Università
Ca'Foscari
Venezia

Aix*Marseille
université
Socialement engagée

Master's Double Degree programme in
Economics, Econometrics and Finance

Final thesis

ECB's Quantitative Easing and Italian bond spreads

An analysis of the Public Sector Purchase
Programme's implementation effects

Supervisor
Prof. Eric Girardin

Graduand
Matteo Loseri
Matriculation Number 890060

Academic Year
2022/2023

Abstract

The impact of monetary policy on sovereign yields and government spreads is a widely discussed topic in the literature. However, country-specific studies are not so common. To address this lack in the literature, this dissertation will investigate the impact of the PSPP program implemented by the ECB over the period between March 2015 and December 2018 on Italian government bond spreads with Germany. To achieve this result, two regression models are fitted to compare changes in the main spread drivers between the period ante and post-PSPP program. What emerges from this analysis is a change in the way investors priced Italian government bonds, with relative consequences in terms of spread. If during the European sovereign debt crisis investors were mostly worried about the long-term perspective of Italy despite the financial tensions, after the PSPP program their concerns shifted to the short-term. This phenomenon may be justified by a "reassurance effect" of the ECB in the long term linked to the new supportive approach adopted during the crisis period. At the same time, investors might have doubted the capacity of the ECB to face a crisis in the short term, due to legal and political constraints.

Contents

Chapter 1

Introduction

This dissertation will focus on the Public Sector Purchase Program (PSPP) purchases, as this is the wider program launched by the ECB and it has multiple scopes. First, it aims to understand if the PSPP program implementation impacted the Italian government bond spread. Second, it assesses if the drivers of the Italian government spread with Germany shifted after an extensive monetary measure such as the Asset Purchase Program. These aspects are a matter of interest to understand if non-standard tools similar to the PSPP could be useful to address problems in the monetary policy transmission to government bond markets, or if they even extend policy transmission asymmetries.

The analysis is conducted through two regression models. The first one (Model A) is fitted on the period between January 2010 and December 2014 and embodies the factors affecting the Italian government bond spread changes ante PSPP program. The second model (Model B), instead, is fitted over the period between January 2015 and December 2018 and includes a proxy for the PSPP implementation. The control variables included in the model combine both country-specific factors (default risk factor, business environment factor, political factor) of Italy and Germany and common factors (announcement effects, European risk factor). All these drivers are inspired by the main literature on sovereign bond yield drivers

that is exposed in the "Literature review" section.

The main finding of this research is the existence of a "reassurance effect" of the ECB over the long term due to the PSPP implementation. The new accommodative approach adopted by the ECB, indeed, was priced by investors who started to rely on it as a long-term guarantee of support for the Italian economy, despite being limited in the short term[1]. Hence, after the PSPP program implementation, investors shifted their attention from the Italian long-term economic perspective to its short-term default risk. Despite not being intuitive at first sight, given the substantial ECB purchases in the government bond market, this dynamic makes sense according to an investor's point of view. In case of a further short-term crisis, it was reasonable to doubt additional ECB support due to the mandate (breach of the 2% inflation level) and political constraints. To minimize losses, it was therefore important for an investor to monitor the Italian default risk, to promptly tackle the situation in case of tensions.

This research contributes to the government bond spreads literature in several ways. Firstly, the way used to proxy QE, to the best of my knowledge, is innovative with respect to the previous literature on government spreads as it considers issuer-specific purchases carried out by the ECB rather than changes in the ECB balance sheet[2]. Secondly, this analysis focuses on Italian government bond spreads, which are rarely studied standalone. Finally, this research points out the significant impact of the PSPP implementation[3] (flow effect) on Italian sovereign bond spread in addition to the most widely studied announcement effect (stock effect).

[1]The extension of the program, indeed, was likely to have exhausted the ECB's capacity to promote new additional ambitious programs in the short term (to meet the mandate and the "frugal countries" opposition).

[2]In Appendix B the same core model used in the dissertation is fitted considering more conventional proxies. As the results demonstrate, to analyze government bond spread phenomena, it is better to use issuer-specific proxies for ECB purchases.

[3]This occurred through a "reassurance effect" over the long-term, which was never unveiled in previous literature.

The dissertation is structured as follows.

Chapter 2 introduces a summary of the key ECB's unconventional monetary policies and provides a recap on the main aspects of the PSPP program. In addition, this chapter offers an overview of the actual state of the art in the government bonds spread literature, with a particular focus on the main connections with unconventional monetary policies in the Eurozone.

Chapter 3 investigates the variables employed as well as the model specification and the rationale behind the models adopted.

Chapter 4 illustrates the most important findings, along with their economic interpretation. In the same chapter, break tests and insights on the model diagnostics are provided.

Appendix A provides more statistics on the variables employed in the dissertation.

Finally, Appendix B complements the research by fitting the core model specification of the dissertation (Model B) with alternative proxies[4] of the Quantitative Easing.

[4]The first alternative proxy relies on the most common approach in the literature, which corresponds to the ECB's assets growth rate of the balance sheet. The second alternative proxy, instead, relies on the growth rate of the securities held for monetary policy aggregate.

Chapter 2

ECB's unconventional monetary policies and literature review

2.1 The roots of the ECB's unconventional monetary policies

The roots of the ECB's unconventional monetary policy rely on the response to the 2008 financial crisis. In August 2007, indeed, when the troubled situation of Lehman Brothers came to light, the interbank market froze due to a general lack of trust in the financial conditions of the other market participants. In this context of widespread uncertainty, interest rates arose, compromising one of the critical transmission channels of monetary policy. The situation required the intervention of the ECB, which occurred with both conventional and non-standard tools. For the sake of this dissertation, unconventional measures are the ones of greater interest. To begin, in October 2008 three important measures were launched. First, the fixed-rate full allotments were introduced to allow banks unbounded access to funds at the main refinancing rate. Second, new long-term refinancing operations (LTRO) were launched. Third, the list of collateral accepted by the ECB was extended, to allow banks

easier access to the funds. In the aftermath of the crisis, the ECB also provided liquidity in foreign currency (mainly US dollars) to support banks with liabilities in currencies different than the Euro. The most interesting measure of these early ECB packages is surely the Covered Bond Purchase Programme (CBPP), implemented between 2009 and 2010 since it was the first time the ECB planned to acquire financial instruments (covered bonds) in the market with an unconventional measure. These tools, with tailored modifications, have been implemented to face crisis periods also in the next years.

After 2009-2010, Europe needed time to recover from the economic consequences of the worst crisis of the previous decade. However, in the meanwhile, rumors about a possible Greek default spread over the world. In May 2010, the lack of demand for European government bonds (mainly for risky countries such as Ireland, Portugal, Spain, and Italy), drove yields to unsustainable levels. For the second time in a few years, the ECB had to face a new and different crisis, where new tools were needed to calm financial markets. In this context, the Securities Markets Programme (SMP) was introduced (May 2010[1]). This measure, formally, aimed at solving a malfunction in the transmission mechanism of the monetary policy. With the SMP, the ECB opened to the acquisition of both private and public securities for the first time. To meet the Treaty provisions, such purchases would occur only on secondary markets, to avoid direct lending to governments. Moreover, sterilization procedures to absorb liquidity linked to such purchases were introduced to avoid potential impacts on inflation.

Effectively, the SMP (supported by the newborn European Financial Stability Mechanism), contributed to the stabilization of financial markets as supported by the decline of government bond yields. On the other hand, despite the efforts, the crisis spread to Spain and Italy after a few months, triggering the doom loop between sovereigns and banks. To face the situation, previous non-standard measures were strengthened and new tools developed. For

[1]Source: `https://www.bundesbank.de/en/tasks/monetary-policy/outright-transactions/terminated-programmes-625984`

this reason, in September 2012, the ECB introduced a new scheme to intervene in secondary government bond markets to solve their distortions: the OMT. The main peculiarities of this instrument were the strong conditionality imposed on the countries that benefitted from the program and the unbounded size of potential purchases. The signal was straightforward: the ECB was ready to face investors who were betting on the default of the weaker European countries. Despite a substantial impact on the government bond yields and on spreads [4], the levels remained unsustainable. At the same time, the Euro Area was experiencing inflation well below the official target of the ECB, set at 2% (below, but close 2%). To meet its mandate and push inflation up in the summer of 2014 the ECB introduced negative interest rates. In the context of the sovereign debt crisis, however, negative interest rates were not enough to raise inflation. Consequently, starting from the end of 2014, new programs were announced. Between October and November 2014, the Covered Bond Purchase Programme 3 (CBPP3) and the Asset-Backed Securities Purchase Program (ABSPP) were implemented. It is important to remark that despite relevant, the size of these programs was contained. The key measure launched by the ECB at the beginning of 2015 was without any doubt the Public Sector Purchase Program (PSPP), which allowed the ECB to purchase government bonds from the secondary market (similarly to the SMP). Since the formal goal was to support inflation, the liquidity was not sterilized (differently from the SMP). The size of this measure is stunning, with cumulative purchases of more than 2.7 trillion euros as of May 2023. This package of measures, along with the Corporate Sector Purchase Program launched in 2016, is commonly known as the Asset Purchase Program (APP), or, less technically, Quantitative Easing.

This summary on key unconventional monetary policies is inspired by Philippine Cour-Thimann and Bernhard Winkler (2013) [9] and Annalisa Ferrando et Al (2021) [15].

2.2 The PSPP program

The PSPP was announced on 22 January 2015 by the ECB Governing Council as a further expansion of the already existing APP[2]. Despite the intervention of the ECB in the secondary government market was not a novelty (the SMP and OMT already opened to such purchases), it surely was the governance of the program, which resulted from a political compromise. Frugal countries, indeed, opposed to the PSPP, worried about the potential losses the operation would imply for the ECB in case of default of an issuer. Moreover, this program was seen as a threat to the fiscal responsibility of Euro Area members. At the same time, the Euro Area level of inflation was well below the target and many countries were experiencing high government yields despite other ECB measures. In conclusion, the common ground (i.e. political compromise) between ECB and frugal countries was found in purchasing securities via National Central Banks (NCB) and distributing them in accordance with the ECB's capital key. The fact that the NCBs are the entities entitled to effectively implement purchases is fundamental, as hypothetical losses arising from government bonds would be suffered by the NCB rather than the ECB[3].

From a legal perspective, despite the governance and distribution of purchases, the legitimacy of the PSPP program was disputed in court. The German Court, indeed, claimed a violation of Article 123 TFUE (Monetary financing of Member States) which ended with a sentence of the European Court of Justice confirming the legitimacy of the program[4].

The PSPP net purchases stopped at the end of December 2018. However, purchases have

[2]To know more, see https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html

[3]To have a better understanding about the destination of profits and losses generated by the NCB, read https://osservatoriocpi.unicatt.it/cpi-archivio-studi-e-analisi-le-banche-centrali-possono-andare-in-perdita-cosa-ne-conseguirebbe (Italian webpage)

[4]To know more, read https://www.simmons-simmons.com/en/publications/cka2ag8omnik30a79d3mvwm85/german-constitutional-court-rules-ecb-exceeded-competences

been carried out also in the first ten months of 2019, for the purpose of reinvesting the principal reimbursed on maturing securities. Despite the initial stop, in November 2019, the ECB resumed buying government bonds as long as necessary to strengthen the accommodative effect of key rates.

Moreover, after the spread of the pandemic crisis in 2020, the ECB boosted the purchases under the APP with temporary additional purchases of 120 billion euros until the end of 2020. In addition, along with the other APP tools, a new package called Pandemic Emergence Purchase Programme (PEPP) was launched. The size of this new measure, as of July 2023, is 1850 billion euros. The net purchases and the reinvestments of the principals reimbursed were expected to end in March 2022 and December 2023, respectively. In March 2022, however, according to the new economic and inflation perspectives, as well as due to the Ukraine war uncertainty, the Council decided to boost the APP purchases. A few months later, in June 2022, due to the increase in inflation, the Council decided to stop the APP net purchases[5]. In conclusion, from March 2023 the ECB started to reduce the securities held for monetary policy[6].

2.3 Literature review

The transmission channels of the APP to sovereign bond yields have been widely studied by the literature and comprehend the signalling channel, a portfolio rebalancing channel, a duration premium channel, a credit premium channel, and a liquidity premium channel (Farinha and Vidrago, 2021 [13]). The signalling channel affects the expectations and, more broadly, the decision-making process of the market participants. The portfolio rebalanc-

[5]The purchases effectively stopped in July 2022.

[6]You can find more information in the Banca d'Italia website: `https://www.bancaditalia.it/compiti/polmon-garanzie/pspp/index.html?dotcache=refresh`

ing channel relies on the existence of preferred habitat investors, which are agents with a strong preference for certain categories of bonds, usually with long maturities (Boermansa and Vermeulen, 2018 [7]). The duration premium channel, instead, refers to the additional compensation an investor requires to hold fixed-income securities with a longer duration. Since duration is a measure of the sensitivity of bond prices to interest rates, this premium is likely to be greater in periods of uncertainty about future monetary policy interventions. Finally, the credit premium and liquidity premiums reductions emphasize the role of quantitative easing in shaping risk perception and increasing liquidity in the market.

According to Altavilla et al. (2015) [3], it is then crucial to discriminate between the announcement effect (also called stock effect) and the implementation of the program (flow effect). The authors found that government bond yields were mostly impacted by the former rather than the latter effect. Moreover, the repercussions on the yields strongly depend on the maturity and their initial level. Government bonds with a maturity of 10 years issued by high-yield countries were the most impacted by the announcement effects of the APP. Specifically, the Altavilla et al. research shows that a statistically significant decrease in the bond yield occurred for peripheral countries only (Italy and Spain).

If the focus is on government bond spreads, since the reference maturity is 10 years and Italy is a high-yield country with respect to Germany, a decrease in the spread level due to announcement effects is expected.

The approach widely adopted by the literature to understand stock effects is the event study methodology. However, as shown by Ansgar Belke and Daniel Gros (2021) [6], such method is applied despite a lack of theoretical basis. In particular, these authors tested the Efficient Market Hypothesis, which according to their findings is rejected. Moreover, as confirmed by the data, spreads even arose (or, at least, remained stable) after the implementation of the QE. The two opposite directions of the stock and flow effects are justified using an argument linked to expectations. Belke and Gros (2021), indeed, suggest the announcement of the

program in the euro area to have lowered sovereign yields because it was expected that, as in the US, this would have led to substantially lower risk-free rates. Later, the implementation clarified the governance of the purchases and disregarded the expectations, increasing the government bond spreads.

It is important to stress that sovereign bond yields as well as spreads are affected by many factors, which are often difficult to disentangle. For instance, the "preferred habitat" literature tries to justify the increase in spread according to the specific preferences of certain classes of investors. As suggested by Woodford (2012) [22] there are categories of investors that hold securities for non-pecuniary reasons. Banks and insurance companies, for instance, could be seen as preferred habitat investors since pushed by the regulation (liquidity and capital requirements) to purchase government securities. On the other hand, it would be difficult to defend this argument in the European Union, as any government bond is equal from a regulatory perspective (Belke and Gros, 2021). Despite being unlikely a preferred habitat linked to a regulatory argument, it is possible to exploit the safe asset channel argument (Jan Willem van den End, 2019 [20]). The author, following an extension of the traditional preferred habitat literature[7] explains the reason behind an increase in spread after the implementation of the QE by distinguishing between demand for safe assets and risky assets. To summarize, Jan Willem van den End highlights that since the ECB purchases were addressed to safe (such as German Bund) and risky assets (as Italian BTP), this could lead to a scarcity of safe assets in the European markets. The combination of this dynamic with the need of certain investors to hold marketable safe assets could result in an increase in government bond spreads due to both scarcity and a safety premium. This mechanism should be stronger in periods of high financial distress. However, the APP was announced and implemented in a period when financial markets were quiet, which could

[7]Traditional preferred habitat literature suggests the preference of investors to be related to the duration of bonds. The extension of such literature allows taking into account not only the duration but also their safety.

justify the reason why the impact on sovereign yields and spread though significant, was lower than expected by investors [8]. The novelty of the Jan Willem van den End research is the application of the safe assets preference argument to the European Quantitative Easing, despite already being developed for other programs and securities. [9]

To summarize, according to these conclusions, we would expect the German sovereign yield to have decreased more than the one of risky countries (such as Italy). This interpretation could explain why government spreads did not decrease after the implementation of the QE. Despite these arguments, it is worth noticing that this approach does not consider other factors that may have positively affected spreads.

For instance, another major driver of government bond spread is the fiscal performance of a country and its fiscal events. According to Afonso et al. (2020) [2], spreads over the period between January 1999 and July 2016 were influenced by the European Commission's (EC) releases of the excessive deficit procedures, higher debt forecast and related to better budget balance forecasts. Concerns related to the macro and fiscal fundamentals strongly arose after the 2007 financial crisis. After the Great Recession, indeed, "movements of macro and fiscal fundamentals explain spread movements well and in a way consistent with theoretical expectations" (Afonso et al.,2012 [1]). To include a general proxy for a country's fiscal fundamentals, many researchers rely on the Credit Agencies' Ratings[10] (Standard & Poor's, Fitch Ratings, Moody's). However, the subprime crisis showed the limits of the agencies' ratings. In addition, despite the usage of objective factors related to a country, CRAs rely on subjective factors that are not publicly disclosed (De Moor et al., 2018 [10]). Moreover, ratings are slow to incorporate new information available. To overcome this limit it is pos-

[8]The reference for the investors was the Federal Reserve quantitative easing, which started in a period of high financial distress.

[9]See Krishnamurthy and Vissing-Jorgensen (2011) [17], Krishnamurthy and Vissing-Jorgensen (2012) [18], D'Amico et al. (2018) [12] for the US; Ferdinandusse et al. (2017) [14], Corradin and Maddaloni (2017) [8], Schlepper et al. (2017) [19] for the Europe.

[10]In theory, this proxy is reasonable because it is a forward-looking measure.

sible to rely on Credit Default Swap (CDS). As shown by Dopierała et al. (2020) [11] in a study related to Emerging Europe, CDS markets seem to anticipate government downgrades by CRAs (the relation with upgrades is less clear) by three months. Van de Ven et al. (2018) even introduced a new way to assign sovereign credit ratings based on CDS spreads.

To summarize, the literature shows that it is preferable to use CDS premia rather than the agency's ratings. Therefore, in this dissertation, CDS spreads will be used to proxy the insolvency risk of a country. Since the insolvency of a country is strongly related to its fiscal soundness, this proxy also incorporates the fiscal fundamentals of a country. On the other hand, it is worth noticing that since CDS are financial instruments, their pricing strongly depends on market dynamics with all the relative implications[11].

[11]For instance, the increase in CDS spread could depend on the market position of certain investors, which may be independent of the fiscal fundamentals of the country.

Chapter 3

Methodology and Data

3.1 Data

This research aims at studying the impact of the implementation of the PSPP program (the bulk of the European Quantitative Easing) on the change in the yield spread between the Italian and German 10 years government bonds.

The period between January 2010 and December 2018[1] is considered. Specifically, the analysis aims at comparing the period before (January 2010 - December 2014[2]) and after the announcement and implementation of the PSPP program (January 2015 - December 2018).

[1]December 2018 coincides with the first net purchases stop, which resumed in November 2019.

[2]This period includes the European sovereign debt crisis.

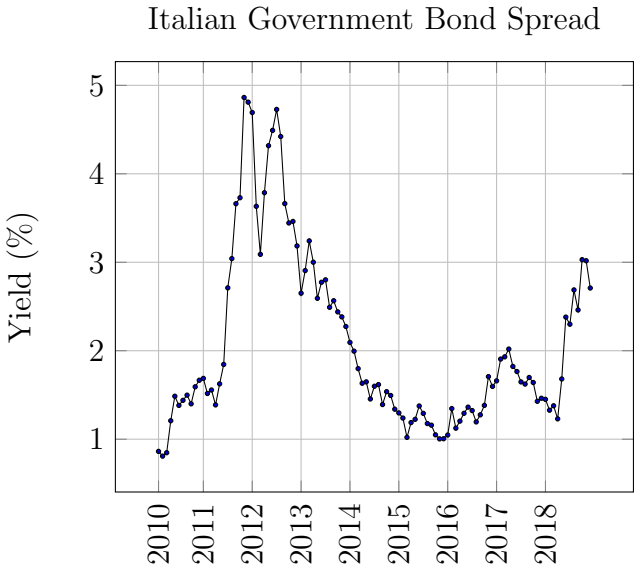

Figure 3.1: 10-year Italian government bond spread between January and December 2018. The spread is computed as the differential between Italian and German government bond yields with a maturity of 10 years. Average monthly data are employed.
Source: calculations on the Investing.com data.

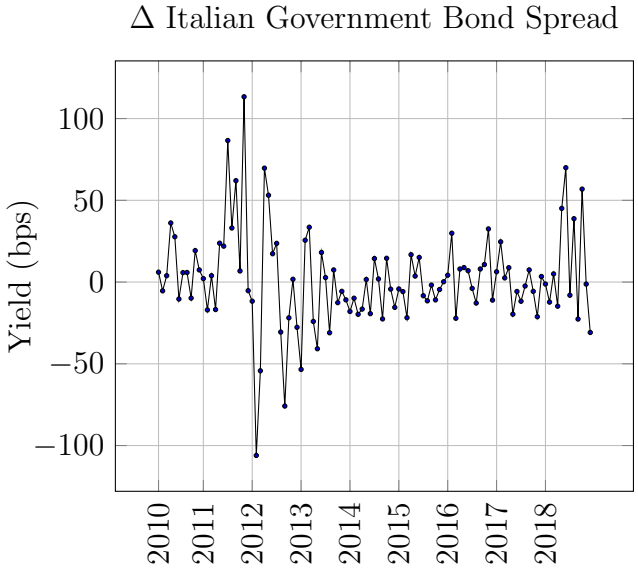

Figure 3.2: First difference of the 10-year Italian government bond spread between January 2010 and December 2018. The spread is computed as the differential between Italian and German government bond yields with a maturity of 10 years. Average monthly data are employed.
Source: calculations on the Investing.com data.

Differently from previous literature in this field, the implementation is proxied considering the country-specific purchases carried out by the ECB. Past research proxied the implementation of the APP measures as the change (or, alternatively, growth rate) of the ECB's balance sheet period after period. The limit of this latter approach is that no distinctions among issuers are considered. Such discrimination is particularly important in analyzing government bond spreads since its fluctuations depend on two different securities, with specific demand and supply dynamics. In addition, the change in the ECB assets could be related to policies external to the pure measure under analysis, affecting (at least partially) the results.
Equation 3.1 punctually shows how the PSPP implementation is proxied.

$$PSPP_t = \log(GER_t - ITA_t) \tag{3.1}$$

where $PSPP_t$ is the proxy of the PSPP program, GER_t are the European Central Bank's monthly purchases of German government bonds and ITA_t are the monthly purchases of Italian government bonds.

For completeness, in Appendix B two additional proxies are provided:

- ECB's assets growth rate;

- Securities held for monetary policy growth rate.

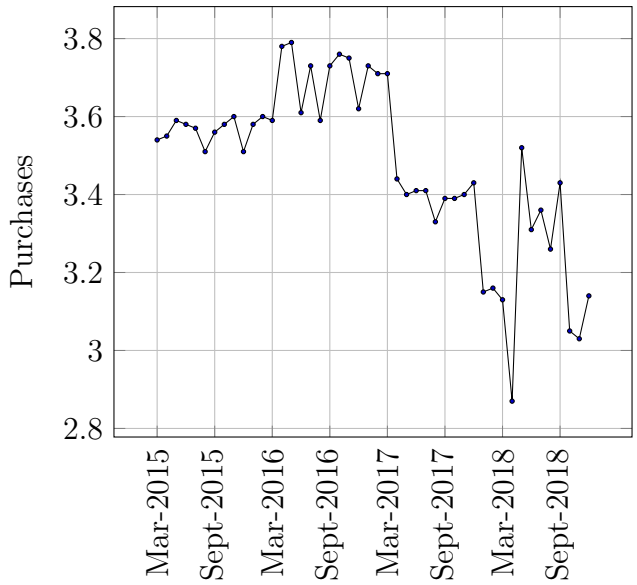

Figure 3.3: Difference between ECB monthly purchases of German and Italian Government Bonds between March 2015 and December 2018. Monthly data at the end of the month. Log transformation of the purchase data is employed after differencing.
Source: `https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html`

Along with the variable of interest, other controls, both country-specific and general, are included to address other risks and factors that may affect spreads.

To proxy the default risk, the spread between the Italian and German CDS premia is considered. CDS premia could be seen as the price investors are willing to pay to get insured against the default of an entity. For this reason, the greater the CDS spread, the greater the default risk of Italy with respect to Germany. This proxy is used rather than credit ratings since as shown in the literature, the former tends to anticipate the latter. Secondly, CDS data are available with higher frequencies than CRA's credit ratings. In addition, we would expect investors to be concerned about the fiscal performance of a country and therefore transfer emerging and future risks on CDS premia. Changes rather than levels are employed due to the non-stationarity nature of CDS spreads. The economic intuition suggests

a positive relationship of this control variable with changes in Italian sovereign bond spread. Equations 3.2 and 3.3 show how this regressor is computed.

$$ExcessCDS_t = CDSItaly_t - CDSGermany_t \tag{3.2}$$

where $CDSItaly$ is the Italian CDS premium and $CDSGermany$ is the German CDS premium.

Then, the value change in subsequent months is computed, to make the time series stationary:

$$CDS_t = ExcessCDS_t - ExcessCDS_{t-1} \tag{3.3}$$

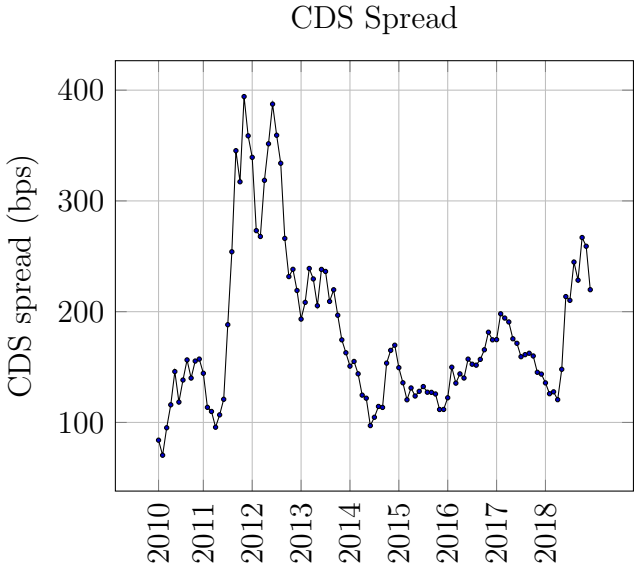

Figure 3.4: Difference between Italian and German CDS premia between January 2010 and December 2018. Average monthly data are employed.
Source: Investing.com

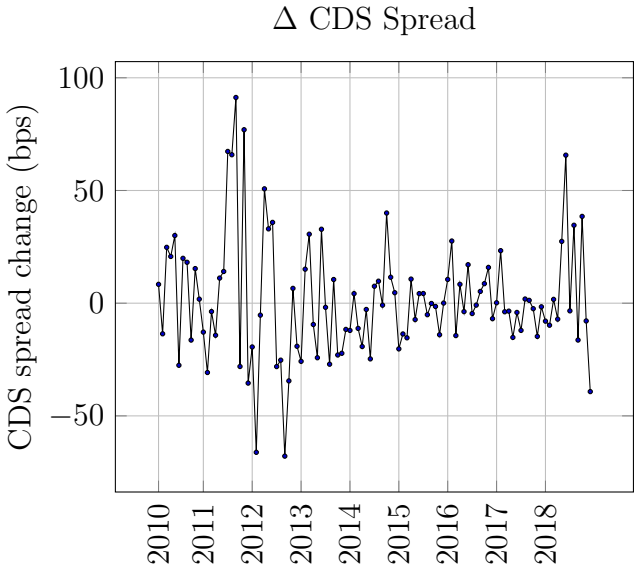

Figure 3.5: Change in the difference between Italian and German CDS premia (i.e. CDS Spread) between March January 2010 and December 2018. Average monthly data are employed.
Source: Investing.com

Economic theory suggests stock prices to be a forward-looking measure since they rely on market expectations about future events. For this reason, following the Kinateder and Wagner (2018)[16] rationale, local equity returns could be interpreted as a proxy of the business environment. Intuitively, if companies in a given country are performing well, we may expect tax revenues to increase as well as a lower unemployment rate in the future.
To proxy the local equity returns the most important financial indexes have been considered for both Italy and Germany. More specifically, FTSE MIB for the former and DAX 30 for the latter. Since the focus of the research are government bond spreads, the difference between the two indexes is considered. Equation 3.4 shows how the business environment factor is computed.

$$LER_t = LER\,ITA_t - LER\,GER_t \tag{3.4}$$

where $LERITA$ are the average monthly FTSE MIB returns and $LERGER$ are the average

monthly DAX 30 returns.

The impact we expect from this regressor is straightforward. If in a given month we detect a positive LER, it means that Italian businesses performed better than German ones improving both Italian employment and tax revenues expectations with respect to Germany. In conclusion, a negative relationship between this control variable and the spread is expected.

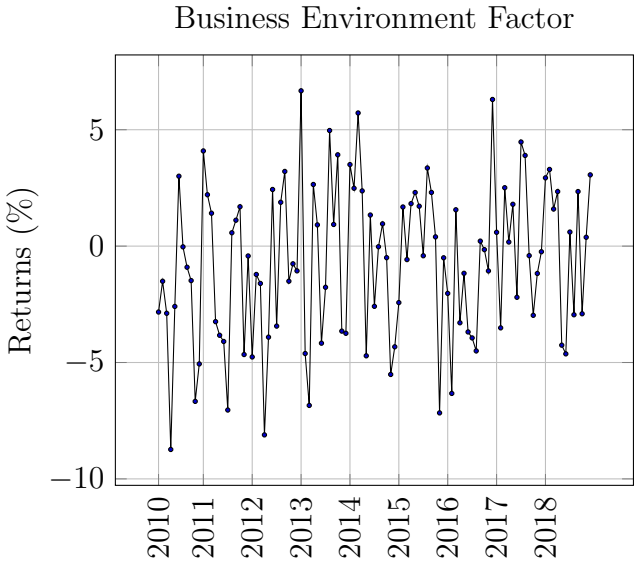

Figure 3.6: Differential local equity returns (FTSE MIB returns - DAX 30 returns) between January 2010 and December 2018. Average monthly data are employed.
Source: Investing.com

Government bond spreads are not only affected by economic variables but also by political events. This is particularly important over the period considered (January 2010 - December 2018), due to the severe impact the sovereign debt crisis had on highly indebted country as Italy. To address the political uncertainty, two proxies are included in the model to distinguish between Italian and German events. It is important to notice that only political elections, government designations, and the period in between are included. Other second-tier events are excluded. The proxy is obtained through a dummy variable[3].

[3]Political events are defined by specific dates. Since this research is based on monthly data, a value equal

Table 3.1 and Table 3.2 illustrate the events included in the two factors for Italy and Germany respectively.

Month	Event
November 2011	Resignation of Berlusconi IV Administration and designation of Monti Administration
February 2013	Political elections
April 2013	Designation of Letta Administration
February 2014	Resignation of Letta Administration and designation of Renzi Administration
December 2016	Resignation of Renzi Administration and designation of Gentiloni Administration
March 2018	Political elections
June 2018	Designation of Conte I Administration

Table 3.1: Italian political events between January 2010 and December 2018. Only political elections or changes in the Administration are considered.

Month	Event
September 2013	Federal elections
December 2013	Designation of Merkel III Administration
September 2017	Federal elections
March 2018	Designation of Merkel IV Administration

Table 3.2: German political events between January 2010 and December 2018. Only political elections or changes in the Administration are considered.

In addition to country-specific factors, also common factors between Italy and Germany are included in the model.

Since over the period considered many programs and policies were announced by the ECB,

to 1 is assigned to the month which includes the political event.

an announcement effect factor is included. Given that the focus of this research is not the announcement effect of the PSPP but rather its implementation, the announcement of the PSPP is not isolated from the other programs announced. Moreover, ordinary decisions such as changes in interest rates are excluded, except for the announcement of the negative rate on the deposit facility in June 2014. The announcement effect factor is proxied through a dummy variable[4]. Table 3.3 shows the most important monetary policy announcements included in the model.

Month	**Announcement**
May 2010	Launch of the SMP
December 2011	Launch of longer LTRO
February 2012	Launch of longer LTRO
September 2012	Launch of the OMT program
June 2014	Introduction of negative deposit facility rate and TLTRO I
January 2015	Launch of the PSPP
March 2016	Launch of TLTRO II and CSPP
December 2016	Extension of the PSPP maturity but reduction in the monthly purchases
October 2017	Extension of the PSPP maturity but reduction in the monthly purchases
June 2018	End of PSPP net purchases in December 2018

Table 3.3: ECB monetary policy announcements included in the models from January 2010 and December 2018.

[4]The same rationale of the political events is applied. Therefore, a value equal to 1 is assigned to the month in which a new policy or relevant change to an existing program is announced.

Another risk that could impact the government bond spread changes is the general level of risk in the market. In general, literature often proxied it with the VIX, which represents the market's expectations for volatility over the coming 30 days[5]. Since the focus of this research is on European countries, the VDAX is employed[6]. The impact that general risk changes may have on the government bond spread is not straightforward, as it depends on the way investors reflect this risk in government bond pricing. Despite this, it is reasonable to expect that the greater the level of international risk, the higher the spread as capital shall fly to safe assets (i.e. the German Bund). In this research, the average monthly VDAX growth rate ($\Delta VDAX$) is employed.

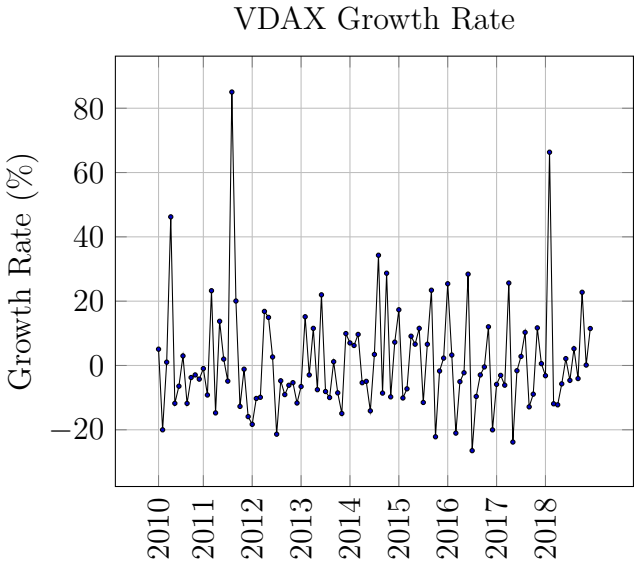

Figure 3.7: VDAX growth rate ($\Delta VDAX$) between January 2010 and December 2018. Average monthly data are employed.
Source: Investing.com

The summary of the variables employed in the model is summarized in Table 3.4 along with the expected relationship with the spread change.

[5]The VIX is a measure of implied volatility derived from options on the S&P 500.
[6]The VDAX relies on the same idea of the VIX but applied to the DAX options rather than S&P ones.

Variable	Expected relationship
$PSPP$	Negative
ΔCDS	Positive
LER	Negative
$POLIT$	Not defined
$POLGER$	Not defined
ANN	Negative
$\Delta VDAX$	Positive

Table 3.4: Expected relationship between the Italian government bond spread change and the variables included in the model. It is expected a negative relationship with ANN since the ECB announced mainly accommodative monetary policies over the period considered, which are likely to lower spreads.

3.2 Methodology

To assess the impact of the PSPP implementation on the Italian government bond spread change, two different regression models are fitted. The first model (A) does not include the PSPP program proxy and is fitted on the period between January 2010 and December 2014 (59 observations). This period of time is chosen to comprehend the European sovereign debt crisis. The second model (B) includes the proxy for the PSPP program and is fitted on the period between January 2015 (announcement of the PSPP) and December 2018 (48 observations), when net purchases stopped for the first time.

The methodology presented allows to understand if the PSPP impacted the changes in spread, in which direction, and if the spread drivers changed with respect to the sovereign debt crisis years.

Equations 3.5 provide the model specification for the period between January 2010 and December 2014. Equation 3.6 provides the model specification for the period between January

2015 and December 2018, by including also the PSPP proxy.

Model (A) between January 2010 and December 2014

$$\Delta SPR_t = \Delta CDS_t + LER_t + POL\,IT_t + POL\,GER_t + ANN_t + \Delta VDAX_t + \epsilon_t \quad (3.5)$$

Model (B) between January 2015 and December 2018

$$\Delta SPR_t = PSPP_t + \Delta CDS_t + LER_t + POLIT_t + POLGER_t + ANN_t + \Delta VDAX_t + \epsilon_t \quad (3.6)$$

where:

- ΔSPR is the Italian government bond spread with Germany
- $PSPP_t$ is the proxy of the PSPP implementation according to Equation 3.1
- ΔCDS is the proxy of the default risk computed as the first difference of Equation 3.3
- LER is the business environment factor according to Equation 3.4
- $POL\,IT$ is the political uncertainty factor for Italy
- $POL\,GER$ is the political uncertainty factor for Germany
- ANN is the announcement effect factor for monetary policy events
- $\Delta VDAX$ is the VDAX growth rate

Chapter 4

Empirical evidence: the PSPP implementation lowered Italian government bond spreads with Germany

The results of the two models are summarized in Table 4.1 and Table 4.2.

The two models show a framework that despite being common in their fundamentals, has several differences. First, what emerges is that Italian government bond spread changes are mainly driven by the change in CDS spread. In addition, the attention of investors to such spread movements even increased after the European sovereign debt crisis. This result seems reasonable since that period of distress showed how fragile indebted countries are and that even European countries are exposed to default risk. On the other hand, the same crisis showed the power of the ECB, which was able to intervene by interpreting rules that initially were seen as an insurmountable obstacle to any strict intervention. In conclusion, despite the reassurance of the ECB actions, investors increased their sensitivities to the default risk,

at least in the Italian case.

The most interesting finding is that the PSPP implementation did lower spreads. This is not obvious since monthly purchases of German securities were constantly higher with respect to the Italian ones. Therefore, excluding any other effect, spreads should have even risen according to this argument only. What the results suggest, instead, is a reassurance of the ECB over the long term, with an immediate impact on government bond spreads. This effect may be due to the maturities of the securities purchased, which are mainly long-term government bonds[1]. If during the period before the European sovereign debt crisis investors were concerned about the long-term perspectives of a country (which are proxied with the Business environment factor, LER), after the PSPP, their attention lowered. Explaining the reasons behind this shift in perspective is not trivial. For instance, investors may have considered the PSPP as the measure that thoroughly exhausted the ECB's capacity to face a potential new crisis in the short term, also from a political perspective. It is indeed important to remark that not all European countries supported the PSPP, as shown by the submission of questions to the ECJ concerning the validity of the program[2]. Therefore, it would be difficult to argue that additional extensive measures would be tolerated by "frugal countries". Along with this concern, is relevant to highlight that no evidence concerning inflation responses to the other previous accommodative monetary policy measures was available. The monetary policy transmission mechanism, indeed, often requires months to shift from the financial sector to the real economy. For instance, from June 2014 both negative deposit facility rates[3] and new tools such as the TLTRO[4] were introduced to impact inflation. In case

[1]The weighted average maturity for Italian and German government bonds purchased from the start of the PSPP were respectively 7.1 and 6.6 years at the end of 2021.
To know more, see https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html#pspp

[2]Only in December 2018 doubts concerning the legitimacy of the PSPP were cleared.

[3]To know more, see `https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/why-negative-interest-rate.en.html`

[4]To know more, see `https://www.ecb.europa.eu/mopo/implement/omo/tltro/html/index.en.html`

of a rise in inflation over the 2% threshold, this would have inhibited the ECB from any accommodative action in case of a crisis in the short term without violating its mandate. This long-term "reassurance effect", in conclusion, could be related to the general idea that the ECB would intervene in the long term in case of default (after restoring its capacity, which was likely to be perceived as exhausted or in doubt in the short term), as demonstrated by its wider interpretation of the mandate as shown by the PSPP program and the previous ambitious programs[5].

Variable	**Estimate**	**P-value**
Intercept	-0.032	0.249
ΔCDS	0.925***	<0.01
LER	-1.777*	0.023
$POL\,IT$	0.065	0.449
$POL\,GER$	0.067	0.483
ANN	-0.009	0.921
$VDAX$	-0.225	0.184
$R^2 = 76.54\%$		
$Adjusted\,R^2 = 73.83\%$		
$F - statistic = 28.27$		

Table 4.1: Estimates of the model fitted on the period between January 2010 and December 2014. Monthly data. To see the model specification, refer to Equation 3.5.

[5]The new approach adopted by the ECB could be resumed in the famous "Whatever it takes" sentence of the former ECB President Mario Draghi pronounced in July 2012. It is important to notice that this approach is compliant with the mandate if and only if the inflation level is below 2%.

Variable	Estimate	P-value
Intercept	0.137*	0.029
$PSPP$	-0.036*	0.046
ΔCDS	1.088***	<0.01
LER	-0.214	0.661
$POL\,IT$	0.014	0.756
$POL\,GER$	-0.003	0.923
ANN	-0.033	0.438
$VDAX$	0.074	0.357
$R^2 = 87.15\%$		
$Adjusted\,R^2 = 84.90\%$		
$F - statistic = 38.74$		

Table 4.2: Estimates of the model fitted on the period between January 2015 and December 2018. Monthly data. To see the model specification, refer to Equation 3.6.

The political factor does not significantly affect the spread changes either for Italian or German events. In the Italian case, however, the impact in both periods is positive, suggesting that the Italian political instability is priced by investors. In the German case, instead, the effects of political events depend on the period considered. During the sovereign debt crisis, indeed, German political events led to an increase in spread. This is reasonable since the German elections of 2013[6] led to the designation of the new government in a few months, without keeping Germany in a long period of political uncertainty. On the contrary, the German elections of 2017[7] showed a politically fragmented Germany. It took, indeed, sev-

[6]The federal elections of 2013 are the most important German political event of the European sovereign debt crisis period.

[7]The federal elections of 2017 are the most important German political event of the period after the introduction of the PSPP.

eral months to find a political agreement between parties. The political uncertainty that followed the German elections of 2017 explains why there is a negative relationship with the Italian spread after January 2015. The announcement of the relevant monetary policies had a downward effect on the Italian government bond spread change, despite not being statistically significant. This effect is not surprising since during the period between January 2010 and December 2018, many relevant accommodative monetary policies were announced.

For both the political factor and the announcement factor, the lack of statistically significant effects could be explained by the limited number of events taken into account by the two dummy variables. Finally, also the impact of the VDAX is not statistically significant and depends on the period considered. Since the VDAX has a significant correlation with the CDS change in the period preceding the introduction of the PSPP program (more than 50%), it is probable that the estimate of the coefficient is affected[8].

4.1 Break test, residuals and model diagnostics

To assess the consistency of the models, the Bai-Perron test for structural breaks [5] is performed on both Model A and B.

During the period antecedent to the PSPP (Model A), one major break is detected in December 2011. In this month, the Sixpack package[9] entered into force. In particular, the stricter rules in terms of debt and conservative fiscal policies could have affected Italy, which is a high-debt country, with struggles in reducing deficits and achieving consistent GDP growth rates.

During the period after the introduction of the PSPP (Model B), instead, a break is detected

[8] An additional problem that prevents the usage of instrumental variables is the definition of causality. It is not clear, indeed, if the change in the CDS spread caused an increase in European uncertainty or vice versa.

[9] The Sixpack is a set of legislative measures that reformed the Stability and Growth Pact (SGP) in response to the financial crisis of 2009. It increased the monitoring of macroeconomic trends and instabilities, strengthening controls and rules to promote more responsible fiscal policies within the EU member states.

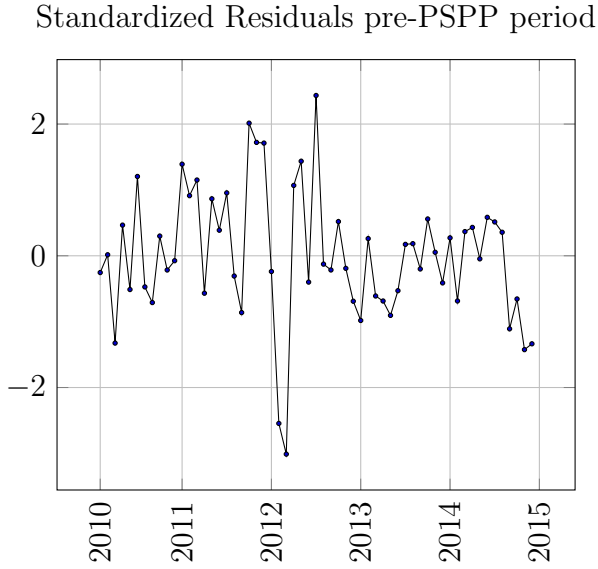

Figure 4.1: Standardized residuals of the model fitted according to Equation 3.5 over the period between January 2010 and December 2014.

in November 2015. In this case, to the best of my knowledge, it is unclear which event could have caused the break. Despite the existence of breaks the two periods are not divided into subsamples for two reasons. First, the analysis aims at analyzing the average effects over the period after the European sovereign debt crisis but before the introduction of the PSPP. Second, the number of observations would not be satisfactory if four subsamples were considered.

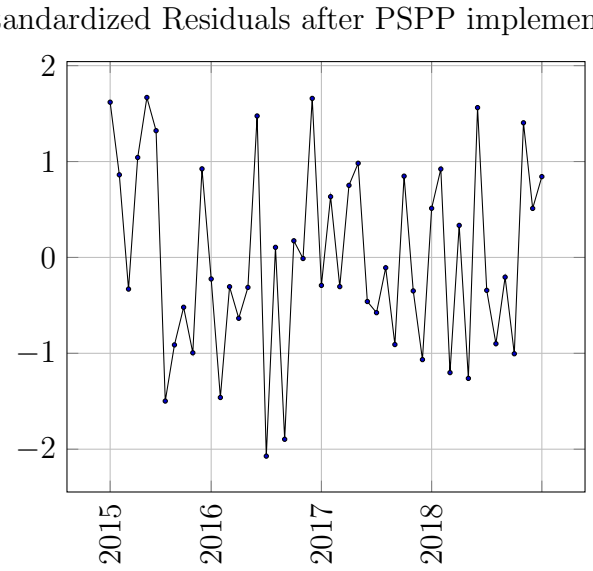

Figure 4.2: Standardized residuals of the model fitted according to Equation 3.6 over the period between January 2015 and December 2018.

	Model pre-PSPP (A)	Model after PSPP implementation (B)
Box-Pierce test	0.582	0.859
Ljung-Box test	0.428	0.684
Breusch-Pagan test	0.404	0.127
Jarque-Bera test	0.278	0.450

Table 4.3: Formal tests on the residuals of Model A (pre-PSPP) and B (after PSPP implementation). The table shows the p-value of the tests.
H0 Box-Pierce and Ljung-Box tests: residuals are not autocorrelated up to lag 15
H0 Breusch Pagan test: the model is not affected by heteroskedasticity
H0 Jarque-Bera test: data are normally distributed.

As shown in Table 4.3, widely used tests are performed to check the validity of the model and the eventual need for robust standard errors. According to the results, both models A and B are not affected by either autocorrelation or heteroskedasticity. Moreover, the residuals are normally distributed, enhancing the accuracy of the statistical tests.

In conclusion, both model A and model B are economically and statistically sound.

Chapter 5

Conclusions

Previous literature on government bond spreads highlighted that the bulk of the Public Sector Purchase Program's (PSPP) impact on sovereign yields was related to announcement effects (stock effects) rather than effective purchases (flow effects). However, by focusing on a specific country (Italy), this research shows that, using an appropriate country-specific proxy for the PSPP implementation, significant impacts of flow effects on government bond spreads are detected.

The framework adopted to get these results is based on two regression models, fitted on the period preceding the PSPP and after such program. The main controls used are both country-specific (default risk, business environment, political uncertainty) and common factors (announcement of monetary policy measures, European risk uncertainty) between Germany and Italy.

The main finding of the dissertation is that the PSPP implementation shifted the investors' concerns from the long-term to the short-term due to a "reassurance effect". The reassurance effect of the ECB over the long term witnesses the widespread idea among investors that in case of Italian future financial tensions, the ECB would intervene to support the weaker European economies. On the other hand, the focus on the short-term default risk intensified,

which is probably attributable to doubts about additional expansive monetary measures in the short term. That is, in case of a further crisis in the short term, investors believed the capacity of the ECB to be compromised due to both potential violations of its mandate[1] or political constraints[2].

To improve this analysis, it would be appropriate to extend the framework used to other European countries. This would be fundamental to confirm the results obtained in this dissertation for the Italian case. In addition, the business environment factor (which proxies the long-term perspectives of the country) could be further improved. If on one hand, indeed, considering the most important financial index of a country as representative of its economy is reasonable, on the other, this is a good assumption if and only if the economy is well represented by that index. In the Italian case, for instance, the FTSE MIB over-represents the banking and energy sectors with respect to the overall Italian economy[3]. Therefore, different and more precise proxies for the business environment factor may be found to test the robustness of the analysis carried out in this dissertation.

[1]Due to the extensive monetary put in place in the previous months, it was reasonable a rise in inflation, which could have prevented the ECB from launching further measures according to its mandate.

[2]European "frugal countries" opposed to the Public Sector Purchase Program, also in court. Therefore, it is reasonable to assume that further expansive measures would not be tolerated.

[3]The Italian economy is mostly composed of small and medium enterprises, whose stocks are not publicly traded.

Appendix A

Descriptive statistics on the data

	BTP(%)	Bund (%)	Spread (%)	Δ Spread (bps)
Mean	3.31	1.25	2.07	1.78
Standard Deviation	1.51	0.96	1.01	29.37
Minimum	1.12	-0.09	0.81	-106.04
Q1	1.98	0.40	1.36	-12.60
Median	3.05	1.19	1.65	0.18
Q3	4.51	1.86	2.69	14.38
Maximum	6.82	3.36	4.86	113.33
IQR	2.51	1.46	1.30	24.97
Skewness	0.37	0.59	1.16	0.39
Kurtosis	-1.01	-0.78	0.47	3.19

Table A.1: Key descriptive statistics of the Italian (BTP) and German (Bund) government bonds with maturity 10 years, Spread and Spread change between January 2010 and December 2018.

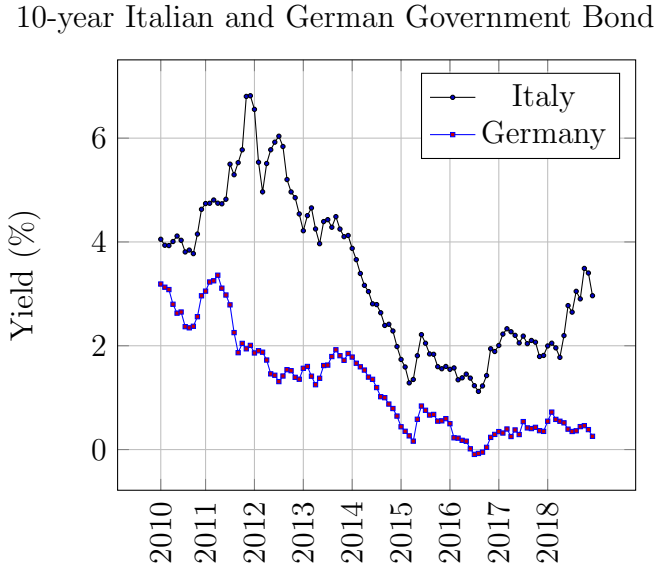

Figure A.1: Comparison between Italian and German 10-year government bond yields between January 2010 and December 2018. Average monthly data.
Source: Investing.com

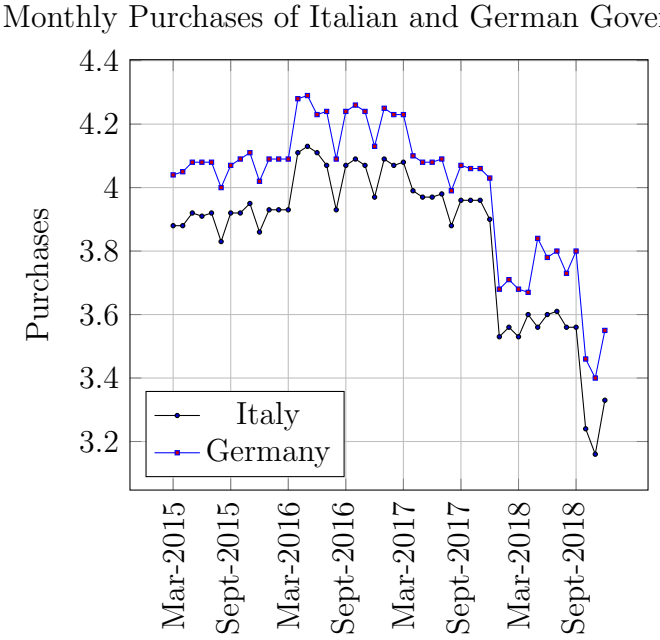

Figure A.2: ECB monthly purchases of Italian and German government bonds between March 2015 and December 2018. Monthly data at the end of the month. Log transformation is employed.
Source: https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html

	German securities purchased (€)	Italian securities purchased (€)
Mean	4.01	3.85
Standard Deviation	0.22	0.24
Minimum	3.40	3.16
Q1	3.84	3.61
Median	4.08	3.93
Q3	4.11	3.98
Maximum	4.29	4.13
IQR	0.23	0.32
Skewness	-1.00	-1.14
Kurtosis	0.16	0.44

Table A.2: Key descriptive statistics of the German and Italian government securities purchased by the ECB on a monthly basis.

	Δ CDS (bps)	LER (%)	Δ VDAX (%)
Mean	1.35	-0.73	1.23
Standard Deviation	25.90	3.32	16.92
Minimum	-67.90	-8.74	-26.49
Q1	-14.22	-3.44	-9.18
Median	-1.83	-0.50	-2.95
Q3	11.52	1.83	9.10
Maximum	91.27	6.67	85.04
IQR	25.45	5.18	17.29
Skewness	0.73	-0.14	1.88
Kurtosis	1.73	-0.60	5.98

Table A.3: Key descriptive statistics of the main control variables used in the model between January 2010 and December 2018.

	Δ Spread	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Δ Spread	1.000	0.847	-0.517	0.234	-0.049	-0.305	0.347
Δ CDS	0.847	1.000	-0.416	0.214	-0.114	-0.355	0.534
LER	-0.517	-0.416	1.000	-0.091	0.038	-0.003	-0.081
POL ITA	0.234	0.214	-0.091	1.000	-0.082	-0.093	0.079
POL GER	-0.049	-0.114	0.038	-0.082	1.000	-0.082	-0.066
ANN	-0.305	-0.355	-0.003	-0.093	-0.082	1.000	-0.032
Δ VDAX	0.347	0.534	-0.081	0.070	-0.066	-0.032	1.000

Table A.4: Correlation matrix for the variables employed in the model fitted on the period between January 2010 and December 2014.

	Δ Spread	ECB	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Δ Spread	1.000	0.093	0.922	-0.484	0.270	-0.130	0.042	0.184
ECB	0.093	1.000	0.230	-0.060	-0.019	-0.022	-0.258	-0.086
Δ CDS	0.922	0.230	1.000	-0.502	0.301	-0.141	0.065	0.122
LER	-0.484	-0.060	-0.502	1.000	0.058	0.093	-0.024	0.025
POL ITA	0.270	-0.019	0.301	0.058	1.000	0.052	0.330	-0.229
POL GER	-0.130	-0.022	-0.141	0.093	0.052	1.000	0.052	0.121
ANN	0.042	-0.258	0.065	-0.024	0.330	0.052	1.000	-0.156
Δ VDAX	0.184	-0.086	0.122	0.025	-0.229	0.121	-0.156	1.000

Table A.5: Correlation matrix for the variables employed in the model fitted on the period between January 2015 and December 2018.

	Δ Spread	Δ CDS	LER	Δ VDAX
Phillips-Perron	<0.01	<0.01	<0.01	<0.01
KPSS	>0.10	>0.10	>0.10	>0.10
Result	Stationary	Stationary	Stationary	Stationary

Table A.6: KPSS and Phillips Perron test for unit roots over the period between January 2010 and December 2014. Dummy variables are not considered.
Null hypothesis Phillips-Perron test: non-stationarity
Null hypothesis KPSS test: stationarity.

	Δ Spread	ECB	Δ CDS	LER	Δ VDAX
Phillips-Perron	<0.01	<0.01	<0.01	<0.01	<0.01
KPSS	>0.10	>0.10	>0.10	>0.10	>0.10
Result	Stationary	Stationary	Stationary	Stationary	Stationary

Table A.7: KPSS and Phillips Perron test for unit roots over the period between January 2015 and December 2018. Dummy variables are not considered.
Null hypothesis Phillips-Perron test: non-stationarity
Null hypothesis KPSS test: stationarity.

	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Tolerance	0.436	0.758	0.948	0.964	0.781	0.644
VIF	2.295	1.320	1.054	1.037	1.281	1.552

Table A.8: Variance Inflation Factor (VIF) and Tolerance for the variables employed in the model fitted on the period between January 2010 and December 2014. Both measures suggest the model to not have multicollinearity problems.

	ECB	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Tolerance	0.830	0.520	0.663	0.678	0.933	0.809	0.807
VIF	1.205	1.923	1.508	1.474	1.072	1.236	1.239

Table A.9: Variance Inflation Factor (VIF) and Tolerance for the variables employed in the model fitted on the period between January 2015 and December 2018. Both measures suggest the model to not have multicollinearity problems.

	ECB	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Seasonality	No	No	No	No	No	No	No

Table A.10: Seasonality test over the period between January 2010 and December 2014. Combined test according to Webel and Ollech (2018) [21].

	ECB	Δ CDS	LER	POL ITA	POL GER	ANN	Δ VDAX
Seasonality	No	No	No	No	No	No	No

Table A.11: Seasonality test over the period between January 2015 and December 2018. Combined test according to Webel and Ollech (2018) [21].

Appendix B

Alternative proxies for the PSPP

The dissertation used as a proxy for the PSPP program the difference between German and Italian securities purchased by the ECB since it is the most precise proxy when studying dynamics involving specific countries. In the following two sections, instead, different approaches are employed, despite using the same model specification (Equation 3.6). The models are fitted on the period between January 2015 and December 2018 only, since the first period does not include any PSPP proxy[1].

First, the ECB assets growth rate is used, to match the most common approach adopted in the literature. Secondly, a specific item offered by the ECB Data Portal is considered (Securities held for monetary policy) to exclude assets not addressed to monetary policy purposes.

[1]Despite being data available also before March 2015, to remain consistent with the previous PSPP proxy and effectively assess the implementation of the PSPP, proxies are considered equal to zero in January and February 2015. In this way, only the growth rates related to the PSPP purchases are considered.

B.1 ECB's assets growth rate

The most common approach in the literature consists in looking at the ECB's assets. Relevant changes in the assets, indeed, are coherent with expansive monetary policies. Despite this, the ECB's assets proxy has a significant limit, as it does not allow any distinction between countries. In the case of the implementation of the PSPP, for instance, the distinction in terms of purchases by country may be relevant. In addition, changes in ECB assets could be affected by policies and phenomena different from the PSPP purchases.

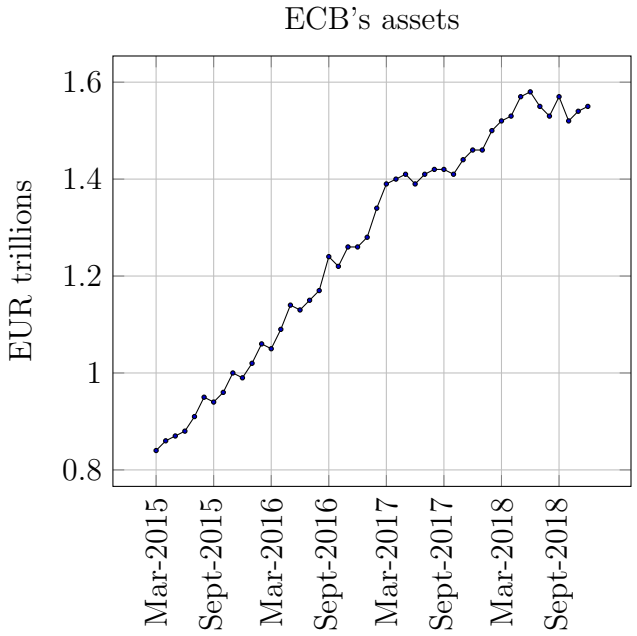

Figure B.1: ECB'assets between March 2015 and December 2018. Monthly data at the end of the month.
Source:`https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=117.BSI.M.4F.N.N.T00.A.1.Z5.0000.Z01.E`

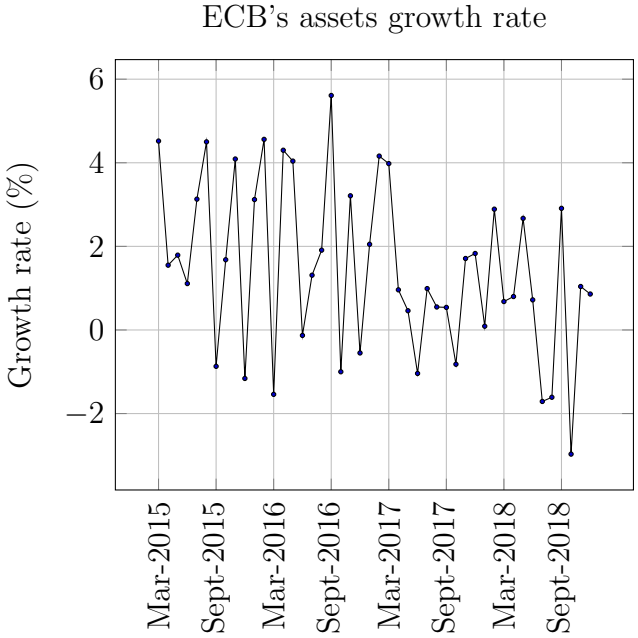

Figure B.2: ECB Assets growth rate between March 2015 and December 2018. Monthly data at the end of the month.
Source: Own calculations from `https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=117.BSI.M.4F.N.N.T00.A.1.Z5.0000.Z01.E` data

The ECB's assets growth rate is used rather than the assets' level due to the non-stationarity of the latter. As clear in Figure B.1, indeed, assets had a significant upward trend during the period after the PSPP implementation.

Variable	Estimate	P-value
Intercept	0.018	0.298
$PSPP$	-0.194	0.769
ΔCDS	1.027***	<0.01
LER	-0.360	0.491
$POL\,IT$	0.024	0.623
$POL\,GER$	-0.009	0.805
ANN	-0.013	0.773
$\Delta VDAX$	0.108	0.194
$R^2 = 85.69\%$		
$Adjusted\,R^2 = 83.19\%$		
$F - statistic = 34.23$		

Table B.1: Estimates of the model fitted with the ECB's assets growth rate proxy for the PSPP on the period between January 2015 and December 2018. Monthly data. To see the model specification, refer to Equation 3.6.

Table B.1 shows the parameter estimates of the model shown in Equation 3.6 using the ECB's assets growth rate proxy for the PSPP. Results in terms of coefficients are similar to the ones of the initial model, confirming its robustness. The main difference concerns the significance of the PSPP. According to the ECB's assets growth rate proxy, the implementation of the PSPP did not significantly affect Italian government bond spreads, which is very difficult to support. Therefore, the results show that to consider country-specific purchases of Section 4 should be preferred to the ECB's assets general proxy.

B.2 Securities held for monetary policy

Since 2009 ECB offers data related to the stock of securities held for monetary policy. The advantage of this item is that it excludes assets different from securities, improving one of the main limits of the ECB's assets growth rate proxy. Despite this improvement, however, the distinction between issuers is not taken into account.

As in the previous case, the model is fitted on the period between January 2015 and December 2018. The model specification is shown in Equation 3.6 and reflects the models already used in the previous sections.

In addition, as in the ECB's assets case, also this proxy requires data to be considered in terms of growth rate. The securities held for monetary policy expressed in euro, indeed, have a clear upward trend and suggest non-stationarity, which is also confirmed by formal tests.

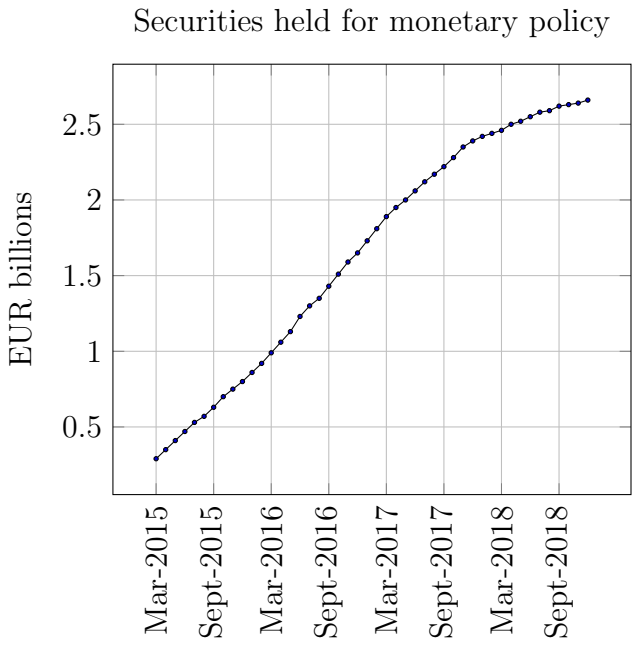

Figure B.3: ECB's securities held for monetary policy purposes between March 2015 and December 2018. Monthly data at the end of the month. Source:`https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=123.ILM.W.U2.C.A070100.U2.EUR`

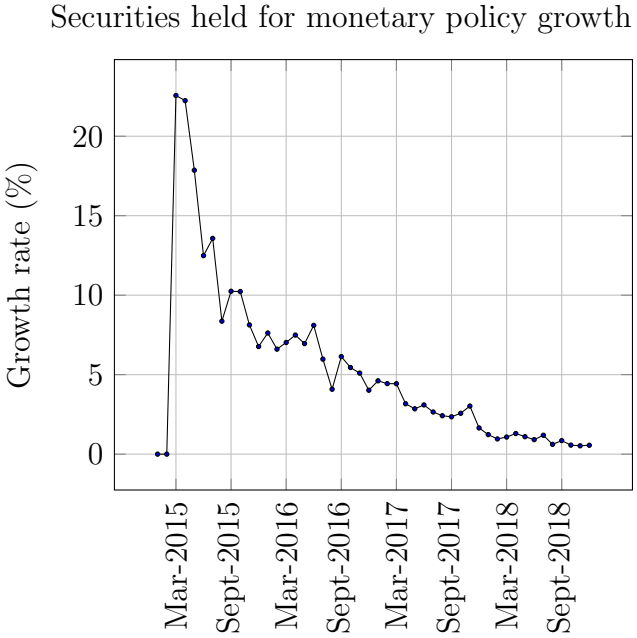

Figure B.4: ECB's securities held for monetary policy purposes growth rate between March 2015 and December 2018. Monthly data at the end of the month.
Source: Own calculations from `https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=123.ILM.W.U2.C.A070100.U2.EUR` data

	ECB's assets	ECB's assets growth rate	SHMP	SHMP growth rate
Seasonality	No	No	No	No
Phillips - Perron test	0.954	<0.01	>0.99	<0.01
KPSS	<0.01	>0.10	<0.01	>0.10

Table B.2: Seasonality combined test according to Webel and Ollech (2018). Stationarity tests according to Phillips-Perron and KPSS tests. All tests refer to the period between January 2015 and December 2018.
H0 Phillips-Perron: non-stationarity
H0 KPSS: stationarity

Variable	Estimate	P-value
Intercept	0.033	0.128
$PSPP$	-0.269	0.279
ΔCDS	1.037***	<0.01
LER	-0.281	0.577
$POL\,IT$	0.011	0.814
$POL\,GER$	-0.018	0.622
ANN	-0.012	0.769
$\Delta VDAX$	0.101	0.217
$R^2 = 86.08\%$		
$Adjusted\,R^2 = 83.65\%$		
$F - statistic = 35.34$		

Table B.3: Estimates of the model fitted with the Securities held for monetary policy proxy for the PSPP on the period between January 2015 and December 2018. Monthly data. To see the model specification, refer to Equation 3.6.

The securities held for monetary policy proxy confirms the results of the ECB asset growth rates proxy. Thus, the direction of the coefficients is the same as the main model. However, even in this case, the PSPP coefficient is not significant, despite a p-value much lower than the one in the wider ECB's assets growth rate proxy (Table B.1). This result confirms the limit of using a proxy that does not take into account the issuers of the securities purchased by the ECB. On the other hand, the lower p-value supports the idea that despite not being precise, this proxy should be preferred to the ECB's assets growth rate.

Bibliography

[1] António Afonso, Michael Arghyrou, and Alexandros Kontonikas. The determinants of sovereign bond yield spreads in the emu. 2012.

[2] Antonio Afonso, João Tovar Jalles, and Mina Kazemi. The effects of macroeconomic, fiscal and monetary policy announcements on sovereign bond spreads. *International Review of Law and Economics*, 63:105924, 2020.

[3] Carlo Altavilla, Giacomo Carboni, and Roberto Motto. Asset purchase programmes and financial markets: lessons from the euro area. 2015.

[4] Carlo Altavilla, Domenico Giannone, and Michele Lenza. The financial and macroeconomic effects of omt announcements. 2014.

[5] Jushan Bai and Pierre Perron. Estimating and testing linear models with multiple structural changes. *Econometrica*, pages 47–78, 1998.

[6] Ansgar Belke and Daniel Gros. Qe in the euro area: Has the pspp benefited peripheral bonds? *Journal of International Financial Markets, Institutions and Money*, 73:101350, 2021.

[7] Martijn Adriaan Boermans, Robert Vermeulen, et al. *Quantitative easing and preferred habitat investors in the euro area bond market*. SSRN, 2018.

[8] Stefano Corradin and Angela Maddaloni. The importance of being special: repo markets during the crisis. *Journal of Financial Economics*, 137(2):392–429, 2020.

[9] Philippine Cour-Thimann and Bernhard Winkler. The ecb's non-standard monetary policy measures: the role of institutional factors and financial structure. *Oxford Review of Economic Policy*, 28(4):765–803, 2012.

[10] Lieven De Moor, Prabesh Luitel, Piet Sercu, and Rosanne Vanpée. Subjectivity in sovereign credit ratings. *Journal of Banking & Finance*, 88:366–392, 2018.

[11] Łukasz Dopierała, Daria Ilczuk, and Liwiusz Wojciechowski. Sovereign credit ratings and cds spreads in emerging europe. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 15(3):419–438, 2020.

[12] Stefania D'Amico, Roger Fan, and Yuriy Kitsul. The scarcity value of treasury collateral: Repo-market effects of security-specific supply and demand factors. *Journal of Financial and Quantitative Analysis*, 53(5):2103–2129, 2018.

[13] Jorge Bento Farinha and José Vidrago. The impact of the ecb's asset purchase programme on core and peripheral sovereign yields and its transmission channels. *The Journal of Economic Asymmetries*, 24:e00213, 2021.

[14] Marien Ferdinandusse, Maximilian Freier, and Annukka Ristiniemi. Quantitative easing and the price-liquidity trade-off. 2020.

[15] Annalisa Ferrando, Alexander A Popov, and Gregory F Udell. Unconventional monetary policy, funding expectations, and firm decisions. 2021.

[16] Harald Kinateder and Niklas Wagner. Quantitative easing and the pricing of emu sovereign debt. *The Quarterly Review of Economics and Finance*, 66:1–12, 2017.

[17] Arvind Krishnamurthy and Annette Vissing-Jorgensen. The effects of quantitative easing on interest rates: channels and implications for policy. Technical report, National Bureau of Economic Research, 2011.

[18] Arvind Krishnamurthy and Annette Vissing-Jorgensen. The aggregate demand for treasury debt. *Journal of Political Economy*, 120(2):233–267, 2012.

[19] Kathi Schlepper, Heiko Hofer, Ryan Riordan, and Andreas Schrimpf. Scarcity effects of qe: A transaction-level analysis in the bund market. 2017.

[20] Jan Willem van den End. Effects of qe on sovereign bond spreads through the safe asset channel. 2019.

[21] Karsten Webel and Daniel Ollech. An overall seasonality test based on recursive feature elimination in conditional random forests. In *Proceedings of the 5th International Conference on Time Series and Forecasting*, pages 20–31, 2018.

[22] Michael Woodford. Methods of policy accommodation at the interest-rate lower bound. 2012.

Acknowledgments

First of all, I would like to thank my family for giving me the chance to study and create the fundamentals for a better future. I promise to commit myself to seize the opportunities that will come.

I would also like to thank all the people I met during this amazing journey. You really made this experience unique. I will never forget the beautiful moments after the lectures or even the exams, when I was with my friends, no matter what happened few minutes before in the classroom.

I really want to thank the guys who shared the French experience with me. I know I often went to sleep too early when the night was coming to life, but the time spent together even for the easiest things has been precious for me.

A special thank you goes to all the people that supported me in any way and who have given and are giving their best to help me achieve my dreams. I will never forget you.

Last but not least, I would like to thank the Ca' Foscari University of Venice, Aix-Marseille University and all the people involved for giving me the opportunity to join and live this Double Degree.