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ECB ASSET PURCHASE PROGRAMS EFFECT ON CORPORATE BOND ISSUANCE

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TABLE OF CONTENTS **page**

LIST OF FIGURES

LIST OF TABLES

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ABSTRACT

The purpose of this thesis is to study the effect of European Central Bank asset purchase programs to corporate bond issuance in European countries. Thesis distinguishes between two main transmission channels of quantitative easing to corporate bond issuance by examining both the debt holdings and purchases effect during the ECB quantitative easing.

Thesis employs a panel dataset of 15 499 bond issues from 19 European countries between years 2000 and 2015 with a series of explanatory variables controlling for changes in the macroeconomic environment and lending behavior. Countries are grouped to developed and frontier markets of the European Union to control for different characteristics in the level of integration to the European financial markets. Additional tests include various econometric techniques and tests for changes in the qualitative factors over the time period.

Results suggest a significant positive relationship between the ECB debt holdings and the corporate bond issuance, i.e. stock effect, which is particularly strong in the developed economies of Europe. This provides further evidence on the existence of portfolio rebalancing where the investors are crowded out from assets that are targeted by the QE. Flow effects of the ECB purchases do not appear to have a significant impact on bond issuance in the European markets. Robustness tests indicate a strong influence from the foreign central banks and that the decrease in credit supply has increased corporate bond issuance after the financial crisis. Additionally, during the QE programs, the average credit rating has decreased indicating that companies with lower credit quality issue more debt during times of excess liquidity. These results provide information to the policy makers on the early impact of the ECB quantitative easing and a basis for analysis on the corporate lending behavior during unconventional monetary policies.

KEYWORDS: Corporate bonds, Monetary policy, Quantitative easing, ECB

1. INTRODUCTION

In the post–crisis global economy the central banks have assumed a key role in guiding the stability of the financial markets. After the key interest rates, that during "normal" market conditions are the main tools for monetary policy, were dropped to zero the central banks of different economic regions have relied on unconventional monetary policies to retain financial stability and stimulate economic activity. The central bank of the United States, namely Federal Reserve System or Fed, began its purchases of Treasury bonds and mortgage backed securities (MBS) in late 2009, a program often referred as quantitative easing or QE.

The European Central Bank (ECB) has also engaged in asset purchase programs in the Eurozone in order to return the European Union back to the path of financial stability. Previous programs, namely the Covered Bond Purchase Program (CBPP) and Security Markets Program (SMP) in 2009 and 2010 respectively, were successful in reducing the volatility of the financial markets and lowered the government bond yields but perhaps different in nature when comparing to the actions taken by Fed. Eventually these programs were terminated and followed by a larger quantitative easing program in 2015. By launching the latest asset purchase program (APP) in March 2015, the ECB committed EUR 60 billion á month to revitalize the Eurozone economy and counter deflation for an extended period of time.

The impact of these quantitative easing programs to the global economy is a matter of great interest to the academic community. Effects of QE to assets such as the government issued debt are somewhat straightforward as they are more or less derived from equilibrium studies of traditional economics by examining yield/price relationship. But since the additional liquidity in the possession of institutional investors has ripple effects to other assets as well, a multiple of interesting and novel research areas emerge. Gilchrist et al. (2015) show that the global corporate bond issuance has increased significantly after the financial crisis and the credit spread between corporate and government debt has shrank significantly. Our interest is to study whether the QE programs, especially in the case of ECB asset purchase programs, have led to this increased eagerness to issue debt to the capital markets.

There are several explanations why QE and corporate bond issuance might be linked together: Firstly, as Fratzscher et al. (2013) show, the purchases of government debt lowers the yields of government bonds which in turn may incentivize investors to search for higher yielding assets. Secondly, the QE contributes positively to general investor confidence by increasing the supply of money which stimulates economic activity. For example, several financial surveys indicated increased investor confidence after the ECB APP was launched and ongoing (Bloomberg, 2015). And thirdly, the purchases of government debt tend to crowd out investors from the markets where the central bank operates. On the investor side this triggers the so–called "portfolio rebalancing" where investors replace government debt securities with assets that hold the similar kind of return and risk (Mishkin, 1996). These three elements and transmission channels will be discussed throughout this thesis. It is also important to address the fact that if traditional hypotheses regarding the efficiency of the financial markets would hold true, the financing decisions should only be driven by the need of funds for investing purposes, not the current price of the debt. These questions are also addressed in the section discussing the corporate capital structure and market timing theories.

Large amount of previous research exist on the possible transmission channels of monetary policy and recent studies such as Duca et al. (2016), Gilchrist et al. (2015) and McCauley et al. (2015) study the effect of Fed quantitative easing to both global and U.S. corporate bond issuance and yields. This thesis contributes to the existing literature by examining purely European sample and including the most recent purchase program to examine the effect of QE to bond issuance. At the time of writing this thesis there are no previous empirical researches studying the effect of the latest APP in Europe. This thesis is thus among the first to assess the early success of the ECB APP in its efforts to revitalize the European economy.

1.1 Purpose of the study

The purpose of this thesis is to examine how ECB's asset purchase programs affect corporate bond issuance. More precisely, this thesis investigates whether the purchases of European government debt securities have an impact on the behavior of the key market participants this is (i.e.) the bond investors and the corporate bond issuers. This includes the

analysis of possible transmission channels of the unconventional monetary policy to corporate bond issuance.

The study analyzes two possible transmission channels of the monetary policy to corporate bond issuance consistent with the previous research by D'Amico and King (2013). The first is the effect of debt holdings in the central bank's balance sheet. This can affect the issuance as the ECB holds an increasing share of the government securities, the lack of availability forces investors to seek for other assets to invest. This channel is hereinafter referred as the "stock effect". The second transmission channel is the effect of purchases or more specifically, the increase in the size of the ECB's debt holdings between time periods. This channel is later referred as the "flow effect". This way it is possible to investigate which is more effective in the European context, the asset holdings or the purchases of the government bonds. The stock and flow effects are examined in the context of 19 European countries which are divided in groups on the basis of the respective countries characteristics and market activity. Two groups of countries are named as "developed" countries comprising of core EU countries and "frontier" markets comprising of countries with less integrated capital markets. The two main explanatory variables are regressed with a set of controlling variables aiming to capture the effects of the surrounding economic environment.

The contribution of this thesis is to provide evidence of the monetary policies effect on corporate bond issuance along with McCauley et al. (2015) and Duca et al. (2016). A large share of the existing studies focus on the quantitative easing effect on bond yields examining especially the impact of U.S. monetary policy. This thesis contributes to the existing literature by focusing on the European environment and thus provides information on the success of quantitative easing in a bank–oriented debt capital market. At the time of writing this thesis, there is no existing empirical research on the latest ECB asset purchase program which commenced in March 2015. Thesis provides information on the effect of decreasing credit supply from the banks to the corporations during financial crisis and finally, how companies with different credit quality react to unconventional monetary policies.

1.2 Research hypotheses

The hypotheses of this study revolve around the issue of whether the monetary policies affect the corporate financing decisions. According to traditional finance theory and efficient capital markets, the timing of the issuance should not play a decisive role in the decision making process but the issuance should be driven purely by investment needs of the company. The first hypothesis is drawn from the connection of the asset purchase programs and corporate debt issuance:

H_0: ECB APP's do not affect the corporate bond issuance in Europe.

H_1: ECB APP's have an effect on corporate bond issuance in Europe.

If it is the case that the null hypothesis is rejected, we can draw two additional hypotheses relating to the stock and flow effects of the asset purchase programs. According to the previous research conducted by D'Amico & King (2013) and Duca et al. (2016) the effect of asset purchase programs can be divided in to these two categories. Second hypothesis is relating to the *stock effect:*

H_2: The amount of debt securities held by the ECB affects corporate bond issuance.

And the third hypothesis relating to *flow effect* is:

H_3: The amount of debt securities purchased by the ECB during a specific time period affects the corporate bond issuance.

In the additional tests we also examine whether the asset purchase programs have encouraged companies with lower credit ratings to issue more debt because of excess market liquidity and increased demand of debt securities. The fourth hypothesis is:

H_4: Corporate bond issues with higher/lower credit ratings increased due to the added demand caused by the QE

Because the hypotheses 2 and 3 can only hold true in case the first null hypothesis is rejected the analysis of the results is somewhat straightforward. In case there is a statistically significant difference in the issuance amounts before and after of the QE started in Europe, we can assume that either one or both of the hypotheses 2 and 3 holds true. The fourth hypothesis is tested on separate regression because the qualitative data on the credit ratings is not included in the benchmark model.

1.3 Structure of the thesis

The thesis proceeds as follows: The second chapter focuses on the theoretical literature discussing bond pricing and risk fundamentals and presents the key theories of corporate financing and capital structure. The third chapter reviews previous literature focusing on empirical research on asset purchase effects on debt capital markets. Fourth chapter presents the data and methodology used in this thesis and discusses the European corporate bond market characteristics before and after the financial crisis. Fifth chapter presents the results of the regression analysis and discusses the results in the context of the hypotheses. Sixth chapter summarizes the main results and provides conclusions and suggestions for future research.

2. THEORY AND CORPORATE BOND FUNDAMENTALS

Although this thesis focuses on the corporate bond issuance and the main hypothesis are not focused on the risk or return characteristics per se, it is beneficial to understand the fundamentals of bonds in general and specifically corporate bonds. After shortly describing the pricing and risk characteristics of corporate bonds, this chapter introduces the issuance process of corporate bonds and the main theories relevant for this thesis.

2.1 Corporate bond pricing and risks

2.1.1 Relationship between yield and price

The cash flows of a bond are its annual coupon payments plus the final principal. Therefore, price (P_0) of a bond is determined by future cash flows: coupon payments (C) and par value (PV) discounted by selected discount rate (r):

$$(1) \qquad P_0 = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \cdots + \frac{C}{(1+r)^n} + \frac{PV}{(1+r)^n}$$

Another important concept of bond investing is yield, indicating the return that investor receives from a bond. Unlike the interest rate used for discounting the yield is not fixed. The current yield is calculated using the following formula:

$$(2) \qquad current\ yield\ = \frac{coupon\ amount}{price}$$

When an investor buys a bond at its face value (par), yield is equal to the interest rate. But often the price does not remain the same for long periods of time and as the price and yield of a bond have a negative correlation, an increase in price decreases the current yield. Common measure to compare bonds with different characteristics is *yield to maturity* (YTM) which indicates the realized return that investor will receive, should he hold the bond to maturity. This combines all the above factors (current market price, par value, coupon payments and time to maturity) into one and therefore it makes it easier to compare bonds with different maturities and coupons. YTM also assumes that the interest payments

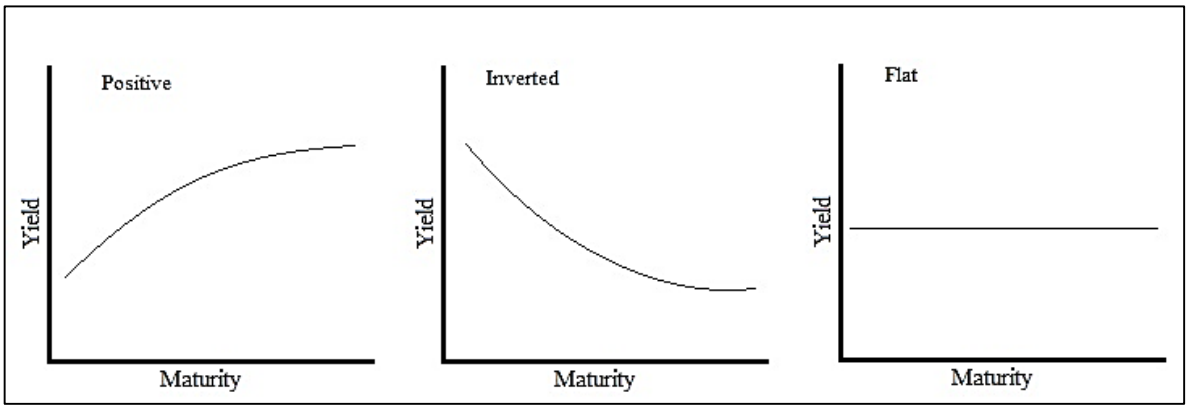
received during the lifespan of the bond are invested at the same rate as the bond's current yield. (Fabozzi 2012: 48–50.)

$$(3) \qquad Yield\ To\ Maturity\ = \frac{C + \frac{PV - P_0}{Number\ of\ years\ to\ maturity}}{\frac{PV + P_0}{2}}$$

2.1.2 Yield curve

The visualization of term structure of interest rates is known as the *yield curve*, which shows the yield on bonds with different maturities as is illustrated in Figure 1. The term structure of interest rate measures the difference in yields of U.S. Treasuries or other non-default securities that differ only in terms of maturity. Yield curve tends to be upward sloping, called the positive yield curve but both inverted and flat yield curves exist when investors expect the future interest rates to decline or the near future of the market is uncertain (Fabozzi 2012: 109). The yield curve reflects investor's expectations about future changes in interest rates, business conditions and monetary policy. Investors usually demand higher yield from long-term bonds than from short-term ones. This is due to the fact that as maturity extends to a longer time period it becomes increasingly difficult to forecast the future changes and bond prices become more volatile. Quantitative easing can be conducted by altering the yield curve to a different shape (see e.g. Operation twist) or if shorter term lending is incentivized, QE pursues to steepen the yield curve by purchasing short term bonds. (Brealey et al. 2011: 84.)

Figure 1. Three different kind of yield curves (Fabozzi 2012: 110)



2.1.3 Corporate bond risks

Understanding how the yield on bonds is defined and calculated is necessary to discuss the fundamental difference between government issued and corporate issued debt. Investors often require a higher coupon or yield from corporations because governments are more reliable in paying back their debt as they can raise taxes from their citizens. This difference in required yield between corporate and government bonds is often regarded as the *yield spread*. In order to understand the corporate bonds from the investor's perspective, a brief overlook of the corporate bond risks and the factors contributing to the yield spread is provided below.

Default risk

The magnitude of default risk is determined by two components: (1) the expected default loss rate – which is the risk that in the event of default, investors will not receive the full amount of the promised cash flows; (2) credit risk premium, which compensates for bearing the default risk on bonds. The expected default loss rate is then directly related to the default probability of the firm and the recovery-rate in the event of default (Fabozzi 2012: 178.):

$$(4) \qquad Expected\ default\ loss\ rate = Default\ rate \times (100\% - Recovery\ rate)$$

Default rate for a company can be evaluated from historical data: Table 1 shows the historical default probability through time of companies with certain credit rating. For example, since 1990 BB- rated issuer has had 1.05% average historical probability of defaulting within one year and 2.80% probability of doing so within two years.

Table 1. Average cumulative default rates (%). Table shows an average default rate in different rating classes and maturities between 1990 and 2014 (Fitchratings 2015)

%	One-year	Two-year	Three-year	Four Year	Five-Year	10-year
AAA	0,11	0,22	0,34	0,47	0,59	0,97
AA	-	-	0,11	0,27	0,44	0,49
A	0,05	0,24	0,42	0,65	0,88	2,04
BBB	0,09	0,47	0,94	1,50	2,03	4,07
BB	0,66	2,25	3,95	5,59	6,94	12,26
B	2,15	4,90	7,50	10,66	13,61	14,81
CCC to C	23,52	30,36	34,73	36,64	38,97	39,88

The second component of default loss rate is the recovery-rate which is the percentage of face value that the holders of defaulted bonds recover. Table 2 shows historical recovery rates in different kind of debt types:

Table 2. Discounted ultimate recovery rates by debt type and seniority (Fabozzi 2012: 175)

Type of Debt/ Seniority	Average Recovery rate (%)
Bank Loan	82
Senior Secured Debt	65
Senior Unsecured Debt	38
Senior Subordinated Debt	29
Subordinated Bond	27
Junior Subordinated Bond	15
All Bonds	37

The second part of default risk, the credit risk premium emerges from the systematic risks included in corporate bonds. Systematic risks are related to the fact that capital markets move together and in case of global recession the defaults tend to cluster which results that the compensation for expected default becomes insufficient as the probability of default increases (Elton et al. 2001.). The systematic risk is also described as the same systematic risk that affects the stock market such as changes in the interest rate or volatility.

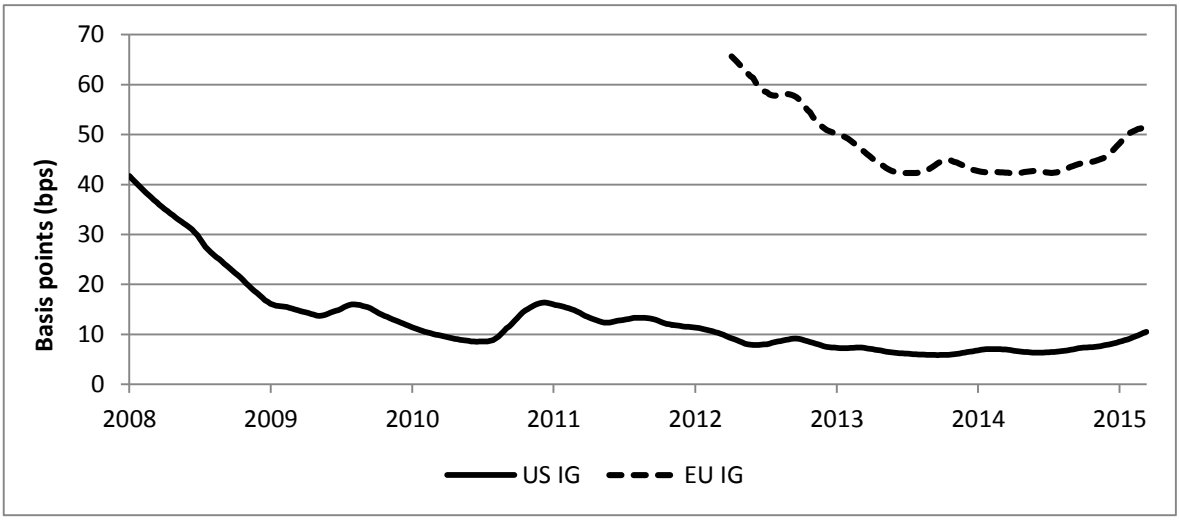
The rise of different derivatives enable market participants to control their credit risk: The most common type of derivative being credit default swap (CDS) where the buyer makes

periodic payments to seller until the maturity or until default event occurs. If default occurs, the seller of CDS buys the bond from the insured at par value. Credit default swap data offers more accurate information about credit risk than bond yield data as it can be seen as a transfer of pure credit risk form one market participant to another while bond price data is subject to several other factors. (Hull et al. 2004.)

Liquidity risk

The liquidity's effect on the price of a bond is quite straightforward: the more liquid the issue – the lower is the liquidity premium. U.S. Treasuries and German 10y Bunds in Europe are one of the most liquid securities in the world, hence for small corporations and small issues, the liquidity effect on yield spread is expected to be greater (Jong & Driessen 2006.). Important determinant of liquidity's effect on the yield spread is whether the issue is "on-the-run", meaning a recently issued and in result more liquid or "off-the-run" which means that the issue is older and traded less (Fabozzi 2012: 108). Liquidity can be measured with the difference between the ask price and the bid price (bid–ask spread) quoted in the market. In Figure 2 is presented the average bid-ask spreads on U.S investment grade corporate bonds compared to European investment grade corporate bonds. After Fed started the QE program in 2008, we can see that the liquidity has significantly improved in the market and the figure clearly shows how the bid–ask spread increases in financial turmoil. Additional observation is that the overall liquidity risk is significantly higher in Europe. The liquidity premium could be a result of lower volumes of trading in Europe and indicates that the debt capital market in Europe is not as active as its counterpart in the U.S.

Figure 2. Bid-ask spread index (BASI) differential between buy and sell trades of the US investment grade corporate debt and European investment grade corporate debt (MarketAxess 2016)



Other risks relating to bond investments

Following list of risks is meant to be complementary and provide an overview of risks that are often mentioned when discussing the risks of corporate bonds (Fabozzi 2012).

Call risk if the bond is callable, in case of a significant decline in interest rates the company is likely to refinance (call) the bond in order to make a new issue of bonds at a lower interest rates. Call option of a bond is generally regarded as a risk to the investor, since the investor has to reinvest the money consequently at lower interest rate.

Market risk emerges from the general shifts in the market conditions. This includes factors such as inflation, interest rates and different policy actions. Because corporate debt instruments offer relatively stable cash flows, the value of these instruments are not as volatile as equities and can be considered as safe-havens when the equities market faces a downturn, at least in the case of U.S Treasuries. Duration is the measure for bond prices sensitivity to interest rate risks and longer maturity bonds have higher duration than short term bonds.

Downgrade risk is related to the assigned credit rating that bond receives from the ratings agency. Because majority of investors assess the overall riskiness of the

company based on the given credit ratings, the deterioration of credit rating will have an impact on the price and yield of the bond. The credit rating system is further explained in the following chapter.

2.1.4 Credit ratings

For an individual investor, it would be difficult to assess all the above mentioned risk factors. For these purposes the "big three" credit rating agencies (CRAs) – U.S.-based Standard and Poor's, Moody's, and Fitch – characterize their assessment of the firm's riskiness with a letter system, the safest being AAA, with lower grades moving to double and single letters. Table 3 is provides the equivalent credit ratings across different rating agencies.

Table 3. Corporate bond ratings systems and symbols (SIFMA 2016)

	Standard & Poor's	Fitch	Moody's
Investment grade	AAA	AAA	Aaa
	AA	AA	Aa
	A	A	A
	BBB	BBB	Baa
Speculative Grade (High yield)	BB	BB	Ba
	B	B	B
	CCC,CC,C	CCC,CC,C	Caa,Ca
	D	D	C

Rating agencies evaluate risk factors from current market conditions like the economic situation in global market, to firm-specific variables such as the financial position of the company in order to determine the probability of company paying back its debts as promised. This is extended with an analysis of the percentage of the funds likely to be returned to the investor in case of a default, the recovery rate. This rating has significant impact on the pricing of corporate's debt as investors require higher return from companies that are more likely to have problems with its payments (SIFMA 2016.).

Financial crisis in 2008 revealed problems in the way the CRAs generate revenues. White (2010) argues that the shift from business model where "investors pay" the agency for the

ratings to a practice where “issuer pays” for the ratings contributed to the subprime mortgage crisis. The problem was that the CRAs were overly optimistic in their assessments of the credit risk of the MBS products which led the investors to believe that the riskiness of these products was lower than it actually was. White (2010) showcases that 90% of the collateralized debt obligation (CDOs) issued between 2005 and 2007 which were originally rated as AAA by the S&P were downgraded as of June 30, 2009 with 80% of these CDOs then rated below investment grade. This provides an example of how the CRAs were pressured to give good ratings to the products because the issuer could always pick another CRA to assess the rating which would mean lower revenues for the rating agency in question.

2.2 Corporate bond issuance

The purpose of this chapter is to introduce the corporate finance decision making process that directs the corporations to issue debt in the capital markets. Because this thesis focuses on the European corporate bond market, it is purposeful to also focus on the characteristics of the European debt capital market which differs from the more mature and liquid U.S. market. Traditionally, the European corporations have been financed mainly by loans from the financial institutions while the U.S counterparts have actively sought financing from the investors in the market. Schinasi & Smith (1998) study the success of the U.S. debt market and identify that among other factors the market power of financial institutions, regulatory policies, taxation and investor base have all contributed to the success of the U.S. debt market and in the same time, the lack of these factors has constrained the development of the debt market in Europe.

The length of the process of bond issuance is dependent on the complexity and the size of the issue. Since the company rarely has the staff or know-how to execute this sort of bond issuance, they hire the help of an investment advisor which handles the process for its clients. The advisor also often underwrites debt and then forms a syndicate with other banks that are willing to purchase a part of the debt. After forming the syndicate, lead advisor will structure the debt by offering it to the institutional investors to determine the right pricing and maturity according to the investor appetite on the market. And once the regulatory paperwork has been complied with, the bond is ready to be released to the market (LSE, 2016.). This whole process can take up to 12 months depending on the

investors appetite which is also why there is a certain risk that the advisor underwrites a debt that, due to the changing market conditions, is not as attractive at time of the release to the market. Therefore after 2008, the underwriting agreements often includes a clause for significant shift in the overall market conditions.

The decision to issue a bond instead of borrowing the money from a financial institution is based on the assessment of the cost and benefits of the alternatives. And even when the company would favor to lend from an institution there can be restrictions in this post-crisis-era that the business operates, which deny the corporate from lending. For example, after the financial crisis, many banks were forced to create larger capital buffers against defaults which caused the banks to decrease their lending. This resulted in a so called "credit crunch" which forced the companies to issue bonds in order to fulfil their need of debt financing (Brunnermeier, 2008). Issuing company may also wish to exploit a low interest environment that is not reflected in the price of a simple bank loan. Additionally, there is a variety of other incentives for the issue e.g. publicity, credit limits or special appetite for corporate debt in the market. These motivations are discussed in the following chapters presenting the theories of debt capital structure.

2.3 Corporate debt capital structure

After familiarizing with the principles of corporate bonds and the general issuance process, it is necessary to analyze the previous theories on why the quantitative easing could have an impact on the issuance of corporate bonds. Since the QE in its current form and scale has not been evidenced in the financial market before, theories of the asset purchase programs effect on the financial market have not yet been included in the prolific studies on debt choice. In order to provide a theoretical background on why the APP could have an impact on the corporate bond issuance, we should focus on the effect on the corporate bonds as a part of capital structure and this way the theory part should appear a bit more coherent. Impact of APP into the corporate decision making process can be explained with existing theories discussing the choice of corporate debt capital structure which can be divided into two classes: (1) trade-off and (2) pecking order theories.

In principal, when a corporation is about to invest into a physical asset or finance a venture, it should decide whether or not to invest based on the rates of return of the investment and

the required interest rate of the funds that are required to finance that investment. According to Modigliani and Miller's (1958) "capital structure irrelevance" if there would be no risk of bankruptcy and no taxation, there would be no optimal capital structure for the investment. But the interest payments on debt offer a tax shield and equity investors often require a higher return which is why a company wishes to optimize the capital structure to achieve a lower average cost of capital. Indeed this explains why the company should maintain a certain share of equity in its balance sheet but does not provide an explanation for switching between the two, i.e. why there is a time-variation in the portion of debt versus equity.

2.3.1 Trade-off theory

Again, referring to Modigliani's study where it is stated that in the efficient markets capital structure is irrelevant and there should not exist a financial gain from switching between debt and equity. Trade-off theories emerged on the principle that companies evaluate costs and benefits of different leverage plans to achieve the optimal capital structure. Trade-off theories can be divided into static and dynamic theories which are shortly described below.

Static trade-off theories

Static trade-off theory emerged after the Modigliani and Miller's study included the tax shield effect of interest payments. If there would be no cost for increasing the share of debt in the company's balance sheet, the optimal capital structure would be 100 percent debt. By introducing the bankruptcy cost into the equation, Myers (1984) stated that a company should set a target debt-to-equity ratio and gradually move toward that target by balancing the interest tax shield against the cost of bankruptcy.

Dynamic trade-off theories

The dynamic trade-off theories emerged from the fact that static theory could not explain the time-varying movements in the companies leverage structure. According to the dynamic theories the financial markets are to some extent inefficient and segmented and the company executives try to time the market for issuing debt or equity, carrying out the so called "market timing theory". Baker & Wurgler (2002) claim that the corporations tend to

issue equity during times of high market value i.e. high share price and consequently use debt to repurchase shares when the equity market value is low. This implies that the equity issues would be more frequent during bull markets and thus the issuance of corporate bonds would increase to fund the repurchases of shares during bear markets. They also state that the corporate capital structure is a result of historical attempts to time the equity market. But later studies (e.g. Leary & Roberts 2005) criticised that the effects of market timing is only temporary and the adjustment/administrative costs relating to issuing new debt or equity restrict the companies from aggressive issuance.

2.3.2 Pecking order theories

In addition of the static trade-off theory Myers (1984) introduced the pecking order theory where he states that the companies prefer internal financing i.e. using retained earnings for investments and if external funds are raised the company considers first debt and then equity issuance. In this framework there is no preferred debt-to-equity ratio but the order of usage is determined by the cost of capital from which the above mentioned pecking order emerges. The key motivation is adverse selection which gives the executive a superior knowledge over an investor and thus the manager always has the opportunity to choose the cheapest mean of financing. Another motivation for the pecking order is the agency theory, claiming that the managers avoid using external financing because it often requires providing financial information to the clients.

The pecking order theory's relevance to bond issuance is limited compared to for example the dynamic trade-off theories. These dynamic theories of financial market's impact on capital structure decisions is a key element when considering the effects of QE to the corporate debt issuance. As the reader now understands the corporate capital structure approach, the following two chapters discusses the theories related to corporate bond issuance in the dynamic trade-off theory's framework. These chapters are meant to clarify the theories discussing the relationship between the investors, corporates and the quantitative easing.

2.3.3 Gap-filling theory

Gap filling theory is important concept for this thesis because it provides us evidence from the previous literature on how the companies adjust the maturity structure of their debt according to the existing market conditions. As the central banks have launched asset purchase programs of government bonds, the demand and supply equilibriums of these government securities changed accordingly. Greenwood et al. (2010) claim that as government debt is purchased from the market by the central banks, corporate bonds with similar maturities provide liquidity to the investors who were bought out from the government securities. Corporates are able to provide this liquidity provided that the risk characteristics and maturities match the investor appetite. The selection of the maturity of the bond issue is widely discussed and previous research focuses on three different methods for corporations to choose correct maturity for their debt issuance, descriptions and critiques is provided below:

(1) Match the maturity of assets and liabilities is based on the static trade-off theory by Myers (1984) which represents very practical point of view to determining the maturity of an issue. But because assets are somewhat constant and do not change in terms of maturity, this approach does not explain the large movements in the issuance levels of short vs. long term debt that have been witnessed in the market.

(2) Alter the liability structure according to the market conditions which translates in to borrowing short term when the yield curve is steeply upward curving to maintain a relatively low interest expense costs (Marsh 1982). Timing the market for low interest rates is questionable since the expectations hypothesis of the term structure of interest rates states that the yield of a longer maturity bond is composed of the yields of shorter maturity bonds. Therefore this approach violates the expectations hypothesis as there should be no financial gain from optimizing the liability structure to the steepness of the yield curve (Faulkender 2005).

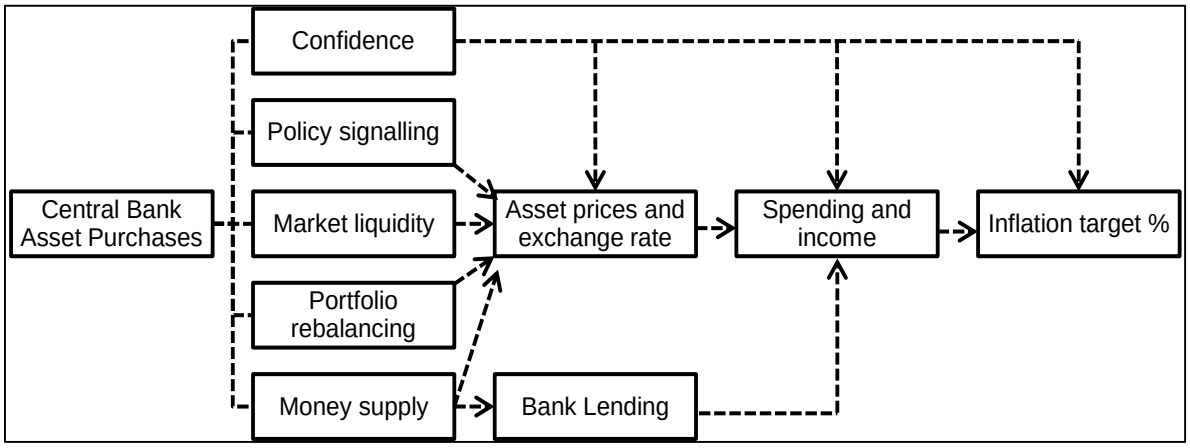
(3) Issue debt according to the expected return. Corporations should issue short term when the return of the short term debt is below the expected return of the long term debt (Baker, Greenwood & Wurgler 2003). Regarding the alternative of executives being able to forecast the expected return of the debt: It is tempting to assume that the corporate financiers have a unique perspective of the developments of the future interest rates but do

the companies have an advantage to detect mispricings over the sophisticated investors (i.e. banks, institutional investors etc.) that purchase the debt issued? Greenwood (2010) also assumes that there is some predictability in the expected returns (i.e. returns are in some sense mean reverting) but that the corporates do not have the ability to predict the future returns. Instead they act as a provider of liquidity when there are movements in the macroeconomic liquidity factors. They find that as the supply of long-term government securities increases, the corporates tend to issue more short term debt to fill around 30 to 40% of the gap created by a shock to the government debt maturity.

2.3.4 Portfolio rebalancing theory

The channels through which the QE affects the financial markets are under rigorous debate. This thesis will not focus on the different theories of monetary policy since only a few of them focuses on impact of QE to the financial market. Origin of the idea that the monetary actions precede movements in the real economy is first observed by Friedman and Schwartz (1963) after which the economists have focused on explaining why this might be the case and introduced effects to interest rates, bank lending, asset prices and so forth. It is to be noted that asset purchase program is applied only if the traditional measures, such as lowering the policy rate close to zero, are not effective. Purchase programs transmit to the market through five channels, all of which increase the aggregate spending and inflation. Firstly, asset purchase programs increase the overall confidence in the market, as the central bank actions tend to decrease volatility in the market and signals that CB is to be supportive in its policies for an extended period of time which often leads to appreciation in the equities market. One could claim that the policy signaling has become increasingly important for the market like the renowned speeches by the heads of the central banks have evidenced. For example, Mario Draghi's speech on 26th of July in 2012 in the midst of the escalation of the sovereign debt crisis calmed the investors and decreased volatility even though no real tools were mentioned. Asset purchase programs also increase the liquidity in the market and increase money supply which should increase bank lending as their increased balance sheets are forwarded to the private sector. Transmission channels of QE are illustrated in Figure 3 below.

Figure 3. Transmission channels of central bank monetary actions. Adopted from Mishkin (1996)



Portfolio rebalancing channel is important to the bond issuance related literature since it focuses on the effect of purchases to the investor portfolios. Fundamental idea is that as the central bank purchases government debt from the private sector, the QE increases the money held by this sector since reserves are transferred in exchange for bonds. Consequently it affects the quantity and mix of securities held by the public as they replace these government securities with assets that may be similar or riskier compared to the previously held assets (Friedman and Schwartz 1963.). During this rebalancing process, the asset prices will rise (i.e. yield decreases) until the market is again saturated. As the hypothesis of this study states, the saturation comes in form of increased corporate bond issuance.

3. PREVIOUS RESEARCH

Previous literature on the implications of QE to the financial market is rather extensive and ranges from a more theoretical approach of QE from the general market equilibrium perspective and, since 2008, empirical studies examining the implications of QE to the financial markets have emerged. The latter group of studies comprises largely of event-studies relating to the effect of U.S. quantitative easing on asset prices and to the different transmission channels of QE. The four main areas of empirical research are (1) transmission channels of QE (2) QE impact on domestic asset prices (3) QE impact on international financial markets and (4) QE impact on corporate debt issuance levels. Since a fair share of the previous research is conducted on the implications of the U.S. Federal reserve operations, Table 4 below is provided for the reader to assess the timeline of U.S. Federal Reserve's monetary actions. It is important to understand that even though Fed finished the latest QE3 purchases in October 2014, the acquired assets from each program will stay in the Fed balance sheet for an extended period of time.

Table 4. Historical events relating to Fed's open market actions after the financial crisis, bolded is the QE program in question followed by short description of the action. (Fed, 2014)

Year	Date	Federal Reserve Open Market Committee (FOMC) actions
2008	25th Nov	QE1: Initial announcement that Fed will purchase up to $100 bn of agency and $500 bn of MBS bonds
2009	18th Mar	QE1: MBS and agency debt purchases increased to $1.2 trillion and $200 billion respectively and purchases of Treasuries up to $300 bn announced
2010	10th Aug	QE2: Fed reserves will be kept on current levels by reinvesting principal payments from MBS and agency debt into longer term U.S. Treasuries
	3rd Nov	QE2: In addition to reinvestment policy, further $600 bn of Treasuries will be purchased with a pace of $75 bn per month by the end of Q2 2011
2011	21st Sep	Operation Twist: $400 bn of 6 to 30 years maturity Treasuries is purchased and equal amount of <3 years maturity will be sold by Q2 2012. Also referred as the Maturity extension program (MEP)
2012	13th Sep/ 12th Dec	QE3: open-ended commitment to monthly purchases $40 bn of MBS agency debt and in December addition $45 bn of Treasuries
2013	18th Dec	QE3: FOMC announces tapering (reducing) the monthly purchases by $10 bn after each meeting
2014	30th Oct	QE3: Monthly purchases are ended, ten months after the tapering announcement.

Previous research on the transmission channels of quantitative easing focus on implications of increased government spending to different asset classes. The objective of these studies often is to measure how the underlying objective e.g. decreasing the long term interest rates was achieved and through which channels this change in the interest rates transmitted. This is closely related the previous section where the Figure 3 described different channels for QE.

Krishnamurthy and Vissing-Jorgensen (2011) were among the first studies to assess the channels and the impact of the U.S. QE1 and QE2 to the interest rates. By using an event-study methodology around the announcement days of the QE programs Krishnamurthy et al. distinquish between six different channels of which three were found significant in both QE1 and QE2 and three of which were applicable only for QE1. A possible explanation for this is that QE1 was directed at MBS, agency and Treasury debt whereas QE2 had a higher emphasis on Treasury debt. Firstly, the *signaling channel* i.e. the financial markets expectation of future lower Federal funds rates which lowers yields on all bonds. Secondly, long term *safety channel* where yields on medium and long maturity bonds fell because of increased demand for safe assets. Thirdly, inflation swap rates indicated that expected inflation increased during QE's which meant larger reductions in real than nominal interest rates. This third channel is named the *inflation channel*. The latter group of channels which were only present during QE1 includes the *equilibrium price channel*. This equilibrium of the mortgage-specific risk in terms of price decreased during QE1 but not during QE2. Second is the *default risk channel* since they find that QE1 lowered the risk premiums of corporate bonds and third is the *liquidity channel* increasing the yields of most liquid bonds. Krishnamurthy et al. especially emphasize the importance of signaling channel in their results and they convey that CB's should be extremely careful regarding the perceived message of the announcements. The importance of signaling channel also reminds about the possibility that the same effect of QE2 could have been achieved by a mere announcement from the FED committing to lower future rates and thus exploiting the signaling channel.

Possible critique to the Krishnamurthy et al. results especially relating to the findings on the importance of signaling channel is that the event study method cannot properly distinguish between expectation channel and effect of the actual intended purchase. If the FOMC would only be implying that the purchases will start, it might not have the same effect than

FOMC actually starting the purchases. Another issue relating to the comparison between the two QE programs is that during QE1 the markets were extremely distressed in the aftermath of the financial crisis which might have even enhanced the importance of the signaling channel i.e. compared to a situation where there would have been less volatility and hence less need for comforting words from the behalf of Fed. One interesting notation is that Krishnamurthy et al. regard the portfolio rebalancing channel in their analysis as a function of the earlier mentioned safety channel. They state that the safety channel applies to assets within a low default risk class and investors substitute purchased assets only within the same risk and maturity class. Later studies such as Duca et al. (2016) have shown that the investors also substitute government debt and MBS's with corporate debt, supporting the portfolio rebalance theory but not the safety channel theory presented by Krishnamurthy and Vissing-Jorgensen.

In a close relationship with the research on the transmission channels of QE is the impact of quantitative easing on both the domestic (i.e. U.S.) and international asset prices. Since the Large Scale Asset Purchase (LSAP) programs in the U.S. were conducted by purchasing both U.S. Treasuries and MBS securities, the literature on the impact of QE to these two securities is somewhat extensive and a few key studies is presented below with the purpose to find the elements that are of relevance for this thesis.

Gagnon et al. (2011) research on the LSAP1 effect on financial markets is one of the benchmark studies in this area of research since it utilizes the event-methodology to study the effect of QE to a wide variety of financial assets, including corporate bond yields. Before discussing the main results of this study, an interesting observation is that rather than just stating the effect on financial markets, the authors also evaluate success of the LSAP program execution. Gagnon et al. claim that by announcing the size of the programs beforehand (LSAP1 was announced to be up to certain amounts of purchases of MBS and Treasuries) the Fed created a self-fulfilling prophecy. By announcing the amounts ex ante, there was little room for adjustments to changing financial environment and investors expected the programs to be executed to the full extent. They leave it for future research to investigate whether the announcement should be closed or open-ended in terms of the size of the program. This is interesting because the ECB restricted to merely announcing the size of the monthly purchases and stating that the purchases will be continued until deemed unnecessary. This is also noted in later studies presented in this section i.e. how the

different announcement methods can create problems for the research for example in the form of endogeneity in the regression (Duca et al. 2016). But in order to return to the conclusions of the research in the Gagnon et al. research: They state that by purchasing long term bonds, the LSAP programs lowered especially the 10 year U.S. Treasury term premium by approximately 30 to 100 basis points (bps) and thus flattening the yield curve from the long-term side. And as the term premium is a component of the expected yield in other risky fixed-income securities, LSAP consequently lowered the yields of corporate bonds as well, even though these were not the direct subject of the purchases. The cumulative effect on corporate bond yield index (issues rated Baa by Moody's) around the FOMC announcement dates of QE1 was around minus 70 bps whereas 10 year U.S. Treasury term premium and MBS agency yield decreased 156 and 113 bps respectively. It is thus evident that the corporate bond yield index was impacted the least compared to the two securities that were a direct target of the program. A (subjective) critique for this article is that the effects of the QE announcements are cumulated over a 2 year period during which the corporate bond yield index fell almost 500 bps indicating that the investor confidence improved significantly during the period. This raises the question of what share of the change in the index during the announcement date is due to the improvement of general confidence in the market and what is accountable for the announcements. The authors address this issue by admitting that the rebound in economic outlook and a sharp reversal of flight–to–quality were part of the reason why their results were robust.

Previously in this thesis we have separated between the effects of QE to stock and flow effect. When discussing these two effects in the context of asset prices, the stock effect translates into cumulative change in yields during the QE program and the flow effect is the change in yields during a specific time-period of purchases. D'Amico and King (2013) investigate the flow and stock effects of large-scale treasury purchases to asset prices Since this distinction between stock and flow effects is important for the outcomes of this thesis, it is worthwhile to explore this research with detail.

D'Amico and King are among the first researchers to employ data on the level of individual issues of Treasury bonds to examine the stock and flow effects to the security directly affected by the LSAP1 in the US. Distinctive is the fact that they focus directly to the $300bn Treasury purchases in 2009 to estimate the "local supply" effect, defined as the decrease in value of a given security in response to purchases of that security and securities

of similar maturity. Stock effects are estimated by modeling the cumulative change in the price of each Treasury issue as a function of the percentage held by the Fed whereas the flow effects are estimated as the change in price of each issue during the day of purchase as a function of the total amount purchased. Equations 5 and 6 are provided for further clarification:

(5) $$Stock\ Effect\ = \frac{Cumulative\ change\ in\ the\ yield}{Total\ Treasury\ debt\ outstanding}$$

(6) $$Flow\ Effect\ = \frac{Change\ in\ yeld\ during\ timeperiod\ t}{Total\ \ Treasury\ debt\ outstanding}$$

The analysis of stock and flow effects is extended with breaking the data into subsamples to account for differences between notes and bonds, short and long maturities and older issues versus recently issued securities which differ in terms of trading volume and liquidity (off-the-run vs. on-the-run issues). Results state that collectively the local supply effect decreased the Treasury yields by 30 basis points, an average of 1 basis point for each $10 billion of holdings (stock effect) and an additional 3.5 basis points reduction in yield accountable for an individual purchase (flow effect). As the authors suggest, if this reduction was transmitted to private credit sector it would have significantly decreased the lending costs of companies and individuals. The research does not explicitly suggest that this would be the case but as the credit spreads declined across the board during the LSAP1, it is probable that also the lending costs declined to some extent. This can be interpreted as supporting evidence for this thesis since the decrease in lending costs can be viewed as an incentive for the companies to increase the issuance of debt.

The studies presented so far have focused on the implications of U.S. quantitative easing to domestic (U.S.) asset prices and yields which provides a good foundation for further analysis but for the purpose of this thesis regarding the European market, it is also necessary to analyze the international implications of U.S. quantitative easing. It is safe to assume that since the U.S. economy can be perceived as an important driver for the world economy and the size of the U.S. QE program was significantly larger in absolute amounts than the ECB's QE, preliminary assessment is that the U.S. QE had a spillover effect on the European credit market as well. The magnitude of this effect is left for the empirical part of this study.

International transmission channels and effects of the U.S. QE programs are discussed in the paper published by Fratzscher et al. (2013) where they examine the international spillovers of the Fed QE distinguishing between emerging and advanced economies, a total of 65 foreign countries are included in the study. Authors focus on investigating capital injections into foreign equity and bond funds during QE1 and QE2 which enables them to observe portfolio flows between U.S. and the foreign countries. A distinctive characteristic of this study is that it does not only focus on the event-window around the announcement of the QE but also to the actual roll-out of the program. By focusing on the operations of Fed rather than the announcements, they gain more insight to the decisions relating to portfolios and re-pricing of credit risk in the global perspective.

Fratzscher et al. detect that the two QE programs differed significantly in terms of the ultimate effect on the market. They argue that the first LSAP increased the prices of bonds and equities in the U.S. which consequently raise the price of the U.S. dollar. Conversely, the second LSAP increased the prices of global equities after which the U.S. dollar depreciated. Authors claim that this is due to different market conditions during the QE programs and also the different products purchased in the two programs (i.e. MBS & Treasury). This is consistent with the underlying goal that the Fed had for the two programs. The first QE was to reduce the cost of borrowing and increase the availability of debt to the private sector whereas the second program was intended to decrease the long term interest rates to support economic activity, boosting asset prices and demand. Another explanation for significant appreciation of U.S. dollar is that once the QE1 started, the investors in emerging economies and to some extent the advanced economies shifted their portfolios towards U.S. equities and bonds because U.S. assets are generally perceived safer than the European counterparts. But during the second program, once the Fed purchased Treasuries from the investors, they were crowded out from these investments and forced to rebalance portfolios towards riskier assets. Once again, this gives an indication of the existence of portfolio rebalancing during asset purchase programs.

Another interesting result from Fratzscher et al. (2013) is that the Fed policies seem to have both pro-cyclical and counter-cyclical effects in emerging and developed economies. It would appear that Fed policies explain around 4.4% of the equity inflows and 6.0% of bond outflows in emerging markets between 2007 and 2011. These figures should be assessed with caution as the employed controlling variables might not be able to fully capture the

convenient timing for in the economic cycle for drawing these conclusions and the authors admit that the endogenous problems are difficult to fully control. Perhaps the significant conclusion is that even in the presence of endogeneity, the sudden changes in capital inflows and outflows are further enhanced by the QE program in the emerging economies as the investors herd in and out of their investments. For the corporate bond issuance topic the research by Fratzscher et al. provides further evidence of the portfolio rebalancing but also regarding the expected result: It seems that the Fed actions have been a major driving force of the global capital movements, which would indicate that the actions by ECB might not prove significant.

When shifting the focus into the studies researching the impact of quantitative easing on corporate bond issuance, at the time of writing this thesis, the literature is still relatively scarce and empirical studies discussing the effects on bond issuance are concentrated on the effects of Fed QE to both U.S. and global market. McCauley et al. (2015) study the effect of quantitative easing to bond issuance denominated in US dollar and analyses the relationship between monetary policy, leverage and the investor risk appetite. They argue that since financial crisis the amount of outstanding debt in USD has increased by 50% from $6 trillion to $9 trillion which indicates that the QE has changed the global liquidity characteristics and especially increased the international holdings of U.S. dollar denominated debt.

Although the focus of the research is slightly tipped towards analyzing the overall credit growth after the financial crisis, the methodology is in itself interesting. How they control for the growth in the credit is one of the key takeaways for the purposes of this thesis and is shortly described below. McCauley et al. distinguish 5 different factors as the determinants of credit growth including short-term rates (borrowing costs), long-term rates (yield on investment), equity market volatility, bond market volatility and global controls. These methods are similar to what is presented by Duca et al. (2016) and are reasoning for the inclusion of these factors also in the regression analysis of this thesis. One interesting fact is that McCauley et al. allow different transmission channels of QE to bond markets whereas Duca et al. assumes more straightforward transmission of QE.

Significant findings emerge from McCauley’s research as they state that the non-financial sector has provided a large share of dollar credit to the non-US residents through corporate

bond markets and the surge in dollar borrowing appears to be associated with decreasing term premium following the Fed actions. This straightforwardly implies that the changing market conditions i.e. decreasing term premium incentivize the corporations to borrow higher amounts of money especially through the bond market. This also implies that McCauley et al. do not consider the portfolio rebalancing or gap-filling theory to explain the movements in the issuance levels. This is at odds with the evidence presented previously in this literature review and also with the next research presented which assumes that the abovementioned theories are the key drivers in pushing corporate issuance on higher levels after the QE.

Duca et al. (2016) analyze the impact of U.S. quantitative easing to global corporate bond issuance including 18 emerging markets (EME) and 20 advanced economies (AE). This research is highly influential to the methods and reasoning applied in this thesis for it investigates specifically the QE impact to bond issuance and combines several theories presented in the Chapter 2 of this thesis with evidence for both gap-filling theory and the portfolio rebalancing channel. In the dependent variable, a distinction is made between stock (level of holdings) and flow (additional purchase) effects similar to D'Amico & King (2013) and explanatory variables include quantitative easing policies and controlling variables relating to global and domestic factors. Explanatory variables are measured in percentage of the respective country's GDP in order to control for the improvements or downturns in the general economic environment. The domestic and global factors are especially designed to capture firm's investment opportunities and credit supply.

For the advanced economies, Duca et al. find that the flow effects are present in both Treasury and MBS purchases. In the case of emerging markets, the QE had a significant impact on the corporate bond issuance levels through the stock channel as they claim that the issuance would have been approximately half of the volume witnessed without the QE. In summary this would mean that stock and flow effects are present in both groups of countries but the flow effect is more important for AE and stock effect in EME.

Especially the first program which included the purchases of MBS products activated the portfolio rebalancing channel. This is not as robust in the case of the Treasury purchases, indicating that the risk characteristics of corporate bonds are too far apart from the Treasuries for investors to switch between them. These results are robust to wide variety of

additional factors which include different measures for risks and more interestingly the test for actions by other central banks. Duca et al. state that the foreign central bank's actions did not have a significant effect on the bond issuance, although the results are only tentative according to the authors. Significant contribution of this paper is that the corporate bond issuance is not only affected by the decreasing yields or cheaper debt, but also by the fact that as investors are forced from the market they replace the government bonds with assets of the same characteristics, in this case the corporate bonds which in turns incentivize corporations to issue more debt. The benchmark model predicts that a purchase of Treasuries equal to 1% of the total debt increases global corporate bond issuance by 0.1%, as for the MBS purchases the respective increase is 0.12%.

After familiarizing with the Duca et al. research the reader might ask why this thesis is focusing on the ECB as it already included in the Duca et al. study. The reason for this is twofold: Firstly, the data utilized by Duca et al. does not include the latest ECB QE program from March 2015, which is significantly larger than the previous programs and is thus expected to provide significant results for the corporate bond issuance in Europe. Secondly, the country specification for advanced economies in Duca et al. included Australia, US and UK which expectedly are not affected by ECB actions as much as their own central banks, which motivates the study of purely European data.

Summary of the previous researches is provided in Table 5. Following chapter focuses on the descriptive information of the data and methodology that are employed in this study.

Table 5. Summary of previous literature

Author	Title	Contribution / Main results
Krishnamurthy and Vissing-Jorgensen (2011)	The effects of quantitative easing on interest rates: channels and implications for policy	Distinguishing between 5 different transmission channels. Highlighting the importance of signaling channel
Gagnon et al. (2011)	The financial market effects of the Federal Reserve's large-scale asset purchases	10-year Treasury lowered by 30-100 bps. Criticize the execution of LSAP program as a self-fulfilling prophecy
D'Amico & King (2013)	Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply	Examines the purchase and balance sheet channel of QE. LSAP decreased 10y yield by 30 bps, average of -1 bps for every $10 bn purchased
Fratzscher et al. (2013)	On the international spillovers of US quantitative easing	Time-series analysis of 65 countries during QE1 and QE2. QE1 boosted US asset prices and USD appreciated & QE2 boosted international asset prices and USD depreciated. Furthermore, QE had a pro-cyclical effect on EMEs
McCauley et al. (2015)	Global dollar credit: links to US monetary policy and leverage	QE1 decreased the Treasury term premium and consequently lowered corp. bond yields. Non-financial sector provided a significant portion of the dollar credit to foreign countries
Duca et al. (2016)	Global Corporate Bond Issuance: What role for US quantitative Easing?	QE increased the global corporate bond issuance especially in EMEs. MBS purchases forced the investors to corporate bonds due to similar risk characteristics. 1% increase in Treasury purchases increased corporate bond issuance by 0.1%

4. DATA AND METHODOLOGY

The purpose of this study is to investigate the ECB APP effect on the corporate bond issuance and contribute to the existing literature on QE effects to financial markets. In order to achieve this goal, a wide range of different data resources is utilized. Description of the data and the methodology is provided in the following subchapters.

4.1 Data

The data employed in this study consists of corporate bonds issued by European companies in the Eurozone countries (EU19) with adding Czech Republic and removing Cyprus from the EU19 description. Reason for this is that the data availability for the variables chosen was extremely low and Czech Republic provides better data availability while being centrally located in Europe. These countries are then divided into developed and frontier markets in order to differentiate between different response to the asset purchase programs due to differences in the level of financial market integration and also to control for the gaps in issuance data in the frontier markets. Grouped countries in Table 6 below.

Table 6. Research countries grouped to developed and frontier markets

Developed markets		Frontier markets	
Germany	DE	Czech Republic	CZ
France	FR	Slovakia	SK
Italy	IT	Slovenia	SL
Spain	ES	Malta	MT
Netherlands	NL	Estonia	EE
Belgium	BE	Latvia	LV
Luxembourg	LU	Lithuania	LT
Finland	FI		
Austria	AT		
Portugal	PT		
Ireland	IE		
Greece	GR		

The bond data consists of 15 499 bonds issued from January 1st 2000 to 31st December 2015. Bond data is downloaded from Bloomberg and includes all issues (matured and

active) from non-financial corporations. Issues are aggregated to quarterly issuance amounts in EUR and allocated to respective ultimate parent country of risk. This means that for example issues by Deutsche Telekom AG's subsidiary "Deutsche Telekom Finance BV" listed in the Netherlands, is accounted as a bond issue in Germany. This method is recommended by e.g. Duca et al. (2016) and Shin (2014). Descriptive statistics of the corporate issuance data is provided in Table 7 below:

Table 7. Descriptive statistics of the dependent variable: quarterly European corporate bond issuance data. Sample period ranges from Q1 2000 to Q4 2015 with a total of 1216 observation points

Description	Market	Mean	Std Dev	Min	Max
Non-financial corporate bond issuance in bn. euros	Developed	4,84	3,04	0,00	54,59
	Frontier	0,15	0,20	0,00	1,94
Non-financial corporate bond issuance as % of GDP	Developed	0,38	0,33	0,00	7,75
	Frontier	0,07	0,19	0,00	3,24
Observations (Quarters)	Developed	768			
	Frontier	448			

As we can see from the descriptive statistics already, the developed markets differ significantly from the frontier markets in terms of activity and size. One could argue that countries included in the frontier markets, do not possess the necessary financial infrastructure to issue debt to the markets which would partly explain the differences. Figure 4 shows how the bond issuance has increased in size after the financial crisis and also illustrates the effect of the financial crisis to the corporate bond market as the banks decreased their lending, the issuance of corporate bonds peaked. It would also appear that the aggregate corporate bond market is increasing over time with the period after the financial crisis averaging well above EUR 600 million in issuance each quarter. Figure 5 represents the corporate bond issuance in percentage of the respective country's GDP and clearly indicates how issuance in the frontier markets has increased significantly after the financial crisis. For the purpose of this thesis the issuance is expressed as percentage of the GDP as it captures the possible economic developments in our regression and eases the problems with possible econometric biases.

Figure 4. Corporate bond issuance in EU19 countries in million euros between 2000 and 2015. 12 month moving average. (Bloomberg 2016)

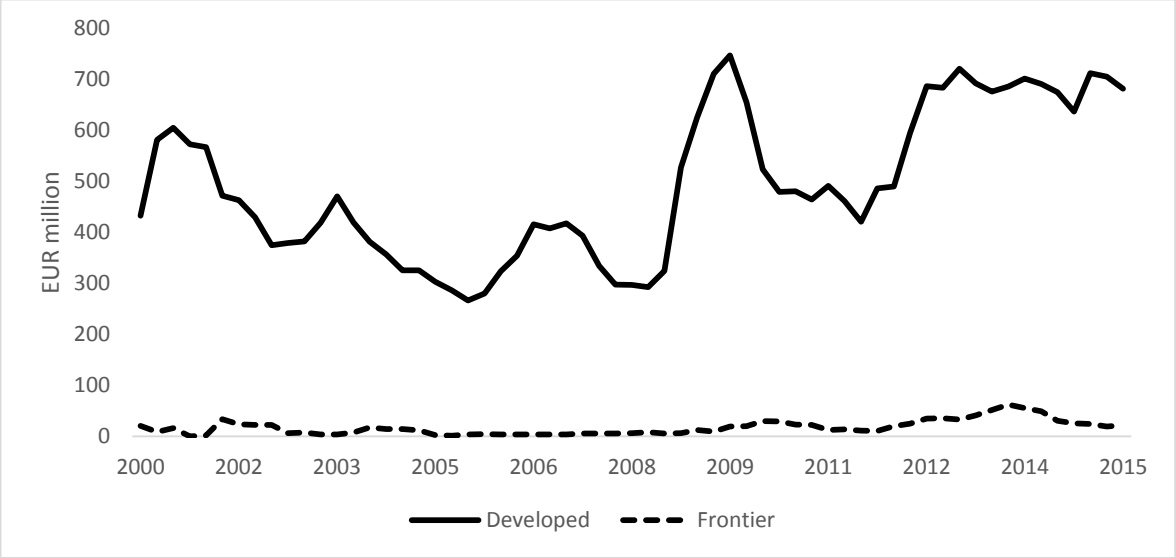
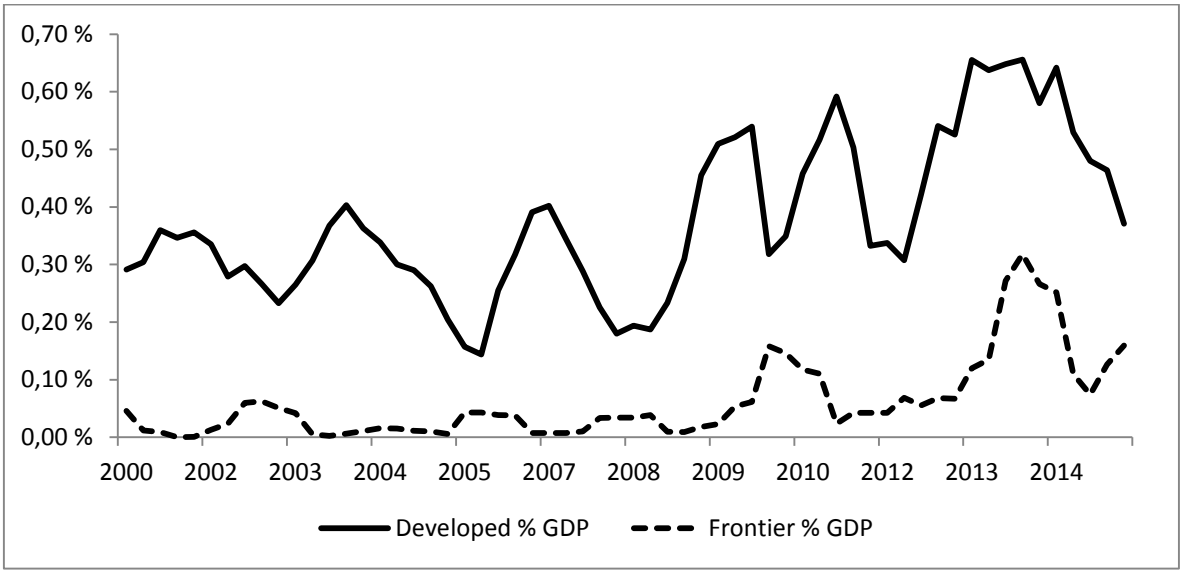


Figure 5. Corporate Bond Issuance in EU19 countries in percentage of GDP between 2000 and 2015. 12 month moving average. (Bloomberg 2016)



Developments evidenced in Figures 4 and 5 of the corporate bond markets are influenced by variety of factors that depend on factors like the economic development, interest rates and the performance of alternative investments such as stocks. In order to account for these

developments, a variety of controlling variables is obtained to control for possible externalities between the dependent and main explanatory variables. Selection of these variables is based on Duca et al. (2016) but altered for the European data set. The controlling factors along with descriptive statistics are provided in Table 8.

Table 8. Descriptive statistics for the main explanatory variables. Sample period from Q1 2000 to Q4 2015

Variable[(1)]	Description	Mean	Std Dev	Min	Max
ECB holdings of debt securities in % of total EU debt – Stock effect	Total amount of debt securities held by the ECB in % of the total debt. Source: ECB and Bloomberg	4,36	3,64	0,70	15,08
ECB purchases of debt securities in % of total EU debt – Flow effect	Change in the amount of securities held by the ECB in % of the total EU debt. Source: ECB and Bloomberg	0,27	0,63	-0,36	3,04
VIX	Average difference in daily closing price for implied volatility of S&P500 during each quarter. Source: Yahoo Finance	20,67	8,24	11,03	58,60
ECB key interest rate (real)	ECB interest rate for deposit facility minus the expected one year ahead inflation expectation. Source: ECB	-0,43	1,05	-1,90	2,05
10 year Benchmark yield	Euro area 10-year Government bond benchmark yield. Source: ECB	3,81	1,07	0,96	5,49
Return of local equities	Local equity market index return in %[(2)] Source: Bloomberg	1,06	11,98	-44,12	72,12
Realized volatility of equities	Quarterly volatility of the country's equity index. Source: Bloomberg	19,38	9,81	0,00	75,58
Domestic claims	Nominal growth rate of the country's bank debt to the private sector. Source: IFS	-0,06	0,73	-4,82	0,91
International bank debt	Nominal growth rate of the international bank debt. Source: IFS	0,79	2,97	-5,42	7,55

[(1)]Table 10 for correlation analysis of the main explanatory variables
[(2)] Appendix 1 for the list of country indices and equity market performance

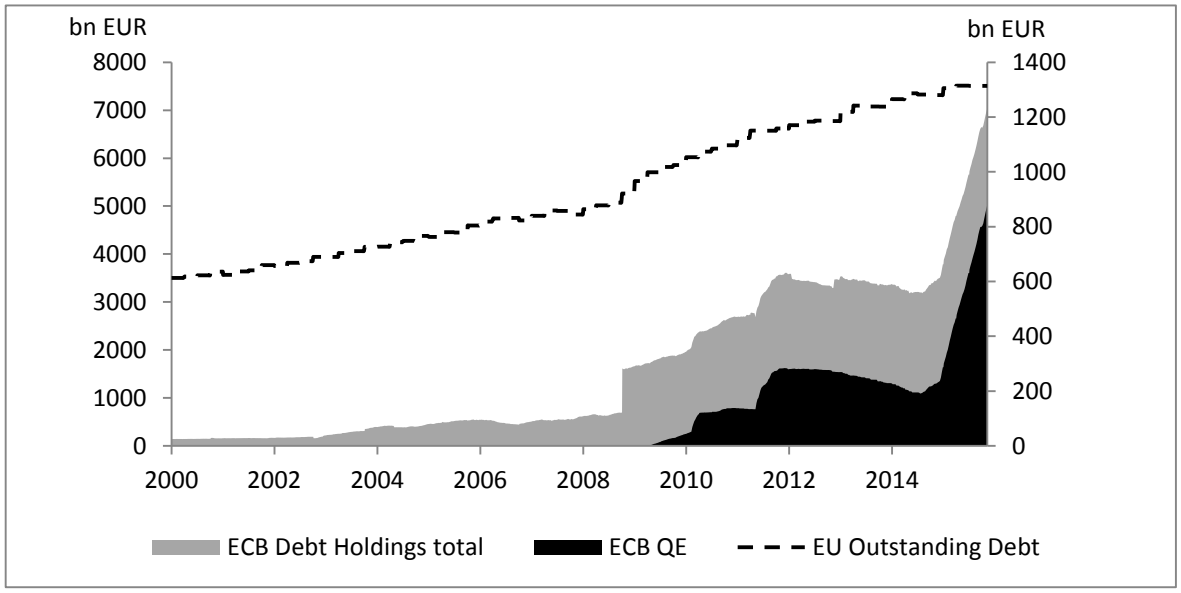
Following sequence is to provide explanations for the explanatory variables and to provide extra insight on how these variables are to effect the corporate bond issuance. Main

explanatory variables relating to the research topic is the effect of both purchases and the holdings of debt securities to the corporate bond issuance. When examining the timeline of the ECB purchases, it becomes evident that the holdings of the government debt increased significantly after the announcement of the first QE program but especially in 2015 once latest purchase program commenced. Table 9 is provided to further clarify the schedule and the magnitude of the ECB purchases and indicates also the significant difference in sizes of the QE programs. By December 2015, the latest QE program is already larger than the previous programs combined and it is expected to continue until economic balance is restored in the Eurozone. Figure 6 further explains the unconventionality of the ECB QE program. Until 2009 the balance sheet of ECB included little government issued securities but has since increase significantly

Table 9. Timeline of the open market operations by the European Central Bank. ECB (2016)

Date	Program	Action	Volume in Dec 2015
2.7.2009	CBPP1	CBPP1: First covered bond purchase program of investment grade covered bonds. Terminated in 30.6.2010	EUR 60.0 bn
10.5.2010	SMP	SMP: Securities Markets Program to ensure liquidity in market segments. Program terminated in 6.9.2012	EUR 210.0 bn
3.11.2011	CBPP2	CBPP2: Direct purchases CB's from primary and secondary markets. Terminated in October 2012.	EUR 16.4 bn
20.10.2014	CBPP3	CBPP3: Third covered bond purchase program to support financing conditions and facilitate credit provision	EUR 143.0 bn
21.11.2014	ASBPP	ABSPP: Purchase of asset-backed securities to diversify funding sources and stimulate new issues from banks.	EUR 15.0 bn
9.3.2015	PSPP	PSPP: Purchase of public bonds i.e. government and multinational agencies located in the euro area.	EUR 500.0 bn

Figure 6. Outstanding Eurozone government debt (left axis) and total ECB debt holdings of (right axis), QE related holdings in black area. Bloomberg (2016)



The main explanatory variable, i.e. the central bank purchases, is separated between the total holdings and additional purchases of the debt securities. This is consistent with D'Amico and King (2013) and Duca et al. (2016) and enables the discovery of both *stock* and *flow effects* of the central bank purchases. Furthermore, as the variable is measured in percentage of the total debt, it supports the discovery of the portfolio rebalancing channel as an increasing share of the total debt is held by the ECB, the investors are crowded out from the debt securities. In December 2015, ECB already owned close to 15% of the total Eurozone government debt.

The implied volatility index or *VIX* measures the average volatility of the S&P500 index in during each quarter and is often used as a indicator of global uncertainty (Bekaert & Hoerova, 2014). Although it is not entirely straightforward, the bonds function at least partially as a safe haven for the equity investors when the uncertainty is high. This does not directly lead to increased issuance but exhibits the increased appetite for stable debt instruments during times of financial distress and high volatility.

The *ECB key interest rate* is set by the ECB governing council for the euro area. ECB can control the banks willingness to deposit funds to the central bank by altering the deposit facility interest rate which determines the interest on overnight deposits. After turning the rate negative in 2014, the ECB has continuedly lowered the rate and as of December 2015

it is set at negative 0.3 per cent. The real key interest rate is calculated by deducting the year ahead inflation expectation (ECB 2016.). The key interest rate can be seen as an indicator of the bank and lending activity as the negative interest rate encourages banks to lend money to the market and private sector.

The Euro area *10-year government benchmark bond yield* is ECB's indicator of the average yield for 10 year government issued debt in the Eurozone. The average yield of 3.81% may seem low but one has to account the relatively long stability of the Eurozone before the financial crisis and strong stable economies such as Germany and France have supported the low yield environment. Previous studies have evidenced the inverse relationship between corporate bond issuance and long term yields. This relates to the theory section of this thesis where the market timing is discussed. Financial managers pursue to benefit from cheaper credit which is why increased levels of corporate bond issuance should be observed during low yield environment (Baker & Wurgler, 2002).

The following two variables are meant to capture the country specific information on the equity markets as the VIX can be perceived as a more general and global indicator of risk. Firstly, the *local equity returns* expresses the market performance of the respective country during each quarter. The indexes used for this variable and country specific statistics are provided in the Appendix 1. Purpose of these variables is to capture the local financing conditions which may vary significantly across Europe. It is also shown in previous research that companies might engage in stock buy-backs financed by issuing bonds when they are expecting positive future returns in the equity market i.e. when the share value is low (Baker, Greenwood & Wurgler 2003). *Local equity market volatility* is included to separate between domestic factors that vary between the countries and the more general indicator VIX. By investigating different countries equity markets it is apparent that there are significant differences between the countries. For example, in Germany the mean return for the DAX index between 2000 and 2015 is 1.36% whereas in Portugal the corresponding return is -0.78%. It is thus reasonable to include the country specific factors into the regression.

Factors relating to the credit supply i.e. the domestic claims and the international bank debt are discussed in the robustness checks section of this thesis along with additional analysis on the QE effect on the individual bond issue characteristics and the effect of other central

banks, namely the Federal Reserve of the U.S, Bank of England and Bank of Japan actions on the Eurozone corporate bond issuance.

4.2 Methodology

Analysis of the variables described in the previous section is conducted with following methodology. Variables are formed into a panel data set by country of issuance following the setup introduced in Duca et al. (2016). Since the data includes quarters of zero issuance especially in the case of frontier markets, the data is treated as unbalanced panel data – the implication of this is further discussed later in this chapter. Regression method used is ordinary least squares (OLS). Duca et al. also suggests using Tobit equation because of the nature of always positive dependent variable (i.e. gross issuance cannot be negative) which is why the results of using the Tobit equation is represented in the robustness checks along with other alternative econometric techniques.

The impact of European central bank asset purchase programs to the corporate bond issuance is evaluated with the following panel setting:

$$(7) \qquad C_{i,t} = \beta_1 Stock_t + \beta_2 Flow_t + \beta_3 Market_t + \beta_4 Domestic_{i,t}$$

where the dependent variable $C_{i,t}$ is the corporate bond issues in country *i* in quarter *t* as a percentage of the country *i* GDP.

The main explanatory variables are *stock effect* which is the ECB debt holdings at the end of quarter *t* as a percentage of the total debt and *flow effect* which is the ECB debt purchases during quarter *t* as a percentage of the total Euro–area debt outstanding. The *Market* variable includes the average VIX return, ECB key interest rate and the benchmark yield for 10 year government bonds in the Eurozone in quarter *t*. These market variables are expected to capture the effect of improved/declined financing conditions on the corporate bond issuance. The *Domestic* variable group includes both the return and volatility of the equity market in country *i* in quarter *t* and are meant to capture the country–specific changes that might affect corporate bond issuance in respective countries. Different from previous research (e.g. McCauley et al. 2014) no distinction between different debt products is made. This is due to couple of reasons: Firstly, the availability of data casts

limits on differentiating between different debt products and countries because the ECB does not report purchase quotas in categorized manner but merely on aggregate level. Secondly, even in the case where categorized data would be available, the decreased volume after separating the products to different debt tranches would reduce the explanatory power of the variables. In researches based on U.S. data the distinction was more obvious as the Fed reported the purchases separately for Treasuries and MBS's.

As mentioned earlier, the dataset includes quarters during which there is no issuance data available. Especially in the case of frontier markets, the portion of zero values is relatively high, 310 out of 448, and the reliability of the regression results must be scrutinized. In the case of developed countries the zero values are less prominent (47 out of 768). Following the reasoning by Woolridge (2002 p.488) if this lack of data would be a cause of economic environment or fiscal imbalances, it would be reflected in the national accounts such as the GDP and act as an evidence that some explanatory variable could explain the zero issuance. But as this is not the case, assumption is made that the zero values in data are likely to be caused by informational reasons (i.e. all issues are not listed in Bloomberg), no further actions are needed as the statistical package Eviews controls for the existence of zero values.

Before conducting the regression analysis on the data set, a choice between fixed effects estimator and random effects estimator in the regression is necessary. As Woolridge (2002, p.481) argues, the random effects estimator should be used if it is expected that the unobserved effect of omitted variables is uncorrelated with the explanatory variables. In practice, this would mean that the explanatory variables are able to almost fully explain the variation in the dependent variable i.e. the issuance amounts. There is a number of reasons why this might not be the case: Firstly, the dataset does not include explanatory variables relating to e.g. corporate developments or more specific variable on the market characteristics. This means that the explanatory variables are probably not able to fully explain the changes in the dependent variable. As Woolridge (2002) expresses, situations where explanatory variables would explain majority of the movements in the dependent variable are rather an exception than a rule. Secondly, the previous researches (e.g. Duca et al. 2016) where random effects estimators are used, assume that there is no significant correlation (i.e. endogeneity) between the explanatory variables. This is not the case in this thesis but it is assumed that the ECB actions are linked to the subsequent actions of the

market participants. For example, in this thesis the additional liquidity provided by the ECB is assumed to have an effect in the benchmark yield as it is previously discussed that the yield is linked to the demand of the government securities.

Assumption that the benchmark yield and the QE are correlated is further evidenced in Table 10 which shows a relatively high correlation coefficients between ECB holdings, 10 year benchmark yield and the policy rate. Also the VIX and local equity return are highly correlated which is partly explained by the asset markets co–movement and is addressed by testing how the regression results are impacted by excluding variables from the regression.

Table 10. Correlation statistics of the main explanatory variables

Variable	ECB Purchases	ECB Holdings	VIX	ECB Policy Rate	Benchmark 10y yield	Local equity return	Local equity volatility
ECB Purchases	**1,000**	0,491	0,245	-0,255	-0,360	-0,131	0,219
ECB Holdings	0,491	**1,000**	-0,166	-0,760	-0,760	0,027	0,052
VIX	0,245	-0,166	**1,000**	0,255	0,349	-0,402	0,615
ECB Policy Rate	-0,255	-0,760	0,255	**1,000**	0,703	-0,211	0,062
Benchmark 10y yield	-0,360	-0,760	0,349	0,703	**1,000**	-0,139	0,091
Local equity return	-0,131	0,027	-0,402	-0,211	-0,139	**1,000**	-0,340
Local equity volatility	0,219	0,052	0,615	0,062	0,091	-0,340	**1,000**

The results for the Hausman–test (Hausman 1978) which is used to choose between random and fixed effect model are presented in Table 11. The test compares the standard error of the random effects estimation to the fixed effect estimation by examining the variance in the explanatory variables from random and fixed model results. The idea is to use random effects model unless the Hausman test rejects the null hypothesis. The illustration is provided in equation 8 where β_{FE} / β_{RE} is the coefficient outputs of fixed effects and random effects estimation while the denominator is the difference in variances of the respective coefficients.

(8) $$Hausman\ test\ = {(\beta_{FE} - \beta_{RE})^2}\Big/{Var(\beta_{FE} - \beta_{RE})}$$

Table 11. Hausman–test scores. A higher precision in the coefficients is visible for distinguishing the different coefficients

Variable	Fixed	Random	Var(Diff.)	Prob.
Stock effect	0.0328538	0.0329009	0.0000003	0.928
Flow effect	-0.1033506	-0.1030885	0.0000032	0.884
ECB policy rate	-0.0413820	-0.0413486	0.0000022	0.982
Benchmark yield	0.0689118	0.0690686	0.0000021	0.914
Local equity return	0.0036906	0.0036727	0.0000000	0.868
Local equity volatility	-0.0008379	-0.0009114	0.0000000	0.609

If it would be the case that the probabilities would be close to zero or less than 0.05 we could accept the null and use the random effects model, but as it is not the case and all p–values range above 0.6 we can safely assume that the fixed effects estimation methods is more efficient for conducting the regressions in this thesis. For the sake of validity, the results from the random effects model and the Tobit equation are included in the robustness checks section of this thesis. The regression also controls for heteroscedasticity in the error terms by using White robust standard errors.

5. EMPIRICAL ANALYSIS

The results of the empirical research are presented in the following section. Firstly, the results of the benchmark model with the main explanatory variables are presented after which we continue with further analysis with additional factors and time periods.

5.1 Benchmark model

Before introducing additional factors in to the equation, the results for the so–called benchmark model are presented in Table 12. The purpose of this is to understand the fundamental effects of the QE in the regression model and to provide a comparison of results to the model applied by Duca et al (2016).

Table 12. Benchmark regression model estimating the impact of ECB asset purchases to corporate bond issuance. First panel presents the impact on all 19 countries, second to developed markets and the third to frontier markets, t–statistics in parenthesis. Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence. Sample data range from Q1 2000 to Q4 2015.

Dependent variable: Corporate bond issuance in % of GDP	All countries	Developed	Frontier
Constant	0,000	0,000	0,000
	-(0,018)	(0,118)	-(0,141)
ECB holdings in % of total debt (Stock)	0,034***	0,045***	0,015**
	(4,577)	(4,072)	(2,091)
ECB purchases in % of total debt (Flow)	-0,056**	-0,086**	0,001
	-(2,024)	-(2,103)	(0,030)
ECB Real Policy Rate	-0,005	-0,005	-0,002
	-(0,204)	-(0,149)	-(0,075)
VIX	0,003	0,006	-0,001
	(1,053)	(1,345)	-(0,423)
10y Benchmark Yield	0,035	0,045	0,013
	(1,573)	(1,348)	(0,611)
Local Equity Return	0,003**	0,005**	0,000
	(2,222)	(2,047)	-(0,265)
Local Equity Volatility	-0,003*	-0,005	-0,001
	-(1,823)	-(1,554)	-(0,593)
R squared	0,500	0,505	0,091
SE of the regression	0,005	0,006	0,003
Observations	1216	768	448

Table 12 indicates a strong positive relationship between ECB debt holdings and the corporate bond issuance. According to the regression results, during the sample period in all cross-section countries, the increase in debt holdings of the ECB increased bond issuance by 0.03 percent of the GDP in each quarter. In cumulative terms this would mean an annual increase of 0.12% in issuance due to ECB QE. This provides evidence of the stock effect in European debt markets i.e. the increased holdings of ECB force the investors to seek alternative investments because of the decreased availability of government debt securities. This result holds true across different econometric methods as is shown in the robustness analysis. The second explanatory variable, the ECB purchases of corporate debt, has a negative impact on the corporate bond issuance according to the regression results. This might seem counterintuitive to the findings relating to the stock effect and deserves a closer examination of the possible reasons behind this result.

The flow effects parameter in the regression is generated as the change in the total debt holdings of the ECB which does not consist purely of the QE purchases made by ECB but also of other debt products held in the balance sheet of ECB. This aggregate amount is affected by other factors such as sovereign states repaying their debt or sterilization of debt securities purchased previously. If we look at the Figure 6 in the chapter 4 which shows the ECB debt holdings we can evidence a significant decline between the years 2012 and 2014 after which the debt holdings surge in 2015 because of the latest APP. ECB states in its press release of 2014 financial statements that the "Total liabilities decreased mainly owing to … sterilizing the liquidity injected under the SMP" and "Total assets decreased, mainly owing to early repayments by counterparties of … longer–term refinancing operations" (ECB a, 2015). This means that during the years of which the corporate bond issuance increased significantly (as evidenced by Figure 4 and 5) the ECB holdings of debt actually decreased which explains the negative coefficient of the ECB purchases in Table 12. This is also consistent with the fact that ECB did not conduct any significant asset purchasing programs between 2012 and 2014 as CBPP2 terminated in Oct 2012 and CBPP3 did not commence before Q4 2014 as Table 9 in Chapter 4 shows.

Before suggesting an adjusted version of the Duca et al. (2016) benchmark model, a brief overlook on the effect of other explanatory variables. It seems that the local equity return has some explanatory power in the case of the developed countries and as the developed economies represent a significant share of the observations in the whole dataset, the

coefficient is significant on 5% level also in the case of all countries. According to the trade–off theory the corporate bond issuance should increase during economic downturns as the companies, presumably, issue debt to engage in share–buybacks. The results in the benchmark model cannot confirm this theory since the bond issuance and equity returns have a positive coefficient, opposite to the theory stated. On the other hand if the equity returns and bond issuance are positively related, this would mean that during economic upswings the lending activity also increases. This could mean that the companies are for example investing more when the confidence in the economy increases along with stock returns and therefore need more debt financing. These motives are purely speculative in nature and a more qualitative data should be employed to account for further analysis on the subject.

5.2 Adjusted model

Next the benchmark model is adjusted to account for the discrepancies observed in the first regression. Firstly, the negative coefficient of the ECB purchases to corporate bond issuance controlled with a dummy variable. The variable excludes the period where the debt holdings of the ECB was decreasing in size i.e. taking the value of zero between Q2 2012 and Q3 2014 and value of one in other periods. This enables us to better assess the effect of the actual ECB asset purchase programs and excludes the period where there were no active asset purchase programs.

Furthermore, the high correlation between VIX and local equity market volatility is addressed by excluding the VIX from the regression results. This still allows us to control for the volatility observed in the market but limits the endogeneity and multicollinearity issues arising from the inclusion of two highly correlated variables into one regression model. The effect of these changes is represented in Table 13 below.

In this adjusted model, the main findings of the benchmark model still hold true. The ECB stock effect is still highly significant in developed European countries with an increase in the holding resulting in approximately 0.034% increase in the debt issuance at 1% confidence level. This translates into annual increase in issuance by 0.13% of the GDP across the developed countries. For the frontier markets the coefficients remain insignificant which is likely a result of smaller number of observations. By excluding the

periods from Q2 2012 to Q3 2014, the flow effect turns positive although remains insignificant. In addition, the dummy variable is highly significant in the case of all countries and frontier markets whereas in developed markets only at 10% confidence level. These findings confirm that the increased level of ECB holdings of debt securities increase corporate bond issuance as the investors are seeking alternative investments due to decreased availability of government debt securities.

Table 13. Adjusted model for estimating ECB QE effect on corporate bond issuance. First panel presents the impact on all 19 countries, second to developed markets and the third to frontier markets, t–statistics in parenthesis. Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence. Sample data range from Q1 2000 to Q4 2015.

Dependent variable: Corporate bond issuance in % of GDP	All countries	Developed	Frontier
Constant	0.001	0.001	0.001
	(1.021)	(0.845)	(0.941)
ECB holdings in % of total debt (Stock)	0.025***	0.034***	0.007
	(2.919)	(2.834)	(0.919)
ECB purchases in % of total debt (Flow)	0.000	-0.021	0.043
	(0.007)	-(0.445)	(1.439)
ECB Real Policy Rate	-0.002	-0.004	0.003
	-(0.069)	-(0.135)	(0.151)
10y Benchmark Yield	0.046**	0.063**	0.015
	(2.087)	(2.032)	(0.760)
Local Equity Return	0.003**	0.005**	0.000
	(2.230)	(2.119)	(0.270)
Local Equity Volatility	-0.001	-0.001	-0.001
	-(0.961)	-(0.559)	-(0.764)
Dummy excl. Q2 2012 - Q3 2014	-0.001***	-0.001*	-0.001***
	-(2.362)	-(1.715)	-(2.644)
R squared	0.502	0.506	0.104
SE of the regression	0.005	0.006	0.003
Observations	1216	768	448
Countries	19	12	7

*Appendix 2 shows different adjustments of benchmark model, results confirm that although removing VIX has a small positive impact on flow effect (-0,056/-0,047), the dummy variable outperforms (-0,056/-0,008).

Two findings emerge from examining other explanatory variables in the adjusted model. Firstly, the benchmark yield for government debt securities in positively correlated with the corporate bond issuance at 5% level in the developed countries and all countries cross–

section. This implies that the decrease in price of the government securities (i.e. the increase in yield) causes the bond issuance to increase. This should not be the case as we have seen in the theory section of this thesis that the increased yield makes the bonds more expensive to the companies to issue (Fabozzi, 2012). It would appear that by removing the period where the balance sheet of ECB decreased, we also lose the effect of significant decrease in the benchmark yield as it dropped from 4% in Q1 2012 to 1.8% in Q3 in 2014. During the same period the issues increased significantly which is could explain the observed coefficients. Also the exclusion of VIX which is strongly correlated with the benchmark yield might have had similar impact on the benchmark yield and issuance movements. Secondly, the positive return on the equity market remains still positively correlated with the corporate bond issuance although only at 5% level. Possible explanation for this might be the strong positive performance after the financial crisis and overall economic upswing which benefited both corporate bond issuance and equity returns as explained in the benchmark regression results.

For the hypotheses presented in Chapter 1, the following conclusions can be made from the results: The null hypothesis of no QE effect on the corporate bond issuance is rejected. The second hypothesis (H_2) of stock effect in the European corporate bond market is accepted with statistical significance at 1% confidence level in the case of developed countries and all countries included in the cross section. Third hypothesis (H_3) is rejected since we find no evidence of flow effect in the European corporate bond markets.

Comparing the results of the adjusted model to the previous results conducted in the U.S. market, it is apparent that the results are only partly in line with each other. D'Amico and King (2013) found that both the stock effect and flow effect contribute to the decrease of the yield curve which would indicate that both of these variables should be significant in our results. Additionally, Duca et al. (2016) only find evidence on the existence of the flow effect in the corporate bond issuance and that these flow effects are more robust in the case of advanced economies. In our model, the flow effect remains insignificant while the stock effect is robust especially in the case of developed European countries. There are several possible explanations for these discrepancies. Both studies used the Fed QE as a dependent variable which alone is enough to explain the differences in the results since the size and timing of these QE programs was different from the ECB APPs. Secondly, the cross-section data in Duca et al. (2016) includes different set of countries, slightly different

methodology and different data source from the one employed in this thesis. All the above factors should limit the doubts in terms of the results of the adjusted model and in order to further examine the validity of the results, we continue to robustness analysis. Also the effect of foreign central banks is examined further in the robustness analysis.

5.3 Robustness tests

5.3.1 Different econometric techniques

In the robustness analysis we first examine whether the use of different econometric methods in the benchmark and adjusted model affect the results. As both models are conducted with fixed effect estimation method, the results are compared to the results of random effects estimation and Tobit model which is employed in previous research conducted by Duca et al. (2016). The special feature of this Tobit model is that it excludes the periods where the dependent variable is zero. Table 14 shows the results for different econometric techniques.

It is apparent from the results of the Table 14 that no significant difference is evidenced between the choice of fixed effects or random effects model. Coefficients and their magnitude are close to same across all explanatory variables. A notion that might catch the eye of the reader is the difference in R–squared between the two models as fixed effects model seems to better explain the variation in the dependent variable with the explanatory variables. Woolridge (2012 p. 493) explains that the fixed effects estimation method favors robustness over efficiency and by reducing the error term, the fixed effects model often produces better R–squared than random effects model. Comparing the results of the Tobit model to the fixed effects model, we can see that the main finding of the stock effect still holds on 5% confidence level while other explanatory variables remain insignificant.

Table 14. Results of the adjusted model in all countries using different econometric technique. First panel fixed effects model, second is the random effects and the third is the Tobit model. t–statistics in parenthesis. Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence. Sample data range from Q1 2000 to Q4 2015.

Dependent variable: Corporate bond issuance in % of GDP	Fixed Effects	Random Effects	Censored model (Tobit)
Constant	0.001	0.001	-0.002
	(1.109)	(0.785)	-(0.740)
ECB holdings in % of total debt (Stock)	0.025***	0.025***	0.034**
	(3.164)	(3.185)	(2.141)
ECB purchases in % of total debt (Flow)	0.000	0.000	-0.073
	(0.007)	(0.004)	-(1.139)
ECB Real Policy Rate	-0.002	-0.002	-0.008
	-(0.074)	-(0.078)	-(0.183)
10y Benchmark Yield	0.046**	0.046**	0.031
	(2.260)	(2.274)	(0.765)
Local Equity Return	0.003**	0.003**	0.001
	(2.393)	(2.392)	(0.357)
Local Equity Volatility	-0.001	-0.001	0.004
	-(1.011)	-(1.006)	(1.350)
Dummy excl. Q2 2012 - Q3 2014	-0.001***	-0.001***	-0.001
	-(2.562)	-(2.580)	-(1.162)
R squared	0.502	0.040	
SE of the regression	0.005	0.005	0.060
Observations	1216	1216	859
Countries	19	19	19

5.3.2 Effect of credit supply

The fact that the European debt markets are still dominated by lending from the financial intermediaries might have an effect on the results of the adjusted model. The external effect of the credit supply is addressed by taking into account the changes in (1) domestic claims which is the growth rate of country's bank debt to the private sectors and (2) the growth rate of international bank debt. Inclusion of these variables enables us to observe whether corporations substitute between corporate bonds and bank lending. For further research on the subject, see for example De Fiore and Uhlig (2015) for evidence of the relationship between bank lending and corporate bond issuance after the financial crisis. Result of including the credit supply characteristics into the adjusted model is presented in Table 15.

Results indicate that the inclusion of these two variables does not have a significant impact on the other variables except for small changes in the coefficients and the domestic claims effect on bond issuance remains insignificant. Interestingly, the international claims show strong negative relationship with the corporate bond issuance in cross sections including the developed countries. This indicates that the corporations have indeed substituted between the two options and the decrease in international bank debt leads to increase in corporate bond issuance. It is noteworthy to appoint that even including these variables relating to the credit supply, the impact of the ECB APPs remains strong in the developed countries.

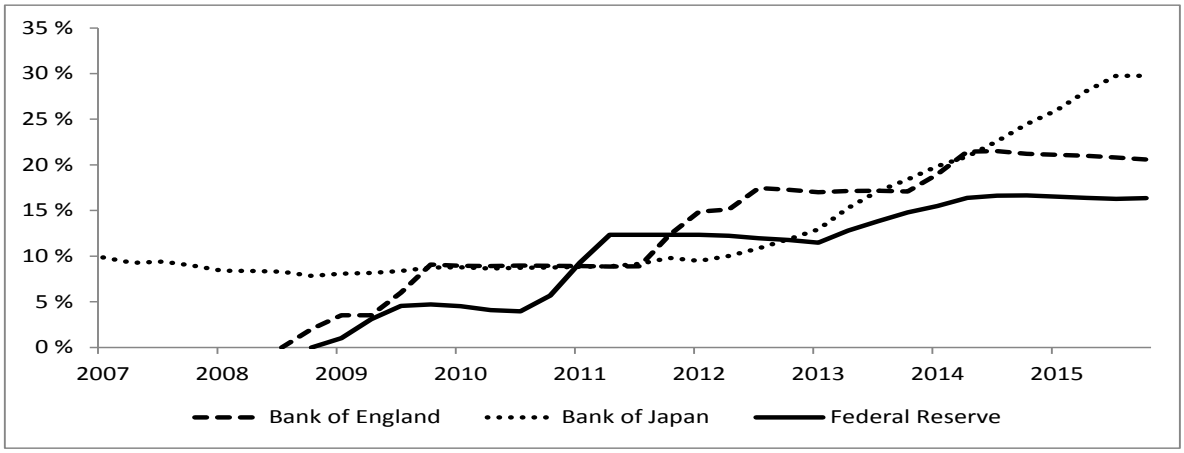
Table 15. Adjusted benchmark model with credit supply effects. First panel presents the impact on all 19 countries, second to developed markets and the third to frontier markets, t–statistics in parenthesis. Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence. Sample data range from Q1 2000 to Q4 2015.

Dependent variable: Corporate bond issuance in % of GDP	All	Developed	Frontier
Constant	0.001	0.002	0.001
	(1.253)	(1.131)	(1.035)
ECB holdings in % of total debt (Stock)	0.024***	0.031**	0.007
	(3.013)	(2.447)	(0.939)
ECB purchases in % of total debt (Flow)	0.000	-0.018	0.042
	(0.005)	-(0.376)	(1.414)
ECB Real Policy Rate	0.000	-0.004	0.007
	(0.008)	-(0.121)	(0.323)
10y Benchmark Yield	0.043**	0.057*	0.011
	(2.035)	(1.813)	(0.555)
Local Equity Return	0.003**	0.005**	0.000
	(2.339)	(2.004)	(0.258)
Local Equity Volatility	-0.002	-0.002	-0.001
	-(1.132)	-(0.871)	-(0.817)
Domestic claims	0.003	0.003	0.004
	(0.398)	(0.206)	(1.181)
International claims	-0.002**	-0.006**	-0.001
	-(2.338)	-(2.124)	-(1.107)
Dummy excl. Q2 2012 - Q3 2014	-0.001***	-0.001	-0.001**
	-(2.397)	-(1.574)	-(2.538)
R squared	0.503	0.507	0.107
SE of the regression	0.005	0.006	0.003
Observations	1216	768	448
Countries	19	12	7

5.3.3 QE programs by other central banks

Figure 7 shows how the holdings of the major central banks internationally have increased due to quantitative easing programs employed across the economies. It is expected that these monetary policies undertaken in foreign economies have had some spillover effects to the European corporate bond market as we have read before from Fratzscher et al. (2013) and Duca et al. (2016). In order to examine these effects, an explanatory variable is added to capture the effects of QE programs by other major central banks including the Bank of England (BoE), Bank of Japan (BoJ) and the Federal Reserve of the United States.

Figure 7. Holdings of debt securities in % of outstanding government debt after the financial crisis. Bloomberg (2016)



Because all QE programs commenced around the same time after the financial crisis, it is not reasonable to include them separately to the regression because of high collinearity between stock/flow effects across the central banks. In Table 16 the main explanatory variables of stock and flow effects are constructed by taking the average holdings of debt products by the central banks as a % of the debt outstanding in the respective area. The controlling variables for economic activity remain the same as in the adjusted model.

We see that the stock effect remains significant although decreases slightly comparing to the original results. Notably, the effect becomes significant also in the case of frontier markets of Europe. This indicates the possibility that the frontier markets did not respond that well to European asset purchase programs but for example the Fed QE programs had a stimulating impact on the frontier market bond issuance. This could be a result of the

frontier markets responding better to differences in timing and magnitude of the CB's purchase programs. Continuing with the example of the Fed QE program – it was announced during the most severe time of uncertainty after the financial crisis and most likely had a significant impact on restoring confidence in all economies, also the frontier markets. As a reminder, these results should be taken with precaution since the data on frontier markets is not as complete as it would be in ideal conditions.

Table 16. Foreign central banks effect on corporate bond issuance. Stock and flow effects of Bank of England, Bank of Japan, Federal Reserve and the European Central Bank are averaged as the percentage of the respective country total debt. First panel presents the impact on all 19 countries, second to developed markets and the third to frontier markets, t–statistics in parenthesis. Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence. Sample data range from Q1 2000 to Q4 2015

Dependent variable: Corporate bond issuance in % of GDP	All countries	Developed	Frontier
Constant	0.000	0.001	-0.001
	(0.095)	(0.299)	-(0.702)
Major CBs - Stock effect	0.017***	0.020***	0.012**
	(3.349)	(2.574)	(2.520)
Major CBs - Flow effect	0.002	0.004	-0.001
	(1.264)	(1.344)	-(0.286)
ECB Real Policy Rate	-0.021	-0.026	-0.009
	-(1.026)	-(0.848)	-(0.468)
10y Benchmark Yield	0.060**	0.077**	0.033
	(2.461)	(2.047)	(1.395)
Local Equity Return	0.003**	0.005**	0.000
	(2.256)	(2.093)	-(0.002)
Local Equity Volatility	-0.001	-0.001	0.000
	-(0.910)	-(0.621)	-(0.131)
Dummy excl. Q2 2012 - Q3 2014	-0.001**	-0.001*	-0.001***
	-(2.380)	-(1.891)	-(1.430)
R squared	0.502	0.506	0.105
SE of the regression	0.005	0.006	0.003
Observations	1216	768	448

To further investigate the impact of foreign central banks, separate regressions on the QE programs of the central banks are provided in Appendix 3. Panel A controls for Fed actions, Panel B for Bank of England and Panel C for Bank of Japan with the adjusted model. Results for the Fed program in Panel A confirm the findings by Duca et al. (2016) that the

flow effects of U.S. QE purchases are positive and highly significant in the case of developed European markets. It is also important to note that as we include the Fed QE into the regression, the coefficients for ECB asset purchase programs become insignificant. This would indicate that the U.S. QE was more important in determining the developments in the European corporate bond issuance. This is in line with the findings from previous research but it is also worth noting that the Fed program commenced several years before the ECB APP and with larger quantities, giving it more time to affect the corporate bond issuance. In Panel B, the purchase programs by the Bank of England do not seem to have a significant impact on the European markets although a more specific research would be necessary to draw further conclusions on the matter as the coefficients for the ECB program become insignificant. Actions by the Bank of Japan in Panel C indicate that the Japanese purchases are not related to the developments in Europe as the coefficients for ECB stock effect remain significant. This implies that the ECB QE programs impacted the European markets more than its Japanese counterparts.

5.3.4 The effect on average credit rating, maturity and yield

This last robustness check focuses on analyzing the characteristics of the debt issues that were observed during the sample period. For these tests we replace the dependent variable with individual regressions for average credit rating, average time to maturity and average coupon. The average coupon is chosen instead of yield since the credit rating and yield would measure the same characteristic i.e. the overall riskiness of the issue. One can argue that the coupon is an indicator of the yield which is noted but it might still provide more insight on the issue characteristics than merely investigating the yield would. These tests are to investigate how quantitative easing has impacted companies with differences in credit quality. Characteristics of these variables are illustrated in Figure 8. Results of the regressions are presented in Table 17.

Figure 8. Historical development of average coupon, credit rating and maturity. Coupon is measured as the average coupon of the issue and expected yield to maturity at issue, credit rating is the average rating as a percentage of the highest (AAA) rating and maturity is the years from issue to final repayment.

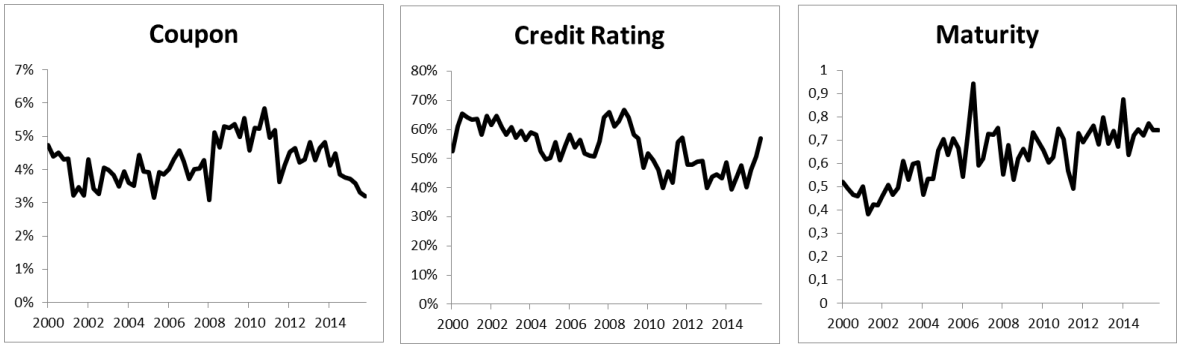


Table 17. QE effects on corporate bond issue characteristics. Coupon, credit rating and average maturity employed as a dependent variable with APP and Market factors as explanatory variables.

Dependent variable:	Coupon	Credit Rating	Maturity
Constant	0,018***	0,516***	0,756***
	(3,157)	(11,793)	(8,172)
ECB holdings in % of total debt (Stock)	0,095**	-0,786**	0,649
	(2,256)	-(2,465)	(0,962)
ECB purchases in % of total debt (Flow)	-0,234	2,289*	-0,507
	-(1,331)	(1,717)	-(0,180)
VIX	0,019**	0,322	-0,210
	(1,879)	(4,133)	-(1,274)
ECB Real Policy Rate	-0,242***	2,811***	-2,276
	-(2,144)	(3,291)	-(1,260)
10y Benchmark Yield	0,406***	-0,107***	-2,984
	(3,504)	-(0,122)	-(1,606)
R squared	0,329	0,707	0,452
SE of the regression	0,006	0,043	0,091
Observations	15499	15499	15499

Apparent from the panels yield and credit rating is that the ECB QE has both increased the amount of high coupon bonds and at the same time encouraged companies with lower credit rating to issue more debt. No significant effect is observed from QE on the average maturity although Figure 8 would suggest that the average maturity has increased after the financial crisis.

The finding that average coupon has increased and at the same time the average credit rating has decreased supports the theory that QE encourages distressed companies to issue more debt. In general one can say that the investors expect higher yield or coupon from companies that have lower credit ratings. We can thus confirm hypothesis four (H_4) stating that the ECB QE has encouraged companies with lower credit ratings to issue more debt in the capital markets. This is partly consistent with the findings of Duca et al. (2016) where they find that Fed QE was associated with lower credit rating and shorter average maturity. These tests on ratings, yield and maturity should be re–examined after the ECB QE has reached its maturity since at the time of writing this thesis it might still be too early to draw any further conclusions.

6. CONCLUSIONS

This thesis investigates the effect of ECB quantitative easing to corporate bond issuance by examining 19 European countries from 2000 to 2015. The study is conducted by examining quarterly issuance amounts in each country with a panel of controlling variables in fixed effect estimation setting. The main results of this thesis are then reviewed in a series of robustness checks with changing econometric techniques and alternative variables.

Previous researches have indicated that the quantitative easing should have two main transmission channels to corporate bond issuance: the impact of ECB holdings of total debt, called the stock effect and the impact of additional purchases, called the flow effect. This thesis finds evidence of the stock effect in the European corporate bond market especially in the developed markets. During the lifespan of the ECB quantitative easing, the stock effect has contributed an annual increase of 0.13% to the European corporate bond issuance measured in % of GDP. Study finds no evidence of the flow effect between the ECB purchases and corporate bond issuance in the European market.

Based on the results and previous literature conducted in the field of monetary policy spillovers, it can be concluded that the ECB QE has affected the financial conditions in the European corporate market. By increasing their holdings in the debt securities, the ECB has crowded out investors from government securities and forced them to replace these assets with corporate debt securities. This in turn has incentivized corporations to issue more debt to the market. This supports the "gap–filling" theory presented by Greenwood et al. (2010) that the corporate debt functions as a replacement for government securities purchased by the central banks. Intervention by the ECB especially in the latest APP commenced in March 2015 has accelerated investor portfolio rebalancing and leads to increased corporate bond issuance across Europe.

Additional findings in the robustness analysis suggest that as the European corporate debt market is still highly bank oriented and that the decrease in the supply of bank debt increases corporate debt issuance. This is consistent with the previous findings from the financial crisis when banks significantly decreased their lending, the corporations responded by entering the debt capital markets with increasing issuance. Although the importance of bond financing in European companies has become more important, the bank

debt still dominates which might also impact the results of this thesis as the responses to QE are not as apparent as they are in the more liquid U.S. market. Additional tests for the impact of foreign central banks QE programs to the European market confirms the previous researches results of strong influence of the Fed QE programs after the financial crisis.

Interesting results emerge when examining the characteristics of the bonds issued during the sample period. From 2000 until 2015 the average maturity has increased although not directly related to the QE as we find no direct relationship between them. But when the average yield and credit ratings of the issues is regressed with the QE variables we find that the asset purchases have both decreased the average credit rating and increased the average yield required. This indicates that the quantitative easing has encouraged companies with higher leverage to issue more debt to the capital markets as the demand for these securities has increased through the stock effects of QE. The rise in high-yield debt should concern also the central bankers responsible for the policies as the increased leverage might prove problematic in case issuing companies experience financial difficulties.

Results of this study also suggest that the latest ECB asset purchase program that commenced in March 2015 will likely have a larger impact on the corporate bond market. One drawback of this study was that the latest program by ECB was not mature enough to determine its full impact on the corporate bond issuance. In future research this analysis should be repeated since now it was possible to capture only the very early impact of this historically large APP by the European Central Bank. One explanation for the insignificant flow effect could be that the previous programs by the ECB have been much smaller and by repeating the study in later time might produce in different conclusions for the stock and flow effect. Second suggestion for future research is to focus with greater detail on sector specific increases in issuance. It would be valuable information to distinguish sectors that are more responsive to accommodative monetary policies. Thirdly, at the time of writing this thesis it is still unclear whether the ECB succeeds in its goal to create price stability and thus a comprehensive evaluation of the performance of the APP should be conducted once the program reaches its maturity.

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Appendix 1. Country specific equity market characteristics. Bloomberg (2016)

Country	Index	Coefficient	Mean	Std Dev	Min	Max
Germany	DAX Index	Return %	1,36	12,54	-36,82	32,87
		90 day Volatility	22,80	10,21	10,06	55,79
France	CAC Index	Return %	0,07	10,17	-28,75	20,86
		90 day Volatility	22,20	9,62	9,66	60,07
Italy	FTSEMIB Index	Return %	-0,57	10,81	-26,51	23,13
		90 day Volatility	22,78	10,01	7,74	57,14
Spain	IBEX Index	Return %	0,19	10,47	-21,43	25,24
		90 day Volatility	22,42	9,05	9,37	56,66
Netherlands	AEX Index	Return %	-0,01	10,79	-32,59	22,24
		90 day Volatility	21,16	11,15	8,82	63,45
Belgium	BELSTK Index	Return %	1,92	9,18	-24,12	21,45
		90 day Volatility	17,31	8,09	7,25	52,15
Luxembourg	LUXXX Index	Return %	0,51	12,66	-32,80	26,60
		90 day Volatility	19,31	8,33	9,83	57,31
Finland	OMXHP Index	Return %	-0,21	11,87	-30,44	20,76
		90 day Volatility	21,80	9,54	11,69	52,05
Austria	ATX Index	Return %	1,97	12,19	-36,74	25,67
		90 day Volatility	20,65	10,63	9,47	72,33
Portugal	PSI20 Index	Return %	-0,78	11,17	-25,01	24,37
		90 day Volatility	17,79	7,18	5,85	46,62
Ireland	ISEQ Index	Return %	1,03	11,88	-34,00	23,70
		90 day Volatility	20,29	9,91	8,38	63,91
Greece	ASE Index	Return %	-1,92	15,17	-37,58	31,21
		90 day Volatility	28,62	11,84	11,17	59,55
Czech Republic	PX Index	Return %	1,25	11,18	-28,76	28,82
		90 day Volatility	20,72	9,40	10,86	75,17
Slovakia	SKSM Index	Return %	2,64	11,08	-20,77	39,88
		90 day Volatility	19,07	6,29	7,96	34,61
Slovenia	SBITOP Index	Return %	1,06	11,23	-37,73	33,89
		90 day Volatility	13,90	6,74	6,65	46,72
Malta	MALTEX Index	Return %	0,69	9,75	-16,60	30,68
		90 day Volatility	10,88	4,35	5,39	30,82
Estonia	TALSE Index	Return %	3,71	15,10	-41,70	48,84
		90 day Volatility	16,53	7,18	6,49	39,99
Latvia	RIGSE Index	Return %	3,21	12,85	-29,88	35,16
		90 day Volatility	20,29	12,06	8,92	75,58
Lithuania	VILSE Index	Return %	3,70	16,40	-44,12	72,12
		90 day Volatility	14,89	7,53	5,89	48,33

Appendix 2. Table of different alterations of the benchmark model. Panel A provides the results, should the adjusted model have only removed VIX. Panel B for results of adjusted model with the year dummy and VIX.

Dependent variable:	Panel A: VIX removed			Panel B: Dummy & VIX included		
Corporate bond issuance in % of GDP	All	Developed	Frontier	All	Developed	Frontier
Constant	0.000	0.000	0.000	0.001	0.001	0.001
	(0.037)	(0.136)	-(0.192)	(1.048)	(0.815)	(0.999)
ECB holdings in % of total debt	0.033***	0.043***	0.015**	0.026***	0.037***	0.007
	(4.457)	(3.851)	(2.122)	(3.271)	(3.042)	(0.877)
ECB purchases in % of total debt	-0.048*	-0.071*	-0.004	-0.008	-0.038	0.049
	-(1.821)	-(1.801)	-(0.147)	-(0.249)	-(0.760)	(1.563)
ECB Real Policy Rate	-0.006	-0.009	-0.001	0.000	-0.001	0.003
	-(0.265)	-(0.268)	-(0.058)	-(0.018)	-(0.023)	(0.133)
10y Benchmark Yield	0.041*	0.058*	0.010	0.041*	0.051	0.018
	(1.922)	(1.826)	(0.500)	(1.908)	(1.551)	(0.897)
Local Equity Return	0.003**	0.004*	0.000	0.003**	0.005*	0.000
	(2.050)	(1.899)	-(0.097)	(2.537)	(2.255)	(0.052)
Local Equity Volatility	-0.002	-0.001	-0.001	-0.003	-0.004	0.000
	-(1.164)	-(0.651)	-(1.069)	-(1.603)	-(1.428)	-(0.312)
VIX				0.002	0.005	-0.001
				(0.993)	(1.288)	-(0.527)
Dummy excl. Q2 2012 - Q3 2014				-0.001**	-0.001**	-0.001***
				-(2.536)	-(1.682)	-(2.671)
R squared	0.500	0.504	0.091	0.502	0.507	0.105
SE of the regression	0.005	0.006	0.003	0.005	0.006	0.003
Observations	1216	768	448	1216	768	448
Countries	19	12	7	19	12	7

Appendix 3. Actions of foreign central banks in separate regressions. . Statistical significance of the explanatory variable indicated with an asterix: * 10%, ** 5% and ***1% level of confidence

	Panel A: ECB & Fed			Panel B: ECB & BoE			Panel C: ECB & BoJ		
Dependent variable: Issuance in % of GDP	All	Developed	Frontier	All	Developed	Frontier	All	Developed	Frontier
Constant	0,003***	0,004***	0,001	0,000	0,000	0,000	0,000	0,000	-0,001
	(2,783)	(2,735)	(0,511)	-(0,153)	-(0,118)	-(0,205)	-(0,090)	(0,011)	-(0,498)
ECB holdings in % of total debt - Stock	0,015	0,025	-0,003	0,006	0,012	-0,009	0,025***	0,034***	0,007
	(1,243)	(1,356)	-(0,222)	(0,437)	(0,577)	-(0,697)	(3,189)	(2,835)	(0,880)
ECB purchases in % of total debt - Flow	0,025	0,011	0,051	0,031	0,017	0,070**	-0,008	-0,030	0,032
	(0,852)	(0,245)	(1,599)	(0,928)	(0,317)	(2,172)	-(0,251)	-(0,607)	(1,058)
ECB Real Policy Rate	0,011	0,017	-0,002	-0,019	-0,025	-0,013	-0,013	-0,016	-0,011
	(0,567)	(0,590)	-(0,108)	-(0,868)	-(0,725)	-(0,603)	-(0,579)	-(0,462)	-(0,512)
10y Benchmark Yield	0,022	0,020	0,023	0,075***	0,097**	0,040	0,063**	0,080**	0,035
	(1,125)	(0,657)	(1,061)	(3,049)	(2,539)	(1,685)	(2,561)	(2,126)	(1,492)
Local Equity Return	0,002	0,002	0,000	0,003***	0,006**	0,000	0,003**	0,005**	0,000**
	(1,450)	(0,824)	(0,398)	(2,759)	(2,430)	(0,464)	(2,315)	(2,122)	-(0,051)
Local Equity Volatility	-0,003**	-0,004*	-0,001	-0,001	-0,001	0,000	-0,001	-0,001	0,000
	-(1,976)	-(1,726)	-(0,549)	-(0,689)	-(0,287)	-(0,273)	-(0,747)	-(0,373)	-(0,316)
Dummy excl. Q2 2012 - Q3 2014	-0,002***	-0,002***	-0,001**	-0,001**	-0,001	-0,001*	-0,001**	-0,001	-0,001
	-(3,548)	-(2,773)	-(2,207)	-(1,759)	-(1,147)	-(1,863)	-(2,330)	-(1,563)	-(2,239)
Federal Reserve - Stock	0,001	-0,002	0,007						
	(0,198)	-(0,201)	(0,992)						
Federal Reserve - Flow	0,002***	0,003***	0,000						
	(4,490)	(4,671)	-(0,230)						
Bank of England - Stock				0,010	0,012	0,009			
				(1,555)	(1,142)	(1,397)			
Bank of England - Flow				-0,002	-0,002	-0,001			
				-(1,632)	-(1,301)	-(1,480)			
Bank of Japan - Stock							0,004	0,004	0,005
							(1,201)	(0,799)	(1,526)
Bank of Japan - Flow							-0,001	-0,001	0,000
							-(0,237)	-(0,174)	(0,128)
R squared	0,507	0,516	0,107	0,504	0,507	0,112	0,503	0,506	0,110
SE of the regression	0,005	0,006	0,003	0,005	0,006	0,003	0,005	0,006	0,003
Observations	1216	768	448	1216	768	448	1216	768	448
Countries	19	12	7	19	12	7	19	12	7