STOCKHOLM SCHOOL OF ECONOMICS
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Corporate bond spreads as a proxy for external finance premium: Differentiating between bonds issued by financial institutions and bonds issued by non-financial corporations

Abstract
The objective of this paper is to study the financial accelerator mechanism by investigating the suitability of corporate bond spreads as a proxy for external finance premium. In particular, the aim is to theoretically and empirically analyze differences in predictive power over short-term real economic activity between two types of corporate bond spreads: corporate bonds issued by financial institutions and bonds issued by non-financial corporations. The topic is motivated by the ongoing debate over monetary policy measures and their effectiveness in stabilizing business cycle fluctuations and by the need for more academic research in this field. The theory of financial accelerator mechanism is first studied and an empirical investigation is then conducted on data from the euro area. The results indicate that while the spreads of corporate bonds issued by non-financial corporations possess leading indicator properties, the spreads of bonds issued by financial institutions do not contain predictive power over the short-term GDP growth. In the past research conducted on the financial accelerator, corporate bonds issued by financial institutions and those issued by non-financial corporations have not been systematically differentiated. This study suggests that a differentiation is needed since it is both theoretically grounded and supported by empirical evidence.

Keywords: External finance premium, financial accelerator mechanism, corporate bond spread, financial institution, the euro area

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1. Introduction

During the recent economic crisis, credit conditions of financial institutions and non-financial corporations gained much interest globally. On May 10th 2010 the Governing Council of the European Central Bank (ECB) decided to conduct interventions in the euro area public and private debt securities markets, under a Securities Markets Programme. The objective of the programme was to address the malfunctioning of securities markets and to restore an appropriate monetary policy transmission mechanism. The President of the ECB, Jean-Claude Trichet, underlined that "the challenge remains for banks to expand the availability of credit to the non-financial sector".[1]

A well-functioning financial system allocates resources effectively and is essential for achieving economic growth. Among others, Jermann and Quadrini (2009) suggest that the declining output growth in 1990-91 and in 2008-09 cannot be explained by standard productivity shocks alone, but that these downturns were strongly influenced by changes in credit conditions. The relationship between the credit market conditions and real economic activity was first formalized by Bernanke, Gertler and Gilchrist (1996, 1999) in their theory of financial accelerator, an important part of the monetary policy transmission mechanism. According to the theory of financial accelerator, adverse shocks to the economy might be amplified - or *accelerated* - by worsening credit market conditions. The original theory does not differentiate between credit received by a firm in the form of bank loan and credit in the form of lending through credit markets. However, much of the empirical testing of the theory has been conducted with credit market lending with one reason for this being data availability.[2] Particularly, a number of researchers have investigated the financial accelerator mechanism by using corporate bond spreads[3] as a proxy for credit market conditions.

When testing the relationship between corporate bond spreads and future output developments – typically the GDP growth or level of investments – evidence has been presented in favour of the existence of the financial accelerator mechanism. Corporate bond spreads have been shown to possess some leading indicator properties over future real activity under certain conditions. However, the evidence on what kind of spreads perform best in prediction is mixed. In the search of better macroeconomic forecasting models that incorporate the financial accelerator mechanism, studies have been conducted to analyze the leading indicator properties of bonds[4] with different maturities, rating classes and issued by firms active in different sectors. The most recent of these studies will be presented in Chapter 3. While extending the knowledge on the workings of the mechanism, these investigations have not yielded a consensus on what types of bond spreads best suit for forecasting.

The purpose of this paper is to add to the existing knowledge on the links between credit market conditions and real economy developments in general, by investigating the financial accelerator mechanism in particular. This study concentrates on describing the fundamental differences between corporate bonds issued by financial institutions and corporate bonds issued by non-financial corporations, and examines whether these differences have implications for the empirical testing of the financial accelerator framework. By highlighting an aspect that has not been fully addressed, I hope to contribute to the field of research.

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[1] These statements were made in the ECB Monthly Bulletin on May 13th 2010.
[2] Loan conditions are often private information while credit market movements are publicly observable.
[3] A spread is typically calculated as the difference between a corporate bond index yield and a proxy for a risk-free interest rate with the same maturity. Section 2.2 provides a more detailed discussion on spreads.
[4] Even if several types of bonds exist, in this paper the word "bond" refers to a corporate bond when not specified otherwise.

The aspect that I wish to shed light is that corporate bonds are issued both by financial institutions (hereafter denoted as "financials") [5] and by non-financial corporations (hereafter denoted as "non-financials"). When testing for the financial accelerator, previous researchers have not in a systematic manner differentiated between these two types of issuers. Instead, indices that include bonds issued by financial institutions and bonds issued by non-financial corporations have been used as a proxy for the credit conditions. Keeping in mind the original theory and due to reasons that follow, I find this approach problematic.

In the corporate bond market the key investors are institutional investors.[6] These include among others banks, insurance companies, and other financial intermediaries. While financial institutions finance themselves partly through issuing bonds, they also act as investors buying corporate bonds issued by non-financials and by other financials. On top of this dual role – issuing bonds for own financing purposes and simultaneously being a bond investor – some financial institutions act as bond market intermediaries[7]. Thus, financials have several roles in the bond markets with some of them being simultaneously issuers, investors and intermediaries. This is an important difference to non-financial corporations which are active on the bond markets in mainly one role: simply issuing bonds as a mean of accessing credit.

When formalizing the theory, Bernanke, Gertler and Gilchrist (1999) (hereafter BGG) differentiated between lenders and borrowers. In their model, households work, consume and invest their savings in a financial intermediary. The financial intermediary pools savings and lends to companies which produce in competitive markets using labour and capital. Capital is financed from retained internal funds or from external borrowing. Retailers purchase production and then differentiate goods and sell in monopolistically competitive markets. This permits price stickiness and provides a role for monetary authority to stabilize inflation. This model allows for investigating the real effects on non-financial corporations if their cost of credit due to some reason suddenly increases.

When one seeks to empirically test the functioning of this theory, using data that includes corporate bond spreads that are issued by financial institutions as a proxy for credit conditions is - in my view - not fully in line with the reasoning of the original theory. This is due to that financials might simultaneously have lender, borrower and intermediary roles while non-financial corporations are borrowers. Since financials might be a source, a catalyst, an intermediary and an object of the financial accelerator mechanism, the corporate bond spreads of financials might not be a suitable proxy for the credit conditions of an economy within the BGG-framework. As far as the author is aware of, this aspect has not been systematically counted for in the empirical investigation that has been conducted on the financial accelerator mechanism.

Grounding my investigation on some fundamental differences between financial institutions and non-financial corporations acting on the bond markets, I aim to analyze the implications when testing for the financial accelerator mechanism in the euro area[8]. To my knowledge, no comparison has been conducted between the short-term predictive power of financial bonds and the predictive power of non-financial bonds. Hereby my intention is to contribute to the

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[5] In this study, financial institutions are considered to include banks, financial service providers and insurance companies.

[6] According to an educational, non-commercial website about bonds, www.investinginbondseurope.org.

[7] E.g. as underwriters or as broker-dealers.

[8] The euro area currently consists of 16 Member States: Belgium, Germany, Ireland, Greece, Spain, France, Italy, Cyprus, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Finland and Slovakia.

field of research by analyzing the differences between financial and non-financial corporate bonds within the framework of financial accelerator theory. Moreover, I aim to examine if the forecasting accuracy can be improved when systematically excluding bonds issued by financial institutions, compared to using a total index that includes both financial and non-financial bonds[9]. This study thus investigates the following three hypotheses;

H1: The financial accelerator mechanism is **present** on a composite of corporate bonds issued by non-financial corporations and is **not present** on a composite of corporate bonds issued by financial institutions. [10]

H2: The financial accelerator mechanism is **more evident**[11] on a composite of non-financial corporate bonds than on a total index that includes both financial and non-financial corporate bonds.

H3: The composite of non-financial corporate bond spreads **better predicts future output**[12] development than the total index spreads.

The detailed criteria for accepting hypotheses H1 and H2 is presented in Section 5.2, and for H3 in Section 5.3. The analysis is conducted on investments grade corporate bonds that are denominated in euro. I compare the predictive power of the three types of spreads - financials, non-financials, and total index including both of the before mentioned - over the euro area GDP growth. The data covers the time from the introduction of the euro to the current date.

This study is motivated by active discussion both among practitioners and among researchers on the links between credit conditions and real economy developments. The various transmission mechanisms involved - one of them being the financial accelerator mechanism - have been and continue to be analyzed, and no consensus regarding their exact forms and magnitudes exists. Yet, the importance of better understanding these links has been acknowledged; recently also by the Chairman of the Federal Reserve, Ben Bernanke. In a testimony regarding economic outlook, he underlined that the Fed has stepped up information gathering to better understand factors that may be inhibiting bank lending while also obtaining additional information on small business credit conditions.[13]

The remaining of this paper is organized as follows. In the next chapter, the theory of financial accelerator is familiarized focusing on the components that are of most relevance for this study. In Chapter 3, some of the more recent empirical evidence is presented. Chapter 4 introduces the data set and the variables that are investigated in the quantitative part of this study. Chapter 5 describes the methodology and some relevant econometric adjustments. The empirical results are analyzed in Chapter 6, followed by a critical discussion and ideas for future research in Chapter 7. Finally, Chapter 8 offers some conclusions. Throughout the paper, an inquisitive reader is referred to the appendices for supplementary data.

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[9] In this paper, the wording "total index" refers to an index that includes both financial and non-financial corporate bonds. On the contrary, the words "index" or "composite" without further specification refer to any combination of corporate bonds that have been indexed (e.g. financials, non-financials or the total index).

[10] For the financial accelerator to be deemed as present, the coefficients are required to be negative and significantly different from zero on ten-percentage level. If these requirements are not fulfilled, the financial accelerator is deemed not to be present.

[11] For H2 to be accepted, the coefficients of non-financials need to show stronger significance levels and better model-goodness-of-fit than the coefficients of the total index.

[12] For H3 to be accepted, the non-financials are required to provide the lowest prediction error.

[13]These remarks were made in a hearing about economic outlook before the Joint Economic Committee, U.S. Congress, in Washington, D.C. on April 14th, 2010.

2. Theoretical framework

The aim of this chapter is to provide a theoretical framework to the empirical research by introducing the theory of the financial accelerator and its essential components. First, the cornerstones of the theory are presented. Then, the concept of external finance premium is studied and corporate bond spreads as potential proxies for credit conditions are discussed. Finally, differences in the risk spreads of financial institutions and risk spreads of on non-financial corporations are examined as applicable for this study.

2.1. The theory of financial accelerator – How small events lead to big output losses

This section 2.1 is based as a whole on Bernanke, Gertler and Gilchrist (1999) when no other reference is given.

A transmission mechanism where adverse shocks to the economy are amplified by worsening credit-market conditions is called the financial accelerator mechanism. A core component of the theory is called e*xternal finance premium* (hereafter EFP) which is the difference between the cost of external finance and the opportunity cost of internal funds. The EFP exists since a firm is always better informed about its own ability to repay commitments in the future than what a lender who provides funding for the firms is. This information asymmetry about the credit risk between the borrower and the lender is a violation to one of the perfect capital market assumptions formalized by Modigliani and Miller (1958).

In the original BGG framework, borrowers are small non-financial firms and lenders are financial intermediaries. An entrepreneur seeks to finance a project and the information asymmetry leads the firm to treat internal funds, e.g. retained earnings, as the cheapest form of financing. If forced to use external finance, the firm prefers debt to outside equity which is the most expensive form of financing. These capital structure preferences are in line with the "pecking-order" theory of corporate finance by Myers (1984). One question that arises is whether the BGG theory is restricted to only model small firms. Since in large, public firms managers and directors typically exercise considerable discretion over a firm's retained earnings,[14] the retained earnings can be treated as internal financing. Thus, the framework accommodates also larger firms.

The external finance premium arises from asymmetric information and varies over time and across firms. In particular, it depends inversely on the financial robustness of the firm, also denoted as firm net worth. For a firm with high gearing the EFP is higher, while a firm with low gearing and mainly internal funding can access external financing with a lower premium. As borrower's net worth is generally pro-cyclical (because of the pro-cyclicality of profits and asset prices, among other factors), the external finance premium will be countercyclical. This mechanism amplifies changes in credit availability and affects investment and production. The financial accelerator mechanism thus implies that an increase in the EFP affects a firm's financing possibilities and thus its output and investment levels, which causes the EFP to rise even more as the net worth sinks. This feedback loop mechanism accelerates the magnitude of an original shock and causes further declines in the output. Consequently, small events can lead to big losses in output.

Since asymmetric information is the driving force behind the mechanism, the theory predicts a differential effect of an economic downturn on borrowers who are subject to severe agency

[14] Alternatively over the retained earnings above some required dividend level.

problems on the credit markets and borrowers who do not face serious agency problems. The difference arises because declines of net worth in downturns raise agency costs of lending – the EFP – for the former but not for the latter. Thus, if the financial accelerator is operative, at the onset of a downturn, there should be a decline in the credit flowing to those borrowers more subject to agency costs. This effect is called the "flight to quality". Furthermore, since EFP arises essentially from uncertainty, the financial accelerator mechanism should be amplified during turbulent times.

Hall and Wetherilt (2002) point out that a considerable advantage of the BGG model is its ability to quantitatively model interactions between capital market imperfections and monetary policy in a sticky-price economic environment. A drawback, however, is that financial institutions are only sparsely modeled. According to the theory, the EFP depends on the strength of the balance sheet of borrowers. Potential effects arising from changes in lending policies of financial intermediaries are not modeled.

To conclude, within the BGG framework the EFP of a firm depends on the severity of its agency problem. For all firms, an increase in the EFP is likely to decrease the future output of the firm. When one aggregates this mechanism from one firm to the whole economy level, it appears possible that changes in the average EFP of the economy may contain some leading information over real economy output developments. These possible predictive capabilities of the EFP have gained some attention when aiming at forecasting macroeconomic developments. Since the actual EFP of an economy is unobservable, researchers have sought for a suitable proxy for it.

2.2. External finance premium and corporate bond spreads as a proxy

There are several generic approaches to the features of the asymmetric information problem that lead to the external finance premium. Hall and Wetherilt (2002) summarize some of the most common sources of this principal-agent dilemma. Firstly, the fact that lenders cannot ex ante observe the quality of investment projects might lead to adverse selection. Secondly, as lenders cannot perfectly monitor the use of borrowed funds there is a risk of moral hazard. Contrary to the wishes of lenders, some borrowers may have an incentive to engage in riskier projects that raise the probability of default. Thirdly, costly state verification exists since lenders must pay a monitoring cost to verify the outcome of borrowers' investment projects and borrowers have an incentive to under-report project outcomes. All of these characteristics result in that lenders face agency costs when supplying funds to borrowers. Consequently, a rational lender is only willing to provide capital if the lender is compensated for the uncertainty and agency costs by the external finance premium.

In the economy, external debt financing can be obtained by raising funds through a loan or by issuing corporate bonds in capital markets. While bonds and loans differ in many ways[15] the main difference is the transferability of the claim: loans are usually private transactions originated by banks and held to maturity, while bonds are public and tradable securities. Even if loan conditions may be used as a proxy for the EFP, this study follows the line of research that has concentrated on credit market lending[16]. A commonly used proxy for the EFP has been the difference between a corporate bond yield and some risk-free benchmark rate with

[15] Including accounting rules, structure and investors.

[16] In this paper, credit market is used as a synonym to bond market and capital market, and refers to the publicly traded market for corporate bonds.

the same maturity. This is often referred to as a spread[17], or risk premium. Berndt and Obreja (2007) point out that the spread of a corporate bond represents compensation for bearing a risk embedded in an asset whose payoffs are contingent on whether a given firm defaults in a certain period of time. From a traditional asset pricing perspective, risk premium is the expected return on a defaultable corporate bond in excess of the risk-free rate. In other words, a spread of a particular corporate bond should compensate for the probability of default multiplied by the cost that occurs for the bond holder in case of a default. Given that credit spreads compensate for the uncertainty about the credit risk - even if they need not be driven by the exact same factors as the external finance premium itself[18]-, they have been deemed to be useful proxy for the EFP. However, all types of corporate bond spreads might not work equally well as a proxy and a carefully selection regarding which types of corporate bond spreads to use appears motivated.

2.3. Lenders and borrowers – And too-big-to-fail

In the BGG framework, the borrowers are non-financial firms while financial intermediaries pool savings from households. In reality, financial institutions borrow the funds they invest and do so to a large extent through capital markets. This section discusses features that are particular to financial institutions and affect their external finance premium. The emphasis lies on describing characteristics that are relevant to this study[19] as this section describes the factors that motivate the empirical research.

In financial markets, those who have a surplus of funds lend to those who have a shortage. A large variety of financial institutions exists revealing the complex requirements of both borrowers and lenders. As has been pointed out, many financial institutions – such as banks and insurance companies – finance themselves partly through external financing. Jimenez et al. (2009) underline that there are two types of agency problems that are involved simultaneously: agency problems between firms and lenders and between the lenders and their financiers. Bank net worth may thus determine the bank’s own agency cost of borrowing, since banks do not only face agency problems with their borrowers (firms), but banks themselves are also self borrowing funds from their depositors and other financiers. Moreover, these two agency problems are interconnected, and lower bank capital has an ambiguous effect on loan supply (Holmstrom and Tirole, 1997, and Diamond and Rajan, 2000).

The original BGG framework concentrates on only one of these agency problems – between financial intermediaries as lenders and non-financial firms as borrowers. Hence, when testing for the functioning of the mechanism in an economy and looking for a real world proxy for the EFP, systematic differentiation between borrowers and lenders would appear consistent with the theoretical foundations. However, corporate bonds are issued by both non-financial corporations and financial institutions and often no differentiation between these has been made when using bond spreads as a proxy for the EFP. This procedure seems not to be fully in line with the original theory. Additionally, further arguments that follow demonstrate the unsuitability of spreads of bonds issued by financial institutions as a proxy for the EFP.

Financial institutions thus have a dual role and fall in the BGG framework to both categories: borrowers and lenders. This dual role has implications for the external finance premium and

[17] Also referred to as default spread or risk spread.
[18] Credit spreads have been shown to respond also to changes in liquidity risk, not only to credit risk (see, for example, Acharya et al., 2010).
[19] The intention is not to fully cover all aspects.

makes it to differ from that of non-financial corporations. Suppose, for example, that future real economy risks have risen due to some negative shock. In the role of lenders, financial institutions will now require higher risk spreads from non-financial firms in order to compensate for the increased uncertainty. However, the external finance premium paid by financial institutions to their financier should not necessary rise. This is due to that the future cash flows of the financial institutions are essentially unchanged: the default risks of non-financial firms have increased but so has the expected return thanks to the higher required risk spreads. Thus, the dual role of financial institutions implies that the EFP of them may respond differently to an economic shock than that of firms that only have a borrower role.

Another difference between financial institutions and non-financial corporations stems from an indirect state guarantee. Suppose that a financial institution is so relevant for the economic system that it is indirectly guaranteed by a state or collectively by a currency union. In this case, whenever an institution comes close to a default, it will be bailed out.[20] This type of „too-big-to-fail“-issue has been actively discussed. Ben Bernanke denoted in a speech that if the recent crisis has a single lesson, it is that the too-big-to-fail problem must be solved.[21] In the midst of the crisis, providing support to a too-big-to-fail institution might represent the best of bad alternatives; without such support there could be substantial damage to the economy. However, the existence of too-big-to-fail firms creates several problems in the long run, among others a severe moral hazard. If creditors believe that an institution will not be allowed to fail, they will not demand as much compensation for risks as they otherwise would, which weakens market discipline. Nor will they invest as many resources in monitoring the firm's risk-taking. The risk spread of a corporate bond issued by this type of financial institution does not reflect the same dynamic as a risk spread of a bond issued by a company that does not have this indirect bail-out guarantee. If a financial institution has no real risk of default, asymmetric information about the credit risk does not matter for a bond investors and no principal-agent problem in the BGG-fashion exists.

It can be concluded that there are several arguments for differentiating between bonds issued by financial institutions and bonds issued by non-financial corporations when aiming at empirically testing the financial accelerator mechanism. The dual role of financial institutions acting as both lenders and borrowers is one particular characteristic. The indirect state guarantee that some of these institutions have is another very special feature. While the former characteristic might have an effect on the spreads of financials that is less obvious, the latter is likely to cause an inflow of capital in case of a shock, consistent with the "flight to quality" dynamic. Consequently, the EFP of financial institutions in likely to be relatively stable and less related to business cycle that that of non-financial corporations. It appears reasonable to count for these factors when looking for a proxy for the external financial premium. Using exclusively spreads of corporate bonds issued by non-financial firms could thus be a more suitable proxy for the external finance premium of firms arising from the agency problem between firms and lenders. Consequently, non-financial spreads could also better predict future output developments.

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[20] Even if failures and rescues of big financial institutions are hardly anything new, there are several recent examples. To name a few, in the U.S. the Fed provided USD 25 billion to an investment bank Bear Sterns in March 2008 to avoid bankruptcy and an insurance company American International Group (AIG) was nationalized in September 2008. In the same year in Europe, the UK government took equity stakes in Royal Bank of Scotland, Lloyds TSB and Halifax/Bank of Scotland, the Swiss government rescued UBS and BayernLB was bailed out by the German taxpayers.

[21] This commentary was made in a testimony about the Causes of the Recent Financial and Economic Crisis, September 2[nd] 2010.

3. Previous research

This chapter gives a comprised overview of recent empirical investigations of the financial accelerator mechanism by briefly summarizing their approaches and the main results found. The aim is to discuss to which degree the theory has been validated by empirical evidence. Moreover, a gap in the research is pointed out followed by a description of how this study intends to contribute by addressing this issue.

Support has been presented in favour of that the financial accelerator can, indeed, be detected in the U.S. (see among others Mueller, 2009, Mody and Taylor, 2004, and Gertler and Lown, 2000) and in the euro area (Buchmann, 2010, and De Bondt, 2004). Even if the evidence on the actual performance of spreads as a predictor of GDP is scarce, composites of corporate bond spreads that reach across different sectors, ratings and maturities have been found to contain some leading indicator properties. Some evidence also suggests that the financial accelerator is stronger in times of turbulence compared to periods of stable economic developments (Gilchrist, Yankow, Zakrajsek, 2009, and Mueller, 2009).

In order to improve the forecasting accuracy, effort has been put to find out whether bonds with a particular maturity or credit rating perform better than others. The types of spreads, lag lengths and statistical models that best suit for predictive purposes remain, however, highly ambiguous. Regarding the suitable rating classes, Mueller (2009), Gilchrist, Yankow and Zakrajsek (2009) and Chan-Lau and Ivaschenko (2001) favour investment grade[22] bonds in prediction in the U.S while Mody and Taylor (2004) and Gertler and Löwn (2000) find long-term high-yield[23] bonds to contain predictive power. In Europe, most of the evidence speaks in favour of using investment grade bonds (Buchmann, 2010, and De Bondt 2004).

Bentsson and Sellberg (2010) test predictive content in spreads of corporate bonds issued by companies active on six different sectors: Consumer goods and services, Basic materials, Industrials, Commodities, Technology and Financials. They find some differences between the strength of the accelerator on the different sectors with Industrials and Consumer goods and services containing the strongest predictive content and Financials the weakest predictive content in most of the forecast horizons. The authors do not, however, offer any theoretical reasoning about why some sectors might contain more or less leading indicator properties than others. When Gilchrist, Yankow and Zakrajsek (2009) test the financial accelerator on non-financial corporate bonds and find that those with intermediate risks contain predictive power over future output development in the U.S, no arguments are presented on why only non-financials are tested. Buchmann (2010), on the contrary, includes spreads from utilities sector, industrials and financials but provides no reasoning for this selection. Furthermore, Mueller (2009) tests several different indices with different ratings and some of the indices include and some of them exclude bonds issued by financials in a rather unsystematic manner.

To summarize, on one hand financials have often been included when looking for a proxy for the EFP and these various composites have been shown to have some leading indicator properties (Buchmann, 2010 and Mueller, 2009, De Bondt, 2004, and Chan-Lau and Ivaschenko, 2001). On the other hand, recent evidence suggests that financials show poor leading indicator properties compared to single sectors such as Industrials (Bengtsson and

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[22] Investment grade rating indicates that a bond has a relatively low risk of default, compared to high yield bonds. Investment grade bonds carry a rating at or above 'BBB' (Standard & Poor’s), and at or above 'Baa' (Moody's). For more information, see www.standardandpoors.com or www.moodys.com.

[23] Bond with a lower credit rating than investment grade bond. Because of the higher risk of default, these bonds pay a higher expected yield. High-yield bonds carry a rating below 'BBB' (S&P), and below 'Baa' (Moody's).

Sellberg, 2010). Moreover, also an index comprising of only non-financials has been shown to contain some leading information about future output developments (Gilchrist,Yankow and Zakrajsek, 2009). Clearly, there has been no systematic differentiation between non-financials and financials when investigating empirically the financial accelerator mechanism. Moreover, the strength of the leading indicator properties of spreads when including respectively excluding financials has not been compared. The question that arises when reviewing the empirical evidence is:

What is the role of corporate bonds issued by financial institutions within the empirical investigation of the financial accelerator mechanism?

Given the theoretical arguments presented earlier in this paper and looking at the research that has been conducted previously, it appears reasonable to investigate whether a differentiation between these two types of spreads has empirical implications. As the risk spreads of financials have been argued to behave considerably differently than those of non-financials, and as the risk spreads of non-financials seem theoretically better proxies for the EFP in the economy, it appears appealing to construct a more suitable composite of corporate bonds that accounts for these arguments. Following the logic of Chatfield (2004), there is always tension in seeking a parsimonious model while ensuring that important effects are not mistakenly omitted from the model. A composite that would include non-financials and exclude financials could outperform a total investment grade index by disregarding bonds with no predictive content. Simultaneously, the composite should contain more leading indicator information than a single sector index by combining the sectors that have been shown to have some predictive power. Moreover, while changes in the sector spreads would intuitively affect the output of that particular sector, it appears hard to formulate economic reasoning for why some business sectors should contain more information about the economy-wide GDP development than others. Non-financials could collectively act as a reasonable proxy for the EFP of the total economy. In conclusion, several arguments and empirical support speak in favour of that the financial accelerator could be more evident on a non-financial composite than on a total index.

So far in this paper, some theoretical and empirical motivations have been presented in favour of examining whether systematically differentiating between financial and non-financials can yield a better forecasting accuracy within the framework of financial accelerator theory. The importance of investigating this is underlined by the magnitude of financial institutions as bond issuers. According to Markit iBoxx database[24], in the euro denominated corporate bond market there are 561 bonds issued by financials and 715 bonds issued by non-financials[25]. Moreover, bonds issued by financials account for 47% of the total index value, while non-financial bonds account for 53% of the value. The non-financials index covers a variety of different sectors[26]. In the financials index, the clear majority are banks (440 of the 561 bonds and 82% of the total value of the financial index.) even if bonds issued by insurance companies (69 bonds, 10%) and financial service providers (52 bonds, 8%) are also included.[27]

[24] The Markit iBoxx index family is published by International Index Company Limited. Prices for all bonds in the indices are provided by ten major financial institutions. Deutsche Börse calculates and disseminates the indices. Rebalancing is done monthly and weighting is based on market capitalization.

[25] As of October 15th, 2010.

[26] Appendix A provides more information about the sectors.

[27] As of October 15th, 2010.

To the knowledge of the author, this is the first study that compares the leading indicator properties of non-financial corporate bond spreads to the leading indicator properties of an index consisting of both financial and non-financials corporate bond spreads. The purpose of the study is to test the three hypotheses presented earlier in order to analyze whether a composite that only includes non-financial corporate bond spreads can outperform a total index that includes both financial and non-financials, when predicting the output development in the euro area.

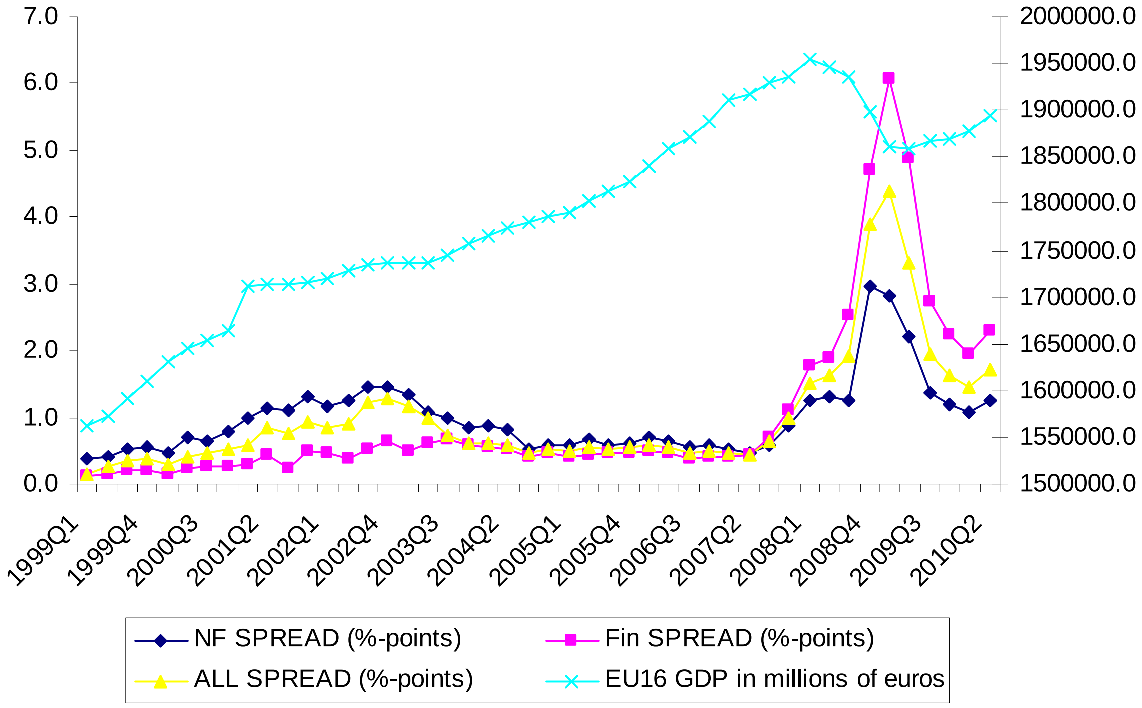
4. Data and variables

This section describes the data set and the variables used in the hypothesis testing. For an overview of all of the included variables, their forms in the regressions as well as the data sources, please see Appendix A.

4.1. Data set

The data examined in this study reaches from the introduction of the euro as an accounting currency in 1.1.1999 to the current date. The graph below shows the dependent variable being the euro area GDP in millions of euros, and the three main explanatory variables being the three types of corporate bond spreads: financials (hereafter denoted by *FIN*), non-financials (hereafter denoted by *NF*), and a combination of both of the before mentioned (hereafter denoted by *ALL*). The spreads are presented in percentage points.

Graph 4.1: Euro area GDP and Corporate Bonds Spreads



Each of the plotted variables show significant irregularities during the latest years. This is apparently due to the economic crisis that hit the world economy in 2008. Considering the length of the data set, this period of extreme values implies a structural break. Structural break possibly leads to extreme outliers and large amounts of noise, and might cause difficulties in interpreting the regression results. Moreover, beyond a certain point the widening in bond spreads may cease to be a reliable linear indicator of future real activity.[28] Hence, I choose to first exclude the crisis when conducting the analysis. Since a recession is typically defined as two consecutive quarters of GDP decline, the crisis is considered to start in the euro area during the second quarter of 2008 and the last quarter to be included in the analysis excluding the crisis is the first quarter of 2008. Later, the crisis is included to test for the predictive power in more turbulent economic conditions and for the model robustness.

[28] This remark was made in an OECD Economic Outlook Report, December 2008.

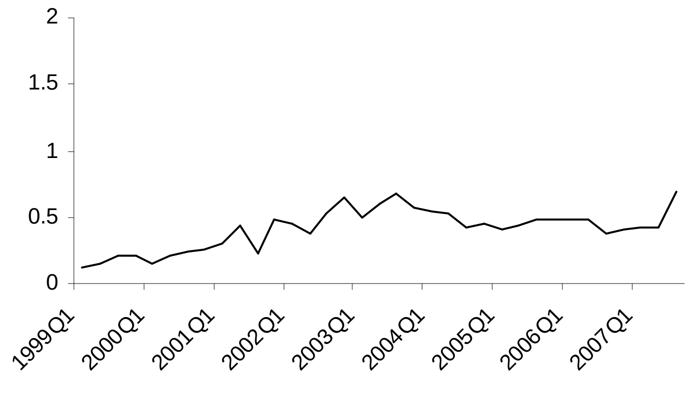
4.2. Explanatory variables

The purpose of the regression analysis is to investigate the leading indicator properties of the different types of spreads – *FIN, NF* and *ALL* – over the future GDP development. These are the three investigated explanatory variables. The corporate bond spread for each of these composites is calculated as the difference between a corporate bond yield index and a benchmark interest rate, both with the same maturity. First, the index yields and maturities of these three different corporate bond composites are extracted from the Markit iBoxx database. Then, an interpolation is conducted in order to match the maturities of the indices and of a corresponding proxy for the risk-free rate. Finally, the spread is calculated as the difference between the yield and the risk-free rate with the same maturity. This procedure results in three time series of spreads, one for *FIN*, one for *NF* and one for *ALL*, each of them on a daily frequency. Since the GDP is reported quarterly, the time series for the spreads are converted to a quarterly frequency by taking period averages.[29]

There are two commonly used alternatives for the proxy of the risk-free rate: yields on the government bonds and swap rates. The euro swap rate is chosen due to the following reasoning. On one hand, the government bond market sometimes experiences low liquidity leading to that government bond yields do not represent the true interest rates at all times (Fleming, 2000, 2001). Moreover, financial institutions must purchase a certain amount of government bonds in order to cope with regulations, which increases the prices of these instruments and drives the yield down (Hull, 2009). Additionally, in the government bond market there are regulation rigidities which might affect the pricing and thus bias the yields (Fabozzi, 2010). Finally, it is a market practise to quote bonds that are denominated in euro and issued by investment grade borrowers in terms of a spread over the swap curve. This speaks for that the market participants that are active in the European credit markets consider the swap curve to be the risk-free benchmark interest rate.[30]

Below, the three explanatory variables are plotted against the time, excluding the financial crisis. In line with the arguments presented earlier, FIN shows lower levels and more stability than NF. ALL appears to follow roughly an average pattern between FIN and NF which is only reasonable given that it is the aggregate of the two.

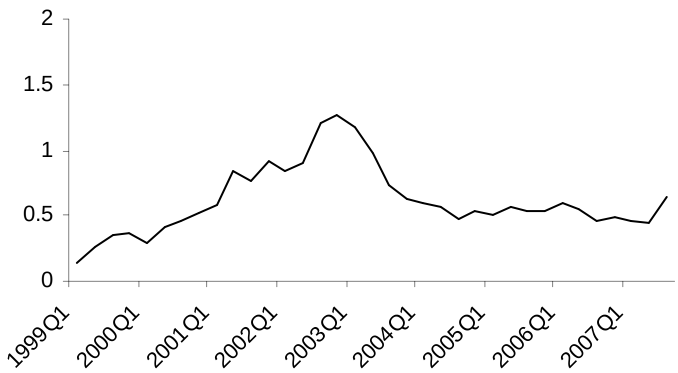
Graph 4.2a: Spreads of corporate bonds issued by financial institutions (in percentage points)



[29] This is a common procedure to avoid daily irregularities that might have an impact if spot data at the end of each quarter would be used instead.
[30] Furthermore, many countries use the swap curve rather than their government bond yield curve as their benchmark interest rate (Fabozzi, 2010).

Graph 4.2b: Spreads of corporate bonds issued by non-financial corporations (in percentage points)

Graph 4.2c: Total index spreads (in percentage points)



4.3. Dependent variable

The dependent variable is denoted by $y_{t,\ t+k}$ and represents the logged annualized cumulative percentage change in the seasonally adjusted real GDP (with the base year being 2000) from time t to $t+k$, where k denotes the number of quarters. The time series for the accumulated GDP development of the euro area (EA16) are extracted from Eurostat. The formula below shows the calculation of $y_{t,\ t+k}$:

Dependent variable: $y_{t,t+k} = (400/k)*[\ln(GDP_{t+k}/GDP_t)]$

The question of how far in the future the possible predictive properties might reach is not an easy one. On one hand, previous researchers have found corporate bond spreads to contain information about future output developments in horizons up to one year (see Mody and Taylor, 2004, and Chan-Lau and Ivaschenko, 2001) or even beyond it (Gilchrist, Yankow and Zakrajsek, 2009, Buchmann, 2009, and Gertler and Löwn, 2000). On the other hand, the scope of this study requires a careful selection of a limited number of testing horizons. Using investment grade bonds in prediction in the euro area, Bengtsson and Sellberg (2010) found no significant predictive power in any of the sectors beyond a horizon of three quarters and De Bondt (2004) found growth predictions to reach up to ten months into the future. Similarly, empirical testing conducted by Mueller (2009) resulted in an outcome where spreads performed in predicting up to three quarters ahead. Building on these insights, I restrict the testing horizons to one, two and three quarters. Acknowledging that possible longer term implications will not be captured, this study concentrates on the short term effects by investigating whether the chosen spreads contain information about future GDP growth one, two or three quarters ahead.

4.4. Control variables

Inflation in the Euro area, the U.S. GDP growth and the euro term spread are all used as control variables in order to investigate whether a relationship between the spreads and the GDP growth exists beyond what can be detected in the control variables. Since these control variables are observed on either monthly basis (inflation) or daily (term spread and U.S. GDP), they are adjusted by taking quarterly period averages. A relationship between each of these variables and the GDP growth has been documented by several previous studies. For instance, inflation has been found to correlate negatively with future GDP growth by Mueller (2009). Espinoza, Fornari and Lombardi (2009) presented evidence that the US GDP growth leads the European GDP growth by a couple of quarters. Whether and in which form a relationship between the GDP growth and the term spread exists has been investigated as well. According to Estrella and Hardouvelis (1991), the term spread is a good indicator of future output, while Berk and van Bergeijk (2000, 2001) found that the yield spread contains only very limited information about future output growth in the euro area. Moneta (2003), however, found the term spread to be a powerful predictor of recessions in the euro area. Given the uncertainty about the importance of the term spread for future economic activity, it is included as a control variable in order to ensure that any potential leading indicator property of spreads is not due to the term spread.

5. Methodology

This section first specifies the models that are tested. Second, three different blocks of analysis are presented: in-sample analysis, out-of-sample forecast and testing the model robustness. Finally, the division of data to sample periods as well as econometric adjustments are briefly discussed.

5.1. Model specification

This paper aims at examining whether the financial accelerator mechanism is present on a composite of corporate bond spreads issued by non-financial corporations and is not present on a composite of corporate bond spreads issued by financial institutions. It is also investigated whether the mechanism is more evident on a composite of non-financial corporate bond spreads than on a total index, and whether the actual output forecast can be improved by systematically excluding the spreads of financials.

For these purposes, I analyze the relationship between the included variables using ordinary least square regression models (hereafter OLS). The data set is processed and analyzed using Stata (v.11.0).

The testing procedure follows those of Buchmann (2009) and Bengtsson and Sellberg (2010). Three OLS-models are tested: Model 0, 1 and 2. Since GDP growth is correlated with its own past values, an autoregressive AR(p) model is used. In the AR(p) model, lagged values of the dependent variable (*y*) are included among the independent explanatory variables.[31] A simple GDP model where the GDP growth is regressed only against lagged values of itself is denoted by Model 0. Model 0 acts as a control model to measure whether corporate bond spreads contain valuable information about future activity, beyond that contained in the history of real activity itself. Model 1 and Model 2 both include each of the spreads – *FIN*, *NF* and *ALL* – one at a time as explanatory variables. In the general regression equations presented below, the explanatory variable is denoted as $SPREAD_t$. The difference between Model 1 and Model 2 is that Model 1 excludes the control variables and Model 2 includes them. Below, the Models 0, 1 and 2 are presented:

M0: $$y_{t,t+k} = \alpha + \sum_{i=1}^{p} \omega_i * y_{t-i,t+k-i} + \varepsilon_t$$

M1: $$y_{t,t+k} = \alpha + \beta * \mathrm{SPREAD}_t + \sum_{i=1}^{p} \omega_i * y_{t-i,t+k-i} + \varepsilon_t$$

M2: $$y_{t,t+k} = \alpha + \beta * \mathrm{SPREAD}_t + \sum_{i=1}^{p} \omega_i * y_{t-i,t+k-i} + \sum_{j=1}^{N} \theta_j * CONTROL_{j,t} + \varepsilon_t$$

As discussed earlier, the purpose is to test the relationship between corporate bond spreads and GDP growth one to three quarters ahead (k=1, 2, 3). The results of Model 1 and 2 with each of the spreads as explanatory variables are compared to each other as well as to Model 0. For the spread of financials, I expect the coefficient of *FIN* to appear insignificant since the arguments suggested no direct inverse relationship with the short-term future output

[31] A general AR(p) model is constructed in the following way: $Y_t = \omega_1 Y_{t-1} + \omega_2 Y_{t-2} + \ldots \omega_p Y_{t-p} + u_t$.

development. On the contrary, as increases in spreads of non-financials and of combined index have been suggested to have a negative impact on the future GDP growth, the coefficients for *NF* and *ALL* are expected to be negative. All of the models 0, 1 and 2 are run for each horizon so that the independent variables are regressors for the GDP growth one, two and three quarters ahead.

The analysis is conducted in three main blocks: in-sample regression analysis, out-of-sample forecasting and finally model robustness testing. Each of these blocks are briefly described next, followed by a description of the data division used for different blocks.

5.2. In-sample analysis

To begin with, the relationships between each of the spreads and the euro area GDP growth within the sample period are analyzed. Both Model 1 and Model 2 are tested and the results are also compared to the simple Model 0.

To argue for a statistically significant relationship between a specific composite and the future GDP growth, the estimated beta for that composite needs to be observed as significantly different from zero. In order to compare the existence and strength of the financial accelerator mechanism between the three different spreads – *FIN*, *NF* and *ALL* - the regression results are evaluated based on the significance levels of the relevant coefficients as well as on the model goodness-of-fit (the adjusted R-squared). The adjusted R-squared is calculated as follows so that a higher value implies a better model fit:

Adjusted R-squared: $$\overline{R}^2 = 1 - \frac{\sum \hat{u}_t^2 /(n-m)}{\sum y_t^2 /(n-1)}$$

For the hypothesis H1 to be accepted, the coefficients of *NF* are required to be negative and significantly different from zero on a ten percentage significance level. Simultaneously, the coefficients of *FIN* are required to be not significantly different from zero on a ten percentage significance level. In case both *NF* and *FIN* are negative and significant, but there are large absolute differences in the p-values, I will test if these differences are significant.

For the hypothesis H2 to be accepted, the coefficients of *NF* need to show stronger significance than the coefficients of *ALL*. Again, in case the significance levels are the same but there are absolute differences, I will test if these differences are significant. Additionally, the model-goodness-of fit needs to be improved by using *NF* as an explanatory variable compared to using *ALL* as an explanatory variable.

5.3. Out-of-sample forecasting

In order to test hypothesis H3 and examine whether the composite of non-financials performs better in actual forecasting than the total index, and out-of-sample forecasting is conducted. Two sets of out-of-sample testing will be made: one set is used for predicting the output during more stable economic times, and another set is used for testing the prediction performance during more turbulent times forecasting the recent recession and the following recovery.

Model 0, 1 and 2 and the estimates from the in-sample period are used in order to predict GDP growth in the out-of-sample periods. The predictions using *NF* and *ALL* will be evaluated based on their Root Mean Square Error (hereafter RMSE). The RMSE summaries the distance between the forecasted and the realised value at each point in time and is calculated as shown below:

RMSE: $RMSE = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\hat{y}_{t,t+k} - y_{t,t+k}\right)^2}$

The regressions with the lowest RMSE are the ones preferred for forecasting purposes. For the hypothesis H3 to be accepted, a model with *NF* as the variable used for prediction is required to provide a smaller RMSE than a model with *ALL* as the variable used for prediction. This requirement needs to be fulfilled both when forecasting in stable conditions as well as when predicting more turbulent economic development.

5.4. Model robustness

In order to investigate whether the in-sample results are robust over time, business cycle and over a structural break, an additional examination is conducted. As will be discussed in the following section, in the original in-sample testing only a subset of the data is used for the model specification. This raises the question of robustness. To analyze whether the in-sample results are not particular for the chosen sample period but indeed observable throughout the data, I conduct a robustness check by doing and additional in-sample testing using the total data set.

5.5. Sample period division

In order to conduct the above described in- and out-of-sample testing, the data needs to be divided into sample periods. To begin with, for the purpose of analysing the financial accelerator mechanism first during more stable economic conditions and then including the recent crisis, the data is divided into two subsets. The Data Set 1 reaches until the first quarter of 2008 and the economic crisis is thus completely excluded. In the Data Set 2, the economic crisis is excluded in the in-sample period, while the out-of-sample period does cover the crisis allowing testing the forecasting accuracy in turbulent conditions. Both Data Set 1 and 2 are divided into two parts, one used for in-sample testing and one for the out-of-sample testing. The breaks between the in- and out-of-sample periods differ for the three different GDP growth horizons. The reason for this is the intention to get the same number of forecasted observations in the out-of-sample forecasting at each GDP growth horizon. The two data subsets and their divisions to in-sample and out-of-sample periods are presented in detail in Appendix B.

Finally, the robustness of the model specifications is investigated by conducting an additional in-sample testing on the full data set.

5.6. Econometric adjustments

In order to conduct a regression analysis with unbiased and efficient coefficients, a number of adjustments with regard to the regression models as well as to the data are required. These procedures are discussed next.

When analysing time-series data, the data needs to be stationary. This is defined by that the mean and variance are constant over time, and that the value of the covariance between two time periods depends solely on the distance and not on the actual time for which the covariance is computed (Gujarati and Porter, 2010). In order to test for this, I plot the variables and look for trends in the graphs, and eventually conduct the Augmented[32] Dickey-

[32] Due to autoregression, the augmented version needs to be used.

Fuller test of unit root. The results clearly show that the data is non-stationary, and thus point out the need for first differentiation. In their first difference forms, all of the variables are weakly dependent and stationary.[33] Thus, the variables in their first difference forms can be used in regressions when aiming for unbiased and efficient coefficients.

A further issue of time series data is the problem of an autocorrelated error term when analysing overlapping observations[34]. In order to correct for this and to generate efficient t-statistics, the Newey and West (1986) corrected standard errors are used.[35] The maximum lag for the error autocorrelation structure is calculated following Stock and Watson (2003) according to the formula below, and then rounded up to an integer:

Maximum lag for the autocorrelation:
$MaxLag = 0.75 * N\hat{}(1/3)$ *where N is the number of observations used in the regression.*

To find the optimal number of lags for the AR(p) model where the GDP growth depends on its own past values, Akaike (1973) Information Criteria (AIC) is used. While other methods such as Baynesian Information Criteria exist, AIC is a widely used model selection criterion in time series analysis (Kedem and Fokianos, 2002) and fits for the purpose of this study. I choose to set the required maximum lag to one year (four quarters) deeming this to be economically viable horizon while simultaneously providing a statistically reasonable ground for the regressions. The reasoning is that choosing a very low maximum lag might lead to a loss of information in lagged variables that are not included, while choosing a very high maximum lag reduces the amount of observations available for the regressions. The lags chosen according to the AIC for each of the regressions are listed in Appendix D.

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[33] See Appendix C for the test results.
[34] The overlaps are due the model specifications where quarterly observations are used but the change in GDP is accounted for horizons longer than one quarter.
[35] This procedure also adjusts for heteroscedasticy.

6. Results

This chapter presents the main outcomes of the empirical research and links the findings to the existing literature. First, an overview of the results is provided. Then, a more detailed discussion on the investigation of each of the three hypotheses and on the model robustness follows.

The empirical part of this study was conducted through OLS- regression analysis with the purpose of investigating three hypotheses. For all regressions, F-statistics indicate that the sets of coefficients used in the regressions are statistically significant on one percent level. The adjusted R-squared of the models generally improves when adding control variables, so that Model 2 is preferred to Model 1. *Table 6.0.* presents an overview of the results.

Table 6.0: Overview of the Hypothesis Testing Results

H1:	The financial accelerator mechanism is **present** on a composite of corporate bonds issued by non-financial corporations and is **not present** on a composite of corporate bonds issued by financial institutions.	**Accepted**
H2:	The financial accelerator mechanism is **more evident** on a composite of non-financial corporate bonds than on a total index that includes both financial and non-financial corporate bonds.	**Accepted**
H3:	The composite of non-financial corporate bond spreads **better predicts future output** development than the total index spreads.	**Not Accepted**

6.1. Differences between spreads of financials and non-financials

Table 6.1 provides some insight about the results regarding the hypothesis H1. The coefficients for the *NF*-variable are in all regressions negative as suggested by the theory. The coefficients are also significant on the one- and three-quarter horizons but not on the two-quarter horizon.

Table 6.1: In-sample testing results for Hypothesis H1 with Data Set 1
Enclosed: P-values that implicate significant coefficients are marked bold.

	Model 1		Model 2	
	FIN	*NF*	*FIN*	*NF*
GDP growth on 1 quarter horizon				
Beta coefficient	0.0042	-2.9496	-1.6846	-2.8508
P-value	0.9980	**0.0250**	0.2980	**0.0210**
Adj. R^2	0.4530	0.5366	0.5274	0.6006
GDP growth on 2 quarter horizon				
Beta coefficient	0.8190	-0.8767	0.5936	-1.0103
P-value	0.3960	0.4870	0.5880	0.4850
Adj. R^2	0.7005	0.7057	0.746	0.7629
GDP growth on 3 quarter horizon				
Beta coefficient	0.0181	-1.0239	-0.4162	-1.7086
P-value	0.9740	**0.0650**	0.4720	**0.0030**
Adj. R^2	0.8365	0.8669	0.8376	0.9168

On the contrary, the coefficients for the *FIN*-variable are along the line insignificant and have sometimes positive, sometimes negative sign. This implies that no statistically significant inverse relationship between the spreads of corporate bonds issued by financial institutions and the short-term GDP development is identified in the data.

Results of Data Set 2 resemble those of Data Set 1 which is only reasonable.[36] Hypothesis H1 is thus accepted. This finding is in line with Bengtsson and Sellberg (2010) who found that the financial accelerator was least evident on financials compared to other five sectors. Furthermore, the results give support to Gilchrist et al (2009) in their choice of only using non-financials when testing for the financial accelerator.[37] Appendix E provides detailed test results regarding hypothesis H1.

6.2. Strength of the financial accelerator

As can be seen in *Table 6.2*, negative coefficients of the *NF*–variable show on all horizons lower p-values than the coefficients for the *ALL*-variable, as well as higher adjusted R-squared values. Using *NF* as an explanatory variable improves the adjusted R-squared also compared to the plain Model 0 indicating that the *NF*-spreads contain leading indicator properties over those contained in the past values of GDP.

[36] Recall that the in-sample testing period is almost the same for both samples as the purpose of having two data sets is to test differences in the out-of-sample forecast in stable versus turbulent economic conditions.
[37] Regardless of whether the choice was unintended, respectively a carefully grounded decision that was simply not discussed in their study.

Table 6.2: In-sample testing results for Hypothesis H2 with Data Set 1
Enclosed: P-values that implicate significant coefficients are marked bold.

	Model 1		Model 2	
	NF	*ALL*	*NF*	*ALL*
GDP growth on 1 quarter horizon				
Beta coefficient	-2.9496	-2.0704	-2.8508	-1.8447
P-value	**0.0250**	**0.0910**	**0.0210**	0.1870
Adj. R^2	0.5366	0.4899	0.6006	0.5429
GDP growth on 2 quarter horizon				
Beta coefficient	-0.8767	-0.7140	-1.0103	-0.7514
P-value	0.4870	0.5770	0.4850	0.5710
Adj. R^2	0.7057	0.6977	0.7629	0.7494
GDP growth on 3 quarter horizon				
Beta coefficient	-1.0239	-0.6764	-1.7086	-0.9433
P-value	**0.0650**	0.3410	**0.0030**	0.1890
Adj. R^2	0.8669	0.8446	0.9168	0.8524

This leads to the acceptance of the hypothesis H2, implying that spreads of non-financials show stronger relation with the future GDP development than the combined spreads which include both non-financials and financials. These results hold both for the Data Set 1 and Set 2 suggesting that the financial accelerator mechanism is, indeed, more evident on non-financials than on combined spreads.

In particular, in both data sets the best goodness-of-fit and the lowest p-value with the negative coefficient provided by Model 2 on the three-quarter-horizon with the non-financial spreads as the explanatory variable. In the Set 1, *NF* is significant on one-percentage level (p-value 0.0030) and the model has an adjusted R-squared of 0.9168. In the Set 2, *NF* is significant on five-percentage level (p-value 0.0470) and with an adjusted R-squared of 0.8607. [38]

In the light of this new evidence, looking at the research conducted by Buchmann (2010) and Mueller (2009) raises some questions. Would their outcomes be altered if the data would only include non-financials instead of a combined index? Could the fragility of results regarding preferred types of maturities and rating classes be reduced by systematically improving the data quality through the exclusion of financials?

6.3. Forecasting accuracy

While the in-sample results provide proof that *NF* contains more predictive power than *ALL*, the out-of-sample testing results are less obvious and provide not much support for using *NF* instead of *ALL* in actual forecasting.

When predicting in stable economic environment (Data Set 1), the forecasting accuracy of *ALL* as the explanatory variable ranks higher than the forecasting accuracy of *NF* on the one- and three-quarter horizon (see *Table 6.2a*). On the two-quarter horizon, *NF* provides the best predictions but the coefficients are insignificant.

[38] Please see Appendix F for more details regarding testing the hypothesis H2.

Table 6.2a: Regression results from out-of-sample testing in stable economic conditions for Hypothesis H3

Enclosed: P-values that implicate significant coefficients are marked bold. The lower RMSE value of each comparison is underlined. In case the lowest of the two RMSE is given by a significant coefficient, it is market by a frame.

Data Set 1:
out-of-sample forecast in stable economic conditions

	Model 1		**Model 2**	
	NF	*ALL*	*NF*	*ALL*
GDP growth on 1 quarter horizon				
P-value of the Beta Coefficient	0.0250	**0.0910**	**0.0210**	0.1870
RMSE	1.4332	[1.3755]	1.3979	1.3763
GDP growth on 2 quarter horizon				
P-value of the Beta Coefficient	0.4870	0.5770	0.4850	0.5710
RMSE	0.7101	0.7260	0.7973	0.8261
GDP growth on 3 quarter horizon				
P-value of the Beta Coefficient	0.0650	0.3410	**0.0030**	0.1890
RMSE	0.6492	0.6465	0.7675	0.7046

When predicting in turbulent economic environment (Data Set 2, see *Table 6.2b*), the out-of-sample testing confirms the in-sample results on the one-quarter horizon: *NF* appears to be able to outperform *ALL* providing the best prediction both with Model 1 (2.9597) and with Model 2 (2.6941). This is consistent with *NF* having the lowest significance level and the best goodness-of-fit on this horizon in the in-sample testing. However, on the three-quarter horizon, all of the best predictions are given by the regression with the *ALL*-variable which has insignificant coefficients. Thus, although the in-sample analysis indicates predictive power on three-quarter horizon, the model does not perform in an expected manner in the actual forecasting.

Table 6.2b: Regression results from out-of-sample testing in turbulent economic conditions for Hypothesis H3

Enclosed: P-values that implicate significant coefficients are marked bold. The lower RMSE value of each comparison is underlined. In case the lowest of the two RMSE is given by a significant coefficient, it is market by a frame.

Data Set 2:
out-of-sample forecast in turbulent economic conditions

	Model 1		Model 2	
	NF	*ALL*	*NF*	*ALL*
GDP growth on 1 quarter horizon				
P-value of the Beta Coefficient	**0.0580**	0.0840	**0.0450**	0.1840
RMSE	2.9597	3.0772	2.6941	2.8444
GDP growth on 2 quarter horizon				
P-value of the Beta Coefficient	0.2440	0.3290	0.3520	0.5790
RMSE	2.2328	2.0742	2.4194	2.4134
GDP growth on 3 quarter horizon				
P-value of the Beta Coefficient	**0.1000**	0.7010	**0.0470**	0.6490
RMSE	1.3095	1.2664	1.3169	1.2865

Due to the mixed results in actual forecasting performance of non-financials and of the total index, the hypothesis H3 cannot be accepted.

6.4. Model robustness

When conducting an additional in-sample testing on the full data set including the recent crisis as a robustness check for the model specifications, the above presented results are to a large degree confirmed. In line with the earlier results, the adjusted R-squared is improved by introducing *NF* as the explanatory variable compared to *ALL* or to the plain Model 0.

While the two-quarter horizon remains with insignificant coefficients both when the total data as well as when only subsets of it are analyzed, the earlier results are to some extend challenged on the three-quarter horizon. In the robustness testing, *NF* is the only variable with expected negative coefficients and with the lowest p-value (0.1100) pointing towards the previous outcomes where *NF* showed the strongest relationship with the output development. Nevertheless, none of the betas are now significant which is a clear difference to the previous results where the three-quarter horizon often was the horizon where the coefficients for *NF* showed the highest significance levels.

An interesting finding of the robustness testing is that on the one-quarter-horizon the coefficient for *FIN* is suddenly negative and significant. Thus, when including the extreme values that occurred during the crisis, financials suddenly gain some leading indicator properties. During the crisis, the assumed indirect state guarantee materialized frequently. Nevertheless, there were some cases such as the allowed collapse of Lehman Brothers in September 2008 that undermined the investor beliefs in that the unspoken bail-out guarantee would hold. The trust crisis that followed the collapse shoot the spreads of financials sky-high as information asymmetry about credit risks suddenly became reality.

However, even when the crisis is included, both *NF* and *ALL* show stronger relationships to the future output levels than *FIN*. The coefficients of *NF* and *ALL* are both significant on one-percentage level compared to that of five-percentage level in the case of *FIN*. Moreover, the lowest p-values and the best goodness-of-fit across the models and forecasting horizons are again provided by the non-financial corporate bond spreads: *NF* has a p-value 0.0000 and adjusted R-squared 0.6945 on the one-quarter horizon in Model 2. This supports the previous outcomes indicating that the financial accelerator is more evident on non-financial corporate bond spreads than on the total index, or on financial spreads. The robustness test hereby suggests that the model specifications and the in-sample results are to a large degree robust over time and business cycle, also when an economic crisis is included. This holds particularly well for the one-quarter forecasting horizon. Detailed values from the model robustness analysis are presented in Appendix H.

7. Discussion

The objectives of this paper were an identification of differences affecting the external finance premium of financial institutions and that of non-financial corporations, and a testing of the implications of those differences within the framework of financial accelerator theory. In order to achieve these objectives, the theoretical background of the financial accelerator mechanism was analyzed by putting an emphasis into describing the suppressed role of financial intermediaries within the framework. Then, the suitability of using spreads of corporate bonds issued by non-financial corporations, and the suitability of including spreads of corporate bonds issued by financial institutions as a proxy for the external finance premium in the euro area was examined empirically with hypothesis testing.

The existing literature provided two insights. First, the theoretical view suggested analyzing lender and borrower roles separately. Second, the recorded praxis of testing the theory empirically revealed another picture. Financial and non-financial bonds had been used in a nonsystematic manner as a proxy for the EFP; sometimes including only one, sometimes the other and often both types of bonds mixed together.

The empirical part of this study provided support for what the theoretical arguments suggested, demonstrating the need for a systematic differentiation between bonds issued by financial institutions and bonds issued by non-financial corporations. This is the first study to compare the predictive capabilities of a corporate bond composite consisting of non-financials to the predictive capabilities of a total index that includes both financials and non-financials.

The data suggested that the financial accelerator is present on non-financial bonds and is not present on financial bonds in the euro area, leading to the acceptance of the first hypothesis. Also the second hypothesis was accepted as non-financial corporate bonds showed stronger leading indicator properties than the total index. These findings were supported by the robustness of the results over various sample periods. An interesting finding is that while the two-quarter testing horizon results were largely insignificant, the results on the one-quarter testing horizon and to some degree also on the three-quarter testing horizon were consistently negative and significant. These differences in the results of the testing horizons motivate further research to fully understand the timing of the mechanism. As the actual forecasting results were mixed, the third hypothesis could not be accepted. The reason for why the significant differences that were found in the in-sample testing between the leading indicator properties of non-financials and those of the total index did not gain further support in the out-of-sample testing remains unexplained and calls for more research in the future.

It would be appealing to closer examine the factors affecting the external finance premium of financial institutions. Even if some work on this has already been done, it would be valuable to better understand the linkages between the credit conditions of financials and if, how and with what kind of potential lags these affect the credit conditions of non-financial corporations and the output levels. Additional variables that were not analyzed in this study but that affect the spreads of financials are not obvious, but they could include factors such as regulative environment, historical reasons or investors' irrationality. Moreover, in this study several types of institutions were classified as financials with the great majority of them being banks. Further insights could be gained by a more detailed analysis of the different types of financial actors and how the BGG-framework could be improved to accommodate them.

Since the empirical data that was analyzed in this study is from the relatively young euro area, investigations on other geographic markets with longer available time series could yield the findings additional support. As this study concentrated on the short-term effects, a potential relation between the spreads of financials and non-financials and the GDP development on a longer horizon could be a topic for further research. Furthermore, more analysis is needed to understand additional factors that influence the financial accelerator mechanism. These factors include but are not limited to the ownership structure of bonds, where some insight has already been provided (see Manconi et al., 2010). Additionally, while in this study it was simply assumed that some shock occurs and its differentiated effects on the EFP of various actors were then analyzed, it would be interesting to examine whether the origin and nature of a particular shock matters for the financial accelerator mechanism. More flexible macroeconomic models that would allow for both a real economy shock and a shock in rational expectations or in investors sentiment could enhance the understanding of the mechanism and provides an avenue for future research.

Finally, questions about causality are present in many economic analyses. The assumption of an increase in the spreads causing the GDP growth to decline has been made in the previous studies and this paper was no exception to that. However, as noted by Chatfield (2004), even if the relationship between a predictor variable and a response variable modeled by a regression is sometimes interpreted as a causal relationship, it might in practise be difficult to decide whether there is a direct link or if the link comes via a relationship with a third, possibly unobserved, variable. While the proposed causality between the spreads and the GDP growth might be a plausible one, it could also be the case that the spreads follow some real economic variables. Felsenheimer and Gisdakis (2008) argue that maybe one is not leading the other but perhaps financial markets and real economy develop hand in hand with spillover effects that are both imminent and persistent. Thus, only a full-fledged macroeconomic model which allows the incorporation of financial markets can be seen as the appropriate way of forecasting economic trends and financial market developments.

As a conclusion, many factors relating to the Bernanke, Gertler and Gilchrist-framework (1999) remain to be analyzed. Nevertheless, this study showed that a systematic differentiation between bonds issued by financial institutions and bonds issued by non-financial corporations when looking for a proxy for the EFP appears well-grounded given theoretical arguments that were supported by empirical evidence.

8. Conclusion

The results of this paper suggest that the traditional financial accelerator theory is too simplified, as it does not take into account the dual role of financial institutions as both lenders and borrowers. Moreover, the indirect state guarantee that many big financial institutions have is not modeled in the Bernanke, Gertler and Gilchrist-framework (1999) framework. Thus, the financial accelerator theory could be further enhanced by systematically differentiating between borrowers and actors that both borrow and lend. In practice, researchers looking for a proxy for the EFP could benefit from excluding corporate bonds issued by financial institutions. Both theoretical arguments and the empirical evidence underline the importance of analyzing the two groups of corporate bond issuers as separate types of actors in the economy. As this has not been done systematically in the past research, I wish to have contributed to the existing knowledge by addressing an important issue that has not gained the attention it deserves.

More focus on developing a comprehensive theory which allows for the multiple roles of financial institutions within the monetary policy transmission mechanism is called for. The role of financial institutions as a potential source and catalyst of business cycle fluctuations is currently heavily debated by researchers, central bankers, regulators as well as other practitioners. As formidable task as it may be, to fully understand and model the mechanism is particularly important now when monetary policy is extensively used in order to stimulate economies around the world.

To summarize, the analysis presented in this paper highlights the need for a systematic differentiation between financial institutions and non-financial corporations as bond issuers within the empirical testing of the financial accelerator theory. These insights motivate further investigations in the search for better macroeconomic forecasting models.

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Appendix A: Data set

Table A.1: Overview of the Variables and the Data Set

Dependent Variable	Description	Form in the regression	Source
Euro Area Real GDP growth	Euro area GDP, adjusted for inflation, seasonality and calendar effects.	Natural logarithm	Eurostat
Independent Variables	**Description***	**Form in the regression**	**Source**
Corporate Bond Spread: Financials - *FIN* (561 bonds)	Contains sub-indices Banks (440), Financial Services (52) and Insurance (69)	First difference	Markit iBoxx EUR Benchmark Index
Corporate Bond Spread: Non-financials - *NF* (715 bonds)	Contains sub-indices Consumer Goods and Services (163), Basic Materials (49), Industrials (120), Commodities (221), Technology and healthcare (162)	First difference	Markit iBoxx EUR Benchmark Index
Corporate Bond Spread: Total Index - *ALL* (1276 bonds)	Contains all bonds that belong to the Financials or to the Non-financials	First difference	Markit iBoxx EUR Benchmark Index
Control Variables	**Description**	**Form in the regression**	**Source**
Term Spread	Calculated as the difference between the 1 and 10 year euro swap rate.	First difference	Bloomberg
Inflation	Harmonized Index of Consumer Prices (HICP).	First difference	Eurostat
US Real GDP growth	The annualized U.S. real GDP growth , adjusted for inflation, seasonality and calendar effects.	First difference	The U.S. Bureau of Economic Analysis

**Note: The spread is calculated as the difference between a bond yield and a Euro swap rate used as a benchmark interest rate. The daily bond yields and maturities are first extracted. Then, the swap rates are interpolated to match the bond maturities. Finally, the difference between the yield and the benchmark is calculated. The numbers in paranthesis are the number of bonds included in the sector indeces as of October 15, 2010.*

Appendix B: Division to sample periods

Table B.1: Division of Data Sets
Enclosed: k=1,2,3 denotes the forecast horizon in quarters.

Data Set 1:
For in-sample testing excluding the crisis,
out-of-sample forecast in stable economic conditions

	k=1:	k=2:	k=3:
In-sample period	1999Q1-2005Q1	1999Q1-2004Q4	1999Q1-2004Q3
Out-of-sample period	2005Q2-2008Q1	2005Q1-2007Q4	2004Q4-2007Q3

Data Set 2:
For in-sample testing excluding the crisis,
out-of-sample forecast in turbulent economic conditions

	k=1:	k=2:	k=3:
In-sample period	1999Q1-2006Q4	1999Q1-2006Q3	1999Q1-2006Q2
Out-of-sample period	2007Q1-2010Q2	2006Q4-2010Q1	2006Q3-2009Q4

Total Data:
For model robustness testing

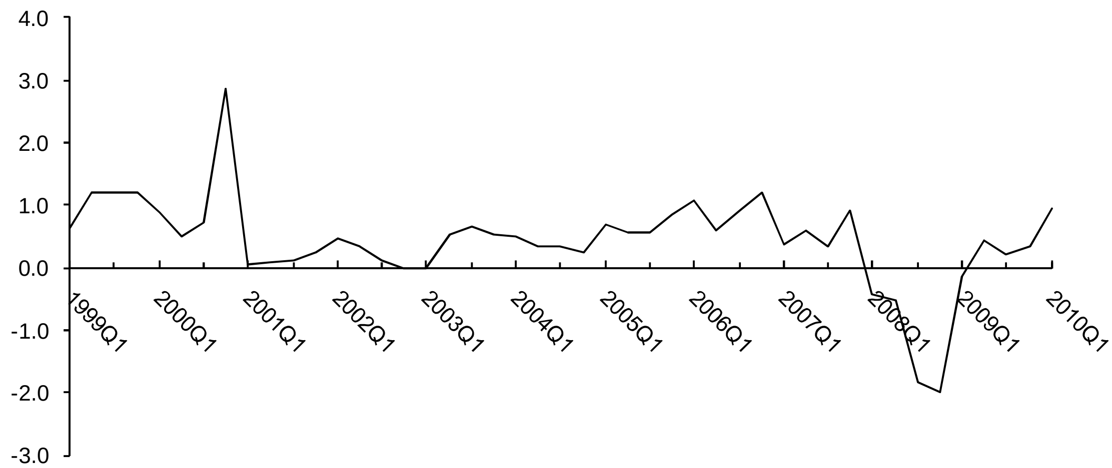
	k=1:	k=2:	k=3:
In-sample period	1999Q1-2010Q2	1999Q1-2010Q1	1999Q1-2009Q4

Appendix C: Results of the augmented Dickey-Fuller test of unit root

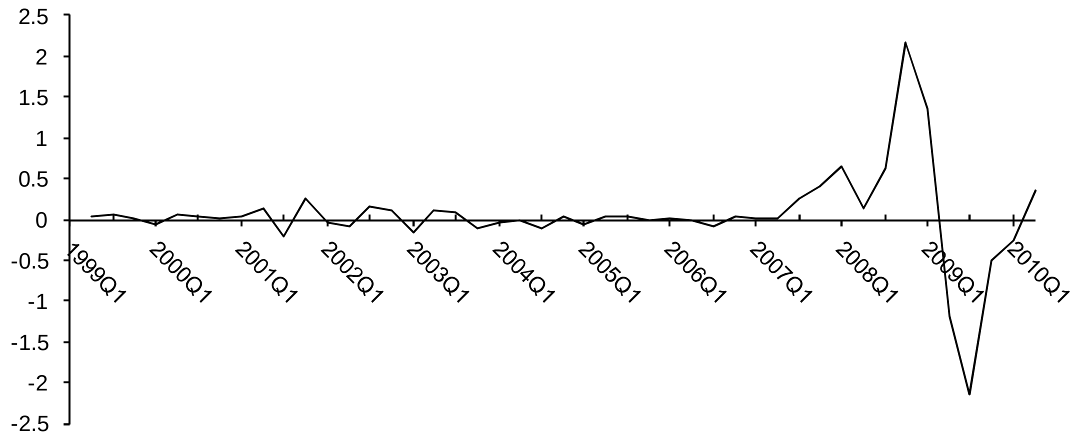
Table C.1: Dickey-Fuller Test Results for Variables in Level and First Difference Forms

Variable	Level Values		First Difference Values		
	Significance level	Lags used	Significance level		Lags used
GDP Growth	-	-	0.0272	**	1
All	0.4014	3	0.0018	***	2
Financials	0.5332	3	0.0051	***	4
Non-financials	0.1721	2	0.0000	***	0
Term Spread	0.1607	2	0.0200	**	2
Inflation	0.1873	4	0.0000	***	4
US GDP Growth	-	-	0.0452	**	3

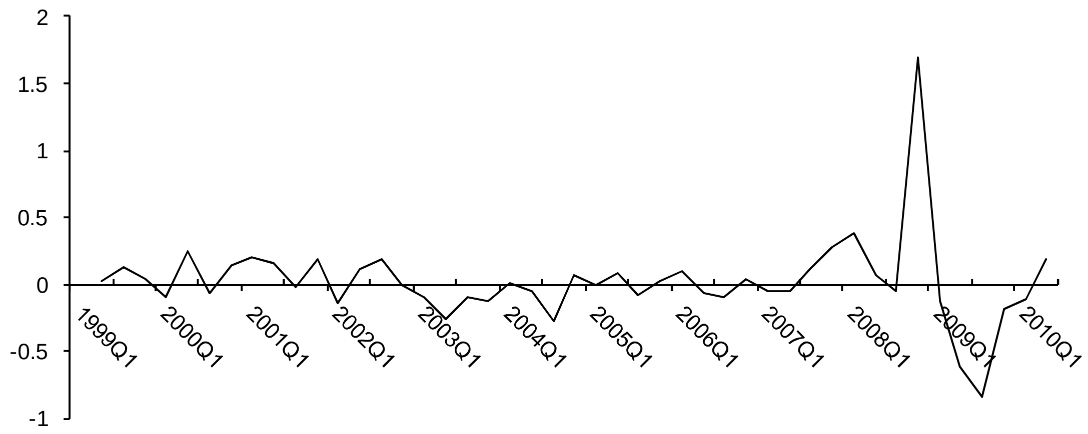
Graph C.1: Dependent Variable GDP development in First Difference Form (k=1) (in percentage points)



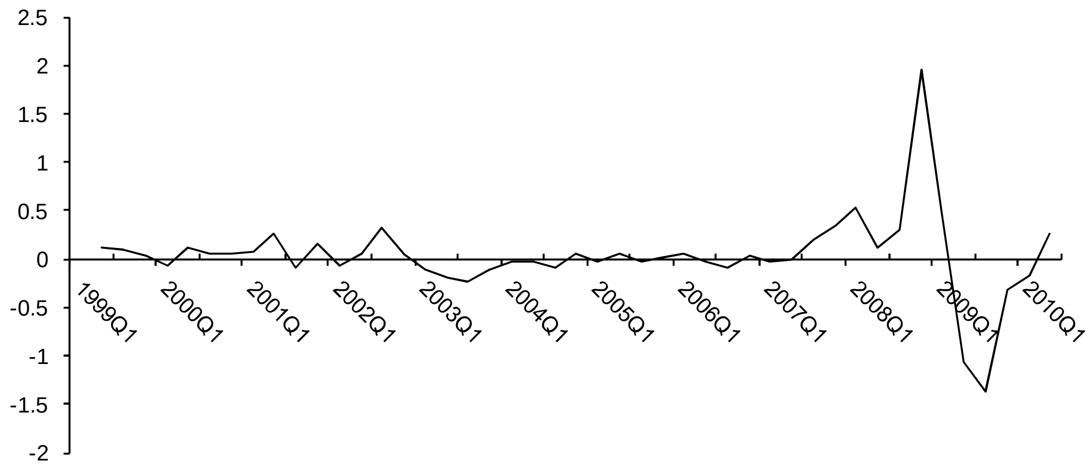
Graph C.2: Independent Variable FIN in First Difference Form (in percentage points)



Graph C.3: Independent Variable NF in First Difference Form (in percentage points)



Graph C.4: Independent Variable ALL in First Difference Form (in percentage points)



Appendix D: Optimal lags for the autoregression

Table D.: Optimal Number of Lags according to the Akaike Information Criterion.
Enclosed: k=1,2,3 denotes the forecast horizon in quarters.

Lags for the simple model, Model 0

	Data Set 1	Data Set 2	Total Data
k=1:	1	1	1
k=2:	3	4	4
k=3:	3	3	3

Data Set 1:
values without paranthesis are lags for Model 1,
values in paranthesis are lags for Model 2

	FIN	*NF*	*ALL*
k=1:	1 (1)	1 (1)	1 (1)
k=2:	3 (3)	3 (3)	3 (3)
k=3:	3 (3)	3 (3)	3 (3)

Data Set 2:
values without paranthesis are lags for Model 1,
values in paranthesis are lags for Model 2

	FIN	*NF*	*ALL*
k=1:	1 (1)	1 (1)	1 (1)
k=2:	4 (4)	3 (2)	4 (2)
k=3:	3 (3)	3 (3)	3 (3)

Total data used in robustness testing:
values without paranthesis are lags for Model 1,
values in paranthesis are lags for Model 2

	FIN	*NF*	*ALL*
k=1:	1 (3)	1 (3)	3 (3)
k=2:	4 (4)	4 (4)	4 (4)
k=3:	2 (2)	3 (3)	2 (2)

Lags used for the Augmented Dickey-Fuller test of unit root:

	GDP Growth	*FIN*	*NF*
Testing Level Values	-	3	2
Testing First Differences	1	4	0
ALL	*Term Spread*	*Inflation*	*US GDP Growth*
3	2	4	-
2	2	4	3

Appendix E: Results from testing Hypothesis H1

Table E.1: Regression results from in-sample testing for Hypothesis H1

Enclosed: k=1,2,3 denotes the forecast horizon in quarters. P-values that implicate significant coefficients are marked bold.

Data Set 1: in-sample testing

Model 0

	Adj. R^2
k=1	0.4778
k=2	0.7094
k=3	0.8467

Model 1

	FIN	NF
GDP growth on 1 quarter horizon		
Beta coefficient	0.0042	-2.9496
P-value	0.9980	**0.0250**
Adj. R^2	0.4530	0.5366
GDP growth on 2 quarter horizon		
Beta coefficient	0.8190	-0.8767
P-value	0.3960	0.4870
Adj. R^2	0.7005	0.7057
GDP growth on 3 quarter horizon		
Beta coefficient	0.0181	-1.0239
P-value	0.9740	**0.0650**
Adj. R^2	0.8365	0.8669

Model 2

	FIN	NF
GDP growth on 1 quarter horizon		
Beta coefficient	-1.6846	-2.8508
P-value	0.2980	**0.0210**
Adj. R^2	0.5274	0.6006
GDP growth on 2 quarter horizon		
Beta coefficient	0.5936	-1.0103
P-value	0.5880	0.4850
Adj. R^2	0.746	0.7629
GDP growth on 3 quarter horizon		
Beta coefficient	-0.4162	-1.7086
P-value	0.4720	**0.0030**
Adj. R^2	0.8376	0.9168

Data Set 2: in-sample testing

Model 0

	Adj. R^2
k=1	0.4653
k=2	0.6970
k=3	0.8656

Model 1

	FIN	NF
GDP growth on 1 quarter horizon		
Beta coefficient	-0.5549	-0.2536
P-value	0.7030	**0.0580**
Adj. R^2	0.4477	0.5007
GDP growth on 2 quarter horizon		
Beta coefficient	**0.7250**	-1.2820
P-value	0.5320	0.2440
Adj. R^2	0.6879	0.7378
GDP growth on 3 quarter horizon		
Beta coefficient	-0.0515	-0.7041
P-value	0.9190	**0.1000**
Adj. R^2	0.8595	0.8685

Model 2

	FIN	NF
GDP growth on 1 quarter horizon		
Beta coefficient	-1.5166	-2.6877
P-value	0.3490	**0.0450**
Adj. R^2	0.4629	0.5196
GDP growth on 2 quarter horizon		
Beta coefficient	1.0634	-1.0834
P-value	0.4420	0.3520
Adj. R^2	0.6866	0.7525
GDP growth on 3 quarter horizon		
Beta coefficient	-0.2368	-0.8489
P-value	0.6250	**0.0470**
Adj. R^2	0.8475	0.8607

Appendix F: Results from testing Hypothesis H2

Table F.1: Regression results from in-sample testing for Hypothesis H2

Enclosed: k=1,2,3 denotes the forecast horizon in quarters. P-values that implicate significant coefficients are marked bold.

Data Set 1: in-sample testing

Model 0

	Adj. R^2
k=1	0.4778
k=2	0.7094
k=3	0.8467

Model 1

	NF	*ALL*
GDP growth on 1 quarter horizon		
Beta coefficient	-2.9496	-2.0704
P-value	**0.0250**	**0.0910**
Adj. R^2	0.5366	0.4899
GDP growth on 2 quarter horizon		
Beta coefficient	-0.8767	-0.7140
P-value	0.4870	0.5770
Adj. R^2	0.7057	0.6977
GDP growth on 3 quarter horizon		
Beta coefficient	-1.0239	-0.6764
P-value	**0.0650**	0.3410
Adj. R^2	0.8669	0.8446

Model 2

	NF	*ALL*
GDP growth on 1 quarter horizon		
Beta coefficient	-2.8508	-1.8447
P-value	**0.0210**	0.1870
Adj. R^2	0.6006	0.5429
GDP growth on 2 quarter horizon		
Beta coefficient	-1.0103	-0.7514
P-value	0.4850	0.5710
Adj. R^2	0.7629	0.7494
GDP growth on 3 quarter horizon		
Beta coefficient	-1.7086	-0.9433
P-value	**0.0030**	0.1890
Adj. R^2	0.9168	0.8524

Data Set 2: in-sample testing

Model 0

	Adj. R^2
k=1	0.4653
k=2	0.6970
k=3	0.8656

Model 1

	NF	*ALL*
GDP growth on 2 quarter horizon		
Beta coefficient	-0.2536	-2.0856
P-value	**0.0580**	**0.0840**
Adj. R^2	0.5007	0.4778
GDP growth on 2 quarter horizon		
Beta coefficient	-1.2820	-0.9708
P-value	0.2440	0.3290
Adj. R^2	0.7378	0.6939
GDP growth on 2 quarter horizon		
Beta coefficient	-0.7041	-0.2127
P-value	**0.1000**	0.7010
Adj. R^2	0.8685	0.86

Model 2

	NF	*ALL*
GDP growth on 2 quarter horizon		
Beta coefficient	-2.6877	-1.8824
P-value	**0.0450**	0.1840
Adj. R^2	0.5196	0.4796
GDP growth on 2 quarter horizon		
Beta coefficient	-1.0834	-0.6831
P-value	0.3520	0.5790
Adj. R^2	0.7525	0.7423
GDP growth on 2 quarter horizon		
Beta coefficient	-0.8489	-0.2619
P-value	**0.0470**	0.6490
Adj. R^2	0.8607	0.8478

Appendix G: Results from testing Hypothesis H3

Table G.1: Regression results from out-of-sample testing for Hypothesis H3

Enclosed: P-values that implicate significant coefficients are marked bold. The lower RMSE value of each comparison is underlined. In case the lowest of the two RMSE is given by a significant coefficient, it is market by a frame.

	Data Set 1: out-of-sample forecast in stable economic conditions		Data Set 2: out-of-sample forecast in turbulent economic conditions	
Model 1	*NF*	*ALL*	*NF*	*ALL*
GDP growth on 1 quarter horizon				
P-value of the Beta Coefficient	0.0250	0.0910	0.0580	0.0840
RMSE	1.4332	1.3755	2.9597	3.0772
GDP growth on 2 quarter horizon				
P-value of the Beta Coefficient	0.4870	0.5770	0.2440	0.3290
RMSE	0.7101	0.7260	2.2328	2.0742
GDP growth on 3 quarter horizon				
P-value of the Beta Coefficient	0.0650	0.3410	0.1000	0.7010
RMSE	0.6492	0.6465	1.3095	1.2664
Model 2	*NF*	*ALL*	*NF*	*ALL*
GDP growth on 1 quarter horizon				
P-value of the Beta Coefficient	0.0210	0.1870	0.0450	0.1840
RMSE	1.3979	1.3763	2.6941	2.8444
GDP growth on 2 quarter horizon				
P-value of the Beta Coefficient	0.4850	0.5710	0.3520	0.5790
RMSE	0.7973	0.8261	2.4194	2.4134
GDP growth on 3 quarter horizon				
P-value of the Beta Coefficient	0.0030	0.1890	0.0470	0.6490
RMSE	0.7675	0.7046	1.3169	1.2865

Appendix H: Results from testing the model robustness

Table H.1: Regression results from in-sample testing for the model robustness

Enclosed: k=1,2,3 denotes the forecast horizon in quarters. P-values that implicate significant coefficients are marked bold.

Model 0

	k=1	k=2	k=3
Adj. R^2	0.4635	0.7636	0.8793

Model 1

	FIN	*NF*	*ALL*
GDP growth on 1 quarter horizon			
Beta coefficient	-1.0540	-2.8674	-3.3446
P-value	0.2110	**0.0000**	**0.0000**
Adj. R^2	0.4884	0.5679	0.5642
GDP growth on 2 quarter horizon			
Beta coefficient	1.2298	2.2195	1.9908
P-value	0.2900	0.1800	0.2240
Adj. R^2	0.7828	0.8066	0.7998
GDP growth on 3 quarter horizon			
Beta coefficient	0.2729	-0.1405	0.3911
P-value	0.2690	0.7060	0.2000
Adj. R^2	0.8817	0.8761	0.8824

Model 2

	FIN	*NF*	*ALL*
GDP growth on 1 quarter horizon			
Beta coefficient	-2.0994	-3.3520	-3.0989
P-value	**0.0430**	**0.0000**	**0.0040**
Adj. R^2	0.6403	0.6945	0.6811
GDP growth on 2 quarter horizon			
Beta coefficient	0.5961	0.1257	1.2079
P-value	0.3120	0.1880	0.1820
Adj. R^2	0.8465	0.8556	0.8558
GDP growth on 3 quarter horizon			
Beta coefficient	0.2724	-0.4793	0.3675
P-value	0.1880	0.1100	0.1480
Adj. R^2	0.8793	0.8781	0.8794