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Economics

The Bank Lending Channel of the ECB's Asset Purchase Programme: Evidence on Monetary Policy Transmission from Euro Area Countries

Economics

Master's thesis

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Turku

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Abstract:

This thesis examines the transmission of the European Central Bank's (ECB) Asset Purchase Programme (APP) through the bank lending channel at the country level. The objective is to determine whether euro area countries' banks with higher pre-APP exposure to APP-eligible sovereign debt securities experienced stronger growth in lending to non-financial corporations following the programme's introduction. In addition, this thesis investigates whether the effectiveness of the APP transmission varied across countries in response to macroeconomic and financial conditions.

The empirical analysis employs a difference-in-differences framework using quarterly panel data for 17 euro area countries over the period 2010-2018. The identification strategy exploits cross-country variation in pre-existing holdings of sovereign debt securities relative to total banking sector assets. Several robustness checks are conducted, including event-study specification, alternative treatment definitions, additional control variables, heterogeneity analyses and leave-one-out estimations.

The results provide only limited evidence that higher APP exposure translated into stronger aggregate lending growth. Across the baseline specifications, countries with higher exposure did not experience significantly stronger lending growth following the introduction of the APP. This finding remains broadly unchanged after controlling for macroeconomic conditions and sovereign spreads. While some specifications produce negative coefficient estimates, the results do not provide evidence that the APP reduced lending. Rather, they suggest that higher exposure was often associated with countries facing structural economic and financial challenges that may have constrained monetary transmission.

The heterogeneity analysis indicates that lending responses differed across financial environments. Countries characterised by higher sovereign spreads exhibited stronger lending responses to APP exposure than financially less stressed countries, suggesting that underlying financial conditions influenced the effectiveness of transmission. At the same time, descriptive evidence shows that the APP coincided with improvements in financial market conditions, including declining sovereign spreads and improving equity market performance.

Overall, the findings suggest that the APP was more successful in improving financial conditions and supporting market functioning than in generating a strong, uniform increase in aggregate bank lending across the euro area. The results highlight the importance of financial conditions, banking-sector characteristics and cross-country heterogeneity in shaping the effectiveness of unconventional monetary policy.

Tiivistelmä:

Tässä tutkielmassa tarkastellaan Euroopan keskuspankin (EKP) Asset Purchase Programme:n (APP) välittymistä pankkien lainanantoon valtiotasolla. Tutkielman tavoitteena on selvittää, kasvoiko pankkilainananto yrityksille voimakkaammin niissä euroalueen maissa, joiden pankkien taseissa oli ennen APP:n alkua enemmän ohjelmaan kelpaavia valtion velkapapereita. Lisäksi tutkielmassa tarkastellaan, vaihteliko APP:n tehokkuus maiden välillä makrotaloudellisten ja rahoitusmarkkinoihin liittyvien olosuhteiden mukaan.

Empiirinen analyysi perustuu difference-in-differences-menetelmään ja kvartaali-paneeliaineistoon, kattaen 17 euroalueen valtiota vuosina 2010-2018. Identifiointistrategia hyödyntää valtioiden välistä vaihtelua pankkisektorin valtion velkapaperien määrässä suhteessa kokonaisvaroihin ennen ohjelman alkua. Tulosten luotettavuutta arvioidaan useilla robustisuustarkasteluilla, kuten event-study-tarkastelulla, vaihtoehtoisilla treatment-määritelmillä, lisäkontrollimuuttujilla, heterogeenisyysanalyysillä ja leave-one-out-estimoinneilla.

Tulokset antavat vain rajallista näyttöä siitä, että suurempi altistuminen APP:lle olisi johtanut voimakkaampaan luotonannon kasvuun. Perusmalleissa suuremman altistuksen maat eivät kokeneet tilastollisesti merkitsevästi voimakkaampaa luotonannon kasvua APP:n aloituksen jälkeen. Tulokset ovat pääosin samat myös kontrolloitaessa makrotaloudellisia olosuhteita ja valtioiden korkoeroja. Tulokset eivät anna myöskään näyttöä siitä, että APP olisi vähentänyt luotonantoa, vaikka joissakin spesifikaatioissa kertoimet ovat negatiivisia. Sen sijaan tulokset viittaavat siihen, että suurempi altistuminen APP:lle oli usein yhteydessä valtioiden taloudellisiin eroavaisuuksiin ja rahoitusmarkkinoiden haasteisiin, jotka saattoivat heikentää rahapolitiikan välittymistä.

Heterogeenisyysanalyysi osoittaa, että luotonannon reaktiot vaihtelivat erilaisissa rahoitusympäristöissä. Valtiot, joissa korkoerot olivat suurempia, reagoivat APP:n altistukseen voimakkaammalla luotonannon kasvulla kuin valtiot, jotka olivat taloudellisesti vähemmän stressaantuneita. Visuaalinen analyysi osoittaa myös, että APP ajoittui samalle ajanjaksolle rahoitusmarkkinoiden parantumisen kanssa, mikä näkyi muun muassa valtioiden korkoerojen kaventumisena ja osakemarkkinoiden vahvistumisena.

Kokonaisuudessaan tulokset viittaavat siihen, että APP onnistui paremmin parantamaan rahoitusmarkkinoiden toimintaa ja vakauttamaan markkinoita kuin aikaansaamaan voimakkaan ja yhdenmukaisen luotonannon kasvun koko euroalueella. Tulokset korostavat rahoitusolosuhteiden, pankkisektorin ominaisuuksien ja valtioiden välisen heterogeenisyyden merkitystä epätavanomaisen rahapolitiikan vaikuttavuuden näkökulmasta.

Key words: Asset Purchase Programme (APP), unconventional monetary policy, bank lending channel, quantitative easing, monetary transmission, euro area, difference-in-differences

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1 Introduction

Following the global financial crisis and the euro area sovereign debt crisis, the European Central Bank (ECB) faced a prolonged period of weak economic growth, low inflation and historically low interest rates. As conventional monetary policy became constrained by the zero lower bound, the ECB increasingly relied on unconventional monetary policy measures to support the Eurozone economy. An important measure was the Asset Purchase Programme (APP), introduced in 2015, under which the ECB purchased large quantities of public- and private-sector securities to ease financing conditions and stimulate economic activity. The programme represented a major shift in euro area monetary policy, as the ECB moved from primarily steering short-term interest rates to actively influencing longer-term financing conditions and the functioning of financial markets through balance sheet expansion.^{2 3}

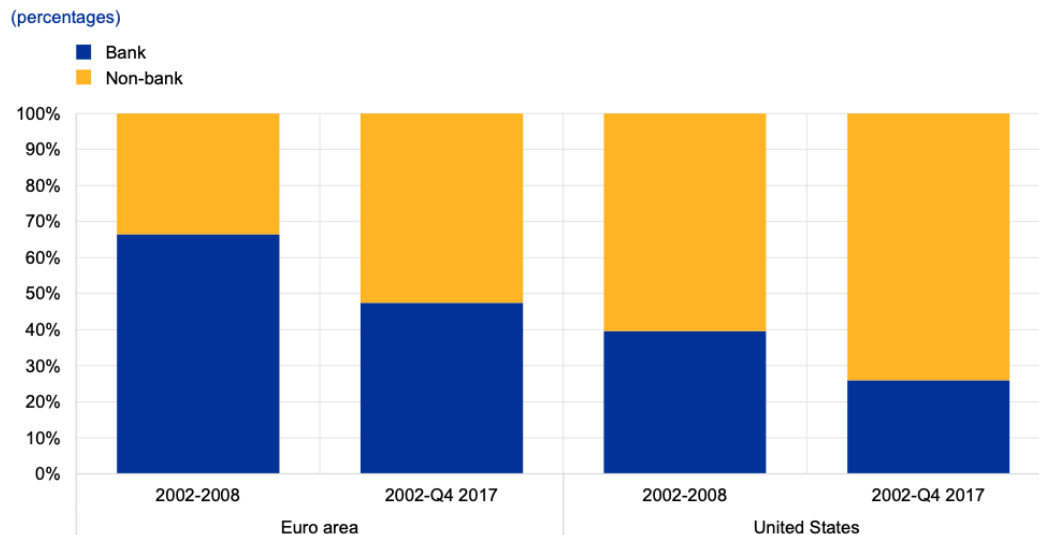


Figure 1: Share of bank and non-bank financing in NFCs' financing in the euro area and the United States^{4 5}

The APP was expected to support the economy through several transmission channels, particularly improving banks' liquidity and encouraging lending to the private sector. This channel is especially important in the euro area, where the financial system relies heavily on bank-based financing. Bank loans constitute almost 50 percent of the external financing of non-financial corporations (NFCs) in

² Beckmann et al., "The ECB asset purchase programmes: effectiveness, risks, alternatives", Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020.

³ Altavilla et al., "Monetary policy, credit institutions and the bank lending channel in the euro area", ECB Occasional Paper Series, No. 222 (2019), 3-4.

⁴ Source: ECB, Federal Reserve System. Altavilla et al., "Monetary policy, credit institutions and the bank lending channel in the euro area", ECB Occasional Paper Series, No. 222 (2019), 5.

⁵ The latest observation is for 2017.

the euro area, compared to only around 25 percent in the United States. This is illustrated in Figure 1. The euro area's financial system is therefore fundamentally bank-based, meaning that changes in banks' balance sheet conditions, funding costs and risk-bearing capacity have direct implications for monetary policy transmission to the real economy. If banks do not pass on improved financial conditions to new lending, the effectiveness of unconventional monetary policy in stimulating investment, output and inflation may remain limited.⁶ For this reason, understanding whether unconventional monetary policy successfully translated into stronger bank lending became one of the central policy questions following the introduction of the APP.

Although existing research generally finds that the APP improved financial market conditions and lowered sovereign bond yields, evidence regarding its effects on bank lending is less precise. Many micro-level studies find that banks more exposed to the APP increased lending more than other banks, while aggregate level studies on APP's impact on economic activity and inflation report highly heterogeneous results, ranging from near-zero effects to sizable macroeconomic stimulus.⁷ This raises an important question: did the APP translate into broader increases in aggregate bank lending across the euro area, or were its effects constrained by weak demand, bank balance sheet conditions and other transmission frictions?

In this thesis, I aim to answer this question by analysing the bank lending channel of the ECB's APP at the country level. The analysis focuses on whether countries with higher pre-APP exposure to sovereign debt securities experienced stronger lending growth following the programme's introduction. In addition, I examine whether the effects of the APP differed across countries depending on loan demand, financial stress and broader macroeconomic conditions. By focusing on country-level outcomes, this thesis complements the existing bank-level literature and evaluates whether the lending responses observed among individual banks were sufficiently strong to generate observable changes in aggregate credit supply.

The empirical analysis uses a difference-in-differences framework with quarterly euro area panel data from 2010 to 2018. The identification strategy exploits differences in pre-existing exposure to APP-eligible sovereign debt securities across euro area countries, allowing for comparison of lending developments between more- and less-exposed countries before and after the introduction of the APP. Overall, the results provide only limited aggregate evidence on the transmission of the bank lending

⁶ Altavilla et al., "Monetary policy, credit institutions and the bank lending channel in the euro area", ECB Occasional Paper Series, No. 222 (2019), 3-6.

⁷ Beckmann et al., "The ECB Asset Purchase Programmes: Effectiveness, Risks, Alternatives", Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020, 14.

channel. While financing conditions improved during the APP period, the lending response appears relatively modest and heterogeneous within countries. Additional analysis suggests that transmission may have varied with countries' financial conditions, highlighting the importance of financial fragmentation and cross-country heterogeneity.

The remainder of the thesis is structured as follows. Chapter 2 reviews the literature on unconventional monetary policy, transmission channels, previous research on the bank lending channel and the APP. Chapters 3 and 4 introduce the data and empirical methodology. Chapter 5 presents the empirical results, while Chapter 6 discusses the findings in relation to the existing literature and monetary transmission constraints. Finally, Chapter 7 summarizes the thesis and its findings.

2 Background and Related Literature

2.1 Unconventional Monetary Policy

2.1.1 Motivation

Unconventional monetary policy refers to measures used by central banks when traditional monetary policy tools, such as short-term interest rates, become insufficient to achieve macroeconomic targets, particularly during periods of economic distress or when interest rates are at their effective lower bound.⁸ While conventional monetary policy primarily relies on short-term interest rates to influence credit conditions and aggregate demand, unconventional policy incorporates tools that influence financial conditions through different channels in times of policy rates being (near) at the zero lower bound, where further reductions are neither feasible nor effective.

Before the global financial crisis in 2008, there was a dominant belief among macroeconomists and policymakers on how to conduct monetary policy and a single target: stable inflation. This period, often referred to as the “Great Moderation”, was characterised by lower volatility fluctuations. Stable inflation was viewed to naturally lead to macroeconomic stability and optimal economic outcomes. This approach was supported by the New Keynesian model, which suggested that constant inflation was the optimal policy, leading to zero output gap. The global financial crisis showed that this assumption did not always hold true. Stable inflation was not sufficient to ensure macroeconomic stability, and the output gap could still vary, leading to a trade-off between two targets. As the crisis progressed and aggregate demand collapsed, central banks promptly cut their policy rates, often to near zero. However, the zero nominal interest rate bound prevented them from lowering rates any further. This constraint highlighted the downside of low average inflation. The crisis demonstrated that a higher average inflation rate could have provided greater flexibility, allowing more substantial interest rate cuts and thus mitigating the decline in output and public finances.⁹

The new monetary policy environment, where policy rates can be near or even below zero, has led to the development and adoption of unconventional monetary policy measures. The zero lower bound creates notable frictions in the banking sector. A key transmission route for monetary policy operates through banks’ balance sheets, where lower policy rates typically reduce financing costs and stimulate

⁸ Horst & Neyer, “The impact of quantitative easing on bank loan supply and monetary policy implementation in the euro area”, University Dusseldorf, No. 325 (2019), 1.

⁹ Blanchard et al., “Rethinking macroeconomic policy”, *Journal of Money, Credit and Banking*, Vol. 42, No. 6 (2010), 199-205.

credit supply. On the other hand, since retail deposit rates cannot fall below zero, the impact of policy rate cuts to or below zero on banks' funding costs weakens. This limits banks' ability to lower loan interest rates without reducing their net interest margins, leading to "reversal rate"— a policy rate threshold below which further easing would have a negative impact on lending and bank profitability and potentially increase risk-taking.¹⁰

2.1.2 Unconventional Policy Instruments

The unconventional monetary policy tools include quantitative easing, forward guidance, credit easing, longer-term refinancing operations (LTROs), targeted longer-term refinancing operations (TLTROs) and negative interest rates. Quantitative easing means the central bank's large-scale asset purchases, typically involving long-term public and private securities. ECB's Asset Purchase Programme is an example of quantitative easing.² Quantitative easing differs from traditional policy by directly affecting on the size and structure of the central bank's balance sheet by increasing reserves above banks' liquidity requirements. Purchases lead to more secure financial conditions by lowering interest rates, decreasing risk premia and encouraging portfolio rebalancing among private investors. Empirical studies in the euro area support the positive macroeconomic effects, such as GDP growth and inflation, from quantitative easing.

While quantitative easing typically focuses on the volume of assets purchased, credit easing targets the composition of these purchases, often with the purpose of restoring credit markets or reducing credit spreads. For the ECB, the distinction between quantitative easing and credit easing can be unclear, as operations such as LTROs are designed to channel liquidity specifically toward bank lending to businesses and households. These operations aim to improve the overall transmission of monetary policy by easing financing constraints in friction-prone markets.¹¹ LTROs and TLTROs are the ECB's instruments to provide conditional long-term funding to banks with incentives linked to lending performance. By lowering funding costs for issuing new loans to businesses and households, these measures aim to stimulate credit supply where direct asset purchases may be less effective.

Forward guidance refers to the central bank's intentional communication regarding the expected direction of the future monetary policy instruments. Expectations of future rates and central bank commitments can considerably affect current financial conditions as the anticipated duration at the

¹⁰ Heider & Leonello, "Monetary policy in low-interest rate environment: reversal rate and risk taking", ECB Working Paper Series, No. 2593. (2021), 2-9.

¹¹ Benigno et al., "The ECB's asset purchase programme: theory, effects, and risks", *Journal of Economic Surveys*, Vol. 37 No. 3 (2022), 893-898.

lower bound influences investors' and borrowers' decisions. At the zero lower bound, managing expectations about the future stance of policy became an essential tool. However, forward guidance is most effective when it is perceived as credible and sometimes involves a commitment mechanism such as a promise to keep policy rates low until certain inflation or employment thresholds are reached. As such commitments are stated publicly, it makes statements more credible and difficult for policymakers to ignore.¹²

Quantitative easing and forward guidance are generally considered complementary measures, especially for influencing yield-curve expectations, whereas credit easing instruments and LTROs address segmentation and imbalances in credit markets. Overall, unconventional monetary policies have played a significant role in supporting the euro area economy during periods when conventional monetary policy hasn't been feasible. However, the relative effectiveness of these instruments depends crucially on the transmission mechanisms. In the euro area's bank-based financial system, this means that improvements in financing conditions do not automatically lead to an increase in lending to the real economy. If banks' balance sheets are weak or credit demand is low, additional liquidity may remain within the financial system rather than supporting productive investments. This underscores the importance of evaluating not only the impact of unconventional policies on financial markets but also their ability to stimulate actual credit growth and economic activity.

2.1.3 Transmission Channels of Unconventional Policies

To evaluate the effectiveness of unconventional monetary policy, it is essential to examine the channels through which they are transmitted to the real economy, impacting bank behaviour, asset prices, expectations, and ultimately, aggregate economic activity. The literature typically distinguishes between two primary transmission channels: the bank lending channel and portfolio rebalancing channel, both of which reflect financial frictions and the role of intermediaries in monetary transmission.¹³ In addition, a signalling channel, operating through forward guidance, can influence expectations about future policy, although it is not the focus of this analysis. Given the bank-based nature of the euro area financial system, this thesis concentrates on the bank lending channel, which is particularly relevant for understanding how the ECB's Asset Purchase Programme may have affected credit supply to the real economy.

¹² Woodford, "Methods of policy accommodation at the interest-rate lower bound", Columbia University, 2012, 2-8.

¹³ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 33.

The bank lending channel describes a mechanism that influences banks' funding conditions and their capacity to supply credit by altering banks' short-term funding costs and liquidity constraints. When monetary policy is tightened, and interest rates rise, banks face higher funding costs. If reserve requirements are binding, this can lead to a reduction in reservable deposits, while at the same time, banks may need to offer higher returns on non-deposit funding sources. As deposit funding declines, banks that cannot easily substitute toward alternative sources of finance may be forced to reduce lending. Both credit supply and aggregate demand contract.¹⁴

Conversely, under expansionary monetary policy, lower interest rates and improved liquidity conditions reduce banks' funding costs and ease financing constraints, thereby supporting credit growth. This highlights that the bank lending channel operates with funding conditions, but its impact may vary depending on the economic environment and the stability of the banking sector. Alternative interpretation by Disyatat (2011)¹⁵ of the bank lending channel emphasises a different causal mechanism. In this framework, deposits are driven by loan creation rather than constraining it, and reserve requirements do not impose a binding limitation on credit supply. Instead, banks' lending decisions are influenced by their balance sheet strength and regulatory constraints. A monetary tightening raises the external finance premium faced by banks, reflecting higher perceived risk and weaker balance sheet conditions. As funding becomes more expensive, banks respond by cutting back lending. Similarly, in an expansionary setting, improved balance sheet conditions and lower perceived risk can reduce the external finance premium, enabling banks to increase lending.¹⁶

In both interpretations, the bank lending channel can be explained by the difficulties banks face in obtaining financing. The impact of monetary policy therefore differs across banks depending on their balance sheet characteristics. This heterogeneity is a key feature of the bank lending channel, as monetary policy does not affect all banks uniformly but rather depends on their ability to access funding and absorb risk. Financial linkages also matter; banks that depend on funding from banking systems exposed to tighter funding conditions are likely to experience stronger effects. Usually, better capitalised banks are more capable of attracting funding and maintaining lending. Bank size may also influence the response, as larger banks possibly benefit from better access to low-cost funding if balance sheet expansion is not associated with increased risk-taking. In contrast, smaller or less

¹⁴ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 30-35.

¹⁵ See Disyatat, "The bank lending channel revisited", *Journal of Money, Credit and Banking*, Vol. 43 No. 4 (2011).

¹⁶ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 30-35.

capitalised banks may face more binding constraints, making their lending behaviour more sensitive to changes in monetary policy.¹⁷

The portfolio rebalancing channel, on the other hand, describes how monetary policy affects the real economy by altering the risk composition and valuation of banks' asset portfolios. Through this channel, changes in monetary policy influence banks' incentives to adjust the allocation of their assets across different classes, affecting credit supply and risk-taking behaviour. The portfolio rebalancing channel operates through changes in values. In the context of expansionary monetary policy, when interest rates decline, the value of banks' long-term assets, such as government securities, increases. These valuation effects strengthen banks' balance sheets and encourage them to hold or expand their holdings of riskier assets, including real-economy lending. This improvement in balance sheet conditions supports greater risk-taking and enhances credit supply.¹⁸

Also, the portfolio rebalancing channel operates through changes in the returns banks earn on their investments. Monetary policy affects yields across both short- and long-term assets, altering the attractiveness of different investment opportunities. Under expansionary monetary policy, lower yields on safe assets reduce their attractiveness, encouraging banks to seek yield by shifting toward higher-return assets such as corporate loans or riskier securities.¹⁹

Under quantitative easing, central bank purchases of low-risk securities alter the risk composition of banks' balance sheets by removing safe assets from the market and compressing yields, thereby incentivising banks to rebalance toward riskier securities or increase lending in search of higher returns. These reallocations can also occur across borders, highlighting the role of global financial linkages.

At the bank level, the strength of this channel depends on existing holdings and balance sheet characteristics. Relevant factors include the type of securities held in the balance sheet, the relative importance of securities holdings and lending and the composition of lending between financial institutions and real economy borrowers. Banks with riskier asset portfolios are typically expected to exhibit stronger transmission through this channel. As with the bank lending channel, bank size and

¹⁷ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 30-35.

¹⁸ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 30-35.

¹⁹ Buch et al., "The international transmission of monetary policy", *Journal of International Money and Finance*, No. 91 (2019), 30-35.

capitalisation also matter, smaller and less capitalised banks may display more pronounced portfolio adjustments in response to monetary policy changes.²⁰

The risk perceived by banks can influence the strength of the portfolio rebalancing channel. Global or aggregate sources of uncertainty may affect banks' willingness to rebalance toward riskier assets differently compared to standard business cycle fluctuations. Elevated global risk or uncertainty may dampen the search-for-yield behaviour, even in an expansionary monetary policy environment, thereby weakening the transmission of this channel.

2.2 ECB's Asset Purchase Program

Since 2014 the ECB has implemented a series of large-scale asset purchase programmes alongside other unconventional monetary policy measures. These purchase operations further expanded through the Pandemic Emergency Purchase Programme (PEPP) in 2020, representing a shift in euro area monetary policy with broad implications for financing conditions and the stability of the European financial system. APP being the fundamental euro area monetary policy instrument, its mission was to influence monetary and financial conditions across all euro area member countries.

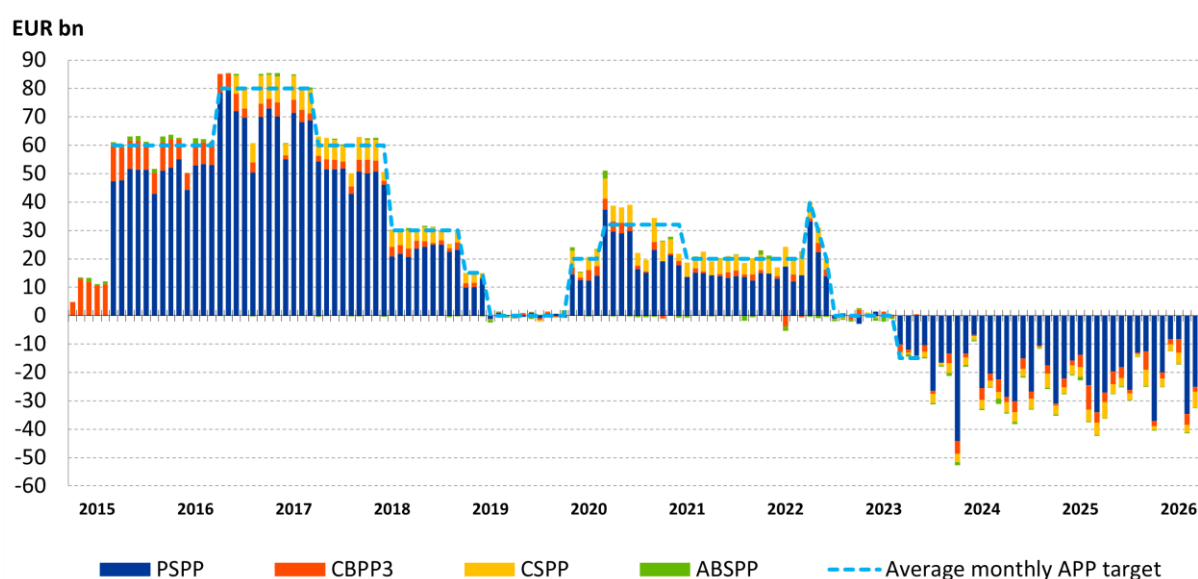


Figure 2: Net asset purchases by programme under APP.²¹

The ECB began systematic asset purchases in October 2014, initially targeting asset-backed securities (ABSPP) and covered bonds (CBPP3). These programmes were later extended to government bonds

²⁰ Buch et al., “The international transmission of monetary policy”, *Journal of International Money and Finance*, No. 91 (2019), 30-35.

²¹ Source: ECB website: Asset purchase programmes.

with the launch of the Public Sector Purchase Programme (PSPP) in 2015, and further to corporate bonds through the Corporate Sector Purchase Programme (CSPP) in 2017. Under the PSPP, purchases were primarily executed by national central banks, with limited risk sharing across the Eurosystem. A key feature of the ECB's asset purchase programmes was their open-ended nature, with the scale of purchases repeatedly adjusted in response to evolving economic conditions. Monthly purchases initially amounted to 60 billion euros, increased to 80 billion in 2016 following the introduction of the CSPP, and totalled approximately 2.59 trillion euros by the end of 2018. The COVID-19 pandemic led to further expansion through the introduction of the PEPP in 2020, which eventually reached 1.85 trillion euros.²²

As such, the APP should not be understood as a single measure, but as a sequence of programmes designed to restore the transmission of monetary policy when short-term interest rates had effectively reached the zero lower bound. When the programme was announced in March 2015, the ECB committed to conducting purchases for at least 19 months, while also emphasising that the duration could be extended if inflation did not converge toward the 2 percent target.²³

The economic rationale behind APP was to push down yields and ease financing conditions in an environment where conventional monetary policy had lost traction. By creating excess demand for targeted securities in secondary markets, the ECB compressed term premia and encouraged portfolio rebalancing into other assets, thereby transmitting lower yields more broadly across financial markets. In addition, the programme supported bank liquidity and credit provision while reinforcing expectations that policy rates would remain low for an extended period.²⁴

2.2.1 Effectiveness of the APP

The effectiveness of the APP can be evaluated through several measures, including financial market stabilisation, impacts on expectations, and the effects on real economic variables such as output and inflation. Empirical studies assessing these effects have employed a range of methodologies, most notably event studies and vector autoregressions (VARs). Despite these methodological differences,

²² Benigno et al., “The ECB’s asset purchase programme: theory, effects, and risks”, *Journal of Economic Surveys*, No. 37 (2023), 890–892.

²³ Benigno et al., “The ECB’s asset purchase programme: theory, effects, and risks”, *Journal of Economic Surveys*, No. 37 (2023), 891.

²⁴ Benigno et al., “The ECB’s asset purchase programme: theory, effects, and risks”, *Journal of Economic Surveys*, No. 37 (2023), 894–899.

the findings are broadly consistent with respect to the estimated effect sizes.²⁵ Across the literature, a robust and recurring result is that APP announcements and implementations had immediate and substantial effects on sovereign bond yields.

Empirical evidence suggests that the APP was particularly effective in stabilising financial market conditions, especially during periods of acute stress. Studies find that the announcement and implementation of the APP significantly reduced long-term sovereign bond yields across the euro area. The decline in yields ranged from 29 to 50 basis points immediately after the key announcements, and, according to some studies, reached 95 basis points by the end of the program. The effect was notably more pronounced in “periphery” countries such as Italy and Spain, where yield declines sometimes exceeded 100 basis points. These effects were largely transmitted through the portfolio rebalancing channel, as central bank purchases encouraged investors to shift toward riskier assets, thereby lowering yields more broadly across financial markets.²⁶ Gambetti & Musso (2020), using a structural approach, find that a substantial share of the yield decline occurred already at the announcement stage rather than during the implementation phase. This suggests financial markets rapidly incorporated expectations of lower term premia and asset scarcity into prices following policy announcements, with more limited additional effects as purchases progressed.²⁷

When it comes to translating financial market stabilisation into improvements in output and inflation, it becomes more complex. Available research indicates a positive but uncertain impact of the APP on both economic activity and consumer prices. The range of estimates is broad: studies using model-based simulations typically report more substantial effects (average GDP impact of 1,1% & inflation increase of 0,8 percentage points), when purely empirical approaches point to more moderate outcomes (average GDP gains of 0,7% and inflation increase of 0,6 percentage points). Effects on real variables were found to be stronger in financially distressed and vulnerable member states.²⁸ Altavilla et al. (2015) document this heterogeneity across euro area countries in their event study of the APP.²⁹ Similarly, Georgiadis & Gräb (2016) show that while APP announcements improved

²⁵ Beckmann et al., “The ECB’s asset purchase programmes: effectiveness, risks, alternatives”, Study for the Committee on Economic and Monetary Affairs, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2020, 8.

²⁶ Beckmann et al., “The ECB’s asset purchase programmes: effectiveness, risks, alternatives”, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020, 8-11.

²⁷ Gambetti & Musso, “The effects of the ECB’s expanded asset purchase programme”, *European Economic Review*, No. 130 (2020).

²⁸ Beckmann et al., “The ECB’s asset purchase programmes: effectiveness, risks, alternatives”, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020, 14–16.

²⁹ Altavilla et al., “Asset purchase programmes and financial markets: lessons from the euro area”, ECB Working Paper Series, No. 1864 (2015).

financial conditions within the euro area, the global spillovers to output and inflation were limited and highly heterogeneous. Emerging markets often experience capital outflows towards advanced-economy bonds, reducing increases in their own GDP, while stronger markets saw milder benefits from euro depreciation and rising equity prices. These findings suggest that the transmission of the APP to real economic outcomes depends importantly on country-specific financial conditions and external linkages.³⁰ It is worth noting that domestic financial system health plays a part in the facilitation of recovery and the support of price stability in stressed countries. Overall, while the APP contributed to lower government bond yields and supported economic activity to some extent, its impact on inflation appears more uncertain and generally smaller than that observed in similar programmes implemented by the US Federal Reserve or the Bank of England.³¹

A consistent theme in the literature is that the effectiveness of the APP diminishes as market conditions normalise. The strongest effects are observed during periods of peak financial stress, with subsequent rounds of asset purchases generating increasingly smaller marginal effects. This suggests that the APP functions primarily as a stabilisation tool rather than a persistent driver of economic expansion. Despite its importance during crises, its role in sustaining long-term economic recovery and achieving inflation normalisation appears more limited in the medium to long run.³²

2.3 The Bank Lending Channel of the APP: Related Literature

2.3.1 Micro-Level Evidence

Recent micro-level evidence on the effects of the APP on bank lending shifts the focus from aggregate policy effects to bank-level transmission mechanisms. The common question is how the programme worked through individual banks, which bank characteristics affected the response and whether credit expansion translated into broader real effects. Across the recent research papers, the evidence is built from confidential bank-level balance sheet data, Bank Lending Survey information and in some cases firm-level outcomes.

When viewed in chronological order, the literature also becomes increasingly precise over time. Earlier APP studies rely mainly on difference-in-differences and matching designs and use survey-

³⁰ Georgiadis & Gräß, “Global financial market impact of the announcement of the ECB’s asset purchase programme”, *Journal of Financial Stability*, No. 26 (2016).

³¹ Beckmann et al., “The ECB asset purchase programmes: effectiveness, risks, alternatives”, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020, 12–16.

³² Beckmann et al., “The ECB asset purchase programmes: effectiveness, risks, alternatives”, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2020, 6–17.

or balance sheet-based proxies for treatment, while later research adds bank-specific demand controls, alternative treatment definitions and firm-level transmission channels to identify heterogeneity more carefully. The broad result is remarkably consistent: APP supports bank lending, but the strength and even the sign of the response depend on bank exposure, balance sheet health, and the degree to which banks use the liquidity to expand credit rather than to repair their own balance sheets.

Blaes et al. (2019) study the effects of APP on euro area lending with refined difference-in-differences, including two types of matching. They combine confidential bank-level balance sheet items, interest rates and Bank Lending Survey responses arguing that matching is needed because it sharpens covariate balance between treated and control banks more effectively than a pure difference-in-differences design. Their research is also comparative, they explicitly compare their work with earlier DiD-based APP studies and add alternative treatment definitions to enhance robustness. The results of their study suggest that the APP successfully increased lending for NFCs, but for limited set of banks. Their found heterogeneous responses are presented later.³³

Altavilla et al. (2020) take a different perspective on the effectiveness of the bank lending channel by estimating changes in loan rates for firms following the introduction of unconventional monetary policy measures. However, this study also includes the effects of TLTROs besides the APP. They use bank-level datasets covering over 80% of the euro area banking system. Methodologically, it employs a VAR approach complemented by a high-frequency event study. The paper finds that these policies helped normalise lending rate conditions by inducing banks that had been previously sluggish in responding to policy rate changes to cut their lending rates.³⁴

Afonso and Pereira (2023) broaden the evidence by moving from bank lending alone to a bank-firm transmission link. They use balance sheet data in a difference-in-differences setup, define treatment through the share of government debt securities in assets and then estimate effects on firm borrowing, employment and fixed capital investment.³⁵

The final paper I will investigate is García-Posada and Paz (2024), while not APP-specific, it provides important benchmark evidence on the bank lending channel of monetary policy. Using confidential Individual Bank Lending Survey (BLS) data combined with bank balance sheet information and high-

³³ Blaes et al., “The effects of the Eurosystem’s APP on euro area bank lending: letting different data speak”, Deutsche Bundesbank, No. 26 (2019), 3-16.

³⁴ Altavilla et al., “Mending the broken link: heterogeneous bank lending rates and monetary policy pass-through”, *Journal of Monetary Economics*, No. 110 (2020).

³⁵ Afonso & Pereira, “Unconventional monetary policy in the euro area. Impacts on loans, employment, and investment”, *International Journal of Finance & Economics*, No. 20 (2023).

frequency monetary policy shocks, the authors examine how monetary policy affects banks' credit supply through changes in credit standards. Their evidence is highly relevant for interpreting APP effects, as it provides a useful benchmark for understanding why banks may respond differently to asset purchase programmes, even when exposed to similar policy shocks.³⁶

2.3.2 Bank Exposure to APP and Lending Behaviour

The research papers differ in how they define exposure to APP, reflecting different identification strategies. Blaes et al. construct two complementary indicators of APP exposure: a survey-based measure derived from banks' self-reported impact of the APP on their liquidity position in the Bank Lending Survey (BLS), and a balance sheet-based measure capturing banks' net selling of government bonds. The former captures perceived liquidity effects, while the latter proxies actual participation in the portfolio rebalancing channel. In contrast, Afonso and Pereira use a purely balance sheet-based approach, defining treatment mechanically using upper percentiles of government debt holdings relative to total assets.

Empirical results consistently indicate that banks that are more exposed to the APP increase their lending more than less-exposed banks do. Blaes et al. estimate that banks reporting a positive liquidity effect exhibit approximately 0.22 percentage-point higher monthly loan growth to non-financial corporations (NFCs) relative to the counterfactual, corresponding to roughly 0.6 percentage points at the quarterly level. Furthermore, their matching-based difference-in-differences estimates show that this effect is robust across alternative identification strategies, supporting the interpretation that APP exposure increases lending.

Afonso and Pereira report strong magnitudes, with banks in the 50th percentile treatment group showing about 3.32% higher loan growth and those in the 75th percentile showing about 5.33% higher loan growth relative to controls: loan growth over assets rises by 2.50% and 4.15%, respectively. These results indicate that exposure to assets targeted by the APP is a key determinant of lending responses, consistent with a portfolio rebalancing mechanism in which central bank purchases of government securities induce banks to shift their portfolios towards loan provision. Because the variation in exposure is measured prior to the programme, the findings support that an increase in credit supply led to more lending. In contrast, the authors do not find evidence that more exposed banks expanded lending more under PEPP (post-2020 period), suggesting that the same transmission

³⁶ García-Posada & Paz, "The transmission of monetary policy to credit supply in the euro area", Banco de España, No. 2430 (2024), 7-16.

mechanism did not operate during the pandemic period. They argue that this is due to the different macro-financial environment during the COVID-19 crisis, in which a flight-to-quality increased banks' demand for safe assets such as government securities. As a result, banks did not rebalance their portfolios toward lending to the same extent, limiting the transmission of asset purchases to credit supply. This highlights that the effectiveness and distribution of monetary policy transmission depend critically on the broader economic context.

Critically, the magnitudes are not directly comparable across papers because the outcome variables differ. Blaes et al. focus on monthly NFC loan growth, and Afonso and Pereira combine bank-level and firm-level outcomes across annual or quarterly balance sheet data. However, the main empirical pattern is consistent: greater exposure to the APP generally increases lending, but only when banks are able and willing to channel the liquidity shock into new lending rather than into balance sheet repair.

2.3.3 Heterogeneity in Bank Responses

Heterogeneity in bank responses to the APP is a central finding across the literature. Blaes et al. show that the expansionary effects of the APP on lending are concentrated among relatively sound banks, while banks with weaker balance sheets respond differently. Well-capitalised banks use the additional liquidity generated by the APP to expand lending to NFCs, whereas weaker banks tend to reduce lending to riskier borrowers and use the programme to repair their balance sheets. The authors also further present that banks with weaker lending responses were characterised by lower capitalisation, higher lending rates and more volatile loan growth prior to the APP. These pre-existing balance sheet vulnerabilities appear to constrain their ability to transmit monetary policy through increased credit supply. As a result, the APP does not uniformly stimulate lending across banks, but instead credit amplifies differences based on financial strength, highlighting the importance of bank-level characteristics in shaping monetary policy transmission.

Afonso and Pereira find heterogeneity in the transmission of asset purchase programmes along several dimensions. Firstly, they find that larger banks (by total assets) had higher loan growth overall. Secondly, they find that larger firms (500+ employees) had lower borrowing growth than smaller firms after the APP. This is consistent with the bank lending channel literature: smaller firms are more

dependent on bank financing because they lack access to capital markets, making them more exposed to shifts in bank credit supply.³⁷

Altavilla et al. find also heterogeneity in the pass-through of unconventional monetary policy measures, and interestingly, they find that it is reversed compared to conventional monetary policy heterogeneity. During unconventional monetary policy, banks with weak balance sheet characteristics were the most responsive to policy rate changes, aggressively cutting lending rates. This was pronounced for banks located in financially stressed countries. They find no evidence that banks with healthier balance sheets would have cut lending rates notably.

The pattern of heterogeneity is consistent with broader evidence on the bank lending channel. García-Posada and Paz show that the effects of monetary policy on credit supply depend critically on bank capitalisation, with poorly capitalised banks more likely to tighten credit standards and reduce lending, particularly during contractionary periods. Moreover, they present that these effects are stronger for riskier borrowers and small firms, indicating that balance sheet constraints shape not only the quantity of lending but also its allocation. This reinforces the interpretation that heterogeneity in APP responses arises from underlying differences in banks' financial strength, which determine whether liquidity shocks are transmitted to the real economy or absorbed by banks' balance sheets.

2.3.4 Aggregate Evidence on the APP and Bank Lending

The aggregate literature on the euro area points to broadly expansionary effects of the APP and other unconventional measures on bank lending, although the size and timing of those effects are not uniform. Across studies, the common finding is that asset purchases eased credit conditions and supported credit across the euro area. At the same time, the strength of transmission varies across sectors and countries, with stronger effects for corporate credit than for household credit and weaker transmission in financially distressed economies. I present two research papers most closely related to this thesis and to the empirical perspective taken in the latter section.

One of the most direct cross-country pieces of evidence is provided by Petrakis et al. (2024), who analyse monthly aggregate loan data for fifteen euro area economies from July 2007 to June 2021.³⁸ Using panel regression, they find that ECB non-regular operations, including APP and related measures, have a positive effect on bank credit. Importantly, their results reveal a structural change

³⁷ Afonso & Pereira, "Unconventional monetary policy in the euro area. Impacts on loans, employment, and investment", *International Journal of Finance & Economics*, No. 20 (2023).

³⁸ Petrakis et al., "The impact of the ECB's non-regular operations on bank credit: cross-country evidence", *Operational Research*, Vol. 24 No. 51 (2024), 1-26.

in the effectiveness of these policies around the zero lower bound (ZLB). While the overall effect of central bank balance sheet expansion suggests that the impact on lending was weaker in the earlier phase of unconventional policy and became stronger once large-scale asset purchases such as the APP were fully implemented.

The study also highlights substantial cross-country heterogeneity. Lending responses are stronger in non-stressed economies, whereas transmission is weaker in distressed countries, banks facing liquidity shortages, high non-performing loans, low capital buffers and ongoing deleveraging pressures. This suggests that while APP supported lending at the euro area level, its effectiveness depended critically on the underlying condition of national banking systems.

A second study by Sleibi et al. (2023) shifts focus from the level of lending to its co-movement across the monetary union.³⁹ Using data from twelve euro area economies, they extract common factors from credit-to-GDP series and estimate their responses to unconventional monetary policy shocks using a VAR. Their results show that shocks to central bank balance sheet variables, such as total assets and excess liquidity, generate positive and statistically significant increases in these common credit factors. This indicates that unconventional monetary policy not only increases aggregate lending but also strengthens the degree to which credit dynamics move together across countries. The effects are substantially stronger for corporate credit than for household credit. In their estimates, the corporate credit factor increases by up to 1.52 percent after five quarters, while the response of the household credit factor peaks at only 0.052 percent. This suggests that APP-type policies primarily operate through the corporate lending channel, consistent with the stronger dependence of firms on bank financing.

Overall, the literature provides consistent evidence that the ECB's asset purchase programmes supported bank lending, but the strength and distribution of this effect depend critically on bank-level and country-level characteristics. In contrast to micro-level evidence, aggregate evidence at the country-level points to more moderate and less precisely identified effects. While unconventional monetary policy improves financial conditions and supports credit growth, the transmission varies across countries depending on the condition of the banking sector and broader macroeconomic environment. This suggests that aggregate lending dynamics may mask substantial underlying

³⁹ Sleibi et al., "Unconventional monetary policies and credit co-movement in the Eurozone", *Journal of International Financial Markets, Institutions & Money*, No. 85 (2023), 1-14.

heterogeneity at the bank level. This thesis contributes to the literature by bridging these micro- and macro-level perspectives.

2.3.5 Heterogeneity in Cross-Country Responses to Unconventional Monetary Policy

A central question in the monetary policy transmission concerns whether it operated uniformly across member countries or instead varied systematically with countries' financial conditions. This is particularly relevant for the bank lending channel because banks across the euro area entered the post-crisis period with very different balance sheet conditions, sovereign exposures and funding constraints. If monetary transmission in general is weaker in financially stressed economies, the effects of the APP on bank lending may also differ substantially across countries.

Burriel and Galesi (2018) ⁴⁰ employ a Global VAR (GVAR) model covering 19 euro area countries over the period 2007-2015 to assess the macroeconomic effects of the ECB's unconventional monetary policy shocks. Although their analysis excludes the APP itself, it remains highly relevant because it examines the same broader question of whether unconventional monetary policy was transmitted evenly across the countries. They analyse how an unconventional monetary policy shocks affect countries when compared across different macroeconomic measures (output and prices). The shock itself is defined as an exogenous expansion of the ECB's balance sheet, where the ECB's total assets are used as the proxy for the unconventional monetary policy instrument. The results are highly heterogeneous and much of the heterogeneity is linked to the sovereign debt crisis and differences in countries' financial conditions.

The authors also compare financially stressed and non-stressed countries by grouping Cyprus, Greece, Ireland, Italy, Portugal and Spain as stressed economies. They find that output responses to unconventional monetary policy are significantly weaker in stressed countries than in non-stressed countries. Furthermore, countries with weaker banking sectors, measured by lower bank capital ratios, benefit less from monetary policy easing.

Grandi (2019) ⁴¹ complements this macroeconomic evidence with a micro-level analysis of the bank lending channel. Using bank-level data across all euro area countries over 2007-2016, the study tests whether monetary policy transmission to bank lending was heterogeneous between stressed and non-stressed countries and whether sovereign exposure explains this divergence. The results confirm

⁴⁰ Burriel & Galesi, "Uncovering the heterogeneous effects of the ECB unconventional monetary policy across euro area countries", *European Economic Review*, No. 101 (2018).

⁴¹ Grandi, "Sovereign stress and heterogeneous monetary transmission to bank lending in the euro area", *European Economic Review*, No. 119 (2019).

significant heterogeneity: a 1% policy rate cut led to a 0.5% increase in lending by banks in stressed countries, compared with a 1.6% increase by banks in non-stressed countries. This finding holds across multiple monetary policy indicators, indicating that the heterogeneity applies to both conventional and unconventional monetary policy transmission.

Within stressed countries, banks with high ex-ante sovereign exposures (75th percentile) expanded lending by only 1.1% in response to a 1% policy rate cut, whereas banks with low sovereign exposures (25th percentile) expanded lending by 3.7%. The marginal effect of monetary policy on lending becomes statistically indistinguishable from zero and even turns negative for banks with very high sovereign exposures.

The sovereign exposure channel operated primarily through banks' holdings of domestic government debt. Sovereign default risk was disproportionately higher for government bonds issued by stressed countries, and because banks exhibited a pronounced home bias in their sovereign debt portfolios, the resulting balance sheet impairment was more severe for banks in those countries. Between 2007 and 2016, 65% of banks in stressed countries held sovereign exposures exceeding 10% of total assets, compared with only 5% of banks in non-stressed countries. Consistent with the findings of Burriel and Galesi, the heterogeneity intensified during and after the sovereign debt crisis, suggesting that financial fragmentation further weakened the effectiveness of policy measures in stressed economies.

Taken together, these two studies provide robust evidence that the transmission of the unconventional monetary policy was not homogeneous across euro area countries. The heterogeneity was economically significant and systematically related to countries' financial health. In general, financially stressed economies experienced weaker transmission of the ECB's unconventional monetary policy measures. Both papers also suggest that financial fragmentation during the sovereign debt crisis weakened monetary policy transmission, particularly in financially stressed economies, contributing to cross-country heterogeneity in policy outcomes.

2.4 Portfolio Rebalancing Channel During the APP

Although this thesis focuses on the bank lending channel, analysing the portfolio rebalancing channel is also important for understanding the broader transmission of the APP. Changes in banks' portfolio allocations can indirectly influence their lending behaviour through balance sheet effects, valuation gains and changes in risk-taking behaviour. Within the broader transmission of the APP, the portfolio rebalancing channel operates through a relatively simple mechanism: by lowering yields on safe long-term securities, central bank purchases encourage investors to move away from those assets and

toward instruments with higher expected returns, including riskier securities and loans. Albertazzi et al. (2018) examine this mechanism using the euro area APP and ask whether the decline in yields generated by the programme translated into observable shifts in portfolio composition across sectors and countries.⁴²

Their identification strategy relies on cross-sectional variation in the APP shock. They use the ECB Security-Holdings Statistic, a confidential dataset with ISIN-level information on securities held by institutional sectors in each euro area country, and combine it with bank-level loan data, loan rates and capital. Ratios, CDS spreads and Bank Lending Survey (BLS) indicators of credit demand. The empirical design is designed to separate portfolio rebalancing from credit demand effects by comparing investment patterns in the same security across different sectors, while also using the programme's country allocation rules and the data's granularity to reduce endogeneity concerns.⁴³

The central finding is that the portfolio rebalancing channel was active but not uniform across the euro area. For the euro area as a whole, the authors do not find a statistically significant relationship between APP exposure and portfolio rebalancing when they focus on newly issued securities. However, the pattern becomes clearer in more vulnerable economies, where larger APP-induced valuation gains are associated with shifts toward riskier securities, especially corporate bonds and credit risk, rather than maturity or currency risk. The extensive-margin analysis shows that this adjustment did not primarily involve a shift into entirely new security categories. Instead, investors reallocated within existing categories, which suggests that portfolio constraints shaped the response.

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The paper also links portfolio rebalancing to bank lending. Using bank-level exposure measures, the authors find that a one-standard-deviation increase in APP-related portfolio valuation is associated with about 2 percentage points higher credit growth. This result remains after controlling for bank-level credit demand based on the BLS, which strengthens the interpretation that the effect operates through credit supply rather than demand alone. The loan-rate results are more differentiated. Higher APP exposure is associated with lower rates on new household loans, while the relation is not significant for non-financial corporations. The authors further show that the lending response is stronger for banks headquartered in less vulnerable countries and weaker for less capitalised banks,

⁴² Albertazzi et al., "Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area", ECB Working Paper Series, No. 2125 (2018), 1-9.

⁴³ Albertazzi et al., "Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area", ECB Working Paper Series, No. 2125 (2018), 4-9

⁴⁴ Albertazzi et al., "Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area", ECB Working Paper Series, No. 2125 (2018), 7-19.

indicating that geographical location mattered more than balance sheet conditions in shaping the ability to rebalance toward lending.⁴⁵

These findings sharpen the interpretation of APP transmission. In vulnerable economies, where risk premia remained high, the APP appears to have worked mainly by inducing a search for yield into riskier securities. In less vulnerable economies, where spreads were already compressed, the same policy shock was reflected more in lending behaviour than in shifts toward riskier securities, which is consistent with a stronger bank lending channel. The contribution of the paper therefore extends beyond documenting the rebalancing effects. It illustrates how the APP's impact on bank lending was part of a broader reallocation of financial portfolios, the form of which depended on country-specific conditions and the structure of financial intermediaries.

2.5 Limits to Monetary Transmission in a Low-Interest Rate Environment

Unlike conventional interest rate policy, asset purchase programmes primarily operate through indirect transmission mechanisms, such as the bank lending and portfolio rebalancing channels discussed in previous chapters. As a result, their effectiveness depends not only on changes in financial market conditions, but also on how banks, firms and households respond to these changes. In a low-interest rate environment, these behavioural responses may weaken or be delayed, implying that improvements in liquidity and financing conditions do not necessarily translate into higher lending, investment or inflation. These limitations can be broadly divided into demand-side constraints, bank-side constraints, and broader macroeconomic or financial environment-related factors. Understanding these limitations is important for interpreting the empirical effects of the APP examined later in this thesis.

2.5.1 Demand-Side Limitations

A liquidity trap occurs when nominal interest rates are close to the zero lower bound while inflation and aggregate demand remain persistently weak. Under these conditions, conventional monetary policy becomes less effective because further reductions in policy rates are constrained. Even when central banks provide additional liquidity or lower long-term yields through unconventional measures, firms and households may remain unwilling to increase borrowing and investment due to

⁴⁵ Albertazzi et al., “Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area”, ECB Working Paper Series, No. 2125 (2018), 17-19.

weak economic expectations and heightened uncertainty. As a result, improvements in financial conditions do not necessarily translate into stronger economic activity or higher inflation.⁴⁶

One of the key limitations to monetary transmission is the weakness of aggregate demand itself. When expected sales, income growth and profit opportunities remain subdued, less expensive financing does not automatically lead to more borrowing or investment.

This dynamic becomes more persistent once deleveraging and uncertainty take hold. Koo (2013) argues that when firms and households shift into debt minimisation, they are no longer interested in additional borrowing at any interest rate, meaning monetary easing loses traction because the private sector becomes focused on repairing balance sheets rather than undertaking new expenditure. In that setting, lenders also become more cautious, reinforcing the contraction in credit and contributing to a prolonged period of stagnation.⁴⁷

Low demand can then become entrenched through sluggish adjustment of expectations. Coibon and Gorodnichenko (2015) document widespread information rigidities among firms, consumers, financial market participants and professional forecasters, implying that beliefs about inflation and economic activity adjust only gradually rather than immediately. In a low-inflation environment, this matters because persistent economic weakness can keep inflation expectations subdued, leaving real interest rates effectively high and weakening the force of monetary stimulus. Consequently, even highly accommodative monetary policy may fail to sufficiently stimulate borrowing and investment if private agents continue to expect low inflation and weak future growth.^{48 49}

This is where credibility and forward guidance become central. Eggertsson and Woodford (2003) show that at the zero lower bound, monetary policy operates largely through expectations about future policy, and that open-market operations are ineffective when they fail to alter those expectations. The effectiveness of forward guidance therefore depends on whether private agents perceive the central bank's commitment as credible. If agents do not believe that the zero lower bound will eventually

⁴⁶ Darvas & Pichler, "Excess liquidity and bank lending risks in the euro area", European Parliament, No. 16 (2018).

⁴⁷ Koo, "Balance sheet recession as the 'other half' of macroeconomics", *European Journal of Economics and Economic Policies: Intervention*, Vol. 10 No. 2 (2013), 136-155.

⁴⁸ Coibon & Gorodnichenko, "Information rigidity and the expectations formation process: a simple framework and new facts", *American Economic Review*, Vol. 105 No. 8 (2015), 2646-2655.

⁴⁹ Eggertsson & Woodford, "Optimal monetary policy in a liquidity trap", NBER Working Paper Series, No. 9968 (2003).

cease to bind, forward guidance loses much of its power, making credibility itself a first-order constraint on monetary transmission.^{50 51}

Overall, the demand-side problem is self-reinforcing: weak demand depresses expectations, pessimism encourages deleveraging, deleveraging suppresses investment and consumption, and subdued expectations further weaken monetary transmission. Under such conditions, unconventional monetary policy may improve financial market conditions while generating more limited effects on credit growth, aggregate demand and inflation.

2.5.2 Bank-Side Limitations

Even when monetary easing lowers market interest rates and improves liquidity conditions, the bank lending channel may weaken if lower rates reduce bank profitability or impose balance sheet constraints. It is well understood that negative shocks to bank balance sheets reduce the supply of credit, and the effectiveness of monetary transmission depends crucially on how banks' assets and liabilities adjust when interest rates decline.

Heider et al. (2023) provide an important starting point by showing why deposit-heavy banks become particularly vulnerable once policy rates become negative. When retail deposit rates reach an effective lower bound, banks are unable to fully pass negative policy rates onto depositors, while returns on loans and other assets continue to decline. As a result, net interest margins become compressed, weakening banks' profitability and potentially reducing incentives to expand lending.⁵²

Eggertsson et al. (2023) also argue that negative interest rates do not necessarily stimulate aggregate demand once bank balance sheets are taken into account. Besides policy rates themselves, the effect of monetary easing also depends on banks' funding structures, profitability and capitalisation. When lower interest rates reduce bank profits, bank net worth may deteriorate, and intermediation costs may increase, particularly when regulatory or capital constraints become binding. Under such conditions, lending may contract rather than expand despite increasingly accommodative monetary policy.⁵³

These mechanisms imply that monetary transmission becomes heterogeneous across banks. Evidence from the literature suggests that the response to negative rates differs according to capitalisation,

⁵⁰ Eggertsson & Woodford, "Optimal monetary policy in a liquidity trap", NBER Working Paper Series, No. 9968 (2003).

⁵¹ Eggertsson et al., "A model of secular stagnation: theory and quantitative evaluation", *American Economic Journal: Macroeconomics*, Vol 11. No. 1 (2019).

⁵² Heider et al., "Banks and negative interest rates", *Annual Review of Financial Economics*, No. 13 (2021), 201-2015.

⁵³ Eggertsson et al., "Negative nominal interest rates and the bank lending channel", *Review of Economic Studies*, No. 91 (2023), 2207-2237.

funding structure and balance sheet composition. While some banks may expand lending in line with the traditional bank lending channel, others may respond more weakly or shift lending toward riskier borrowers in search of higher returns. Consequently, the same policy rate cut may have expansionary effects for some banks while even constraining lending for others.⁵⁴

Brunnermeier and Koby (2018) extend this argument by introducing the concept of reversal rate. They argue that there exists a threshold beyond which further monetary easing becomes contractionary because the negative effects on bank profitability outweigh the usual expansionary effects of lower interest rates and asset revaluation. The reversal rate depends on factors such as bank capitalisation, leverage constraints, deposit funding structures and the elasticity of deposit supply. In prolonged low-interest rate environments, these factors may gradually reduce the effectiveness of monetary policy transmission through the banking sector.⁵⁵

The literature therefore suggests that, in a prolonged low-interest rate environment, the banking sector can become both the main transmission channel and one of the primary sources of transmission frictions. This is particularly relevant for evaluating the APP, since asset purchases may support monetary transmission through lower yields and portfolio rebalancing, while simultaneously interacting with negative interest rates in ways that compress bank profitability and affect lending behaviour unevenly across banks.

2.5.3 Environment-Related Limitations

Lastly, it is also important to consider the financial environment in which the APP operated. Although the ECB implemented a common monetary policy across the euro area, financing conditions differed substantially between member countries due to fragmentation in financing markets, differences in banking sector conditions, sovereign stress and elevated uncertainty. As a result, the transmission of monetary policy remained uneven across countries even after the introduction of large-scale asset purchases.

One of the central problems was financing market fragmentation. Hovarth (2018) defines fragmentation as a divergence in financial conditions and asset prices across euro area countries resulting from declining cross-border financial integration. While euro area financial markets had become increasingly integrated before the global financial crisis, this process reversed sharply after 2008 and intensified during the sovereign debt crisis. The main consequence for monetary policy was

⁵⁴ Heider et al., “Banks and negative interest rates”, *Annual Review of Financial Economics*, No. 13 (2021), 203-210.

⁵⁵ Brunnermeier & Koby, “The reversal interest rate”, NBER Working Paper Series, No. 25406 (2018), 1-30.

an impairment in interest rate pass-through. In several stressed economies, bank lending rates no longer adjusted smoothly to ECB policy rate cuts, meaning that financing conditions remained tight despite increasingly accommodative policy.⁵⁶

Importantly, this weak pass-through was not primarily caused by a reduced responsiveness of bank rates to policy changes themselves, but by rising lending mark-ups reflecting higher sovereign and credit risk. Banks in financially vulnerable countries incorporated these risks into lending rates, thereby keeping borrowing costs elevated even as policy rates declined. The effects were particularly visible in southern European economies, where financial instability and fiscal stress were most pronounced. Diverging inflation rates amplified these differences further by producing increasingly heterogeneous real interest rates across the euro area countries. Fragmentation therefore had direct macroeconomic consequences, since firms and households in stressed countries faced significantly tighter financing conditions than those in core economies.⁵⁷

As discussed before, Altavilla et al. (2020) explain how this fragmentation translated into heterogeneous monetary transmission at the bank level. The effectiveness of pass-through increasingly depended on banks' balance sheet conditions rather than on the policy stance itself.⁵⁸

The key factors behind this divergence were weak capitalisation, high sovereign exposure, elevated non-performing loans and unstable funding structures. The study shows that unconventional monetary policy partly repaired the distortions after 2014. Asset purchases and related non-standard measures reduced funding costs, strengthened bank balance sheets through asset revaluations and improved expectations about future monetary accommodation. This suggests that the APP functioned not only as an expansionary policy tool but also as an attempt to restore the transmission mechanism itself.⁵⁹

Financial fragmentation was further reinforced by asymmetric transmission of sovereign stress across the euro area. Apostolakis et al. (2019) show that financial stress spillovers differed systematically between northern and southern member states. Southern economies were more heavily affected by internal sovereign debt shocks, whereas northern economies were more exposed to external financial

⁵⁶ Horvath, "Financial market fragmentation and monetary transmission in the euro area: what do we know?", *Journal of Economic Policy Reform*, Vol. 21 No. 4 (2018), 319-331.

⁵⁷ Horvath, "Financial market fragmentation and monetary transmission in the euro area: what do we know?", *Journal of Economic Policy Reform*, Vol. 21 No. 4 (2018), 319-322.

⁵⁸ Altavilla et al., "Mending the broken link: heterogeneous bank lending rates and monetary policy pass-through", *Journal of Monetary Economics*, No. 10 (2020).

⁵⁹ Altavilla et al., "Mending the broken link: heterogeneous bank lending rates and monetary policy pass-through", *Journal of Monetary Economics*, No. 10 (2020), 93-95.

disturbances. The authors find a high degree of cross-country interconnectedness, indicating that financial stress was rapidly transmitted across euro area economies, even though the intensity and direction of these spillovers differed across countries.⁶⁰

These asymmetries created additional challenges for a common monetary policy. The same monetary intervention could stabilise financing conditions in one part of the euro area while remaining less effective elsewhere because countries faced different underlying sources of financial stress. This reflected a structural feature of the monetary union: monetary policy was centralised, while fiscal conditions, banking systems and sovereign risks remained national.

Bedendo and Colla (2015) further demonstrate how sovereign stress is transmitted into the real economy through corporate financing conditions. Using CDS data for non-financial corporations across euro area countries, they show that increases in sovereign risk were associated with significantly higher corporate credit risk. The effects were particularly strong for corporates dependent on domestic demand and bank financing, as they were more exposed to deteriorating domestic financial conditions. Sovereign stress therefore affected not only governments and banks, but also private-sector borrowing costs and investment conditions. This created an additional source of divergence in monetary transmission, since corporates in financially stressed countries remained exposed to higher financing costs even when the ECB lowered risk-free rates through the APP.⁶¹

A further limitation to monetary transmission was elevated economic uncertainty. Hauzenberger et al. (2025) show that uncertainty significantly weakens the effectiveness of conventional monetary policy in the euro area. During periods of high uncertainty, the effects of interest rate changes on economic indicators such as GDP and investment become substantially smaller because firms and households respond more cautiously to policy signals. Since monetary policy operates partly through expectations, uncertainty weakens transmission by making future economic conditions more difficult to assess.⁶²

The authors find that unconventional monetary policy remained relatively more effective than conventional policy under high uncertainty, particularly in reducing long-term bond yields and supporting financial conditions. However, uncertainty still limited the broader real economic

⁶⁰ Apostolakis et al., “Financial stress and asymmetric shocks transmission within the Eurozone. How fragile is the common monetary policy?”, *North American Journal of Economics and Finance*, No. 50 (2019).

⁶¹ Bedendo & Colla, “Sovereign and corporate credit risk: evidence from the Eurozone”, *Journal of Corporate Finance*, No. 33 (2015).

⁶² Hauzenberger et al., “Monetary policy under economic uncertainty: evidence from the euro area”, *SUERF Policy Brief*, No. 1248 (2025), 3-4.

response. Even when the APP successfully compressed yields and improved liquidity conditions, firms and households could remain reluctant to increase borrowing, investment or consumption. In such environments, accommodative monetary policy may stabilise financial markets without generating a proportionate increase in real economic activity.⁶³

It can be concluded that the effectiveness of the APP depended heavily on country-specific financial and macroeconomic conditions. Financial fragmentation, weak bank balance sheets, sovereign stress and elevated uncertainty all contributed to uneven monetary policy transmission across the euro area. As a result, the effects of unconventional monetary policy were not uniform across member countries, banks or borrowers. This provides an important motivation for the empirical analysis that examines whether APP-related lending effects differed across countries within the euro area.

⁶³ Hauzenberger et al., “Monetary policy under economic uncertainty: evidence from the euro area”, SUERF Policy Brief, No. 1248 (2025), 1-5.

3 Empirical Strategy

3.1 Research Question and Hypotheses

The main objective of this thesis is to examine the transmission of the ECB's Asset Purchase Programme bank lending channel at the country level. While the bank lending channel operates through individual banks, country-level empirical analysis captures the aggregate outcome of heterogeneous bank-level responses within each country. Given this background, the initial research question is: "Did countries with higher exposure to APP-eligible securities experience stronger growth in lending to non-financial corporations during the APP period?" Since banks within a country differ in their balance sheet characteristics and exposure to the APP, the aggregate lending response may mask significant heterogeneity. Therefore, country-level analysis provides evidence on whether the effects of the APP in the bank lending channel were strong enough to translate into macro-level changes in the credit supply. In addition, this thesis examines whether the effectiveness of the APP varied across countries in response to prevailing macroeconomic conditions. In a low-interest rate environment, factors such as weak credit demand may limit the transmission of unconventional monetary policy to aggregate lending outcomes. The follow-up research question therefore is: "How did macroeconomic conditions influence the transmission of the APP to bank lending during the programme period?" Together, these questions aim to evaluate if balance sheet effects were strong enough under given macroeconomic conditions to generate observable changes in aggregate lending.

Based on the literature on unconventional monetary policy, the bank lending channel and limits to monetary transmission in a low-interest rate environment, my thesis formulates the following hypotheses.

H1: Countries with higher exposure to APP experience stronger transmission to aggregate bank lending.

By lowering yields and improving financial conditions, the APP is expected to support bank lending to the real economy. At the country level, this effect should be observable if banks' exposure to APP is sufficiently large.

H2: Country-level measures capture only sufficiently strong bank-level transmission, as heterogeneous lending responses within countries may weaken the overall impact.

Building on the previous hypothesis, country-level analysis on the effectiveness of the transmission is not the most precise form of measure. Banks within a country differ in their responsiveness to

unconventional monetary policy. As a result, heterogeneous bank-level responses may partially offset each other when aggregated to the national level, limiting the observed lending effects.

H3: Adverse macroeconomic conditions weaken the transmission of the APP to bank lending at the country level.

The effectiveness of the transmission of the APP may be constrained by broader macroeconomic conditions, particularly a low-interest rate environment. Weak credit demand, subdued inflation expectations and elevated uncertainty may weaken the transmission through the bank lending channel.

By focusing on country-level outcomes, this thesis complements existing bank-level studies of APP on bank lending by examining whether heterogeneous micro-level responses accumulate into macroeconomically relevant changes in lending. This thesis contributes to the related research by providing country-level evidence on the transmission of the APP to bank lending. Lending growth is interpreted as an observable indicator of monetary policy transmission rather than as a final economic outcome. This allows the analysis to assess whether heterogeneous bank-level responses accumulate into macro-level lending dynamics.

3.2 Measuring Exposure to the Asset Purchase Programme

To examine whether the APP affected bank lending differently across euro area countries, I construct a measure of countries' exposure to APP-related asset purchases using pre-programme banking sector balance sheet data.

The exposure measure is based on holdings of sovereign debt securities held by monetary financial institutions (MFIs), expressed relative to total assets:

$$Exposure_c = \frac{Eligible\ assets_c^{pre}}{Total\ assets_c^{pre}},$$

where “c” denotes country and “pre” refers to the average value over the period 2010Q1-2014Q4.

This approach follows the broader identification logic used in studies such as Afonso and Pereira (2022)⁶⁴ and Blaes et al. (2019)⁶⁵, which use pre-programme sovereign bond holdings to capture differences in banks' exposure to APP-related purchases. The measure is motivated by the fact that

⁶⁴ Afonso & Pereira, “Unconventional monetary policy in the euro area. Impacts on loans, employment, and investment”, *International Journal of Finance & Economics*, No. 20 (2023).

⁶⁵ Blaes et al., “The effects of the Eurosystem's APP on euro area bank lending: letting different data speak”, Deutsche Bundesbank, No. 26 (2019).

the Public Sector Purchase Programme (PSPP) constituted the largest component of the APP, with sovereign bond purchases accounting for most total asset purchases.

Using sovereign debt securities rather than corporate securities is more consistent with the composition of the APP and with the portfolio rebalancing channel emphasised in the literature. Under this channel, banks holding larger amounts of APP-eligible sovereign securities may experience stronger balance sheet effects, potentially increasing their ability to increase loans to the private sector.

The exposure measure is constructed using pre-treatment averages to avoid endogeneity concerns. Measuring exposure prior to the announcement and implementation of the APP ensures that the treatment variable is predetermined with respect to the policy intervention and reflects structural differences in banking sector balance sheet composition across countries, rather than responding to the program itself.

3.3 Empirical Model Specification

The objective of my empirical analysis is to examine whether countries with higher exposure to APP-related sovereign securities experienced stronger growth in bank lending following the introduction of the APP.

Since the APP was implemented simultaneously across euro area countries, but exposure differed across countries due to differences in banking sector balance sheet composition, a difference-in-differences framework with continuous treatment intensity is appropriate. Rather than dividing countries into arbitrary “treated” and “control” groups, the specification allows treatment effects to vary continuously with the degree of exposure.

The baseline empirical specification follows the general structure used in studies such as Afonso and Pereira (2022)⁶⁶, while adapting the framework to country-level data and focusing on differences in pre-APP exposure across the euro area.

The baseline regression model is:

$$\log Y_{c,t} = \alpha c + \delta t + \beta(Exposure_c \times Post_t) + \gamma_1 X_{1,c,t} + \gamma_2 X_{2,c,t} + \varepsilon_{c,t},$$

⁶⁶ Afonso & Pereira, “Unconventional monetary policy in the euro area. Impacts on loans, employment, and investment”, *International Journal of Finance & Economics*, No. 20 (2023).

where $(Y_{c,t})$ denotes loans to non-financial corporations (NFCs) in country c at time t . The variable $Exposure_c$ measures pre-APP sovereign debt securities holdings relative to total assets, while $Post_t$ the dummy variable is equal to one from 2015Q1 onward.

Country fixed effects (α_c) control for time-invariant institutional and financial differences across countries, such as banking sector structure, legal systems and financial market characteristics. Time fixed effects (δt) absorb euro-area-wide shocks affecting all countries simultaneously, including common monetary policy actions and aggregate macroeconomic developments.

The model additionally includes macroeconomic control variables to account for economic conditions that may independently affect bank lending. These controls include real GDP growth and the unemployment rate. GDP growth captures differences in economic activity and credit demand conditions, while unemployment reflects labour market conditions and broader economic slack.

To partially distinguish loan supply effects from loan demand effects, the empirical part also includes the BLS indicator for enterprise loan demand. Altavilla et al. (2021) emphasise that lending developments reflect both supply and demand conditions and show that controlling for credit demand is important when evaluating monetary policy transmission through banks.⁶⁷

In an additional specification, I control for sovereign spreads to account for differences in financial conditions across countries. The spread variable is defined as the difference between each country's 10-year government bond yield and the Germany's 10-year government bond yield. Sovereign spreads are commonly used as an indicator of financial stress and fragmentation within the euro area. Including this variable helps assess whether differences in sovereign risk and financing conditions influence the estimated relationship between APP exposure and bank lending.

The empirical analysis is complemented by event-study, heterogeneity and robustness analyses to evaluate the validity of the parallel trends assumption, examine whether APP transmission differed across economic environments and assess the stability of the estimated effects across alternative specifications and samples.

⁶⁷ Altavilla et al., "Credit Supply and Demand in Unconventional Times", *Journal of Money, Credit and Banking*, Vol. 53, No. 8 (2021).

3.4 Model Challenges and Identification Issues

3.4.1 Endogeneity of APP Exposure

An important identification challenge is that countries with higher APP exposure may differ systematically from countries with lower exposure in ways that also affect bank lending. Banking sectors with larger holdings of sovereign debt securities may reflect underlying differences in financial structure, sovereign risk exposure, post-crisis banking conditions or macroeconomic weakness. As a result, APP exposure may correlate with factors that independently influence lending outcomes.

To address reverse causality concerns, exposure is measured using pre-treatment data before the launch of the APP in 2015. More specifically, the exposure is calculated as the average ratio of government debt securities holdings to total assets over the period 2010Q1-2014Q4. Using pre-APP balance sheet characteristics ensures that the exposure measure is predetermined with respect to the policy intervention and reflects structural differences in banking sector portfolios across countries rather than responses to the APP itself.

The empirical specification additionally includes country and time fixed effects together with macroeconomic control variables. Nevertheless, the empirical analysis cannot fully rule out the possibility that countries with different APP exposure experienced different post-crisis recovery dynamics unrelated to the APP. Consequently, the estimated coefficients should be interpreted as differential lending responses associated with exposure intensity rather than as a fully causal treatment effect.

3.4.2 Parallel Trends Assumption

Identification in continuous treatment difference-in-differences models relies on a conditional parallel trends assumption. Callaway et al.⁶⁸ discuss how identification in continuous treatment settings requires parallel trends to hold across exposure intensities rather than simply between treated and untreated groups. In this thesis, the identifying assumption is that, in the absence of the APP, countries with different levels of pre-APP exposure would have experienced similar trends in bank lending conditional on fixed effects and macroeconomic controls.

⁶⁸ Callaway et al., "Difference-in-differences with a continuous treatment", 2024.

This assumption may be difficult to satisfy in the euro area because countries entered the APP period with different post-crisis conditions, banking-sector structures and sovereign-debt vulnerabilities. The euro area sovereign debt crisis affected financial sectors across countries with markedly different intensity, reflecting a bank-sovereign nexus that hit high-yield countries such as Italy and Spain considerably harder than core countries like Germany.⁶⁹ These heterogeneous post-crisis banking conditions may have produced diverging lending trends even in the absence of the APP.

To evaluate the parallel trends assumption, I implement an event-study specification to examine lending dynamics before and after the introduction of the APP. The event-study allows visual inspection of whether differential lending trends were already present before 2015. If countries with different exposure levels display similar pre-treatment trends, it supports the validity of the identification assumption.

Another challenge discussed by Callaway et al. is that interaction models with continuous treatment assume a linear relationship between treatment intensity and treatment effects. In this thesis, treatment intensity is measured continuously to preserve cross-country variation in APP exposure and avoid arbitrary treatment thresholds. To evaluate whether the results depend on this specification choice, I also include a binary treatment robustness check based on pre-APP exposure splits.

3.4.3 Loan Demand vs Loan Supply Problem

A central challenge in interpreting lending developments is that observed lending volumes reflect both credit supply and demand conditions. Consequently, increases in bank lending following the APP cannot automatically be interpreted as evidence of stronger credit supply.

This is particularly relevant in the post-crisis euro area environment characterised by weak investment activity, low inflation expectations, elevated uncertainty and liquidity trap conditions. Even if the APP improved bank balance sheets and financing conditions, firms may still have exhibited weak demand for credit. Therefore, changes in lending may partly reflect fluctuations in loan demand rather than the transmission of monetary policy through banks.

To partially distinguish loan supply effects from loan demand effects, I include a loan demand indicator. Including this variable helps control for changes in credit demand that may otherwise confound the interpretation of lending developments after the introduction of the APP.

⁶⁹ Stracca, “The global effects of the euro debt crisis”, ECB Working Paper Series, No. 1573 (2013).

I will complement the empirical analysis with a heterogeneity analysis based on loan demand conditions. This allows me to examine whether APP transmission was stronger in countries or periods characterised by relatively stronger credit demand.

3.4.4 Aggregation Problem

Another important challenge is that I am using country-level aggregate data, while the transmission of the APP operates partly through heterogeneous bank-level balance sheet adjustments. As emphasised in the APP literature, banks may respond differently to unconventional monetary policy depending on their balance sheet structure, capitalisation, liquidity position and risk exposure.

Country-level aggregation may therefore mask heterogeneous bank-level responses. While some banks may increase lending following balance sheet improvements, others may use improved liquidity to repair balance sheets, reduce leverage or lower risk exposure. Aggregating lending responses at the country level may consequently weaken the observable lending responses.

This issue is also discussed in studies such as Blaes et al.⁷⁰, which show that APP transmission effects differ substantially across banks depending on their balance sheet characteristics and exposure to sovereign securities. While this thesis does not use bank-level data, it analyses whether heterogeneous bank-level responses accumulate into observable macro-level lending changes.

Accordingly, the estimated coefficients in this thesis should be interpreted as aggregate lending responses at the country-level rather than as micro-level causal effects on individual banks.

3.4.5 Small Sample Constraints

The empirical analysis is additionally constrained by the relatively small number of euro area countries and the simultaneous implementation of the APP across the Eurozone. Unlike staggered policy interventions, the APP affected all euro area countries at broadly the same time, implying that identification relies primarily on differences in treatment intensity rather than treatment timing.

The limited cross-sectional dimension reduces statistical power and constrains the use of more flexible estimation methods. In particular, the relatively small number of countries makes highly parametrised specifications difficult to estimate reliably. For this reason, I use a relatively simple

⁷⁰ Blaes et al., “The effects of the Eurosystem’s APP on euro area bank lending: letting different data speak”, Deutsche Bundesbank, No 26 (2019).

specification with continuous treatment intensity, country and time fixed effects and a limited set of macroeconomic controls.

Standard errors are clustered at the country level to account for serial correlation and within-country dependence over time. Nevertheless, given the limited number of countries, statistical inference should be interpreted with caution.

3.5 Robustness and Event-Study Strategy

To evaluate the robustness of the baseline difference-in-differences specification, I conduct several additional checks. These are intended to assess whether the estimated relationship between APP exposure and bank lending is sensitive to alternative specifications, sample composition, macroeconomic conditions and measures of financial stress.

First, I implement an event-study specification to examine lending dynamics before and after the introduction of the APP. The event-study allows me to evaluate the parallel trends assumption by testing whether countries with different levels of pre-APP exposure exhibited systematically different lending trends prior to 2015. In addition, the specification provides evidence on the dynamic evolution of lending responses following the introduction of the APP.

Second, the baseline specification is extended with additional macroeconomic control variables. Macroeconomic controls, including GDP growth and the unemployment rate, are introduced to account for broader economic conditions that may affect lending independently of the APP. Additional specifications include a loan demand indicator from the ECB Bank Lending Survey and a sovereign spread measure to examine whether credit demand conditions and financial stress influence the estimated relationship between APP exposure and lending.

Third, the empirical analysis includes tests for heterogeneity. Countries are divided by pre-treatment loan-demand conditions and financial-stress levels to examine whether APP transmission differed across economic environments. The financial stress classification is based on average sovereign spreads during the pre-APP period. These analyses help assess whether the effectiveness of the APP transmission depended on country-specific financial and macroeconomic conditions.

Fourth, a binary treatment specification is estimated as an alternative to the continuous exposure measure used in the baseline model. Countries are divided into higher and lower-exposure groups, and the results are compared with those from the continuous treatment framework. While the continuous specification remains the preferred approach because it preserves variation in exposure

intensity across countries, the binary specification provides an additional test of whether the findings depend on the exact treatment definition.

Fifth, I conduct a leave-one-out analysis in which the baseline model is re-estimated repeatedly while excluding one country at a time. This robustness check evaluates whether the results are driven by any single country and helps identify influential observations within the sample.

Finally, I estimate an alternative regression specification using only the post-APP period. Rather than comparing pre- and post-treatment outcomes, this specification examines whether countries with higher pre-APP exposure systematically exhibited different lending outcomes during the APP period. Although this approach does not provide a causal estimate of the APP effect in the same way as the difference-in-differences framework, it offers a complementary perspective on the relationship between exposure and lending.

4 Data

The empirical analysis is conducted using quarterly country-level data obtained from the European Central Bank (ECB) Data Portal (balance sheet items, Eurostat, DataStream and ECB Bank Lending Survey). The dataset combines banking-sector balance sheet variables with macroeconomic indicators. The sample consists of 17 euro area countries observed between 2010Q1 and 2018Q4. The sample period ends in 2018Q4 to ensure that the analysis captures the effects of APP and is not influenced by the introduction of the Pandemic Purchase Programme (PEPP) during the COVID-19 period. Bulgaria, Croatia, Latvia and Lithuania are excluded due to their later euro area adoption and limited availability of comparable pre-APP data. All variables are converted to quarterly frequency to ensure consistency across countries and over time.

Table 1 presents the definitions, sources and units of the variables used in the analysis.

The dependent variable is loans to non-financial corporations (NFCs), measured as the outstanding stock of loans granted by monetary financial institutions (MFIs), excluding the Eurosystem. This variable captures aggregate bank lending to the real economy. Since the objective of the thesis is to study the transmission of APP exposure to bank lending, loans to NFCs provide a direct measure of credit supplied to firms.

The key explanatory variable measuring exposure to the APP is constructed from holdings of debt securities issued by euro area general governments and held by MFIs. These securities closely correspond to the asset classes predominantly purchased under the Public Sector Purchase Programme (PSPP), which formed the largest component of the APP. The variable therefore captures cross-country differences in banking sector exposure to APP-eligible sovereign securities prior to the implementation of the programme.

Macroeconomic variables include real GDP growth and the unemployment rate. In addition, I use a survey-based indicator (BLS) for enterprise loan demand. The loan demand indicator measures the net percentage of banks reporting an increase in loan demand from enterprises over the previous three months.

To complement the analysis of lending dynamics, I also use the EURO STOXX 50 equity index and long-term interest rate variable to capture differences in macroeconomic and financial conditions across countries during the APP period. In the descriptive analysis, sovereign yield spreads relative to Germany are constructed using long-term interest rates to also examine financial fragmentation within the euro area.

Table 1. Variable definitions and data sources.

Variable	Description	Source	Unit
Total assets	Total assets of MFIs	BSI	EUR millions
Debt securities	Holdings of debt securities issued by euro area General Government held by MFIs	BSI	EUR millions
Loans to NFCs	Loans to non-financial corporations granted by MFIs (excluding the Eurosystem)	BSI	EUR millions
Real GDP growth	Real gross domestic product growth rate, year-on-year	Eurostat	Percent
Unemployment	Unemployment rate, Total population aged 15 to 74	Eurostat	Percent
Loan demand	Enterprise loan demand	BLS	Net percentage
Long-term interest rate	Long-term government bond interest rate for convergence purposes (10-year maturity)	Eurostat	Percent
EURO STOXX 50 index	EURO STOXX 50 equity price index, quarterly average closing value	DataStream	Index points

Balance-sheet variables are measured as end-of-period outstanding amounts. Monetary financial institutions exclude the Eurosystem. Loan demand is measured as the net percentage of banks reporting an increase in enterprise loan demand over the past three months, as reported in the ECB Bank Lending Survey.

5 Results

This chapter presents the empirical results of the analysis examining the effects of the APP on lending to non-financial corporations in the euro area. I begin the analysis with baseline difference-in-differences estimates and then progressively extend the specification by incorporating additional macroeconomic controls, loan demand and sovereign spreads. The chapter further examines whether the relationship between APP exposure and lending varies across countries with differing demand conditions and levels of financial stress. To assess the robustness of the findings, alternative specifications based on a binary treatment definition and an alternative exposure-based regression approach are also considered. The validity of the identifying assumptions is evaluated through an event-study specification. Finally, the chapter analyses broader developments in financial markets and sovereign spreads to place the empirical findings in the wider context of euro area monetary transmission.

5.1 Baseline Difference-in-Differences

Baseline Difference-in-Differences Estimates of APP Exposure on Lending

	Baseline
Exposure $\times$ Post	-0.695 (1.800)
Country FE	Yes
Time FE	Yes
SE clustered by	Country
Standard errors in parentheses.	

Table 2: Baseline Difference-in-differences. *** $p < 0.001$, ** 0.01 , * $p < 0.05$.

Table 2 presents the baseline difference-in-differences estimates of the relationship between APP exposure and bank lending. The baseline regression model includes country and time fixed effects, yet no macroeconomic control variables. The coefficient on the interaction term between exposure and the post-APP period is negative, suggesting that countries with higher pre-APP exposure to sovereign securities did not experience stronger lending growth after the introduction of the APP. However, the estimated coefficient is statistically insignificant and associated with a relatively large standard error.

The result therefore does not provide evidence that countries with higher pre-APP exposure experienced stronger aggregate lending growth following the introduction of the APP. Although the

estimated coefficient is negative, its lack of statistical significance implies that the relationship cannot be distinguished from zero within this specification.

5.2 Adding Macroeconomic Controls

Difference-in-Differences Estimates of APP Exposure on Lending

	Baseline	Macro controls
Exposure $\times$ Post	-0.695 (1.800)	-0.504 (1.653)
GDP growth	No	-0.022** (0.006)
Unemployment rate	No	0.015 (0.010)
Country FE	Yes	Yes
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 3: Difference-in-differences with macro controls. *** $p < 0.001$, ** 0.01, * $p < 0.05$.

Table 3 extends the baseline specification by including macroeconomic control variables for GDP growth and the unemployment rate. After adding these controls, the estimated coefficient on the interaction between APP exposure and the post-treatment period remains negative and statistically insignificant. The magnitude of the coefficient decreases from -0.695 to -0.504, indicating that the inclusion of the macroeconomic controls does not substantially alter the main finding. Overall, the results continue to provide no evidence that countries with higher APP exposure experienced stronger aggregate lending growth after the introduction of the APP.

Among the control variables, GDP growth is statistically significant and negatively associated with lending growth during the sample period. While this relationship may appear unexpected, it should not be interpreted causally. One possible explanation is that developments in lending during the post-crisis period were influenced by factors such as balance sheet adjustments, financial sector conditions and credit demand dynamics that are not fully captured by GDP growth alone.

In contrast, the unemployment rate is not statistically significant, suggesting that differences in unemployment do not account for a substantial share of the variation in lending growth once country and time fixed effects are included.

Overall, the inclusion of macroeconomic controls does not materially change the baseline results. Although GDP growth is significantly associated with lending developments, APP exposure is not. This suggests that differences in pre-APP exposure alone do not explain cross-country variation in aggregate lending growth during the APP period.

5.3 Controlling for Loan Demand

Difference-in-Differences Estimates with Loan Demand

	Baseline	Macro controls	+ Loan Demand
Exposure $\times$ Post	-0.695 (1.800)	-0.504 (1.653)	-4.960* (2.130)
GDP growth	No	-0.022** (0.006)	-0.018* (0.007)
Unemployment rate	No	0.015 (0.010)	0.025 (0.012)
Loan demand	No	No	0.0003 (0.001)
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
SE clustered by	Country	Country	Country
Standard errors in parentheses.			

Table 4: Difference-in-differences with loan demand (Estonia, Malta & Slovakia excluded due to data availability). *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

The specification is further extended by including the Bank Lending Survey loan demand indicator as an additional control variable. Due to data availability constraints, Estonia, Malta and Slovakia are excluded from this analysis, resulting in a reduced sample of 14 countries.

After controlling for loan demand, the estimated coefficient on the interaction between APP exposure and the post-treatment period becomes substantially larger in magnitude and statistically significant. The coefficient remains negative, suggesting that countries with higher pre-APP exposure experienced weaker lending growth following the introduction of the APP once differences in control variables are taken into account. This result contrasts with the positive lending effects commonly reported in the micro-level APP literature.

At the same time, the loan demand variable itself is not statistically significant, and its estimated coefficient is close to zero. The significance of the APP exposure coefficient should therefore be

interpreted cautiously. The change in the estimated exposure effect may partly reflect the reduced country sample rather than the direct impact of controlling for loan demand. Nevertheless, the result indicates that the estimated relationship between APP exposure and lending is sensitive to model specifications and sample composition.

Among the macroeconomic controls, GDP growth remains negative and statistically significant, while the unemployment rate remains statistically insignificant. Overall, the results suggest that the negative relationship between APP exposure and lending growth becomes more pronounced in the reduced sample, although the underlying mechanism remains difficult to identify precisely.

5.4 Controlling for Spreads

Difference-in-Differences Estimates with Spreads			
	Baseline	Macro controls	+ Spread
Exposure $\times$ Post	-0.695 (1.800)	-0.504 (1.653)	-0.029 (1.508)
GDP growth	No	-0.022** (0.006)	-0.019* (0.007)
Unemployment rate	No	0.015 (0.010)	0.014 (0.010)
Spread	No	No	0.034** (0.014)
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
SE clustered by	Country	Country	Country
Standard errors in parentheses.			

Table 5: Difference-in-differences with spread (Estonia excluded due to data availability). *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Lastly, Table 5 extends the baseline specification by including the sovereign spread (10Y interest rate to Germany) as an additional control variable alongside GDP growth and unemployment. Sovereign spread capture differences in financing conditions and perceived sovereign risk across euro area countries.

After controlling for sovereign spread, the estimated coefficient on APP exposure in the post-treatment period remains statistically insignificant and approaches zero. This suggests that differences

in pre-APP exposure do not explain cross-country variation in lending even when controlling for financial conditions.

The sovereign spread variable is positive and statistically significant, indicating that lending growth was associated with differences in sovereign financing conditions during the sample period. One possible interpretation is that countries experiencing higher sovereign stress also saw greater improvements in financial conditions as spreads declined following the APP and related policy measures.

GDP growth remains statistically significant and negative, while the unemployment rate remains statistically insignificant. Overall, the results suggest that sovereign financing conditions are more closely associated with aggregate lending developments than differences in APP exposure itself. The findings therefore reinforce the conclusion that broader financial conditions played an important role in shaping lending outcomes during the APP period, while the direct effect of exposure to APP-eligible securities remains difficult to identify at the country level.

5.5 Heterogeneity Analysis

5.5.1 Heterogeneity by Loan Demand

Difference-in-Differences Estimates by Loan Demand		
	Low loan demand	High loan demand
Exposure $\times$ Post	0.118 (2.600)	-8.465*** (0.949)
GDP growth	-0.004 (0.004)	-0.014* (0.005)
Unemployment rate	0.061** (0.016)	0.007 (0.004)
Country FE	Yes	Yes
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 6: Heterogeneity analysis: loan demand. 7 low demand countries, 7 high demand countries, reduced sample size. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 6 reports difference-in-differences estimates separately for countries with low and high pre-treatment loan demand to analyse whether the transmission of the APP differed across demand

conditions. Low and high loan demand groups are based on countries average loan demand during period from 2010Q1 to 2014Q4. The estimated coefficient on the interaction term $\text{Exposure} \times \text{Post}$ is close to zero and statistically insignificant for the low-demand group, whereas the coefficient is large, negative and highly significant for the high-demand group. These results suggest that the relationship between APP exposure and lending differed substantially across demand environments.

The findings indicate that APP transmission appears to have been considerably more negatively in countries with higher pre-treatment loan demand. In contrast, in low-demand group improvements in financing conditions did not translate into statistically significant changes in lending. The results are interesting, as high loan demand translating into negative loan growth looks counterintuitive. However, these results alone do not reveal the specific banking environments under which demand for loans was high.

These results should be interpreted cautiously, given the reduced sample sizes in each subgroup and the possibility that the estimated effects also capture differences in bank balance sheet conditions, macroeconomic uncertainty and broader cross-country heterogeneity within the euro area. Nevertheless, the results provide suggestive evidence that the effectiveness of the APP depended not only on financing conditions but also on the underlying strength of loan demand within the economy.

5.5.2 Heterogeneity by Financial Stress

To examine whether the effects of the APP differed according to financial conditions, I conduct a test where countries are divided into financially stressed and non-stressed groups based on their average sovereign spread during the period from 2010Q1 to 2014Q4. Countries are divided by the median, and as the spread data is missing from Estonia, it is considered a non-stressed country, as has been done in other studies as well. Higher spreads are associated with higher sovereign risk and weaker financial conditions, which could imply that monetary policy transmission operates differently across these groups.

Table 7 presents the difference-in-differences estimates for stressed and non-stressed country groups. The results indicate substantial heterogeneity. Among stressed countries, the coefficient on the exposure is positive and statistically significant. This suggests that within this group, countries with higher pre-APP exposure experienced stronger lending growth. In contrast, the estimated coefficient for non-stressed countries is negative and statistically insignificant, providing no evidence that higher exposure was associated with stronger lending growth in these economies.

Difference-in-Differences Estimates by Financial Stress

	Stressed countries	Non-stressed countries
Exposure $\times$ Post	2.480* (1.038)	-1.434 (1.312)
GDP growth	-0.006 (0.005)	-0.023 (0.005)
Unemployment rate	0.020 (0.013)	0.003 (0.003)
Country FE	Yes	Yes
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 7: Heterogeneity analysis: financial stress. Stressed countries: Cyprus, Ireland, Italy, Malta, Portugal, Slovenia, Slovakia and Spain. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

These findings differ from the baseline results, which showed no significant relationship between exposure and lending when all countries were pooled together. One interpretation is that the effects of the APP were not uniform across the euro area countries, where sovereign spreads and financial frictions were initially higher. In those economies, APP improvements in financial conditions may have translated more strongly into new lending. In non-stressed countries, where financing conditions were already relatively favourable prior to the APP, additional improvements may have had a more limited impact on lending behaviour.

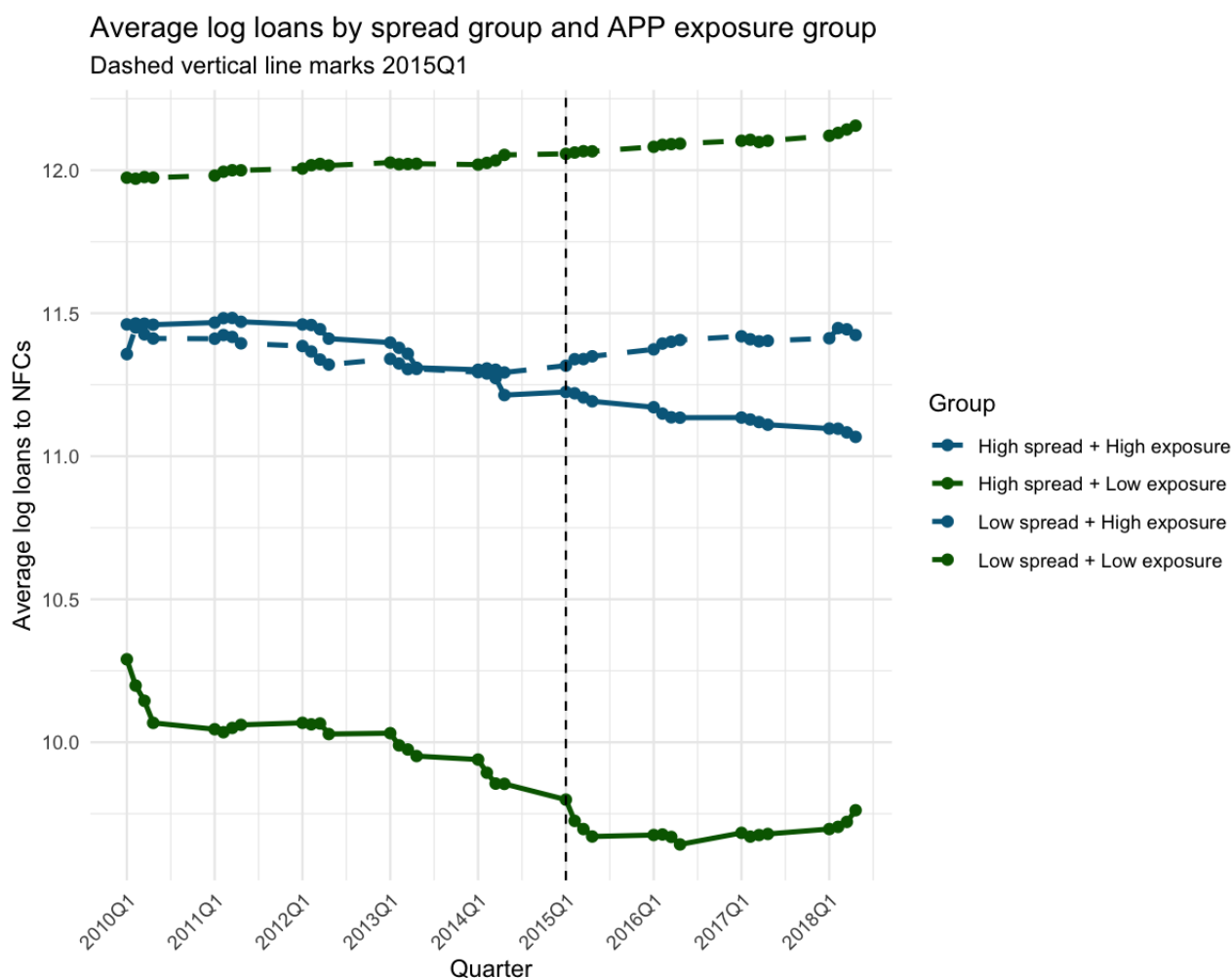


Figure 3: Average loans by spread and APP exposure group.

Figure 3 provides a descriptive illustration of lending developments across groups defined by both financial stress and APP exposure. The figure shows that lending differed substantially across these groups throughout the sample period. Among high-exposure countries, lending increased modestly after the introduction of the APP in the low-spread group, while lending continued to decline in the high-spread group. Among low-exposure countries, changes in lending are much less pronounced, although lending again appears to develop more favourably in the low-spread group than in the high-spread group.

These patterns suggest that financial conditions may have played an important role in shaping lending developments during the APP period. In particular, higher APP exposure alone does not appear to be associated with stronger lending when countries also faced elevated sovereign stress. However, the figure does not control for other country-specific factors that may also explain differences in lending dynamics.

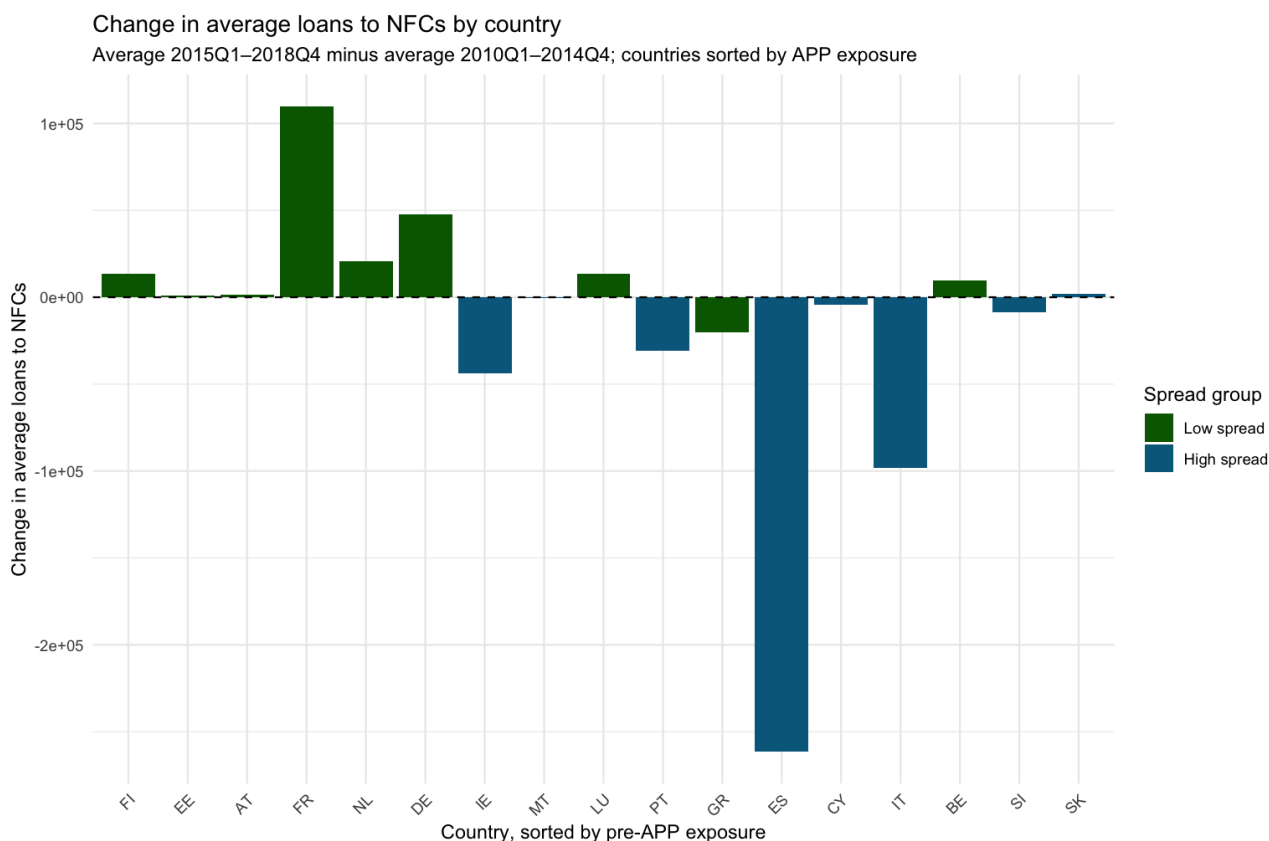


Figure 4: Change in average loans by country.

Figure 4 further illustrates cross-country variation by showing the change in average lending between the pre-APP period (2010Q1-2014Q4) and the APP-period (2015Q1-2018Q4). Considerable heterogeneity is visible across countries. Several low-spread countries experienced increases in lending following the introduction of the APP, whereas several high-spread countries recorded weaker lending.

At the same time, the figure highlights that financial stress alone cannot fully explain lending outcomes. Significant variation remains within both spread groups, suggesting that country-specific factors may have influenced lending.

5.6 Alternative Regression Specification

As a complementary analysis, the relationship between APP exposure and lending is examined using an alternative regression specification that focuses only on the APP-period (2015Q1-2018Q4). Unlike the baseline difference-in-differences model, this approach does not focus on changes in lending after the introduction of the APP. Instead, it estimates whether countries with higher per-APP exposure to sovereign debt securities had systematically different lending outcomes during the APP period. The purpose of this exercise is not to identify a causal APP effect, but rather to assess whether the exposure

measure is associated with lending outcomes once the programme was already in place. Because the exposure measure is time-invariant, country fixed effects cannot be included in this specification. The estimation model is as follows:

$$\log Y_{c,t} = \alpha + \delta t + \beta Exposure_c + \gamma_1 X_{1,c,t} + \gamma_2 X_{2,c,t} + \varepsilon_{c,t}, t \geq 2015Q1.$$

Alternative Regression Estimates		
	GDP growth and unemployment	+Spread
Exposure	-10.757 (5.569)	-14.257** (4.354)
GDP growth	-0.161 (0.102)	-0.152 (0.090)
Unemployment rate	0.061 (0.076)	0.056 (0.083)
Country FE	No	No
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 8: Alternative regression specification. *** p<0.001, ** 0.01, * p<0.05.

Table 8 reports the results. In the first specification, controlling for GDP growth and unemployment, the coefficient on the pre-APP exposure is negative and statistically significant only at the 10 percent level. This suggests that countries with higher exposure to APP-eligible securities tended to have lower lending levels during the APP period. The estimated relationship becomes stronger after additionally controlling for sovereign spreads. In this specification, the exposure coefficient remains negative and becomes statistically significant at the 1 percent level.

The results therefore indicate a negative association between pre-APP exposure and aggregate lending outcomes during the APP period. It is worth noting that the interpretation of this specification differs from the baseline difference-in-differences model. Because the regression is estimated only for the post-APP period and does not exploit changes relative to the pre-treatment period, the estimated coefficient may also capture persistent differences between higher- and lower-exposure countries. For this reason, the alternative specification is viewed primarily as a robustness exercise rather than as a causal estimate of the APP's lending effect.

5.7 Robustness Checks

5.7.1 Binary Treatment Specification

Binary Difference-in-Differences Estimates of APP Exposure on Lending

	Top 30% treated	Top 60% treated
Top 30%	-0.081	
Exposure $\times$ Post	(0.145)	
Top 60%		-0.153
Exposure $\times$ Post		(0.125)
Country FE	Yes	Yes
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 9: Baseline binary difference-in-differences

Binary Difference-in-Differences Estimates of APP Exposure on Lending with Macro Controls

	Top 30% treated	Top 60% treated
Top 30%	-0.085	
Exposure $\times$ Post	(0.128)	
Top 60%		-0.130
Exposure $\times$ Post		(0.092)
GDP growth	-0.022**	-0.021***
	(0.006)	(0.005)
Unemployment rate	0.016	0.016
	(0.011)	(0.011)
Country FE	Yes	Yes
Time FE	Yes	Yes
SE clustered by	Country	Country
Standard errors in parentheses.		

Table 10: Binary difference-in-differences with macro controls. *** p<0.001, ** p<0.01, * p<0.05.

Table 9 shows binary difference-in-differences estimation based on a split whether the country belonged to the top 30% or top 60% of APP exposure before 2015. In both specifications, the coefficient on the interaction term Exposure $\times$ Post is negative, although neither estimate is

statistically significant. The results, therefore, do not provide different evidence from the previous continuous treatment specification.

Table 10 extends the binary difference-in-differences specification, including macroeconomic controls for GDP growth and unemployment. The estimated coefficient on Exposure $\times$ Post remains negative and statistically insignificant in both treatment definitions. GDP growth is negative and statistically significant across both specifications, while unemployment is not statistically significant.

Compared to continuous treatment, the binary treatment specification continues to show weak estimation of APP exposure on lending. While the binary specification serves as a useful robustness check, the results suggest that the relationship between APP exposure and lending may be better captured by continuous exposure rather than by dividing countries into treated and control groups.

5.7.2 Leave-One-Out Analysis

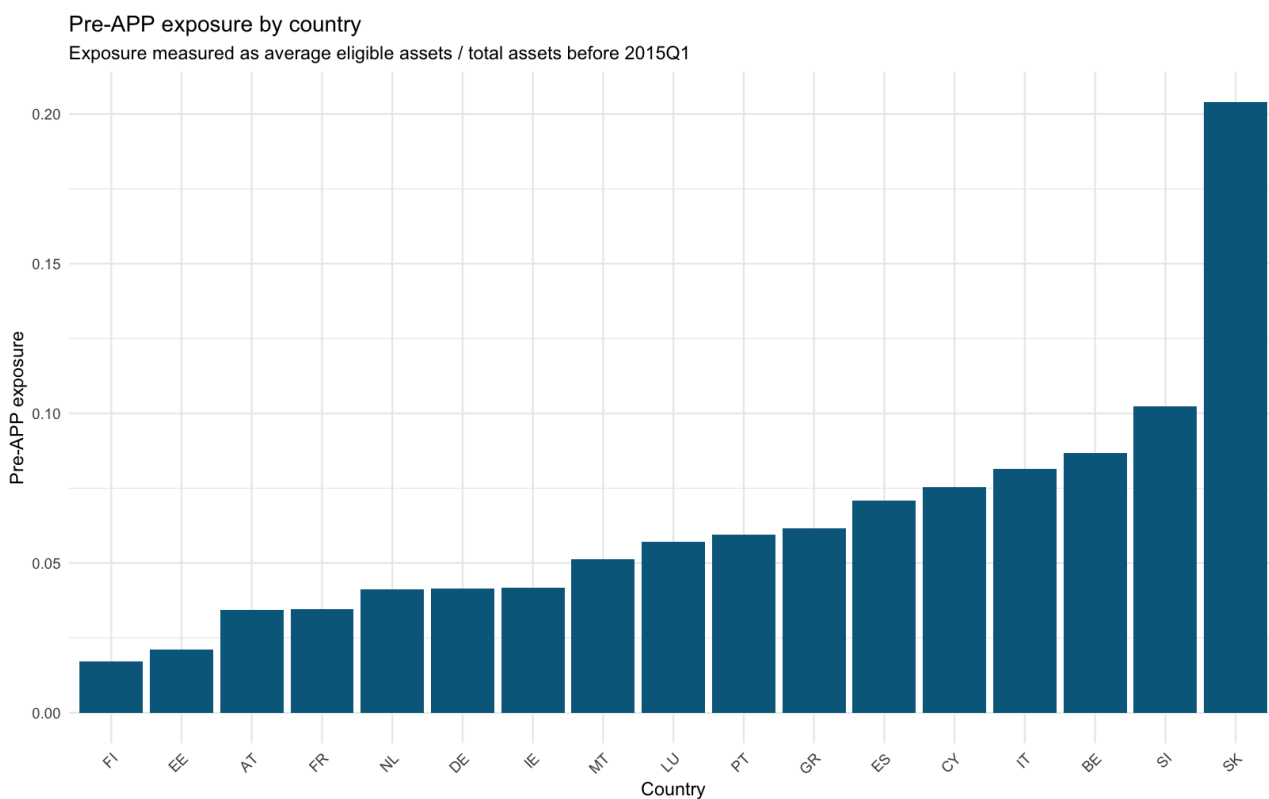


Figure 5: Pre-APP exposure by country. Average value pre-APP period (2010Q1-2014Q4).

To analyse whether the difference-in-differences results are driven by any individual country, the estimation is done repeatedly while excluding one country at a time. Appendix 4 reports the estimated coefficients on the interaction term for each leave-one-out specification.

The results indicate that the main findings are generally robust to the exclusion of individual countries. For most countries, the estimated coefficients remain close to the baseline estimates and statistically insignificant across all specifications. This suggests that the absence of a strong positive lending effect is not driven by any single country in the sample.

An important exception is Slovakia. When Slovakia is excluded, the estimated coefficient becomes substantially more negative and statistically significant in all specifications. This indicates that Slovakia has a noticeable effect on the results and partially offsets the negative relationship observed in the full sample. As shown in Figure 5, Slovakia had the highest pre-APP exposure ratio among all countries while simultaneously experiencing relatively stable lending developments during the sample period. Consequently, its inclusion weakens the overall negative association between APP exposure and lending growth.

Nevertheless, the broader conclusion remains unchanged. The leave-one-out check does not reveal any country whose exclusion would generate evidence of a positive and statistically significant APP lending effect. Instead, the results continue to suggest that countries with higher pre-APP exposure did not experience systematically stronger lending growth following the introduction of the APP.

5.8 Event-Study Evidence

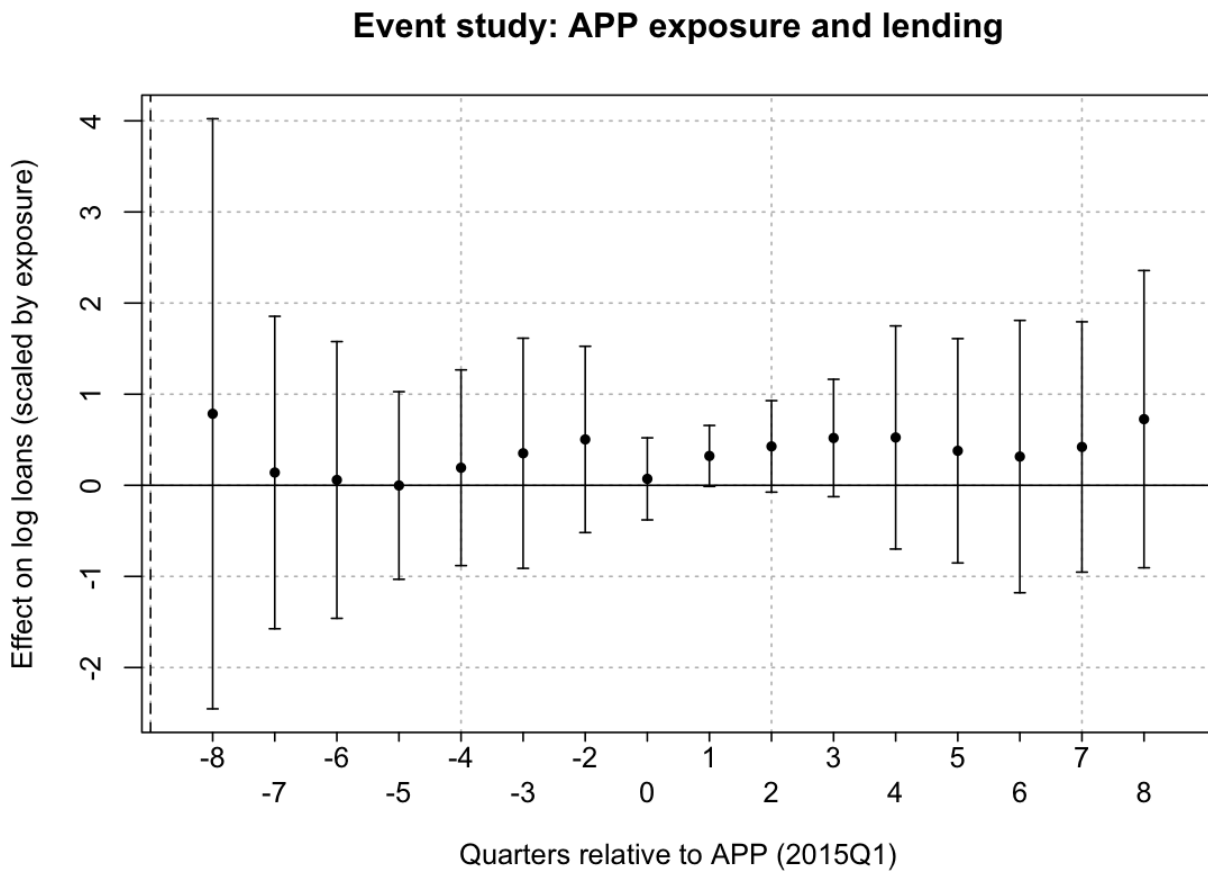


Figure 6: Event-study estimates

Figure 6 presents event-study estimates of the relationship between pre-APP exposure and lending to firms. The coefficients are normalised relative to the introduction of the APP quarter 2015Q1. The event-study is used to examine the validity of the parallel trends assumption and to analyse the dynamic evolution of lending responses over time.

The pre-treatment coefficients are small and statistically indistinguishable from zero, supporting for the absence of strong differential pre-trends between countries with varying levels of APP exposure. This suggests that, prior to the implementation of the APP, lending developments evolved similarly across the countries, supporting the identification strategy used in the difference-in-differences analysis.

Following the introduction of the APP, the estimated coefficients become slightly positive on average and remain above zero throughout the post-treatment period. This pattern suggests that countries with higher pre-APP exposure tended to experience somewhat stronger lending developments after the

introduction of the programme. However, the confidence intervals remain relatively wide, and most coefficients are not statistically distinguishable from zero. Consequently, the event-study does not provide strong statistical evidence of an immediate or precisely estimated lending response.

Nevertheless, the post-treatment coefficients show a gradual, persistent positive pattern rather than a sharp, one-time increase. This is consistent with the possibility that any effects of the APP on lending occurred only slowly over time. Such a gradual response would be plausible given that changes in bank balance sheets, portfolio allocation decisions and loan granting typically occur with delays.

This interpretation should also be considered in the broader context of the ECB's unconventional monetary policy environment during the period. In addition to the APP, the ECB simultaneously implemented other instruments, particularly LTROs and targeted longer-term refinancing operations (TLROs), which were designed to support bank lending by providing favourable long-term funding conditions. As a result, the event study coefficients may capture the combined effects of several unconventional policy measures operating through related transmission channels rather than the effect of the APP in isolation.

5.9 Financial Market and Sovereign Spread Developments

Figures 7-9 place the empirical lending results into the broader context of euro area financial market developments during the APP period. While previous estimations focused directly on the relationship between APP exposure and lending, the figures illustrate how financial conditions, sovereign risk and aggregate lending evolved around the introduction of the programme.

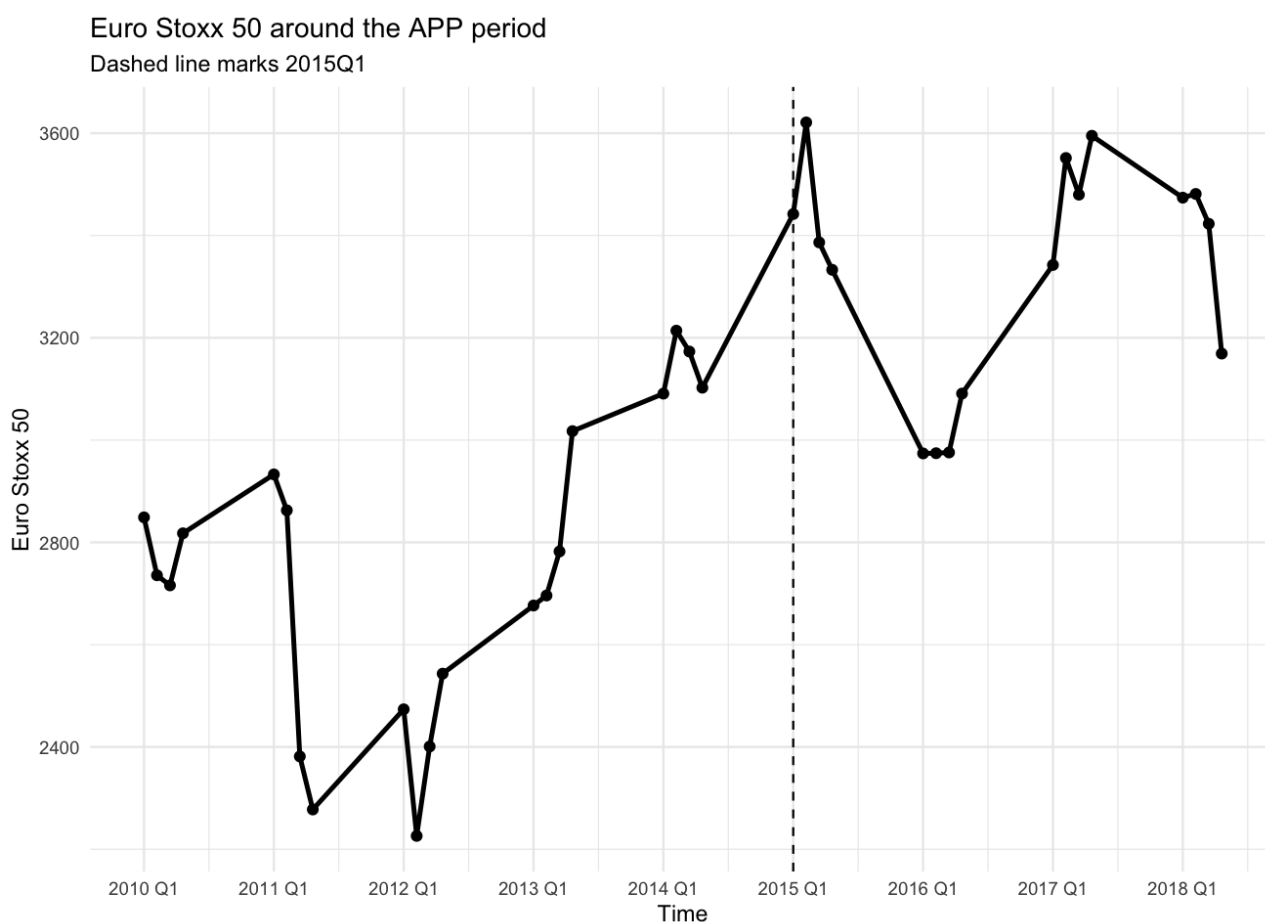


Figure 7: Euro Stoxx 50 at the APP period

Figure 7 shows the development of the Euro Stoxx 50 index over the sample period. Financial markets improved substantially following the introduction of the APP, with equity prices recovering from a weak post-crisis environment and remaining at elevated levels for most of the programme period. This pattern is consistent with the literature on the portfolio rebalancing channel, according to which large-scale asset purchases support asset prices and improve overall financial conditions through lower yields and increased risk-taking incentives.

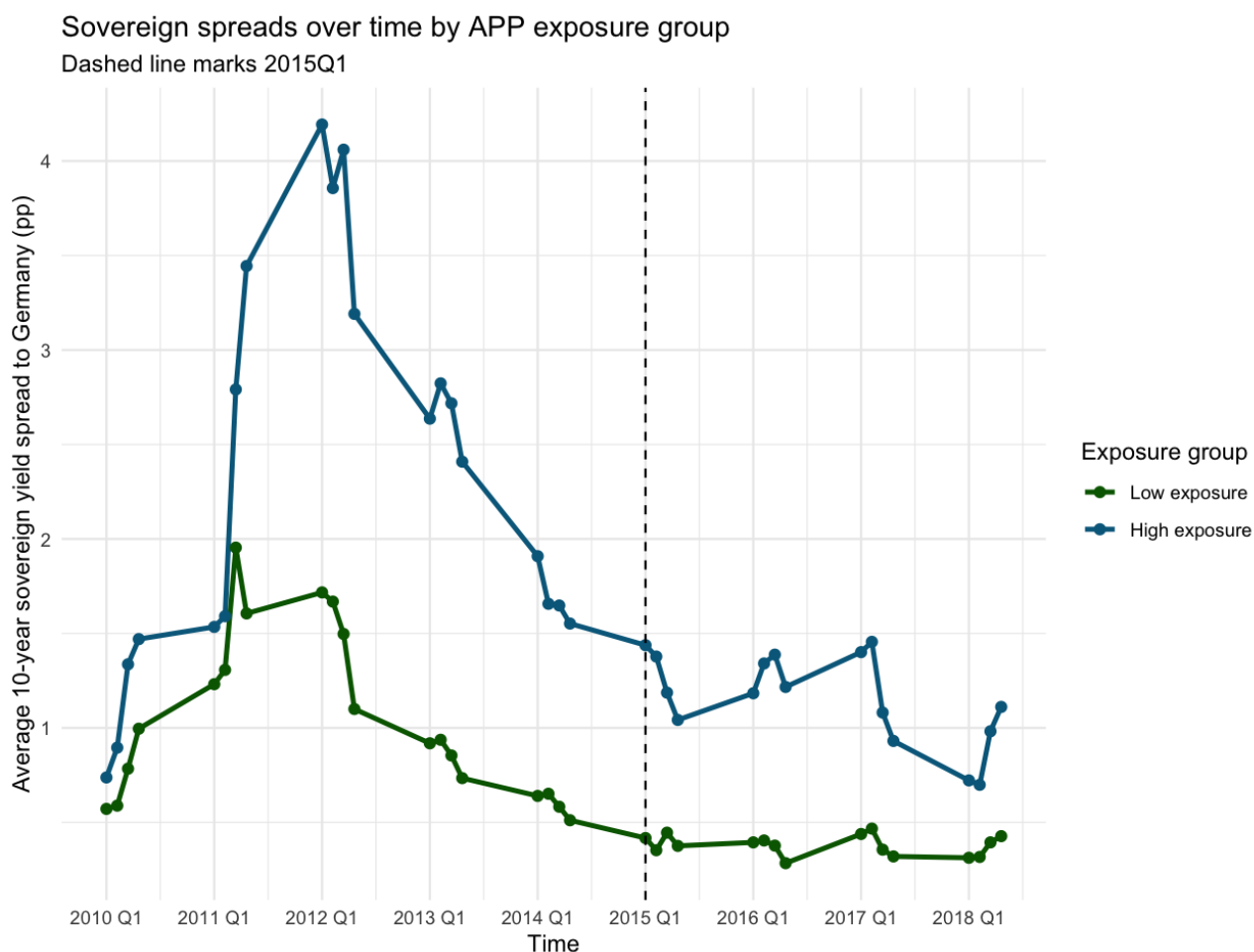


Figure 8: Sovereign spreads over time by APP exposure group (split median)

Figure 8 presents spreads (countries mean 10Y interest rate relative to Germany's) for different exposure groups. Groups are again divided by the median, and exposure groups are presented with different colours. Sovereign spreads declined considerably after 2012 and remained lower during the APP period, particularly for more exposed countries. This suggests that the APP contributed to improved financing conditions and reduced fragmentation within euro area sovereign debt markets. The spread developments are also consistent with earlier literature suggesting that sovereign risk and financial fragmentation played important roles in shaping monetary transmission.

On the other hand, Figure 9 presents the evolution of lending to firms by exposure group. Prior to the introduction of the APP, the high-exposure group already had weaker lending dynamics compared to the low-exposure group. The lower-exposure countries exhibit relatively more stable lending trends before 2015.

Following the introduction of the APP, the divergence between the two groups remains visible. Lending in the low-exposure group gradually increases over time, while lending in the high-exposure

group remains comparatively weak and continues to trend downward for much of the post-treatment period.

The figure therefore does not provide descriptive evidence that countries with higher APP exposure experienced stronger aggregate lending growth following the introduction of the APP. Instead, the graphical evidence is more consistent with the regression results presented earlier in the chapter, which show that higher APP exposure is not associated with stronger lending outcomes.

At the same time, the figure should be interpreted with caution because exposure groups already differ substantially before the APP period. Consequently, figure cannot establish a causal effect of the APP on lending dynamics.

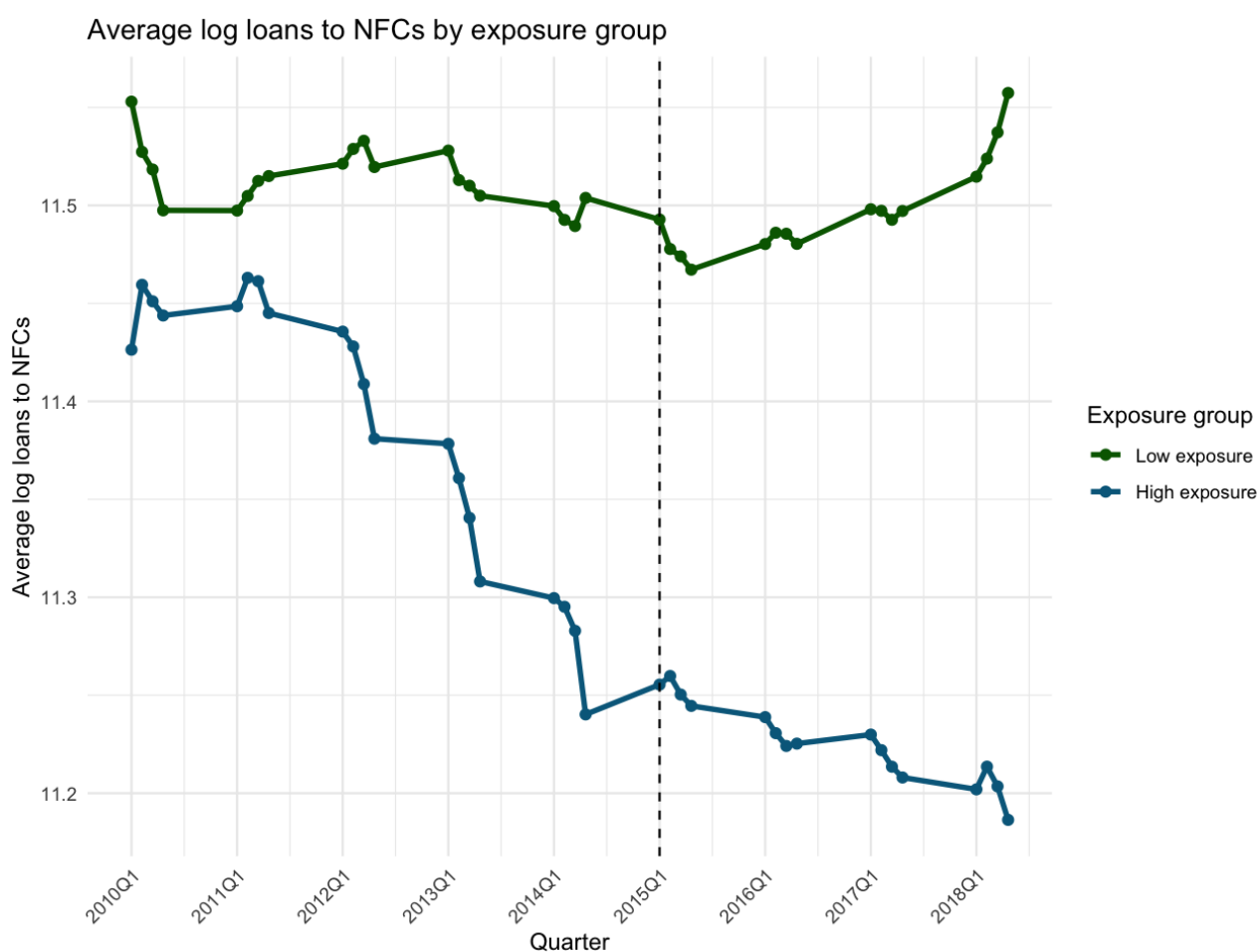


Figure 9: Average loans to NFCs over time by pre-APP exposure group (split median). The dashed line marks the start of the APP.

5.10 Summary of Findings

Overall, the empirical results provide limited evidence that higher APP exposure led to a stronger increase in lending to firms in the euro area. The baseline difference-in-differences estimates did not

show statistically significant effects of APP exposure on lending following the introduction of the programme. This conclusion remained unchanged after controlling for macroeconomic conditions and sovereign spreads.

When loan demand was included as an additional control, the estimated effect of APP exposure became negative and statistically significant. However, because this specification relies on a reduced sample of countries and the loan demand variable itself was statistically insignificant, the results should be interpreted with caution. The finding nevertheless suggests that the estimated relationship between APP exposure and lending is sensitive to model specification and sample composition.

The heterogeneity analysis indicated that the effects of the APP were not uniform across countries. Splitting the sample by pre-treatment loan demand revealed substantially different results across demand environments. More importantly, the financial stress analysis showed that countries characterised by higher sovereign spreads experienced a positive and statistically significant relationship between APP exposure and lending, whereas no corresponding effect was observed among non-stressed countries. This suggests that the transmission of the APP may have depended on countries' underlying financial conditions.

The event-study analysis supports the validity of the difference-in-differences design by providing no evidence of strong differential pre-trends between countries with different levels of APP exposure. Following the introduction of the APP, the estimated coefficients became moderately positive on average but remained imprecisely estimated and generally statistically insignificant. The results therefore do not provide strong evidence of a sharp or immediate lending response, although they are consistent with the possibility of gradual effects over time.

Additional robustness checks broadly support the main conclusions. Binary treatment specifications yielded results similar to the continuous treatment model, showing no statistically significant positive lending effect of APP exposure. The leave-one-out analysis further indicated that the findings are not driven by any single country, although Slovakia had a noticeable influence on the magnitude of the estimated coefficients due to its exceptionally high pre-APP exposure.

The alternative regression specification, estimated only for the APP period, revealed a negative association between pre-APP exposure and lending outcomes. This result is not interpreted causally, but it reinforces the broader finding that countries with higher exposure to APP-eligible securities did not experience stronger aggregate lending growth during the programme period.

Finally, descriptive evidence shows that the APP coincided with substantial improvements in financial market conditions. Sovereign spreads declined considerably, and equity markets recovered during the programme period.

Taken together, the results suggest that the APP was more successful in improving financial conditions and reducing financial fragmentation than in generating a broad-based expansion in aggregate bank lending. The findings point to the importance of country-specific financial conditions and heterogeneous transmission mechanisms in shaping the effectiveness of unconventional monetary policy across the euro area.

6 Discussion and Interpretation

6.1 Interpreting the Lending Channel Results

The empirical results presented in the previous chapter provide only limited evidence that higher APP exposure translated into stronger aggregate lending growth across the euro area as a whole. The baseline difference-in-differences estimates did not show a statistically significant relationship between pre-APP exposure and lending following the introduction of the programme. This finding remained broadly unchanged after controlling for macroeconomic spreads.

The empirical findings in this thesis differ somewhat from the micro-level APP literature reviewed earlier. Studies such as Blaes et al. (2019) and Altavilla et al. (2021) generally find that banks more exposed to APP-related liquidity shocks increased lending more than less exposed banks. However, these studies rely on highly granular bank- and firm-level datasets that enable the identification of transmission mechanisms within individual banks. In contrast, the empirical analysis in this thesis uses aggregate country-level lending data, where substantial heterogeneity across banks, firms and financial conditions is averaged into a single macroeconomic outcome. As a result, positive lending responses among some banks may become considerably weaker when aggregated to the country level.

Rather than contradicting the micro-level evidence, the results suggest that lending responses identified at the bank level did not translate into a strong and uniform increase in aggregate lending across euro area countries. The estimated coefficients were generally associated with relatively large standard errors, indicating considerable uncertainty surrounding the magnitude of aggregate lending responses.

The results also indicate that APP transmission may not have been uniform across countries. The heterogeneity analysis based on financial stress showed a positive and statistically significant relationship between APP exposure and lending in countries characterised by higher sovereign spreads, while no corresponding effect was observed among lower-spread countries. This finding suggests that country-specific financial conditions may have influenced the strength of transmission and supports the broader literature emphasising heterogeneity in euro area monetary policy transmission.

The findings are therefore more closely aligned with the aggregate literature, which tends to identify weaker and more heterogeneous lending effects. For example, Petrakis et al. (2024) show that APP-

related measures supported lending overall, but transmission differed substantially depending on the conditions of national banking systems and broader macroeconomic conditions.

One possible explanation for the relatively weak aggregate lending effects is that banks did not fully pass through liquidity to new lending to firms. The literature emphasises that banks may respond to liquidity shocks not only by expanding credit, but also by repairing balance sheets and increasing holdings of safer assets. This is consistent with Appendix 2, which shows that countries with higher pre-APP exposure maintained relatively high shares of sovereign debt securities on their balance sheets throughout the APP period. Rather than fully reallocating portfolios toward lending, banks may therefore have retained substantial holdings of securities even after financial conditions improved.

This interpretation is also linked to the heterogeneity findings in the micro-level literature, where stronger lending responses are often concentrated among healthier and better-capitalised banks. If a substantial share of banks remained constrained by weak profitability, capital pressures or elevated risks, the aggregate lending response to the APP may have remained limited even if some banks expanded lending.

The results also suggest that the APP may have operated more strongly through financial markets than through aggregate bank lending. The descriptive evidence presented in Chapter 5 shows clear improvements in sovereign spreads and broader financial market conditions during the APP period. However, these improvements were not accompanied by a similarly strong increase in aggregate lending across the euro area. This suggests that while the APP was successful in easing financing conditions, the transmission of these improvements into aggregate credit growth remained uneven and depended on country-specific financial and economic conditions.

6.1.1 Negative Coefficients

An aspect of the results that deserves attention is the repeated occurrence of negative coefficient estimates across several specifications. Although most estimates are statistically insignificant and therefore do not provide strong evidence that the APP reduced lending, the negative signs are nevertheless notable because they run counter to the initial hypothesis that higher APP exposure would be associated with stronger lending growth. This pattern becomes especially visible in the loan demand specification, the alternative regression model and the leave-one-out analysis excluding Slovakia, where the estimated coefficients become both economically larger and statistically significant.

One possible explanation is that the exposure measure captures not only the intensity of APP transmission but also broader differences in countries' financial conditions following the sovereign debt crisis. The negative coefficients may partly reflect underlying economic and financial weaknesses rather than a direct contractionary effect of the APP itself. Another explanation relates to balance sheet adjustment within the banking sector. Some banks may use improved liquidity (especially in financially vulnerable countries) to strengthen capital positions and reduce risk.

Excluding Slovakia, which had by far the highest pre-APP exposure in the sample, results in considerably more negative coefficient estimates. This suggests that the overall results are sensitive to a small number of highly exposed observations and that substantial heterogeneity exists even among countries with similar exposure levels.

Overall, the negative coefficients should not be interpreted as evidence that the APP reduced lending. Rather, they suggest that countries with higher exposure to APP-eligible securities may also have faced structural conditions that limited the translation of improved financial conditions into stronger aggregate lending.

6.2 Financial Conditions and Cross-Country Heterogeneity

One of the most interesting findings of this thesis is that the estimated lending effects of the APP appear to differ across countries depending on their financial stress. While the baseline difference-in-differences specification provides little evidence of a strong aggregate lending response for the euro area, the heterogeneity analysis suggests that this average result may conceal important cross-country differences.

When countries are divided by their pre-APP sovereign spread levels, a positive and statistically significant relationship between APP exposure and lending is observed among financially stressed countries, whereas no significant relationship is observed among non-stressed countries. Although these results should be interpreted cautiously, given the relatively small number of countries in each subgroup, they suggest that financial conditions may have influenced the strength of monetary policy transmission.

These findings are broadly consistent with the literature reviewed in Chapter 2.3.5. Burriel and Galesi (2018) show that the macroeconomic effects of unconventional monetary policy differed substantially across euro area countries, with responses depending on sovereign risk and banking sector conditions. Similarly, Grandi (2019) finds that monetary policy transmission through the bank lending channel varied significantly across countries and was closely linked to sovereign exposures and financial

stress. Together, these studies suggest that a common monetary policy may generate different outcomes across countries when financial conditions are uneven.

Several reasons could explain why APP transmission may have differed across countries. One possibility is that countries classified as financially stressed were generally more vulnerable following the sovereign debt crisis. Banks in these economies often held relatively larger amounts of domestic government bonds on their balance sheets and were therefore more exposed to sovereign risk. Improvements in sovereign bond markets generated by the APP may consequently have strengthened bank balance sheets and funding conditions more strongly in these countries than in countries facing lower financial stress.

However, the descriptive evidence presented in Figure 3 does not indicate a uniformly stronger lending among all high-exposure countries. While lending increased modestly in the low-spread high-exposure group after the introduction of the APP, it declined in the corresponding high-spread high-exposure group. This apparent inconsistency illustrates a distinction between descriptive and regression-based evidence. The difference-in-differences estimates assess whether lending developments changed relative to the counterfactual represented by lower-exposure countries in the same financial-stress category, whereas the descriptive figure shows only raw lending developments. Consequently, the positive coefficient estimated for stressed countries does not imply that lending increased absolutely in every stressed country, but rather that more exposed countries performed relatively better than less exposed countries within that group.

Nevertheless, the stressed-country subsample contains a limited number of countries, which reduces statistical power and increases sensitivity to individual observations. Furthermore, the leave-one-out analysis indicates that Slovakia has a notable influence on the estimated coefficients in the baseline regressions. While the heterogeneity results provide suggestive evidence that financial conditions influenced APP transmission, they should therefore be viewed as explanatory rather than definitive evidence of stronger lending effects in financially stressed economies.

Overall, the findings suggest that APP transmission may have depended on the financial environment in which banks operated. Although the programme did not generate strong aggregate lending responses across the euro area, its effects appear to have been more pronounced in countries facing greater financial stress, highlighting the financial fragmentation when evaluating the effectiveness of unconventional monetary policy.

6.3 Transmission Constraints

The limited empirical evidence suggests that increased liquidity did not translate into strong lending. The literature reviewed in Chapter 2.5 suggests several potential explanations related to demand-side, bank-side and environment-related transmission constraints.

One potential explanation concerned credit demand. However, the heterogeneity analysis does not suggest that stronger loan demand amplified the transmission of the APP to bank lending. Instead, the estimated relationship between APP exposure and lending was strongly negative in countries characterised by higher pre-treatment loan demand, while no significant relationship was observed among low-demand countries. This finding is contrary to the simple expectation that stronger demand conditions would facilitate monetary transmission. Countries with stronger measured loan demand could have simultaneously been affected by other factors that constrained lending growth.

The empirical results are consistent with the literature, suggesting that monetary easing may stabilise financial conditions without generating a sufficiently strong increase in aggregate demand once the economy is constrained by the zero lower bound. Koo's (2013) balance sheet recession framework helps explain why private-sector deleveraging may weaken the transmission of monetary policy to lending and investment. In such conditions, the private sector may prioritise reducing debt rather than increasing credit, limiting the effectiveness of asset purchases.

Bank-side constraints may have further weakened transmission. The literature review earlier emphasises that banks facing profitability pressures, capital constraints, or elevated risk perceptions may respond cautiously to monetary easing. Rather than expanding lending aggressively, banks may use the extra liquidity to strengthen balance sheets or adjust portfolio composition. This interpretation is supported in Appendix 2, which shows that countries with higher pre-APP exposure continued to hold substantial amounts of sovereign securities throughout the APP period. While this does not imply that banks failed to increase lending, it suggests that part of the liquidity generated by the APP may have remained within financial portfolios rather than being directly transmitted into new credit to firms.

The event-study results also indicate that the APP's lending effects were gradual rather than immediate. Although post-treatment coefficients are generally positive, they remain imprecisely estimated and do not provide evidence of a sharp increase in lending following the programme's introduction. This pattern is consistent with the argument of Coibon and Gorodnichenko (2015), who suggest that inflation and growth expectations may adjust only slowly in low-inflation environments.

If firms continue to expect weak future demand and limited growth opportunities, improvements in financing conditions may take time to influence investment and borrowing decisions.

Taken together, these findings suggest that the effectiveness of the APP depended not only on the programme itself but also on the economic environment in which it operated. The programme appears to have succeeded in improving financial conditions, yet the transmission of these improvements into aggregate lending was likely constrained by a combination of banking sector conditions, financial fragmentation and broader post-crisis economic environment. These provide a plausible explanation for why financial markets responded more strongly to the APP than aggregate bank lending in the empirical analysis.

6.4 Bank- vs Country-Level Transmission

An important implication of the findings is that the estimated effects of unconventional monetary policy depended substantially on the level of analysis. While much of the APP bank lending literature relies on bank-level data and generally identifies positive lending responses among more exposed banks, the country-level results presented in my empirical part indicate considerably weaker and less uniform effects. Understanding this difference is important when evaluating the programme's overall effectiveness.

The previously discussed micro-level literature consistently finds that banks with greater exposure to APP-related liquidity shocks expanded lending more than less exposed banks. Studies such as Blaes et al. (2019), Altavilla et al. (2021) and Afonso & Pereira (2022) identify positive lending effects after controlling for bank-specific characteristics, borrower quality and credit demand conditions. These studies can isolate the behaviour of individual banks and therefore capture transmission mechanisms that may not be visible in aggregate data.

In contrast, the country-level approach in this thesis measures the net effect of monetary transmission across the entire banking sector within each country. As a result, positive lending responses among some banks may be offset by weaker responses elsewhere. This interpretation is consistent with the micro-level literature itself, which emphasises substantial heterogeneity across banks. Better capitalised banks often appear more willing to expand lending following monetary easing, whereas weaker banks may use improved liquidity to strengthen balance sheets, reduce risk or maintain holdings of safer assets. When these different responses are aggregated together, the resulting country-level effect may be considerably smaller than the individual bank-level effects observed in micro-data.

Country-level aggregation may also mask heterogeneity among borrowers. Previous research suggests that lending effects were often stronger for larger and financially stronger borrowers. If additional credit remained concentrated within particular sectors, regions or firm groups, aggregate lending measures may underestimate the extent to which the programme affected specific parts of the economy. In this sense, the absence of a strong aggregate lending response should not be interpreted as evidence that the APP had no effect on lending behaviour.

It is therefore reasoned that micro- and macro-level evidence should be understood as complementary rather than contradictory. Micro-level studies provide evidence that the APP influenced bank behaviour and credit supply decisions, while country-level analyses assess whether these individual responses accumulated into economically meaningful changes in aggregate lending. The results of this thesis suggest that although the APP likely affected lending decisions within parts of the banking sector, these effects were not sufficiently strong or widespread to generate a large and uniform increase in aggregate lending across euro area countries.

6.5 Policy Implications

The findings of this thesis suggest that the effectiveness of the APP bank lending channel transmission should not be evaluated solely based on aggregate lending outcomes. While the empirical results provide only limited evidence that higher APP exposure generated stronger aggregate lending growth across the euro area, the descriptive evidence indicates meaningful improvements in financial market conditions during the programme period.

The results also highlight the importance of country-specific financial conditions for monetary transmission. The heterogeneity analysis indicates that APP transmission may have differed across financial environments, with stronger lending effects observed among financially stressed countries than among non-stressed countries. This could mean that the effects of unconventional monetary policy depend not only on the policy but also on the condition of the banking sector and the broader financial status of the country.

Even when asset purchases successfully reduce sovereign yields and ease financing conditions, transmission to the real economy may remain limited if banks remain cautious, firms are unwilling to borrow or economic uncertainty remains elevated. This is why it is important to consider both financial and real-economy channels when evaluating the effectiveness of unconventional monetary policy.

The findings therefore support the view that monetary policy alone may not always be sufficient to generate a strong recovery in lending and investment in a prolonged low-interest-rate environment. The effectiveness of asset purchases may be enhanced when accompanied by policies that strengthen banking-sector resilience, reduce financial fragmentation and support investment opportunities in the real economy. Monetary policy and broader economic policies should be viewed as complementary rather than independent tools.

6.6 Limitations and Directions for Future Research

Several limitations should be noted when interpreting the results of this thesis.

First, the empirical analysis relies on aggregate country-level data. While this is useful for evaluating whether lending effects accumulated into observable macroeconomic outcomes, it inevitably masks substantial heterogeneity within countries. Banks differ in their capitalisation, balance sheet structure, sovereign exposures and lending behaviour, while firms differ in their financing needs and creditworthiness. As a result, positive lending responses become more difficult to detect at the aggregate level.

Second, the exposure measure used in this thesis is based on pre-APP holdings of sovereign debt securities relative to total assets. Although this approach follows the logic of earlier studies and provides a reasonable proxy for potential APP exposure, it does not directly observe actual asset sales to the ECB or portfolio adjustments following the introduction of the programme. In addition, exposure may partly capture broader differences in post-crisis financial vulnerability across countries. As discussed earlier, countries with higher exposure often overlapped with economies more heavily affected by the sovereign debt crisis, making it difficult to fully separate APP exposure from underlying structural differences.

Third, the identification of APP-specific effects remains challenging because the programme was implemented alongside other unconventional monetary policy measures. During the sample period, the ECB also employed instruments such as LTROs, TLTROs and negative interest rates. Although difference-in-differences framework helps isolate variation related to APP exposure, some of the estimated effects may still reflect the broader unconventional monetary policy environment rather than the APP alone.⁷¹

⁷¹ Paper by Sugo & Vergote, “Who takes the ECB’s targeted funding?”, ECB Working Paper Series (2020), No 2439, shows countries that used most TLTROs from September 2014 to March 2017. Countries using most TLTRO’s are not in general same countries as high exposure countries in this thesis, supporting my difference-in-differences setup.

Fourth, the heterogeneity and robustness analyses highlight the importance of sample composition. The financial stress analysis is based on relatively small groups of countries, and the leave-one-out test shows that Slovakia exerts a noticeable influence on some estimated coefficients due to its exceptionally high pre-APP exposure. While these additional analyses provide useful insights into cross-country differences, they also suggest that the estimated relationship is not certain.

Despite these limitations, the country-level perspective remains valuable because it complements the micro-level literature by examining whether bank-level responses translated into broader aggregate lending dynamics. While many existing studies focus on individual banks, this thesis contributes by analysing how monetary transmission appeared at the macroeconomic level.

Several directions for future research emerge from the results. First, future studies could use bank-level or loan-level datasets to examine whether positive lending responses identified in the micro-level literature were concentrated among specific banks, sectors or borrower groups. Such data would allow to distinguish more clearly between portfolio rebalancing, balance sheet repair and credit supply effects.

Second, future research could investigate more directly the role of financial stress and sovereign exposure in shaping APP transmission. The heterogeneity analysis presented in this thesis suggests that lending responses may have differed across financial environments, but the limited number of countries makes it difficult to draw strong conclusions. More detailed bank-level evidence could provide a clearer understanding of how sovereign risk, bank balance sheet strength and financial fragmentation influenced monetary transmission.

Finally, future work could also examine the interactions among different unconventional monetary policy instruments. Since the APP operated alongside TLTROs and other policies, understanding how these policies complemented or reinforced one another would provide a more complete picture of the transmission in the euro area.

7 Conclusions

The objective of this thesis was to examine whether the ECB's Asset Purchase Programme (APP) increased new credit to firms in the euro area through the bank lending channel. More specifically, the analysis examined whether countries with higher pre-APP exposure to sovereign debt securities experienced stronger lending growth following the programme's introduction and whether macroeconomic and financial conditions influenced the strength of this transmission. By focusing on country-level outcomes, I aimed to assess whether the heterogeneous lending responses observed in the micro-level literature translated into observable macroeconomic changes in credit supply.

Using a difference-in-differences framework with quarterly country-level data from the beginning of 2010 to the end of 2018, the empirical results provide only limited support for the first hypothesis that higher APP exposure was associated with stronger aggregate lending growth. Across the baseline specifications, countries with higher pre-APP exposure did not experience significantly stronger lending growth following the programme's introduction. This finding remained broadly unchanged after accounting for macroeconomic controls, sovereign spreads and alternative binary treatment definitions. The event-study analysis similarly provided no evidence of a strong or immediate lending response following the introduction of the APP. Although the post-treatment coefficients became moderately positive on average, they remained imprecisely estimated throughout the period.

At the same time, several specifications produced negative coefficient estimates. The loan demand specification yielded a statistically significant negative coefficient, and similar results were observed in the alternative regression specification and in some robustness checks. Even though these findings are not necessarily evidence that the APP reduced lending, they suggest that higher APP exposure was not systematically associated with stronger lending outcomes. Instead, results indicate that highly exposed countries often faced economic and financial conditions that may have limited the transmission of additional liquidity into aggregate credit growth.

The heterogeneity analysis provides further evidence that APP transmission was not uniform across countries. While the loan demand analysis produced mixed results, the financial stress heterogeneity analysis suggested that countries with higher sovereign spreads experienced a stronger interaction between APP exposure and lending than financially less stressed countries. Although these results are gained using a limited number of countries, they suggest that underlying financial conditions influenced the effectiveness of monetary transmission and that euro area-wide averages may mask important cross-country differences.

The descriptive evidence indicates that the APP contributed to improvements in financial market conditions during the programme period. Sovereign spreads narrowed considerably, and equity market conditions improved, suggesting that the ECB was successful in reducing financial stress across the euro area. Results support the view that the APP may have operated more effectively through financial market stabilisation and portfolio valuation effects than through a broad-based expansion of bank lending.

From the perspective of the banking sector, one possible explanation for the lack of positive response is that banks did not fully transmit APP-related liquidity into new lending. Countries with higher exposure to APP-eligible sovereign securities maintained relatively large holdings of these assets throughout the programme period. This suggests that part of the liquidity generated by the APP may have been used for other balance sheet operations than increasing credit to firms.

The findings provide support for the second hypothesis of this thesis. Previous bank-level studies generally find that banks with greater exposure to APP-eligible assets increased lending more than less exposed banks. In contrast, the results in this thesis point to considerably weaker effects. Rather than contracting the micro-level literature, these results imply that positive lending responses among some banks may have been offset by weaker responses elsewhere within the same country. Country-level aggregates appear to capture only sufficiently strong and widespread transmission effects in lending.

The third hypothesis proposed that adverse macroeconomic conditions may weaken the APP's transmission to bank lending. The empirical evidence provides some support to this view, although the results are more complex than initially expected. The findings suggest that the effectiveness of unconventional monetary policy depended not only on the programme itself but also on a broader economic and financial environment in which it operated. Financial stress, banking-sector conditions and cross-country differences appear to have influenced the strength of transmission, highlighting the importance of considering the broader context in which monetary policy is implemented.

Several broader implications follow these empirical findings. First, the results suggest that improving financial conditions alone may not be sufficient to generate a strong expansion in aggregate lending. Second, the effectiveness of unconventional monetary policy appears to depend heavily on country-specific financial and economic conditions. Even when monetary policy successfully reduces financial stress and improves financing conditions, transmission to the real economy may remain uneven across countries. Third, the findings highlight the importance of complementary policies. Measures that strengthen banking sector resilience, reduce financial fragmentation and support

productive investment may improve the effectiveness of future unconventional monetary interventions.

Several limitations are nevertheless acknowledged. Most importantly, the empirical analysis is conducted using aggregate country-level data, which cannot capture the heterogeneity that exists across individual banks and borrowers. In addition, the exposure measure cannot perfectly isolate APP-specific effects from other unconventional monetary policy measures implemented during the same time. The leave-one-out analysis further demonstrates that some results are sensitive to influential countries, reflecting the challenges of conducting empirical analysis with a relatively small number of euro area countries. Future research could therefore extend the analysis using bank- or loan-level datasets, which would allow more accurate identification of transmission mechanisms and a deeper understanding of the role of financial stress and banking-sector characteristics in shaping monetary policy transmission.

Overall, the findings of this thesis suggest that the ECB's APP was more successful in stabilising financial conditions and supporting market functioning than in generating a strong and uniform increase in aggregate bank lending across the euro area. Also, the transmission of unconventional monetary policy is shaped not only by the design of the policy itself, but also by the financial and economic environment in which it operates.

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Appendices

Appendix 1 Declaration of the Use of Artificial Intelligence

In the creation of this thesis, I utilized generative artificial intelligence for several support tasks. The tools, their purpose, and the verification measures are detailed below. I confirm that I have used all AI tools with the necessary care and caution, have fully disclosed their use in accordance with university policy, and take full responsibility for all content presented in this thesis.

1. Tool: OpenAI's ChatGPT (GPT-5 Versions)

- **Stage of Use:** Composition, editing, learning, coding, improving language
- **Purpose of Use:** I used ChatGPT to correct and improve my writing, improve my understanding of certain topics, help structure thesis, help with coding in R and with the errors received in R.
- **Example Prompt (January 23, 2026):** *"How to make a regression table to Microsoft Word from my statistical results in R?"*
- **Verification:** No text from the AI was used in the thesis itself; it only guided my thought process. I carefully proofread all suggested changes to ensure that the original meaning of my arguments was not altered and that the academic content remained accurate. I retained final control over the text. When working with my code in R, I checked the commands suggested by AI from R guide to ensure that it is fitting for my purpose.

2. Tool: DeepL

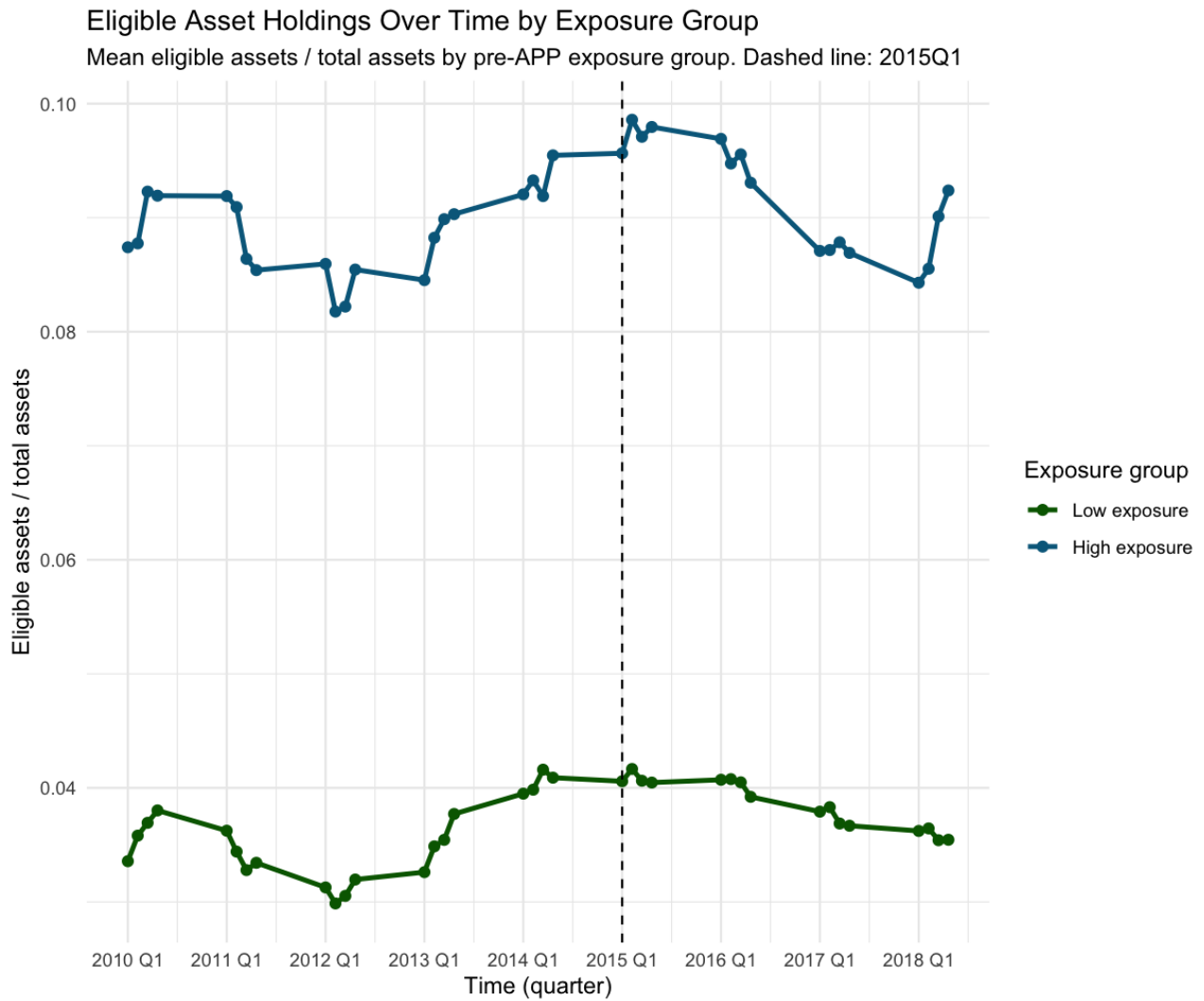
- **Stage of Use:** Composition, editing
- **Purpose of Use:** AI-based spelling corrections and language improvements were used throughout the writing of this paper to enhance readability.
- **Verification:** I carefully proofread all suggested changes to ensure that the original meaning of my arguments was not altered and that the academic content remained accurate. I retained final control over the text.

3. Tool: Grammarly

- **Stage of Use:** Composition, editing
- **Purpose of Use:** AI-based writing corrections and language improvements were used throughout the writing of this paper to enhance readability.

- **Verification:** I carefully proofread all suggested changes to ensure that the original meaning of my arguments was not altered and that the academic content remained accurate. I retained final control over the text.

Appendix 2 Eligible Asset Holdings Over Time by Exposure Group



Appendix 3 High and Low APP Exposure Countries and High and Low Spread Countries

Low APP exposure countries	High APP exposure countries
Austria	Belgium
Germany	Cyprus
Estonia	Greece
Finland	Italy
France	Luxembourg
Ireland	Portugal
Malta	Slovenia
Netherlands	Slovakia
	Spain
Low spread countries	High spread countries
Austria	Cyprus
Belgium	Italy
Germany	Ireland
Greece	Malta
Estonia	Portugal
Finland	Slovenia
France	Slovakia
Netherlands	Spain
Luxembourg	

Appendix 4 Leave-One-Out Estimation

Dropped country	Baseline	Macro controls	Macro controls & spread
AT	-0.608 (1.824)	-0.486 (1.682)	0.013 (1.536)
BE	-0.855 (1.993)	-0.612 (1.8)	-0.13 (1.646)
CY	-0.654 (1.772)	-0.485 (1.68)	0.028 (1.527)
DE	-0.592 (1.806)	-0.44 (1.673)	0.071 (1.53)
EE	-0.39 (1.769)	-0.061 (1.622)	-0.029 (1.508)
ES	-0.617 (1.688)	-0.462 (1.572)	-0.022 (1.437)
FI	-0.246 (1.69)	-0.144 (1.57)	0.427 (1.365)
FR	-0.489 (1.78)	-0.381 (1.651)	0.139 (1.497)
GR	-0.703 (1.779)	-0.462 (1.688)	0.062 (1.562)
IE	-1.083 (1.852)	-0.808 (1.554)	-0.387 (1.448)
IT	-0.685 (1.828)	-0.438 (1.659)	0.04 (1.507)
LU	-0.621 (1.855)	-0.481 (1.681)	0.002 (1.539)
MT	-0.704 (1.81)	-0.496 (1.642)	-0.014 (1.51)
NL	-0.586 (1.805)	-0.424 (1.654)	0.076 (1.508)
PT	-0.731 (1.759)	-0.556 (1.612)	-0.04 (1.435)
SI	0.04 (1.123)	0.228 (1.024)	0.683 (0.897)
SK	-5.816** (2.336)	-5.508** (1.958)	-4.94** (2.167)

*** p<0.001, ** p<0.01, * p<0.05. Standard errors in the parathesis.

Appendix 5 Difference-in-Differences Estimation Summary

Difference-in-Differences Summary Table

	Baseline	Macro controls	+Spread	+Loan demand
Exposure $\times$ Post	-0.695 (1.800) t = -0.386 p = 0.704	-0.504 (1.653) t = -0.305 p = 0.764	-0.029 (1.508) t = -0.019 p = 0.985	-4.960** (2.130) t = -2.329 p = 0.037
GDP growth		-0.022*** (0.006) t = -3.624 p = 0.002	-0.019** (0.007) t = -2.861 p = 0.012	-0.018** (0.007) t = -2.594 p = 0.022
Unemployment rate		0.015 (0.010) t = 1.430 p = 0.172	0.014 (0.010) t = 1.353 p = 0.196	0.025* (0.012) t = 1.997 p = 0.067
Sovereign spread			0.034** (0.014) t = 2.507 p = 0.024	0.017 (0.011) t = 1.451 p = 0.171
Loan demand				0.000 (0.001) t = 0.482 p = 0.637
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
SE clustered by	Country	Country	Country	Country

p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in the parenthesis.

Appendix 6 Correlation Matrix of Main Explanatory Variables

	Exposure	GDP growth	Unemployment rate	Loan demand	Spread
Exposure	1.000	-0.013	0.180	0.121	0.143
GDP growth	-0.013	1.000	-0.332	0.394	-0.250
Unemployment rate	0.180	-0.332	1.000	-0.096	0.364
Loan demand	0.121	0.394	-0.096	1.000	-0.237
Spread	0.143	-0.250	0.364	-0.237	1.000