REM WORKING PAPER SERIES

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REM Working Paper 0218-2022

March 2022

REM – Research in Economics and Mathematics
Rua Miguel Lúpi 20,
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ISSN 2184-108X

REM – Research in Economics and Mathematics

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Unconventional Monetary Policy in the Euro Area. Impacts on Loans, Employment, and Investment*

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February 2022

Abstract

Using a difference-in-differences identification strategy on a micro panel at the bank and firm level, we study the transmission effectiveness of ECB's large-scale asset purchasing programs programs (i.e. APP and PEPP) in the Euro area. Our findings show: first, balance sheet composition of banks is an important determinant of monetary policy transmission. We tested this hypothesis by showing that banks more exposed to government debt securities had higher loan growth than less exposed banks after the APP announcement. By extension, this could lead to heterogeneous economic impacts depending on the geographical location of exposed banks. For the PEPP, contrary to the APP, we did not find a portfolio-rebalancing channel for banks that were more exposed to government debt securities. Second, using balance sheet data on corporates, we verify that firms that borrowed more increased employment and fixed capital investment, albeit to a lesser degree than before the APP announcement. Furthermore, our sample shows that corporations in countries with banks more exposed to government debt securities had higher borrowing growth and fixed capital growth versus countries with less exposed banks.

Keywords: unconventional monetary policy, difference-in-differences, euro area, employment, investment
JEL: C23, D22, E52, E58, G11, G20,

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* This work was supported by the FCT (Fundação para a Ciência e a Tecnologia) [grant numbers UIDB/05069/2020, 2021.06646.BD]. The opinions expressed herein are those of the authors and not necessarily those of their employers. Any remaining errors are the authors' sole responsibility
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1. Introduction

How did unconventional monetary policy (UMP) programs affect loans, employment, and investment in the euro area? Is the asset composition of banks an important determinant of monetary policy transmission? Did banks with larger holdings of government debt securities extended more credit to the economy after the asset purchase programme (APP) and the pandemic emergency purchase programme (PEPP)? We use a difference-in-differences methodology on a micro panel with observations at the bank and firm level constructed with data from the Bureau van Dijk database to study the transmission effectiveness of monetary policy to the real economy in the Euro area. Specifically, we analyze the impact on loans, employment, and fixed capital investment. The increased use of UMP by central banks around the world in recent years has made it a timely topic subject of ongoing debate. The majority of research on this strand of literature in the European case focuses mainly on interest rates and loan creation. This paper adds to the literature on the transmission effectiveness of unconventional monetary policy programs regarding its effect on real economic variables, such as employment and investment.

The paper is organized as follows. Section 2 reviews the literature of monetary policy and transmission mechanisms to the real economy. Section 3 provides an overview of monetary policy programs in the Euro Area. Section 4 provides the methodology. Section 5 reports the empirical analysis and section 6 concludes.

2. Literature

The present study follows closely on the literature strands of monetary policy transmission channels, specifically the bank lending channel and the portfolio-rebalancing channel. The body of work on this subject has been growing in recent years motivated by the increased use of unconventional policies by central banks.

The most direct transmission mechanism of monetary policy to the real economy is the bank lending channel. Correspondingly, Ben S. Bernanke and Blinder (1992) show that a tightening of monetary policy, via the fed funds rate, results in a reduction of loans underwritten by banks, depressing the economy and rising unemployment. These effects are usually heterogeneous in economic agents; For instance, Gertler and Gilchrist (1994) investigate monetary policy responses of small versus large manufacturing firms. They conclude that smaller firms have less access to capital markets making them more dependent on bank financing and therefore more exposed to central bank tightening policy. This finding is indicative that the bank lending channel of monetary policy will have a disproportionate effect on smaller firms. This conclusion is consistent with Duygan-Bumpa et al. (2015) who find that financing constraints of small firms in financing dependent industries were a main contributor to unemployment in the US during the great recession. In accordance, Arce et al. (2017) and Betz and De Santis (2019) argue that the ECB's CSPP program was successful in increasing the number of loans to smaller firms. Additionally, De Santis and Zaghini (2021) find that the CSPP increased the amount of corporate securities issued, CSPP eligible corporations benefiting the most.

Ben S Bernanke and Gertler (1995) noted that setting the Fed funds rate, which is a short-term interest rate, has implications for the long-term output of durable goods and long-term rates. To this puzzle, Bernanke and Gertler called the black box of monetary policy. Today, this phenomenon is usually referred to as forward guidance (McKay et al., 2016) and is one of the main mechanisms used by central banks to influence long-term interest rates in the economy. It could also be argued that unconventional monetary policy announcements influence long-term yields, serving as a form of forward guidance and acting through the signaling channel. Monetary policy announcements can have significant impacts on yields, for instance, Afonso et al. (2018) concluded that the OMT intervention had a significant effect on the pricing of yields of European government bonds, particularly on periphery countries. Under the OMT program, the ECB signaled that it was willing to do "whatever it takes" to support the Euro, however there was no massive purchase of assets in the market. Arce et al. (2017) also noted that the signaling channel could have larger effects on yields than the actual purchasing of assets. Krishnamurthy and Vissing-Jorgensen (2011) notes that during QE2, the FED only purchased US treasuries and makes the argument that the same effect could have been achieved without purchasing these assets in the market and putting its balance sheet at risk. Nevertheless, it is often argued that the purchasing of assets reinforces the commitment by the central bank to maintain rates low as a rate hike could create significant losses. Arce et al. (2017) find a positive impact on excess yields after the ECB purchased the assets, albeit significantly lower than when the program was announced.

Ex ante, unconventional monetary policies have the goal of increasing inflation to meet the target set by the central bank, reduce market interest rates, spur credit expansion, and stimulate GDP growth (Bowdler and Radia, 2012). Looser monetary policy is associated with an increase in bank lending, however the consensus regarding the impact on the economy and transmission channels is a subject of ongoing debate.

The ECB's securities market programme (SMP) was smaller and had different objectives than other LSAP programs such as the APP, the PEPP, and the QE programs undertaken by the Fed and the bank of England. The aim of the SMP was to address the "mal-functioning monetary policy transmission mechanism" as stated by the ECB, while other LSAP programs had the stated intent to make monetary policy more accommodating after reaching lower levels of interest rates or even the zero-lower bound (ZLB). Nevertheless, Koetter (2020) studied the SMP program impact on German bank lending and argues that banks exposed to sovereign debt issued by the SMP's targeted securities loaned more than less exposed banks, the impact being more significant for commercial lending, confirming the presence of a portfolio rebalancing channel. Furthermore, Eser and Schwaab (2013) conclude that the SMP program was successful in reducing the yields of the program's targeted government debt securities, as intended by the ECB.

Rodnyansky and Darmouni (2017) research how QE in the US affected bank lending activity. They find that banks with a larger share of mortgage back securities (MBS) loaned more after QE, judging the asset distribution of the balance sheets of banks important for transmission effectiveness. Banks with the largest share of targeted assets will benefit the most. In another US centric study, Luck and Zimmermann (2020) showed that the Fed's QE programs affected real economic outcomes via the bank lending channel, specifically reducing unemployment, the effect being more pronounced in geographical areas where banks held more troubled assets, particularly MBS. However, they do not find significant extended credit after the Fed purchased treasuries. In this paper we find that banks more exposed to government debt securities extended more credit after the ECB's APP than less exposed banks. Blattner et al. (2021) also concludes that banks more exposed to sovereign debt securities loaned more after LSAP programs in Europe.

Balfoussia and Gibson (2016) analyzed the potential impacts of TLTROs using a VAR framework and concluded that these policies have the potential of generating positive economic activity in the Euro area, including the more vulnerable countries. Fisera and Kotlebova (2020) analyzed the impact of UMP policies on newer Euro area members (Lithuania, Estonia, Latvia, Slovakia, and Slovenia) and determined that these policies did not have any statistically significant effects on lending for this group of Euro area members. This is an interesting result because since the GDP of these countries grew at a faster pace than their Euro area counterparts, there could be an expectation of more investment and growth opportunities. Afonso and Sousa-Leite (2020), on the other hand, find a positive and statistically significant effect of TLTRO programs on bank lending in the Euro area, the effect being stronger in less vulnerable countries. Albertazzi et al. (2018) also argues that during the APP less vulnerable countries loaned more than vulnerable ones. One explanation given is that the spreads in less vulnerable countries were already compressed so banks rebalanced their portfolios towards higher yielding private debt.

We should also accentuate that some researchers articulated concerns about the long-term implications of unconventional monetary policies. The most underscored being deflationary pressures experienced in the years following the programs (Dell'Ariccia et al., 2018) (Andrade et al., 2016), the muted response of the macroeconomy (Acharya et al., 2019), negative interest rates or near the ZLB for prolonged periods, central bank independence (Cobham, 2012), and increased risk taking under the search for yield mechanism (Jiménez et al., 2014). Additionally, if LSAP programs relaxed countries' interest service burden on newly issued debt, it could be the wrong incentive to employ fiscal prudence and reduce debt to GDP levels, one of the causes that led to the Euro area sovereign debt crisis. Acharya et al. (2019) and Bonfim et al. (2020) also highlight the fact that UMP achieved stability but did not fully translate into economic growth. The authors argue that these policies could bring about zombie lending which could be an explanation for the muted response of the economy.

Regarding public and private investment, Afonso and St. Aubyn (2019) conclude, using a VAR methodology with a sample of 17 OECD countries, that public investment generates GDP growth in 12 countries of the sample and private investment generates GDP growth for all countries in the sample. This conclusion puts emphasis on the importance of investment for potential future economic growth, hence justifying the inclusion of this variable in our analysis.

3. Overview of Monetary Policy Programs in the Euro Area

The principal objective of central banks is to maintain the price level within target. Monetary policies could also be devised to ensure other objectives such as easing financing conditions and promoting full employment. Central banks are paying increasingly more attention to these additional objectives when designing policies. The main channel through which monetary policy stimulates the real economy is the bank lending channel. In a conventional scenario, monetary authorities would lower short term interest rates that, in turn, influences interest rates applied by commercial banks to loans underwritten to households and firms facilitating consumption and investment. The ECB's deposit rate facility reached the

ZLB on 11 July 2012 and it was further reduced to -0.10% on 11 June 2014 (see figure 1). Without much room to decrease interest rates further, the ECB turned to UMP to stimulate inflation, stabilize financial markets, decrease government bond yields, increase bank credit, and spur economic activity. UMP, as designed by the ECB, usually takes two forms: Special credit conditions for the banking industry (e.g. LTROs and TLTROs) and large-scale asset purchasing programs (e.g. SMP, APP, and PEPP). This paper focuses on the ECB's large-scale asset purchasing programs (LSAPs), more specifically on the APP and the PEPP.

Prior to reaching the ZLB, the ECB had already resorted to UMP programs, albeit in smaller scale. For example, the SMP was a response to the rising yields of Euro area government bonds of affected regions (Greece, Ireland, Portugal, Spain, and Italy). The SMP was announced on 9 May 2010 and was active through 6 September of 2012. The program purchased a total of €218 billion of government debt securities from the targeted countries. Despite the small scale and scope, the SMP was effective at easing financing conditions for the economy (Koetter, 2020). On 22 January 2015 the ECB's Governing Council announced the APP as a response to historical low inflation and to ease financing conditions in the Euro area. The APP is comprised by four subprograms, each specializing in a type of security. The APP subprograms are the public sector purchase programme (PSPP), the corporate sector purchase programme (CSPP), the asset-backed securities purchase programme (ABSPP), and the third covered bond purchase programme (CBPP3). The ABSPP and the CBPP3 had already been introduced in late 2014, the announcement served mainly to communicate the PSPP, which is the largest subprogram. Under the APP, the ECB and the affiliate national central banks (NCBs) planned to purchase a combined amount of €60 billion of eligible assets per month. Later, this figure was revised to €80 billion from April 2016 to March 2017, €60 billion from April 2017 to December 2017, €30 Billion from January 2018 to September 2018, and €15 billion from October 2018 to December 2018 (see figure 2). The APP was formally ended on the 19th of December 2018, however it was again reinstated on the 12th of September 2019 at a pace of €20 billion per month under the justification: To "reinforce the accommodative impact of its [ECB's] policy rate." By December 2018, the total holdings under the APP amounted to €2.567 trillion which, for perspective, represents about 22% of the Euro area nominal GDP in 2018. By December 2018, the percentage holdings for the ABSPP, CSPP3, CSPP and PSPP were 1.07%, 10.20%, 6.93%, and 81.80% respectively (See Table I). The majority of securities purchased were under the PSPP, hence the hypothesis formulated in this paper: Did banks with larger holdings of government debt securities loaned more to the real economy after LSAPs? On 18 March 2020, as a response to the COVID-19 pandemic, the ECB's Governing Council announced the PEPP. This program would be an extension of the APP program still underway at the time. The PEPP had a planned purchasing amount of €750 billion of assets until at least the end of 2020. Additionally, the PEPP increased the scope of the CSPP to include commercial paper of sufficient quality.

TABLE I: *APP program holdings in millions of euros by December 2018*

ABSPP	CBPP3	CSPP	PSPP	APP
27,511	262,201	178,050	2,102,048	2,569,810
1.07%	10.20%	6.93%	81.80%	100%

Source: ECB

FIGURE 1: *ECB Key Interest Rates*

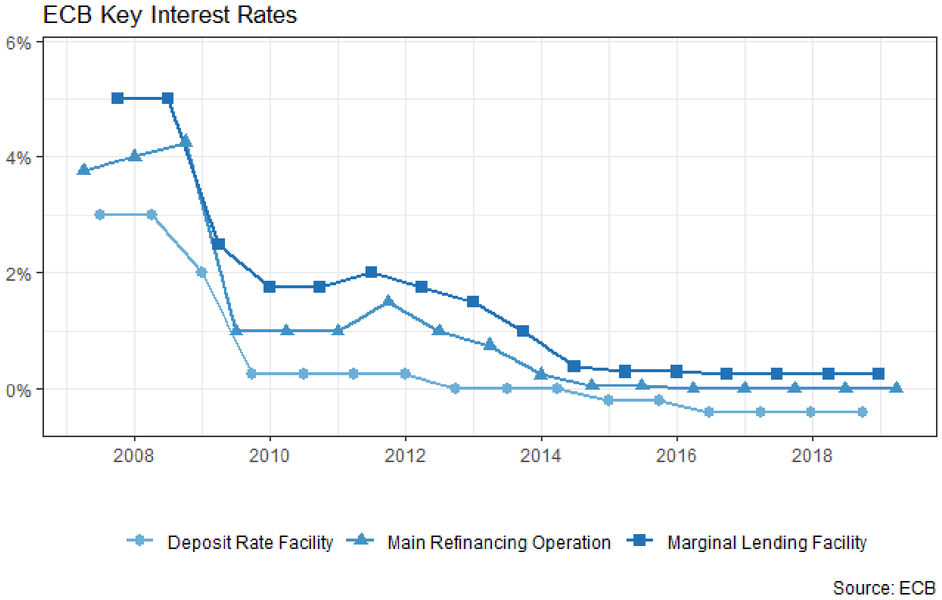
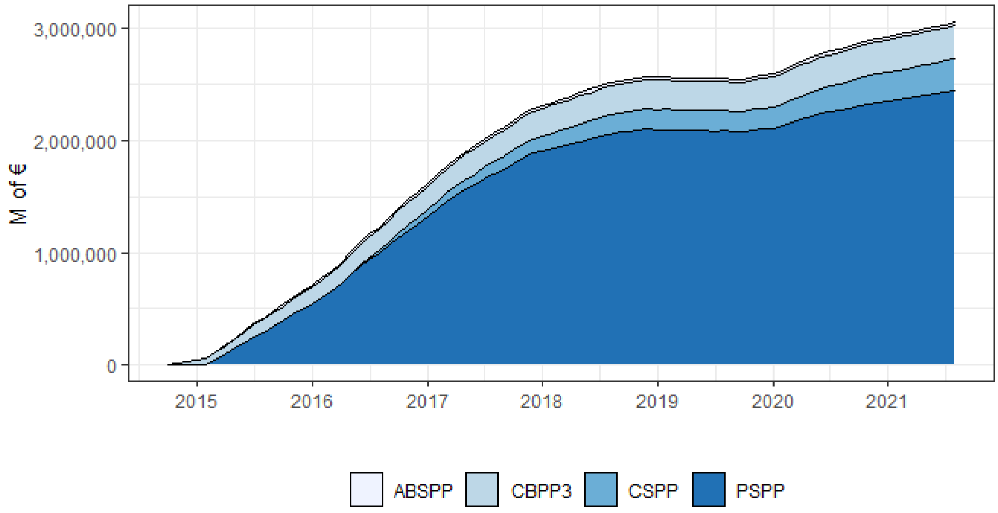


FIGURE 2: *Total holdings APP Program in millions of euros*



Source: ECB

Monetary Policy Transmission

There are several transmission channels identified in the literature through which UMP operates. The portfolio rebalancing channel is a transmission channel where holders of targeted assets will reallocate their investments to other, perhaps higher yielding assets (Gambetti and Musso, 2017; Albertazzi et al., 2018; Koijen et al., 2017). If the central bank is buying government and corporate debt securities and hence increasing their valuations, banks could diverge their investment allocation to other assets such as traditional bank loans. The CSPP, for instance decreased the yields of targeted corporate securities (Arce et al., 2017) and thus returns of traditional loans could become a viable substitute. In this paper, we test the portfolio-rebalancing channel for government debt securities in the Euro area. That is, if banks more exposed to government debt securities extended more credit to the real economy. If confirmed, the results would suggest heterogeneous responses to monetary policy by banks depending on their balance sheet allocation.

The signaling channel is another transmission channel that influences asset prices (Krishnamurthy and Vissing-Jorgensen, 2011). Under this channel, the ECB is showing the market that is committed to keep interest rates low/high or will increase/reduce asset purchases. The actions and announcements will signal central bank intentions for the future. This channel is usually quite powerful. For instance, concerning the CSPP, the biggest decrease in excess yields of targeted and non-targeted corporate debt securities was on the date of the announcement rather than on the date of the actual purchase of the securities (Arce et al., 2017).

Under the refinancing channel, debtors would get additional income from refinancing their debts. The lowering of the deposit rate facility could influence interbank interest rates such as the euribor, and by extension commercial bank interest rates. The reduction of benchmark rates gives debtors additional disposable income, either through refinancing or, in the case of flexible interest rate loans, reduced monthly payments without refinancing. This increase in disposable income could induce aggregate demand growth (Di Maggio et al., 2019). An important consideration from this conclusion is that an increased flow of bank lending put towards refinancing older liabilities is not necessarily a bad outcome in the short term. This phenomenon was verified in the US after the first round of QE (Rodnyansky and Darmouni, 2017; Luck and Zimmermann, 2020).

4. Methodology

We use a micro panel with bank-level and firm-level data to assess if banks more exposed to government debt securities provide more credit to the economy. In addition, we assess if extended firm borrowing generated increases in employment and fixed capital investment. Building on a specification design implemented by Rodnyansky and Darmouni (2017) and Luck and Zimmermann (2020), our analysis is divided in two stages. First, we test if a treatment group of banks loaned more to the real economy during the APP and PEPP programs. The treatment groups in this section will be the 50th and 75th percentile of banks with the largest share of government debt securities to total assets. Figure 7 and table VI in the Appendix shows the average exposure to government debt securities to total assets for the treatment and control groups. The period used for the APP is from 2012 to 2018 and the period used for the PEPP is 2019 and 2020. Specification (1) represents the baseline difference-in-differences for the bank-level data:

$$y_{bt} = \beta\left(\mathrm{Treat}_b^{(j)} \times \mathrm{LSAP}_t^{(j)}\right) + \Theta X_{bt}^{(k)} + \phi X_{bt}^{(k)} \mathrm{LSAP}_t^{(j)} + \lambda_b + \tau_t + \epsilon_{bt} \qquad (1)$$

where y_{bt} is the outcome variable, the growth of loans of bank b at time t ($\Delta\log(Loans)$). The outcome variable will also take the form of loans over assets growth of bank b at time t $\left(\Delta \frac{Loans}{Total\ Assets}\right)$, to test if there was a balance sheet shift by banks towards loans. $Treat_b^{(j)}$ represents a binary variable equal to 1 for the treatment group and zero otherwise. $LSAP_t^{(j)}$ is a binary variable equal to 1 for the period after the announcement of program j and 0 otherwise. $X_{bt}^{(k)}$ is a vector of k bank-level controls. To account for potential changes in the relationship of controls after LSAP programs, the controls are interacted with the event dummy variable. λ_b represents firm fixed effects and τ_t represents time fixed effects. Standard errors are clustered at the bank level.

An additional specification for the bank-level data, equation 2, will test the exposure of the banking sector in the various Euro area countries and how it affected the various outcome variables.

$$y_{bt} = \beta\left(Exposure_b^{(j)} \times LSAP_t^{(j)}\right) + \Theta X_{bt}^{(k)} + \phi X_{bt}^{(k)} LSAP_t^{(j)} + \lambda_b + \tau_t + \epsilon_{bt} \qquad (2)$$

where the exposure will equal the ratio of government debt securities relative to total assets in the year-end reporting before the announcement of program j of bank b: $Exposure_b^{(j)} = \left(\frac{Gov.Debt\ Securities}{Total\ Assets}\right)_b^{(j)}$. For the APP program, the exposure used is year-end 2014 and for the PEPP is year-end 2019. Similar to equation (1), $LSAP_t^{(j)}$ is a binary variable equal to 1 after the announcement of program j and 0 otherwise. $X_{bt}^{(k)}$ is vector of k bank-level controls, the same as in the previous specification. The controls are interacted with the event dummy variable.

In the second stage, if indeed a portfolio rebalancing channel is verified in the first stage, we use a similar panel framework but with firm-level data. We will test if borrowing growth translated into employment growth and fixed capital investment growth before and after the LSAP programs by interacting loan growth with the APP dummy (equation 3). If this variable is negative, then loans generated less employment and fixed capital investment growth after the LSAP program, deeming the bank lending channel less effective. We also test if corporates, in countries where banks are more exposed to government debt securities, experienced larger growth in borrowing, employment, and fixed capital investment versus the control group (equation 4). In addition, we will test if larger firms had lower bank borrowing growth than smaller firms as they are more dependent on bank lending (equation 5). We consider large firms having 500 employees or more.

$$y_{ft} = \beta\left(\Delta Log(Loans)_{ft} \times LSAP_t^{(j)}\right) + \Theta X_{ft}^{(k)} + \phi X_{ft}^{(k)} LSAP_t^{(j)} + \lambda_f + \tau_t + \epsilon_{ft} \qquad (3)$$

$$y_{ft} = \beta\left(Treat\_Country_f \times LSAP_t^{(j)}\right) + \Theta X_{\mathrm{ft}}^{(\mathrm{k})} + \phi X_{\mathrm{ft}}^{(\mathrm{k})} LSAP_t^{(j)} + \lambda_f + \tau_t + \epsilon_{ft} \quad (4)$$

$$y_{ft} = \beta\left(Treat\_Large_f \times LSAP_t^{(j)}\right) + \Theta X_{ft}^{(k)} + \phi X_{ft}^{(k)} LSAP_t^{(j)} + \lambda_f + \tau_t + \epsilon_{ft} \quad (5)$$

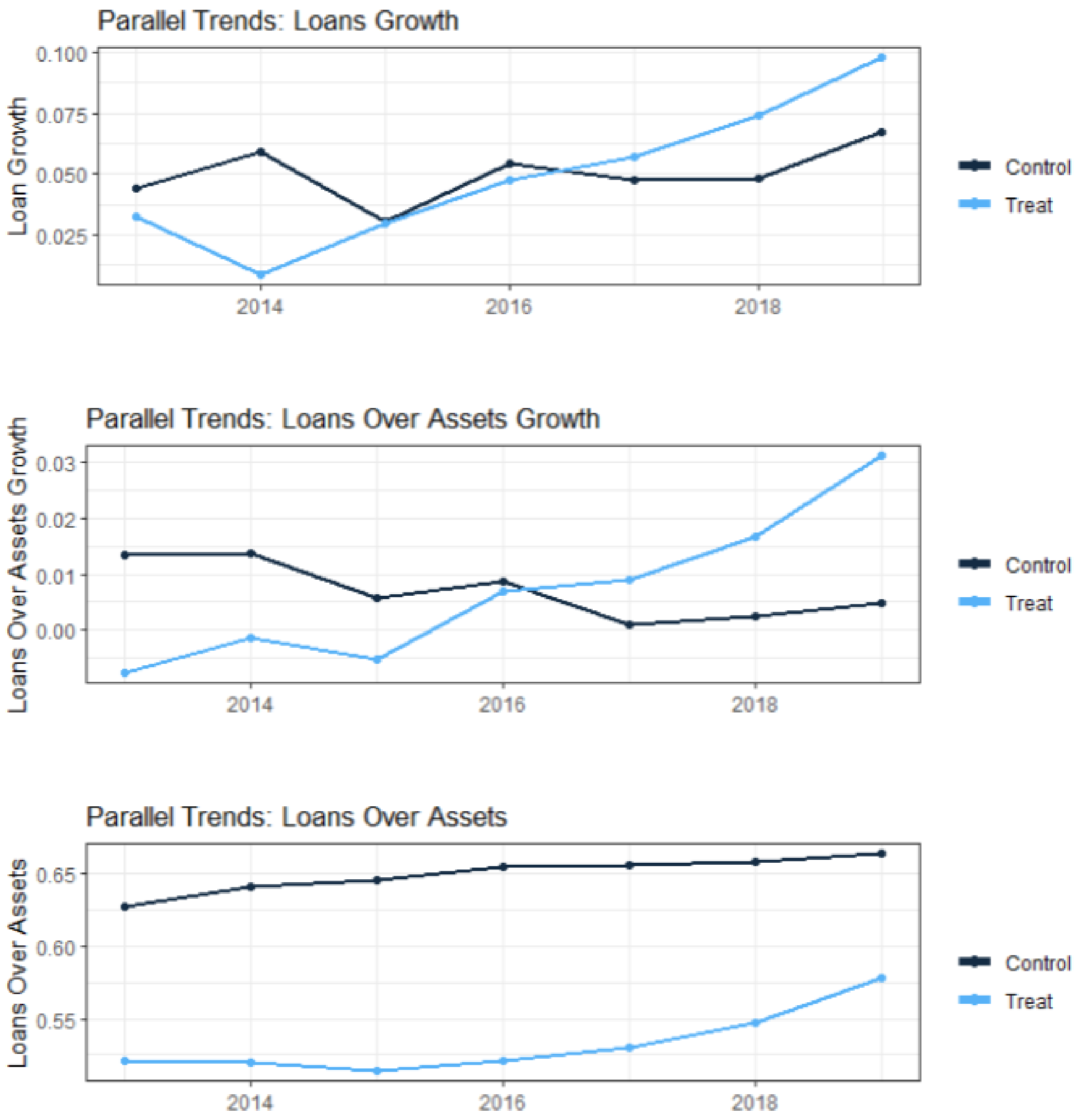
where the outcome variables y_{ft} are growth of loans, growth of employees, and growth of fixed assets for firm f at time t. Treat_Country will represent a binary variable equal to 1 for firms in countries with banks more exposed to government debt securities (Slovenia, Slovakia, Italy, Spain, Portugal, and Belgium) and zero otherwise. Treat Large will represent a binary variable equal to 1 for firms with more than 500 employees in 2014 and 0 otherwise. $LSAP_t^{(j)}$ will represent a binary variable equal to 1 for the period after the announcement of program j and 0 otherwise. $X_{\mathrm{ft}}^{(\mathrm{k})}$ is a vector of k firm-level controls. To account for potential changes in the relationship of controls after LSAP programs, controls are interacted with the event dummy variable. λ_f represents firm fixed effects and τ_t represents time fixed effects. Standard errors are clustered at the firm level.

The firm-level dataset includes companies from 12 countries. The countries that comprise the treatment group are Slovenia, Slovakia, Italy, Spain, Portugal, and Belgium. The control group is Estonia, Finland, France, Germany, Greece, and Ireland. Seven Euro area countries were not included due to non-available data: Austria, Cyprus, Lithuania, Luxembourg, Latvia, Malta, and the Netherlands. The regression period used for the APP program will be 2013 to 2018 to allow first difference of growth variables as the earliest available data is from 2012.

To guarantee the validity of the difference-in-differences specification, the verification of the parallel trends assumption between the treatment groups and control groups would be preferable. Using bank-level data, Figure 3 suggests that the treatment group shows a sustained growth of loans and loans over assets for the period after the APP announcement. We can also verify the increase in the exposure to loans by the treatment group since year-end 2015 through year-end 2018. The exposure to loans over total assets increased, on average, over 5 percent during this period.

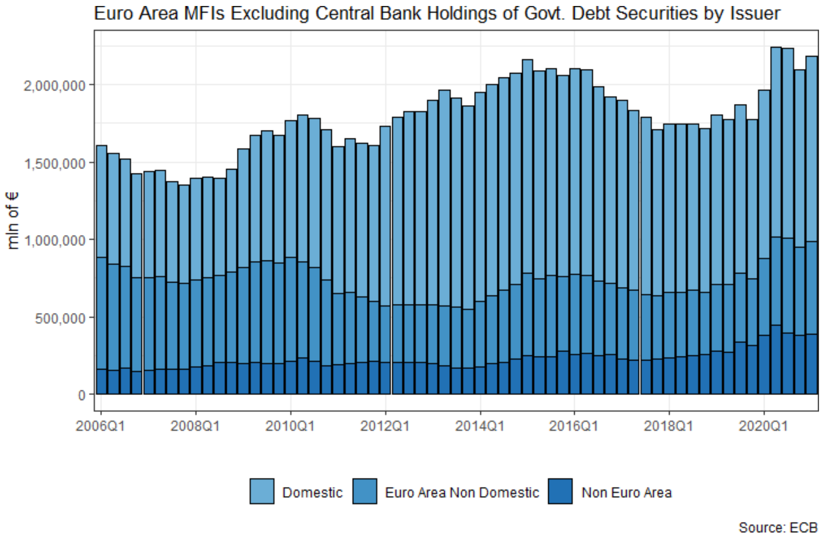
The data on the micro panel has N>T, therefore we deemed a panel fixed effects or random effects approach appropriate. A Hausman test and a Breusch-Pagan Lagrange multiplier test were conducted and it was concluded that a fixed effects model would be the most appropriate model to use. Time fixed effects were included because it would be reasonable that events in this period could affect the lending behavior of all banks, such as improvements in the general European economy for instance. In addition, time dummies proved to be significant justifying its inclusion. To account for potential heteroskedasticity, robust standard errors at the bank/firm level are used. In addition, we're assuming that government debt securities reported in the balance sheet represents mainly Euro area government debt securities, which is a realistic assumption looking at aggregated data from the ECB database. Most government debt securities reported in the balance sheet of banks in the Euro area are domestic and Euro area government debt securities as shown in Figure 4.

FIGURE 3: *This graph shows the average growth of loans and loans over assets for banks in the Euro area. The treatment group is the* 50^{th} *percentile of banks with the largest exposure to government debt securities*



Source: Bank Focus and Authors' Calculations

FIGURE *4*



5. Empirical Analysis

5.1. Overview of Data

We use a sample dataset from Bureau van Dijk Bank Focus and Orbis Europe database. This dataset provides yearly balance sheet data at the bank and firm level. We employ a difference-in-differences specification where our treatment variables are the 50th and 75th percentile of banks with larger holdings of government debt securities relative to total assets. We test the portfolio-rebalancing channel for government debt securities by assessing if these banks loaned more to the real economy after the APP and PEPP. Then, using individual data on corporates, we assess if firm borrowing was put towards employment and investment before and after the programs. In addition, we check if firms in countries where banks were more exposed to government debt securities increased borrowing, employment, and fixed capital investment versus firms from countries with less exposed banks. Geographical areas where banks loaned more could have experienced larger economic impacts through the bank-lending channel. Rodnyansky and Darmouni (2017) and Luck and Zimmermann (2020) make compelling cases for this phenomenon in the US with mortgage-backed securities (MBS). Lastly, we also test if larger firms borrowed less after LSAP programs as argued by Duygan-Bumpa et al. (2015), Arce et al. (2017), Betz and De Santis (2019), and De Santis and Zaghini (2021).

Our results suggest that banks with a larger share of government debt securities relative to total assets had higher loan growth and loans over assets growth than less exposed banks after the APP, but not after the PEPP. We suggest that perhaps a flight-to-quality effect could be diminishing the portfolio-rebalancing channel for government debt securities, however we do not delve deeply in answering this question, leaving it for future research. We offer this suggestion based on conclusions of other researchers that a flight-to-quality phenomenon took place during the COVID-19 pandemic (Papadamou et al., 2021), and also because we verified an increase in the aggregated exposure to government debt securities by banks in the Euro area from 4.52% in Q4:2019 to 4.88% in Q4:2020 (see figure 6 and table V in the Appendix). Comparing this to the APP period, we see that banks reduced exposure to government debt securities from 5.96% in Q4:2014 to 4.52% in Q4:2019.

Regarding the analysis at the firm-level, firms that borrowed more after the APP seem to put it towards employment and fixed capital investment, however to a lower degree than before the APP program. Firms from countries with more exposed banks also had higher growth in borrowing and in fixed capital investment versus firms in countries with less exposed banks. Finally, we find that larger firms (500 employees or more) had lower borrowing growth than smaller firms. The main conclusions, which are in line with the literature on the subject, are that the balance sheet composition of banks is an important determinant for the portfolio-rebalancing channel of monetary policy transmission. This phenomenon could lead to heterogeneous economic impacts depending on the geographical location of more exposed banks.

5.2. APP

5.2.1. Banks

The regression results of equation 1 and 2 for the period 2012 through 2018 covering the APP are shown in Table II. The main conclusions are that the 50th and 75th percentile of banks with the highest exposure to government debt securities had a higher growth in loans of about 3.32% and 5.33% respectively relative to the control group. Both results are statistically significant at the 1% level. Regarding the balance sheet shift towards loans, banks from the 50th percentile treatment group had, on average, a larger growth of loans over assets of 2.50% compared to the control group and the 75th percentile treatment group had, on average, 4.15% higher growth than the control group, both results being statistically significant at the 1% level. The fact that the 75th percentile coefficient was larger than the 50th percentile for both loans and loans over assets is an argument in favor of the hypothesis that banks more exposed to government debt securities did extend more credit in the form of loans after the APP. This relationship might not be verified in other programs, as we will see in the PEPP program.

TABLE *II: This table shows the regression results of equation 1 and 2 using micro panel data constructed from the Bureau van Dijk Bank Focus database, covering the APP. The treatment groups are the* 50^{th} *and the* 75^{th} *percentile of banks with the largest exposure of government securities to total assets.The Exposure variable represents the ratio of government debt securities to total assets in 2014.*

Dependent Variables:		log(Loans)			$\Delta Log(Loans)$			$\Delta \frac{Loans}{TotalAssets}$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables									
Log(Total Assets)	0.8076***	0.8194***	0.8192***	0.2268***	0.2319***	0.2317***	-0.0084	-0.0023	-0.0025
	(0.0808)	(0.0817)	(0.0808)	(0.0498)	(0.0502)	(0.0493)	(0.0097)	(0.0119)	(0.0112)
$\frac{Deposits}{TotalAssets}$	-0.0006	0.1388	0.1084	0.2962***	0.3400***	0.3039***	0.1194***	0.1821***	0.1533***
	(0.1942)	(0.1568)	(0.1675)	(0.1134)	(0.1099)	(0.1127)	(0.0334)	(0.0385)	(0.0369)
$\frac{Equity}{TotalAssets}$	0.8362**	0.8528**	0.8602**	0.4029***	0.4193***	0.4282***	0.1112*	0.1244*	0.1316**
	(0.4136)	(0.4025)	(0.4074)	(0.1493)	(0.1524)	(0.1495)	(0.0567)	(0.0636)	(0.0577)
ROA	-1.815***	-2.009***	-2.046***	2.562***	2.461***	2.418***	0.3600	0.2528	0.2182
	(0.6989)	(0.7152)	(0.7273)	(0.6427)	(0.6367)	(0.6319)	(0.2367)	(0.2545)	(0.2521)
Log(Total Assets) × APP	0.0049	0.0021	0.0032	-0.0030	-0.0055**	-0.0043*	-0.0012*	-0.0033***	-0.0024***
	(0.0044)	(0.0041)	(0.0041)	(0.0024)	(0.0025)	(0.0024)	(0.0007)	(0.0010)	(0.0009)
$\frac{Deposits}{TotalAssets}$ × APP	0.1452*	0.0953	0.1072	-0.0990***	-0.1190***	-0.1049***	-0.0087	-0.0333***	-0.0222**
	(0.0859)	(0.0733)	(0.0771)	(0.0363)	(0.0349)	(0.0360)	(0.0089)	(0.0120)	(0.0108)
$\frac{Equity}{TotalAssets}$ × APP	-0.6468**	-0.6636**	-0.6290**	-0.3678**	-0.3969**	-0.3563**	-0.0511	-0.0707	-0.0400
	(0.2971)	(0.3048)	(0.2940)	(0.1741)	(0.1770)	(0.1734)	(0.0671)	(0.0758)	(0.0712)
ROA × APP	4.360**	4.355**	4.412**	0.8174	0.8893	0.9583	0.2455	0.2801	0.3370
	(1.909)	(1.997)	(1.982)	(1.616)	(1.657)	(1.623)	(0.4341)	(0.4931)	(0.4713)
Exposure × APP	0.4463**			0.1984***			0.2301***		
	(0.2197)			(0.0519)			(0.0217)		
$Treat 50^{th} perc.$ × APP		0.0284			0.0332***			0.0250***	
		(0.0174)			(0.0102)			(0.0035)	
$Treat 75^{th} perc.$ × APP			0.0451			0.0533***			0.0415***
			(0.0301)			(0.0119)			(0.0048)
Fixed-effects									
bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks	524	524	524	524	524	524	524	524	524
Fit statistics									
Observations	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668
R^2	0.99656	0.99645	0.99646	0.29877	0.29606	0.29903	0.24587	0.18573	0.20488
Within R^2	0.40049	0.38226	0.38367	0.07673	0.07317	0.07707	0.13238	0.06319	0.08522

Clustered (bank) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Other relevant conclusions are that bank size, as measured by total assets, is correlated with loan growth during the full period under analysis. The interaction total assets times the APP dummy variable is negative for both the growth of loans and loans over assets which suggests that large size, as measured by total assets, was not as important for determining loan growth after the APP. Banks with more deposits relative to total assets are correlated with the growth of loans and loans over assets. The interaction of deposits over assets times the APP dummy variable is also negative for both the growth of loans and loans over assets. Banks' capitalization, as measured by equity over assets, is correlated with an increase in loan growth and growth of loans over assets. The interaction equity over assets times the APP dummy variable is negative for loan growth, which suggests that less capitalized banks had higher loan growth compared to the period before the APP. This result is in line with Jiménez et al. (2014). Lastly, banks' profitability, as measured by ROA, is correlated with an increase in loan growth for the full period.

To confirm these initial results, we conduct a similar analysis with aggregated yearly data from the ECB database[1]. We now estimate a similar equation 1 and 2, but now the data and controls are at the country-level. The advantages of this strategy are threefold; first, we can double-check our results with another, unrelated dataset. Second, we have more details that allows us to potentially draw further conclusions (e.g., classifications of loans to households and corporations). Third, under this specification we can control for the TLTRO undergoing during the period by including NCB lending to MFIs. The downside is that this specification has fewer observations and is more naïve. The dataset includes 17 Euro area countries. The treatment group is comprised by eight countries with banking industries most exposed to Euro area government debt securities relative to total assets (Slovenia, Slovakia, Italy, Spain, Portugal, Belgium, Ireland, and Luxembourg) versus the control group (Austria, Cyprus, Estonia, Germany, Finland, France, Greece, Malta, and the Netherlands). Latvia and Lithuania were not included because they only joined the Euro area in January 2014 and January 2015 respectively. The period used in this analysis is also yearly, from 2012 to 2018.

The results are shown in table VIII and IX in the Appendix. The conclusions drawn are similar to the micro panel. The results show that the treatment group had a statistically significant larger growth in loans and loans over assets relative to the control group. More exposed countries had larger significant growth in loans to non-financial corporations than to households compared to the control group. These results, similarly to the micro panel, suggest the presence of a portfolio-rebalancing channel for government debt securities after the APP.

We have conducted an event study with the micro panel data to understand how loan growth and loans over assets growth evolved over time. We estimate equation 6.

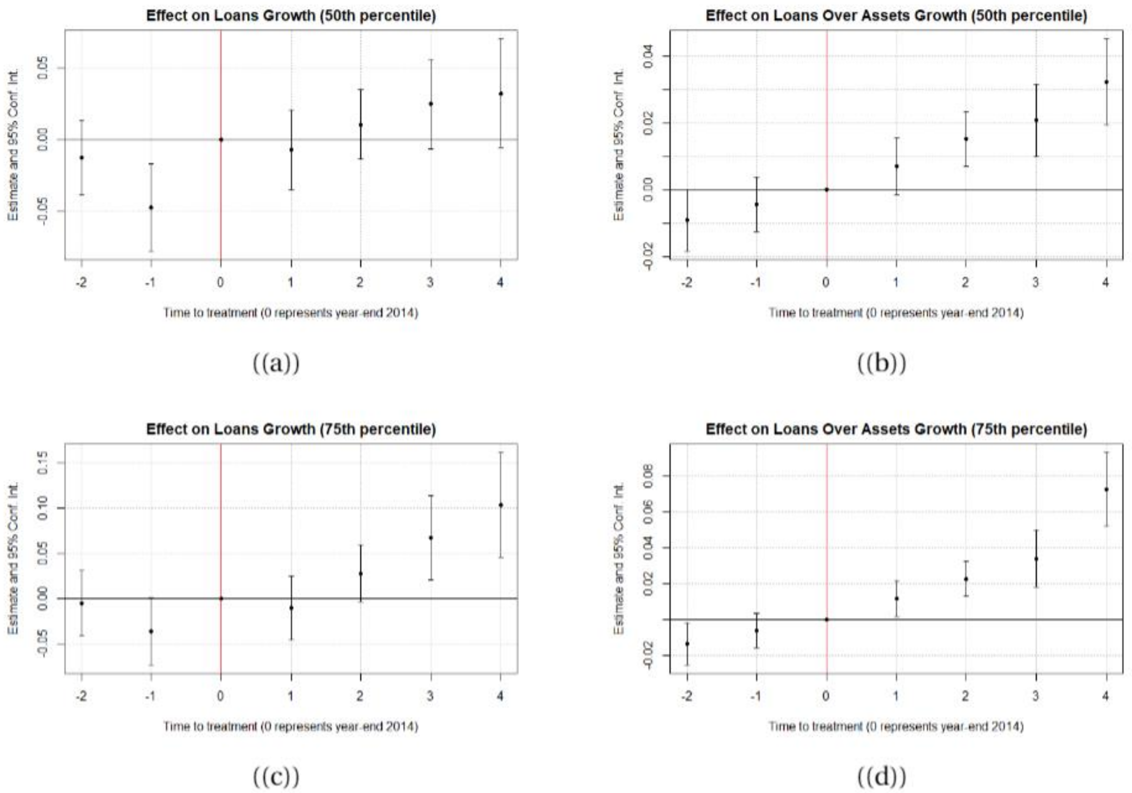
$$y_{bt} = \sum_{t=-2}^{-1} \beta_t TreatTime_{tb} + \sum_{t=1}^{4} \beta_t TreatTime_{tb} + \phi X_{bt}^{(k)} + \lambda_b + \tau_t + \epsilon_{bt} \qquad (6)$$

where y_{bt} is the outcome variable growth of loans and growth of loans over assets. We define$\mathrm{TreatTime}_{\mathrm{tb}} = Treat_b \times Time_Period_t$, where $Treat_b$ will equal 1 for banks in the treatment group and zero otherwise, and $Time\_Period_t$ will equal 1 if we are in time period t and zero otherwise. The coefficient $\beta_{t=0}$ will represent year-end 2014 and will be specified to zero, the remaining coefficients will be compared to this reference point. One of the time

[1] We also estimated the model with quarterly data and obtained same general results, the coefficients of interests showing a 5% significance level. Data and results available upon request.

coefficients will need to be set to zero because of multicollinearity. Figure 5 and Table VII (in the Appendix) shows the results obtained. From this specification we see that the coefficients become increasingly statistically significant after time zero (Q4:2014) and positive. We also verify that the impact in loan growth was not immediate but increased over time.

FIGURE 5*: These 4 figures plot the time coefficients of specification 6.*



5.2.2. Corporates

A sample comprising of 83,623 companies in the Euro area is retrieved from the Bureau van –ijk - Orbis Europe database and is used to understand the impact of the APP at the firm level. This dataset will allow us to test if borrowing growth translated into employment and fixed capital investment growth before and after the APP. Bank's exposure to government debt securities in each country is calculated with aggregated data from the ECB and shown in Table V in the Appendix. Our dataset from the Bureau van Dijk – Orbis Europe includes companies from 12 countries. The countries that comprise the treatment group are Slovenia, Slovakia, Italy, Spain, Portugal, and Belgium. The control group is Estonia, Finland, France, Germany, Greece, and Ireland. Seven Euro area countries were not included due to non-available data: Austria, Cyprus, Lithuania, Luxembourg, Latvia, Malta, and the Netherlands. This specification will allow us to assess how efficient was borrowing after the APP by interacting loan growth with the APP dummy. We will also test if larger firms borrowed less compared to smaller firms after the APP, as argued by Betz and De Santis (2019), Arce et al. (2017), and De Santis and Zaghini (2021).

Before proceeding to the results, an important assumption that needs to be made to validate our hypothesis is that the increase in loans was contributed by an increase in the supply of loans and not due to an increase in the demand for loans, an issue also highlighted by Luck and Zimmermann (2020). To ensure this is indeed the case, figure 8 in Appendix plots the interest rate minus euribor rate, which can be a proxy for banks' profit margin on loans. This indicator has been steadily decreasing since mid-2012. This simple formulation provides some evidence that loan growth could be mostly explained by an increased supply of loans rather than demand. Another important assumption is that markets are local, that is that commercial banks provide loans mainly to their domestic market and less to foreign markets, which we assume a sensible assumption.

Table III shows the results from the regression of firms growth in loans, employment and fixed assets (equations 3, 4, and 5). There are five main conclusions drawn and some accessory ones. Enumerating the main conclusions: First, an increase in loans is correlated with an increase in employment as expected, however the coefficient of the interaction Δlog (Loans) × APP is negative, suggesting that loans generated less employment growth after the APP announcement albeit still positive. The growth in employment explained by increased borrowing is significantly lower than before the APP.

Second, an increase in loans is correlated with an increase in fixed capital investment, however, similar to the case for employment, the coefficient of the interaction Δlog (Loans) × APP is negative, suggesting that loans generated less fixed capital investment after the APP albeit still positive and large.

Third, firms in countries with more exposed banks had higher borrowing growth than the control group after the announcement of the APP, as expected ex ante. However, it is important to mention that overall aggregate bank loans to the corporate sector remained stable or decreased during this period. The increase in aggregate bank loans relative to total assets was mainly to households (see figure 6). The finding that banks more exposed to government debt securities extended more credit to corporates than households is corroborated by the conclusions from the bank aggregate data analysis from tables X and XI (in the Appendix).

TABLE *III: This table shows the regression results of equations 3, 4, and 5 with firm-level data for the APP program from 2013 to 2018. The treatment group is comprised by firms in countries with banks more exposed to government debt securities, namely Slovenia, Slovakia, Italy,Spain, Portugal, and Belgium, the control group is comprised by companies in Estonia, Finland,France, Germany, Greece, and Ireland. The Large dummy variable will equal 1 for firms with 500employees of more.*

Dependent Variables:		$\Delta log(loans)$			$\Delta log(Employees)$			$\Delta log(FixedAssets)$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables									
Log(total_assets)	0.4217***	0.4222***	0.4216***	-0.1370***	-0.1347***	-0.1347***	0.3067***	0.3213***	0.3208***
	(0.0094)	(0.0094)	(0.0093)	(0.0031)	(0.0030)	(0.0030)	(0.0064)	(0.0063)	(0.0063)
$\frac{Equity}{TotalAssets}$	-0.0003	-0.0003	-0.0003	-0.0008	-0.0007	-0.0008	-0.0090***	-0.0107***	-0.0104***
	(0.0022)	(0.0021)	(0.0022)	(0.0021)	(0.0021)	(0.0021)	(0.0034)	(0.0037)	(0.0036)
ROA	-0.0044	-0.0045	-0.0045	0.0038	0.0036	0.0037	0.1529***	0.1465***	0.1480***
	(0.0066)	(0.0066)	(0.0066)	(0.0061)	(0.0061)	(0.0061)	(0.0382)	(0.0349)	(0.0357)
$\frac{FixedAssets}{TotalAssets}$	0.1786***	0.1752***	0.1777***	-0.0121*	-0.0116*	-0.0109	1.746***	1.745***	1.750***
	(0.0238)	(0.0239)	(0.0238)	(0.0067)	(0.0067)	(0.0067)	(0.0169)	(0.0169)	(0.0169)
Log(employees)	-0.0339***	-0.0353***	-0.0350***	0.5443***	0.5436***	0.5442***	-0.0426***	-0.0461***	-0.0438***
	(0.0073)	(0.0073)	(0.0073)	(0.0046)	(0.0046)	(0.0046)	(0.0040)	(0.0041)	(0.0041)
Log(total_assets) × APP	0.0004	0.0002	0.0004	0.0120***	0.0120***	0.0120***	-0.0027**	-0.0030**	-0.0028**
	(0.0022)	(0.0022)	(0.0022)	(0.0008)	(0.0008)	(0.0008)	(0.0012)	(0.0012)	(0.0012)
$\frac{Equity}{TotalAssets}$ × APP	-4.96×10^{-6}	-2.95×10^{-5}	-4.43×10^{-5}	0.0009	0.0008	0.0008	0.0034*	0.0044**	0.0040**
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0020)	(0.0020)	(0.0019)
ROA × APP	0.0025	0.0026	0.0026	-0.0034	-0.0033	-0.0033	-0.0707***	-0.0690***	-0.0709***
	(0.0066)	(0.0066)	(0.0066)	(0.0061)	(0.0061)	(0.0061)	(0.0164)	(0.0164)	(0.0163)
$\frac{FixedAssets}{TotalAssets}$ × APP	0.0115	0.0149	0.0126	-0.0034	-0.0031	-0.0038	-0.0799***	-0.0751***	-0.0802***
	(0.0106)	(0.0107)	(0.0106)	(0.0034)	(0.0034)	(0.0034)	(0.0057)	(0.0058)	(0.0057)
Log(employees) × APP	-5.57×10^{-5}	0.0010	0.0016	-0.0238***	-0.0237***	-0.0245***	-0.0017	-0.0004	-0.0025
	(0.0029)	(0.0029)	(0.0030)	(0.0010)	(0.0010)	(0.0011)	(0.0015)	(0.0015)	(0.0015)
Treat country × APP		0.0230***			0.0022			0.0280***	
		(0.0064)			(0.0019)			(0.0032)	
Large dummy × APP			-0.0448*			0.0184**			0.0199**
			(0.0268)			(0.0073)			(0.0080)
$\Delta log(loans)$				0.0153***			0.0477***		
				(0.0008)			(0.0017)		
$\Delta log(loans)$ × APP				-0.0108***			-0.0191***		
				(0.0010)			(0.0019)		
Fixed-effects									
company	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firms	83,623	83,623	83,623	83,623	83,623	83,623	81,938	81,938	81,938
Fit statistics									
Observations	501,738	501,738	501,738	501,738	501,738	501,738	491,628	491,628	491,628
R^2	0.08678	0.08681	0.08679	0.35767	0.35653	0.35655	0.25884	0.25293	0.25276
Within R^2	0.00905	0.00907	0.00905	0.25145	0.25012	0.25014	0.12953	0.12259	0.12240

Clustered (company) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Fourth, firms in countries with more exposed banks did not have higher employment growth but did have higher fixed capital investment growth than the control group.

Fifth, the coefficient of large firms' dummy variable is negative, meaning that the growth in borrowing was lower versus smaller firms (we classified large firms as having 500 or more employees). This result is in line with Duygan-Bumpa et al. (2015), Arce et al. (2017), Betz and De Santis (2019), and Gertler and Gilchrist (1994). Larger firms had higher growth in employment and fixed capital investment versus smaller firms after the APP. Larger firms could, theoretically, have easier access to market financing, thus their investments would not be hampered by the reduction in bank loans compared to smaller firms.

Other important conclusions are that the size of the firm, as measured by total assets, is statistically significant in predicting loan growth, employee growth, and fixed assets growth. The amount of employees is statistically significant in predicting borrowing growth, the coefficient being negative and statistically significant at the 1% level. This result is consistent with the large dummy variable coefficient result. The coefficient regarding the degree of capitalization (as measured by equity over assets) for fixed assets growth is negative and statistically significant at the 1%, albeit very small. The coefficient regarding profitability (as measured by return on assets) is positive and statistically significant at the 1% level for fixed assets growth. The majority of interactions of the controls with the APP dummy were not significant suggesting there was not any large change in the relationship of these variables after the APP.

5.3. PEPP

5.3.1. Banks

The same exercise done for the APP is also performed for the PEPP with a sample of 1,082 Euro area banks. The analysis is conducted for two periods, 2019 and 2020. Year-end 2019 represents the period before the treatment and year-end 2020 the period after the treatment. It should be noted that by year-end 2020 the pandemic was still ongoing and perhaps this shorter time span might still not be fully representative of the whole effects, nevertheless it can serve as an indication of the effects one year after the program.

Table IV shows the regression results of equation 1 and 2. The main conclusions are that banks with a higher proportion of government securities in their balance sheet, contrary to the APP program, did not have higher loan growth than the control group after the PEPP. In fact, the results suggest that there was a reduction in the loans over total assets. The COVID-

19 pandemic was a very uncertain period and perhaps a flight-to-quality mechanism was taking place (Papadamou et al., 2021). Under a flight-to-quality scenario, there is less appeal for riskier assets and an increased appeal for safer assets, deeming the portfolio-rebalancing channel ineffective for Euro area government securities. Indeed, banks' exposure to government debt securities relative to total assets increased from 4.52% on Q4:2019 to 4.88% on Q4:2020 (see table V and figure 6 in the Appendix). If a reduction in exposure to government debt securities by banks is not verified taken together, then a portfolio rebalancing is not expected ex ante. Given this conjecture, we leave for future research to assess in more rigorous detail if indeed a flight-to-quality happened during the PEPP program. We also note that the exposure to government debt securities right before the PEPP was significantly lower than for the APP (figure 7 and table VI in the Appendix). If banks were less exposed in general, there was less room for portfolio rebalancing.

TABLE IV: *This table shows the regression results of equation 1 and 2 for the PEPP using a sample of 1,082 banks from the Bureau van Dijk - Bank Focus database. The treatment groups are the* 50^{th} *and the* 75^{th} *percentile of banks with the largest exposure of government securities to total assets in year-end 2019. In this analysis we are assessing if banks more exposed to government debt securities loaned more after the PEPP.*

Dependent Variables:	$log(Loans)$			$\Delta log(Loans)$			$\Delta \frac{Loans}{Total\ Assets}$		
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables									
$log(Total\ Assets)$	0.8754***	0.8763***	0.8759***	0.5816***	0.5792***	0.5790***	-0.0704*	-0.0739*	-0.0727*
	(0.0631)	(0.0629)	(0.0630)	(0.1029)	(0.1022)	(0.1021)	(0.0398)	(0.0399)	(0.0396)
$\frac{Deposits}{Total\ Assets}$	0.0188	0.0183	0.0214	0.5049**	0.5131**	0.5065**	0.0972	0.0949	0.0925
	(0.1058)	(0.1056)	(0.1055)	(0.2394)	(0.2402)	(0.2366)	(0.0607)	(0.0606)	(0.0602)
$\frac{Equity}{Total\ Assets}$	0.9573	0.9548	0.9628	1.699	1.728	1.708	0.9344***	0.9317***	0.9272***
	(0.7955)	(0.7970)	(0.7952)	(1.468)	(1.465)	(1.466)	(0.3408)	(0.3417)	(0.3407)
ROA	0.1772	0.1774	0.1785	3.200***	3.195***	3.198***	0.5879***	0.5896***	0.5841***
	(0.2016)	(0.2018)	(0.2015)	(0.5618)	(0.5593)	(0.5657)	(0.0767)	(0.0765)	(0.0773)
$log(Total\ Assets)$ × PEPP	-0.0077***	-0.0077***	-0.0078***	-0.0084*	-0.0087*	-0.0084*	-0.0013	-0.0010	-0.0011
	(0.0018)	(0.0018)	(0.0018)	(0.0047)	(0.0048)	(0.0047)	(0.0008)	(0.0009)	(0.0009)
$\frac{Deposits}{Total\ Assets}$ × PEPP	-0.0637*	-0.0648*	-0.0630*	-0.0878	-0.0821	-0.0843	-0.0130	-0.0098	-0.0126
	(0.0348)	(0.0342)	(0.0341)	(0.0727)	(0.0736)	(0.0746)	(0.0092)	(0.0092)	(0.0091)
$\frac{Equity}{Total\ Assets}$ × PEPP	0.1860	0.1858	0.1867	-0.4625	-0.4632	-0.4624	-0.0256	-0.0240	-0.0272
	(0.1718)	(0.1721)	(0.1718)	(0.7007)	(0.7000)	(0.7035)	(0.0500)	(0.0503)	(0.0502)
ROA × PEPP	-0.2181	-0.2219	-0.2169	0.6514	0.6773	0.6649	-0.0592	-0.0524	-0.0552
	(0.2244)	(0.2253)	(0.2244)	(1.229)	(1.263)	(1.256)	(0.0770)	(0.0752)	(0.0761)
Exposure × PEPP	0.0153			-0.0526			-0.0585**		
	(0.0331)			(0.1945)			(0.0244)		
$Treat50^{th}$ × PEPP		0.0004			0.0056			-0.0058**	
		(0.0044)			(0.0117)			(0.0025)	
$Treat75^{th}$ × PEPP			0.0045			-0.0017			-0.0103***
			(0.0058)			(0.0188)			(0.0032)
Fixed-effects									
company	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks	2,164	2,164	2,164	2,164	2,164	2,164	2,164	2,164	2,164
Fit statistics									
Observations	4,328	4,328	4,328	4,328	4,328	4,328	4,328	4,328	4,328
R^2	0.99928	0.99928	0.99928	0.62089	0.62084	0.62080	0.59729	0.59580	0.59738
Within R^2	0.43605	0.43598	0.43620	0.08696	0.08685	0.08675	0.12156	0.11830	0.12175

Clustered (company) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Other important results are that larger banks, as measured by total assets, had larger growth of loans. Banks with a larger ratio of deposits to total assets had larger growth of loans. More capitalized banks, as measured by equity over assets, had larger growth of loans over assets, the coefficient being statistically significant at the 1% level. More profitable banks, proxied by return on assets, had larger growth of loans and loans over assets, the results being statistically significant at the 1% level. Most of the interaction coefficients are not statistically significant, except for the interaction of total assets times the PEPP dummy variable to explain loan growth, however the coefficient is small and only statistically significant at the 10% level. The low significance of the interactions signifies that there were no changing characteristics in the growth of loans and loans over assets after the PEPP.

Table X and XI in the Appendix shows the results using aggregated data from the ECB database, similar to the analysis for the APP program, this time using quarterly data[2]. In summary, the results confirm the micro panel analysis. The results suggests that countries with banks more exposed to government debt securities had insignificant higher growth in the sum of loans to households and corporations. When we subdivide loans, the coefficient Treat × PEPP is significant for the growth of loans to corporations, which is indicative that countries with more exposed banks had higher growth than the control group, however the coefficient is only significant at the 10% level, therefore we offer some reservations in drawing conclusions in this regard. Given this, we confirm the results from the micro panel and deem that a portfolio-rebalancing channel for government debt securities was not verified for the PEPP program. Figure 6 (in the Appendix) shows a slight decrease in exposure to loans and an increase in the exposure to government and corporate debt securities from year-end 2019 to year-end 2020, which is congruent with our regression results. As we could not verify a portfolio-rebalancing channel for the PEPP program, we will not test the bank-lending channel with corporate data as done for APP.

5.3. Possible improvements

There are a few limitations inherent to our identification strategy and dataset. First, our bank-level micro panel does not have information regarding the types of loans granted by banks (i.e. classification of loans to households or firms) therefore we are only able to test the impact on bank loans in general. To overcome this limitation, we use an aggregated dataset

[2] This regression was also executed using yearly data, the results obtained were similar for the coefficients of interest, that is no significance. Data and results available upon request.

from the ECB database to compare the results obtained using the micro panel, however this analysis is more naive. Second, the dataset does not have information regarding corporate debt securities holdings by banks, therefore we are only able to classify banks based on their exposure to government securities and not exposure to corporate securities. Another limitation of the micro panel is the inability to control for other unconventional monetary policies ongoing during the same period, specifically the TLTRO programs. This could generate problems such as omitted variable bias and endogeneity. In the analysis with aggregated data from the ECB database we control for this variable. Lastly, regarding equation 3, we are assuming that borrowing growth averages for the firms in our sample is representative for the country, which could not be the case.

6. Conclusion

This paper analyzes LSAP (i.e. APP and PEPP) impacts on loans, employment, and fixed capital investment in the Euro area. Using a difference-in-differences specification on a micro panel at the bank-level, we show that banks more exposed to government debt securities had higher growth of loans granted to the economy than less exposed banks after the APP announcement. This result suggests that the asset composition of banks can influence monetary policy transmission to the economy, operating through the portfolio-rebalancing channel. However, this relationship was not confirmed for the PEPP. A possible explanation offered, although not analyzed in rigorous detail in this paper, is a flight-to-quality by banks during the COVID-19 pandemic hence deeming the portfolio-rebalancing channel for safe assets diminished.

If more exposed banks extended more credit after the APP, then economic impacts could be heterogenous depending on the geographical location of these banks. To assess this hypothesis, we used balance sheet data from 83,623 companies from 12 Euro area countries. Our results suggest that firm borrowing growth was correlated with employment and fixed capital investment growth, however with significantly lower magnitude than before the APP announcement. Furthermore, our data shows that firms in countries with more exposed banks had higher borrowing growth versus the control group. Lastly, we find that larger firms (with 500 employees or more), had lower borrowing growth versus smaller firms. These conclusions add to the empirical literature on monetary policy transmission and further informs that the composition of banks' balance sheets matter for monetary policy transmission effectiveness and magnitude.

As suggestions for future research, it could prove interesting to execute a similar analysis but with more granular data, specifically subdividing regions further and including data regarding corporate debt securities to understand how it impacts bank loans. A second suggestion would be to study the refinancing activity of households and firms during this period and understand if the additional disposable income generated additional consumption and investment. Lastly, it could be worthwhile to assess if banks engaged in flight-to-quality during the COVID-19 pandemic.

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Appendix

Euro area MFIs excluding central banks exposure to governmentdebt securities

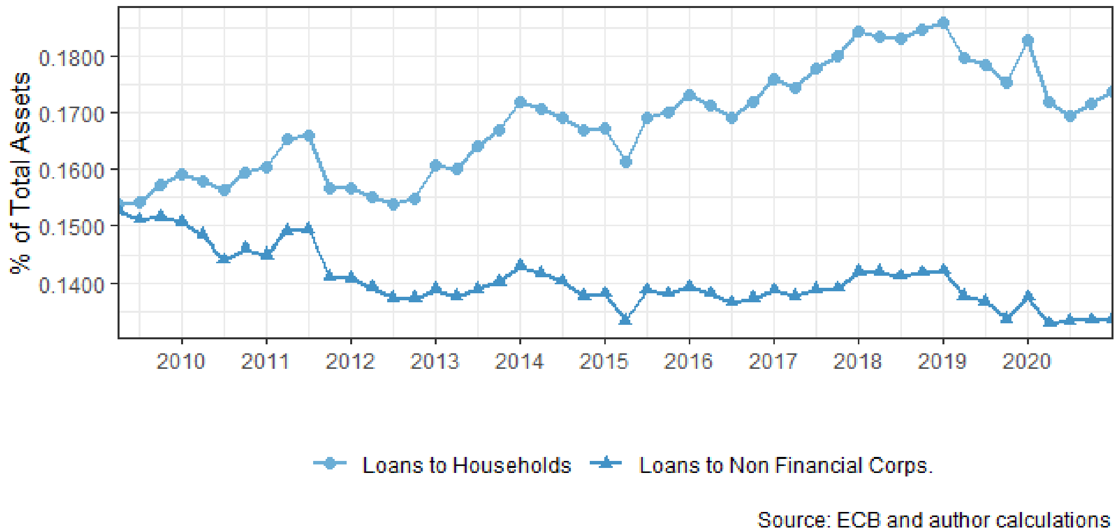
TABLE *V: Percentage of Euro area government debt securities relative to total assets reported by Euro area MFIs excluding central banks*

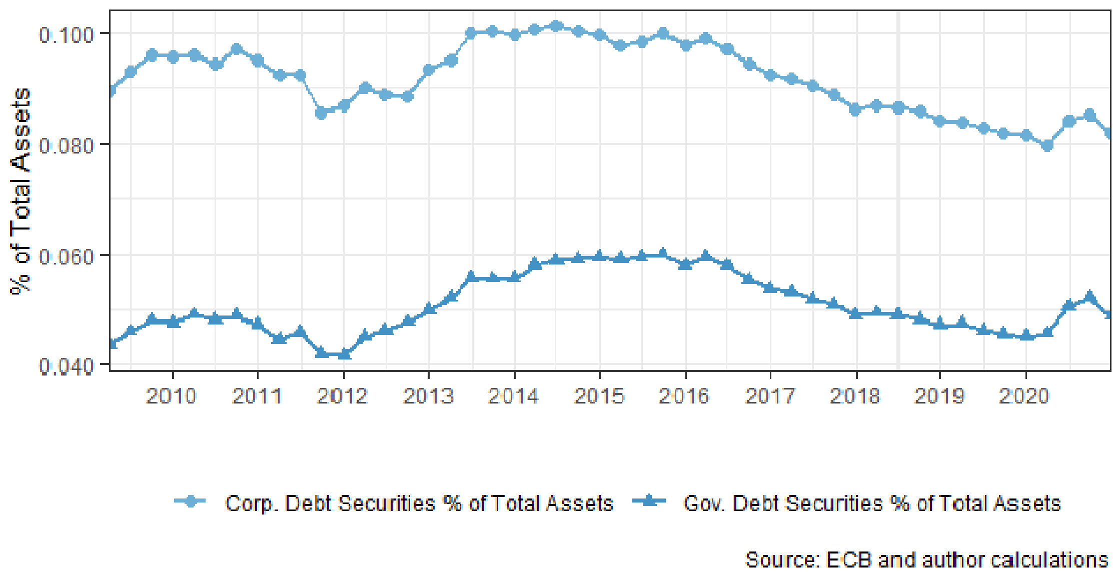
Period	Q4:2010	Q4:2011	Q4:2012	Q4:2013	Q4:2014	Q4:2015	Q4:2016	Q4:2017	Q4:2018	Q4:2019	Q4:2020
Euro Area	4.73%	4.17%	4.98%	5.57%	5.96%	5.80%	5.39%	4.90%	4.72%	4.52%	4.88%
Austria	3.06%	2.78%	3.44%	4.17%	5.87%	5.92%	6.14%	5.52%	4.85%	4.29%	4.16%
Belgium	9.34%	8.61%	8.29%	8.39%	7.79%	8.08%	6.61%	5.99%	5.85%	4.97%	5.93%
Cyprus	11.61%	6.86%	5.06%	5.90%	5.10%	3.35%	3.23%	4.37%	8.88%	8.28%	8.61%
Germany	3.89%	3.51%	4.10%	4.56%	4.66%	4.73%	4.29%	3.85%	3.35%	3.06%	3.05%
Estonia	2.76%	1.46%	0.76%	2.02%	1.98%	0.56%	1.27%	1.22%	1.06%	0.98%	2.02%
Spain	4.90%	5.67%	7.17%	8.70%	10.50%	9.86%	9.41%	9.05%	9.14%	8.37%	8.77%
Finland	1.29%	1.17%	1.44%	2.32%	2.75%	2.65%	2.50%	2.25%	1.36%	1.20%	1.25%
France	4.19%	2.56%	3.28%	3.32%	3.46%	3.08%	2.78%	2.22%	1.89%	1.97%	2.35%
Greece	8.97%	9.65%	4.44%	3.19%	3.17%	3.66%	3.39%	4.78%	5.49%	7.33%	10.54%
Ireland	2.82%	3.49%	4.44%	4.66%	6.65%	6.16%	5.41%	5.24%	5.17%	4.48%	5.82%
Italy	6.50%	6.19%	8.45%	10.15%	10.71%	11.12%	10.91%	10.21%	11.53%	11.93%	12.67%
Lithuania	5.98%	4.27%	4.40%	6.55%	5.84%	6.37%	4.77%	4.14%	3.65%	3.70%	4.09%
Luxembourg	5.75%	5.33%	5.62%	5.26%	6.36%	5.63%	5.06%	4.67%	4.03%	4.06%	5.67%
Latvia	2.85%	2.61%	2.72%	2.54%	2.70%	3.80%	4.78%	4.39%	4.22%	4.19%	7.03%
Malta	5.04%	5.87%	4.05%	4.80%	4.74%	5.72%	5.81%	5.01%	6.08%	7.38%	9.37%
Netherlands	4.51%	3.55%	3.76%	4.36%	4.18%	3.88%	3.57%	3.18%	2.82%	2.49%	2.62%
Portugal	4.84%	4.54%	6.28%	7.26%	8.69%	9.68%	10.52%	11.45%	12.86%	13.54%	14.40%
Slovenia	8.24%	9.22%	9.48%	13.98%	17.31%	17.39%	15.48%	13.16%	13.69%	13.00%	11.80%
Slovakia	21.66%	20.21%	20.27%	18.62%	17.12%	16.49%	14.38%	10.96%	10.11%	9.91%	9.98%

Source: ECB and authors' calculations

Percentage of loans and debt securities relative to total assets

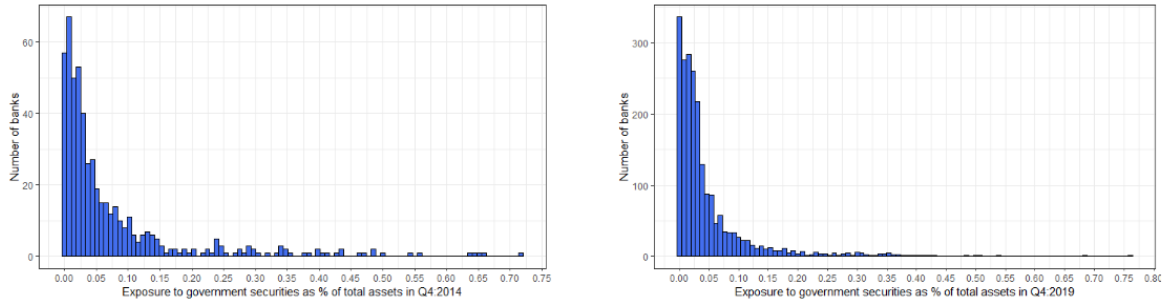
FIGURE 6: *The top graph shows the percentage of loans to households and non-financial corporation relative to total assets reported by Euro area MFIs excluding central banks. The bottom graph shows the amount of corporate debt securities and government debt securities relative to total assets reported by Euro area MFIs excluding central banks.*





Exposure to government debt securities

FIGURE 7: *This figure shows histograms of the exposures to government debt securities from our sample from the Bureau van Dijk - Bank focus database at Q4:2014 (a) and Q4:2019 (b).*



((a)) ((b))

TABLE VI: *This table shows the average exposure to government debt securities to total assets for the treatment and control variables from the bureau van Dijk - bank focus database. The exposure for the APP is at Q4:2014 and the PEPP is at Q4:2019*

Exposure to government debt securities as % of total assets

Treat 50th percentile		
	APP	PEPP
Control	1.3188%	0.9982%
Treatment	13.6239%	8.7647%
Treat 75th percentile		
	APP	PEPP
Control	2.6376%	1.8495%
Treatment	21.9728%	13.9774%

Results event study

TABLE *VII: This table shows the event study results of equation* 6 *using micro panel data at the bank-level. The treatment groups are the* 50^{th} *and the* 75^{th} *percentile of banks with the largest exposure of government securities to total assets. Controls are removed from the table for simplicity; however, they are the same as specifications 1 and 2.*

Dependent Variables:	$\Delta\frac{Loans}{TotalAssets}$		$\Delta Log(Loans)$	
Model:	(1)	(2)	(3)	(4)
Variables				
treat_50 × time_to_treat = -2	-0.0091*		-0.0123	
	(0.0047)		(0.0132)	
treat_50 × time_to_treat = -1	-0.0044		-0.0471***	
	(0.0041)		(0.0155)	
treat_50 × time_to_treat = 1	0.0070		-0.0071	
	(0.0044)		(0.0141)	
treat_50 × time_to_treat = 2	0.0152***		0.0107	
	(0.0042)		(0.0123)	
treat_50 × time_to_treat = 3	0.0207***		0.0251	
	(0.0055)		(0.0160)	
treat_50 × time_to_treat = 4	0.0323***		0.0325*	
	(0.0065)		(0.0194)	
treat_75 × time_to_treat = -2		-0.0135**		-0.0048
		(0.0060)		(0.0184)
treat_75 × time_to_treat = -1		-0.0063		-0.0359*
		(0.0049)		(0.0188)
treat_75 × time_to_treat = 1		0.0117**		-0.0101
		(0.0050)		(0.0180)
treat_75 × time_to_treat = 2		0.0227***		0.0282*
		(0.0051)		(0.0161)
treat_75 × time_to_treat = 3		0.0341***		0.0675***
		(0.0081)		(0.0236)
treat_75 × time_to_treat = 4		0.0727***		0.1037***
		(0.0105)		(0.0296)
Fixed-effects				
bank	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes
Fit statistics				
Observations	3,668	3,668	3,668	3,668
R^2	0.18662	0.23102	0.29342	0.30465
Within R^2	0.06421	0.11529	0.06968	0.08448

Clustered (bank) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

APP - Banks Aggregate Data

TABLE *VIII: This table shows the regression results using aggregated data from the ECB database. We assess if a treatment group of countries had higher growth of loans after the APP versus a control group. The treatment group consists of countries with banking industries most exposed to government debt securities in Q4:2014 namely Slovenia, Slovakia, Italy, Spain, Portugal, Belgium, Ireland and Luxembourg. The control group is comprised by Austria, Cyprus, Estonia, Germany, Finland, France, Greece, Malta, and the Netherlands*

Dependent Variables:	$\Delta log(Loans\ House. + Corps.)$		$\Delta log(Loans\ Households)$		$\Delta log(Loans\ Corporations)$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\Delta log(MFI\ Total\ Assets)$	0.0784	0.0448	0.0304	0.0170	0.1397	0.0864
	(0.0736)	(0.0738)	(0.0825)	(0.0799)	(0.1170)	(0.1165)
$\frac{Capital and Reserves}{Total Assets}$	0.0860	0.0168	0.1853	0.1518	-0.0056	-0.0903
	(0.2617)	(0.2687)	(0.1763)	(0.1830)	(0.3724)	(0.3876)
$\Delta log(GDP)$	-0.6093*	-0.5431*	-0.4763*	-0.4406*	-0.8199	-0.7541
	(0.3043)	(0.2641)	(0.2510)	(0.2485)	(0.5361)	(0.4625)
$\Delta \frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets}$	0.0225	-0.0837	0.0242	-0.0256	0.0226	-0.1146
	(0.1515)	(0.1523)	(0.1426)	(0.1338)	(0.2075)	(0.2049)
$\Delta log(Total\ Assets) \times$ APP	0.0998	0.1395	0.1907	0.2078	0.0154	0.0729
	(0.1329)	(0.1349)	(0.1715)	(0.1752)	(0.1246)	(0.1214)
$\frac{Capital and Reserves}{Total Assets} \times$ APP	-0.0298	0.0616	-0.0419	-0.0063	-0.0176	0.1305
	(0.1107)	(0.1066)	(0.1503)	(0.1380)	(0.2107)	(0.2085)
$\Delta log(GDP) \times$ APP	0.2722	0.1736	0.3161	0.2682	0.1472	0.0267
	(0.3114)	(0.2557)	(0.2452)	(0.2306)	(0.5216)	(0.4427)
$\Delta \frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets} \times$ APP	-0.0716	0.0619	-0.0563	0.0055	-0.0787	0.0968
	(0.2325)	(0.2499)	(0.2714)	(0.2713)	(0.2416)	(0.2564)
Exposure × APP	0.5747**		0.2553		0.8006***	
	(0.2232)		(0.1751)		(0.2180)	
Treat × APP		0.0433**		0.0164		0.0722***
		(0.0158)		(0.0152)		(0.0205)
Fixed-effects						
country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	119	119	119	119	119	119
R^2	0.75357	0.74338	0.68039	0.67674	0.71640	0.71921
Within R^2	0.26948	0.23927	0.14703	0.13728	0.27967	0.28682

Clustered (country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

TABLE *IX: This table shows the regression results using aggregated data from the ECB database. We assess if a treatment group of countries had higher growth of loans over assets after the APP versus a control group. The treatment group consists of countries with banking industries most exposed to government debt securities in Q4:2014 namely Slovenia, Slovakia, Italy, Spain, Portugal, Belgium, Ireland and Luxembourg. The control group is comprised by Austria, Cyprus, Estonia, Germany, Finland, France, Greece, Malta, and the Netherlands*

Dependent Variables:	$\Delta\frac{Loans\,House.+Corps.}{Total\,Assets}$		$\Delta\frac{Loans\,Households}{Total\,Assets}$		$\Delta\frac{LoansCorporations}{Total\,Assets}$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\Delta log(MFI\ Total\ Assets)$	-0.3039***	-0.3194***	-0.1726***	-0.1767***	-0.1313***	-0.1427***
	(0.0435)	(0.0437)	(0.0217)	(0.0212)	(0.0313)	(0.0330)
$\frac{CapitalandReserves}{Total\,Assets}$	0.0867	0.0539	0.0618**	0.0563**	0.0249	-0.0024
	(0.0744)	(0.0745)	(0.0248)	(0.0224)	(0.0581)	(0.0598)
$\Delta log(GDP)$	-0.2319*	-0.2001*	-0.1375*	-0.1340*	-0.0944	-0.0661
	(0.1217)	(0.0965)	(0.0673)	(0.0638)	(0.0822)	(0.0690)
$\Delta\frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets}$	0.0587	0.0087	-0.0082	-0.0175	0.0670	0.0262
	(0.1653)	(0.1525)	(0.0763)	(0.0689)	(0.0965)	(0.0947)
$\Delta log(Total\ Assets)$ × APP	0.0080	0.0265	0.0002	0.0043	0.0079	0.0222
	(0.0952)	(0.0979)	(0.0552)	(0.0553)	(0.0440)	(0.0466)
$\frac{CapitalandReserves}{Total\,Assets}$ × APP	-0.0512	-0.0091	-0.0275	-0.0161	-0.0237	0.0070
	(0.0505)	(0.0410)	(0.0360)	(0.0335)	(0.0311)	(0.0328)
$\Delta log(GDP)$ × APP	0.1768	0.1301	0.1216*	0.1138*	0.0552	0.0164
	(0.1245)	(0.0975)	(0.0662)	(0.0630)	(0.0873)	(0.0747)
$\Delta\frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets}$ × APP	-0.0816	-0.0188	0.0253	0.0373	-0.1070	-0.0561
	(0.2023)	(0.1950)	(0.1044)	(0.0975)	(0.1051)	(0.1077)
Exposure × APP	0.2689***		0.0568		0.2121***	
	(0.0920)		(0.0359)		(0.0641)	
Treat × APP		0.0199**		0.0056*		0.0143**
		(0.0076)		(0.0031)		(0.0054)
Fixed-effects						
country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	119	119	119	119	119	119
R^2	0.74319	0.72885	0.71536	0.71710	0.71188	0.66935
Within R^2	0.65489	0.63562	0.60072	0.60316	0.55950	0.49446

Clustered (country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

PEPP - Banks Aggregate Data

TABLE X: *This table shows the regression results using aggregated data from the ECB database. We assess if a treatment group of countries had higher growth of loans after the PEPP versus a control group. The treatment group consists of countries with banking industries most exposed to government debt securities in Q4:2019 namely Portugal, Slovenia, Italy, Slovakia, Spain, Cyprus, Malta, Greece, Belgium. The control group is comprised by Austria, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Netherlands.*

Dependent Variables:	$\Delta log(Loans\,House.+Corps.)$		$\Delta log(Loans\,to\,Households)$		$\Delta log(Loans\,to\,Corps.)$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\Delta log(MFI\,Total\,Assets)$	0.0161	0.0062	0.0433	0.0281	-0.0157	-0.0176
	(0.0615)	(0.0627)	(0.1072)	(0.1121)	(0.0470)	(0.0418)
$\frac{Capital and Reserves}{Total Assets}$	-1.306**	-1.284**	-1.943	-1.870	-0.6941	-0.7344
	(0.5927)	(0.5971)	(1.555)	(1.556)	(0.5625)	(0.5848)
$\Delta log(GDP)$	0.7285**	0.7213**	0.7835	0.7703	0.5845*	0.5854*
	(0.2937)	(0.2842)	(0.4611)	(0.4543)	(0.2956)	(0.2923)
$\Delta \frac{NCB\,Lending\,to\,MFIs}{Total\,Bank\,Assets}$	-0.7089	-0.7048	-1.493	-1.484	0.1129	0.1108
	(0.5951)	(0.6020)	(1.107)	(1.119)	(0.2687)	(0.2529)
$\Delta log(Total\,Assets) \times$ PEPP	-0.1539*	-0.1054	-0.3272*	-0.2830*	0.0388	0.0849
	(0.0803)	(0.0794)	(0.1649)	(0.1400)	(0.1437)	(0.1486)
$\frac{Capital and Reserves}{Total Assets} \times$ PEPP	-0.0377	-0.0629	-0.0390	-0.0382	-0.0129	-0.0648
	(0.1240)	(0.1163)	(0.1768)	(0.1806)	(0.2385)	(0.2232)
$\Delta log(GDP) \times$ PEPP	-0.8633***	-0.8045***	-0.5547	-0.5476	-1.185***	-1.075***
	(0.2385)	(0.2473)	(0.3710)	(0.3701)	(0.2862)	(0.2967)
$\Delta \frac{NCB\,Lending\,to\,MFIs}{Total\,Bank\,Assets} \times$ PEPP	0.4068	0.3696	1.317	1.260	-0.6315**	-0.6395**
	(0.5295)	(0.5333)	(1.033)	(1.037)	(0.2722)	(0.2911)
Exposure × PEPP	-0.0129		-0.3727*		0.4115**	
	(0.1255)		(0.1818)		(0.1944)	
Treat × PEPP		0.0131		-0.0159		0.0451*
		(0.0107)		(0.0149)		(0.0221)
Fixed-effects						
country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	152	152	152	152	152	152
R^2	0.90408	0.90546	0.83164	0.82583	0.83433	0.83877
Within R^2	0.40168	0.41026	0.35243	0.33009	0.36837	0.38529

Clustered (country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

TABLE *XI: This table shows the regression results using aggregated data from the ECB database. We assess if a treatment group of countries had higher growth of loans over assets after the PEPP versus a control group. The treatment group consists of countries with banking industries most exposed to government debt securities in Q4:2019 namely Portugal, Slovenia, Italy, Slovakia, Spain, Cyprus, Malta, Greece, Belgium. The control group is comprised by Austria, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Netherlands*

Dependent Variables:	$\Delta\frac{Loans(House.+Corps.)}{TotalAssets}$		$\Delta\frac{Loans\,Households}{TotalAssets}$		$\Delta\frac{LoansCorporations}{TotalAssets}$	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\Delta log(MFI\ Total\ Assets)$	-0.3912***	-0.3974***	-0.2241***	-0.2285***	-0.1671***	-0.1689***
	(0.0204)	(0.0207)	(0.0237)	(0.0252)	(0.0187)	(0.0170)
$\frac{CapitalandReserves}{TotalAssets}$	-0.6262***	-0.6093**	-0.4428	-0.4210	-0.1834	-0.1883
	(0.2125)	(0.2243)	(0.3202)	(0.3259)	(0.1461)	(0.1503)
$\Delta log(GDP)$	0.2610**	0.2563**	0.1457	0.1419	0.1154**	0.1145**
	(0.1142)	(0.1096)	(0.0969)	(0.0962)	(0.0513)	(0.0452)
$\Delta\frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets}$	-0.3568	-0.3540	-0.3714	-0.3688	0.0146	0.0148
	(0.2370)	(0.2420)	(0.2351)	(0.2388)	(0.0614)	(0.0579)
$\Delta log(MFI\ Total\ Assets)$ × PEPP	-0.1020*	-0.0738	-0.0950**	-0.0835**	-0.0070	0.0097
	(0.0487)	(0.0515)	(0.0341)	(0.0292)	(0.0410)	(0.0419)
$\frac{CapitalandReserves}{TotalAssets}$ × PEPP	-0.0309	-0.0437	-0.0228	-0.0213	-0.0081	-0.0224
	(0.0707)	(0.0712)	(0.0329)	(0.0378)	(0.0713)	(0.0656)
$\Delta log(GDP)$ × PEPP	-0.3527***	-0.3222***	-0.1259	-0.1267	-0.2268***	-0.1955***
	(0.1079)	(0.1101)	(0.0741)	(0.0741)	(0.0698)	(0.0666)
$\Delta\frac{NCB\ Lending\ to\ MFIs}{Total\ Bank\ Assets}$ × PEPP	0.1733	0.1498	0.3135	0.2973	-0.1402**	-0.1475**
	(0.2234)	(0.2282)	(0.2258)	(0.2281)	(0.0625)	(0.0676)
Exposure × PEPP	-0.0357		-0.1175***		0.0818	
	(0.0658)		(0.0348)		(0.0534)	
Treat × PEPP		0.0054		-0.0057		0.0112*
		(0.0066)		(0.0036)		(0.0056)
Fixed-effects						
country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	152	152	152	152	152	152
R^2	0.92361	0.92423	0.89739	0.89114	0.84032	0.84891
Within R^2	0.82662	0.82802	0.77689	0.76328	0.64796	0.66690

Clustered (country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Commercial interest rates minus 3M Euribor

FIGURE *8: Euro area bank interest rates applies to corporates minus 3 month Euribor rate*