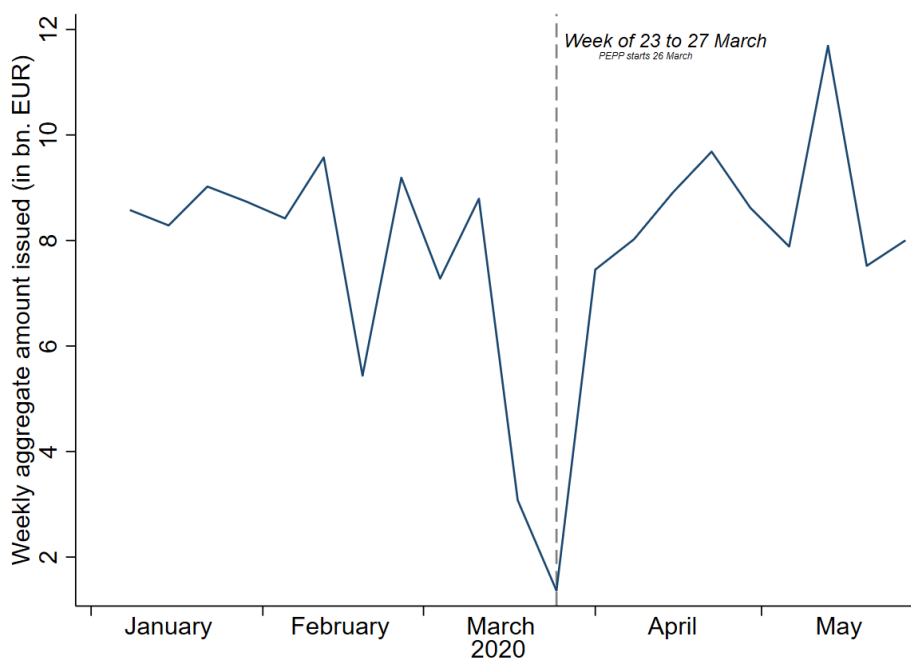


Figure 1: **Aggregate outstanding volume of commercial paper issued (non-financial companies)** This figure shows the evolution of an index of the aggregate outstanding volume of euro-denominated commercial paper issued by euro-area non-financial companies between February 1, 2020 and May 29, 2020. The index is set at zero on March 12, 2020. Data on outstanding commercial paper is collected from the ECB's Centralised Securities Database (CSDB).



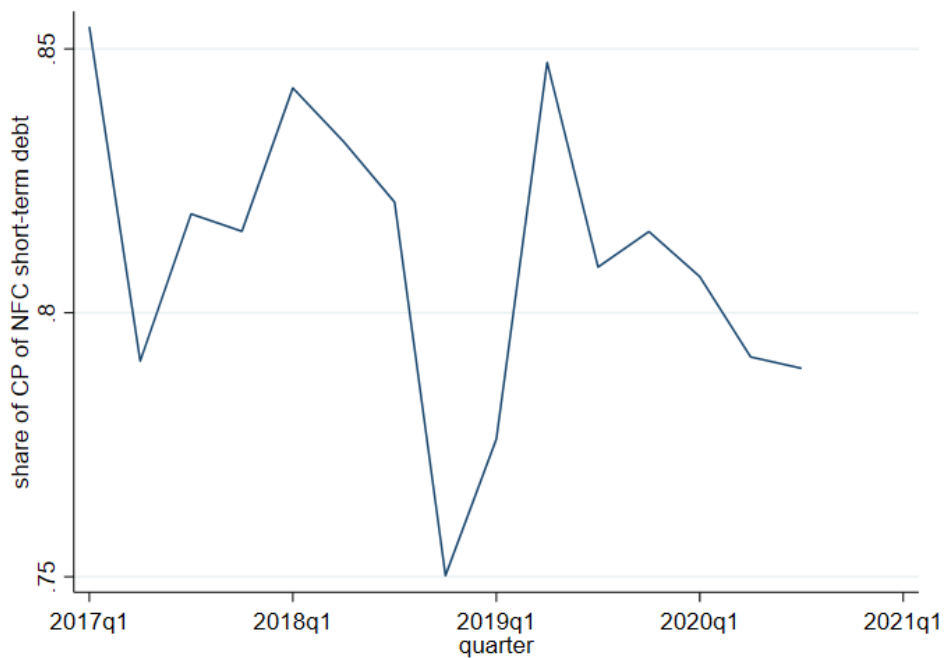


(a) Nr. of issuances

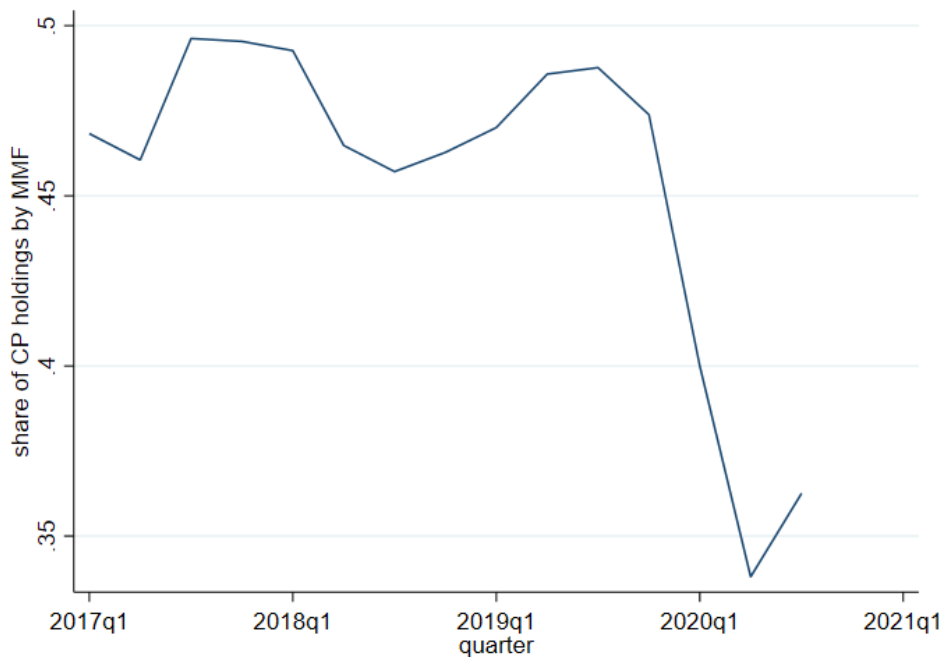


(b) Weekly issuance volume

**Figure 2: Weekly number and volume of commercial paper issuances (non-financial companies).** Panel (a) of this figure shows the number of euro-denominated commercial paper issuances by euro-area by non-financial companies on a weekly basis between January 6, 2020 and May 30, 2020. Panel (b) shows the weekly aggregate amount of euro-denominated commercial paper issued by euro-area by non-financial companies, in billion euro. All data on commercial paper issuances is collected from the ECB's Centralised Securities Database (CSDB).



(a) Commercial paper share of NFCs' short-term debt



(b) Commercial paper share of MMFs' holdings

**Figure 3: Relevance of commercial paper for non-financial corporations and money market funds.** Panel (a) of this figure shows commercial paper share issued short-term market debt of non-financial corporations (NFCs) on a quarterly basis between 2017 and 2020. Commercial paper issuances of NFCs are collected from the ECB's Centralised Securities Database (CSDB). Panel (b) shows the holding share of commercial paper by money market funds (MMFs) on a quarterly basis between 2017 and 2020. Holdings statistics of MMFs are collected from the ECB's Security Holdings Statistics (SHS).

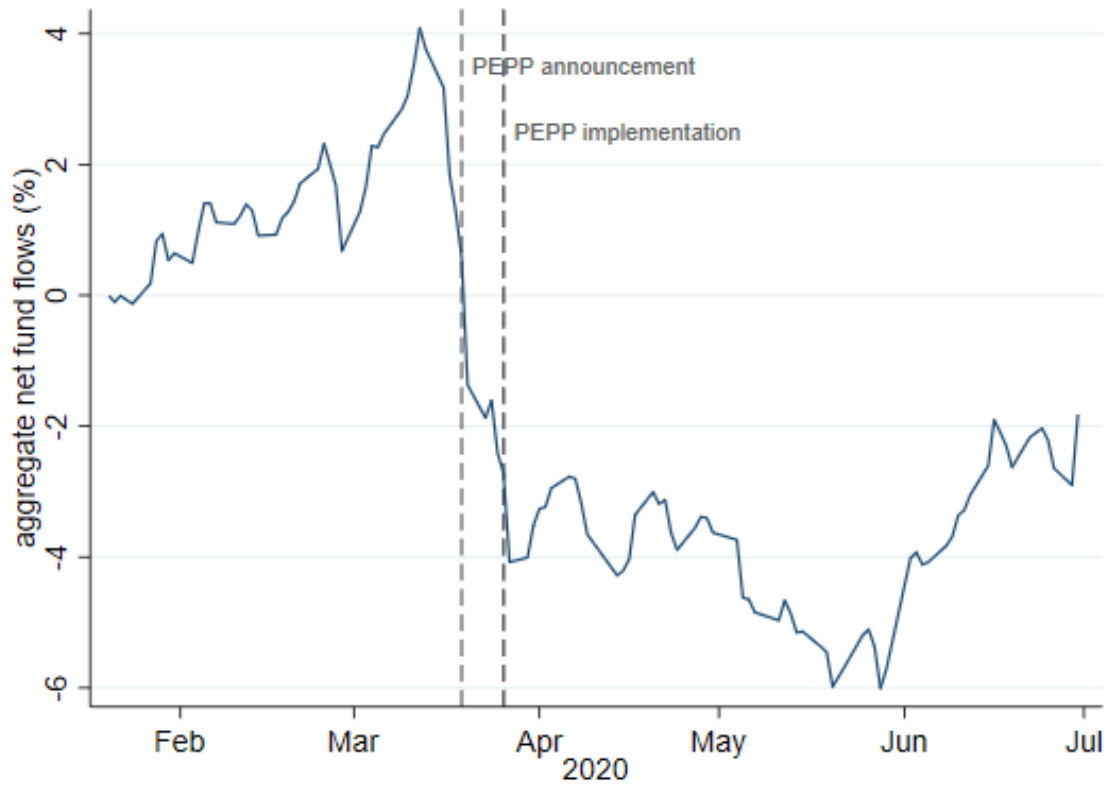


Figure 4: **Aggregate net fund flows** This figure shows the evolution of a fund flow index of money market funds investing into the euro area. The index is set at zero on January 13, 2020. The sample period from January 13, 2020 to June 30, 2020. Data on fund flows is calculated using the Thomson Reuters Lipper database.

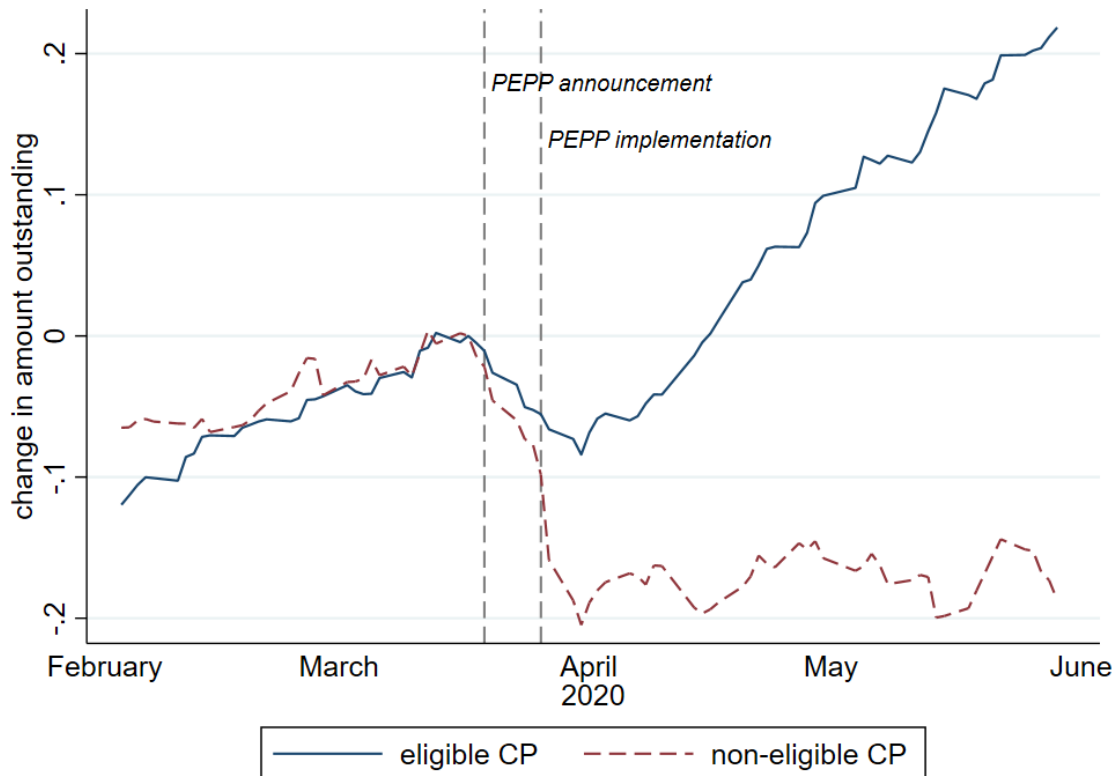


Figure 5: **Aggregate outstanding volume of commercial paper issued (non-financial companies)** This figure shows the evolution of two indices: the solid blue line represents and index of the aggregate outstanding volume of euro-denominated commercial paper issued by euro-area non-financial companies (NFCs) that fulfills the eligibility requirements for the ECB’s Pandemic Purchases Programme (PEPP). The dashed red line shows a similar index, but for commercial paper that is not eligible for PEPP. Both indices are set at zero on March 12, 2020. The sample period is February 1, 2020 until May 29, 2020 Data on outstanding commercial paper is collected from the ECB’s Centralised Securities Database (CSDB). Data on paper eligibility is based on the list of eligible ECB collateral (<https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html>).

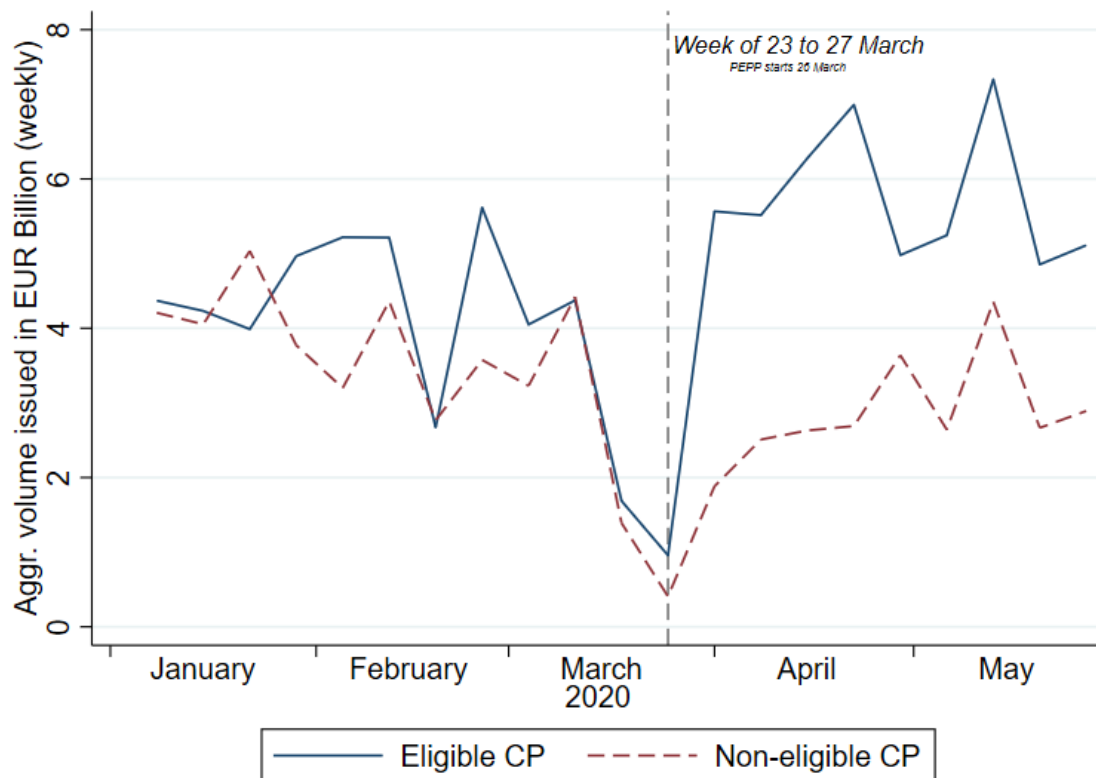


Figure 6: **Aggregate weekly volume of commercial paper issued (non-financial companies)** This figure shows the evolution of the aggregate volume (in billion euro) of euro-denominated commercial paper issuance for two distinct types of commercial paper: the solid blue line represents the weekly aggregate volume of euro-denominated commercial paper issued by euro-area non-financial companies (NFCs) that fulfills the eligibility requirements for the ECB's Pandemic Purchases Programme (PEPP). Similarly, the dashed red line shows the aggregate issuance volume of commercial paper that is not eligible for PEPP. The sample period is January 6, 2020 until May 29, 2020. Data on the issuance of commercial paper is collected from the ECB's Centralised Securities Database (CSDB). Data on paper eligibility is based on the list of eligible ECB collateral (<https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html>).

Table 1: Summary Statistics

Isin-level						
	N	mean	p50	sd	p5	p95
Issuance volume (million EUR)	1323	43.87	25.00	55.61	2.50	150.00
Maturity (days))	1323	85.90	51.00	92.45	7.00	364.00
Yield (%) - annualized	1128	0.16	0.06	0.45	-0.37	0.71
Eligible	1323	0.37	0.00	0.48	0.00	1.00
Fund-firm level						
Commercial paper holdings (fund-firm level, million EUR)	1513	30.36	20.01	35.88	1.50	89.95
Negative flow	1513	0.60	1.00	0.49	0.00	1.00
Fund flow	1513	-0.04	-0.05	0.31	-0.47	0.47
Firm-level						
	N	mean	p50	sd	p5	p95
Rollover dummy	167	0.37	0.00	0.48	0.00	1.00
Growth outstanding CP (%)	167	-0.08	-0.08	0.85	-1.72	2.00
Negative flow dummy	167	0.59				
Weighted fund flow	167	-0.03	-0.04	0.21	-0.39	0.37
Log(total assets)	147	23.23	23.13	1.32	21.35	25.32
Leverage	137	0.70	0.70	0.19	0.38	1.00
Return on assets (%)	137	3.15	2.66	3.31	-1.05	9.09
Eligibility dummy	167	0.54				

In the top panel, the sample consists of all euro-denominated commercial paper (isin-level) issued by euro-area non-financial companies between February 28, 2020 and April 23, 2020 (i.e. 4 weeks before and 4 weeks after the ECB's Pandemic Purchases Programme (PEPP) became active). *Issuance volume (in million EUR)* is the amount of the commercial paper issuance, *Maturity (days)* is the initial maturity of the commercial paper, *Yield (%) - annualized* is the annualized interest rate (in percent) and *Eligible* is a dummy equal to one in case the firm issuing the commercial paper at any point during the sample period issued eligible commercial paper. The second panel shows summary statistics at the fund-firm level. Commercial paper holdings (fund-firm level, million EUR) is the amount of commercial paper of firm  $f$  that is held by fund  $i$ . The bottom panel presents firm-level summary statistics for all non-financial firms included in our sample. *Rollover dummy* is a dummy variable equal to one if a firm was able to rollover its maturing commercial paper between February 28, 2020 and March 31, 2020. *Log(Total assets)* is the natural logarithm of a firm's total assets. *Leverage* is defined as 1-(equity over total assets). *Eligible* is a dummy equal to one in case the firms issues commercial paper that fulfills the requirements to be eligible under the PEPP. *Fund flow* is the weighted average of the net fund flows between the end of February 2020 and the end of March 2020 of the money market funds that hold commercial paper of a firm, with the weights equal to the share of a firm's commercial paper that was held by a particular money market fund at the end of February, 2020. Isin-level commercial paper data is collected from the ECB's Centralised Securities Database (CSDB). Data on paper eligibility is based on the list of eligible ECB collateral (<https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html>). Firm balance sheet data is the accounting data for 2019, taken from the Bureau van Dijk Orbis database. Data on fund flows is calculated using the Thomson Reuters Lipper database.

Table 2: Commercial paper and outflows from money market funds

	(1)	(2)	(3)
Dependent variable =	Log(outstanding commercial paper (EUR)) <sub>i,f,t</sub>		
Post <sub>t</sub> x Negative flow <sub>i</sub>	-0.227* (0.116)	-0.164* (0.0888)	-0.129** (0.0596)
Post <sub>t</sub>	0.113 (0.0866)		
Negative flow <sub>f</sub>	0.173 (0.258)	0.148 (0.260)	
Observations	1,513	1,448	1,446
R-squared	0.296	0.233	0.692
Firm FE	Y	Y	Y
Firm-time FE	N	Y	Y
Fund FE	N	N	Y

The sample consists of all non-financial firms whose outstanding commercial paper is at least partly owned by money market funds at any point in time between February 28, 2020 and May 31, 2020. The depend variable is the log of the total amount outstanding commercial paper of firm  $f$  that is owned by money market fund  $i$  at time  $t$ . Time  $t$  is either February 28, 2020 or March 31, 2020. *Negative flow<sub>i</sub>* is a dummy equal to 1 when the net fund flow of fund  $i$  between February 28, 2020 and March 31, 2020 was negative. *Post* is a dummy equal to one on March 31, 2020. Information on the issuance of commercial paper is collected from the ECB's Centralised Securities Database (CSDB). Data on fund flows is calculated using the Thomson Reuters Lipper database. Standard errors are clustered at the firm level.

Table 3: Commercial paper and outflows from money market funds

Dependent variable =	(1)	(2)	(3)	(4)	(5)
	Log(outstanding commercial paper (EUR)) <sub>i,f,t</sub>				
Firm variable =	Covid	Total assets	Leverage	ROA	Interest coverage ratio
Negative flow <sub>i</sub> x Post <sub>t</sub>	-0.0845 (0.0546)	-0.208*** (0.0590)	-0.115** (0.0568)	-0.173*** (0.0629)	-0.182*** (0.0631)
Negative flow <sub>i</sub> x Post <sub>t</sub> x Firm variable <sub>f</sub>	-0.155* (0.0911)	0.200** (0.100)	-0.0812 (0.108)	0.0951 (0.0949)	0.0642 (0.107)
Negative flow <sub>i</sub> x Firm variable <sub>f</sub>	0.214* (0.109)	-0.225 (0.155)	-0.0408 (0.137)	-0.0297 (0.134)	-0.0207 (0.159)
Observations	1,495	1,288	1,288	1,288	1,055
R-squared	0.703	0.687	0.686	0.686	0.697
Firm FE	Y	Y	Y	Y	Y
Firm-time FE	Y	Y	Y	Y	Y
Fund FE	Y	Y	Y	Y	Y

The sample consists of all non-financial firms whose outstanding commercial paper is at least partly owned by money market funds at any point in time between February 28, 2020 and May 31, 2020. The depend variable is the log of the total amount outstanding commercial paper of firm  $f$  that is owned by money market fund  $i$  at time  $t$ . Time  $t$  is either February 28, 2020 or March 31, 2020. *Negative flow<sub>i</sub>* is a dummy equal to 1 if the net fund flow of fund  $i$  between February 28, 2020 and March 31, 2020 was negative. *Post* is a dummy equal to one on March 31, 2020. In column 1, *Firm variable<sub>f</sub>* is a dummy variable equal to one if the firm operates in a sector seen as non-essential during the Covid-19 pandemic, and in which teleworking is not possible (e.g. construction sector, hotels). In columns 2 to 5, *Firm variable<sub>f</sub>* is a dummy variable equal to one if the firm is in the highest tercile of the distribution of a particular firm characteristic, where each column focusses on a different firm characteristic (total assets, leverage, return on assets, and interest rate coverage ratio, respectively). Information on the issuance of commercial paper is collected from the ECB's Centralised Securities Database (CSDB). Data on fund flows is calculated using the Thomson Reuters Lipper database. Covid sector classification is taken from JCR (2020). Firm balance sheet data is taken from the Bureau van Dijk Orbis database. Standard errors are clustered at the firm level.



Table 4: Commercial paper and weighted fund flows at the firm level

	(1)	(2)	(3)	(4)	(5)	(6)
	Rollover probability			Growth outstanding CP (%)		
Negative flow <sub><i>i</i></sub>	-0.302*** (0.0746)	-0.286*** (0.0835)	-0.284*** (0.0898)	-0.496*** (0.144)	-0.430*** (0.155)	-0.387** (0.167)
Log(total assets) <sub><i>i</i></sub>		0.0712*** (0.0270)	0.0738** (0.0301)		0.0615 (0.0423)	0.0385 (0.0501)
Leverage <sub><i>i</i></sub>		0.0557 (0.231)	0.0708 (0.277)		-0.162 (0.385)	0.177 (0.438)
Return on assets <sub><i>i</i></sub> (%)		0.0275** (0.0120)	0.0222 (0.0140)		0.0274 (0.0200)	0.0162 (0.0249)
Constant	0.544*** (0.0608)	-1.226* (0.697)	-1.275 (0.786)	0.215 (0.134)	-1.144 (1.033)	-0.830 (1.260)
Observations	167	137	126	167	137	126
R-squared	0.095	0.240	0.271	0.083	0.203	0.245
Covidsector FE	N	Y	N	N	Y	N
Covidsector-country FE	N	N	Y	N	N	Y

The sample consists of all non-financial firms whose outstanding commercial paper is at least partly owned by money market funds at any point in time between February 28, 2020 and May 31, 2020. In columns 1 to 3, the depend variable is a dummy variable equal to one if a firm  $f$  was able to rollover its maturing commercial paper between February 29, 2020 and March 31, 2020. In columns 4 to 6, the dependent variable is the firm-level growth rate in commercial paper outstanding over the same time period (in %).  $Negative\ flow_f$  is a dummy equal to 1 if the average weighted net fund flows of all funds  $i$  that hold commercial paper of firm  $f$  on February 28, 2020 was negative. Columns 2 and 5 include Covidsector fixed effects, which groups sectors in 5 buckets: (i) essential and fully active sectors, (ii) active but teleworking sectors, (iii) partly essential and partly active, (iv) non-essential and partly active, and (v) closed. In columns 3 and 6 we include country-covidsector fixed effects. Information on the issuance of commercial paper is collected from the ECB's Centralised Securities Database (CSDB). Data on fund flows is calculated using the Thomson Reuters Lipper database. Covid sector classification is taken from JCR (2020). Firm balance sheet data is taken from the Bureau van Dijk Orbis database. Robust standard errors in parentheses.

Table 5: Commercial paper and PEPP eligibility at the firm level

	(1)	(2)	(3)	(4)	(5)
	March	April	March	April	April-May
Eligibility dummy <sub><i>i</i></sub>	0.00516 (0.0725)	0.324*** (0.0749)	-0.113 (0.0958)	0.333*** (0.101)	0.425*** (0.0953)
Negative flow <sub><i>i</i>,March</sub>	-0.301*** (0.0759)	-0.0918 (0.0764)	-0.298*** (0.0925)	-0.0869 (0.0974)	-0.0687 (0.0921)
Log(total assets) <sub><i>i</i></sub>			0.0906** (0.0364)	0.0270 (0.0383)	0.0377 (0.0362)
Leverage <sub><i>i</i></sub>			0.133 (0.267)	-0.0430 (0.281)	-0.231 (0.266)
Return on assets <sub><i>i</i></sub> (%)			0.0226 (0.0152)	-0.00265 (0.0160)	-0.0204 (0.0151)
Constant	0.541*** (0.0762)	0.413*** (0.0772)	-1.622* (0.891)	-0.160 (0.938)	-0.249 (0.887)
Observations	167	167	134	134	134
R-squared	0.095	0.122	0.291	0.225	0.294
Covidsector-country FE	N	N	Y	Y	Y

The sample consists of all non-financial firms whose outstanding commercial paper is at least partly owned by money market funds at any point in time between February 28, 2020 and May 31, 2020. In columns 1 and 3, the depend variable is a dummy variable equal to one if a firm  $f$  was able to rollover its maturing commercial paper between February 29, 2020 and March 31, 2020. In columns 2 and 4, the depend variable is a dummy variable equal to one if a firm  $f$  was able to rollover its maturing commercial paper between March 31, 2020 and April 30, 2020. In column 5, the depend variable is a dummy variable equal to one if a firm  $f$  was able to rollover its maturing commercial paper between March 31, 2020 and May 31, 2020. *Negative flow<sub>*f*</sub>* is a dummy equal to 1 if the average weighted net fund flows between February 28, 2020 and March 31, 2020 of all funds  $i$  that hold commercial paper of firm  $f$  on February 28, 2020 was negative. Columns 3 to 5 include Covidsector-country fixed effects. The covidsector variable groups sectors in 5 buckets: (i) essential and fully active sectors, (ii) active but teleworking sectors, (iii) partly essential and partly active, (iv) non-essential and partly active, and (v) closed. Information on the issuance of commercial paper is collected from the ECB's Centralised Securities Database (CSDB). Data on fund flows is calculated using the Thomson Reuters Lipper database. Covid sector classification is taken from JCR (2020). Firm balance sheet data is taken from the Bureau van Dijk Orbis database. Robust standard errors in parentheses.

Table 6: PEPP and commercial paper - volumes and maturity

	(1)	(2)	(3)	(4)
	Log(Volume per issuance)		Log(Maturity (days))	
Eligible <sub>i</sub> x Post <sub>t</sub>	0.470*** (0.119)	0.510*** (0.110)	0.695*** (0.151)	0.714*** (0.146)
Post <sub>t</sub>	-0.292*** (0.0950)		-0.393*** (0.0901)	
Observations	1,323	1,323	1,323	1,323
R-squared	0.496	0.516	0.461	0.473
Week FE	N	Y	N	Y
Firm FE	Y	Y	Y	Y
No. firms	129	129	129	129

This table analyses commercial paper issuances (at the isin-level) during the 8 weeks around the launch of the ECB's Pandemic Emergency Purchase Programme (PEPP).  $\text{Log}(\text{Volume per issuance})$  is the logarithm of the issued amount.  $\text{Post}$  is a dummy equal to 0 during the 4 weeks before the start of the PEPP ( March 26, 2020), and equal to 1 during the first 4 weeks of PEPP.  $\text{Eligible}$  is a dummy equal to 1 for firms that issued eligible commercial paper at least one point in time between February 28, 2020 and May 31, 2020 commercial paper, and 0 otherwise. All columns include firm fixed effects. In columns 2 and 4 we additionally add week fixed effects. Standard errors are clustered at the firm level. Each firm in our sample has at least 1 issuance in the pre-PEPP period, and at least 1 issuance during the post period.

Table 7: PEPP and commercial paper yields: maturity buckets

	(1) Yield (%) - all	(2) Yield (%) - all	(3) Yield (%) - below 1 month	(4) Yield (%) - 1 to 3 months	(5) Yield (%) - 3 to 6 months	(6) Yield (%) - above 6 months
Eligible <sub>i</sub> x Post <sub>t</sub>	-0.00345 (0.0570)	-0.00438 (0.0546)	0.230 (0.246)	-0.138** (0.0620)	-0.253* (0.138)	0.0384 (0.0870)
Post <sub>t</sub>	0.385*** (0.0462)					
Log(Maturity) <sub>i,j</sub>	0.0967*** (0.0149)	0.101*** (0.0153)	0.0375 (0.130)	0.123*** (0.0250)	0.254*** (0.0683)	0.322** (0.153)
Observations	1,101	1,101	102	579	72	80
R-squared	0.780	0.807	0.755	0.780	0.887	0.932
Week FE	N	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
No. firms	123	123	16	87	21	22

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This table analyses the yield on commercial paper issuances (at the isin-level) during the 8 weeks around the launch of the ECB's Pandemic Emergency Purchase Programme (PEPP). In columns 1 and 2 we include all issuances with an initial maturity below 367 days. In columns 3 to 6 we split this sample in 4 subgroups, based on initial maturity: column 3 includes issuances with an initial maturity below 1 month, column 4 includes issuances with a maturity from 1 to 3 months, column 5 includes all issuances with initial maturity from 3 to 6 months, and column 6 all issuances between 6 months and a year. *Yield(%)* is the annualized yield of the commercial paper. *Post* is a dummy equal to 0 during the 4 weeks before the start of the PEPP (March 26, 2020), and equal to 1 during the first 4 weeks of PEPP. *Eligible* is a dummy equal to 1 for firms that issued eligible commercial paper at least one point in time between February 28, 2020 and May 31, 2020 commercial paper, and 0 otherwise. *Log(Maturity)<sub>i,j</sub>* is the logarithm of the initial maturity (in days) of the commercial paper *j* issued by firm *i*. All specifications include firm fixed effects. Specifications 2 to 6 also include week fixed effects. Standard errors are clustered at the firm level. Each firm in our sample has at least 1 issuance in the pre-PEPP period, and at least 1 issuance during the PEPP period.