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Collateral easing and safe asset scarcity: How money markets benefit from low-quality collateral

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This paper contains research conducted within the network "Challenges for Monetary Policy Transmission in a Changing World Network" (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

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Collateral Easing and Safe Asset Scarcity: How Money Markets Benefit from Low-Quality Collateral

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Abstract

We show that central bank lending against lower quality collateral can improve conditions in the repo market. For identification we take advantage of a pandemic-related temporary extension of the collateral framework of the European Central Bank (ECB), which allows banks to pledge previously ineligible credit claims as collateral for refinancing operations. We use a difference-in-differences approach and exploit banks that do not mobilize credit claims ex ante as a control group. We find that banks affected by the temporary extension pledge newly eligible credit claims in order to reduce the encumbrance of high-quality marketable assets. Treated banks lend out these marketable assets as collateral in the repo market, which helps to alleviate asset scarcity.

JEL Classification: E43, E44, E58, G21
Keywords: asset scarcity, money markets, monetary policy, collateral framework

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1 Introduction

Central banks provide credit against adequate collateral. An appropriate collateral framework is therefore a cornerstone for the implementation of monetary policy. Yet, there is no clear consensus about the optimal design of collateral policies (Bindseil & Papadia, 2006; Nyborg, 2017a,b). In fact, central banks' collateral frameworks differ greatly, from a narrow definition in the US to a very broad definition in the Eurozone.[1]

While an adequate collateral framework should primarily insure central banks against potential losses, recent work ascribes a more proactive role to collateral policies. They can act as a monetary policy tool through their impact on financial markets. For example, once an asset becomes eligible as central bank collateral, securities lending activity increases and bond yields decline, ultimately benefiting the issuer of the bond (Pelizzon et al., 2024). In this study, we highlight that the transmission of collateral policies to financial markets is not limited to such direct eligibility effects. It even works across broader and very distinct asset classes. In particular, we show that a temporary relaxation in the Eurosystem's collateral rules for non-tradable credit claims increases the availability of tradable government bonds for private collateral markets which, in turn, stimulates overall repo market activity. Such additional lending supply is particularly valuable when the market has a structural deficit of safe assets. By accepting an extended set of non-marketable, low-quality assets as eligible collateral, central banks can thus promote the proper functioning of a market which is itself crucial for a smooth monetary policy transmission to the broader economy (Bindseil & Logan, 2019).

As an element of pandemic-related emergency operations, the ECB Governing Council passed a set of collateral easing measures, which included a temporary extension of its additional credit claim (ACC) framework on April 7, 2020. The main intention of such collateral easing measures is that a broader range of eligible collateral amplifies banks' access to central bank liquidity and ultimately supports bank lending to the real economy.[2] Prior studies find evidence consistent with this conjecture: the introduction of the first

[1]A number of reports issued by the Bank for International Settlements gives a general overview on central bank collateral frameworks (e.g. BIS, 2013, 2015). Bindseil et al. (2017) give a more explicit account of the Eurosystem's collateral framework. Tamura & Tabakis (2013) discuss the use of credit claims within this framework.

[2]Under the current fixed-rate, full allotment liquidity operations, banks can borrow any amount given that they have enough suitable collateral at their disposal. Hence, the main constraint for accessing central bank funding is collateral availability.

ACC framework in 2012 had positive effects on both lending volumes (Cahn et al., 2017) and lending rates (Mésonnier et al., 2022). A second effect of such collateral easing measures, which has received considerably less attention, stems from the existence of linkages between the public (i.e. ECB) and private (i.e. repo) collateral markets. Large banks, which are major participants in both markets and substitute between the two, could change their borrowing behavior when the (implicit) cost of borrowing in one of the two markets goes down. In our setting, a shift towards a broader set of central bank collateral should incentivize banks to pledge the newly eligible "cheaper", low-quality collateral for central bank funding while using "expensive", highly-valued collateral in repo transactions. As a consequence, the overall amount of high-quality collateral available to the private market should increase.[3]

In this paper, we exploit the extension of the ACC framework towards a broader set of eligible credit claims as a laboratory to study said link between central banks' collateral policies and the private collateral market. For identification, we leverage the fact that some banks actively use the option to hand in credit claims as central bank collateral while other banks do not. Moreover, the decision not to pledge credit claims cannot be adjusted on short notice as processing times for a collateral account can span several weeks.[4] A temporary relaxation of collateral rules should thus only enable the group of banks with an already mixed collateral pool to pledge newly eligible credit claims instead of high-quality marketable assets when participating in monetary policy operations. The reason for doing so is that certain marketable assets, like government bonds, carry higher opportunity costs because they are liquid and sought-after assets for other private market transactions. With fewer government bonds becoming encumbered for central bank funding, banks could lend them out in the repo market to earn a bond's specialness premium while investing the borrowed cash at a higher risk-free rate. Importantly, this additional bond supply of banks could promote overall repo market functioning in that it helps to reduce the shortage of safe assets in private collateral markets.

[3]The underlying trade-off between the positive effect of a broader collateral set on market functioning on the one hand, and the increased riskiness of the collateral pool on the other hand can also be found in the model Choi et al. (2021). They theoretically analyze the optimal lending policy for a central bank to show that a central bank's decision to increase the set of lower quality assets that can be pledged does not necessarily decrease output and may even increase it.

[4]Indeed, none of the banks in our sample starts to pledged credit claims as a reaction to the ACC extension. Hence, these banks remain unaffected by the policy change which makes them a suitable control group for our study.

Our main results are in line with the above conjecture. In our first set of results, we show that extended collateral eligibility through the ACC framework indeed incentivizes banks to pledge a different kind of collateral (BIS, 2015). More specifically, banks with an existing pool of non-marketable collateral at the Eurosystem pledge more such non-marketable assets in the form of additional credit claims once the framework extension is in place. At the same time, these banks reduce the pledging of marketable assets, in particular government bonds. In a back-of-the-envelope calculation, we estimate that an additional EUR 100 billion of government bonds would have been encumbered for central bank funding absent this change in the pledging behaviour. Additional tests further reveal that banks are especially reluctant to pledge government bonds with a higher specialness in the repo market. This indicates that banks seem to have some kind of pecking order when deciding which assets to pledge for central bank liquidity and that elevated demand for a bond in the repo market seems to play an important role in this ordering.

In our second set of results, we document that a central bank's collateral policy influences repo market activity. We start off with a simple test to empirically confirm the existence of a link between public and private collateral markets. We find that collateralized lending of central banks has a meaningful impact on private collateral markets, as evidenced by significantly lower securities lending volumes and lower collateral reuse for bonds that are more intensely pledged with the Eurosystem.

Based on the exogenous variation in banks' collateral pledging behavior induced by the ACC framework extension, we then provide evidence that collateral policies can impact repo activities in a causal manner. More specifically, we document that those banks which have the opportunity to hand in additional credit claims after the collateral framework extension – and make use of it as we have shown – also become more active in the repo market. They increase their securities lending volumes, both in absolute terms but also net of their securities borrowing activity. Importantly, the granularity of our dataset enables us to include *bond x time* fixed effects in the majority of our tests. This allows us to directly control for borrowing demand and other time-varying fundamentals of a particular bond on any given day. We can thus ascribe the observed increase in securities lending volumes to differences in banks' lending supply and their preceding collateral choice for obtaining central bank funding.[5] Looking more closely at the heterogeneity across treated banks, we further establish that the effect is stronger for banks with a larger buffer of collateral in their collateral accounts with the central bank, that is, banks which should be more inclined to deploy retained high-quality assets elsewhere. Moreover, we find the effect to be more pronounced for banks with ex-ante riskier loan portfolios, which we take as a proxy for a bank's individual exposure to the ACC framework extension.

In additional tests, we find that the increase in repo activity is conditional on the bank's ownership share of a bond while it does not depend on how intensely the bank has pledged the bond for refinancing operations in the past. This sheds some light on how exactly banks respond to the new collateral framework: They do not remove encumbered assets from their collateral pools at the Eurosystem but rather lend out a larger part of their bond holdings as they no longer need to retain them as collateral for future central bank funding. Hence, in our case, collateral policy transmission to the collateral market does not work through a bank's existing collateral pool but rather through its potential collateral pool for new refinancing operations. Such a finding can be informative for the optimal sequence of policy measures: accepting a broader set of collateral *before* launching attractive (targeted) refinancing operations, like the ones in 2020, does not only ensure sufficiently broad access to central bank funding but it can also, as we show here, limit distortions in private collateral markets.

Finally, we test whether the results that are observable at the bank-level also feed through to the bond level. We find this to be the case. Bonds which are held by a higher fraction of banks with non-marketable collateral at the Eurosystem experience an increase in overall lending volume, an increase in their reuse, a decline in their specialness, and a decline in their rate dispersion. This result underscores that choices made by individual banks in response to the collateral framework extension also matter for market outcomes. We therefore conclude that the Eurosystem's decision to relax the eligibility criteria for credit claims has helped to alleviate safe asset scarcity in the repo market.

Overall, our results demonstrates that a central bank's choice to lend against low-quality, non-tradable collateral can have a positive spillover effect on the "plumbing" of collateral markets. For the period under consideration, which is characterized by

[5]This strategy is inspired by the inclusion of firm-time fixed effects (Khwaja & Mian, 2008) in much of today's banking literature in order to disentangle credit demand from credit supply. Also see Elsayed et al. (2023) or Kaldorf & Poinelli (2024) for a similar approach in a related context.

collateral-driven repo markets and a constant scarcity of safe assets, we document how a collateral easing package can help to alleviate downward pressure on repo rate by creating additional supply for the private collateral market. Regardless of the specific situation, however, the established link between collateral policy choices and repo market functioning might as well extend to more general settings: Insofar as a broader collateral set lowers the (implicit) cost of borrowing liquidity from the central bank, a similarly designed collateral easing package could in principle also help to alleviate upwards pressure on repo rates in a funding-driven market environment (as opposed to a collateral-driven repo market environment) by reallocating funding demand of large banks from the private to the public market.

Furthermore, to the extent that a well-functioning repo market is required to smoothly transmit interest rate decisions to financial markets (Fritsche et al., 2020) – by limiting dispersion in rate pass-through to banks' funding costs for example (Nguyen et al., 2023) – a broader set of eligible collateral can support the transmission of monetary policy. Relatedly, Guimaraes et al. (2023) show that monetary policy has a larger effect on financial markets when market liquidity is higher. A central bank's collateral framework should thus be viewed as a supplementary tool for the conduct of monetary policy, all the more so when balance sheets and collateral pools are as sizable as in recent years or, put differently, when central banks themselves contribute to safe asset scarcity. As such, our findings can bear implications for new operating frameworks of monetary policy implementation, as far as they are different variants of a floor system with correspondingly large balance sheets and ample liquidity (Brandao-Marques & Ratnovski, 2024).

Our findings can further inform the currently ongoing policy debate about pre-positioning of collateral. Proposals by King (2016) and G30 Working Group (2024) aim to overcome a shortcoming of current Lender-of-Last-Resort (LoLR) regimes by limiting contagion ex ante in a world of nearly instantaneous bank runs. These proposals require banks to post enough collateral to cover, after haircuts, all runnable liabilities, e.g. deposits and other short-term debt. Central banks would support this with an efficient collateral management system, which could lead to a situation where even more assets have to become eligible as collateral.[6] In this regard, our paper can provide valuable insights about potential effects of an (even) broader collateral framework on repo markets and on trade-offs between smoother monetary policy transmission and adequate protection of central bank balance sheets against potential losses in a new LoLR regime.

1.1 Related Literature

The role of collateral for the conduct of monetary policy has been analyzed both theoretically and empirically. On the theoretical side, Koulischer & Struyven (2014) argue that a lack in the quantity or quality of collateral can affect interest rates even when the monetary policy stance remains constant. Looser collateral policies in times of crisis can mitigate this effect (see also Bindseil (2013)). Departing from a slightly different angle, Choi et al. (2021) argue that lending against low-quality collateral can further be optimal in terms of real outcomes when taking into account the spillover effect of a narrow framework on money markets.

In Choi et al. (2021) banks rely on market funding and the collateralized market is built around a general collateral basket of unknown quality, i.e. the focus lies on the effect of a broader collateral framework on *funding- or liquidity-driven* money market transactions, and, subsequently real outcome. Our setup differs along two important dimensions. First, we do not focus on real outcomes but on certain aspects of market functioning. Second, contrary to Choi et al. (2021), in the Eurozone the near totality of the collateral is not against a basket of unknown quality but rather of known quality, i.e. special repo. Thus, our focus is on *security-driven* repos with the aim of sourcing a specific bond, which is the more common type of transaction in the period under consideration (see for example ECB, 2021) – although we argue in the introduction that the interaction between public and private markets for collateralized funding could also persist in a more liquidity-driven environment.

Empirical studies on central banks' collateral frameworks can be broadly divided into two groups. One group of papers looks at the pledging behavior of banks under a broad collateral framework. Based on collateral data from the Eurosystem, Fecht et al. (2016)

[6] Central banks would effectively become lender of first resort while ideally protecting themselves against credit losses. This would, however, crucially depend on an adequate calibration of haircuts on pledged collateral and on complementary reforms in banking regulation and supervision, which are beyond the remit embedded in central banks' operation frameworks.

document that the central bank receives more risky and more illiquid collateral from banks. Using data from the Bank of England, De Roure & McLaren (2021) reach the same conclusion. In a similar vein, Drechsler et al. (2016) show that lender-of-last-resort operations from the Eurosystem involve riskier types of collateral, particularly pledged by weakly capitalized banks. In contrast to that, Lenzi et al. (2023) find no connection between the financial soundness of Italian banks and the composition of their collateral pools in more recent times. Cassola & Koulischer (2019) take a somewhat different perspective: they model a bank's collateral choice after a change in the haircut policy of the central bank and find that higher haircuts on low-rated collateral lead to reduced use of the same type of collateral. We extent this literature by unveiling a similar effect after a temporary relaxation in collateral rules for low-quality collateral. Moreover, our identification strategy allows us to document in a more stringent way that a broader collateral framework incentivizes banks to not only shift the composition of their collateral pool towards lower quality, non-marketable assets but to put a larger fraction of unencumbered marketable assets to productive use elsewhere at the same time.

The second group of papers investigates how changes to the collateral framework of central banks affect bank lending. Hüttl & Kaldorf (2022) examine the introduction of the single list of collateral in 2007 and find that harmonized collateral rules stimulate loan supply. Barthélémy et al. (2017) highlight that banks which pledge more illiquid collateral have a more resilient lending activity. Using data on French banks, a set of papers exploits the initial introduction of additional credit claims to document an outwards shift of credit supply for newly eligible firms (Bignon et al., 2016; Mésonnier et al., 2022). Our study is distinct from the above as we focus on securities lending instead of bank lending. While the latter is clearly a primary objective for the conduct of monetary policy, a sound repo market with limited levels of asset scarcity can support a smooth transmission of monetary policy impulses (Nguyen et al., 2023). Our finding that a broader collateral framework can be beneficial for repo market functioning, in that it improves the supply of high-quality assets for private transactions instead of locking them up at the central bank, adds a new dimension to this context.

In this regard, we also relate to the literature on asset scarcity in repo markets. A number of papers has shown that central banks themselves induce scarcity through their asset purchase programs (Arrata et al., 2020; Aggarwal et al., 2021; Baltzer et al., 2022).

On the other hand, adequate central bank policies – such as securities lending facilities (Greppmair & Jank, 2023) or less restrictive collateral rules as we highlight – can help to at least partially mitigate these scarcity effects again.

On top of that, we extend prior work on the value of asset pledgeability. For example, Chen et al. (2023) provide evidence on how eligibility affects bond yields in the Chinese corporate bond market. Corradin & Rodriguez-Moreno (2016) demonstrate that different eligibility criteria affect the relative pricing of otherwise similar bonds. In the context of repo markets, Pelizzon et al. (2024) document an increase in both supply and demand levels once corporate bonds become eligible as central bank collateral. The novelty of our studies is to show that changes in the eligibility of one particular asset class, non-traded credit claims, can create spillover effects to other classes and markets, in our case sovereign bonds traded in the secured money market.

Finally, our study contributes to the literature on unconventional central bank refinancing operations. A large number of studies in this field, e.g. Benetton & Fantino (2021) and Da Silva et al. (2021), focus on lending outcomes and whether such targeted measures are effective and in line with the stated objectives. Other aspects such as the collateral being posted for these operations, are typically left aside. One notable exception is Carpinelli & Crosignani (2021) who explicitly analyze the role of collateral eligibility for the transmission of central bank liquidity provision. We consider yet another aspect of this story: Instead of only looking at the assets which are being deployed as collateral to secure such funding, we are interested in the assets which are *not* being deployed. In doing so, we highlight that an extension of the collateral framework can create an effect across different asset classes and ultimately helps to safeguard the transmission process of monetary policy by improving supply conditions in the repo market.

The remainder of the paper is organized as follows. In Section 2, we discuss the general rational of collateral frameworks and provide background on the specific collateral framework of the Eurosystem. In Section 3, we provide a description of our data sources and introduce our empirical setup, our identification strategy and a set of stylized facts. Section 4 presents our results on collateral pledging and securities lending behaviour of banks. Finally, we conclude in Section 5.

2 Collateral Frameworks - Rational & Background

2.1 Rational of collateral frameworks

Collateral frameworks are an integral part of how central banks provide liquidity to the financial system. A common principle of all collateral frameworks dates back to Bagehot (1873): Central banks should lend against good collateral at an appropriate price while managing the risk associated with such activity. This risk management aspect highlights the need to limit operational losses that could materialize when a counterparty defaults. It is reflected in the rate charged for the provision of liquidity, the access criteria to liquidity, and, most importantly, in the haircut schedules adopted to the collateral. Central banks differ in their design of collateral frameworks, which can be explained by differences in local factors such as (a) the financial market structure (bank-based versus market-based), (b) central bank legislation, and (c) the level of development of a country.

Collateral frameworks can be classified according to a number of aspects (see BIS (2013)). Those include: (i) counterparty eligibility, i.e. whether the lending operations or facilities are restricted to a selected few institutions (e.g. the primary dealer system in the US) or accessible for a broad set of counterparties like in the Eurosystem; (ii) uniform or differentiated collateral sets, i.e. whether a single collateral set is applicable to all operations like in the Eurosystem or whether the central bank is differentiating its eligible collateral set and assigning it to specific types of operations like in the US and UK; (iii) earmarked vs. pooled, i.e. whether collateral delivered is earmarked for specific loans or operations like in the UK or pooled whereby collateral is pledged into a pool, with lending backed by the value of the whole pool and not linked to individual assets (Eurosystem); (iv) acceptance of a narrow or a wide range of assets and issuer types, i.e. whether only certain types of eligible issuers are accepted (sovereigns or public sector) like in the case of open market operations in the US, or a wide range like in the Eurozone, where also obligations of financial and non-financial private sector entities are accepted, which can be marketable securities or even certain loans.

Generally speaking, the optimal collateral framework for a given central bank should strike a balance between a smooth conduct of monetary policy on the one hand and an adequate protection of the central bank balance sheet against potential losses on the other hand. In this respect, the increased scarcity of safe assets driven by liquidity regulation[7] and by the extensive asset purchase programs, which have made central banks the largest single owners of safe bonds, has brought up one additional argument: The acceptance of a more wide range of eligible assets can have positive side effects on the availability of safe assets for private market transactions. This can reduce asset scarcity, which might in turn be beneficial for a smooth monetary policy transmission.[8]

We use the Eurozone as laboratory for our empirical analysis in Section 4. We therefore turn to a description of the collateral framework in the Eurozone and also describe the extension of the ACC framework in April 2020, which we exploit as a natural experiment in our main empirical tests.

2.2 Institutional Background in the Eurozone

The collateral framework in the Eurozone is characterized by a broad set of counterparties that are eligible for refinancing operations. This is because the financial system in the Eurozone is bank-based. The collateral set is uniform and applicable to all operations.[9] Banks pledge their collateral into a pool and lending is backed by the value (post-haircut) of the entire pool. The Eurosystem accepts a wide range of assets and issuers (Eberl & Weber, 2014) in order to grant the very diverse set of counterparties a sufficient degree of access to central bank operations (Bindseil et al., 2017).[10] In general, banks can choose between marketable securities, such as government or corporate bonds, and non-marketable securities, such as credit claims (Tamura & Tabakis, 2013). Figure 1 depicts the composition of the Eurosystem's collateral pool over time by asset type. Marketable assets accounted for at least 75% of mobilized collateral up until the second quarter of 2020. Since then, the share of marketable assets decreased by around 10 percentage points with credit claims largely soaking up this share. Looking at credit claims as collateral

[7]The introduction of liquidity regulation (Liquidity Coverage Ratio, LCR, and Net Stable Funding Ratio, NSFR) after the GFC have created an increased demand for safe assets.

[8]See e.g. Nguyen et al. (2023), who show that the passthrough of policy rates to repo rates (which can, in turn, affect banks' collateralized funding costs to a varying degree), is hampered when government bonds are scarce.

[9]An exception is the Emerging Liquidity Assistance, ELA, where solvent but illiquid banks can pledge collateral of lower quality.

[10]The general documentation lays out the criteria that need to be fulfilled for securities to be acceptable as collateral (For more details see: `https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014O0060&qid=1663161472069&from=EN`.)

in more detail, one can see that (a) credit claims represent the single largest asset class in the collateral pool since 2014 and that (b) their share steadily increased from 19% in 2013 to 33% in 2022, with a particular large jump in the first half of 2020. One likely reason for the significant increase in non-marketable collateral is the extension of the ACC framework in early April 2020.

ACCs are credit claims that do not fulfill all the eligibility criteria applicable under the general collateral framework. In contrast to the general collateral framework, which applies to the Eurosystem as a whole, ACC frameworks are country-specific. In 2011, the ECB approved an ACC framework for four countries for the first time in an attempt to alleviate the negative effects of rating downgrades during the sovereign debt crisis on the eligible collateral pool. On April 7, 2020 the ECB passed a set of collateral easing measures. These included a temporary haircut reduction (proportionally by 20%) across all eligible asset classes and, most importantly for our purposes, an extension of the ACC framework, which now includes loans guaranteed by government schemes and loans with lower credit quality for a broader set of countries (see, e.g. de Guindos & Schnabel, 2020). While the main purpose of the extension is to give banks incentives to provide loans to the real economy, the program can in principle also have effects on the collateral composition of banks vis-a-vis the Eurosystem. The idea is that banks can now pledge additional credit claims instead of marketable securities as the latter feature higher opportunity costs owing to their higher liquidity and fungibility.

The marketable securities that remain unencumbered can in turn be used for other purposes, such as making them available for lending in the repo market. After all, banks can generates additional revenue through lending out their bond inventories, especially when a lot of bonds trade at a premium relative to the general collateral rate. Hence, the extension of the ACC framework might positively affect collateral markets when marketable securities are repoed out instead of being pledged in central bank refinancing operations. Increased availability of high-quality assets in the repo market can then help to alleviate asset scarcity as far as securities lending volumes rise and specialness premia fall as a consequence of the positive supply shock (a recent industry report by ICMA (2021) mentions that collateral easing measures taken by the ECB indeed helped to reduce pressure on repo markets)

3 Empirical Design

3.1 Identification Strategy

In order to identify how a broader collateral framework can affect banks' collateral pledging and securities lending behavior, we start with a simple observation: some banks routinely pledge credit claims when they participate in the Eurosystem's refinancing operations while other banks exclusively pledge marketable assets. The reason for banks not to hand in credit claims as collateral can in principle be two-fold: First, there might be institutional restrictions like the bank's business model that prevents the bank from handing in credit claims. Second, there are additional costs and hurdles associated with the use of credit claims as collateral: extended documentation requirements, legal restrictions on the mobilization or transferability of credit claims, less automated procedures for collateralisation, lack of standardization, limited rating availability, limited secondary market activity, or legal uncertainty regarding the existence of the credit claim (see, e.g. Bundesbank, 2023; Tamura & Tabakis, 2013). These additional barriers, together with the fact that admission to the operating systems for submitting credit claims takes a certain time, make it rather unlikely that banks without any non-marketable collateral in their pool are going to start to pledge credit claims in the short-term or as a reaction to a temporary extension of the collateral framework. In other words, the decision to use credit claims as central bank collateral should not change with the natural experiment, which is key for our identification strategy to work. We verify this claim by checking whether any bank in our sample starts to hand in credit claims as collateral *only after* the collateral framework extensions. We find this not to be the case. This means that only a bank with a mixed collateral pool prior to the framework extension should benefit from the collateral easing measures while a bank whose collateral pool consists only of marketable assets should not be affected when additional credit claims become eligible as collateral. As a consequence, only the former type of bank should have the flexibility to shift its collateral pool towards previously ineligible credit claims while using available marketable securities, in particular high-quality bonds, elsewhere. Summing up, our identification strategy to pin down the effect of a central bank's collateral framework on repo market functioning consists of two major elements: (1) the ACC framework extension as a natural experiment[11] and (2) the ex-ante composition of a bank's collateral pool at the Eurosystem to define our treatment group, that is banks with both marketable and non-marketable collateral in their pool, and our control group, that is banks without non-marketable collateral in their pool.[12]

3.2 Stylized Facts

We underpin the proposed identification approach with a set of stylized facts about the collateral pledging behavior of treated versus control banks before and after the introduction of the collateral easing package in April 2020. First, Figure 2 displays the evolution of the *stock of collateral* pledged in refinancing operations with the Eurosystem for treated and control banks (indexed to 1 in January 2020, i.e. at the start of our sample period). Both groups expand their collateral pools to a similar degree in 2020 as a result of their increased usage of refinancing operations. The increase in the period before the ACC extension reflects participation in the first three operations of the bridge LTRO between March 17 and April 7, 2020. The increase in the post-period mainly relates to the fourth operation of the third TLTRO series on June 24, 2020.[13]

While the pattern in Figure 2 shows a similar evolution of the *stock of collateral* for treated and control banks, it does not yet reveal if all assets are equally affected or if banks apply some kind of pecking order in deciding which assets to mobilize as collateral for refinancing operations. As a second stylized fact, we therefore take a closer look at the asset classes underlying the *change in the collateral pool* of both groups.

Figure 3 condenses the main findings into one picture. Here, we break down the two substantial *additional flows into the collateral pool* of treated and control group in the pre- and post-ACC periods by more granular asset classes. We distinguish between four types of assets: marketable securities issued by central governments, other marketable

[11] Note that the other element of the ECB's collateral easing package, i.e. the 20% haircut reduction mentioned above, is unlikely to affect our results as it applies to all eligible assets proportionally, thus, affecting all banks similarly.

[12] Our identification approach resembles that of two recent studies by Anbil et al. (2023) and Minoiu et al. (2024) which look at the effects of COVID-19 facilities on credit conditions. These studies use pre-existing familiarity of banks with the FED's discount window as an instrumental variable for program participation. While we do implement the same instrumental variable approach, our results would not change if we were to follow their empirical methodology more closely.

[13] The bridge LTRO was implemented against the background of the Covid-19 pandemic in order to immediately bridge the euro area financial system's liquidity needs until the fourth TLTRO-III operation, which settled on June 24, 2020 and had very favorable conditions.

securities, regular credit claims and additional credit claims. The decomposition for the control group is depicted in the upper part of Figure 3 and serves as a benchmark to see which type of assets are being mobilized to access additional central bank funding and whether banks without non-marketable collateral choose to supply different assets to their collateral pools over time. In line with the conjecture that these banks should not be able to take advantage of the ACC framework extension but need to use collateral of higher quality instead, we see that they pledge both substantial but also comparable fractions of government bonds in both periods. Specifically, around 51% (61%) of additional central bank funding of these banks are backed by government bonds in the pre- and post-period, respectively.

For the subset of banks with non-marketable collateral, the picture looks quite different. As can be seen in the lower part of Figure 3, around 50% of additional central bank refinancing is backed by government bonds prior to the ACC extension. This number is nearly identical to the one of the control group, which strongly suggests that both groups' pledging behavior with regard to highest-quality assets is comparable absent the treatment. For the post-period, in turn, only 5% of additional refinancing is backed by government bonds. The remainder is made up of 13% other marketable assets, 24% regular credit claims and, most importantly, 58% additional credit claims (up from 6% in the pre-period). This shows that not only do banks in the treatment group move from marketable to non-marketable collateral, they more specifically pledge "low-quality" credit claims while keeping "high-quality" government bonds at their disposal. To get a sense of the economic magnitude of the effect, we conduct the following back-of-the-envelope calculation: We assume that without any modification to the collateral framework, treated banks would have maintained a stable composition of their collateral pool over time. We thus take the pre-period fraction of each asset class and multiply it with the post-period increase in central bank funding to get a counterfactual estimate for the amount of encumbered assets given the observed level of refinancing. Comparing this amount to the actual amount of encumbered assets shows that an additional EUR 105 billion of government bonds (equivalent to around 1% of total euro area government debt outstanding at the end of 2020) would have been locked up in the central bank's collateral pool absent the extension of the ACC framework.

3.3 Methodology & Regression Setup

Our main empirical analysis proceeds in two steps. In the first step, we conduct a more formal test of the pledging behaviour of banks. Our main hypothesis is that banks which previously handed in credit claims as collateral benefit from the extension of the ACC framework insofar as they can now resort to a broader pool of eligible collateral. In deciding which collateral to pledge for refinancing operations, they should then optimally pledge the asset with the lowest opportunity cost first and only hand in assets with higher opportunity costs once the unencumbered holdings of other assets become exhausted. While the argument itself sounds straightforward, it is challenging to provide exact estimates of an asset's pledging cost, even more so as the cost itself might be bank-specific and dependent on the other asset classes that a bank can choose from. In order to circumvent these issues, we focus on the difference between government bonds and non-government bonds. We argue that government bonds carry the highest opportunity costs across asset classes and that these costs are rather independent of idiosyncratic bank factors given their abundant use in repo markets and the central role they play in a regulatory context. Hence, we explicitly differentiate between government bonds and other bonds when we implement the following test:

$$CollPledged_{b,s,t} = \beta \times Post_t \times Treated_b \times Government_s + \mathbf{X}'_{b,t}\gamma + \alpha_{b,s} + \alpha_{s,t} + \epsilon_{b,s,t} \quad (1)$$

where the dependent variable $CollPledged_{b,s,t}$ is the nominal amount of bond s pledged by bank b in week t, scaled with the bond's amount outstanding. The main explanatory variables are: $Post$, which is a dummy variable that equals one for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise, $Treated$, which is a dummy variable that equals one for banks which have non-zero mobilized non-marketable collateral in the year prior to the framework extension and zero otherwise, and $Government$, which is a dummy variable that equals one when the bond is issued by a euro-area central government. We expect β to be negative, which would indicate that treated banks are more reluctant to pledge high-quality collateral, in the form of government bonds, relative to control banks once the modified ACC framework is in place because they now have a broader set of eligible collateral and can optimally use high-quality assets elsewhere.

Regarding repo market activity, we then hypothesize that treated banks increase their securities lending volume more than the control group because of two complementary factors: First, treated banks should have additional government bonds at their disposal as they can resort to a broader disjunct set of collateral with lower opportunity costs for central bank refinancing operations. Put differently, the (shadow) cost of borrowing liquidity from the central bank decreases for treated banks. Second, they have an explicit incentive to supply their disposable government bonds to the repo market as demand for safe assets is elevated and exceeds available supply in the period under consideration due to high levels of asset scarcity.[14] Therefore, an expansion of securities lending activities is likely to translate into additional income for treated banks. In other words, the high value of collateral makes it very attractive to look for trading opportunities in the private market. Based on these considerations, we run the following difference-in-differences regression to establish a link between the design of a central bank's collateral framework and repo market activity:

$$Y_{b,s,t} = \beta_1 \times Post_t \times Treated_b + \mathbf{X}'_{b,t}\gamma + \alpha_{b,s} + \alpha_{s,t} + \epsilon_{b,s,t} \tag{2}$$

The main coefficient of interest in this specification is again β, which captures any differences in the repo market activities of treated versus control banks in the context of the ACC framework extension.

Irrespective of whether we analyze collateral pledging behaviour or securities lending activities of banks, we include *bond* $\times$ *time* fixed effects in all our regressions to control for any security-specific time-varying observable or unobservable characteristics (e.g., liquidity, risk, issuance amount, lending/borrowing demand, asset purchases) and *bank* $\times$ *bond* fixed effects to control for any unobserved matching between characteristics of banks and bonds (i.e., a bank's preference for a particular bond). Furthermore, we control for a host of bank-specific, time-varying characteristics to account for remaining differences in observables that are not spanned by the chosen fixed effects structure but could nevertheless affect our results. Specifically, our set of control includes information on total assets,

[14] While Sylvestre & Coutinho (2020) provide tentative evidence along these lines, they also acknowledge the difficulties in modeling the relationship between Eurosystem collateral and the repo market due to the heterogeneities in banks' balance sheets and collateral mobilisation strategies.

equity ratio, loan ratio, reserve ratio and bond ratio to capture changes in the balance sheet structure of each bank. Moreover, we control for both bridge LTRO and TLTRO take-up of individual banks, bank credit risk as captured by CDS spreads, liquidity risk as proxied by the undrawn amount of credit lines Acharya et al. (2024) and cumulative credit line drawdown to get a sense of a bank's exposure to the dash-for-cash episode. Finally, we include information on the maturity structure of a bank's loan and bond portfolio and position-level information on a bank's bond holdings. Throughout the analysis, standard errors are clustered at the bank and time level as treatment varies along these two dimensions.

3.4 Data Description

For the empirical analysis, we collect data from multiple sources and construct a unique data set which combines granular information on a bank's collateral pool, its bond holdings and its repo market activity. With regard to bank collateral for monetary policy operations, we have access to the "Use of Collateral Database" (UCDB), a proprietary database from the Eurosystem which contains detailed information on the collateral pool of each bank accessing the Eurosystem's balance sheet. For marketable instruments, we observe weekly snapshots of the amount of collateral a bank pledges (both in nominal and haircut-adjusted terms) at the individual bond-level. For non-marketable instruments, i.e. credit claims, we have two distinct data points per bank at the same weekly frequency: the total amount of regular credit claims that are used as collateral as well as the amount of additional credit claims. The sample period is January 2020 to July 2020, i.e. six month around the ACC program. We exclude banks with less than EUR 10 billion of total assets over the sample period to make sure that small banks with a special business (e.g. provision business) do not bias our results. After applying this filter, we have information on the collateral pool of 206 banks from the entire euro area in the UCDB sample.

The second main dataset we use is the securities holdings statistics group data (SHS-G), which contains a detailed view on the security portfolios of more than 100 significant euro area banking institutions. Security-level holdings are reported at a quarterly frequency for both the entity- and the group-level. We use the data to gather information on individual bond holdings at the bank level and the ownership structure of bonds at the instrument level.

Finally, with regard to banks' money market activities, we focus on the secured segment of the market. The data set we use is the money market statistical reporting data (MMSR). The MMSR contains transaction-level information on repo market activity of the largest euro area banks. We observe both lending and borrowing activities of each bank. The data covers an extensive set of information regarding counterparties, collateral, and the terms of each transaction. For this paper, we restrict our attention to the most common types of repo trades: First, we only consider centrally cleared trades, which make up the majority of trades, since we want to abstract from counterparty risk. Second, we only consider trades with a one-day maturity, i.e. trades in the overnight-next, tomorrow-next, and spot-next segment, which represent the most liquid segment of the repo market. Third, we only consider repo transactions with collateral issued by central governments which is by far the most commonly traded collateral in the market. We end up with 38 banks in the MMSR sample, which are responsible for the largest share of money market activity in the euro area. To match the frequency of the other datasets, we collapse the MMSR to a weekly level by summing up individual deal volumes and taking volume-weighted averages of individual deal rates for a given bank-bond pair.

We complement our three main datasets with bank balance sheet information from the Individual Balance Sheet Indicators (IBSI), additional bond characteristics from the centralised securities database (CSDB) and the eligible assets database (EADB), time series information on a bond's amount outstanding, auction dates and futures delivery dates from Thomson Reuters Eikon, and proprietary Eurosystem information on asset purchases and central bank refinancing operations.

Before we proceed, we want to highlight the key advantage of our data. The level of granularity in both the UCDB and the MMSR allows us to match the data at both the bank as well as at the bond level: Matching the data bank-by-bank is essential for connecting the pledging and repo trading behaviour of individual banks. Analyzing both actions in conjunction enables us to pin down whether banks adjust their activities in response to the broader collateral framework, accounting for any confounding factors at the bond level. Matching the data bond-by-bond on the other hand allows us to track for each bond the amount which is locked in as collateral at the Eurosystem and the amount which is lent and borrowed in private market transactions. Hence, we can also quantify whether any changes across all banks or subgroups thereof have a material impact on the bonds which serve as collateral or whether the effects we observe for individual banks average out in the aggregate. Combining these two dimensions should thus help us to establish a well-founded case for any interaction between central bank's collateral frameworks and market functioning.

3.5 Descriptive Statistics

Descriptive statistics for the treatment and control group are display in Table 1. In Panel A we report summary statistics for the UCDB sample of banks. The last column reports standardized difference as a means of comparison which, unlike a standard t-test, is not affected by the size of the sample (Austin, 2009). Taking an upper limit of 0.25 for group imbalances (as suggested by e.g. Stuart, 2010), treated and control groups in our unmatched sample differ along roughly half of all dimensions. In particular, we can observe that treated banks are larger and have a higher loan ratio, which aligns with the fact that larger banks are supposedly the ones with a more diversified business model including both large bond and credit portfolios. In combination with a more enhanced operational and technological infrastructure, this could ultimately better enable them to manage the pledging of non-marketable collateral. Moreover, they have a larger TLTRO take-up and are more risky from both a credit risk and a liquidity risk perspective. Finally, they hold more government bonds and bonds with longer maturities.

Turning to Panel B, which reports summary statistics for the MMSR sample of banks, which is the sample for the majority of our tests, we notice that both groups are more homogeneous overall. All but three characteristics are either below the threshold of 0.25 or reasonably close to it. The only remaining imbalances across groups are total assets, bond maturity and equity ratio.[15]

Finally, Table 2 contains summary statistics for several repo market variables at both

[15] While we acknowledge that the control group in the MMSR sample consists of only five banks, we want to stress that these banks are responsible for a sizeable 20% of repo activity in the MMSR. Hence, a comparison between securities lending activities of treated and control banks within a difference-in-difference setting can still be reasonably fair as long as both groups are comparable along other important dimensions. This seems to be the case in our setting. Moreover, with the modified treatment definition that uses both bank-level variation in ACC usage and country-level variation in ACC introduction (see robustness checks in Section 4.2.1), the number of control and treated banks is more balanced with 21 banks in the control group and 17 banks in the treatment group.

the bank-bond (Panel A) and bond-level (Panel B). On average, we observe that MMSR reporting banks are active on both sides of the market with their securities lending volume exceeding their borrowing volume. This makes them net suppliers of bonds in the European repo market. Furthermore, we observe a positive 2.56 basis point spread of repo rates to the general collateral rate and a sufficient degree of variation in specialness spreads with a standard deviation of 7.26 basis points.

4 Results

In the following section, we proceed in two steps to evaluate whether a central bank's collateral framework choice can have a positive spillover effect for private repo market functioning. We start by asking if the 2020 collateral framework extension towards a set of lower quality non-marketable assets influences banks' collateral pledging behavior. In short, we find that banks which have the option to hand in additional credit claims employ fewer government bonds as central bank collateral. This aligns with our hypothesis that banks switch to collateral with lower opportunity costs and retain assets with higher opportunity costs on their balance sheets. In the second set of tests, we then show that the same banks use these unencumbered bonds for private collateral market transactions. They lend out a higher fraction of their government bond holdings through repos which ultimately compresses scarcity premia in secured money markets. Overall, our results thus demonstrate how public and private collateral markets interact and how this interaction is shaped by a central bank's collateral framework choice.

4.1 Collateral Pledging Behavior

In our first series of tests, we study the difference-in-differences regression setup from equation (1) to examine the collateral pledging behavior of banks, that is, we conduct a more formal analysis of Figure 3. The results are summarized in Table 3. The dependent variable is the nominal amount of a marketable security pledged by a bank with the Eurosystem scaled with the bond's amount outstanding, computed at the bank-bond level. In Panel A, we consider all banks with a collateral pool in the UCDB and total assets of at least 10 billion EUR. In Panel B, we only look at the subset of MMSR reporting agents. In both cases, we only include observations in the regression sample for which we observe a non-zero portfolio holding in the respective quarter. When there is no pledging for a bank-bond pair in a given week we set the pledged amount to zero.

As a starting point, we report coefficient estimates of a simpler version of equation (1), where we do not distinguish between government bonds and other bonds, in column (1). We obtain a small and statistically insignificant coefficient estimate. Next, we split the sample into other marketable assets (e.g. corporate bonds, covered bonds, ABS, etc.) (column 2) and government bonds (column 3). We obtain an insignificant coefficient in column (2) and a statistically significant and negative coefficient in column (3). Thus, treated banks pledge less high-quality collateral (government bonds) relative to control banks, which is in line with the hypothesis developed above. Instead of a sample split, in column (4) we include a triple interaction with an indicator variable for government bonds. We obtain a negative and significant coefficient estimate for the triple interaction.

For the subset of MMSR banks in Panel B, we obtain very similar results across all specifications which demonstrates that our findings are not driven by a particular group of banks without significant repo activity.[16]

Next, we perform three additional tests, which are shown in the Online Appendix. First, we more explicitly test for pre-trends in the pledging behavior of treatment and control group by replacing the *Post* dummy with a set of dummy variables for each month. Figure IA.1 documents the absence of such trends together with a significant reduction of government bonds being pledged by treated banks in each month following the framework change. In sum, both aspects lend further support to our identification strategy. For completeness, we do not find any corresponding effects for non-government bonds as can be seen in Figure IA.2.

Second, in Table IA.1 we show that we obtain similar effects when we aggregate the collateral positions to the bank-level. The alternative level of aggregation also helps us to shed light on the economic significance of the effect. By multiplying the coefficient in Table IA.1, Panel A, column (3) with the total nominal value of pledged government bonds in a bank's collateral pool, we find that, on average, treated banks use approximately

[16] In unreported results, we further analyze to what extent our main effect could be explained by differences in national ACC frameworks by augmenting our main specification with *bank country x time* fixed effects. While such a specification is rather restrictive, essentially comparing responses of treated and control banks headquartered in the same country in the same week, our results continue to hold.

1 billion EUR fewer government bonds as central bank collateral once the framework extension is in place.

In our final test, we augment our treatment definition in the following way. In addition to considering information about the collateral pool of individual banks before the framework extension, we also consider country-level differences in the implementation of ACC frameworks over time. In particular, we label banks as treated if they fulfill two conditions: (1) they have marketable and non-marketable collateral before April 2020 and (2) they are headquartered in countries with the earliest ACC framework adoption (France, Spain, Italy, Austria, Cyprus, Ireland, Portugal) in 2012. Our choice to use such country-level variation relies on two arguments: First, as far as the decision to set up an ACC framework is at least partially taken in response to the needs of the national banking system, we expect banks of early-mover countries to generally benefit from an extended eligibility of non-marketable collateral. Second, we expect banks with a longer exposure to ACC frameworks to be more accustomed to the use of non-standard non-marketable collateral, which means that they have established business routines enabling them to swiftly take advantage of any further extensions. The caveat of limiting treatment to banks in countries with earlier ACC frameworks is that some of the remaining banks which are headquartered elsewhere, and are thus part of the control group, start to pledge ACCs after further NCBs implemented their own ACC frameworks in April 2020. This means that the identification of our effect of interest is not as clearcut as in our baseline case, for which we do not see any change in the collateral mobilization strategy of control banks (as described in Section 3). Nevertheless, results when using this alternative treatment definition are in line with our baseline estimates as visualized in Table IA.2. Importantly, we continue to find that banks with mixed collateral pools in early-mover ACC countries pledge fewer government bonds in response to the 2020 collateral easing package. Different from our main results, however, we find that in the UCDB sample (Panel A) banks also tend to pledge relatively fewer non-government bonds, suggesting a broader shift from marketable to non-marketable collateral. We further observe that the difference-in-difference coefficient on government bonds in column (3) is smaller relative to our baseline case. We attribute this difference to the fact that the control group is at least partially affected by the treatment, leading to a downward bias in the estimates.

All in all, our findings in Table 3 reveal that treated banks are more reluctant to pledge government bonds as central bank collateral after the extension of the collateral framework towards lower quality non-marketable credit claims. Given that government bonds are the main form of collateral in secured money market transactions, this sets the stage for the repo market analysis in the upcoming section.

Collateral Pecking Order: Before we turn to studying banks' securities lending behavior, we take a deeper look at the subset of government bonds that banks can pledge as collateral in our sample to examine whether banks have some kind of pecking order when deciding which assets to pledge for central bank funding. To do so, we interact the *Post* $\times$ *Treated* dummy with a set of bond-level characteristics. Since we are interested in whether banks take into account the opportunity cost of privately lending out the bond instead of using it as central bank collateral, we limit our attention to characteristics which serve as proxies for the demand for a certain bond in the repo market: gross lending volume, net lending volume, and specialness of a bond. Moreover, we consider the issuer rating, the haircut gap (Jasova et al., 2024) and the residual maturity of a bond as additional features that could play a role in the pledging decision. The results are presented in Table 4. In column (1), our first demand proxy is the bond's securities lending volume in the past week. Although we find the triple interaction to be negative, which would be in line with banks being more reluctant to pledge bonds with a high demand in the repo market, the coefficient is insignificant. The same is true when we use the securities lending volume net of borrowing in column (2). When we use the bond's specialness, on the other hand, we find the triple interaction to become significant at the 5% level (column 3). This suggests that the propensity to use a bond as central bank collateral decreases with the expected return on lending out the bond in the private market. In column (4), we further show that this result cannot be explained by other fundamental bond characteristics that might as well be related to a bond's specialness. Specifically, we orthogonalize specialness with respect to a bond's amount outstanding, time to maturity, a dummy for auction dates, a dummy for futures delivery dates, and a dummy for the on-the-run status of the bond. When we run the regression using this alternative specialness measure, we find a coefficient which is very comparable to the one in column (3). Finally, none of the other characteristics influences the decision to pledge a bond as central bank collateral in a systematic way, as can be seen from the insignificant coefficients on issuer rating, haircut gap, and residual maturity in columns (5) to (7).

4.2 Repo Market Activity

Before proceeding the estimation of regression equation (2) to investigate whether the relaxation of the collateral framework in the Eurozone has an effect on repo market activity, we first run some preliminary regressions. In particular, we examine whether there is a measurable association between banks' collateral pledging and repo market activity after we account for a host of bond- and bank-specific factors. In a nutshell, we expect that more intense pledging of a bond should lead to lower availability of the bond for money market transactions since the high-quality asset is tied up at the central bank. Said link between the public and private collateral market is the main focus of our analysis from here on.

To briefly summarize the correlational evidence from these preliminary regressions, we find that at the bank-bond level (Panel A of Table IA.3), both gross and net lending of a bond decline significantly when a bank has pledged a higher amount of a given bond as collateral with the Eurosystem. At the bond-level (Panel B of Table IA.3), we find a decrease in both lending and borrowing volumes together with a weak decline in re-use activity when a bond is being used as central bank collateral to a larger extent. In either case, however, we do not find a significant effect on pricing.[17] We refer the reader to the Online Appendix for further details and now move on to the main part of our analysis, where we exploit the 2020 collateral easing package to causally identify the link between public and private collateral markets.

4.2.1 Difference-in-Difference Test

As explained above, the introduction of the modified ACC framework creates a source of exogenous variation in banks' collateral pledging behaviour vis-à-vis the Eurosystem by implicitly lowering the costs for obtaining central bank funding. Important for our purpose, the decision to extend the ACC framework is unlikely to be directly influenced by prevailing repo market conditions at that time. After all, the main intention behind

[17] To be more precise, we do observe an increase in specialness when bonds are being pledged more intensely at the ECB (i.e. for higher values of *Collateral pledged*) once we relax the stringency of the fixed effects and include only time FEs instead of Bond $\times$ Time + Bank $\times$ Time FEs (at the bank-bond level) or Issuer $\times$ Maturity Bucket $\times$ Time FEs (at the bond-level).

the program was to amplify banks' access to central bank liquidity in order to support bank lending to the real economy. Based on these insights, we use the policy change to investigate whether the relationship between banks' collateral pledging and repo market activities that we have documented in the previous section also allow for a more causal interpretation.

To do so, we turn to the estimation of regression equation (2) and examine whether treated banks, i.e. those with non-marketable collateral in the period before the policy change, scale up their securities lending activities in the money market in response to the collateral easing package of April 7, 2020. Table 5 presents evidence consistent with this reasoning. In column (1) we document that *Net Lending* amounts of a given bond in a given week increases significantly for treated banks. This is in line with the hypothesis developed in Section 3.3. The effect is statistically significant at the 1% significance level. The coefficient estimate suggests that treated banks increase their bond lending to the repo market by 0.50 percentage points. In economic terms, this corresponds to 11% of the sample standard deviation of *Net Lending* (0.50 / 4.03). Thus, we find that treated banks indeed offer a non-negligible amount of their retained high-quality assets in the repo market after the ACC extension is in place. Importantly, as we include *bond* $\times$ *time* fixed effects in our regression setup, we are able to control for bond demand (similar to the Khwaja & Mian (2008) estimator in the banking literature). This means that we can attribute the observed increase in securities lending volume to differences in *banks' bond supply*, which is a crucial piece of evidence for our story.

Next, we confirm that the effect on *Net Lending* is driven by a change in the securities lending activity of banks. Using the gross securities lending volume as dependent variable in column (2), we find a positive and highly statistically significant coefficient. At the same time, the coefficient estimate of the same regression with gross securities borrowing amount as dependent variable is negative though not statistically different from zero (column (3)). In sum, these results are in line with the fact that treated banks have more government bonds at their disposal because they do no longer pledge these bonds as central bank collateral under the extended collateral framework. Unencumbered high-quality assets are then sourced to the repo market which increases a bank's bond lending activity. Bond borrowing, on the other hand, remains unaffected by the policy change.[18] In columns (4) and (5) we additionally consider the reuse rate and the reuse amount as dependent variables. However, we do not find an effect for treated banks after the extension of the ACC program. Finally, column (6) shows results for the specialness spread as dependent variable. We obtain a negative coefficient estimate, which is not statistically different from zero. This last result suggests that although treated banks increase their repo activity in terms of volumes, they do not adjust their pricing relative to another bank lending out the same bond at the same time.

Parallel Trends: The validity of our difference-in-differences setup hinges on the parallel trends assumption. To investigate the timing of the effect and whether the parallel trends assumption is met, we run the following dynamic version of regression (2):

$$Y_{b,s,t} = Treated_b \times \sum_{k=0}^{T} \beta_k \cdot D_t + \mathbf{X}'_{b,t}\gamma + \alpha_{b,s} + \alpha_{s,t} + \epsilon_{b,s,t} \tag{3}$$

where D_t is an indicator variable that equals one in month t, and zero otherwise, with March 2020 serving as the baseline effect. $Y_{b,s,t}$ is either *Net Lending Volume* or *Gross Lending Volume*. Figure 4 plots the effect on *Net Lending* and reveals that, prior to the ACC extension in April 2020, the interaction terms are small and not statistically significant. Afterwards, the estimates increase and remain statistically significant for the rest of the sample period, which suggests that the collateral easing measures are an important driver of net securities lending volumes over an extended period of time. Figure IA.3, which is available in the Online Appendix, shows a similar pattern as we replace *Net Lending* with *Gross Lending*.

Modified Treatment Definition: Analogous to before, we conduct a second robustness test where we consider our alternative treatment definition which combines bank-level information on the composition of the collateral pool with cross-country differences re-

[18]As in the previous section, we also verified to what extent the main results on repo activity could be explained by differences in national ACC frameworks by augmenting our main specification with *bank country x time* fixed effects. We find that our results continue to hold although the size of our coefficients is somewhat lower, which we attribute to the additional layer of stringency that such fixed effects entail.

garding the initial implementation of ACC frameworks in 2012.[19] Results are presented in Table IA.4. We continue to find a significant and sizable increase in *Net Lending* (Column 1) and *Gross Lending* (Column 2). Moreover, *Gross Borrowing* declines as well in this case. All else equal, this last effect should lead to a further increase in bond availability in the repo market. Once again, the magnitude of the coefficients in Table IA.4 is smaller relative to the ones observed in Table 5, reflecting the downward bias from having effectively treated banks from countries without already existing ACC frameworks in the control group. Despite this shortcoming, however, the robustness check demonstrates that our main result does not seem to hinge on our chosen definition of treated banks but that the treatment definition could as well be combined with information on country-level differences in ACC programs from a period well before our sample starts.

4.2.2 Heterogeneities of Treated Banks

Next, we conduct an analysis to study potential heterogeneities across treated banks. We do so by introducing a set of conditional treatment dummies, to better understand which banks are increasing their securities lending activities. In column (1) of Table 6 we split the treatment dummy according to the median of the variable *Overcollateralization*, which we define as follows:

$$Overcollateralization = \frac{Collateral\ Pool\ after\ haircut - Total\ Refinancing}{Collateral\ Pool\ after\ haircut} \tag{4}$$

Typically, a bank's collateral portfolio with the central bank is larger than the amount borrowed in refinancing operations. All else equal, a bank that holds a larger buffer of collateral in their collateral account with the central bank therefore needs to pledge less additional collateral for a given amount of additional refinancing. This potentially increases the bank's incentives to use its high-quality assets for other purposes. Consistent with this line of reasoning, we find a somewhat larger effect on *Net Lending* for banks with a high overcollateralization ratio. The difference of the two coefficients (Treated-High versus Treated-Low) is significant at the 10% level.

[19] In addition to demonstrating the robustness of our main result, this modified treatment definition comes with the benefit of giving us a more balanced panel of treated and control group, with 17 treated and 21 control banks. However, one should again bear in mind that some banks of the modified control group start to pledge ACCs after April 7, 2020. This could lead to a bias that is not present in the baseline case where none of the control banks mobilizes ACCs at any point in time.

Next, we construct the variable *Collateral Constraint*, which we define as follows:

$$Collateral\ Constraint = \frac{Amount\ of\ Collateral\ Pledged}{Amount\ of\ Collateral\ on\ Balance\ Sheet} \tag{5}$$

Banks that pledge all potentially eligible assets with the central bank, have a value of 'Collateral Constraint' equal to one. This means that they are potentially constraint to obtain additional central bank funding.[20] We find a somewhat smaller coefficient estimate for banks that have below-median values of *Collateral Constraint*. However, the difference in the coefficients (Treated-High versus Treated-Low) is not statistically significant.

In column (3) we look at the share of credit claims (as a fraction of the total collateral pool) that a bank has prior to the ACC extension as another source of heterogeneity. The variable is inspired by Mésonnier et al. (2022), who use it as an opportunity cost measure. We find that the treatment effect is somewhat larger for banks with a larger credit claims share. However, the difference is again not statistically different from zero.

Lastly, we compute the variable *Portfolio Risk*, which is the volume-weighted credit quality step (CQS) of a bank's non-marketable collateral.[21] In other words, the variable measures the average credit risk of a bank's loan portfolio to non-financial corporation. The construction of the variable requires detailed information on the loan portfolio of banks. We take this information from the AnaCredit dataset.[22] If available, we then use ratings of each debtor to compute the CQS. In the remaining cases, we use the default probabilities reported in the AnaCredit data to compute the CQS. In column (4) of Table 6 we find a larger treatment effect for banks with ex-ante riskier credit claims. The difference of the coefficients (Treated-High versus Treated-Low) is significant at the 1% level. A possible explanation for this result is that the modified ACC framework primarily aims at credit claims with lower credit quality and government-guaranteed loans, which

[20]When a bank pledges all eligible assets but does not use them for refinancing operations, i.e. when it is highly overcollateralized, it is unlikely to be constraint already. We adjust the median split of high- vs low-*Collateral Constraint* accordingly by re-classifying banks with above-median *Overcollateralization* values to be part of the latter group.

[21]To assess the credit quality of eligible assets, the Eurosystem takes into account information - ratings or probabilities of default - from credit assessment systems belonging to one of three sources: (1) external credit ratings (ECAIs), (2) national central banks' in-house credit assessment systems (ICASs), and (3) counterparties' internal ratings-based (IRB) systems. See ECB webpage for more information.

[22]More information on the data can be found here. Details on the preparation of the dataset and the construction of the variable are available upon request.

are also extended to riskier firms (see, e.g. Jiménez et al., 2022). Therefore, the variable *Portfolio Risk* might capture some type of ex-ante bank exposure to the ACC framework extension, which is why we see stronger effects for highly exposed banks.

4.2.3 Where does the additional supply come from? Old Collateral versus Yet Retained Collateral

As already explained above, one key advantage of our empirical analysis is the high level of granularity and complementarity of our dataset, giving us a holistic view on a bank's collateral pool (UCDB), its bond holdings (SHS-G), and its repo market activity (MMSR). In the subsequent analysis, we exploit these features and ask where the bonds that end up in the private collateral market after the ACC framework extension are actually coming from. In principle, there are two options: A bank could actively take out a bond from its collateral pool to subsequently lend it out in the repo market. In this case, we would expect the effect to be stronger for "old collateral", i.e. bonds which have been pledged as collateral prior to the ACC extension. Alternatively, a bank could use a larger part of its bond holdings for repo market lending, knowing that it no longer needs to retain as many bonds as potential collateral for central bank funding under the extended collateral framework. In this case, we would expect the effect to be stronger for "retained collateral", i.e. bonds which are part of a bank's bond portfolio prior to the ACC extension.

To test both explanations, we modify our main regression equation (2) and interact the *Post* $\times$ *Treated* dummy with two additional variables. In Panel A of Table 7 we include the variable $D_{Pledged}$, which is a dummy variable that takes the value of 1 whenever the bond was pledged as collateral with the Eurosystem in the four weeks leading up to the ACC extension.[23] Moreover, we include the variable D_{Held} into the regression, which takes the value of 1 whenever the bond is held on the bank's balance sheet but hasn't been pledged prior to the ACC extension, i.e. at the end of Q1/2020, and zero otherwise. For both *Net Lending* (column 1) and *Gross Lending* (column 2), we obtain a positive and statistically significant coefficient estimate for the triple interaction term with D_{Held} while the triple interaction with $D_{Pledged}$ remains insignificant. This suggests that banks do not remove

[23] We choose the four-weeks window for two reasons: (1) Previously pledged bonds might not immediately be lend out in the repo market; (2) Taking a longer window gives us more variation for our regressions.

already encumbered assets from their collateral pools with the Eurosystem for their repo market lending. They rather lend out a larger part of their yet retained bond holdings once the extended ACC framework is in place. A more general implication of this finding is that the ownership structure of a bond *within a certain group of investors* – in our case banks with versus banks without non-marketable collateral – matters for the availability of the bond in the repo market. This is a novel finding compared to existing studies which have examined the impact of ownership structure across bonds for repo market supply (see, for example, Arrata et al., 2020; Greppmair & Jank, 2023).

In Panel B we present very similar regressions with continuous versions of the two dummy variables. We include the variable *Amount Pledged*, which is the amount of a bond pledged by a bank as collateral for refinancing operations with the Eurosystem, scaled by the bond's amount outstanding and the variable *Amount Held* into the regression, which is the amount of a bond held by a bank on its asset side of the balance sheet, scaled by the bond's amount outstanding. Results are very similar as in Panel A in this case.

4.2.4 Bond-Level Analysis

In the final step, we document that the observed changes in the securities lending activities of treated banks following the ACC extension also have a material impact on the aggregate bond level. For this analysis, we collapse our MMSR data into a bond-week panel. Moreover, since treatment is so far defined at the bank-level, we need to construct a set of new variables which act as proxies for the treatment intensity of each bond. All else equal, these variables should reflect that bonds with higher ex-ante exposure to treated banks are more likely to be affected by the ACC extension given that these banks on average increase their repo lending relative to control banks. To measure a bond's exposure to treated banks, we use information regarding the holder structure of the bond and information regarding the intensity at which treated and control banks pledge the bond as collateral with the Eurosystem. To be more specific, $Frac_{Held}$ ($Frac_{Pledged}$) is defined as the amount of a bond held (pledged) by banks with non-zero mobilized non-marketable collateral, scaled by the total amount held (amount pledged) across all banks in the sample. Whether the effect is driven by ownership structure, i.e. $Frac_{Held}$, or pledging intensity, i.e. $Frac_{Pledged}$, is again a question of whether the treated banks source the bonds for their repo market activity from their collateral pool or from their bond portfolio. Importantly, each bond-level treatment variable is fixed before the ACC framework extension in April 2020 in order to reduce endogeneity issues.

Table 8 displays the results. Across all specifications, we include *bank* $\times$ *bond* and *issuer* $\times$ *maturity* $\times$ *time* fixed effects. Moreover, we include control variables related to both the bank and the bond dimension. As bank-level controls, we take the same set of bank characteristics as before but now calculate volume-weighted averages across banks. As bond-level controls, we include a dummy for the on-the-run status of a bond, and dummy variables to capture auctions and CTD bonds for futures delivery dates. Moreover, we include variables capturing the effect of central bank's asset purchase programs, both in terms of stock and flow.

In columns (1) and (2), we look at the net and gross securities lending volumes. We find that bonds that are held by a higher fraction of treated banks experience a significant increase in gross but not in net lending volumes relative to other bonds. Looking at column (2), for a one standard deviation increase in $Frac_{Held}$, gross lending increases by 1.17 (31.134 x 0.0376) percentage points, which corresponds to a 11% increase relative to the variable's standard deviation (1.17 / 10.73). Defining treatment through pledging intensity ($Frac_{Pledged}$) yields an insignificant result. This highlights once more that the effect we document works through the bond portfolio of a bank: when deciding on which assets to retain for refinancing operations, banks factor in a broader collateral framework and use previously ineligible low-quality assets as collateral while lending out the remaining unencumbered high-quality bonds in the repo market. On the other hand, they do not retrieve those bonds that are already part of the collateral pool with the Eurosystem. In column (3), where gross borrowing is the dependent variable, we obtain a positive and significant coefficient estimate for the interaction between *Post* and $Frac_{Held}$, albeit the magnitude is smaller compared to the corresponding coefficient in column (2). This finding rationalizes why we do not find any significant change in *Net Lending* in column (1). Repo and reverse repo volumes at the bond-level move in tandem and any increase in lending is matched by a comparable increase in borrowing.

Columns (4) and (5) then look at collateral reuse. We find a significantly positive effect on the reuse amount when treatment intensity is defined through asset holdings in Column (5). This implies that a bond held by a higher fraction of treated banks is reused to a larger extent, which increases the overall availability of safe assets in the market (Jank et al., 2022; Inhoffen & van Lelyveld, 2024), despite the insignificant increase in net lending that we observe. In column (6), where the specialness spread is the dependent variable, we obtain a negative and statistically significant coefficient estimate for the interaction between *Post* and $Frac_{Held}$. In economic terms, bonds which are predominantly held by treated banks experience a decrease in specialness by 0.5 basis points (for a one standard deviation increase in $Frac_{Held}$) relative to other bonds, which amounts to about 8% of the standard deviation of specialness. This is an important result as the specialness of a bond can be interpreted as a scarcity premium (Arrata et al., 2020; Corradin & Maddaloni, 2020). A decline in specialness is therefore a sign for lower levels of asset scarcity. Lastly, in column (7) we run a regression with the variable *Rate Dispersion*, which Duffie & Krishnamurthy (2016) define as the volume-weighted absolute deviation of rates from average rates in a given week as dependent variable. Again, we obtain a negative and statistically significant coefficient estimate for the interaction of *Post* with $Frac_{Held}$.

To further strengthen our results, we proceed by splitting bonds by their average level of specialness. To the extent that a broader collateral framework helps to alleviate pressure in repo markets, we should find the previous effects to be more prevalent in the subsample of bonds with high specialness, or put differently, larger demand-supply imbalances. Table IA.5 provides supportive evidence for this conjecture. Comparing coefficients across Panel A and Panel B, one can see that the previously documented effects are by large only present in the subsample of bonds with above-median specialness. Moreover, both the statistical and the economic significance of coefficients in this subsample is now higher in comparison to the full sample coefficients in Table 8. Finally, not only the reuse amount but both net lending volume and reuse rate also increase significantly in the subsample of high specialness bonds. In combination, this lends further support to our story as it suggests that a larger set of non-marketable central bank collateral helps to unlock additional bond supply for the repo market, especially when such supply is scarce.

All in all, a broader collateral framework can thus help to improve repo market functioning by increasing the availability of high-quality assets for private market transactions. Affected banks scale up their securities lending activities which ultimately leads to higher reuse of bonds and a concomitant compression of scarcity premia and rate dispersion, with a particular strong effect on bonds that face larger demand-supply imbalances.

5 Conclusion

This paper provides empirical evidence on how central bank collateral policies spill over to repo markets. We document that a shift towards a broader set of eligible non-marketable collateral can promote market functioning to the extent that it increases the amount of high-quality collateral available to the market. Our findings suggest that banks affected by a temporary extension of the collateral set pledge newly eligible credit claims instead of government bonds. Banks then lend out retained high-quality bonds as collateral in the repo market, which helps to alleviate asset scarcity.

The overarching goal of a collateral framework of a central bank is to balance the smooth conduct of monetary policy on the one hand and an adequate protection of the central bank balance sheet against potential losses on the other hand. Recent evidence shows that asset scarcity can negatively affect the transmission of monetary policy by delaying the pass-through of policy rates to the repo market. Taking our main result on how collateral easing can address such scarcity, one could thus argue that a broader collateral framework might in turn be beneficial for a smooth monetary policy transmission. Furthermore, it is possible that the documented link between public and private collateral markets extends beyond the specific period of collateral-driven repo markets as a broader collateral framework can potentially support repo market functioning in different market environments. We document a supply side effect on collateral-driven repo markets, in that an extended set of collateral leads to a shift of banks' government bond supply from public towards private collateral markets. Nonetheless, one could also imagine a demand side effect on funding-driven repo markets, insofar as an extended set of eligible collateral with lower opportunity costs can incentivize banks to increase borrowing from the central bank, thereby lowering funding demand pressure in private repo market. We leave an explicit exploration of this alternative story to future research.

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Figures and Tables

Figure 1: Use of Collateral and Outstanding Credit

This figure shows the total amount of collateral (by asset type) mobilised for refinancing operations with the Eurosystem from 2014 until 2022 Q2. The blue line depicts the average amount of credit outstanding. The black dashed line depicts the share of non-marketable assets (credit claims) in the collateral pool. Source: https://www.ecb.europa.eu/paym/coll/charts/html/index.en.html

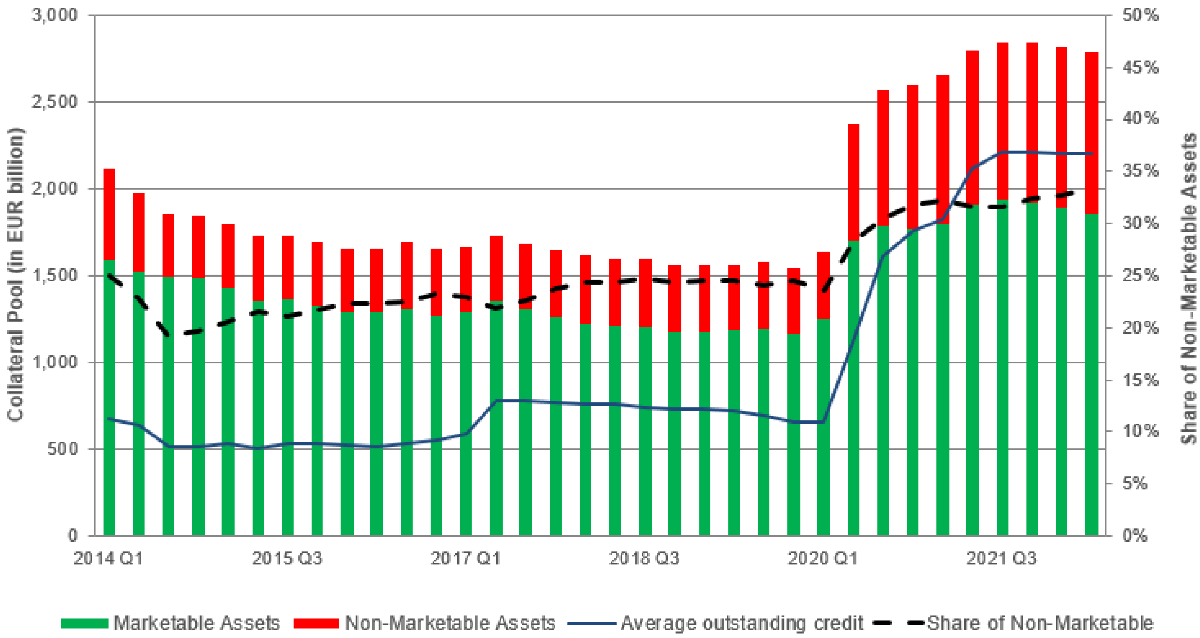


Figure 2: Pledged Collateral - Identification

This figure shows the evolution of collateral mobilised for refinancing operations with the Eurosystem for 2020. The solid red line depicts the evolution of the collateral pool of treated banks, i.e. banks that have credits claims pledged as collateral prior to the ACC extension. The solid blue line depicts the evolution of the collateral pool of banks belonging to the control group, i.e. banks that only have marketable assets pledged as collateral prior to the ACC extension. Both lines are indexed to have a value of 100 at the beginning of January 2020. The black vertical line marks the time of the extension of the ACC framework.

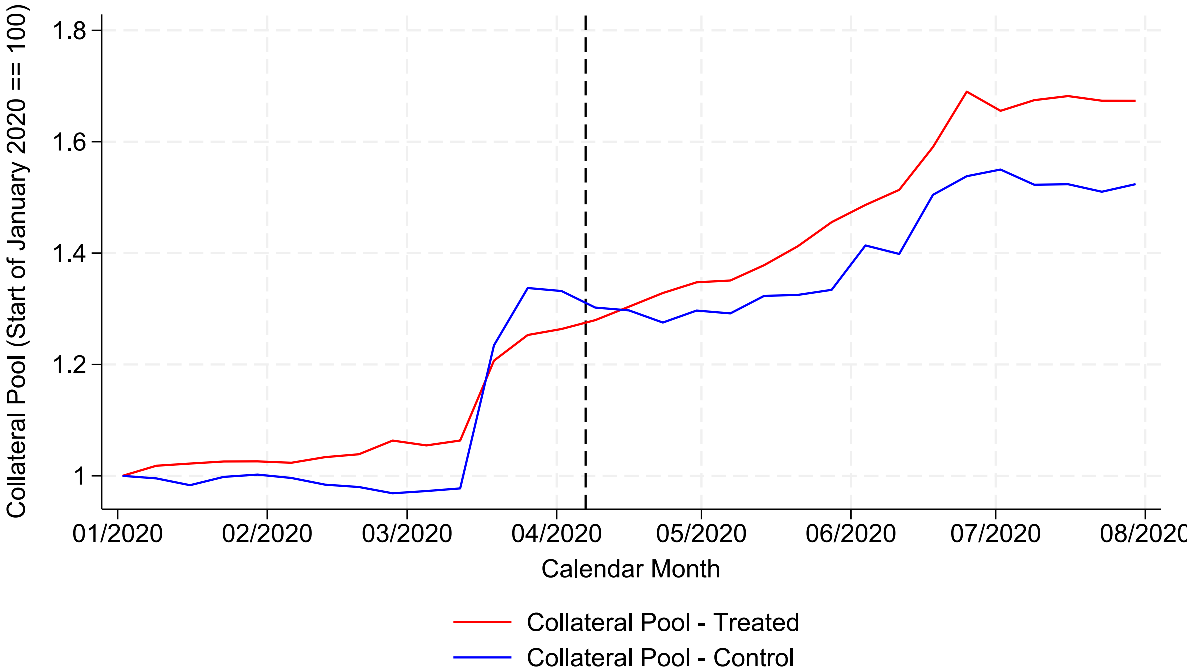
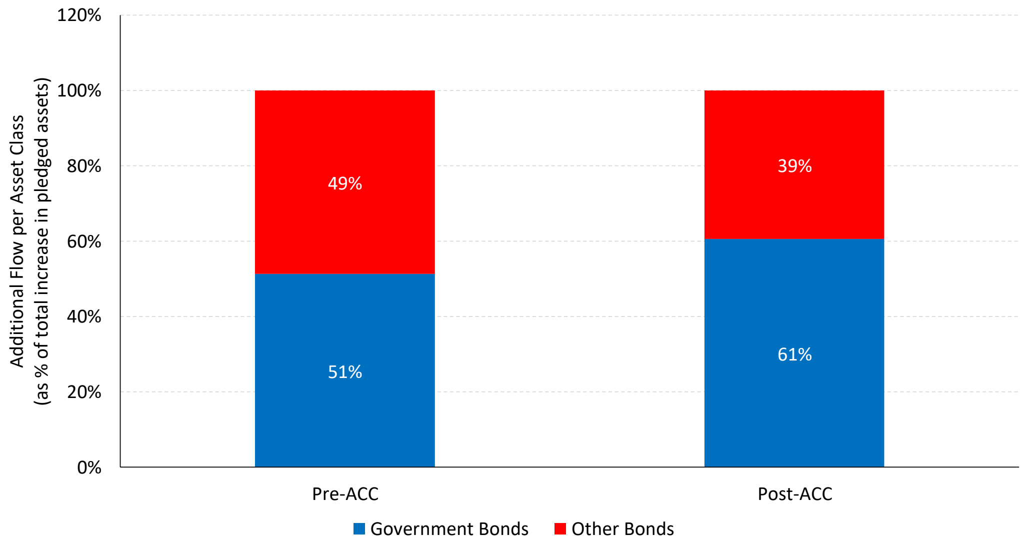


Figure 3: Pledged Collateral - Difference-in-Difference

This figure shows the decomposition of the flows of the collateral pool into the type of collateral banks mobilise for additional refinancing with the Eurosystem. As our starting point, we take the total increase in collateral pledged for refinancing operations in the six months before and after the extension of the ACC framework on April 7, 2020, respectively. Each bar then gives a decomposition of these additional refinancing uptakes into different types of pledged collateral. We distinguish between four types of assets: government bonds, other marketable bonds, regular credit claims (RCC), and additional credit claims (ACC). The upper graph shows the collateral posted by banks without non-marketable assets (credit claims). The lower graph shows the collateral posted by banks with non-marketable assets.

(a) Banks without Non-Marketable Assets (Control Group)



(b) Banks with Non-Marketable Assets (Treatment Group)

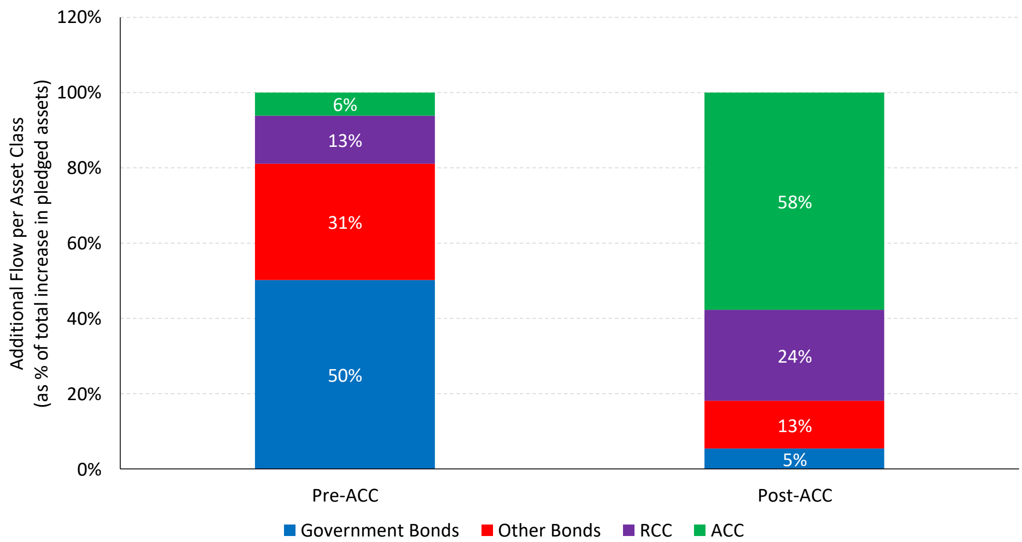


Figure 4: Coefficient Plot - Net Lending

Figure 4 shows the results for estimating the regression equation (2) as shown in Table 5 with monthly dummies instead of the *Post* dummy. March 2020 serves as the baseline effect. The dependent variable is the net lending volume of bonds in the repo market. We plot the dynamic coefficient on the treatment dummy with 95% confidence bands based on standard errors clustered at the bank and time level.

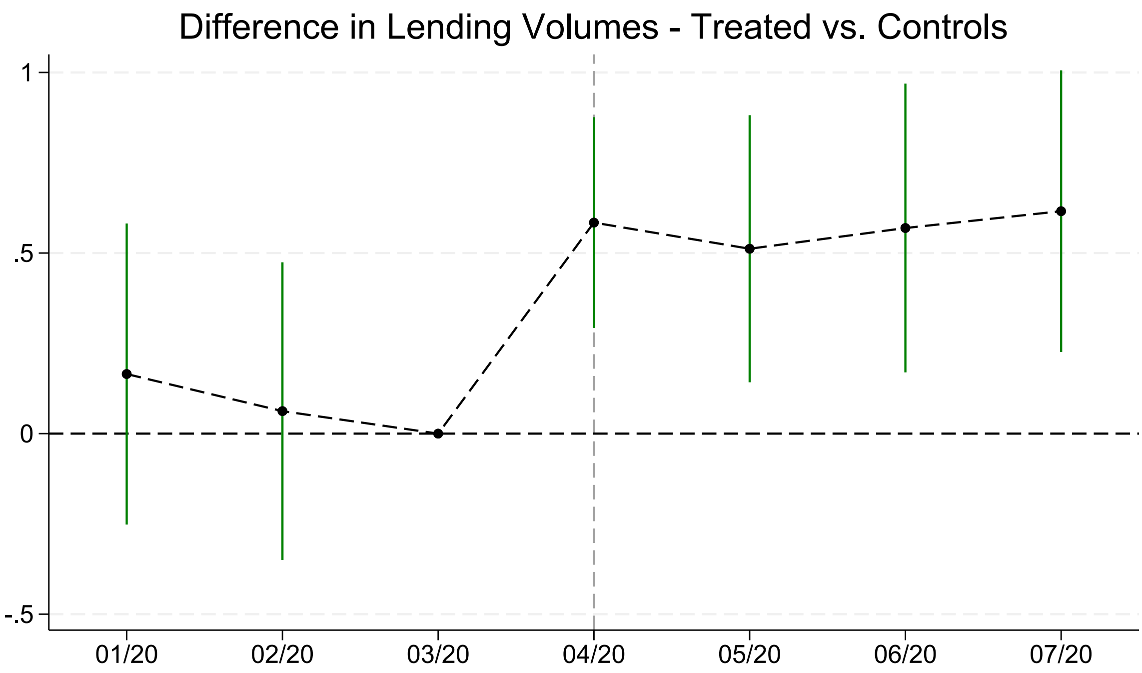


Table 1: Summary Statistics - Bank level

Table 1 shows summary statistics for the bank level variables used in the analysis. 'Treated' is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. 'Total Assets' is a bank's total assets. 'Equity ratio' denotes the ratio of a bank's equity over total assets. 'Loan ratio' are loans over total assets. 'Bond ratio' is the ratio of all bonds that a bank holds over total assets. 'Reserves ratio' is the ratio of banks' central bank reserves over total assets. 'Bridge LTRO ratio' ('TLTRO ratio') is the amount of central bank funding obtained in the 2020 bridge LTRO (TLTRO III) operations over total assets. CDS is a bank's CDS spread. 'Cum.Drawdown' is the cumulative change in drawn credit lines over the sample period over total assets. 'Liquidity Risk' is the amount of undrawn credit lines over total assets as in Acharya et al. (2024). 'Loan Ptf. Maturity' ('Bond Ptf. Maturity') is the value-weighted maturity of a bank's loan (bond) portfolio. 'Government Bond Share' is the share of government bonds in a bank's bond portfolio. With the exception of 'TLTRO', the table is based on data from the first quarter of 2020, i.e. prior to the ACC extension. Panel A shows summary statistics for the UCDB sample and Panel B contains summary statistics for the MMSR sample.

Panel A: UCDB Sample

	No. Control Banks: 93			No. Treated Banks: 113			
	Mean	Median	Std.Dev	Mean	Median	Std.Dev	Stddiff
Total Assets	49.65	22.28	108.30	124.82	50.88	201.79	-0.44
Equity Ratio	7.59	7.25	5.30	8.47	8.16	3.77	-0.20
Loan Ratio	31.24	28.40	25.44	39.90	43.34	20.40	-0.38
Bond Ratio	10.82	8.39	11.72	10.74	9.46	7.48	0.01
Reserve Ratio	6.05	4.58	5.96	5.05	4.22	4.44	0.20
Bridge LTRO (Pre)	0.08	0.00	0.70	0.29	0.00	1.18	-0.06
TLTRO (Post)	1.08	0.00	3.03	3.88	1.42	5.08	-0.36
CDS	53.86	46.47	46.10	81.65	75.18	56.26	-0.53
Cum.Drawdown	0.04	0.00	0.74	0.11	0.00	0.43	-0.13
Liquidity Risk	2.71	0.11	4.38	4.58	2.93	5.30	-0.38
Loan Ptf. Maturity	7.64	7.58	4.27	8.09	7.01	4.79	-0.10
Bond Ptf. Maturity	4.76	4.23	3.45	6.02	4.85	3.32	-0.38
Government Bond Share	19.55	0.00	31.75	29.21	19.34	30.87	-0.31

Panel B: MMSR Sample

	No. Control Banks: 5			No. Treated Banks: 33			
	Mean	Median	Std.Dev	Mean	Median	Std.Dev	Stddiff
Total Assets	466.37	398.18	232.61	366.16	253.07	281.59	0.36
Equity Ratio	4.79	5.14	1.48	7.08	6.74	3.25	-0.74
Loan Ratio	29.32	27.98	15.83	25.76	26.45	16.06	0.22
Bond Ratio	8.42	6.14	7.01	7.07	6.94	4.69	0.27
Reserve Ratio	4.47	5.68	2.75	4.43	3.84	2.42	0.01
Bridge LTRO (Pre)	0.02	0.00	0.07	0.26	0.00	1.00	-0.25
TLTRO (Post)	1.86	0.20	2.42	2.99	1.30	3.94	-0.31
CDS	53.28	35.87	40.24	73.54	50.31	68.50	-0.31
Cum.Drawdown	0.04	0.00	0.12	0.09	0.00	0.45	-0.12
Liquidity Risk	3.50	1.45	4.42	3.22	1.92	3.75	0.07
Loan Ptf. Maturity	6.83	5.81	2.10	7.68	6.54	5.47	-0.16
Bond Ptf. Maturity	5.06	4.79	2.69	5.99	5.50	2.49	-0.37
Government Bond Share	38.26	28.33	25.88	38.83	36.56	25.89	-0.02

Table 2: Summary Statistics - Repo Market Activity

Table 2 shows summary statistics for the main variables used in the empirical analysis. Panel A displays summary statistics for the sample used in Section 4.2.1. Panel B displays summary statistics for the sample used in Section 4.2.4. The variables 'Gross Securities Lending Volume' and 'Gross Securities Borrowing Volume' denote the security lending (borrowing) volume scaled by a bond's amount outstanding (in %), respectively. 'Net Securities Lending Volume' denotes the security lending volume net of the security borrowing volume scaled by a bond's amount outstanding (all in %). 'Specialness Spread' is the volume-weighted rate of all securities lending transaction on a given day (in basis points) net of the GC pooling rate. 'Reuse Amount' is the amount of reused collateral (as defined in Jank et al. (2022)) scaled by a bond's amount outstanding (in %). 'Reuse Rate' is the amount of reused collateral scaled by incoming collateral (in %). 'Rate Dispersion' is the volume-weighted absolute deviation of rates from the average rate (as in Duffie & Krishnamurthy (2016)). 'Post' is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise and 'Treated' is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. '$\text{Frac}_{\text{Pledged}}$' and '$\text{Frac}_{\text{Held}}$' is the fraction of a bond's overall amount pledged (held) that comes from treated banks, respectively. The sample period is January to July 2020.

Panel A: Bank-Bond Level

	Mean	Median	Std.Dev	Obs
Post	0.58	1.00	0.49	132,810
Treated	0.88	1.00	0.33	132,810
Gross Securities Lending Volume	1.14	0.14	2.73	132,810
Gross Securities Borrowing Volume	1.04	0.12	2.76	132,810
Net Securities Lending Volume	0.10	0.01	4.03	132,810
Specialness Spread	2.56	1.60	7.26	85,782
Reuse Amount	0.30	0.00	0.98	132,810
Reuse Rate	16.52	0.00	34.33	132,810

Panel B: Bond Level

	Mean	Median	Std.Dev	Obs
Post	0.58	1.00	0.49	11,128
$\text{Frac}_{\text{Pledged}}$	47.97	31.10	48.44	11,128
$\text{Frac}_{\text{Held}}$	78.61	93.25	28.16	11,128
Gross Securities Lending Volume	12.34	9.49	10.46	11,128
Gross Securities Borrowing Volume	10.62	7.48	10.73	11,128
Net Securities Lending Volume	1.72	1.50	10.23	11,128
Specialness Spread	1.98	1.25	6.18	11,128
Reuse Amount	7.28	4.76	7.93	11,128
Reuse Rate	53.59	48.45	31.14	11,128
Rate Dispersion	2.41	1.65	2.28	11,128

Table 3: Difference-in-Difference - Pledged Collateral

Table 3 shows the result for the fixed-effects panel regression, where the dependent variable is the weekly nominal value of marketable bonds pledged by banks as part of their collateral pool with the Eurosystem scaled by the bond's amount outstanding. In Panel A, we include all banks for which we have collateral pool information from the UCDB. In Panel B, we only include banks which also act as MMSR reporting agents. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise; *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension; *Government*, which is a dummy variable that equals 1 for bonds issued by central governments. The sample period is January 2020 to July 2020. We exclude banks with less than EUR 10 billion of total assets over the sample period. Bank-level control variables are summarized in Table 1. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: UCDB Banks

Dependent variable: Nominal Value Pledged *per Bond* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x Treated	0.0036	0.0518	-0.1169**	0.0587
	(0.06)	(0.70)	(-2.32)	(0.77)
Post x Treated x Government				-0.1869**
				(-2.11)
Adj. R2	.8674	.8635	.8582	.8675
Obs	676,306	495,257	181,049	676,306

Panel B: MMSR Banks

Dependent variable: Nominal Value Pledged *per Bond* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x Treated	-0.1303	-0.0597	-0.2917***	-0.0499
	(-1.27)	(-0.50)	(-3.94)	(-0.41)
Post x Treated x Government				-0.2502**
				(-2.69)
Adj. R2	.8252	.8227	.7207	.8252
Obs	412,466	301,208	111,258	412,466

Bank-level Controls	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table 4: Pledged Government Bonds & Money Market Conditions

Table 4 shows the result for the fixed-effects panel regression, where the dependent variable is the weekly nominal value of marketable securities (bonds) pledged by banks as part of their collateral pool with the Eurosystem scaled by the bond's amount outstanding. We include all banks for which we have collateral pool information from the UCDB. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise and *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. We interact these variables with *Gross Lending*, which is the previous week's securities lending volume of the bond; *Net Lending*, which is the previous week's securities lending volume (net of borrowing) of the bond; *Specialness*, which is the previous week's specialness spread; *Specialness*$_\perp$, which is the previous week's specialness spread, orthogonalized with respect to a bond's rating, time to maturity, amount outstanding, on-the-run status, cheapest-to-delivery status and auction cycle; *Rating*, which is the bond issuer rating; *haircut gap*, which is the difference between private market and ECB haircut as in Jasova et al. (2024); *Maturity Remaining*, which is the residual maturity of a bond. The sample period is January 2020 to July 2020. We only consider government bonds pledged as collateral for the analysis. We exclude banks with less than EUR 10 billion of total assets. Bank-level control variables are summarized in Table 1. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Dependent variable:	Nominal Value Pledged scaled by Amount Outstanding						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post x Treated	-0.1197**	-0.1176**	-0.1170**	-0.1286**	-0.1021**	-0.0987*	-0.0374
	(-2.31)	(-2.23)	(-2.38)	(-2.48)	(-2.16)	(-1.88)	(-1.06)
Post x Treated x Gross Lending	-0.0321						
	(-1.56)						
Post x Treated x Net Lending		-0.0211					
		(-1.20)					
Post x Treated x Specialness			-0.1147**				
			(-2.27)				
Post x Treated x Specialness$_\perp$				-0.0974**			
				(-2.06)			
Post x Treated x Rating					-0.0360		
					(-0.71)		
Post x Treated x Haircut Gap						0.0372	
						(0.43)	
Post x Treated x Maturity Remaining							-0.0426
							(-0.63)
Adj. R2	.7748	.7748	.7754	.7753	.7748	.7779	.7750
Obs	115,974	115,974	115,974	115,974	115,974	114,227	115,974
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table 5: Money Market Activity - Difference-in-Difference

Table 5 shows the result for the fixed-effects panel regression. In column (1) the dependent variable is the net securities lending volume (defined as gross lending - borrowing) of bank b in bond i on week t, scaled by bond i's amount outstanding. In column (2) the dependent variable is the gross securities lending volume of bank b in bond i on week t, scaled by bond b's amount outstanding. In column (3), the dependent variable is the gross securities borrowing amount. The dependent variable is the reuse rate in column (4) and the reuse amount in column (5). In column (6) the dependent variable is the volume-weighted deal rate across all lending transactions of bank b in bond i on week t (net of the GC rate). The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise and *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. The sample period is January 2020 to July 2020. Bank-level control variables are summarized in Table 1. Fixed effects are included as shown at the bottom of the table. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Lending Rate
	(1)	(2)	(3)	(4)	(5)	(6)
Post x Treated	0.4983***	0.3695***	-0.1288	1.0924	-0.0298	-0.1504
	(2.96)	(2.82)	(-1.35)	(1.12)	(-0.84)	(-0.63)
Adj. R2	.4228	.4568	.4723	.2187	.2642	.7207
Obs	132,810	132,810	132,810	132,810	132,810	85,094
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table 6: Money Market Activity - Heterogeneities of Treated Banks

Table 6 shows additional result for the fixed-effects panel regression, where the dependent variable is the net securities lending volume (defined as gross lending - borrowing) of bank b in bond i on week t, scaled by bond i's amount outstanding. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise and *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. The variable *Treated* is further split according to the median of the variable *Overcollateralization* (columns 1), *Collateral Constraint* (column 2), *Share Credit Claims* (column 3) and *Portfolio Risk* (column 4). The variables are discussed in Section 4.2.2. We report the difference in the coefficients between $Post\ x\ Treated_{High}$ and $Post\ x\ Treated_{Low}$ and the t-value of a significance test of this difference. The sample period is January 2020 to July 2020. Bank-level control variables are summarized in Table 1. Fixed effects are included as shown at the bottom of the table. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Dependent variable:	Net Lending scaled by Amount Outstanding			
	Overcollateralization	Collateral Constraint	Credit Claim Share	Portfolio Risk
	(1)	(2)	(3)	(4)
Post x $\text{Treated}_{\text{High}}$	0.5816***	0.4106*	0.5564***	0.6742***
	(3.34)	(2.01)	(3.46)	(3.31)
Post x $\text{Treated}_{\text{Low}}$	0.3642*	0.5477***	0.4610**	0.2172
	(1.88)	(3.14)	(2.29)	(1.14)
Adj. R2	.4229	.4229	.4228	.4232
Obs	132,810	132,810	132,810	132,810
$\text{Treated}_{\text{High}}$ - $\text{Treated}_{\text{Low}}$	0.2173*	-0.1371	0.0953	0.4571***
	(1.73)	(-1.02)	(0.63)	(2.59)
Bank-level Controls	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table 7: Linking Collateral Pledging to Money Market Activity

Table 7 shows the result for the fixed-effects panel regression at the bank-bond level. In column (1) the dependent variable is the weekly net securities lending volume, scaled by a bond's amount outstanding. In columns (2) and (3) the dependent variable is the scaled gross securities lending (borrowing) volume, respectively. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise, and *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension. In Panel A the variables of interest are $D_{Pledged}$ and D_{Held}, which are equal to one when a bank pledged the bond as collateral (held but did not pledge the bond) prior to the ACC extension, respectively. In Panel B the variables of interest are *Amount Pledged* and *Amount Held*, which is the scaled amount of a bond that a bank pledged as collateral (held in its portfolio) prior to the ACC extension, respectively. The sample period is January 2020 to July 2020. Bank-level control variables are summarized in Table 1. Fixed effects are included as shown at the bottom of the table. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: Dummy

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing
	(1)	(2)	(3)
Post x Treated	0.0935	-0.0009	-0.0945
	(0.74)	(-0.01)	(-1.03)
Post x $D_{Pledged}$	-0.5003*	-0.2630	0.2373
	(-1.72)	(-1.16)	(1.33)
Post x Treated x $D_{Pledged}$	0.4251	0.2052	-0.2199
	(1.14)	(0.60)	(-1.16)
Post x D_{Held}	-1.1406***	-0.9958***	0.1449
	(-7.90)	(-6.22)	(1.46)
Post x Treated x D_{Held}	0.9272***	0.8647***	-0.0625
	(6.24)	(5.57)	(-0.54)
Adj. R2	.4234	.4563	.4722
Obs	132,810	132,810	132,810

Panel B: Amount (% Outstanding)

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing
	(1)	(2)	(3)
Post x Treated	0.3214**	0.1964*	-0.1250
	(2.07)	(1.76)	(-1.24)
Post x Amount Pledged	-0.4205	-0.2447	0.1759
	(-1.56)	(-1.05)	(1.13)
Post x Treated x Amount Pledged	0.4544	0.2684	-0.1860
	(1.53)	(1.03)	(-1.18)
Post x Amount Held -1.0558***	-1.0246***	0.0312	
(-8.55)	(-8.00)	(0.86)	
Post x Treated x Amount Held 0.9366***	0.8905***	-0.0460	
(7.04)	(6.76)	(-0.98)	
Adj. R2	.4234	.4563	.4721
Obs	132,810	132,810	132,810

Bank-level Controls	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time

Table 8: Bond-Level Effects

Table 8 shows the result for a fixed-effects panel regression at the bond level, where the dependent variables are: net securities lending volume in column (1), gross securities lending volume in column (2), securities borrowing volume in column (3), the reuse rate in column (4), the reuse amount in column (5), the specialness (lending rate net of the GC rate) in columns (6), and the rate dispersion in column (7), of bond i in week t, respectively. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise; $Frac_{Held}$, which is the pre-ACC amount of bond i held by banks which have non-zero mobilised non-marketable collateral scaled by the holdings of all sample banks; and $Frac_{Pledged}$, which is the pre-ACC amount of bond i pledged by banks which have non-zero mobilised non-marketable collateral scaled by the bond's total collateral value pledged by all sample banks. As control variables, we include on the bond-level: dummy variables for on-the-run status, for auction periods and the cheapest-to-deliver (CTD) in Futures contracts as well as variables related to stock and flow of the central bank's asset purchase programs. Bank-level control variables are summarized in Table 1. We aggregate these to the bond-level by taking value-weighted averages, with weights given by a bank's pre-ACC share of repo volume for a given bond. We report t-statistics based on standard errors clustered at the bond and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Specialness	Rate Dispersion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post x $Frac_{Pledged}$	0.0113	0.0094	-0.0020	0.0189	0.0057	-0.0024	0.0001
	(1.50)	(1.20)	(-0.32)	(0.88)	(1.00)	(-0.78)	(0.07)
Post x $Frac_{Held}$	0.0107	0.0367***	0.0260*	0.0314	0.0227**	-0.0146**	-0.0031**
	(0.69)	(2.78)	(2.01)	(1.01)	(2.20)	(-2.36)	(-2.05)
Adj. R2	.5039	.6363	.6469	.5778	.6382	.5477	.5217
Obs	11,128	11,128	11,128	11,128	11,128	11,128	11,128
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer x Maturity x Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time

A Additional Figures and Tables

Figure IA.1: Coefficient Plot - Pledged Government Bonds

Figure IA.1 shows the results for estimating the regression equation (1) as shown in Table 3, Panel A, with monthly dummies instead of the *Post* dummy. March 2020 serves as the baseline effect. The dependent variable is the nominal amount of a bond pledged by a bank scaled with the bonds outstanding amount. The sample is limited to government bond holdings. We plot the dynamic coefficient on the treatment dummy with 95% confidence bands based on standard errors clustered at the bank and time level.

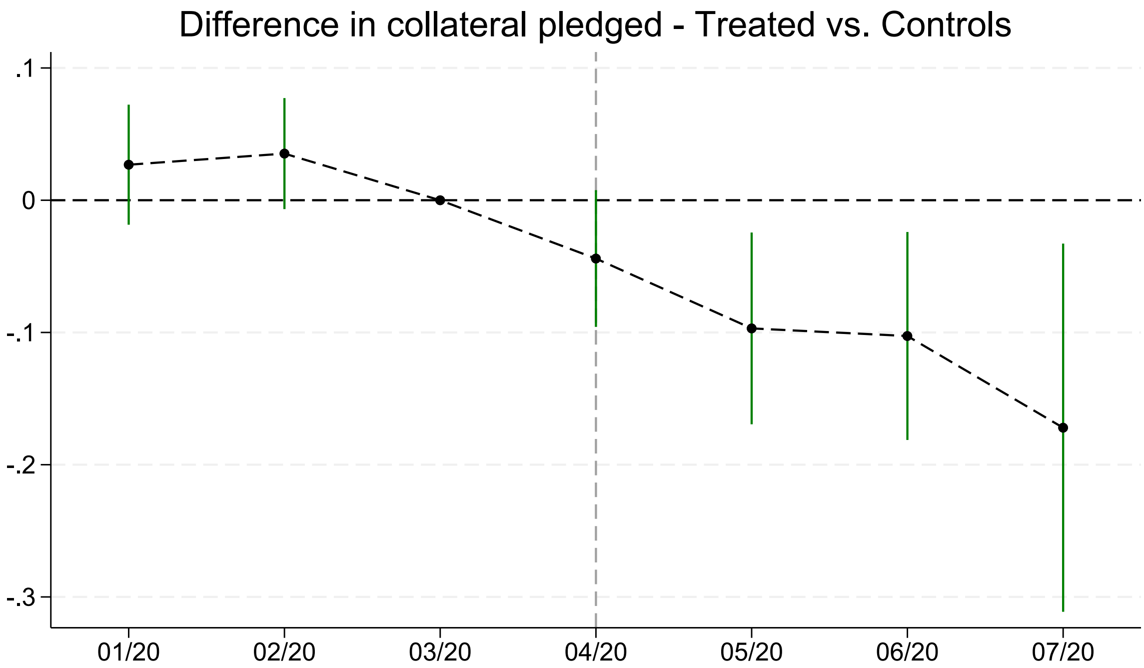


Figure IA.2: Coefficient Plot - Pledged Non-Government Bonds

Figure IA.2 shows the results for estimating the regression equation (1) as shown in Table 3, Panel A, with monthly dummies instead of the *Post* dummy. March 2020 serves as the baseline effect. The dependent variable is the nominal amount of a bond pledged by a bank scaled with the bonds outstanding amount. The sample is limited to non-government bond holdings. We plot the dynamic coefficient on the treatment dummy with 95% confidence bands based on standard errors clustered at the bank and time level.

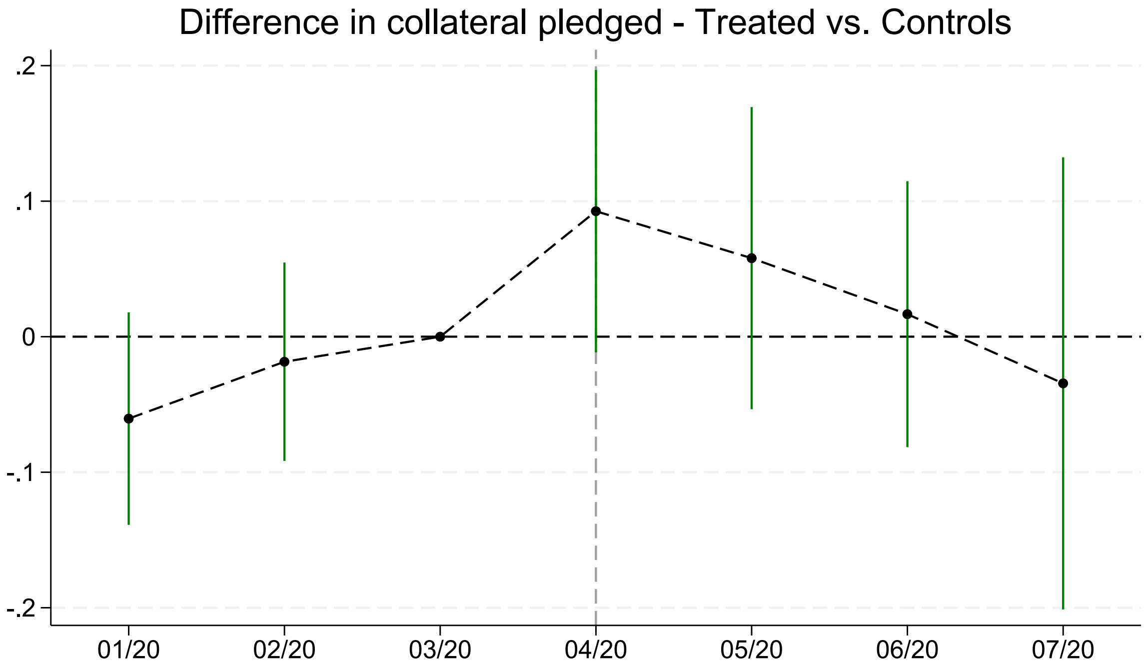


Figure IA.3: Coefficient Plot - Gross Lending

Figure IA.3 shows the results for estimating the regression equation (2) as shown in Table 5 with monthly dummies instead of the *Post* dummy. March 2020 serves as the baseline effect. The dependent variable is the gross lending volume of bonds in the repo market. We plot the dynamic coefficient on the treatment dummy with 95% confidence bands based on standard errors clustered at the bank and time level.

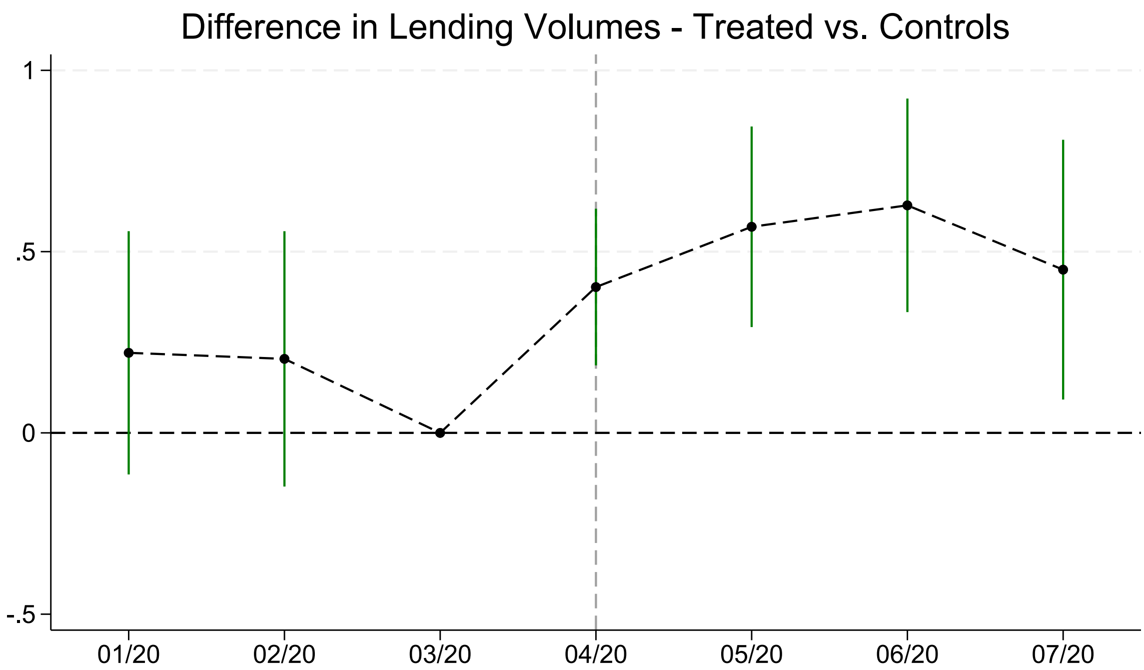


Table IA.1: Difference-in-Difference - Pledged Collateral (Bank-Level)

Table IA.1 shows the result for the fixed-effects panel regression, **conducted at the bank-level instead of the bank-bond-level as in Table 3. The dependent variable is the aggregated weekly nominal value of all government versus non-government bonds pledged by banks as part of their collateral pool with the Eurosystem scaled by the aggregate amount outstanding of government and non-government bonds, respectively.** In Panel A, we include all banks for which we have collateral pool information from the UCDB. In Panel B, we only include banks which also act as MMSR reporting agents. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise; *Treated*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension; *Government*, which is a dummy variable that equals 1 for bonds issued by central governments. The sample period is January 2020 to July 2020. We exclude banks with less than EUR 10 billion of total assets over the sample period. Bank-level control variables are summarized in Table 1. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: UCBD Banks

Dependent variable: Nominal Value Pledged *per Asset Class* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x Treated	-0.2075	0.0841	-0.4216**	-0.0004
	(-1.69)	(0.59)	(-2.34)	(-0.00)
Post x Treated x Government				-0.4802**
				(-2.27)
Adj. R2	.7778	.9522	.8503	.7896
Obs	5,492	2,969	2,520	5,492

Panel B: MMSR Banks

Dependent variable: Nominal Value Pledged *per Asset Class* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x Treated	-0.5121*	0.4896	-0.7129*	0.4010
	(-1.92)	(1.30)	(-2.02)	(0.50)
Post x Treated x Government				-1.0514
				(-1.47)
Adj. R2	.7705	.9675	.8554	.7984
Obs	1,458	840	617	1,458

Bank-level Controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table IA.2: Difference-in-Difference - Pledged Collateral (Country-Level Treatment)

Table IA.2 shows the result for the fixed-effects panel regression, where the dependent variable is the weekly nominal value of marketable bonds pledged by banks as part of their collateral pool with the Eurosystem scaled by the bond's amount outstanding. In Panel A, we include all banks for which we have collateral pool information from the UCDB. In Panel B, we only include banks which also act as MMSR reporting agents. The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise; **$\textit{Treated}_{\textit{Country}}$, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension and are located in first-wave ACC countries (FR, ES, BE, GR)**; *Government*, which is a dummy variable that equals 1 for bonds issued by central governments. The sample period is January 2020 to July 2020. We exclude banks with less than EUR 10 billion of total assets over the sample period. Bank-level control variables are summarized in Table 1. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: UCDB Banks

Dependent variable: Nominal Value Pledged *per Bond* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x $\text{Treated}_{\text{Country}}$	-0.1950***	-0.2510***	-0.0837***	-0.2248***
	(-3.50)	(-3.25)	(-2.79)	(-3.07)
Post x $\text{Treated}_{\text{Country}}$ x Government				0.0958
				(1.38)
Adj. R2	.8676	.8637	.8582	.8676
Obs	676,306	495,257	181,049	676,306

Panel B: MMSR Banks

Dependent variable: Nominal Value Pledged *per Bond* scaled by Amount Outstanding				
	(1)	(2)	(3)	(4)
	All bonds	Other bonds	Government	All bonds
Post x $\text{Treated}_{\text{Country}}$	-0.1230**	-0.1261	-0.0673*	-0.1465*
	(-2.16)	(-1.67)	(-1.94)	(-1.96)
Post x $\text{Treated}_{\text{Country}}$ x Government				0.0725
				(0.99)
Adj. R2	.8253	.8228	.7204	.8253
Obs	412,466	301,208	111,258	412,466

Bank-level Controls	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table IA.3: Collateral Pledging and Money Market Activity - Simple Test

Table IA.3 shows the result for the fixed-effects panel regression, where the dependent variables are: net securities lending volume in column (1), gross securities lending volume in column (2), gross securities borrowing volume in column (3), the reuse rate in column (4), the reuse amount in column (5), and the volume-weighted lending rate (net of the GC rate) in column (6). The main explanatory variables are *Collateral Pledged*, which is the amount of a security pledged with the Eurosystem scaled by a bond's amount outstanding and lagged by one period. In Panel B, we include on the bond-level: dummy variables for on-the-run status, for auction periods and the cheapest-to-deliver (CTD) in Futures contracts as well as variables related to stock and flow of the central bank's asset purchase programs. Bank-level control variables are summarized in Table 1. We aggregate these to the bond-level by taking value-weighted averages, with weights given by a bank's pre-ACC share of repo volume for a given bond. Fixed effects are included as shown at the bottom of the table. The sample period is January 2020 to July 2020. In Panel A, we report t-statistics based on double-clustered standard errors at the bank and time level, in parentheses. In Panel B, we report t-statistics based on double-clustered standard errors at the bond and time level. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: Bank-Bond-Level

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Specialness
	(1)	(2)	(3)	(4)	(5)	(6)
Collateral Pledged	-0.1669***	-0.1237***	0.0432	-0.1958	0.0030	0.0100
	(-2.98)	(-3.50)	(1.38)	(-0.82)	(0.32)	(0.81)
Adj. R2	.4315	.4630	.4836	.2228	.2676	.7342
Obs	132,754	132,754	132,754	132,754	132,754	85,035
Bond x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Panel B: Bond-Level

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Specialness
	(1)	(2)	(3)	(4)	(5)	(6)
Collateral Pledged Pledged	-0.1735	-0.7960***	-0.6225**	-1.1995*	-0.2936*	0.0306
	(-0.84)	(-3.40)	(-2.66)	(-1.73)	(-1.79)	(0.38)
Adj. R2	.5130	.6324	.6475	.5692	.6345	.5388
Obs	11,989	11,989	11,989	11,989	11,989	11,989
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Issuer x Maturity x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time

Table IA.4: Money Market Activity - Difference-in-Difference (Country-Level Treatment)

Table IA.4 shows the result for the fixed-effects panel regression. In column (1) the dependent variable is the net securities lending volume (defined as gross lending - borrowing) of bank b in bond i on week t, scaled by bond i's amount outstanding. In column (2) the dependent variable is the gross securities lending volume of bank b in bond i on week t, scaled by bond b's amount outstanding. In column (3), the dependent variable is the gross securities borrowing amount. The dependent variable is the reuse rate in column (4) and the reuse amount in column (5). In column (6) the dependent variable is the volume-weighted deal rate across all lending transactions of bank b in bond i on week t (net of the GC rate). The main explanatory variables are: *Post*, which is a dummy variable that equals 1 for the time period after the extension of the ACC program on April 7, 2020 and zero otherwise and ***$Treated_{Country}$*, which is a dummy variable that equals 1 for banks which have non-zero mobilised non-marketable collateral in the year prior to the ACC framework extension and are located in first-wave ACC countries (FR, ES, BE, GR)**. The sample period is January 2020 to July 2020. Bank-level control variables are summarized in Table 1. Fixed effects are included as shown at the bottom of the table. We report t-statistics based on standard errors clustered at the bank and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Lending Rate
	(1)	(2)	(3)	(4)	(5)	(6)
Post x $\text{Treated}_{\text{Country}}$	0.4662***	0.2212**	-0.2449**	1.4236	0.0226	0.0002
	(3.52)	(2.28)	(-2.70)	(1.49)	(0.69)	(0.00)
Adj. R2	.4231	.4567	.4726	.2187	.2643	.7207
Obs	132,810	132,810	132,810	132,810	132,810	85,094
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bond x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time	Bank, Time

Table IA.5: Bond-Level Effects - Sample Split

Table IA.5 shows the result for a fixed-effects panel regression at the bond level, where the dependent variables are indicated in the column headers. **In Panel A, we include bonds with above-median market-level specialness throughout the sample period. In Panel B, we include bonds with below-median market-level specialness throughout the sample period.** Main explanatory variables and control variables are described in Table 8. We report t-statistics based on standard errors clustered at the bond and time level, in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: Above-Median Specialness

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Specialness	Rate Dispersion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post x $Frac_{Pledged}$	0.0261**	0.0196	-0.0065	0.0240	0.0070	-0.0092*	-0.0005
	(2.18)	(1.39)	(-0.68)	(0.82)	(0.64)	(-1.98)	(-0.32)
Post x $Frac_{Held}$	0.0324*	0.0465**	0.0140	0.0847**	0.0239*	-0.0201**	-0.0055**
	(1.77)	(2.58)	(0.99)	(2.20)	(1.74)	(-2.22)	(-2.69)
Adj. R2	.3852	.6087	.5953	.5187	.6438	.4347	.5268
Obs	5,264	5,264	5,264	5,264	5,264	5,264	5,264

Panel B: Below-Median Specialness

Dependent variable:	Net Lending	Gross Lending	Gross Borrowing	Reuse Rate	Reuse Amount	Specialness	Rate Dispersion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post x $Frac_{Pledged}$	-0.0114	-0.0094	0.0020	-0.0259	-0.0006	-0.0022	-0.0010
	(-1.01)	(-0.82)	(0.20)	(-0.76)	(-0.08)	(-1.05)	(-0.93)
Post x $Frac_{Held}$	-0.0124	0.0400*	0.0524**	-0.0287	0.0340*	-0.0038	-0.0018
	(-0.51)	(1.79)	(2.25)	(-0.50)	(1.97)	(-0.70)	(-0.71)
Adj. R2	.5774	.6481	.6737	.5925	.5914	.7624	.3867
Obs	5,343	5,343	5,343	5,343	5,343	5,343	5,343

Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer x Maturity x Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered S.E.	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time	Bond, Time