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Stine Louise Daetz

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Ph.D. School in Economics and Management

PhD Series 31-2018

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Essays on Financial Frictions in Lending Markets

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Ph.D. School in Economics and Management
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Preface

This thesis includes three essays that I worked on during my Ph.D. studies at the Copenhagen Business School, Department of Finance. While the articles overlap in the aim of understanding financial frictions in lending markets, they are self-contained and can be read independently.

This thesis has benefited from the advice, helpful comments and support of many people. First of all, I would like to thank my advisors at CBS, Jens Dick-Nielsen and David Lando, for their tremendously help, support and advice at any point in time. Their guidance contributed significantly to my academic development and also helped me to tackle the academic job market. In particular, I am grateful to Jens Dick-Nielsen's continuous encouragement and availability to give advises. I would also like to thank David Lando's for his general mentorship and to take this opportunity to also gratefully acknowledge the financial support of the FRIC Center for Financial Frictions (grant no. DNRF102). I am further thankful to Marti G. Subrahmanyam for hosting my visits at NYU Stern, his mentorship through our joint research work, as well as his general support during my final years of the Ph.D. studies. In addition, I would like to thank my co-authors, Dragon Y. Tang, Sarah Q. Wang and Mads S. Nielsen for their patience, support, and our great discussions that provided me with significant learning experiences.

Finally, I would also like to thank my colleagues and friends for their support. In particular, I would like to thank the faculty at CBS and my fellow Ph.D. students for their patience, valuable feedback and helpful discussions, as well as for making my years as a Ph.D. student enjoyable and instructive. Most importantly, I am thankful for the invaluable support and love of Rasmus, my family, and friends, and their unwavering believe in me.

Stine Louise Daetz
Frederiksberg, June 2018

Summary in English

Essay 1: The Value of Bond Underwriter Relationships

with Jens Dick-Nielsen and Mads Stenbo Nielsen

The first essay shows that corporate bond issuers derive value from bond underwriter relationship capital. A strong underwriter relationship enables the underwriter to credibly certify the issuer on the bond market which is fundamental for firms when issuing new debt and refinancing maturing debt. In order to empirically verify this certification hypothesis we study corporate bond issuing firms' underwriter relations and analyze their value for the issuing firm.

First, we look at the unconditional effect of switching underwriter and empirically test the benefit of having a strong underwriter relationship by analyzing firms' underwriter relations and bond issuance cost. Within this framework we find that when a bond issuer utilizes an existing underwriter relationship when rolling over bonds, it lowers both the indirect and direct issuance costs. Accordingly, it is as a baseline costly for the firm to switch underwriter. Second, we document that issuers are adversely affected by underwriter distress as we find that the credit risk of the underwriter spills over to the credit risk of the issuer. If an underwriter ends up in financial distress it weakens the underwriter's ability to connect the bond issuer with investors and to credibly certify the issuer. As this is costly for the bond issuer when rolling over maturing bonds, we argue that the weakened relationship leads to higher credit risk of the issuing firm. By constructing an issuer specific measure of underwriter distress we explicitly find that the variation in the credit risk of related underwriters helps explain the variation in the credit risk of bond issuers. While we do find that the effect is pronounced in the case of an actual default of an underwriter that will force firms to switch underwriter, we document that the effect is also economically significant for just higher level of underwriter distress.

Consistent with the certification hypothesis we find that the credit risk spillover is more pronounced for low-rated firms which are usually also more opaque and, therefore, more dependent upon the underwriter certification. The impact of underwriter distress is also stronger for firms with a high fraction of short-term debt, i.e., firms with an imminent need for underwriter services for rolling over maturing bonds. Thus, underwriter distress can be characterized as a rollover risk for the issuer. Overall, the essay shows that underwriter relationships are valuable for corporate bond issuers.

Essay 2: Corporate Hedging and Debt Extension

The second essay provides a detailed investigation of the implications of creditors' use of credit default swaps (CDSs) for the debt financing of related firms. CDSs are financial derivatives that protect the buyer against default of a given reference firm. The availability of CDS contracts has in general been outlined to improve bank lending by reducing financial frictions on the supply side of credit. Using unique and comprehensive CDS and credit registry data from Deutsche Bundesbank I explicitly study the CDS holdings of banks with a credit relationship to the reference firm and analyze the role of the variation in creditors use of CDSs for the borrower's debt financing. As outlined in the data creditors typically hold multiple CDSs written on the same firm and are often also net sellers of CDS contracts written on their own borrowers.

Focusing on firm-level credit exposures I find that the credit extension arising due to the availability of CDSs significantly depends upon creditors' net CDS positions. Specifically, I find that firms where the creditors are net credit protection buyers have relatively less credit available relative to firms where the creditors are net credit protection sellers. Although individual creditors may extend their credit exposure to firms for certain levels of credit hedging, I find that the effect is not significant on the aggregated level. This is probably due to the offset effect by the firm's other creditors. While creditors typically buy CDS contracts on more risky borrowers, I also show that the results are robust when I explicitly control for firms' credit risk. Furthermore, the effect is pronounced when CDS contracts are illiquid.

In regards to firms' refinancing risk, I find that firms with net CDS-buying creditors relative to firms with net CDS-selling creditors have lower debt maturity and are more constrained with respect to the type of debt they can issue when they refinance their maturing debt. However, I do not find that the direct debt financing costs these firms are higher. Accordingly, the results suggest that the change in firms' refinancing conditions are caused by creditors' aim for lower monitoring costs that is supplementary to the decrease in credit risk stemming from their credit hedging. Although firms with available CDS contracts still have lower rollover risk compared to firms for whom CDS contracts are not available, the essay provides evidence that the CDS positions of creditors may imply an indirect cost to firms in form of credit rationing.

Essay 3: Can Central Banks Boost Corporate Investment: Evidence from ECB's Liquidity Injections

with Marti G. Subrahmanyam, Dragon Y. Tang, and Sarah Q. Wang

The third essay investigates whether unconventional monetary interventions by central banks can stimulate corporate investment and, thus, affect the real economy. Specifically, we address this question by analyzing ECB's three-year Longer-term Refinancing Operations (LTROs) as of 2011-2012. The LTROs were large liquidity injections that were implemented to support the real economic recovery after the European Sovereign Debt Crisis and provided cheap funding to Eurozone banks. For the empirical investigation of the impact of such liquidity interventions, we make use of comprehensive data on banks' use of the LTRO funds and Eurozone non-financial corporations' investment policies around the LTRO implementation.

We start our analysis by documenting that corporations outside the Eurozone which were not directly affected by LTROs reduced investments more than Eurozone corporations following the LTROs. Since corporate investment in the onset of the credit crisis was decreasing, such a counterfactual analysis suggests that the massive liquidity injections helped Eurozone corporations to decelerate their investment decline. However, against our expectations of an increase in investment for corporations in the Eurozone after the LTROs, we find that the investments of these corporations are negatively associated with the amount of funds their banks obtained from the ECB. Studying the characteristics of banks that made use of the LTROs, we find that riskier banks had a higher LTRO uptake and that in particular borrowers of these banks reduced investment following the LTROs.

When further investigating the role of bank risk in explaining the decrease in corporate investment, we find that the effect is pronounced for corporations with a greater exposure to bank debt, which suggests that bank risk and the signaling role of the banks' LTRO uptake might have impeded the transformation of liquidity injection into real economic outputs. In addition, we document that the negative investment effect of the unconventional LTROs varies across banks' LTRO-repayment policies and show that smaller corporations whose lenders' held the LTRO funds for a longer period did increase investment after the LTROs. Furthermore, we find that when fiscal policies of local governments were accommodative to ECBs interventions, corporate investment increased in response to their lenders' LTRO uptakes. Overall, the results in this essay suggest that central banks' liquidity injections can decelerate economic decline, but also highlight the significance of bank and country characteristics that impede the effectiveness of unconventional monetary policies in improving real economic output.

Summary in Danish

Essay 1: The Value of Bond Underwriter Relationships

with Jens Dick-Nielsen and Mads Stenbo Nielsen

Det første essay viser at det er værdifuldt for udstedere af virksomhedsobligationer at have underwriter relationer. En stærk underwriter relation gør det muligt for underwriteren at afgive en troværdig certificering af udstederen på markedet hvilket er essentielt for virksomhedens refinansiering af gæld. Vi efterviser denne certificerings-hypotese empirisk ved at undersøge udsteders underwriter relationer og at teste værdien af disse for den udstedende virksomhed.

Først analyserer vi den ubetingede effekt af at skifte underwriter ved empirisk at teste hvorvidt der er fordele ved at have en stærk underwriter relation i henhold til omkostninger forbundet med obligationsudstedelser. På baggrund af denne analyse kan vi konstatere at både de indirekte og direkte udstedelsesomkostninger er lavere når virksomheden benytter sig af en eksisterende underwriter relation. Det er derfor som udgangspunkt forbundet med omkostninger for virksomheden at skifte underwriter. For det andet viser vi at udstedere er negativ påvirket af finansielt udfordrede underwritere, i og med at vi finder at kreditrisikoen af relaterede underwritere spiller over til kreditrisikoen af den udstedende virksomhed. Hvis en underwriter kommer i finansiell nød svækkes underwriterens evne til at mægle mellem obligationsudstederen og investorer samt at afgive en troværdig certificering af udstederen. Da det dermed er omkostningskrævende for obligationsudstederen at refinansiere dens gæld vil den svækkede relation føre til en øget refinansierings-risiko for udstederen. Ved at konstruere et udsteder-bestemt mål for underwriters risiko viser vi eksplicit at det ikke kun er deciderede konkurser af underwriter, men også blot øget kreditrisiko af underwritere, der kan forklare obligationsudsteders kreditrisiko.

I overensstemmelse med certificerings-hypotesen finder vi at kreditrisiko afsmitningen er mere udpræget blandt lavt-rangerede virksomheder der typisk er mere skrøbelige og derfor også i højere grad er afhængige af underwriterens certificering. Effekten er desuden større for virksomheder med en stor andel af kortfristet gæld, det vil sige virksomheder med et særskilt behov for underwriternes service i forbindelse med refinansiering af gæld. Dermed kan underwriters finansielle nød blive karakteriseret som refinansierings-risiko for udstederen. Samlet set viser denne artikel at underwriter relationer er værdifulde for udstedere af virksomhedsobligationer.

Essay 2: Corporate Hedging and Debt Extension

Det andet essay analyserer betydningen af kreditorers brug af credit default swaps (CDSer) for gældsfinansieringen af relaterede virksomheder. CDSer er finansielle derivater der beskytter køberen mod fallit af en given reference virksomhed. Tilgængeligheden af CDS kontrakter er generelt blevet udpeget for at være gavnligt i henhold til bankers udlån da det reducerer finansielle friktioner på udbudssiden af lån. Ved at gøre brug af enestående og omfattende CDS og kredit register data fra Deutsche Bundesbank analyserer jeg eksplicit CDSer der bliver holdt af banker med en kredit relation til den underliggende virksomhed og undersøger betydningen af variationen i disse kreditorers brug af CDSer for låntagerens gældsfinansiering. De detaljerede data viser at kreditorer typisk holder mange CDSer skrevet på den samme virksomhed og ofte faktisk også er (netto) sælgere af CDS kontrakter der relaterer sig til deres egne låntagere.

I henhold til virksomheders totale krediteksponering finder jeg at omfanget af den kreditforøgelse der opstår på baggrund af tilgængeligheden af CDS kontrakter i høj grad afhænger af kreditorernes netto CDS positioner. Nærmere sagt, finder jeg at virksomheder, hvis kreditorer er netto købere af kreditbeskyttelse har relativt mindre kredit til rådighed end virksomheder, hvis kreditorer er netto sælgere af kreditbeskyttelse. P trods af at individuelle kreditorer øger deres krediteksponeringer til virksomheder for givne niveauer af kreditbeskyttelse, så finder jeg ikke at denne effekt er signifikant på det aggregerede niveau. Dette skyldes formentlig at virksomhedens øvrige kreditorer opvejer effekten. Desuden finder jeg at resultaterne er robuste nr jeg eksplicit kontrollerer for låntagernes kreditrisiko samt en mere udpræget effekt for virksomheder og i perioder hvor likviditeten af CDS kontrakter er lav.

I forhold til virksomheders refinansierings-risiko finder jeg at virksomheder med netto CDS-købende kreditorer relativt til netto CDS-sælgende kreditorer har kortere løbetid på gæld og er mere begrænset i henhold til den type af gæld de kan udstede når de skal refinansiere deres gæld. Samtidig, finder jeg dog ikke at disse virksomheder har højere direkte gældsomkostninger hvilket indikerer at effekten på virksomheders refinansieringsbetingelser først og fremmest skyldes kreditorers sigte efter lavere overvågningsomkostninger. Selvom virksomheder med udestående CDS kontrakter generelt har lavere refinansierings-risiko sammenlignet med virksomheder for hvilke CDS kontrakter ikke er tilgængelige, så illustrer dette essay at CDS positioner af kreditorer kan indebære en indirekte omkostning for virksomheder i form af kreditrationering.

Essay 3: Can Central Banks Boost Corporate Investment: Evidence from ECB's Liquidity Injections

with Marti G. Subrahmanyam, Dragon Y. Tang, and Sarah Q. Wang

Det tredje essay undersøger hvorvidt ukonventionelle monetære interventioner kan påvirke real økonomien ved at stimulere virksomheders investeringer. Vi undersøger denne problemstilling ved at analysere ECB's Longer-Term Refinancing Operations (LTRO'erne) fra 2011/2012. LTRO'erne omfattede en stor likviditetsindsprøjtning der skulle understøtte et opsving i realøkonomien efter den europæiske gældskrise og indebar en billig finansiering for banker i eurozonen. For at undersøge effekten af sådanne likviditetsinterventioner benytter vi et omfattende datasæt der inbefatter oplysninger om bankers brug af LTRO finansieringen og ikke-finansielle virksomheders investeringer omkring implementeringen af LTRO'erne.

Vi starter med at dokumentere at virksomhederne udenfor eurozonen, som ikke (direkte) var påvirket af LTRO'erne, reducerede deres investeringer mere efter LTRO'erne end virksomhederne i eurozonen. I forhold til det generelle fald i virksomheders investeringer efter gældskrisen så indikerer denne kontrafaktiske analyse at den massive likviditetsindsprøjtning hjalp med at opbremse nedgangen i investeringerne af virksomhederne i eurozonen. Mod vores forventning om at virksomhederne i eurozonen øgede deres investeringer efter LTRO'erne, finder vi dog at virksomhedernes investeringer generelt er negativ associerede med størrelsen af LTRO-finansieringen af deres banker. Ved at belyse egenskaberne på de banker der benyttede sig af LTRO'erne finder vi at risikobetonede banker i langt højere grad gjorde brug af LTRO-finansieringen og at især låntagere af disse banker reducerede deres investeringer efter LTRO'erne.

Ved endvidere at undersøge bankernes kreditrisiko og dens rolle for virksomhedernes fald i investeringer finder vi at effekten er størst for virksomheder der er mere eksponeret overfor bankgæld. Dette indikerer at kreditrisikoen af banker og signalværdien af bankers optag af LTRO-finansieringen kan have forulempet den real økonomiske effekt som oprindeligt var tiltænkt den givne likviditetsindsprøjtningen. Vi kan yderligere dokumentere at den negative investeringseffekt af de ukonventionelle LTRO'er varierer med bankernes tilbagebetalinger af LTRO-finansieringen og viser herunder at mindre virksomheder, hvis bank tilbagebetalte LTRO-finansieringen relativt sent, faktisk øgede deres investeringer efter LTRO'erne. Ligeledes finder vi at virksomheder i lande med en lempelig finanspolitik i forhold til ECB's interventioner øgede deres investeringer som følge af bankers optag af LTRO'erne. Derved indikerer resultaterne i denne artikel at central bankers likviditetsindsprøjtninger kan opbremse økonomisk nedgang, men tydeliggør samtidig også at den real økonomiske effekt af likviditetsindsprøjtninger er meget afhængig af bankers og landes karakteristika og håndtering af ukonventionel pengepolitik.

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Introduction

This thesis consists of three self-contained essays. All three share the aim of providing a better understanding of financial frictions in corporate lending markets, but can be read independently. The first essay (co-authored with Jens Dick-Nielsen and Mads Stenbo Nielsen) investigates the value of bond underwriter relationships for corporate bond issuers. The essay documents that bond issuing firms do derive value from underwriter relationships capital by showing that corporate bond issuers benefit from utilizing existing underwriter relationships when rolling over bonds, but also are exposed to the distress of related underwriters. The second essay analyses the impact of creditors' use of Credit Default Swaps (CDS) for the debt financing of reference firms. The essay shows that the extent to which the availability of CDS contracts relaxes firms' debt financing conditions depends on creditors' specific CDS positions and, in fact, may imply an indirect cost to firms in the form of credit rationing. The third essay (co-authored with Marti G. Subrahmanyam, Dragon Y. Tang and Sarah Q. Yang) considers the effectiveness of central bank policies in terms of stimulating the real economy via significant liquidity injections to the banking system. By investigating the ECBs Longer-Term Refinancing Operations (LTROs) as of 2011/2012 and the effect of the LTROs on corporate investment policies the essays shows that the LTROs helped to decelerate the decline in corporate investment following the 2008 credit crisis. However, the essay also highlights the difficulties of stimulating corporate investment through liquidity injections to the banking system, especially when the balance sheets of banks are impaired.

The first essay sets the stage by investigating the value of bond underwriter relationships for corporate bond issuing firms. The role of a corporate bond underwriter is to facilitate the sales of newly issued corporate bonds and a strong underwriter relationship enables the underwriter to credibly certify the issuer on the bond market. In line with this certification hypothesis, but contrary to the findings in prior studies, we find that corporate bond issuers do retain value from underwriter relationships. First, we document the value of underwriter relationships by collecting data on U.S. non-financial firms' bond issuance costs and underwriter relations, and empirically test for the effect of a strong relationship between the issuing firm and the bond underwriter. Within this framework

we find that when a bond issuer utilizes an existing underwriter relationship in repeated bond issuances it lowers both the indirect and direct issuance costs. Accordingly, loyalty towards the underwriter is rewarded and as a baseline it is costly for the firm to switch underwriter. Second, we document that the same corporate bond issuers do derive value from underwriter relationship capital by showing that issuers are adversely affected by underwriter distress. Specifically, we find that the credit risk of the underwriter spills over to the credit risk of the issuing firm. We argue that if an underwriter ends up in financial distress it weakens the underwriter's ability to connect the bond issuer with investors and to credibly certify the issuer. As this is costly for the bond issuer when rolling over maturing bonds, the weakened relationship leads to higher credit risk of the issuer. By constructing an issuer specific measure of underwriter distress we explicitly find that the variation in the credit risk of related underwriters helps explain the variation in the credit risk of bond issuers. While we do find that the effect is pronounced in the case of an actual default of an underwriter, that will force firms to switch underwriter, we document that the effect is also economically significant for just higher level of underwriter distress. It is in particular these findings of an anticipation effect and issuing firms' involuntary switches of underwriters that distinguishes this study from the existing literature and suggests the value of underwriter relationships. Furthermore, and consistent with the certification hypothesis, we find that the credit risk spillover is more pronounced for low-rated firms which are usually also more opaque and, therefore, more dependent upon the underwriter certification. In addition, the impact of underwriter distress is stronger for firms with a high fraction of short-term debt, i.e., firms with an imminent need for underwriter services for rolling over maturing bonds. Thus, underwriter distress can be characterized as a rollover risk for the issuer.

While, the first essay contributes to the literature by documenting that corporate bond issuers derive value from underwriter relationships, the second essay investigates firms' credit relationships and focuses on the role of creditors' use of CDS for firms' debt financing. CDSs are financial derivatives that protect the buyer against default of a given reference firm and the availability of CDS contracts has been outlined to be accommodative in reducing financial frictions on the supply side of credit. While prior studies have shown that the existence of CDS markets are positively correlated with relaxed borrowing conditions for non-financial firms, this essay documents that the significance of the impact of CDS on firms' debt financing depends to a large extent on creditors' specific holdings of CDS contracts that are written on the firms' debt. Specifically, I find that CDS positions of creditors may imply an indirect cost to firms in the form of credit rationing. The results provided in this essay are based upon an empirical investigation that makes use of unique and comprehensive CDS position and

German credit registry data from Deutsche Bundesbank. First of all, the combination of these data allows me to investigate the impact of CDS holdings by the firms' own creditors which is important for the channel of an effect of CDS on firms' borrowing conditions. Secondly, the use of detailed firm-bank-level CDS position data provides this study with the unique feature to analyze the impact of the amount of creditors' CDS holdings at a given point in time, but in particular also allows to separate between the impact of creditors which are (net) buyer or seller of credit protection. This is of particular importance as the data reveals that creditors typically hold multiple CDSs written on the same firm and often also are net sellers of CDS contracts written on their own borrowers. Accordingly, the main contribution of this essay is that it provides a more detailed understanding of the implications of variations in creditors' CDS holdings across firms and time. Furthermore, this essay also contributes to the discussion of the impact of the existence of CDS for corporate lending more generally by focusing on the implications of creditors' net CDS holdings for firms' overall borrowing conditions, as well as by evaluating the effect of variations in creditors' use of CDS contracts conditional on the general availability of CDS contracts. Focusing on firm-level credit exposures I find that the credit extension arising due to the availability of CDSs significantly depends upon creditors' net CDS positions. Specifically, the results outline that firms where the creditors are net credit protection buyers have relatively less credit available relative to firms where the creditors are net credit protection sellers. Although individual creditors may extend their credit exposure to firms for certain levels of credit hedging, I find that the effect is not significant on the aggregate level probably because the effect is offset by the firms' other creditors. While creditors typically buy CDS contracts on borrowers with higher credit risk, the results are robust when I explicitly control for firms' credit risk. Furthermore, the effect is pronounced when CDS contracts are illiquid. Investigating firms' debt financing conditions more generally, I find that firms with net CDS-buying creditors relative to firms with net CDS-selling creditors have lower debt maturity and are more constrained with respect to the type of debt they can issue when they refinance their maturing debt. However, I do not find that these firms have significantly higher direct debt financing costs. Accordingly, the results suggest that the change in firms' refinancing conditions are caused by creditors' aim for lower monitoring costs that is supplementary to the decrease in credit risk stemming from their credit hedging. However, the analysis also outlines that firms with available CDS contracts on average have lower refinancing risk compared to firms for whom CDS contracts are not available. Overall, this essay highlights that although the existence of CDS contracts tend to reduce financial frictions in lending market, the use of CDS contracts by the firm's own creditors may come at an indirect cost to the firm in form of credit rationing.

In contrast to the first two essays, the third essay exemplifies how frictions in lending markets can have real economic implications. Specifically, the third essay investigates the effectiveness of central bank policies in terms of stimulating the real economy via significant liquidity injections to the banking system. We address this question by analyzing ECB's three-year Longer-term Refinancing Operations (LTROs) as of 2011/2012 that were unconventional liquidity injections of significant size and scope and provided cheap funding to Eurozone banks. By improving liquidity in the banking sector the aim of these interventions were to help the real economic recovery after the European Sovereign Debt Crisis. For the empirical investigation of the real effects of such central bank liquidity interventions, we make use of comprehensive data on Eurozone banks' use of the LTRO funding, as well as investment policies of Eurozone non-financial corporations around the LTRO implementation. We start our analysis by documenting that non-Eurozone corporations, which were not directly affected by LTROs, reduced investments more than Eurozone corporations following the LTROs. Since corporate investment in the onset of the credit crisis in general was decreasing, such a counterfactual analysis suggests that the massive liquidity injections helped Eurozone corporations to decelerate their investment decline. However, against our expectations of an increase in investment for Eurozone corporations and after the LTROs, we find that the investments of these corporations are negatively associated with the amount of LTRO funds their banks obtained from the ECB. Studying the characteristics of banks that made use of the LTROs, we find that riskier banks had a higher LTRO uptake and that, in particular, borrowers of these banks reduced investment following the LTROs. When further investigating the role of bank risk in explaining the decrease in investment, we find that the effect is pronounced for corporations with a greater exposure to bank debt, which suggests that bank risk and the signaling role of the banks' LTRO uptake might have impeded the transformation of liquidity injection into real economic measures. In addition, we document that the negative investment effect of the unconventional LTROs varies across banks' LTRO-repayment policies and show that smaller corporations whose lenders' held the LTRO funds for a longer period did increase investment after the LTROs. Furthermore, we find that when fiscal policies of local governments were accommodative to ECB's interventions, corporate investment increased in response to their lenders' LTRO uptakes. Overall, this essay contributes to the debate about effectiveness of unconventional monetary policy by suggesting that central banks' liquidity injections can decelerate economic decline. However, we also highlight the difficulties of stimulating corporate investment through liquidity injections into the banking sector. Accordingly, the essay sheds light on the significance of frictions in lending markets for the effectiveness of central bank policies that aim at improving real economic measures via bank lending markets.

Chapter 1

The Value of Bond Underwriter Relationships

with Jens Dick-Nielsen and Mads Stenbo Nielsen

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Abstract

We show that corporate bond issuers benefit from utilizing existing underwriter relationships when rolling over bonds, but at the same time become exposed to underwriter distress. A strong relationship enables the underwriter to credibly certify the issuer resulting in lower direct issuance costs and lower underpricing. However, if the underwriter becomes distressed, this spills over to the issuer's credit risk, because it weakens the relationship and increases the risk of involuntary relationship termination. The credit risk spillover is more pronounced for risky, opaque issuers with high rollover exposure, i.e., those issuers most in need of certification by an underwriter.

1. Introduction

The value created by the relationship between an issuer of a security and the underwriter can be characterized as relationship capital (Rajan (1992), and James (1992)). Prior studies have shown that for equity offerings the issuer is able to capture part of the relationship capital value (Burch, Nanda, and Warther (2005), and Fernando, May, and Megginson (2012)). However, the same studies do not find any evidence that the issuer of a corporate bond retains value from the underwriter relationship and loyalty towards the underwriter is therefore not rewarded. Contrary to this, we find that when bond underwriter relationships are weakened it affects corporate bond issuers negatively, implying that corporate bond issuers do derive value from underwriter relationship capital.

The role of a corporate bond underwriter is to facilitate the sales of newly issued corporate bonds. This includes determining the proper offering price and finding potential investors using the underwriter's investor connections (Nagler and Ottonello (2017)). There is ample evidence in the literature that the choice of bond underwriter will affect the success of the bond issue on the primary market (Fang (2005), Yasuda (2005), Andres, Betzer, and Limbach (2014), and Carbó-Valverde, Cuadros-Solas, and Rodríguez-Fernández (2017)), as well as on the secondary market (Dick-Nielsen, Feldhütter, and Lando (2012)). Our results suggest that these benefits, at least partly, accrue due to a strong relationship between underwriter and issuer. The strong relationship can be seen in that the credit risk of the lead underwriter spills over to the credit risk of the issuing firm which is consistent with relationship capital being valuable for the issuer.

When issuers derive value from underwriter relationship capital it suggests that the issuers benefit from certification (Burch, Nanda, and Warther (2005)). In line with this argument, we show that certification by the lead underwriter is helpful in reducing asymmetric information between the issuer and the investors, ultimately resulting in a higher net price on the primary market (Fang (2005), and Carbó-Valverde, Cuadros-Solas, and Rodríguez-Fernández (2017)). While it is often true that some information such as credit ratings (Fernando, May, and Megginson (2012)) are available to investors,

this does not satisfy investors. Certification is instrumental in finding the proper offering price and investor allocation; The Credit Roundtable (2015) reports that new bond issues are usually announced and priced (sold) within the same day, and usually with only very limited information available to the investors. The books can close as soon as 15 minutes after the announcement and the average is within one to two hours. While there used to be an issuer conference call for the bond investors to ask questions, the standard is now that there is no contact between the bond investor and the issuing firm. Investors may not even have the preliminary prospectus and bond indentures before the books are closed. The situations described by The Credit Roundtable (2015) highlight that bond investors are dependent upon the recommendation (certification) by the underwriter. Thus, it is crucial that the bond underwriter knows and has a strong relationship to the issuing firm in order to be able to credibly certify the bond issuance.

If the underwriter ends up in financial distress it weakens the underwriter's ability to connect the bond issuer with investors. Investors may no longer believe in the underwriter's expertise to provide accurate recommendations if the underwriter itself is in distress. To enhance their own chances of short-term survival, distressed underwriters may even be prone to moral hazard resulting in biased recommendations. Thus, distress of the underwriter increases the risk that the issuers lose their valuable underwriter relationship capital. Consistent with this, we find empirically that underwriter distress affects the financial health of those firms with strong relationships to the underwriter. Our results show that establishing a new relationship to another underwriter with other investor connections is costly and the issuer would therefore, everything else equal, be worse off by switching underwriter. While firms may benefit from switching underwriter (see, e.g., Krigman, Shaw, and Womack (2001), and Fernando, Gatchev, and Spindt (2005)), this switch usually occurs voluntarily and not because of outside pressure. Ultimately, if an underwriter ends up in distress it takes time for the issuer to establish an equally good relationship to a new underwriter. We show that not utilizing an existing underwriter relationship when issuing bonds, in general, increases both the direct issuance costs, as well as the underpricing in the secondary market. These findings are in contrast to those of Burch, Nanda, and Warther (2005) who find no benefits of underwriter loyalty for corporate bond issuers.

For a given firm, we measure the distress of the issuer-underwriter relationship by first identifying the lead underwriters of all bonds currently outstanding. The credit default swap (CDS) spread of each lead underwriter, as a proxy for their credit risk, is then weighted in proportion to how many of the firms' currently outstanding bonds the underwriter has underwritten. Hence, our firm-specific relationship distress measure will be high if a dominant lead underwriter ends up in financial distress. Using this

measure, we show that the firm-specific underwriter credit risk helps explain the CDS spreads, i.e., credit risk, of bond issuers, both in levels and in changes. Consistent with the certification hypothesis, we find that the sensitivity of firms' credit risk to underwriter distress is larger for speculative-grade issuers, i.e., exactly those who would benefit the most from certification. Furthermore, within our time period from 2004 to 2012 there are several large underwriters which default, most prominently, Bear Stearns, Lehman Brothers, and Wachovia. We show that there is a clear difference in the evolution of the credit risk for firms with a strong relationship to these underwriters compared to the rest of the market.

If the underwriter relationship capital is valuable, we expect underwriter distress to have a larger impact on firms with an imminent underwriting need. This would be the case for firms with a high fraction of short-term debt. Because firms usually rollover maturing debt, these firms would need to issue bonds again soon (Opler, Saron, and Titman (1997), Hovakimian, Opler, and Titman (2001)). We find support for this hypothesis as our results suggest that underwriter distress matters more for firms with a large amount of debt maturing over the coming year, i.e., firms with a high rollover exposure. Hence, our findings indicate that underwriter distress increases the rollover risk for bond issuers. Furthermore, we verify that the increased rollover risk is not caused by a more illiquid secondary market as in He and Xiong (2012).

The spill over from underwriter distress to the issuer's credit risk is statistically, as well as economically significant. While the first order determinants of issuer credit risk continues to be firm fundamentals, we find that variation in underwriter distress has the same explanatory power as variation in, e.g., firm leverage. For a firm with a median distressed underwriter relationship, underwriter distress can explain around 8 percent of the firm's credit spread. Contrary to this, Chen, Cui, He, and Milbradt (2017) calibrate the impact of rollover risk on the credit spread as defined in He and Xiong (2012). They find that rollover risk in their calibration accounts for 5 percent of the credit spread.

Our study is closely related to that of Burch, Nanda, and Warther (2005) and Fernando, May, and Megginson (2012). Burch, Nanda, and Warther (2005) find that switching bond underwriter decreases fees on average. However, their result is driven by issuers who voluntarily graduate to higher-quality underwriters while obtaining lower fees. In this study, we find the opposite result, namely, that switching underwriter increases fees and underpricing. The contrasting results hinge on the distribution of voluntary versus involuntary underwriter changes within the sample. To circumvent this issue, we take an approach similar to Fernando, May, and Megginson (2012) and Kovner (2012), and look at the effect of underwriter distress. In particular, Fernando, May, and Megginson (2012) investigate the impact of the Lehman Brothers default and find, in contrast to us,

no significant impact for bond underwriter clients. However, as their paper only looks at the impact over the few days surrounding the default announcement and, hence, ignores any anticipation effect, the effect they find is a lower bound for the total impact of underwriter distress. Consistent with their results we find little incremental effect of the default itself. However, we do find a significant and large anticipation effect for bond issuers. Our underwriter relationship distress measure based on CDS spreads exactly measures the degree to which underwriter defaults are anticipated by the market.

Firms that seek to borrow money can broadly speaking choose between obtaining bank loans or issuing corporate bonds, and, accordingly, our study is also related to the banking literature. First, firms often choose bond underwriters based on their prior banking relations (Yasuda (2005), and Drucker and Puri (2005)). A distressed bond underwriter could therefore imply a distressed bank lending relationship. However, we verify empirically that bank loan underwriter distress (see, e.g., Acharya and Mora (2015)) and bond underwriter distress are separate contributors to issuer credit risk. Second, in the banking literature the role of a bank is often emphasized as being able to overcome asymmetric information about the quality and effort of the borrowing firm. In contrast, investors in the corporate bond market are assumed to rely only on public information (see, e.g., Diamond (1991a), Rajan (1992), Besanko and Kanatas (1993), and Bolton and Freixas (2000)). Theoretically, firms with higher observable quality therefore go to the corporate bond market, while more risky and opaque firms choose to build a relationship with a bank. However, we show that this distinction is not a clear cut and that bond issuers also benefit from certification.

2. Underwriter Relationships and Issuance Costs

Before we investigate the impact of underwriter distress on relationship capital, we look at the unconditional effect of switching underwriter. Underwriter distress is potentially costly for the bond issuer because it weakens the underwriter’s ability to certify the issuer and connect the issuer to investors. To avoid this, the issuer could in principle just switch underwriter and, thereby, prevent any costs associated with having a distressed underwriter. However, this can only be done if bond issuers do not derive value from relationship capital. Burch, Nanda, and Warther (2005) show that it, in general, is costly to switch underwriter between equity offering, whereas Krigman, Shaw, and Womack (2001) and Fernando, Gatchev, and Spindt (2005) show that it, under some circumstances, can be beneficial.¹ We investigate the potential benefits of loyalty for corporate bond issuers

¹The authors show that firms may obtain additional and influential analyst coverage from the new lead underwriter and typically choose to graduate to higher reputation underwriters.

by looking at the gross spread paid to the underwriter for providing the underwriter service, as well as the underpricing in the secondary market.

To investigate the underwriter relationship benefits on gross spreads of corporate bonds, we collect the spread as a percentage of the offering price from FISD for all corporate bonds available. We label this variable *Gross Spread*. In the spirit of Gande, Puri, Saunders, and Walter (1997), we let the gross spread depend upon credit rating, bond type, issuer industry, time to maturity, offering amount, and whether it is an issuance under rule 144a. Furthermore, we add a dummy for whether the issuer is utilizing an existing lead underwriter relationship. We label the dummy *Existing UW Relation*, and in our definition, the issuer is using an existing relationship if one or more lead underwriters involved in the new issuance also have been used for the issuance of a currently outstanding bond. We restrict the analysis to issuers classified as industrial by FISD and summary statistics are given in Table 1, Panel A. More specifically, we look at the following regression:

$$\begin{aligned} \text{Gross Spread}_i = & \alpha + \beta_1 \times \text{Existing UW Relation}_i + \beta_2 \times \text{Time to Maturity}_i \quad (1) \\ & + \beta_3 \times \text{Offering Amount}_i + \beta_4 \times \text{Rule 144a}_i + \beta_5 \times \text{Bond Type}_i \\ & + \beta_6 \times \text{Credit Rating}_i + \beta_7 \times \text{Industry}_i + \epsilon_i \end{aligned}$$

where i is the i 'th bond issue.² The estimated regression coefficients can be seen in Table 2. Looking at specification (a) and (b), we see that a larger issuance size and a shorter time to maturity both lowers the gross spread, and that issuing under Rule 144a is more expensive. However, we also see that using an existing relationship lowers the gross spread. In other words, switching underwriter, on average, is costly. In the special case of an initial public bond offering (IPO) the issuer does not, by definition, have any existing bond underwriter relationship. To address this, the third regression specification includes a dummy for IPOs, *IPO dummy*. Consistent with the certification hypothesis, we find that IPOs have higher costs as the issuers in these types of offerings have no existing benchmarks or underwriter relationships. For seasoned issuances it is beneficial for the issuer to utilize existing underwriter relationship capital, rather than switching underwriter, as it lowers the direct rollover costs for the issuer.

While the gross spread measures the direct issuance costs, we can also look at the implicit costs of underpricing in the secondary market (Cai, Helwege, and Warga (2007), and Nagler and Ottonello (2017)). We define the variable *Underpricing* and measure underpricing as the relative difference in prices between the average transaction price from TRACE over the first two weeks of trading and the offering price on the primary

²*Bond Type* and *Industry* are given on the levels available from FISD. *Credit Rating* is an indicator for investment-grade issuer versus speculative-grade issuer.

market.³ A positive underpricing return means that the bond is traded at higher prices on the secondary market compared to the primary market, which is an implicit cost for the issuer as known from the IPO literature. Using the same regression specifications as for gross spread, we see from Table 2, specification (d) to (f) that utilizing an existing relationship also lowers the indirect issuance costs in the form of lower underpricing.⁴

Looking at the marginal regressions (a) and (d), the effect of having an underwriter relationship is quite significant. It lowers direct issuance costs by almost 20 basis points, i.e., from 103 bps to 84 bps, and it lowers underpricing from an average of 75 bps to 24 bps. For seasoned bond issuers approximately 60 percent of the bonds are issued using an existing underwriter relationship. In general, bond issuers can switch underwriter either because they are forced to do it or because they choose to do it. A forced shift of underwriter is most likely costly whereas a voluntary switch may be an advantage. The disadvantage we find from switching underwriter should therefore be interpreted as a lower bound for the costs of a forced new underwriter relationship across all bond issuers. In that regards, our contrasting findings compared to those in Burch, Nanda, and Warther (2005) are driven by sample difference in terms of the voluntary versus involuntary underwriter changes. In the following sections, we look at the impact of underwriter distress which is a more direct identification of the risk of being forced into a new relationship (see, e.g., Fernando, May, and Megginson (2012), and Kovner (2012)).

3. Underwriter Distress and Issuer Credit Risk

An involuntary switch of underwriter is most likely costly for the bond issuer, especially, if there is an imminent need for the underwriting service. In this section, we test to what extent underwriter distress can help explain issuer credit risk. We expect the sensitivity towards underwriter distress to be most pronounced for firms with high rollover exposure, as well as for opaque firms who stand to gain the most from certification. We first define an underwriter distress measure and, then, use this measure to test several hypotheses relating underwriter distress to the distress of their client firms.

3.1 Underwriter Distress Measure

Each corporate bond issuer has underwriter relationships to one or more banks.⁵ When measuring how distressed a firm's underwriter relationships are, it is important to dif-

³Transaction prices from TRACE are cleaned as in Dick-Nielsen (2009).

⁴The results are robust to alternative specifications of the underpricing measure where we use shorter time windows of the trading period.

⁵Every time we refer to underwriter we implicitly mean the lead underwriter(s) of the bond issuance in question. Most bonds are issued using only a single lead underwriter.

ferentiate between whether a given underwriter is core or periphery to the firm. We therefore count the firm’s number of bonds currently outstanding that are underwritten by a particular underwriter. Based on this, we calculate the average CDS spread of all of the firm’s underwriters weighted by the number of bonds they each have underwritten. In this way, we get an issuer-specific underwriter distress measure, *UW Risk*, where we proxy for underwriter distress by the underwriter’s CDS spread. Hence, if several of a firm’s bonds have been issued using a single underwriter, which typically is the case, then that underwriter’s CDS spread will be given a larger weight in the distress measure. The issuer-specific underwriter distress measure is defined as:

$$\text{UW Risk}_{it} = \frac{\sum_{j=1}^{N_t} \text{UW CDS}_{jt} \times \text{Number of bonds}_{ijt}}{\text{Total number of bonds}_{it}} \quad (2)$$

where i is the i ’th issuer, j is the underwriting bank, UW CDS_{jt} is the five-year log CDS spread of the j ’th underwriter in month t , and N_t is the number of underwriter connections in month t .⁶ An underwriter may be close to default, but if that underwriter has only been used for the issuance of a tiny fraction of the bonds outstanding, then it should not matter much for the issuing firm. On the other hand, if the firm’s main underwriter is in distress then this will have a large impact on the issuer-specific underwriter distress measure. In order to determine the lead underwriter relationships for each U.S.-corporate bond we use the Mergent FISD database. Table 3 shows the 20 most active underwriter banks for bonds outstanding at some point during the period 2004-2012. As shown in Column (b), the most active underwriters are JP Morgan, Citibank, and Goldman Sachs. Hence, these are the banks with the most corporate bond client firms during our sample period. We restrict our underwriter sample to the list of the 20 most active underwriter banks so that our empirical results do not get distorted by atypical underwriters which have only been used by very few issuers. For each of the top 20 underwriters, we collect CDS spread data from Markit.⁷

3.2 Firm Fundamentals and Market Data

For all firms with a CDS spread in the Markit database, we collect quarterly firm fundamentals from Compustat (North America). As financial and utility firms typically have special capital structures we exclude these from the analysis (SIC codes 4900 to 4999 and 6000 to 6999), as well as firms with no SIC code. The remaining firms constitute our sample of corporate bond issuers. Table 3, Column (c), shows the number of client firms in the final sample for each of the top 20 underwriters. The distribution of under-

⁶Our results are robust to the alternative specification where each underwriter is weighted by the amount outstanding of each bond issue.

⁷Markit data is available from 2004 which thereby determines the starting point of our sample.

writer relationships is almost the same as in the full sample except with fewer issuers. The reduction in client firms is mainly driven by the availability of CDS spreads. All CDS spreads are for the five-year CDS contract recorded at the beginning of the month. Therefore, our sample is naturally biased towards larger firms, i.e., firms with access to financing through corporate bonds and, furthermore, bond issuers with a CDS spread. This selection bias helps differentiating our sample from the typical banking relationship firm sample which usually consists of medium and smaller sized firms.

For the choice of potential determinants of issuer credit risk we largely follow Blanco, Brennan, and Marsh (2005), Collin-Dufresne, Goldstein, and Martin (2001), and Longstaff, Mithal, and Neis (2005) and collect a standard set of firm fundamentals from Compustat.⁸ *Leverage* is measured as the book value of long-term debt plus debt in current liabilities, divided by total assets. *Equity Volatility* is calculated using total stock returns for the preceding 90 days. Following Bates, Kahle, and Stulz (2009) and Subrahmanyam, Tang, and Wang (2017), we measure *Cash* as the corporations' cash holdings and cash equivalents, scaled by total assets. *Firm Size* is measured by the natural logarithm of total assets. *Profitability* is measured as operating income to total revenue. Furthermore, we collect market wide variables to proxy for the business cycle. These are the one-year swap rate from the Federal Reserve Bank, *1yr Swap*, and the CDX index (CDX.NA.IG), *CDS Index* provided by Markit. The CDX index is an average of the top industrial investment-grade CDS spreads. Table 1, Panels B and C, provides summary statistics for all variables. Finally, we collect bond rating data from FISD and stock price information from CRSP.

3.3 The Impact of Underwriter Distress

If a financial institution, acting as an underwriter, is in distress it may not be able to assist client firms in issuing new bonds. This could impair future investment decisions in these firms and, in particular, make it costly for the firms to roll over maturing debt. The firms could potentially switch to a new underwriter, but this would also be costly as shown in the previous section. Furthermore, the firms may have other relationship ties to the underwriter which could amplify the effect of underwriter distress (we return to this issue in Section 4). The expected implication for the issuing firm is that when the underwriter is in distress it will have a negative effect on the financial health of the issuing firm. Hence, the credit risk of the underwriter spills over to that of the issuing firm.

As a first rough indication of the impact of underwriter distress, we investigate the impact of the loss of an underwriter relationship, caused by the default of the underwriter.

⁸All quarterly data are interpolated to obtain monthly data.

Figure 1 shows the time series of the bond issuing firms' average CDS spread based upon their existing underwriter relationships. We split the sample of issuers into two groups; those with a relationship to a defaulting underwriter, i.e., Bear Stearns, Lehman Brothers, or Wachovia, and those without. Figure 1 indicates that the group of bond-issuers with a connection to an underwriter which defaults is more credit risky than the other group.

In order to test this hypothesis more formally, we use the underwriter distress measure, *UW Risk*, defined above. We look at several versions of the following regression:

$$\begin{aligned} \text{CDS Spread}_{it} &= \alpha + \beta \times \text{UW Risk}_{it} + \text{Controls}_{it} + \epsilon_{it} \\ &= \alpha + \beta \times \text{UW Risk}_{it} + \gamma_1 \times \text{Leverage}_{it} + \gamma_2 \times \text{Equity Volatility}_{it} \\ &\quad + \gamma_3 \times \text{Profitability}_{it} + \gamma_4 \times \text{Cash}_{it} + \gamma_5 \times \text{Firm Size}_{it} \\ &\quad + \gamma_6 \times \text{1yr Swap}_t + \gamma_7 \times \text{CDS Index}_t + \epsilon_{it} \end{aligned} \tag{3}$$

where i is the i 'th issuing firm and t is the month. As a proxy for firms' credit risk we use *CDS Spread* which is the natural logarithm of the CDS spreads consistent with the approaches in both Ericsson, Jacobs, and Oviedo (2009) and Bai and Wu (2016). To mitigate the effect of potential outliers, we winsorize all variables at the 1st and 99th percentiles.

The results of the regressions are listed in Table 4 and the full sample refers to the sample that includes all available data from 2004 to 2012. In the first regression (specification (a)), we include underwriter distress as the only regressor. Our underwriter distress measure is highly significant in this marginal specification, and the size of the coefficient on *UW Risk* is robust to including firm characteristics (specification (b)). The firm characteristics used here are leverage and equity volatility, which are known to be important predictors of credit risk (Merton, 1974) and have been shown to be the main predictors of CDS spreads (Ericsson, Jacobs, and Oviedo (2009) and Bai and Wu (2016)). We also add cash holdings, firm size, and profitability.

We expect that higher leverage and higher equity volatility implies higher credit risk, which is also what we see in Table 4. Furthermore, the results show that larger and more profitable firms are less credit risky, while firms with higher cash holdings are more credit risky. The latter finding is consistent with Harford, Klasa, and Maxwell (2014) who show that cash holdings are used as a buffer for risky firms when rolling over their debt.

While there is cross-sectional variation in the underwriter distress measure, there is also a strong time series correlation with general market conditions. During the 2008 financial crisis both bond-issuing and bond-underwriting firms were constrained, independently of them having an underwriter relationship. Hence, when *UW Risk* is significant in the regression we could just be picking up this time series correlation. In order to

control for this, we include *1yr Swap* and *CDS Index* to take account of general market movements. This limits the sample to 2006 to 2014 because the CDX index data is not available before 2006. In Table 4, we see that including the market variables reduces the influence of the underwriter distress measure. However, the measure is still highly significant even after controlling for general market movements.

Since CDS spreads are not defined after a default, underwriters naturally exit our underwriter distress measure calculation upon their default. However, excluding the relationship with a defaulted underwriter is counter-intuitive because we expect issuing firms to be affected the most by underwriter distress exactly when the underwriter defaults. Instead, the measure *UW Risk* will by construction outline a drop after an underwriter defaults, as the remaining underwriter relationships are less credit risky. We explicitly investigate the effect of an underwriter default in Section 3.7, but, at this point, we merely exclude firms from the regression in the six months following the default of an underwriter. In Table 4, specification (d), we see that excluding these firm observations has very little impact on the estimated coefficients and, for now, we therefore continue to work with the sample where relationships to a defaulted underwriter are excluded. Overall, the results in Table 4 support the hypothesis that underwriter distress spills over to the credit risk of the bond issuer. In Table 5, we run the same set of regressions, but this time we use changes instead of levels. Again, we see that the *UW Risk* measures is highly significant.

We can refine the connection between underwriter distress and bond issuer distress even further: To the extent that the underwriter certifies the quality of the bonds, a strong relationship should matter most for risky, opaque firms. These are the type of bond issuers who would benefit the most from certification, and also the type of issuer for whom we expect it to be most costly to build a new underwriter relationship. We therefore split the sample into investment-grade and speculative-grade rated bond issuers. Table 6 shows that the *UW Risk* measure is highly significant for both investment-grade and speculative-grade rated issuers. However, the coefficient for issuers with a speculative-grade rating is larger, both for the regression in levels and in changes. Hence, the results in Table 6 indicate that the underwriter relationship, consistent with the certification hypothesis, is more important for riskier firms.

While we argue that the causality is a spill over from underwriter to bond issuer, one could also consider the reverse causality. If causality was reversed it would imply that firms with excessive risk choose more credit risky underwriters.⁹ However, we do not find evidence for such an effect in the data. The reverse causality is most easily investigated

⁹By excess risky we here mean that the firm's CDS spread could not be explained by the other controls in the regression, i.e., firm fundamentals and business cycle proxies.

by considering the time series dimension. Before the crisis, Lehman Brothers was not significantly more risky than other underwriters. As Lehman Brothers' CDS spread rose during the crisis, reverse causality should then have implied that excess credit risky firms establish new underwriter relationships to Lehman Brothers. However, rather than finding this to be a dominant behavior, we find that relationships are very sticky. In particular, we observe that in the 12 months leading up to the default only 11 firms established new underwriter relationships to Lehman Brothers out of a total of 63 firms with a connection to Lehman Brothers. Furthermore, we find that these new firms are not excess credit risky at the inception of the relationship.¹⁰ In other words, those firms which experience an increase in credit risk because of a connection to Lehman Brothers had, for the vast majority, also a connection to Lehman Brothers before it became more credit risky than other underwriters. Hence, we do not find evidence for the presence of a reverse causality in our results.

3.4 Rollover Risk

Firms often aim at maintaining a target leverage ratio (Opler, Saron, and Titman (1997), and Hovakimian, Opler, and Titman (2001)) and, hence, often roll over maturing debt by replacing maturing bonds with newly issued bonds. In order to roll over bonds, firms need to make use of their underwriter relationship. If the underwriter is distressed, then the bond-issuing firms are exposed to higher costs when rolling over their debt which may further translate into higher credit risk (He and Xiong (2012)). It is therefore interesting to investigate to what extent the underwriter distress measure is specifically connected to rollover risk.

In order to test this rollover exposure hypothesis, we identify all firms with an imminent need for rolling over maturing debt. Specifically, we follow He, Wang, and Qi (2014), and Harford, Klasa, and Maxwell (2014) and use $Debt \leq 1yr / Assets$ which is defined as the amount of long-term debt maturing within one year relative to total assets. When the rollover exposure is high, we would expect underwriter distress to have a larger impact.¹¹ We test the hypothesis by including the interaction between rollover exposure and the underwriter distress measure into the regression from before:

¹⁰Specifically, we investigate whether firms with a connection to, respectively, Bear Stearns, Lehman Brothers, and Wachovia, at the time of their default, already two years prior to the default had higher CDS spreads than the average firm in our sample. We do not find significant differences.

¹¹Again one could consider the reverse causality. However, the capital structure and, thus, rollover exposure is chosen at a point before there are any significant differences between underwriters' credit risk.

$$\begin{aligned} \text{CDS Spread}_{it} = & \alpha + \beta_1 \times \text{UW Risk}_{it} + \beta_2 \times \frac{\text{Debt}_{\leq 1\text{yr}_{it}}}{\text{Assets}_{it}} \\ & + \beta_3 \times \frac{\text{Debt}_{\leq 1\text{yr}_{it}}}{\text{Assets}_{it}} \times \text{UW Risk}_{it} + \text{Controls}_{it} + \epsilon_{it} \end{aligned} \quad (4)$$

where i is the i 'th issuing firm and t is the month. The controls are the same as in our base regression model (3). The coefficients are shown in Table 7. For brevity, and as all control variables are significant with the expected signs, we have excluded the coefficients for the control variables.

In Table 7, Panel A, specification (a) and (d), we see that when underwriter distress increases, the credit risk of bond issuers increases more for firms with higher rollover exposure. The coefficient is not significant for investment-grade firms but is significant for speculative-grade firms. When *UW Risk* is high enough, i.e., slightly above the median for speculative-grade firms, credit risk is also an increasing function of rollover exposure. In other words, as the amount of short-term debt increases so does the CDS spread as long as the underwriter distress measure is above a certain threshold. Related studies have shown that firms roll over part of their debt already two to three years before maturity (Xu (2017)). Therefore, we also investigate firms' holdings of long-term debt maturing within two and three years. For the two-year horizon the effect is still present (although the coefficients are smaller), whereas for the three-year horizon the results are insignificant. Hence, there seems to be an amplifying effect of higher rollover exposure, but when increasing the debt maturity horizon the effect gradually vanishes, intuitively, because the rollover exposure approaches total debt.

As a robustness check we look at an alternative definition of firms' rollover exposure calculated as maturing long-term debt scaled by total long-term debt instead of by total assets. The results are shown in Table 7, Panel B, and are very similar. In robustness tests we also replace the five-year bond-issuer CDS spread with a one-year CDS spread. The results show that long-term debt due within one year remains significant for speculative-grade issuers, but that debt due within two and three years are not significant. This again supports the hypothesis that higher rollover exposure increases the sensitivity towards underwriter distress.

3.5 Underwriter Distress and Bond Illiquidity

Both theoretical (He and Xiong (2012)) and empirical (Valenzuela (2015), and Nagler (2017)) findings suggest that secondary market illiquidity could spill over to the primary market and induce rollover risk because of depressed offering prices. Hypothetically, this effect could be attributed to underwriter distress as well. Dick-Nielsen, Feldhütter, and Lando (2012) show that when the lead underwriter of a bond goes into distress, the bond

becomes less liquid in the secondary market. This is because the underwriter often also acts as market maker in the secondary market. Since underwriter distress leads to a less liquid secondary market it would indirectly spill over to a price discount for new bonds on the primary market. This price discount is what is defined as rollover risk in He and Xiong (2012). Note that this market making hypothesis is complementary to the certification hypothesis, i.e., these are two different ways in which underwriter distress might impact issuer credit risk.

To test the market making hypothesis, we first verify that underwriter distress leads to a less liquid market (Dick-Nielsen, Feldhütter, and Lando (2012)) by estimating the following regression:

$$\text{Bid-Ask Spread}_{it} = \alpha + \beta \times \text{UW Risk}_{it} + \epsilon_{it} \quad (5)$$

where i is the i 'th issuing firm and t is the month. *Bid-Ask Spread* is the average effective bid-ask spread across all outstanding bonds from the same issuer. The bond specific bid-ask spread is calculated as the monthly average across the daily difference between volume weighted bid and ask transaction prices.¹² From Table 8, Panel A, we see that the UW Risk measure is significant in explaining the bid-ask spread so that higher underwriter distress leads to more illiquid bonds for the client firms. This suggests that part of the underwriter distress effect could be due to a spill over from a less liquid secondary market. To test whether there also exists a bond liquidity effect on corporate credit risk that is independent of underwriter distress, we first calculate *Bid-Ask Spread Residual* as the residual from the bid-ask spread regression specified in Equation (5) and then include this bid-ask spread residual in the base regression from Equation (4).

Table 8, Panel B, first of all shows that bond issuers' bid-ask spreads on their own are significant in explaining issuer credit risk (specification (a)). That is, when the market becomes more illiquid, the issuer credit risk is higher consistent with the findings in Valenzuela (2015) and Nagler (2017). However, as we will show in the next section, the impact from illiquidity is not economically significant despite being statistically significant. Thus, while we do find evidence for positive correlation between bond liquidity and corporate credit risk, we do not find strong support for the market making hypothesis in our sample.

In the remaining specifications in Panel B we include the bid-ask spread residual instead of the bid-ask spread directly. The results show that in all specifications, underwriter distress remains significant. In some of the specifications the bid-ask spread residual also comes out as significant, while the interaction between the firm's rollover

¹²We only use institutional size transactions above \$100,000 as in Bessembinder, Kahle, Maxwell, and Xu (2009).

exposure and the bid-ask spread residual never comes out significant. It is mainly this latter interaction which has been taken as evidence that rollover risk (in the sense of He and Xiong (2012)) matters for issuer credit risk. Thus, in contrast to the related literature our results suggest that the market maker effect is small in our sample and, furthermore, to a large extent is due to underwriter distress causing the bonds to be less liquid in the secondary market.

3.6 Economic Significance

So far, we have shown that underwriter distress contributes significantly to explaining the credit risk of bond issuers. In this section we further investigate whether the effect is also economically significant. We evaluate the economic impact by investigating how much of the variation in issuer credit risk that can be explained by variation in underwriter distress. If large differences in underwriter distress also lead to large differences in CDS spreads of bond issuers, then we will conclude that the effect is economically significant.

Using the regression specification from Table 8, specification (c), we calculate the contribution of our underwriter distress measure for each issuer, i , and each month, t , as:

$$\begin{aligned} \text{UW Risk contribution}_{it} &= \hat{\beta}_1 \times \text{UW Risk}_{it} + \hat{\beta}_3 \times \frac{\text{Debt}_{\leq 1\text{yr}_{it}}}{\text{Assets}_{it}} \times \text{UW Risk}_{it} \quad (6) \\ &= \text{CDS Spread}_{it} - \text{Non-UW Risk variables}_{it} \end{aligned}$$

After having calculated the underwriter distress contribution for each CDS spread observation we calculate the distribution of this contribution across time and issuers. Following the approach in Dick-Nielsen, Feldhütter, and Lando (2012), we then calculate the width of the distribution by looking at the difference between the 50% percentile and the 5% percentile:

$$\text{UW Risk contribution}^{50\%} - \text{UW Risk contribution}^{5\%}$$

This difference can be interpreted as the part of the variation in the CDS spread, between an issuer with a median distressed underwriter and an issuer with a minimum distressed underwriter, which can be explained by the difference in underwriter distress.¹³ We split the sample into issuers with an investment-grade rating versus a speculative-grade rating and form separate distributions for each of these rating classes.

Table 9, Panel A, shows the estimates of economic significance (distribution widths) of the underwriter distress measure, as well as of some of the other control variables.

¹³This approach is essentially equivalent to evaluating the impact of, for example, a one standard deviation shock to UW Risk. However, it should be more robust as it controls for possible covariation between UW Risk and other independent variables.

Relative to each of the other variables, the impact from underwriter distress is rather large. However, the combined effect of all firm fundamentals is still larger than the underwriter distress effect (although adding up the individual effects of fundamental variables ignores possible correlation). Since the log difference can be interpreted as a relative difference, we can see that the underwriter distress impact is approximately 35 percent larger for an investment-grade rated median underwriter-distressed bond issuer compared to an issuer with a minimum distressed underwriter. The effect for speculative-grade firms is larger at 46 percent.

Another way to evaluate the impact, also following Dick-Nielsen, Feldhütter, and Lando (2012), is to measure the underwriter distress contribution relative to the size of the total issuer CDS spread. We therefore calculate the relative spread contribution as follows:

$$\frac{\text{UW Risk contribution}_{it} - \text{UW Risk contribution}^{5\%}}{\text{CDS Spread}_{it}}$$

where i is the i th issuer and t is the month. Finally, we form the distribution of this ratio and look at the median of the distribution. Table 9, Panel B, shows the median numbers for investment-grade and speculative-grade rated firms. Using this approach we see that underwriter distress explains around 8 percent of the total credit risk for both investment-grade and speculative-grade firms. This fraction is again comparable to the best single firm fundamentals factor. It can also be compared to the credit spread contribution of 5 percent from rollover risk in Chen, Cui, He, and Milbradt (2017).

Note that the bond illiquidity residual can only explain around 1 percent of the spread. Since the coefficient on bid-ask spread alone in the regressions in Table 8 was twice that of the residual, then illiquidity cannot explain more than 2 percent of the credit spread. Hence, the economic impact of the market making hypothesis is rather small compared to the total effect of underwriter distress of around 8 percent.

3.7 Default of an Underwriter

Most of the previous tests have excluded the CDS spread of an issuing firm if it had an underwriter default within the past six months (except Tables 4 and 5). This was done because underwriter default is a rare event which could be biasing results when analyzing issuer distress after an underwriter defaults. In this section, we revisit the effect of having an underwriter defaulting.

The underwriter distress measure does at all times consist of the CDS spreads of underwriters 1) who are currently alive, i.e., not in default, and 2) with whom the firm currently has bonds outstanding. Hence, the measure has the counter-intuitive behavior that right after an underwriter defaults the underwriter distress measure will most likely

improve because the riskiest underwriter is taken out. This is counter-intuitive as we would think that the loss of an underwriter is the ultimately worst case of underwriter distress. Given a default of an underwriter relationship the firm is forced to build a new relationship (or tighten the relationships with other existing underwriters). Furthermore, the default of an underwriter is likely to happen when the market and other underwriters are distressed as well.

We consider three specific cases where an underwriter defaulted or experienced a situation similar to a default. First, we consider the default and takeover of Bear Stearns in March 2008. Second, we consider the default of Lehman Brothers. After some turmoil starting in August 2008, Lehman Brothers defaulted in September 2008. Third, we look at Wachovia. In April 2008, Wachovia reported large losses and ended up being acquired by Citigroup in September 2008. The most important dates and events for each of these underwriter defaults are listed in Table 10.

Figure 3 shows the time series of the average CDS spread for firms with an underwriter relationship to Bear Stearns, Lehman Brothers, and Wachovia, respectively.¹⁴ In each sub-figure, the sample of firms is split into two types of bond-issuers; those with an underwriter relation to Bear Stearns, Lehman Brothers, or Wachovia, respectively, at the point of their defaults, and those without a relation to any of these underwriters (control group). After normalizing the average CDS spread of the sub-samples to the same starting point, we see from Figure 3 that the group with a defaulted underwriter is more credit risky than the control group.

Similar to the former regressions, we tease out the effect of a defaulting underwriter by looking at the regression specification from Equation (4). Now we also include firms that have had an underwriter defaulting within the last six months, but control for this by adding a time-dependent dummy to the regression in the following way. For the default of Lehman Brothers, we add a dummy variable which is equal to one only in the first month after the default of Lehman Brothers, and only if the issuer had an underwriter relationship with Lehman Brothers. We subsequently replace this variable with another dummy which is equal to one in the two month following the default etc., all the way up to six months after the default. These dummies account for the special circumstances of losing an underwriter relationship after a default over different time horizons. We produce the same dummies for the default of Bear Stearns and the default of Wachovia. Table 11 shows the estimates from these regressions. The table only reports the coefficient for the default dummy for each of the regressions.

The defaulting underwriter coefficient is significant for the first three to five months

¹⁴In order to provide a clearer study, we exclude in this analysis all firms that had a relationship to more than one of the three defaulted underwriters.

after the default. This indicates that the credit risk of the issuer is at an elevated level right after the elimination of an underwriter relationship. As we extend the time horizon of the default dummy the issuing firm has time to build new relationships. The combined effect of the increase in CDS spread from the dummy and the drop in UW Risk from eliminating the riskiest underwriter almost cancels out in the sense that the drop in the UW Risk measure is offset by the increase in the dummy. Thus, the resulting issuer credit spread is fairly constant at the level from when the underwriter defaulted. The credit spread then improves after four to six months at which point the underwriter distress measure for the issuer’s remaining underwriters is no longer affected by the default event.

It is difficult to extrapolate too much from these three default events. First, defaults are rare. Second, the types of default differ significantly from each other. Both Bear Stearns and Wachovia are effectively taken over immediately by other firms. The issuing firms then need to rebuild their relationship with the new owners. On the other hand, for the case of Lehman Brothers there is no one who takes over their responsibilities. Therefore, it would be natural to expect that this default had a larger impact on issuer credit risk than the other two events, but this does not seem to be the case. Figure 3 reveals that the elevated level of credit risk maybe last slightly longer, but it is not materially different. This may be caused by the fact that all other underwriters at the same time experience a large shock to their default risk and becomes distressed. In other words, as the entire market is distressed it may be difficult to distinguish the underwriter risk of one issuer from that of another issuer.

4. Bond Underwriter versus Bank Loan Provider

The bond issuer underwriter relationship is different from the traditional banking relationship. The syndicate members in a bank loan directly contribute funds to finance the loan whereas the bond underwriter primarily acts as an intermediary. However, it is common for the bond issuer to find its underwriter among existing banking relationships (Yasuda (2005)). The underwriter distress effect we find could therefore be a proxy for a distressed banking relationship. As a robustness test and, in order to separate the two effects, we construct a bank loan relationship distress measure similar to the underwriter distress measure. For each firm we collect information on syndicated loans from SDC Dealscan and the bank loan distress measure is then the weighted average of the syndicate members’ five-year log CDS spread for all loans currently outstanding. We limit the banks to the same list of top 20 underwriter banks that we used for the underwriter distress measure but we add any top 20 syndicate bank which was not part of the bond underwriter sample (see Table 3).

In order to distinguish between a firm's dependence on its bank loan connection versus its bond underwriter connection, we multiply the underwriter distress measure with the ratio of outstanding corporate bond debt to the sum of bond and bank loan debt, $Bond\ Debt / Total\ Debt$, and, similarly, multiply the bank distress measure with the fraction of outstanding bank loan debt, $Bank\ Debt / Total\ Debt$. The idea is that if corporate bond debt only accounts for a small fraction of the overall debt, then it is unlikely that the underwriter relationship should be important compared to the bank loan relationship, and vice versa. Table 1, Panel D, reports summary statistics for the sample and shows that the dependence upon bank loan debt is rather evenly distributed between firms with low and high dependence, respectively.

We add the two distress measures along with the bond debt fraction to the base regression from Equation (3). The results are reported in Table 12. The coefficient on the bond debt fraction is negative, indicating that firms financed with more corporate bond debt compared to bank debt are less risky. This is consistent with the idea that more opaque firms seek out a banking relationship (see, e.g., Rajan (1992)). However, for the firms with a high bond debt fraction, we see that underwriter risk is equally important. Both the underwriter risk and the bank risk coefficients are significant, i.e., both types of relationships impact the credit risk of the firms. Which of the two types of relationships is most important in the end then depends on the primary financing source for the specific firm.

5. Conclusion

We show that corporate bond issuers derive value from bond underwriter relationship capital. When a bond issuer utilizes an existing underwriter relationship, it lowers both the indirect and direct issuance costs. Furthermore, issuers are adversely affected by underwriter distress and the credit risk of the underwriter spills over to the credit risk of the issuer. We show this by constructing an issuer specific measure of underwriter distress. This measure captures the average weighted stress of the issuer's underwriter connections. Our findings suggest that bond underwriters benefit from certification by the underwriter. Consistent with this hypothesis, we show that the effect of underwriter distress is stronger for speculative-grade rated firms which are usually also more opaque and, therefore, more dependent upon certification. The impact of underwriter distress is also stronger for firms with a high fraction of short-term debt, i.e., firms with an imminent need for underwriter services for rolling over maturing bonds. Thus, underwriter distress can be characterized as a rollover risk for the issuer.

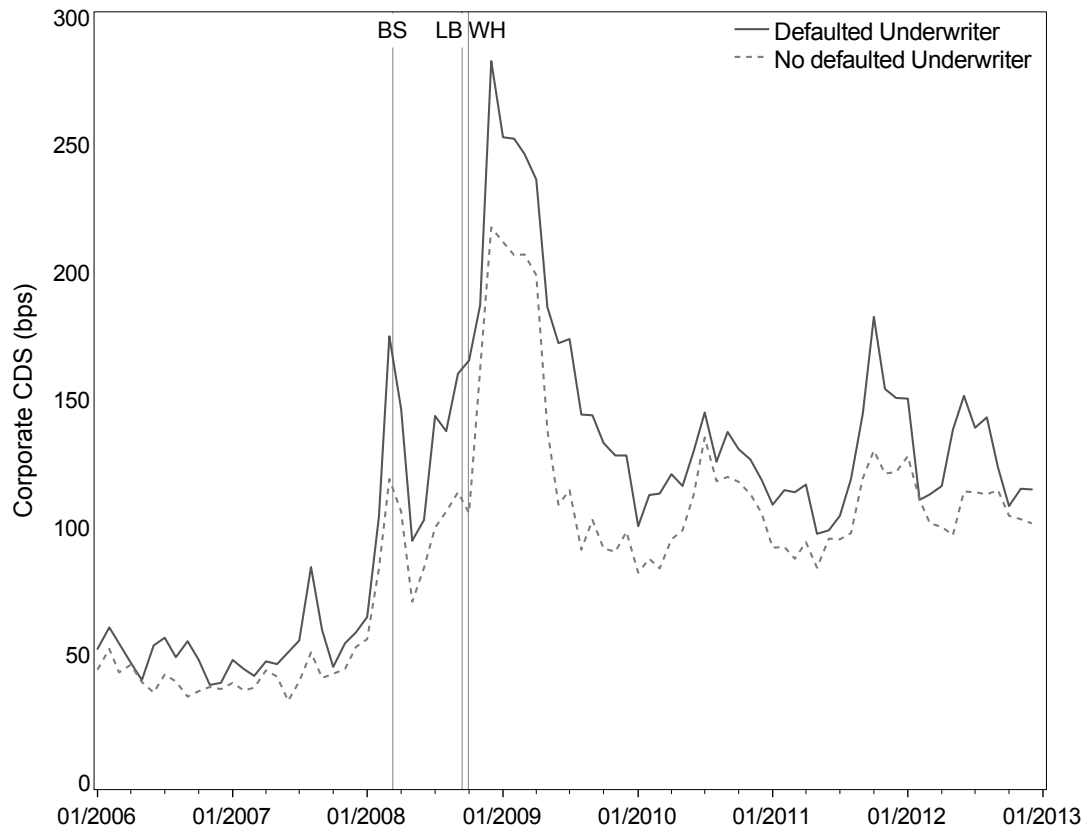


Figure 1
CDS Spreads of corporate bond issuers

This figure shows the development in the CDS spreads of U.S.-based firms for the period 2006 to 2012. The CDS spread is the average (median) of monthly primo-months observations of five-year CDS spreads, given in basis points. Issuers are separated into *Defaulted Underwriter* and *No Defaulted Underwriter* samples based upon whether the firm had a relationship to an underwriter that defaulted within the sample period. Specifically, the figure includes the issuer relationships to top-20 underwriters within the sample period, where the sub-sample of defaulted underwriters includes the default of Bear Stearns (BS) on March 14, 2008, Lehman Brothers (LB) on September 15, 2008, and Wachovia (WH) on September 29, 2008.

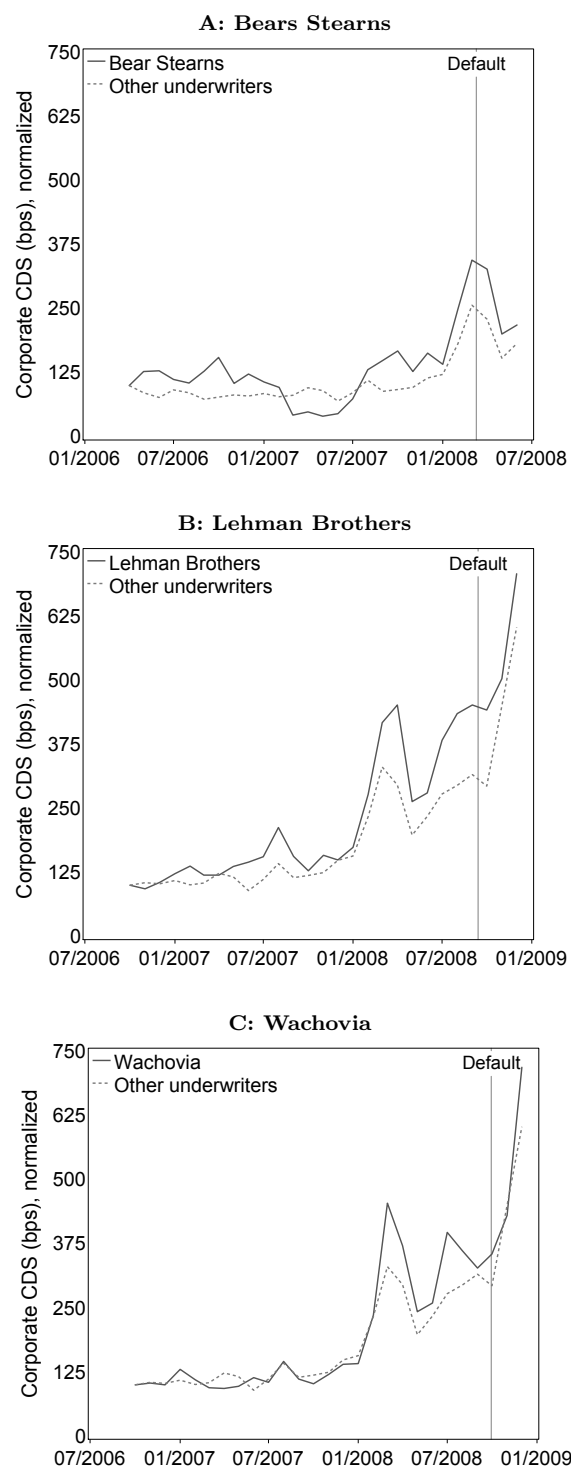


Figure 3
The impact of underwriter default on issuer CDS spreads

These figures show the development in CDS spreads of firms that have an underwriter relationship to Bear Stearns, Lehman Brothers or Wachovia, as well as for firms that do not have an underwriter relationship to these underwriters. Bear Stearns defaulted on March 14, 2008, Lehman Brothers defaulted on September 13, 2008, while Wachovia defaulted on September 29, 2008. The CDS spread is the median beginning of month five-year CDS spread in bps across issuers in the sample. The average CDS spread of each sub-sample is normalized to the same starting point two years before the default of the respective underwriter. The sample of firms is based on Compustat and Mergent Fisd. The CDS data is taken from Markit.

Table 1
Summary statistics

<i>Panel A: Gross Spread and Underpricing</i>							
	Gross Spread	Underpricing	Existing UW Relation	IPO	Time to Maturity	Offering Amount	Rule 144a
Mean	0.93	0.40	0.47	0.19	11.20	0.36	0.25
SD	0.95	1.05	0.50	0.39	9.07	2.25	0.43
Q1	0.35	-0.00	0.00	0.00	6.00	0.08	0.00
Q2	0.65	0.14	0.00	0.00	9.64	0.20	0.00
Q3	1.00	0.71	1.00	0.00	10.30	0.40	1.00
Bonds	41,465	41,465	41,465	41,465	41,465	41,465	41,465

<i>Panel B: Firm Characteristics and Market Measures</i>											
	CDS Spread	UW Risk	Lev.	Eq. Vol	Firm Size	Pro-fit.	Cash	UW Rel.	Bonds Outst.	1yr Swap	CDS Index
Mean	4.63	4.26	0.31	0.11	9.09	0.12	0.09	2.75	5.48	2.42	4.27
SD	0.89	1.05	0.16	0.15	1.11	0.09	0.09	1.79	4.70	1.91	0.50
Q1	3.96	3.23	0.20	0.06	8.24	0.06	0.03	1.50	2.00	0.54	3.88
Q2	4.53	4.64	0.27	0.08	8.99	0.10	0.06	2.00	4.00	2.07	4.32
Q3	5.26	5.08	0.39	0.10	9.83	0.18	0.12	4.00	7.00	4.28	4.50
Firms	329	329	329	329	329	329	329	329	329		

<i>Panel C: Firm Characteristics by Credit Rating Group</i>														
	Investment-grade							Speculative-grade						
	CDS Spread	UW Risk	Lev.	Eq. Vol.	Firm Size	Pro-fit.	Cash	CDS Spread	UW Risk	Lev.	Eq. Vol.	Firm Size	Pro-fit.	Cash
Mean	4.22	4.32	0.26	0.10	9.42	0.15	0.09	5.47	4.19	0.41	0.14	8.41	0.08	0.09
SD	0.63	1.03	0.12	0.16	1.05	0.08	0.09	0.73	1.09	0.18	0.15	0.90	0.07	0.08
Q1	3.79	3.28	0.18	0.06	8.62	0.08	0.03	5.12	3.11	0.26	0.08	7.73	0.03	0.03
Q2	4.24	4.69	0.24	0.07	9.38	0.13	0.06	5.49	4.42	0.40	0.10	8.25	0.07	0.06
Q3	4.62	5.10	0.32	0.09	10.1	0.20	0.13	5.99	5.02	0.51	0.13	8.97	0.13	0.12
Firms	221	221	221	221	221	221	221	109	109	109	109	109	109	109

<i>Panel D: Firm Characteristics and Bank Risk Measures for Subsample</i>									
	CDS Spread	UW Risk	Lev.	Eq. Vol.	Firm Size	Pro-fit.	Cash	Bond Ratio	Bank Risk
Mean	4.81	4.17	0.36	0.11	9.08	0.13	0.07	0.61	4.06
SD	0.92	0.85	0.17	0.14	1.20	0.09	0.07	0.23	0.93
Q1	4.24	3.29	0.24	0.06	8.12	0.07	0.02	0.44	3.08
Q2	4.77	4.49	0.31	0.09	8.95	0.11	0.05	0.61	4.45
Q3	5.44	4.87	0.45	0.11	9.88	0.18	0.09	0.80	4.82
Firms	188	186	188	188	188	188	188	188	188

The table provides summary statistics for all regression variables. *Gross spread* is the bond issuance costs as a fraction of offering price. *Underpricing* is the relative price difference between the offering price and the average transaction price of a bond over the two weeks after issuance. *Existing UW Relation* is a dummy which is one if one or more lead underwriters for the new issuance have also been used for an currently outstanding bond. *IPO* is a dummy which is one if it is the first bond issuance by the firm. *Time to Maturity* is measured in years. *Offering Amount* is the natural logarithm of the offering amount in millions. *Rule 144a* is a dummy which is one if the bond was issued under Rule 144a. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. *UW Risk* is the natural logarithm of the average related underwriter CDS spread weighted by number of outstanding bonds underwritten for each issuer. *Leverage* is the book value of long-term debt plus debt in current liabilities divided by total assets. *Equity Volatility* is calculated using total stock returns for the preceding 90 days. *Firm Size* is the natural logarithm of total assets. *Profitability* is operating income to total revenue. *Cash* is the ratio of cash and cash equivalents to total assets. *UW Relations* is the number of underwriter relations of the average firm across time. *Bonds Outstanding* is the number of bonds held by the average firm across time. *1yr Swap* is the one year swap rate from the Federal Reserve Bank. *CDS Index* is the natural logarithm of the 'CDX.NA.IG'-index spread provided by Markit. *Bond Ratio* is the ratio of bonds to bank debt. *Bank Risk* is the natural logarithm of the average related bank syndicate members' CDS spreads weighed by loan size. *Investment-grade (Speculative-grade)* refers to a firm with a S&P credit rating that is equal to 'BBB' or higher ('BB' or lower). The sample period is 2004-2012, and the variables are based on monthly observations. The data are obtained from Compustat N.A., CRSP, Mergent FISD, TRACE, Markit, and SDC Dealscan.

Table 2
Underwriter relation effect on gross spread and underpricing

	Gross Spread			Underpricing		
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	1.030*** (106.39)			0.747*** (34.49)		
Existing UW Relation	-0.194*** (-14.14)	-0.237*** (-17.26)	-0.077*** (-5.54)	-0.509*** (-19.32)	-0.167*** (-6.39)	-0.079*** (-2.88)
Time To Maturity		0.004*** (6.39)	0.007*** (10.88)		0.003** (2.43)	0.004*** (2.86)
Offering Amount		-0.004* (-1.91)	-0.003 (-1.22)		0.115*** (4.93)	0.130*** (5.61)
Rule 144a		0.194*** (5.77)	0.036 (1.09)		0.405*** (12.38)	0.312*** (9.14)
IPO Dummy			0.699*** (38.50)			0.408*** (9.14)
Bond Type Dummy	N	Y	Y	N	Y	Y
Credit Rating Dummy	N	Y	Y	N	Y	Y
Industry Dummy	N	Y	Y	N	Y	Y
<i>R</i> -square	0.010	0.310	0.360	0.051	0.296	0.304
<i>N</i>	19257	19107	19107	6992	6990	6990

This table presents estimates of the effect of utilizing an existing underwriter relationship on the gross spread and underpricing. *Gross Spread* is the fees paid to underwriter as a fraction of the offering price. *Underpricing* is defined as the return between the offering price and the average price of the bond over the first two weeks of trading on the secondary market. *Existing UW Relation* is a dummy which is equal to one if the bond is issued using an underwriter which has also been used for another currently outstanding bond from the same firm. *IPO Dummy* is a dummy equal to one if the respective bond issue is the first bond issuance for the firm. For gross spread (in percentage points), we use all bonds from FIRD and for underpricing (in percentage points) we use all bonds available in TRACE. (***) denotes significance at the 1% level, ** at the 5% level, and * at the 10% level. The numbers in parentheses are t-statistics.)

Table 3
Top-20 bond underwriters (2004-2012)

Financial institution (Lead underwriter)	Country of origin	Number of clients within sample period	Number of clients within firm sample
	(a)	(b)	(c)
ABN Amro Bank	NLD	60	6
Banc of America	USA	1419	109
Barclays	GBR	633	32
Bank One	USA	71	7
BNP Paribas	FRA	170	10
Bear Stearns	USA	239	9
Canadian Imperial Bank of Commerce	CAN	34	1
Citibank	USA	1743	123
Credit Suisse	CHE	884	57
Deutsche Bank	GER	909	61
Goldman Sachs	USA	1605	68
HSBC Bank	GBR	200	7
JP Morgan	USA	2610	143
Lehman Brothers	USA	910	42
Merrill Lynch	USA	1270	59
Morgan Stanley	USA	1324	66
Salomon Brothers	USA	563	
Union Bank of Switzerland	CHE	615	
Wells Fargo	USA	365	23
Wachovia	USA	433	28

The table presents the 20 most active banks serving as underwriters of corporate bonds outstanding in the period from 2004 to 2012. The list counts the number of U.S. corporate bond issuances where the respective financial institution acted as the lead underwriter. The number of clients in column (b) refers to the number of non-financial firms that issued bonds using the given underwriter, while the number of clients in column (c) refers to the number of non-financial firms within our sample.

Table 4
Underwriter distress effect on credit risk

	CDS Spread			
	Full sample (a)	Full sample (b)	Full sample (c)	Sample without default (d)
UW Risk	0.400*** (14.35)	0.404*** (18.45)	0.156*** (3.97)	0.151*** (3.77)
Leverage		2.203*** (8.89)	2.087*** (8.12)	2.059*** (8.23)
Equity Volatility		1.394*** (5.56)	1.951*** (5.71)	1.934*** (5.88)
Firm Size		-0.276*** (-7.48)	-0.246*** (-6.34)	-0.254*** (-6.83)
Profitability		-2.585*** (-5.99)	-2.429*** (-5.89)	-2.398*** (-5.85)
Cash		0.692** (2.14)	0.527 (1.59)	0.515 (1.57)
1yr Swap			-0.038** (-2.43)	-0.045*** (-2.94)
CDS Index			0.407*** (5.87)	0.383*** (5.36)
<i>Adj. R-square</i>	0.150	0.560	0.580	0.577
<i>N</i>	18588	18553	15016	14767

This table presents estimates of the effect of underwriter distress on issuer credit risk. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. *UW Risk* is the natural logarithm of related underwriters' average CDS spreads, weighted by the number of underwritten bonds outstanding. Specification (d) excludes observations for firms where one of the related underwriters has defaulted within the last six months. The main sample period is 2004-2012, based on monthly observations. When using market measures, the sample period is reduced to 2006-2012 due to lack of data availability. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 5
Changes in underwriter distress and credit risk

	Δ CDS Spread			
	Full sample (a)	Full sample (b)	Full sample (c)	Sample without default (d)
Δ UW Risk	0.259*** (5.87)	0.245*** (5.61)	0.151*** (3.23)	0.150*** (3.11)
Δ Leverage		0.253*** (3.56)	0.183*** (3.10)	0.192*** (3.23)
Δ Equity Volatility		0.135*** (2.93)	0.080*** (2.63)	0.081*** (2.63)
Δ Firm Size		-4.444** (-2.42)	-3.053 (-1.57)	-3.325* (-1.64)
Δ Profitability		-0.000 (-1.39)	-0.000 (-0.79)	-0.000 (-0.74)
Δ Cash		0.001*** (3.78)	0.001*** (4.34)	0.001*** (4.45)
Δ 1yr Swap			-0.163** (-2.34)	-0.182*** (-2.63)
Δ CDS Index			0.605*** (11.13)	0.613*** (10.33)
<i>Adj. R-square</i>	0.129	0.161	0.335	0.334
<i>N</i>	18126	17576	14447	14208

This table presents estimates of the effect of changes in underwriter distress on issuer credit risk. Δ CDS Spread is the relative change in the natural logarithm of the CDS spread on the five-year contract of the issuing firm from month $t-1$ to month t , given in percentages. Δ UW Risk is the relative change in natural logarithm of related underwriters' average CDS spreads from month $t-1$ to month t , weighted by the number of underwritten bonds outstanding. The regressions exclude observations for firms where one of the related underwriters has defaulted within the last six months. The main sample period is 2004-2012, based on monthly observations. When using market measures, the sample period is reduced to 2006-2012 due to lack of data availability. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 6
Credit ratings and underwriter distress effect

	CDS Spread			Δ CDS Spread	
	Investment-grade (a)	Speculative-grade (b)		Investment-grade (c)	Speculative-grade (d)
UW Risk	0.154*** (4.41)	0.211*** (3.55)	Δ UW Risk	0.089** (2.30)	0.307*** (2.84)
Leverage	0.599** (2.18)	1.464*** (6.65)	Δ Leverage	0.201*** (3.41)	-0.032 (-0.18)
Equity Volatility	1.446*** (3.77)	1.441*** (5.27)	Δ Equity Volatility	0.070** (2.01)	0.116** (2.52)
Firm Size	-0.186*** (-5.72)	-0.059 (-1.03)	Δ Firm Size	-2.540 (-0.96)	-4.622 (-1.53)
Profitability	-1.176*** (-2.61)	-1.627*** (-3.42)	Δ Profitability	-0.001*** (-2.87)	0.001* (1.69)
Cash	-0.081 (-0.27)	0.668 (1.18)	Δ Cash	0.001*** (5.99)	-0.020** (-2.38)
1yr Swap	-0.067*** (-4.40)	0.014 (0.58)	Δ 1yr Swap	-0.182*** (-2.87)	-0.139 (-1.33)
CDS Index	0.542*** (8.20)	0.261*** (2.61)	Δ CDS Index	0.702*** (12.04)	0.355*** (3.96)
<i>Adj. R-square</i>	0.532	0.446	<i>Adj. R-square</i>	0.366	0.327
<i>N</i>	10709	4019	<i>N</i>	10347	3825

This table presents estimates of the effect of underwriter distress on issuer credit risk conditional on firms' credit rating. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contracts of the issuing firm. *UW Risk* is the natural logarithm of related underwriters' average CDS spreads, weighted by the number of underwritten bonds outstanding. We separate between issuers that are investment-grade rated and speculative-grade rated firms. *Investment-grade* (*Speculative-grade*) refers to a firm with a S&P credit rating that is equal to 'BBB' or higher ('BB' or lower). Specifications (a) and (b) show the effect in levels, while specifications (c) and (d) show the effect in changes. The regressions exclude observations for firms where one of the related underwriters has defaulted within the last six months. The sample period is 2006-2012, based on monthly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 7
Rollover risk and underwriter distress effect

<i>Panel A: Maturing Debt to Total Asset</i>						
	CDS Spread			CDS Spread		
	Investment-grade			Speculative-grade		
	(a)	(b)	(c)	(d)	(e)	(f)
UW Risk	0.149*** (3.80)	0.128*** (3.08)	0.123*** (2.92)	0.185*** (3.12)	0.183*** (2.99)	0.213*** (3.39)
UW Risk $\times \frac{\text{Debt} \leq 1\text{yr}}{\text{Assets}}$	0.312 (0.43)			1.007* (1.91)		
$\frac{\text{Debt} \leq 1\text{yr}}{\text{Assets}}$	-0.272 (-0.08)			-4.724** (-2.05)		
UW Risk $\times \frac{\text{Debt} \leq 2\text{yr}}{\text{Assets}}$		0.695 (1.31)			0.600* (1.75)	
$\frac{\text{Debt} \leq 2\text{yr}}{\text{Assets}}$		-2.725 (-1.14)			-2.655* (-1.76)	
UW Risk $\times \frac{\text{Debt} \leq 3\text{yr}}{\text{Assets}}$			0.556 (1.43)			0.056 (0.18)
$\frac{\text{Debt} \leq 3\text{yr}}{\text{Assets}}$			-2.123 (-1.19)			-0.032 (-0.02)
Controls	Y	Y	Y	Y	Y	Y
Adj. R-square	0.531	0.531	0.531	0.447	0.447	0.445
N	10685	10625	10620	4028	4028	4028

<i>Panel B: Maturing Debt to Total Long-term debt</i>						
	CDS Spread			CDS Spread		
	Investment-grade			Speculative-grade		
	(a)	(b)	(c)	(d)	(e)	(f)
UW Risk	0.155*** (4.00)	0.128*** (2.96)	0.102** (2.16)	0.175*** (3.01)	0.150** (2.50)	0.174*** (2.83)
UW Risk $\times \frac{\text{Debt} \leq 1\text{yr}}{\text{Debt}}$	-0.000 (-0.00)			0.443** (2.20)		
$\frac{\text{Debt} \leq 1\text{yr}}{\text{Debt}}$	-0.000 (-0.00)			-2.265*** (-2.88)		
UW Risk $\times \frac{\text{Debt} \leq 2\text{yr}}{\text{Debt}}$		0.142 (1.00)			0.448*** (2.90)	
$\frac{\text{Debt} \leq 2\text{yr}}{\text{Debt}}$		-0.687 (-1.11)			-2.190*** (-3.39)	
UW Risk $\times \frac{\text{Debt} \leq 3\text{yr}}{\text{Debt}}$			0.191 (1.61)			0.165 (1.40)
$\frac{\text{Debt} \leq 3\text{yr}}{\text{Debt}}$			-0.870 (-1.63)			-0.838* (-1.65)
Controls	Y	Y	Y	Y	Y	Y
Adj. R-square	0.530	0.529	0.530	0.452	0.455	0.447
N	10685	10594	10589	4028	4026	4026

This table presents estimates of the effect of rollover exposure and underwriter distress on issuer credit risk. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. *UW Risk* is the natural logarithm of related underwriters' average CDS spreads, weighted by the number of underwritten bonds outstanding. In Panel A the rollover exposure is proxied by the outstanding debt due in one, two, and three years, scaled by total assets. In Panel B the rollover exposure is proxied by the outstanding debt due in one, two, and three years, scaled by total long-term debt. We separate between issuers that are investment-grade rated and speculative-grade rated firms. Investment-grade (Speculative-grade) refers to a firm with a S&P credit rating that is equal to 'BBB' or higher ('BB' or lower). The regressions exclude observations for firms where one of the related underwriters has defaulted within the last six months. The sample period is 2006-2012, based on monthly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 8
Bond illiquidity and underwriter distress effect

<i>Panel A: Underwriter Distress Effect on Bond Illiquidity</i>								
	Bid-Ask Spread				Bid-Ask Spread			
	Investment-grade				Speculative-grade			
	(a)				(b)			
Intercept	-13.902				-0.237			
	(-3.38)				(-0.04)			
UW Risk	11.053***				8.231***			
	(9.45)				(6.12)			
Controls	N				N			
Adj. R-square	0.111				0.079			
N	12152				4862			

<i>Panel B: Bond Illiquidity and Underwriter Distress Effect on Corporate Credit Risk</i>								
	CDS Spread				CDS Spread			
	Investment-grade				Speculative-grade			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Bid-Ask Spread	0.002*** (3.03)				0.002** (2.46)			
UW Risk		0.172*** (4.79)	0.168*** (4.21)	0.168*** (4.20)		0.251*** (4.17)	0.221*** (3.64)	0.212*** (3.57)
Bid-Ask Residual		0.001*** (2.80)	0.001* (1.73)	0.001 (1.63)		0.002*** (2.59)	0.002* (1.71)	0.002** (2.01)
UW Risk × $\frac{\text{Debt} \leq 1\text{yr}}{\text{Assets}}$			0.305 (0.40)				0.952* (1.69)	
Bid-Ask Residual × $\frac{\text{Debt} \leq 1\text{yr}}{\text{Assets}}$			0.019 (1.38)				0.015 (1.37)	
UW Risk × $\frac{\text{Debt} \leq 1\text{yr}}{\text{Debt}}$				0.057 (0.36)				0.423** (2.10)
Bid-Ask Residual × $\frac{\text{Debt} \leq 1\text{yr}}{\text{Debt}}$				0.006 (1.52)				0.001 (0.27)
$\frac{\text{Debt} \leq 1\text{yr}}{\text{Assets}}$			-0.054 (-0.01)				-4.532* (-1.79)	
$\frac{\text{Debt} \leq 1\text{yr}}{\text{Debt}}$				-0.159 (-0.24)				-2.215*** (-2.85)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Adj. R-square	0.531	0.535	0.535	0.533	0.428	0.448	0.450	0.455
N	10020	9919	9900	9900	3821	3790	3760	3760

This table presents estimates of the effect of bond illiquidity and underwriters distress on issuer credit risk. Panel A shows the estimates of the regression of firms' bond illiquidity on our measure for underwriter distress. Bond illiquidity is proxied by *Bid-Ask Spread* which is calculated as the average effective bid-ask spread across outstanding bonds from issuer. *UW Risk* is the natural logarithm of related underwriters' average CDS spreads, weighted by the number of underwritten bonds outstanding. In Panel B we use the bid-ask spread residual obtained from the regressions in Panel A and regress *CDS Spread* on Bid-Ask Residual, proxies for firms' rollover exposures, as well as other controls from our baseline model specification. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. Firms' rollover exposures are proxied by the ratio of debt maturing within one year, scaled by total assets and total debt, respectively. We separate between issuers that are investment-grade rated and speculative-grade rated firms. Investment-grade (Speculative-grade) refers to a firm with a S&P credit rating that is equal to 'BBB' or higher ('BB' or lower). The regressions exclude observations for firms where one of the related underwriters has defaulted within the last six months. The sample period is 2006-2012, based on monthly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 9
Economic significance of underwriter distress

<i>Panel A: Absolute CDS Spread Contribution</i>						
	UW Risk	Bid-Ask Residual	Leverage	Equity Volatility	Firm Size	Profitability
	(a)	(b)	(c)	(d)	(e)	(f)
Investment-grade	0.351	0.040	0.065	0.050	0.366	0.215
Speculative-grade	0.460	0.060	0.336	0.073	0.092	0.236
<i>Panel B: Relative CDS Spread Contribution</i>						
	UW Risk	Bid-Ask Residual	Leverage	Equity Volatility	Firm Size	Profitability
	(a)	(b)	(c)	(d)	(e)	(f)
Investment-grade	7.784%	1.011%	1.611%	1.232%	8.993%	5.142%
Speculative-grade	7.978%	1.105%	6.319%	1.307%	1.576%	4.233%

This table presents estimates of the economic significance of underwriter distress. The estimation is based upon the results obtained in Table 8, specification (c) and (g). The absolute credit risk contribution is estimated as the difference between the 50% and 5% percentile in the distribution of the respective component. The relative credit risk contribution is estimated as the difference between issuer specific components and the 5% percentile, scaled by the size of CDS spread (bps). Column (a) presents the contribution of *UW Risk* and is defined as

$$\text{UW Risk contribution}_{it} = \hat{\beta}_1 \times \text{UW Risk}_{it} + \hat{\beta}_3 \times \frac{\text{Debt} \leq 1\text{yr}_{it}}{\text{Assets}_{it}} \times \text{UW Risk}_{it}$$

The contributions of factors presented in the table are estimated following the same approach. Column (b) shows the contribution of *Bid-Ask Residual* and refers to the bond illiquidity effect that is unrelated to the underwriter distress effect. Columns (c) to (f) show the contributions of *Leverage*, *Equity Volatility*, *Firm Size* and *Profitability*. We separate between issuers that are investment-grade rated and speculative-grade rated firms. Investment-grade (Speculative-grade) refers to a firm with a S&P credit rating that is equal to 'BBB' or higher ('BB' or lower). The sample period is 2006-2012, based on monthly observations.

Table 10
Key credit events for defaulted underwriters

<i>Panel A: Bear Stearns</i>	
Jun-2007	Bear Stearns commits \$1.6bn in secured loans to bail out its hedge Bear Stearns High-Grade Structured Credit Fund.
Jul-2007	The Bear Stearns High-Grade Structured Credit Fund has lost more than 90% of its value, while another hedge fund, Bear Stearns High-Grade Structured Credit Enhanced Leveraged Fund, loses all of its value. In the end, both hedge funds filed for Chapter 15 bankruptcy.
Dec-2007	The bank reports its first ever quarterly loss, which is nearly four times the analysts' forecasts.
Mar-2008	Carlyle Capital Corporation (CCC), a hedge fund partly owned by Bear Stearns, collapses due to large losses in mortgage backed securities arising from the severely weakened housing market. Consequently, and due to its exposure to the hedge fund and investors grown anxiousness, Bear Stearns shares fall by 17%. On March 14, 2008, JP Morgan and the New York Federal Reserve rush to the rescue Bear Stearns, while its' shares crashes by almost 50%. JP Morgan agrees to buy Bear Stearns in a deal that values Bear Stearns shares at \$2 each, with JP Morgan exchanging 0.05473 of each of its shares for one Bear share. Due to legal challenges against the low share price offer claimed by some of Bear Stearns' shareholders, JP Morgan raises its offer for Bear Stearns to \$10 a share for the takeover.
<i>Panel B: Lehman Brothers</i>	
Dec-2007	Lehman Brothers bypasses Bear Stearns as the largest underwriter of mortgage-backed securities. However, at the same time, it closes one of its subprime-lending units which eliminates approximately 1,200 jobs.
Mar-2008	Due to the concern that Lehman Brothers would be the next Wall Street financial institution to collapse after Bear Stearns, the shares fall as much as 48%. However, most of Lehman Brothers' stock losses recover in the following weeks.
Jun-2008	Lehman Brothers announces its first quarterly loss since going public and sells \$6 billion of stock to bolster capital.
Aug-2008	Shares drop 13% due to the announcement that Lehman Brothers solicited buyers for its investment-management division.
Sep-2008	Lehman Brothers shares plunged by additionally 45% after a dismissed capital infusion and reports a \$3.9 billion third-quarter loss, the largest in its history. Accordingly, it announces plans to sell a majority stake in its asset-management unit and to spin off commercial real-estate holdings. In collaboration with the U.S. Treasury and Federal Reserve, Bank of America Corp. emerges as potential buyer. On September 12, 2008, Moody's announces a potential credit downgrade and outlines the need for a "stronger financial partner" which lead to an immediate drop in Lehman Brothers' shares of 42%. Government agencies react by urging Wall Street chiefs to find a solution. In an effort to prevent the liquidation of Lehman Brothers, finance leaders meet at the Federal Reserve Bank of New York on September 13, 2008, and Bank of America and Barclays emerge as bidders. However, due to a fail to secure guarantees against losses, both bidders withdraws from their offer the following day. On September 15, 2008, Lehman Brothers petitioned for Chapter 11 bankruptcy and listed \$639 billion of assets in the largest filing in U.S. history.
<i>Panel C: Wachovia</i>	
Apr-2008	Wachovia announces first quarterly loss in seven years.
Sep-2008	Wachovia experienced large outflows of deposits and drops in the stock price due to the collapse of Washington Mutual, the largest U.S. savings and loan association. As a reaction to the FDIC's declaration that Wachovia was "systemically important" to the health of the economy, and thus could not be allowed to fail, Citigroup agreed to takeover Wachovia's banking operations for \$1 per share.
Oct-2008	Though the liquidity provision by Citigroup would have allowed Wachovia to continue its operations, Wells Fargo and Wachovia announced on October 3, 2008, their merge in an all-stock transaction requiring no government involvement. The agreement included a purchase of Wachovia in entirety for \$15.1 billion (approximately \$7 per share) and Wells Fargo's purchase of Wachovia was closed on December 31, 2008. In the meanwhile, Citigroup filed a \$60 billion lawsuit against Wachovia and Wells Fargo for interfering with Citigroup's takeover of Wachovia's banking operations.

The table lists the key events leading up to the default of underwriters that are included in our sample of the 20 most active lead underwriters, i.e., Bear Stearns (Panel A), Lehman Brothers (Panel B) and Wachovia (Panel C).

Table 11
Underwriter default and issuer credit risk

<i>Panel A: Bear Stearns</i>						
	CDS Spread					
	1 mth. (a)	1-2 mth. (b)	1-3 mth. (c)	1-4 mth. (d)	1-5 mth. (e)	1-6 mth. (f)
Default Dummy	0.182*** (8.36)	0.153*** (3.74)	0.125* (1.75)	0.120 (1.64)	0.125* (1.69)	0.119 (1.54)
Controls	Y	Y	Y	Y	Y	Y
Adj. R-square	0.842	0.842	0.842	0.842	0.842	0.842
N	396	396	396	396	396	396

<i>Panel B: Lehman Brothers</i>						
	CDS Spread					
	1 mth. (a)	1-2 mth. (b)	1-3 mth. (c)	1-4 mth. (d)	1-5 mth. (e)	1-6 mth. (f)
Default Dummy	0.049 (1.40)	0.112** (1.98)	0.159*** (2.58)	0.123** (2.15)	0.046 (0.72)	-0.010 (-0.11)
Controls	Y	Y	Y	Y	Y	Y
Adj. R-square	0.651	0.652	0.652	0.652	0.651	0.651
N	1813	1813	1813	1813	1813	1813

<i>Panel C: Wachovia</i>						
	CDS Spread					
	1 mth. (a)	1-2 mth. (b)	1-3 mth. (c)	1-4 mth. (d)	1-5 mth. (e)	1-6 mth. (f)
Default Dummy	0.217*** (2.99)	0.248*** (3.35)	0.227*** (3.00)	0.138 (1.34)	0.047 (0.34)	-0.108 (-0.65)
Controls	Y	Y	Y	Y	Y	Y
Adj. R-square	0.581	0.582	0.582	0.581	0.580	0.580
N	1208	1208	1208	1208	1208	1208

This table presents estimates of the effect of underwriter default on issuer credit risk. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. *Default Dummy* is a dummy variable that is equal to one for the months after the underwriter defaults, and zero otherwise. Panel A shows the results where we analyse the impact of the default of Bear Stearns (March 14, 2008). Panel B shows the results where we analyse the impact of the default of Lehman Brothers (September 15, 2008). Likewise, Panel C shows the results where we analyse the impact of the default of Wachovia (September 29, 2008). In specification (a), the dummy is only equal to one in the month following the underwriter default. In specification (b), (c), (d), (e), and (f), the dummy is equal to one in the month following the underwriter default, as well as respectively two, three, four, five, and six month after. In all model specifications, we use the sub-sample of firms that have a relationship to the underwriter and perform the regression on firms' CDS spread using the baseline model specification. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 12
Bond underwriter versus bank loan provider

	CDS Spread
$\frac{\text{Bond Debt}}{\text{Total Debt}}$	-0.939* (-1.74)
$\text{UW Risk} \times \frac{\text{Bond Debt}}{\text{Total Debt}}$	0.210*** (3.17)
$\text{Bank Risk} \times \frac{\text{Bank Debt}}{\text{Total Debt}}$	0.201** (2.52)
Leverage	1.641*** (6.17)
Equity Volatility	2.233*** (5.24)
Firm Size	-0.15*** (-3.36)
Profitability	-2.59*** (-4.90)
Cash	0.501 (0.97)
1yr Swap	-0.05*** (-2.61)
CDS Index	0.152* (1.69)
<i>Adj. R-square</i>	0.614
<i>N</i>	5183

This table presents estimates of the effect of bond underwriter distress versus bank loan provider distress. *CDS Spread* is the natural logarithm of the CDS spread on the five-year contract of the issuing firm. *UW Risk* is the natural logarithm of related underwriters' average CDS spreads, weighted by the number of underwritten bonds outstanding. *Bank Risk* is the natural logarithm of the average related bank syndicate members' CDS spreads weighted by loan size. *Bond Debt to Total Debt* is the outstanding corporate bond debt, scaled by the sum of bond and bank loan debt. Likewise, *Bank Debt to Total Debt* is the outstanding bank debt, scaled by the sum of bond and bank loan debt. The regressions exclude observations for firms where one of the related underwriters has defaulted within the last six months. Further, only firms for which we have lender information from SDC Dealscan are included. The sample period is 2006-2012, based on monthly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Chapter 2

Corporate Hedging and Debt Extension

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Abstract

This paper studies the effect of Credit Default Swaps (CDSs) on firm-level debt financing using credit registry data and unique and comprehensive data on CDS positions. While CDSs help to reduce frictions in credit markets, this paper documents that the variation in credit extensions to firms caused by the availability of CDS contracts can be explained by the creditors' net CDS positions. Firms where the creditors are net protection buyers have relatively less credit available and are more constrained in terms of debt refinancing. This effect is strongest when CDS liquidity is low. Overall, I find that the CDS positions of creditors may imply an indirect cost to firms in the form of credit rationing.

1. Introduction

Since its introduction in the early 2000s the role of Credit Default Swaps (CDSs) for credit markets and corporate financing has been highly debated. CDSs are financial derivatives that protect the buyer against default of a given reference firm and the availability of CDS contracts has been outlined to be accommodative in reducing financial frictions on the supply side of credit. However, after the U.S. Financial Crisis Inquiry Commission concluded that banks' use of over-the-counter derivatives like CDSs had contributed significantly to the 2007-08 financial crisis it has been highly discussed that CDSs can harm not only their buyers and sellers, but the whole economic system. Specifically, the concern has been raised that buyers and sellers of CDSs may upset the value of the insurance-like contracts by affecting the financing and credit risk of CDS reference firms. Banks that trade CDS contracts may, depending on their credit relationship with the CDS reference firm, exploit their CDS position by offering or withholding finance, and/or by changing the type of financing given to the firm. Accordingly, the existence of CDSs is not trivial to the firm and can become decisive to the firm's debt financing. While the literature so far has focused on the impact of either the availability of CDS contracts or banks' use of CDS contracts to manage their lending, there is still a lack of understanding of the role of creditors' use of CDS contracts from the firm's perspective. In the paper I fill this gap by examining firm-level credit exposures and variations in creditors' CDS holdings, conditional on the availability of the CDS contracts. For the empirical investigation I make use of unique and comprehensive CDS position and regulatory credit registry data from the Deutsche Bundesbank which allows me for a given firm to have a clear identification of the significance of creditors' CDS positions relative to their credit supply. By explicitly identifying the role of *creditors'* use of CDSs for firms' *total debt financing* the paper shows that the magnitude of relaxed debt financing conditions arising from the availability of CDS contracts significantly depends on creditors' net CDS positions and may imply an indirect cost to firms in the form of credit rationing.

At large, the discussion of how CDSs may impact firms' debt financing has been argu-

ing that CDS contracts, as a financial tool, can help to reduce frictions on the supply side of corporate debt financing. Following the theoretical literature, buyers of CDS contracts, that have a credit relationships with the reference firm, may strategically change their lending behavior to the underlying firm (e.g., Bolton and Oehmke (2011), Parlour and Winton (2013), Darst and Rafayet (2016), and Danis and Gamba (2018)). As outlined in these papers, when creditors hedge their credit exposures it provides an opportunity for them to e.g. change the type of debt securities it invests in, reduce their regulatory capital requirement, and/ or reduce the limited commitment problem of the borrower which may affect the value of a respective CDS contract. As the existence of CDS markets, thus, reduces financial frictions on the supply side of credit, the availability of CDS contracts can lead to more liquid lending markets (see e.g., Bank for International Settlements (2006), Faulkender and Petersen (2006), and Lemmon and Roberts (2010)) and, accordingly, affect firms' debt financing. Using CDS quote data Saretto and Tookes (2013) investigate the availability of CDSs and provide empirical evidence that firms, in general, are able to maintain higher leverage and longer debt maturities after their debt is traded on the CDS market. Using bank-firm specific CDS position data, Gündüz, Ongena, Tümer-Alkan, and Yu (2017) show that banks that properly hedge themselves using CDS contracts extend relatively more credit to risky corporations. However, while CDSs may increase lending after CDS contracts become available and individual creditors may extend their credit to firms in accordance to their hedged credit positions, it is unclear to what extent this affects the debt financing of the individual firm. CDSs are typically only available for larger firms with multiple creditors. Hence, it is not obvious that the use of a CDS contract by an individual creditor affects the firm's total debt financing. Furthermore, creditors may change their CDS positions over time and, in fact, often also sell CDS contracts written on their own borrowers' debt. While the related literature almost exclusively has been studying the effect of creditors' use of CDS contracts as a hedging device, it is important for the discussion of the impact of CDSs on firms' debt financing to consider creditors' *net* CDS holdings and the variation across firms and time.¹

In order to provide a detailed empirical investigation of the role of creditors' use of CDSs for firms' total debt financing I collect comprehensive CDS position and credit registry data from the Deutsche Bundesbank.² The CDS position data cover information on outstanding CDS contracts on German reference entities and contain specific information on the buyer/seller of each CDS contract, including their respective position

¹To the best of my knowledge, only Caglio, Darst, and Parolin (2017) provide an investigation of the impact of CDS contracts that are sold by bank holding companies.

²Examples of empirical studies that use similar data are Gündüz, Ongena, Tümer-Alkan, and Yu (2017), who make use of the Small Bang in the European CDS market in order to investigate the impact of CDS hedging positions on the amount of credit offered by individual creditors, as well as Caglio, Darst, and Parolin (2017), who investigate the use of CDS contracts by U.S. based bank holding companies.

in (net) notional terms. The German credit registry data contain information on the creditor-borrower relationships and the credit outstanding between these counterparts. In contrast to the data used in the related literature, the combination of the CDS position and credit registry data ensures clear identification of the credit relation between the holder of a CDS contract and the underlying reference firm which is essential for the link between CDSs and firms' debt financing. Moreover, the data allows me to investigate creditors' net CDS position and the significance of these relative to their credit exposures. This is of particular interest in terms of determining the effect of variations in creditors' CDS holdings and the impact of credit protection buyers versus sellers. For the empirical specification I merge these data with firm fundamental and detailed debt holding data from Compustat Global, Capital IQ, and SDC Dealscan.

Making use of this unique data sample, I first analyze the impact of the presence of *creditors* that hold CDS contracts. I find that firms with available CDS contracts are able to maintain higher credit levels, and specifically show that the higher credit supply stems not only from those creditors that hold the CDS contract, but also from the firm's remaining creditors. In line with Saretto and Tookes (2013), these results suggest that CDS contracts improve credit markets, more generally. However, when investigating the variation in creditors' CDS holdings I also find that the magnitude of the effect depends on the creditors' actual use of CDS contracts. Firms have significantly lower credit available when their creditors are net buyers of credit protection relative to when the firm's creditors are net sellers of credit protection, or during periods where none of their creditors hold a CDS contract written on their debt. In order to provide more granular insight about these differences in creditors' supply of credit I study the ratio of creditors' CDS holdings relative to the firm-level, i.e., aggregated credit exposures. First, and based upon a sample defined on the firm-bank level, I find in line with Gündüz, Ongena, Tümer-Alkan, and Yu (2017) that individual creditors that hold CDS contracts as a baseline provide more credit to CDS reference firms. However, I also find that the credit extension is *decreasing* in the bank-specific CDS to credit exposure ratios and even may become negative. These results suggest that firms, towards which creditors to a larger extent hedge their credit exposures, obtain relatively less additional credit. I next confirm this finding on the firm level by showing that firms have significantly less credit available when their creditors in sum have hedged a high share of the total credit exposures to a firm. In contrast, firms whose creditors' hold significant sell positions in CDS contracts written on the firm's debt have significantly more credit available. In order to address concerns of the results being purely driven by differences in firms' credit risk I study the firm level determinants of creditors' use of CDS contracts in my sample and confirm that the effect of creditors' CDS holdings is robust. Furthermore, I investigate

the significance of the presence of CDS creditors and find an amplified effect on the firm-level credit exposures when more of the firm's creditors hold CDS contracts on the firm's debt.

For the debate about the net impact of creditors' CDS holdings on firms' debt financing, it is not only important to investigate the level of credit provided to the firm, but also the implications it may have on firms' debt financing conditions, more generally. To do so, I follow the discussion in, e.g., Saretto and Tookes (2013), Brunnermeier (2009) and Krishnamurthy (2010), and analyze firms' debt maturity and changes in specific debt maturity tranches of firms' outstanding debt. Independent of the actual net CDS holdings of a firm's creditors, I find that firms have longer debt maturities when their creditors hold CDS contracts. Furthermore, I show that the increase stems from the replacement of short-term debt with more long-term debt. This suggests that refinancing with longer-term debt is more likely for firms where the creditors hold CDS contracts. However, the results also outline that the refinancing of debt for firms with net CDS-buying creditors does not occur before maturity and is replaced with relatively short-term debt. Meanwhile, I find that firms are able to refinance early and have a significant extension of medium-term debt when their creditors are net CDS sellers implying that the debt maturity extension is more significant for these firms. As I further document that the impact on debt maturity is pronounced for firms with relatively low additional debt capacity I argue that firms with low probability of a credit extension and, potentially, high credit risk, still may benefit from their creditors' CDS holdings in terms of debt refinancing. Related to the investigation of CDSs' impact on firms' refinancing conditions, I also briefly analyze the impact on other measures for firms' costs of debt. While I do not find evidence that firms pay higher interest payments, the results indicate that firms to a higher extent rely on bonds than bank debt when their creditors are credit protection buyers. Thus, the debt financing of the individual firm may become limited in its refinancing options when they have creditors that hold CDS contracts on their credit. Overall, the results of relatively lower debt maturity and more contracted refinancing options in the case of net protection-buying creditors highlight banks use of CDS contracts for monitoring purposes as suggested in, e.g., Parlour and Winton (2013) and Streit (2015).

Finally, I provide an analysis of the impact of creditors' CDS holdings that is supplementary to the more general impact of CDS contracts. From the firm's perspective CDS holdings by its creditors is endogenous. Hence, it is not enough to address implications of the availability of CDS contracts but also whether and how the creditors' specific CDS holdings affect the financing of firms *after* their creditors start to trade CDS contracts on the firm's debt. While I do find a significant role of the liquidity of CDS contracts

written on a firm's debt, I show that the variation in CDS holdings by a firm's creditors helps explain differences in firm-level credit exposures, especially when their creditors only occasionally hold CDS contracts on the firm's debt.

2. Related Literature

As of now, this paper is among the few papers investigating the role of CDS for corporate lending using granular CDS position and credit data on the bank-firm level. Using a similar data sample on German banks, Gündüz, Ongena, Tümer-Alkan, and Yu (2017) investigate banks' motives for CDS trading and the impact of CDS contracts on credit availability around the European Small Bang (2008 to 2010). The authors find that individual banks hedge credit exposures to risky firms with CDS contracts and reallocate credit to safer firms. Only when banks properly hedge themselves, they extend relatively more credit to risky firms. Using U.S.-based CDS position and credit registry data, Caglio, Darst, and Parolin (2017) investigate the impact of banks' usage of CDS contracts and the respective impact on firms' credit risk. The authors document that banks hold large CDS positions to credit exposure ratios and show that rather than leading to an increase in credit risk of the reference entity, creditors' holding of CDS positively affects credit risk. While these papers provide insights on banks' usage of CDS trading and its impact on credit provision on the bank-firm level, this study supplements these findings by using similar data but then providing an understanding of the net impact of creditors' CDS holdings from the firm's perspective. Specifically, this paper adds insight on the role of creditors' CDS holdings for firms' total credit, i.e., both the credit provided by CDS and non-CDS creditors, as well as the magnitude of these results compared to the effect of the existence of CDS markets more generally. In particular from an economic perspective it is important to consider the overall implications of CDS contracts for firms' debt financing.

Turning to the impact of CDS contracts on the firm level, there is a fairly rich literature. However, to a large extent these studies are based CDS quote data and without granular information on the firm-bank relation, i.e., whether the holder of the CDS is a lender of the firm or not. In regards to the impact of CDS on firm fundamentals, Saretto and Tookes (2013) provide an empirical investigation on non-financial firms in the S&P index and show that firms with existing CDS quote data are able to maintain higher leverage ratios and on average are characterized by longer debt maturities. Using similar data, Ashcraft and Santos (2009) investigate the cost of debt financing in the onset of CDS trading and do not find that CDS affect the borrowing cost for the average borrower. Moreover, the authors find a small positive impact of CDS trading on spreads issued to

safe firms and outline that the benefit increases when market becomes sufficiently liquid. Overall, these papers exemplify that firms may not necessarily be worse off due to the availability of CDS contracts. Supplementary to these studies, this paper investigates differences in firms' debt financing due to creditors' CDS holdings and highlights the role of a credit relationship between the holder of the CDS and the underlying firm, as well as creditors' specific CDS positions.

As known from the existing literature, one of the main determinants of credit risk is the firm's leverage ratio. Accordingly, when firms obtain higher leverage ratios due to creditors' CDS holding, then this may increase the credit risk for these firms (at least relative to other similar firms or before having debt traded in the CDS market). In an empirical study using corporate-level CDS trading data and a sample of U.S. non-financial firms, Subrahmanyam, Tang, and Wang (2014) support this spillover mechanism by documenting that the inception of CDS trading increases the probability of a credit downgrade and bankruptcy of firms. In addition, Subrahmanyam, Tang, and Wang (2017) find that firms hold more cash after becoming traded on the CDS market, which partly is financed by new debt issuances. In particular, the authors show that the effect is amplified for firms with a lot of long-term debt maturing within the next year reflecting firms' precautionary cash holding motives (Bolton, Chen, and Wang (2013), Bolton, Chen, and Wang (2014)). Henceforth, when firms become traded on the CDS market, they may follow more conservative liquidity policies and have higher marginal values of improved lending conditions. Altogether, these studies also highlight a potential impact of CDS contracts on firms' refinancing risk. As proposed in the theoretical paper by Leland and Toft (1996) and empirically confirmed by Brunnermeier (2009) and Krishnamurthy (2010) firms with shorter average debt maturity or more short-term debt face greater default risk due to the higher rollover frequency. While firms, accordingly, care about the maturity of their outstanding debt (e.g., Choi, Hackbart, and Zechner (2016), Harford, Klasa, and Maxwell (2014), Serveas and Tufano (2006), and Lins, Serveas, and Tufano (2010)), the ability to refinance their debt depends on general credit market conditions (e.g., Xu (2017)) and creditors' supply of more long-term debt (e.g., Brunnermeier and Oehmke (2013)).³ Further, Almeida, Campello, Laranjeira, and Weisbenner (2011) exemplify the economic importance of firms' refinancing ability for the real economy by documenting that firms with a high ratio of long-term debt maturing around the peak of the 2007-08 crisis invested less than otherwise similar firms. Hence, to the extent that the presence of CDS contracts may affect the type of credit by providing more long-term debt then this

³Xu (2017) finds that especially firms of low-quality refinance early and during times with favorable conditions. Brunnermeier and Oehmke (2013) theoretically show that firms reliance on short-term financing is the outcome of a maturity rat race in which the borrowers choice of a short-term financing structure is the response to other creditors' simultaneous opt for shorter maturity contracts.

will also be beneficial for firms. As firms’ refinancing risk in particular is lowered when short-term debt is replaced with more long-term debt this paper not only investigates firms’ debt maturity, but in particular firm’s reliance on short-term versus long-term debt.

While the empirical literature has provided some evidence of the role of CDSs for corporate policies and credit risk, the discussion of specific channels through which CDSs affect corporate financing measures has mainly been based on theoretical studies.⁴ Black and Hu (2008) were the first to discuss the so-called “empty” creditors, i.e., creditors, that due to the holding of debt and CDS contracts of the same reference entity at the same time, no longer are exposed to the credit risk of the debtor. As argued in Bolton and Oehmke (2011) the “empty creditor problem” describes the situation where the creditor, due to the insurance against the default of the debtor, no longer may have an interest in the efficient continuation of the debtor, and even may push the debtor into inefficient bankruptcy or liquidation. As a baseline, this reduces the ex-post limited commitment problem of the borrower to repay its debt and, hence, allows for an ex-ante extension of credit to the borrower.⁵ Similar, Parlour and Winton (2013) outline in a theoretical paper that CDSs help creditors to lay-off credit risk because private information advantages combined with CDS holdings make the creditors able to better monitor their borrowers. Accordingly, creditors’ may extend credit to safe loans in order to increase their profits. Further, Darst and Rafayet (2016) show in a theoretical model that CDS can alter the type of debt securities and also increase credit supply to include more risky securities for a higher price. Danis and Gamba (2018) show using a theoretical model that CDSs may increase firms’ default probabilities but also reduce the occurrence of strategic defaults. Specifically, the authors find that the latter effect dominates and, in particular, allows firms to gain from less costly financing, which then leads to higher investment and corporate value. As one of the few and more recent empirical papers, Streitz (2015) documents that banks, whose borrower’s debt is actively traded in CDS markets, are less likely to syndicate loans and retain a larger loan fraction. In line with this, and also using syndicated loan data, Shan, Tang, and Yan (2016) find that firms become more likely to switch to new lenders after the inception of CDS trading on their debt and suggest a rather negative impact of creditors use of CDS contracts. As proposed by these papers, the key mechanism for the impact of CDSs is that the holder of the CDS contract is a creditor of the firm and because of the lending relationships can extend

⁴The exemptions are Gündüz, Ongena, Tümer-Alkan, and Yu (2017) and Caglio, Darst, and Parolin (2017) who investigate specific bank-firm effects of CDS holdings.

⁵The authors argue that CDS contracts increase creditors’ debt renegotiation power and make them less willing to give credit to distressed borrowers, while good firms will be able to obtain higher leverage ratios.

or withdraw financing to the firm. Contrary to the related empirical literature that has been investigating firms' aggregated financing using information on the availability of CDS contracts, this paper will, due to the use of regulatory data, focus on the impact of *creditors'* CDS activity, conditional on the availability of CDS contracts.

3. Data and Empirical Specification

The aim of this paper is to provide a more comprehensive and explicit understanding of the role of creditors' use of CDSs for firms' debt financing. Specifically, this paper focuses on identifying implications of creditors' net CDS holdings, i.e., the amount of credit protection bought and sold by the firm's own creditors, which are supplementary to the role of CDS contracts for credit markets more generally. In order to address these issues I combine CDS position, credit registry and other firm fundamental data from several data sources and then provide an empirical investigation using these data.

3.1 Data

The data sample in this paper is based on confidential data from the German Credit Registry (MiMik) provided by the Deutsche Bundesbank. The credit registry data contains quarterly information on bank-firm credit exposures held by German banks for the period 1993-Q2 to 2016-Q2.⁶ The advantage of this data is that it not only allows me to obtain information on firms' credit relationships, but also information on the credit amount held by individual creditors. The credit measure in the credit registry data is defined fairly broadly and covers both loans and corporate bonds on the firm-bank level.⁷ In order to obtain information on outstanding CDS contracts on the firms covered in the credit registry data I collect comprehensive CDS position data from the Trade Information Warehouse (TIW) of the Depository Trust and Clearing Corporation (DTCC).⁸ The data has been collected since 2008 and contains weekly data on German banks' positions in CDS contracts where the reference entity is a German firm. The data covers more than 95 % of global standard single-name CDS contracts and includes, in contrast to publicly available DTCC data, information on both the buyer and the seller of the CDS contract, as well as the reference firm. Most importantly, the data also contains bank-

⁶The credit data is only available for firms with outstanding credit of at least 1.5 million euro at the end of each quarter. For details, please see Section 14 of the Banking Act (Deutsche Bundesbank (2001)).

⁷Items that are not included in the credit measure are bank exposures, e.g., shares in other enterprises and securities in the trading portfolio. For detailed definitions, please see, e.g., Section 19 of the Banking Act (Deutsche Bundesbank (2001)), Schmieder (2006), Ongena, Tünmer-Alkan, and von Westernhagen (2012).

⁸I thank Yalin Gündüz for kindly sharing the CDS position data.

specific CDS position information such as the number of contracts outstanding and the notional amount bought and/or sold by the individual bank.⁹

Next, I match the credit registry and CDS position data on the firm-bank level. The sample period is 2008-Q1 to 2016-Q2 and is limited by the availability of the CDS position data. Based upon the credit registry and CDS position data I first identify all firms on which there are, respectively, are no, traded CDS contracts, as well as the credit exposure of each firm-bank pair. Secondly, I use the combined data sample to reveal whether the individual creditor holds a CDS contract that is written on the respective firm's debt. The unique data allows me for each firm (borrower) to distinguish between the creditors that hold CDS contracts (CDS creditors), and the creditors that do not hold CDS contracts (non-CDS creditors). As this paper focuses on the role of *creditors'* use of CDSs, the identification of CDS creditors is key for the empirical investigation. Thirdly, I exploit the comprehensive CDS position data by determining whether the individual creditors are net protection buyers or sellers, and the magnitude of their CDS holdings. This is of particular interest in order to differentiate between the general impact on credit markets due to the prevalence of CDS contracts and the firm-specific impact on debt financing due to creditors' holdings of CDSs.

- Figure 1 -

Figure 1 shows the time series of aggregated CDS holdings by German banks on German non-financial firms. While the banks during most of that sample period have been buyers of credit protection (indicated by a positive CDS net notional value), the figure outlines most interestingly that the same banks in recent years have been net sellers of credit protection.¹⁰ In gross terms, the German CDS market reached its peak in late 2010 accounting for about 11% of the total credit amount outstanding and since then, come down to a value of about 4% of firm-level credit exposures. Accordingly, the figure highlights the necessity for studying the impact of both buy and sell CDS positions of banks, as well as the impact of creditors' CDS holdings supplementary to the general effect of the existence of these markets.

- Table 1 -

In addition, Table 1 summarizes credit and CDS statistics for firms with available CDS and credit registry. As outlined in the table, the CDS reference firms in my baseline sample have on average 15 different credit relationships of which 3 relate to banks that

⁹The data contains end-of-week holdings after all new trades, assignments, terminations and amendments.

¹⁰As shown by Caglio, Darst, and Parolin (2017) hedge and mutual funds have in recent years been the typical counterparts and holders of CDSs and the trend has been similar in the U.S.-based CDS market.

also trade CDS contracts on the firm’s debt. The average firm-level credit exposure is approximately 1,025 million euro of which about one-third is held by CDS creditors.¹¹ The aggregated firm-level credit exposures have been fairly stable over time while the share of credit held by CDS creditors, similar to the size of the CDS market, has been decreasing over time. Further, the table outlines that not only the amount of credit protection bought relative to credit protection sold has been decreasing, but also that the number of contracts that were bought compared to the number of contracts that were sold has been decreasing. This confirms that the liquidity of the German CDS market has been decreasing, but also that creditors in recent years to a larger extent have become net sellers of CDS contracts.

In addition to the detailed CDS position and credit registry data, I collect other firm fundamental data from the Compustat Global database.¹² From this source, I collect all yearly and quarterly corporate financial and stock price data for the period 2008-Q1 to 2016-Q2. Further, I supplement the data from Compustat with firm-level data from the Capital IQ and the Mergent FISD databases. In contrast to Compustat, Capital IQ compiles, *inter alia*, detailed information on corporate debt structure, using footnotes contained in the firm’s financial reports. Specifically, I obtain data on firms’ debt maturity structure from this source. In addition, I collect bond-related information on the firm level from Mergent FISD. To mitigate the effect of outliers, I winsorize data from these sources at the 1st and 99th percentiles. As this study investigates the impact of creditors’ CDS holdings on firm-level debt financing measures which are very different for financial and utility firms, I follow the literature and exclude financial firms (SIC codes 6000 to 6999), utility firms (SIC codes 4900 to 4999) and firms for which no SIC code is available. Further, as firms that act as CDS reference entities are relatively large firms compared to the average firm covered in the credit registry data and in order to provide a more unbiased sample, I exclude all small and medium-size firms from the CDS position and credit registry sample by restricting the sample to firms with an aggregated credit exposure that on average is within the 1st and 99th percentiles of that of the identified CDS firms. Finally, I restrict the sample to only include firms for which credit registry data from the MiMik database as well as firm fundamental data from Compustat and Capital IQ is available.¹³ My final sample consists of 78 non-financial German firms, of

¹¹For comparison, the average non-CDS reference firm in the credit registry data has 14 credit relations and the total firm-level credit exposure is approximately 570 million euro. These values refer to quarterly observations of 2,267 non-financial firms operating in the same industry as the identified CDS reference firms.

¹²The advantage of using data from Compustat rather than, for instance, Amadeus or USTAN, is that I have quarterly rather than only annual data, which allows for greater granularity in my analysis.

¹³I follow the conventional approach in related empirical research (e.g., Bates, Kahle, and Stulz (2009)) and assume that a firm has no merger and acquisition activities in a given quarter if it is reported as “missing” by Compustat. I use the same argument for observations of capital expenditures.

which 31 act as reference entities in CDS contracts. In the latter, I will refer to CDS reference entities as *CDS Firms*, and to the remaining firms as *Non-CDS Firms*.

3.2 Empirical Specification

In order to investigate the role of creditors' CDS holdings for firms' debt financing I first analyze the implications for firms' debt financing. Specifically, I use the firm-specific credit exposures which I obtain using the quarterly bank-firm credit registry data from MiMik and by aggregating individual banks' credit exposures to the firm level. As the credit measure in MiMik covers firms' total credit amounts, i.e., both loans and corporate bonds, a change in this measure will reflect the extension or withdrawal of debt financing to the firm. Based upon these data I use *Total Credit Ratio* and *Total Credit Amount* as my key measures. *Total Credit Amount* is the natural logarithm of the firm-specific credit exposure at the end of a quarter, while *Total Credit Ratio* is the firm-specific credit exposure at the end of a quarter, scaled by total assets. In the empirical analyses I use various versions of both measures. Second, I investigate the role of creditors' CDS holdings for firms' debt refinancing by analyzing the type of credit provided to the firms. As a proxy for firms' exposure to debt refinancing I mainly use the variable *Debt Maturity* which is the principal-weighted maturity of all debt as reported in Capital IQ and given in years. To proxy the direct cost of debt I use information on the firm's total interest and related payments and define the variable *Interests To Credit* as the total amount of interests, scaled by total credit outstanding. To further test for the changes in the type of debt I use *Bonds To Debt* which I define as the ratio of the principal of the firm's outstanding bonds to total bank debt.

For the choice of potential determinants of the outlined firm-level debt financing measures and the empirical design I largely follow Saretto and Tookes (2013), Ashcraft and Santos (2009), and Subrahmanyam, Tang, and Wang (2017) and relate the measures to a set of explanatory variables obtained from Compustat.

- Table 2 -

Table 2, Panel A, presents base firm characteristics for the CDS and non-CDS firm sample. As seen from the table, the average CDS firm has slightly more credit outstanding and a higher leverage ratio than non-CDS firms. In particular, the average leverage ratio is 27.7% and 25.0% for CDS and non-CDS firms, respectively, implying that CDS firms, compared to non-CDS firms, to a higher extent rely on debt financing. Accordingly, I also find that CDS firms have a higher ratio of interest payments, while the debt maturity of CDS and non-CDS firms is actually very similar. However, and in line with Saretto and Tookes (2013) and Caglio, Darst, and Parolin (2017), I also find wide variation in

the debt financing across both CDS and non-CDS firms. With respect to other base firm characteristics Table 2, Panel A, outlines that the average CDS firm in my sample is larger, uses more commercial papers and has a slightly lower Z-score, but else wise is similar to the average non-CDS firm.

In order to analyze the implications of creditor' use of CDS contracts I relate various proxies to the outlined firm-level debt financing measures. To control for fundamental differences between CDS and non-CDS firms I use *CDS Firm* which is a dummy variable equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. To capture the impact of the presence and magnitude of creditors' actual CDS holdings I first create quarterly firm-bank-specific CDS measures based on the weekly CDS position data. To this end, I follow the approach in Caglio, Darst, and Parolin (2017) and use the average of the weekly CDS positions of the last three weeks before the final week in a given quarter.¹⁴ Then, similar to banks' credit exposures I calculate firm-specific CDS measures in a given quarter by aggregating creditors' CDS position on the firm level. Following this methodology I obtain quarterly data on the number of CDS contracts bought and sold, the net notional values of these contracts, as well as how many of a firms' creditors hold a CDS contract in a given month. Based upon this quarterly information I then define several variables to measure the extent to which the firm's creditors hold CDS contracts on the firm. As a proxy for the presence of CDS creditors in a given quarter I use *CDS Outstanding* which is a firm-quarter-level dummy that is equal to one in quarters where at least one of the firm's creditors holds a CDS contract on the firm, and is zero otherwise.¹⁵ As a proxy for the significance of creditors' CDS positions I use the comprehensive firm-level information on the outstanding CDS contracts. Specifically, I make use of various versions of the variable *CDS Coverage*, which is defined as the total net notional amount of all creditors' outstanding CDS contracts, scaled by the aggregated credit exposure to the firm. That is,

$$\text{CDS Coverage}_{it} = \frac{\text{Total CDS Net Notional}_{it}}{\text{Total Credit Exposure}_{it}} \quad (1)$$

where t indicates the year-quarter and i refers to the firm, and the CDS net notional value is the CDS notional amount bought net of the CDS notional amount sold.¹⁶ While the size of *CDS Coverage* measures the fraction of the firm-specific credit exposure that is covered by outstanding CDS held by their creditors, the sign of the ratio outlines whether the creditors are net buyers or net sellers of credit protection. Specifically, the

¹⁴In robustness tests I use end of quarter observations and obtain similar results.

¹⁵In contrast to the measures used in the related literature, *CDS Outstanding* reflects *both* the CDS trading and outstanding CDS positions of the reference firm's *creditors* and on a *quarterly* basis.

¹⁶In robustness tests I use the weighted average of each individual CDS net notional to credit exposure ratios and find that the main results are robust to this alternative specification.

ratio will be positive when the creditors in sum are net protection buyers and, thus, hedge their credit exposures. In contrast, the ratio will be negative when the creditors in sum are net protection sellers and, in fact, implicitly increase their credit exposures. Further, the ratio will be equal to zero when there are (in net terms) no outstanding CDS contracts in the respective quarter. As outlined in Table 2, Panel B, about 9 percent of a CDS firm’s creditors hold CDS contracts on the firm in a given quarter. Accounting for the credit supply of these creditors, the average CDS firm has a CDS coverage ratio of approximately 7 percent implying that the creditors on average are net protection buyers. As I find that the number of CDS contracts bought is slightly lower than the number of CDS contracts sold, the notional value of credit protection bought by creditors is in fact larger than the notional value of credit protection sold by creditors. However, the coverage of creditors’ CDS contracts shows a substantial variation both in terms of sign and size and will, in line with the measures’ definition, vary both across firms and across time. For the more formal study of the firm and quarter-specific effect of creditors’ CDS holdings on firms’ debt financing I mainly use firm-level panel regressions where I regress the measures for firms’ debt financing on proxies for the CDS activity of the respective firms’ creditors, as well as a set of control variables. In order to allow for a general lagged effect of the time-varying measures of creditors’ CDS holdings, as well as to address concerns of reversed causality I use the one-quarter lagged versions of the CDS-related in all empirical specifications. Specifically, I use various versions of the following panel regression model specification, i.e.,

$$\text{Debt Financing Proxy}_{it} = \alpha + \beta \text{CDS Activity Proxy}_{it-1} + \theta X_{it} + \epsilon_{it} \quad (2)$$

where t indicates the year-quarter and i refers to the firm. In terms of the controls in the model, X_{it} , I follow the literature and include firm fundamentals, as well as industry, firm, time and rating fixed effects. The set of controls used in the specific model depends on the choice of the debt financing proxy used as dependent variable. Definitions of all variables included in the regression models are presented in Appendix Table A1.

4. Creditors’ CDS Holdings and Firm Credit

In this section, I study the impact of creditors’ CDS holdings for the firm-level credit exposure. Within this, I focus not only on the effect on the total credit supplied to reference firms, but investigate in particular whether creditors’ CDS holdings affect *both* the credit supplied by CDS and non-CDS creditors. As creditors typically hold multiple CDS contracts and can be (net) buyers or sellers of CDS contracts I further study the impact on the aggregate credit amount provided to a firm conditional on creditors’ net

CDS holdings and discuss the determinants of creditors' CDS positions.

4.1 CDS Creditors and Credit Supply

Following Saretto and Tookes (2013), firms with traded CDS contracts are able to maintain higher leverage ratios. This is because the availability of CDS contracts implies that capital suppliers have the ability to hedge their credit risk and, thus, can overcome credit supply frictions. However, from the individual firm's point of view it is not obvious whether, and to what extent, the pure availability of CDS contracts will affect the total credit supplied to the firm. First, CDS contracts are not necessarily traded by one of the reference firms' own creditors. In fact, CDS contracts can be traded by any bank or financial institution that may, or may not, have a lending relationship with the firm. This not only implies that the presence of a CDS contract does not necessarily reflect an actual hedging strategy of a bank towards its credit exposure to the firm, but also that the holder of the CDS contract has, or has not, the ability to directly affect the credit supply to the firm. Second, firms typically have multiple creditors where each lender may, or may not, hold a CDS contract. Moreover, each of the creditors that do hold a CDS contract may be either a buyer or a seller of a CDS contract and, furthermore, change its CDS holdings over time. Consequently, each of the lenders does, or does not, have an incentive to change its credit supply. Taking this to the firm's perspective, the question is then whether the potential change in individual creditors' credit supply implies a significant impact on the *total* credit supplied. Hence, while there may be fundamental differences between firms that have, or do not have, CDS contracts traded on their debt, it is important to investigate the granularity of the impact of CDSs conditional on the CDS holdings of all of a firms' respective creditors and the variations in these across CDS firms and time.

As a baseline study, I first investigate the effect of the pure presence of outstanding CDS contracts held by the firm's own creditors. The analysis is conducted based upon the sample of CDS and non-CDS firms, and the results are presented in Table 3.

- Table 3 -

In Model (1) and (2), I investigate the impact of the presence of CDS creditors on firms' *Total Credit Ratio*, which is the firm-specific credit exposure, scaled by total assets. In line with Saretto and Tookes (2013), the results in Model (1) suggest that CDS firms, i.e., firms for which a CDS in general is available, have higher credit ratios than non-CDS firms.¹⁷ In addition, I find the signs of the control variables to be in line with

¹⁷In robustness test I find similar results when using firms' (book value based) leverage ratios which I calculate as the sum of current and long-term debt as defined in Compustat, scaled by total assets.

the general predictions, e.g., larger firms are less financially constrained and, thus, rely more on equity markets than on credit markets, higher volatility increases firms' default probabilities leading to lower credit ratios, debt capacity is higher for firms with fixed assets, the availability of commercial paper programs expands access to debt markets. The results in Model (2) further suggest that firms whose creditors actively trade CDS contracts have higher credit ratios and thus, that the effect of CDS contracts is not solely due to fundamental differences between CDS and non-CDS firms.¹⁸ In order to investigate whether the difference in the credit ratio is due to a difference in the credit amount supplied to the firm Model (3) presents the results where I use the natural logarithm of the total credit supplied by the firm's creditors as dependent variable. As seen, I again find a positive coefficient for *CDS Outstanding* indicating that firms experience an extension of credit when the firm's own creditors use CDS contracts.¹⁹ However, as CDS-trading banks typically are larger and, thus, in general are expected to provide more credit to firms compared to non-CDS creditors, the findings for *CDS Outstanding* may simply reflect differences in lender characteristics rather than implications of the outstanding CDS contracts. If this is the case, then one would expect only the fraction of credit that is held by CDS creditors to be larger, while the credit of other creditors should not be affected (or even be lower). Models (4) and (5) of Table 3 present the results where I analyze the impact of the presence of CDS creditors on the credit amount that is supplied by CDS and non-CDS creditors, respectively.²⁰ I find positive and significant coefficients for *CDS Outstanding* for the credit exposures of both CDS and non-CDS creditors. Hence, the results suggest that the effect of the presence of CDS creditors is not driven by differences in lender characteristics. Moreover, the presence of CDS creditors may also lead to a credit extension by non-CDS creditors.²¹

4.2 The Impact of Creditors' Net CDS Positions

Although the typical view is that creditors are credit protection buyers, the descriptive analysis in Section 3 revealed that creditors often also are net sellers of CDS contracts. In terms of the impact of CDSs on the credit amount provided to firms one would expect that the impact depends on whether the creditors have bought, respectively sold, credit

¹⁸Appendix Figure A1 graphically confirms these findings by outlining that the CDS firms covered in the data sample during the whole sample period have higher credit ratios than their non-CDS counterparts, but also that the difference in the credit ratio has been varying over time.

¹⁹I find that firms' *Total Credit amount* is increased by 0.673 which corresponds to that the total credit amount of the average firm is approximately 11.1 percent higher due to the presence of CDS creditors.

²⁰For the sample of non-CDS firms, I infer a quasi *CDS Creditor Credit Amount* by aggregating the credit exposure of banks that in general trade CDS contracts in my sample.

²¹Appendix Figure A2, Panel A and Panel B, shows that the share of credit held by CDS-trading banks for both CDS and non-CDS firms has been steadily decreasing in recent years.

protection on their own borrowers. To that extent, it is first of all interesting to investigate whether the credit extension found in the previous section is due to the presence of CDS creditors that are protection buyers or protection sellers, or both. Furthermore, a finding that reveals a differential effect on firm-level credit exposures due to the creditors' CDS position would support the evidence of a creditor-related effect that is supplementary to the implications of CDS contracts for credit markets, more generally. While the literature has outlined that individual creditors that hedge their credit exposure using CDS contracts have an incentive to extend their credit supply (e.g., Bolton and Oehmke (2011)), it is likely that firms with creditors that on average are protection buyers will experience lower credit supply. CDSs are insurance-like contracts that hedge against the credit risk of reference firms and, thus, most likely held by creditors that want to decrease their credit risk. In contrast, one would expect no, or even a, positive impact on the credit supplied to the firm when their creditors are net protection sellers. However, given a constant demand for credit by the firm and its typical reliance on multiple creditors, any change in the credit exposure of one CDS holding creditor may be offset by the firm's other CDS creditors and/or non-CDS creditors. Contrary to other CDS creditors' credit supply, non-CDS creditors' credit supply is more directly linked to the credit risk of the firm as these by definition do not hedge their credit exposures.²²

In order to investigate the role of creditors' position in CDS contracts, I next present the results of an analysis where I regress the firm's total credit amount, respectively the credit held by CDS creditors and non-CDS creditors, on proxies for creditors' net CDS positions and the standard set of controls. As a measures for creditors' net CDS positions, I use the net value of all creditors' outstanding CDS position, i.e., the notional amount of CDS bought minus the notional amount of CDS sold. Specifically, I define *Net Buyer* (*Net Seller*) as a dummy variable that is equal to one if the net CDS position of the firm's creditors is positive (negative), and is equal to zero otherwise. The results are shown in Table 4.

- Table 4 -

I find positive and significant coefficients for *CDS Outstanding* in all model specifications indicating that firms have more credit available when their creditors hold CDS contracts that are written on the firm's debt. However, I also find that the magnitude of this effect depends on the creditors' net CDS positions. As shown in Models (1), (3), and (5) I find negative coefficients for *CDS Outstanding* \times *Net Buyers* that are significant at the 5% level. Hence, the total credit amount available to firms is lower when their

²²The credit exposure of non-CDS creditors may indirectly be affected by the CDS creditors' usage of CDS contracts, if related changes in the credit supply by these creditors affects the overall credit risk of the firm.

creditors are net buyers of CDS and the lower credit supply stems from both CDS and non-CDS creditors. In contrast, and as shown in Models (2), (4), and (6), I find positive coefficients for *CDS Outstanding* \times *Net Sellers* in all model specifications. Although the statistical significance is weak, the results suggest that the total credit amount available is higher when the firm’s creditors are net sellers of CDS contracts and that the increase in credit is driven by non-CDS creditors. Thus, in relative terms the results indicate that the effect of having net CDS-buying creditors is rather negative for the individual CDS firms, while CDS firms may be able to obtain additional credit when they have net CDS-selling creditors. However, when also accounting for the effect on firm-specific credit exposures stemming from the availability of CDS contracts, I find that CDS firms independent of their creditors’ CDS positions have more credit available than their non-CDS counterparts (or during period where the creditors hold no CDS written on the firm’ debt).²³ Overall, the analysis reveals that the impact of CDS contracts on firm-level credit exposures depends upon the CDS position of creditors and supports the result that the effect on firm-specific credit exposures is caused by the creditors’ actual CDS holdings.

4.3 The Variation in Creditors’ CDS Coverage

In the previous analysis I find evidence of lower credit supply from both CDS and non-CDS creditors when their creditors are net protection buyers and relaxed credit supply when their creditors are net protection sellers. This finding stands in contrast to some related studies that investigate how individual creditors may change their debt financing to a firm after having bought a CDS contract on that firm. Based upon a theoretical model, Bolton and Oehmke (2011) argue that the holding of a CDS contract by a lender changes the credit relation between the lender and the borrower. Specifically, the creditor may be willing to extend its credit exposure as the CDS strengthens the creditor’s position in ex post debt renegotiation. In line with this Gündüz, Ongena, Tümer-Alkan, and Yu (2017) find that creditors hedging their credit exposure by 50 to 200 percent, compared to other creditors, increase credit to riskier firms in the onset of the Small Bang in Europe. However, regarding the discussion of the role of CDS contracts for firms’ *aggregate* lending the outlined bank-firm level effect may be impeded. Credit extensions by individual creditors that are due to their purchase of credit protection may be minor in terms of a firm’s total lending and/or, potentially, offset by the lending of the firm’s other creditors. Further, banks may adjust their credit supply in accordance to their net CDS position that can be both net buy and net sell positions. In order to address this discussion in

²³The aggregated credit exposures related to CDS firms’ whose creditors are net protection buyers (sellers) is approximately 6.8 percent (13.8 percent) higher than that of the average non-CDS firm.

more detail, the next section first provides a brief investigation of the implications of creditors' CDS holdings for the credit supply on the *bank-firm* level before turning to a more thorough analysis of the variation in creditors' net CDS positions and its impact on the credit supply on the firm level.

4.3.1 Creditors' Hedging and Firm-bank-level Credit

To enhance the understanding of the effect of creditors' CDS holdings for firm-level credit this section briefly investigates the impact of individual creditors' CDS holdings for bank-firm-level credit. Specifically, I test the effect of a creditors CDS holding for the credit provided to that firm by conducting an analysis on the bank-firm level and in the sample that is obtained before aggregating creditors' credit exposures and CDS positions on the firm level.²⁴

In Appendix Table A2, Panel A, I first investigate the role of outstanding CDS contracts for individual by separating between creditors which in a given quarter respectively are net protection buyers and net protection sellers. Specifically, I use bank-firm specific dummy variables that are equal to one in a given quarter, if the creditor has bought more, respectively less, credit protection on the firm's debt than it has sold. As dependent variable I use the natural logarithm of the respective banks' credit exposures to the firm. As outlined in the table, Models (1) and (2) show positive and significant coefficients both when the creditor is a net protection buyer and net protection seller indicating a general increase in the credit supplied to firms on which the creditor holds a CDS contract. However, in contrast to the findings on the firm level I find that the increase in bank-firm level credit is larger when the creditor is a net protection buyer.

In Panel B of Appendix Table A2, I further exploit whether the impact depends on the ratio of creditors' total credit exposure that is covered by the creditors' outstanding CDS contracts. In order to be able to differentiate between a baseline CDS effect and actual coverage effect I also include a firm-bank specific dummy variable that is equal to one, if the creditor in the given quarter holds a CDS position on the firm's debt (*Bank CDS Position*). In Model (1), I capture the bank-specific CDS coverage effect by also adding the firm-bank-specific ratio of the creditor's CDS net notional, scaled by the credit exposure of the respective bank. In Model (2), I then analyze the bank-specific CDS coverage in more detail by using dummy variable for specific ranges of this ratio. As seen from both models, I in general find positive and significant coefficients for *Bank CDS Position* suggesting that creditors that hold CDS contracts, in general, provide

²⁴The analysis is supplementary to Gündüz, Ongena, Tümer-Alkan, and Yu (2017) as it also provides insight on to what extent lower or higher hedge ratios, including negative hedge ratios of a creditor affects the firm-level credit exposure.

more credit to reference firms. However, I also find a negative and significant coefficient for the bank-specific CDS coverage ratio suggesting that the impact is lower for higher hedge ratios. The findings in Model (2) outline that credit in fact is *withdrawn* for CDS hedge ratios above one or below minus one, i.e., when the CDS net notional outstanding is larger than the creditor's credit exposure. In contrast, creditors on average provide more credit in case of relatively low CDS coverage ratios. The results exemplifies that while individual creditors may extend credit to firms due to their use of CDS contracts the magnitude varies a lot depending on the extent to which they hedge their credit protection and may, potentially, also lead to a lower credit supply to the firm. Overall, these results provide evidence that it is likely that different levels of credit hedging by creditors of the same firm partly, or totally, may offset each other.

4.3.2 Creditors' CDS Coverage and Firm-level Credit

In this section I study the variation in creditors' net CDS positions and its impact on firms' total credit exposures by investigating the ratio of firms' total credit amount that is covered by outstanding CDS contracts held by its creditors. In order to help the interpretation of the results and to avoid concerns about selection bias, I conduct the analysis based on the firm level sample including CDS firms only. The results are presented in Table 5.

- Table 5 -

Similar to the study on the firm-bank level, I include the measure *CDS Outstanding* to capture the baseline effect of the presence of CDS creditors. Then, in Panel A, I use the measure *CDS Coverage* which is calculated as the net value of all creditors' outstanding net CDS positions, scaled by the firm-level credit exposure. The measure not only captures whether the creditors are net buyers or sellers of CDSs, but also the significance of their holdings. The results in Models (1) and (2) provide evidence that the finding that CDS firms are able to maintain higher credit ratios when their creditors hold CDS contracts is robust also in the sample of CDS firms only. However, I further find (like in the analysis on the firm-bank level) that firms' credit ratios are decreasing in the firm-specific CDS coverage ratio, i.e., the more the creditors hedge, the less credit is available to the firm. Furthermore, the negative correlation between the credit amount available and creditors' CDS coverage ratio is confirmed when I in Models (3) to (8) analyze the impact on firms' total credit amount, as well as the credit amount held by CDS creditors and non-CDS creditors, respectively.

In order to differentiate between the size and position effect, I next rerun the analysis using dummies for certain levels of the total CDS coverage ratio. In particular, I use

dummies for observations where the total CDS coverage ratio is positive, respectively negative, and the CDS notional value covers a high, medium or low fraction of the aggregated credit exposure.²⁵ The results are presented in Panel B of Table 5. In Models (1) and (2) I again investigate the impact on firms' total credit ratios. Overall, the results suggest that the impact on firms' credit ratios is negative in case of positive CDS coverage ratios and positive in case of negative CDS coverage ratios. However, I only find a significant effect when the firm-specific CDS coverage ratio is high and creditors are net protection buyers. Meanwhile, the coefficient for *CDS Outstanding* is positive and significant at the 5% level suggesting that CDS firms are able to maintain higher credit ratios, except for the case of very high levels of CDS hedging by their creditors. The results in Models (3) through (8) further show that both CDS and non-CDS creditors significantly reduce their credit supply when the degree of CDS hedging is high. However, the impact is larger, and also statistically significant for medium levels of credit protection for the credit exposures by non-CDS firms. Although the statistical significance is weak, the results in this specification furthermore suggest that non-CDS creditors, in contrast to CDS creditors, may be willing to extend their credit exposure during periods where the notional value of CDSs sold by the firm's creditors is large relative to the firm-level credit exposure.

4.4 The Role of Firms' Credit Risk

Overall, the results outline that the credit extension that as due to the availability of CDS contracts is less pronounced (and potentially countered) for CDS firms when their creditors on average use CDS contracts for hedging purposes relative to when their CDS creditors are net sellers of CDS contracts. However, as the findings furthermore suggest a clear separation between the credit amount provided by CDS and non-CDS creditors, the results may also raise concern about that the results are driven by firm characteristics rather than creditors' CDS trading. On the one hand, creditors may to a larger extent become net CDS buyers when the credit risk of the firm is high and *therefore* provide less credit to these firms. At the same time, non-CDS creditors of the same firm may provide even less credit due to their lack of hedging towards firms with, potentially, higher credit risk. Similar, creditors' may only sell credit protection on borrowers that are relatively safe firms. On the other hand, if the variation in the aggregated credit exposures of a firm is not driven by firm characteristics then the CDS holdings by a firm's creditors may imply unanticipated financial constraints to the firm. In particular, this may explain why firms may choose to switch to new lenders after the inception of CDS trading as

²⁵In particular, I separate the positive observations of the CDS coverage ratio based upon the Q25 and the Q75-quartiles, while I only separate the negative observations based upon the median values.

suggested in Shan, Tang, and Yan (2016). To provide more insights about the issue of unobserved firm heterogeneity, I next investigate the role of firm characteristics for the effect on firm-specific credit exposures.

As CDSs hedge the buyer against the credit risk of the reference firm, I start by examining to what extent lagged values of measures that reflect a firm's financial health explain creditors' CDS holdings. In particular, I use proxies for the firm's credit risk (*Z-score* and *Rating*), income (*Profitability*), debt financing (*Leverage* and *Short-term Debt*), as well as financial constraints (*Firm Size*). The analysis is conducted in the sample of CDS firms only and the results are presented in Table 6, Panel A.

- Table 6 -

In Models (1) to (3), I focus on the role of credit risk measures in explaining the presence of CDS creditors by regressing the dummy variable *CDS Outstanding*, as well as the dummy variables where I condition on creditors' net CDS positions (*CDS Outstanding* \times *Net Buyers* and *CDS Outstanding* \times *Net Sellers*), on the set of measures of firms' financial health and industry-fixed effects. The results show that the presence of CDS creditors is positively correlated with firms' leverage ratios and that firms with lower (higher) ratings, i.e., lower (higher) repayment probabilities, are more likely to have CDS creditors that are net protection buyers (sellers). Although the statistical significance is weak, the results furthermore suggest that firms are more (less) likely to have net selling (buying) CDS creditors when they are more (less) profitable and/or have less (more) short-term debt. In Models (4) to (5) I likewise report the determinants of *CDS Coverage*, conditional on creditors' net CDS positions, in order to test whether the credit risk measures also explain the variation in the firm-specific CDS coverage ratios. Although the statistical significance is not as strong as before, the results show that higher levels of credit risk of the firm leads to higher positive CDS coverage ratios and, thus, reveal that firms' credit risk and financial constraints positively relate to creditors' CDS holdings.

Next, I utilize the results obtained from the investigation of the determinants of firms' CDS coverage in a robustness test. Specifically, I use the CDS coverage residual to capture the CDS coverage impact and isolate the effects due to firm's credit risk. In order to distinguish between the effect of net protection-buying creditors and net protection-selling creditors I define *CDS Coverage* \times *Net Buyers Residual*, respectively *CDS Coverage* \times *Net Sellers Residual*, to be equal to the average firm-specific CDS coverage residual value obtained from the determinants of the CDS coverage model given by Model (4), respectively Model (5), of Panel A in Table 6. Then I investigate the impact of the CDS coverage residual on firms' total credit ratios, as well as the credit ratios held by CDS and non-CDS creditors to test whether creditors' CDS holdings has a affect on firms' overall debt financing. As the residual measure should only capture the effect of

creditors' CDS holdings that is not driven by the credit risk of the firm, I only expect to find a significant effect for CDS creditors' credit ratios to the extent that they *strategically* change the credit exposures to their borrowers. In the regression on non-CDS creditors' credit ratio I expect only a significant CDS coverage residual coefficient to the extent that non-CDS creditors off-set the changes in the credit supply by CDS creditors. The analysis is again conducted in the sample of CDS firms only and the results are presented in Table 6, Panel B. Models (1), (3) and (5) show the results in case of net protection-buying creditors and outline that the result of lower credit supply by CDS creditors is robust when controlling for the firm's financial health while the effect on firms' total credit ratio or the credit supply by non-CDS creditors is insignificant. As the coefficient in the model for firms' total credit ratio is also negative, the results indicate that CDS firms have less credit available when their creditors are protection buyers. However, the effect may be minor in terms of their aggregate credit exposure, probably because non-CDS creditors partly off-set the reduction in credit supply. In contrast, Models (2), (4) and (6) outline robust results regarding an increase in firms' total credit ratio and the credit supplied by CDS creditors in case of net protection selling creditors while the effect on the credit ratio of non-CDS creditors is insignificant. Overall, the robustness test provides evidence that CDS firms may benefit in terms of a credit extension from having creditors that are net protection sellers, but also may experience that credit is withdrawn when the creditors are net protection buyers.

In terms of the economic significance of these findings, it is clear that the individual firm will be more exposed to changes in the credit supply caused by creditors' CDS holdings the more creditors of the firm hold (or are able to hold) CDS contracts on the firm's debt. Furthermore, one would expect that the effect on the firm-specific credit exposures is only pronounced for firms with a high share of CDS creditors *if* the effect indeed stems from creditors' CDS holdings. In other words, if the effect is purely driven by firm characteristics, then there should be no difference between the credit amount provided by CDS creditors and non-CDS creditors, respectively. I test this hypothesis by utilizing differences in the presence of CDS creditors across CDS firms. Specifically, I separate CDS firms into the samples of *High CDS Creditor Ratio* and *Low CDS Creditor Ratio*, where *High CDS Creditor Ratio* (*Low CDS Creditor Ratio*) refers to firms where the ratio of CDS creditors to total creditors is above (below) the median value. The results are presented in Appendix Table A3 and provide evidence that both the results of lower credit supply in the case of net CDS-buying creditors and the results of higher credit supply in the case of net CDS-selling creditors are driven by the sample of firms that have a relative high share of CDS creditors. Hence, the results suggest that the effect is indeed driven by the CDS trading of a firm's creditors and moreover that the

economic significance is largest for firms with a high share of CDS creditors.

Before turning to the discussion of the significance of these results relative to the liquidity in CDS markets, the next section studies whether creditors' CDS holdings also affect firms' debt financing more generally.

5. Creditors' CDS Holdings and Debt Refinancing

The previous section showed that the availability of CDS contracts increases the credit amount available to firms, but also that the level of credit exposures *across* CDS firms depends on creditors' actual CDS holdings. Accordingly, it is likely that creditors' CDS holdings also affect firms' debt refinancing. Changes in firms' refinancing conditions are not only determined by the level of credit provided, but may, particularly, be reflected in the type of debt provided. The credit extension or withdrawal may come at cost or be beneficial in terms of maturity, interest payments and/or the type of debt. As outlining potential costs or benefits of creditors' CDS holdings is key for the determination of the overall implications of CDS contracts for firms' refinancing this section investigates whether the availability of CDS contracts and creditors' CDS holdings affect also other measures of a firm's debt financing.

5.1 The Effect on Debt Maturity

In order to test the impact of creditors' CDS holdings on reference firms' debt refinancing, I first investigate the impact of creditors' CDS holdings on firms' overall debt maturity. Following, e.g., Diamond (1991b) and Brunnermeier and Oehmke (2013), firms with longer debt maturities are better able to mitigate the potential refinancing risk associated with short-term debt. Longer debt maturities naturally imply that the firm will have to refinance its debt less often and an increase in firms' debt maturity may imply a lower default probability as it increases the probability of debt repayment (e.g., Leland and Toft (1996), Brunnermeier (2009), and Krishnamurthy (2010)). In contrast, creditors may have an incentive to lower the maturity of newly issued debt as a more frequent debt rollover of the firm will lower the creditors' monitoring costs. This is in line with Parlour and Winton (2013) who show that creditors may buy CDS contracts to reduce their monitoring costs by laying-off credit risk. Accordingly, it is likely that creditors, who have bought credit protection on a firm, also provide more short-term debt to firms. Conversely, if the creditor successfully reduces all its monitoring costs by holding a CDS contract on the firm, then the creditor may even be willing to extend the maturity of the firm's debt.

For the empirical analysis on the impact of creditors' CDS holdings on firms' refi-

nancing risk, I first determine firms' overall debt maturity, *Debt Maturity*, by calculating the principal weighted average debt maturity of the firm's outstanding debt. If creditors' CDS holdings positively affects firms' refinancing risk then I first of all expect a positive correlation between creditors' CDS holdings and *Debt Maturity*, as well as that the effect is independent of creditors' net CDS positions. To test this hypothesis, I regress *Debt Maturity* on the specified firm-level measures of creditors' CDS holdings, as well as a set of controls, including time, industry, firm and rating fixed effects following Saretto and Tookes (2013). The results are presented in Table 7.

- Table 7 -

In Models (1) to (4) I first provide an analysis conducted in the sample of both CDS and non-CDS firms. Although, I find a positive coefficient for *CDS Firm* in Model (1), the results outline no significant difference between CDS and non-CDS firms' debt maturity for my sample. Instead, the results in Model (2) show that firms have significantly longer debt maturity in quarters where at least one of the firm's creditors holds a CDS contract on the firm.²⁶ The finding is in line with Saretto and Tookes (2013), but specifically suggests that the effect on firms' debt maturity is linked to time-variations in creditors' CDS holdings. In Models (3) and (4) I further explore potential difference due to creditors' net CDS positions. While I do find a negative, respectively a positive, coefficient in the case of creditors that are net protection buyers, respectively sellers, the effects are not statistical significant compared to the debt maturity of non-CDS firms. Henceforth, relative to non-CDS firms, the results suggest that CDS firms' refinancing risk is lower due to the presence of CDS creditors. In order to explore this positive impact on firms' debt refinancing in more detail, Model (5) and (6) present the results where I investigate the effect of creditors' net CDS positions sample of only CDS firms. As outlined in the table, I actually find significant differences in the debt maturity across CDS firms; firms with creditors that are net protection buyers have shorter debt maturities than firms with creditors that are net protection sellers. Relative to non-CDS firms, the debt maturity is only increased by 0.26 years for firms whose creditors' are net buyers of CDSs while the debt maturity is increased by 1.59 years for firms whose creditors' are net seller of CDSs.²⁷

In order to help the understanding of the variation in the impact on CDS firms' debt maturity it is of interest to study the source of the change in debt maturity. Theoretically

²⁶ Assuming that all variables are at the mean level, the results suggest that debt maturity is increased by 0.92, i.e., about one year, when their creditors' hold a CDS contract on the firm.

²⁷ Compared to Saretto and Tookes (2013) who find that the debt maturity is increased by 1.09 to 1.79 years after the introduction of CDSs my findings show how the differences in creditors' net CDS position helps explaining the variation in the effect on debt maturity.

may an increase in firms' debt maturity arise not only due to the issuance of new, long(er)-term debt, but also due to the lack of refinancing of maturing debt. That is, the relative shorter debt maturity of firms whose creditors' are net buyers of CDSs may simply be caused by the lower supply of credit that was documented in Section 4. In particular, this could arise if the firm's creditors choose to refinance only a fraction of the firm's maturing debt. However, the relative shorter debt maturity may also be caused by a shorter maturity of newly issued debt and, thus, imply a change in the type of debt. Likewise, may the relative longer debt maturity of firms whose creditors' are net sellers of CDSs be due to a significant lower amount of short-term debt, larger amount of long-term debt, and/ or replacement of short-term debt with more long-term debt. Accordingly, the change in these firms' debt maturity could either arise due to foregone debt refinancing or a change in the type of debt. In order to outline the source for the change in debt maturity I next study changes in specific debt tranches that arise due to creditors' CDS holdings. In particular, I analyze the amount of the firm's debt that is due in one year (*Debt Due: 0-1 Yr*), two to five years (*Debt Due: 2-5 Yrs*), five to ten years (*Debt Due: 5-10 Yrs*), as well as ten to thirty years (*Debt Due: 10-30 Yrs*), all scaled by the total debt outstanding. I conduct the analysis in the sample of only CDS firms and present the results in Table 8.

- Table 8 -

Although I do not find a significant impact of the pure presence of creditors with CDS holdings the results outline significant effects when I account for whether the firm's creditors are net protection buyers or sellers. As shown in Models (1), (3), (5), and (7), firms with creditors that are net protection buyers have a higher ratio of debt that is due within one to five years and a lower ratio of debt that is due within the next year. This suggests, that debt maturity extension is caused by the refinancing of maturing debt with relative short-term debt. In addition, the results indicate a potential lower share of debt that matures within five to ten years which, in accordance to the previous finding of lower credit supply to firms with net protection buyers, may reflect that creditors lower their provision of medium-term debt (rather than short-term debt) in order to reduce their monitoring costs. In contrast, Models (2), (4), (6), and (8), show that when firms have creditors that are net protection sellers then the firm has a significant lower share of debt that is due within two to five years while fraction of debt due in five to ten years is higher. This not only suggests a decrease in more risky debt but also, since I do not find a significant decrease in long-term debt, that the increase in debt due within five to ten years must stem from issuance of new debt. Overall, the firm's short-term debt is refinanced with more long-term debt which, all else equal, will be beneficial for the firms as it not only implies a less frequent debt refinancing, but also that the firms are able to

refinance their debt early, i.e., before maturing. As suggested by Xu (2017), the latter effect in particular helps firms to manage their refinancing risk.

In order to understand the significance of the debt maturity results compared to changes in the firm-level credit exposure, Appendix Table A4 presents the results of an analysis where I test the impact on debt maturity *conditional* on the firm's debt capacity using the firm's leverage ratios.²⁸ Overall, I find that especially firms with low debt capacity will experience an effect in terms of debt refinancing. This is intuitive as firms with low debt capacity in general will be financially constrained and only have very limited options for additional credit supply. Hence, for these firms will a change in debt maturity still be an option to impose relaxation of financing constraints, without providing more credit.

5.2 The Effect on Other Costs of Debt

In terms of firms refinancing of debt, the previous analysis revealed that firms' whose creditors make use of CDS contracts on average have more credit available, as well as longer debt maturity. Although, I find that CDS firms in overall may experience relaxed refinancing conditions there is a significant variation in firms' debt refinancing options. Accordingly, it is likely that there also is a association between creditors' use of CDS and the more direct costs related to the firm's debt financing. To the extent that the relaxed refinancing conditions come at a price and/or the presence of CDS contracts may affect the probability of debt refinancing (for instance due to the higher level of credit), then one would expect an increase in the firm's debt financing costs. To address this issue, I provide an empirical investigation of direct costs associated with creditors' CDS holdings by focusing on firms' amount of interest payments as proxy for firms' direct debt financing costs. Accordingly, I define *Interest To Credit* as the firm's interests and related payments, scaled by total credit outstanding.²⁹ The model specification is similar to the ones used before and the results are presented in Table 9, Panel A.

- Table 9 -

In Model (1) to (3) I first conduct the analysis in the sample of both CDS and non-CDS firms. While only being statistical significant on the 1% level, the results in Model (1) on the one hand indicates that CDS firms compared to non-CDS firms have higher interest payments but on the other hand also outlines that the magnitude is lower in quarters

²⁸Specifically, I separate firms into the sample of *Low Debt Capacity* and *High Debt Capacity* where *Low Debt Capacity* (*High Debt Capacity*) refers to firms with average leverage ratios above (below) the median.

²⁹In robustness tests I use the ratio of interest payments to total assets, as well as the natural logarithm of interest payments and find that the results and conclusions are robust to both alternative specifications.

where their creditors actually hold CDS contracts. While the findings suggest that CDS firms pay relatively more in interest, the net effect turns out to be negligible in terms of magnitude and statistical insignificant. In Models (2) and (3), respectively Models (4) and (5), I further investigate whether the effect depends on the creditors' net CDS positions. Although, the results suggest higher interest payments for firms with creditors that are net protection buyers relative to those firms that are net protection sellers, I do not find significant coefficients in these specification. Thus, the results suggest no significant higher direct costs caused by creditors' CDS holdings and due to a higher reliance on debt financing by CDS firm. This is in line with Ashcraft and Santos (2009) who find that the availability of CDS contracts do not affect bonds spreads for the average borrower, as well as Caglio, Darst, and Parolin (2017) who show that CDS firms on average do not become more risky when the creditors hold CDS contracts.

While firms interest payment is a direct proxy of the costs of debt, firms may also face other costs associated with their debt financing. In particular, firms may become more financially constrained if the CDS holding of its creditors significantly limits the *type* of debt they can issue. A limitation on the type of debt reduces the firm's flexibility in terms of debt refinancing and will, accordingly, be costly for the firm. As documented by Becker and Ivashina (2014), firms switch from loans to bonds at times characterized by tight lending standards. Thus, if I find an increase in firm's bond to bank debt ratios due to creditors' CDS holdings, respectively their CDS net positions, then this would reflect a contraction in the overall credit provision by the firm's creditors. In Table 9, Panel B, I analyze this hypothesis by using the measure *Bond To Debt*, which is the firm's amount of bonds outstanding, scaled by total debt. Models (1) to (3) again show the results where I conduct the analysis in the sample of both CDS and non-CDS firms. The result in Model (1) indicates that CDS firms relative to non-CDS firms to a higher extent rely on bonds than on bank debt (e.g., similar to Shan, Tang, and Yan (2016)), but that there is no baseline effect of creditors' CDS holdings. However, Models (2) and (3) outline a significant variation due to creditors' net CDS positions. That is, when their creditors are net protection buyers (sellers) I find that firms to a higher (lower) extent rely on bonds than on bank debt. Thus, the firm's refinancing conditions in terms of the type of debt indeed seem to be tightened when their creditors are net buyers. While this is intuitive, it also outlines, in the light of the previous findings that the credit, that potentially will be withdrawn from firms once their creditors become net protection buyer, is bank debt. While I do not find significant results in the analysis conducted on only CDS firms (Models (4) and (5)), there seems not to be a large variation in CDS firms' bond to debt ratios over time.

6. Creditors' CDS Holdings versus CDS Liquidity

The previous sections showed that the presence of CDS creditors on average increases the credit supply and lengthens the debt maturity, but that the magnitude depends on the actual CDS positions of the creditors. When creditors are net buyers of CDS contracts the debt maturity and credit amount available to firms is significantly lower than when their creditors are net sellers of CDS contracts. Thus, while firms with net protection-buying creditors relative to firms with net protection-selling creditors are more financially constrained, the net effect of the availability of CDS contracts is still positive. However, following the related literature the effect of creditors' ability to hedge their credit risk with CDS contracts will to a high extent depend on the liquidity in CDS markets. If CDS markets are very liquid, then banks are able to manage their credit exposure on a frequent basis and at relatively low costs. Contrary, if CDS markets are not very liquid, then it may be hard for banks to find a counterpart and manage their credit risk on a frequent basis. Hence, in terms of the role of CDS contracts for firms' debt financing one would expect that the credit extension caused by the availability of CDS contracts, and relative to non-CDS firms, is more significant when CDS markets are liquid. Specifically, when only few CDS contracts are traded on a firm's debt then the effect of the availability of CDS contracts may only be minor, and may even become insignificant in terms of magnitude. Meanwhile, the effect of creditors' CDS holdings in relative terms may become more important when liquidity is low. In the extreme case, CDS firms may even experience having a lower amount of credit available than non-CDS firms. In order to investigate the economic significance of creditors' net CDS holdings for firms' debt financing *relative* to the liquidity of CDS contracts I next study the effect of creditors' CDS holdings on the credit amount available to firms conditional on the liquidity of CDS contracts written on the firm's debt. As a proxy for how liquid CDSs are for a given firm I use the natural logarithm of the average number of contracts *traded* by the firm's creditors within a given quarter and define the variable *CDS Liquidity*. *CDS Liquidity* will be high if the creditors of a firm trade a lot of CDS contracts on the firm.³⁰ The results are presented in Table 10.

- Table 10 -

In Model (1) I first test the effect of firm-specific CDS liquidity by conducting an analysis in the sample of both CDS and non-CDS firms and interacting the measure for the presence of creditors with CDS contracts and *CDS Liquidity*. As seen in the table, I find a positive and significant coefficient for *CDS Outstanding* \times *CDS Liquidity* while

³⁰Compared to the CDS coverage ratio, *CDS Liquidity* does not reflect creditors demand for buying or selling credit protection.

that of *CDS Outstanding* is positive, but insignificant. This suggests that there is a linear relation between the number of contracts held by the firm's creditors and the impact on firm credit. This is intuitive as creditors' ability to hedge their credit exposure becomes more likely and/or comes at a lower cost when CDS contracts are more liquid. However, the results also suggest that the effect of liquid CDS contracts dominates the baseline impact of having a CDS creditor.

To the extent that the impact on firms' credit amount found earlier is caused by differences in the liquidity of CDS contracts only, I expect the effect on firm-specific credit exposures to be positive for firms with liquid CDS contracts and negative for firms with rather illiquid CDS contracts. Said in other words, the effect should be independent of creditors' net CDS positions, i.e., whether the creditors are net protection buyers or sellers. In contrast, if there is any supplementary effect of the actual CDS trading of creditors, then I expect to find a significant effect that depends upon creditors' CDS holdings. To test this hypothesis, I use the firm-specific CDS liquidity measure and separate my sample of CDS firms into the samples of *Liquid CDS* and *Illiquid CDS*. *Liquid CDS* (*Illiquid CDS*) refers to firms and quarters where the number of CDS contracts written on the firm is above (below) the median value. As shown in Models (2) and (3), as well as Models (4) and (5), I find negative coefficients for firm-quarters observations where the creditors are net protection buyers and positive coefficients for firm-quarters where the creditors are net protection sellers. However, the coefficients are only statistically significant for the sample of firms with illiquid CDS contracts. Thus, although there is a non-negligible effect of the availability of CDS contracts that increases with the liquidity in these markets, the results confirm the presence of a supplementary effect of creditors' actual CDS holdings, especially for firms and during times where CDS contracts are illiquid. Since, the liquidity in CDS markets in the onset of the U.S. Financial Crisis in general has been decreasing this finding is of particular interest in terms of the impact of CDS contracts for firm's debt financing going forward.

7. Conclusion

Supplementary to what has been shown in the related literature, this paper provides a thorough investigation of the role of creditors' CDS holdings for firms' total debt financing based upon comprehensive CDS position and regulatory German credit registry data. Using this unique data sample, I focus on the impact of *creditors'* CDS holdings on firm-level credit exposures and refinancing abilities, that in contrast to other CDS-trading banks have the ability to offer or withhold finance and/or change the type of financing given to the firm.

In line with the literature, I find that the availability of CDS contracts on average implies that the reference firms have a higher credit amount available. However, I explicitly show that the magnitude is significantly lower for firms where the creditors are net protection buyers relative to firms where the creditors are net protection sellers. While this is in line with the fact that creditors typically buy CDS contracts on firms that are more credit risky, I find that the results of a lower credit amount provided to these firms is robust to when I control for firms' credit risk. I also find that firms with CDS-buying creditors have relatively lower debt maturity and are more constrained with respect to the type of debt they can issue. In other words, the potential benefits that arise from the availability of CDS contracts are significantly less pronounced when a firm's creditors are net protection buyers. However, as I do not find an increase in the direct costs of debt, the results moreover suggest that the change in firms' refinancing conditions are caused by creditors' aim for lower monitoring costs that is supplementary to the decrease in credit risk stemming from their CDS buy position. The findings of relaxed debt financing conditions for firms with net protection-selling creditors outline that creditors also exploit their simultaneous CDS positions and credit relationships when they are net CDS sellers. Although firms with available CDS contracts have lower rollover risk compared to firms for whom CDS contracts are not available, the results suggest that the CDS positions of creditors may imply an indirect cost to firms in form of credit rationing. In particular, I find the effect of variations in creditors' CDS holdings to be important during periods, respectively for firms, with illiquid CDS contracts.

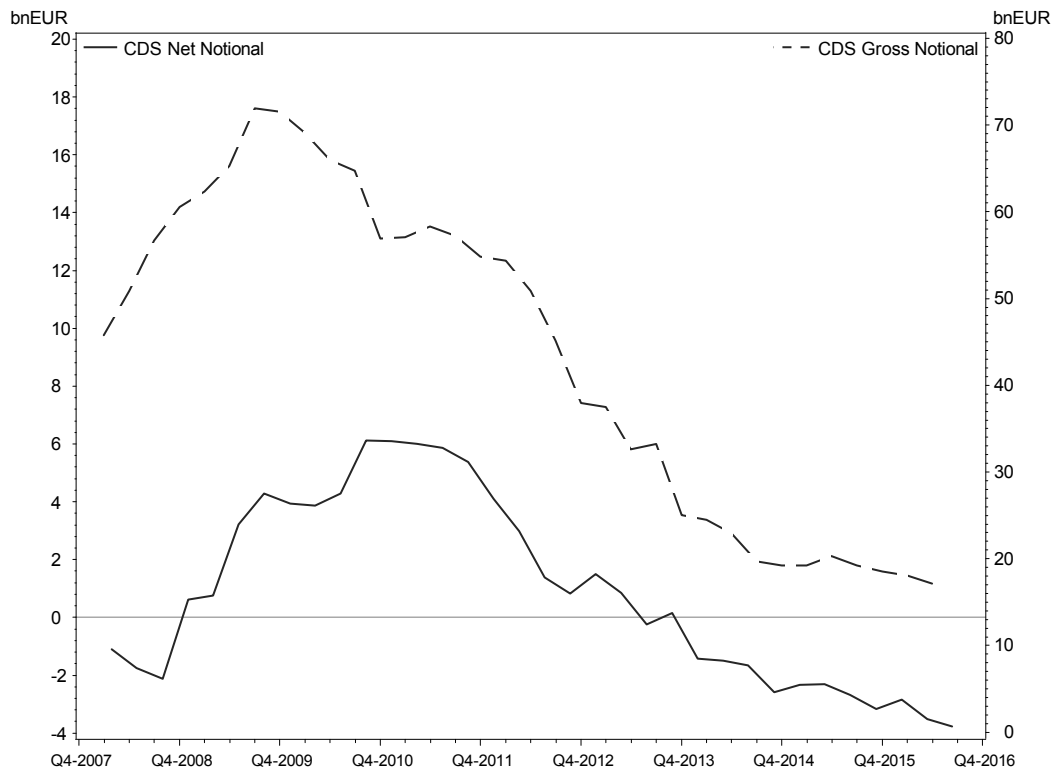


Figure 1
Time series of CDS holdings by German banks

This figure shows the time series of the aggregated CDS holdings by German banks on German non-financial firms. The net (solid line) and gross (stacked line) notional amount of CDS refer to the amount of credit protection bought net of credit protection sold and the aggregate amount of credit protection bought and sold, respectively. The numbers reflect the holdings of CDS contracts written on firms with available CDS position data (DTCC TIW) and credit registry data (Deutsche Bundesbank). The time period is 2008-Q1 to 2016-Q2 and all numbers are end of quarter holdings and given in billion euro.

Table 1
Credit of reference firms and creditors' net CDS holdings

<i>Sample: German CDS reference firms</i>				
	Full Sample: 2008-Q1 to 2016-Q2 (1)	Period		
		Recession: 2008-Q1 to 2011-Q3 (2)	Recovery I: 2011-Q4 to 2013-Q3 (3)	Recovery II: 2013-Q4 to 2016-Q2 (4)
<u>Credit Relations:</u>	15.0	16.0	16.0	15.0
- Creditor with CDS position	3.0	4.0	3.0	3.0
<u>Credit Exposure (mEUR):</u>	1024.5	1090.4	844.8	1105.0
- Creditor with CDS position	342.0	339.1	336.2	278.5
<u>CDS Net Notional (mEUR):</u>	16.3	68.5	21.4	-16.9
- Gross amount bought	120.9	184.4	128.9	79.9
- Gross amount sold	106.5	101.3	103.0	115.5
- Number of contracts bought	21.3	22.9	27.6	13.0
- Number of contracts sold	29.3	18.9	27.8	45.8
<i>N</i>	1475	646	351	478

This table presents sample statistics of CDS and credit related measures of German non-financial firms for the period 2008-Q1 to 2016-Q2. The numbers reflect median values of firm-level measures for firms with available CDS position and credit registry data and are based upon end-of-quarter observations. *Credit Relations* reflects the number of creditors for the average firm. *Credit Exposure* is the total credit amount outstanding of the average firm, given in million euro. *CDS Net Notional* is the CDS notional amount bought net of the CDS notional amount sold by a firms' creditors, given in million euro. *Creditor with CDS position* refers to the creditors of firm that also trade CDS contracts written on the firm. The CDS position data is from DTCC (TIW), while the credit information is based upon the credit registry data (MiMik) provided by the Deutsche Bundesbank.

Table 2
Summary statistics

<i>Panel A: Firm Fundamentals</i>												
	CDS Firms (N: 31)						Non-CDS Firms (N: 47)					
	N	Mean	StdD	Q25	Median	Q75	N	Mean	StdD	Q25	Median	Q75
Credit Amount	971	6.45	1.40	5.75	6.53	7.34	1485	5.78	1.26	5.29	5.76	6.36
Leverage	972	0.27	0.21	0.15	0.23	0.35	1490	0.25	0.16	0.11	0.24	0.36
Debt Maturity	758	3.32	2.66	2.00	3.25	4.46	854	3.32	3.35	1.80	3.00	4.26
Short-term Debt	972	0.21	0.18	0.06	0.16	0.34	1490	0.24	0.22	0.07	0.19	0.34
Interest To Credit	913	0.06	0.33	0.03	0.08	0.09	1365	0.02	0.26	0.01	0.03	0.05
Firm Size	972	9.62	1.53	8.58	9.71	10.7	1490	7.76	1.32	6.99	7.60	8.50
Profitability	972	0.02	0.02	0.01	0.02	0.03	1490	0.02	0.02	0.01	0.02	0.03
Cash	972	0.08	0.05	0.04	0.07	0.11	1490	0.09	0.07	0.03	0.06	0.13
Fixed Assets	972	0.26	0.17	0.11	0.25	0.35	1490	0.21	0.16	0.09	0.17	0.27
Volatility	972	0.01	0.01	0.00	0.01	0.02	1490	0.01	0.01	0.00	0.01	0.01
CP-Program	972	0.27	0.4	0.00	0.00	1.00	1490	0.03	0.18	0.00	0.00	0.00
Z-Score	972	2.08	3.48	-0.33	1.94	3.28	1490	3.99	9.35	-0.87	2.09	3.36
Rating	972	1.35	1.31	1.00	1.00	1.00	1490	1.47	1.48	1.00	1.00	1.00

<i>Panel B: CDS-related Measures</i>						
	CDS Firms (N: 31)					
	Obs	Mean	StdD	Q25	Median	Q75
CDS Coverage	972	0.07	0.50	-0.01	0.00	0.06
CDS Creditor Ratio	972	0.09	0.10	0.02	0.07	0.14
CDS Liquidity	755	1.53	1.45	0.99	1.45	1.71

The table provides firm-level summary statistics for the samples of CDS- and non-CDS firms, respectively. Panel A shows statistics related to base firm fundamentals. Panel B shows statistics of CDS-related measures for the sample of CDS firms. *Total Credit Amount* is the natural logarithm of the firm-specific credit exposure. *Leverage* is the book value of long term debt plus debt in current liabilities, divided by total assets. *Debt Maturity* is the average debt maturity of all outstanding debt, weighted by the principal of the debt, and given in years. *Interest To Credit* is the sum of interest and related payments, scaled by the firm-specific credit exposure. *Firm Size* is the natural logarithm of total assets. *Profitability* is earnings before interest and taxes, scaled by total assets. *Cash* is cash and cash equivalents, scaled by total assets. *Short-term Debt* is the fraction of long-term debt due within one year, scaled by to total long-term debt. *Fixed Assets* is net property plant and equity, scaled by total assets. *Volatility* is the average volatility 2-digit SIC-code. *CP Program* is a dummy variable equal to one if the corporation has an outstanding commercial paper program. *Z-Score* is the Altman Z-score. *Rating* is average of firm-bank specific assigned ratings as defined in the German credit registry data. *CDS Coverage* is sum of CDS notional bought minus the sum of CDS notional sold by all creditors of a firm, scaled by the firm-specific credit exposure. *CDS Creditor Ratio* is the number of creditors that hold a CDS on the firm's debt, scaled by the total number of creditors of the firm. *CDS Liquidity* is the natural logarithm of the average number of outstanding CDS contracts within a given quarter. The sample period is 2008-Q1 to 2016-Q2, and the variables are based on quarterly observations. The firm fundamental data are obtained from Compustat Global and Capital IQ, while the credit registry data are obtained from MiMik (Deutsche Bundesbank) and the CDS position data are obtained from DTCC (TIW). For details, please see Appendix Table A2.

Table 3
The presence of CDS creditors and firm credit

	Total Credit Ratio		Total Credit Amount	Credit Amount: CDS Creditors	Credit Amount: Non-CDS Creditors
	(1)	(2)	(3)	(4)	(5)
CDS Firm	2.534*** (7.50)	0.824* (1.88)	-0.35*** (-3.8)	1.133*** (3.67)	-0.30** (-2.0)
CDS Outstanding		2.390*** (6.08)	0.673*** (7.75)	1.456*** (5.25)	0.933*** (6.92)
Industry Leverage	-3.41 (-1.3)	-4.51* (-1.8)	0.219 (0.39)	-1.89 (-1.0)	-2.61*** (-3.0)
Firm Size	-2.26*** (-23.)	-2.30*** (-23.)	0.329*** (17.0)	-1.53*** (-22.)	-0.76*** (-23.)
Cash	-4.07*** (-2.7)	-2.83* (-1.8)	-2.21*** (-6.6)	-2.39** (-2.2)	-0.44 (-0.8)
Volatility	-11.7*** (-3.3)	-10.5*** (-3.0)	-14.7* (-1.8)	-68.0*** (-2.7)	-37.5*** (-3.1)
Profitability	-5.35 (-1.2)	-5.25 (-1.1)	-0.54 (0.5)	-2.29 (-0.7)	-2.95** (-1.9)
Fixed Assets	7.728*** (7.23)	9.127*** (8.41)	-2.55*** (-11.)	7.280*** (9.51)	1.847*** (4.95)
Net Working Capital	11.30*** (5.01)	10.31*** (4.60)	0.523 (1.03)	7.222*** (4.56)	3.088*** (4.01)
Capital Expenditure	-6.76* (-1.6)	-5.03 (-1.2)	-0.21 (-0.2)	-1.78 (-0.6)	-3.24** (-2.3)
Acquisition Activity	-1.71 (-0.6)	-0.80 (-0.3)	0.093 (0.16)	-1.20 (-0.6)	0.404 (0.46)
Dividends	1.528*** (4.97)	1.409*** (4.61)	0.148** (2.15)	1.069*** (4.96)	0.340*** (3.24)
CP Program	2.512*** (8.38)	2.336*** (7.82)	0.163** (2.45)	1.525*** (7.24)	0.810*** (7.89)
Sovereign Risk	0.854 (0.05)	-1.10 (-0.0)	3.213 (0.96)	-2.36 (-0.2)	1.260 (0.24)
Intercept	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y
Sample	Full	Full	Full	Full	Full
R-square	0.634	0.640	0.634	0.572	0.741
N	2343	2343	2382	2343	2343

This table presents estimates of the effect of creditors' CDS holdings on firm-specific credit exposures in the sample of German non-financial firms. In Models (1) and (2) I use *Total Credit Ratio* which is the firm's total credit amount, scaled by total asset. In Models (3) to (5) I use *Total Credit Amount* which is defined as the natural logarithm of firm-specific credit exposures, as well as *Credit: CDS Creditors* (*Credit: Non-CDS Creditors*) which is the natural logarithm of the credit amount provided by creditors that hold (do not hold) CDS contracts. The variable *CDS Firm* is a dummy equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, industry and rating fixed effects. The analyses are conducted in the sample of CDS and non-CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 4
Creditors' CDS positions and firm credit

	Total Credit Amount		Credit Amount: CDS Creditors		Credit Amount: Non-CDS Creditors	
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Firm	-0.36*** (-3.8)	-0.36*** (-3.8)	5.145*** (77.6)	5.143*** (77.5)	-1.44*** (-13.)	-1.44*** (-13.)
CDS Outstanding	0.774*** (7.96)	0.634*** (7.12)	0.719*** (10.4)	0.623*** (9.91)	0.842*** (7.82)	0.678*** (6.88)
CDS Outstanding \times Net Buyers	-0.15** (-2.3)		-0.11** (-2.4)		-0.17** (-2.3)	
CDS Outstanding \times Net Sellers		0.131* (1.88)		0.063 (1.28)		0.166** (2.15)
Industry Leverage	0.118 (0.21)	0.121 (0.21)	1.599*** (4.05)	1.629*** (4.11)	0.466 (0.75)	0.456 (0.73)
Firm Size	0.326*** (16.9)	0.326*** (16.9)	0.126*** (9.33)	0.127*** (9.40)	0.325*** (15.2)	0.326*** (15.3)
Cash	-2.18*** (-6.5)	-2.19*** (-6.5)	-1.30*** (-5.5)	-1.32*** (-5.5)	-2.00*** (-5.4)	-2.01*** (-5.4)
Volatility	-14.4* (-1.8)	-14.4* (-1.8)	-6.11 (-1.1)	-6.20 (-1.1)	-23.0*** (-2.6)	-23.0*** (-2.6)
Profitability	-0.46 (-0.4)	-0.47 (-0.4)	-1.27* (-1.8)	-1.30* (-1.8)	-1.53 (-1.4)	-1.54 (-1.4)
Fixed Assets	-2.54*** (-11.)	-2.53*** (-11.)	-1.09*** (-6.7)	-1.08*** (-6.7)	-2.23*** (-8.8)	-2.21*** (-8.7)
Net Working Capital	0.477 (0.94)	0.487 (0.96)	0.922*** (2.58)	0.940*** (2.63)	0.333 (0.59)	0.339 (0.60)
Capital Expenditure	-0.19 (-0.2)	-0.19 (-0.2)	-1.07* (-1.6)	-1.07* (-1.6)	-0.92 (-0.9)	-0.92 (-0.9)
Dividends	0.144** (2.08)	0.144** (2.09)	0.130*** (2.68)	0.132*** (2.71)	0.163** (2.13)	0.163** (2.13)
Acquisition Activity	0.137 (0.23)	0.131 (0.22)	-0.00 (-0.0)	-0.01 (-0.0)	0.153 (0.24)	0.151 (0.23)
CP Program	0.163** (2.45)	0.162** (2.43)	0.364*** (7.76)	0.364*** (7.74)	0.234*** (3.18)	0.232*** (3.15)
Sovereign Risk	2.866 (0.86)	2.913 (0.87)	2.890 (1.23)	3.010 (1.28)	4.356 (1.18)	4.370 (1.18)
Intercept	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y
Sample	Full	Full	Full	Full	Full	Full
R-square	0.635	0.634	0.964	0.964	0.574	0.574
N	2382	2382	2382	2382	2382	2382

This table presents estimates of the effect of creditors' CDS positions on firm-specific credit exposures in the sample of German non-financial firms. In Models (1) and (2) I use *Total Credit Amount* which is defined as the natural logarithm of firm-specific credit exposures. In Models (3) to (6) I use *Credit: CDS Creditors* (*Credit: Non-CDS Creditors*) which is the natural logarithm of the credit amount provided by creditors that hold (do not hold) CDS contracts. The variable *CDS Firm* is a dummy equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, industry and rating fixed effects. The analyses are conducted in the sample of CDS and non-CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 5
Creditors' CDS coverage and firm credit

<i>Panel A: CDS Coverage Ratio</i>								
	Total Credit Ratio		Total Credit Amount		Credit Amount: CDS Creditors		Credit Amount: Non-CDS Creditors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDS Outstanding	0.253*** (4.68)	0.259*** (4.78)	-0.06 (-0.9)	-0.04 (-0.5)	-0.18** (-1.9)	-0.15* (-1.7)	0.126 (1.16)	0.159 (1.51)
CDS Coverage		-0.07* (-2.2)		-0.43*** (-10.)		-0.43*** (-8.0)		-0.53*** (-8.5)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Intercept	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS	CDS	CDS	CDS
R-square	0.565	0.568	0.851	0.867	0.770	0.786	0.754	0.773
N	923	923	945	945	945	945	945	945

<i>Panel B: Levels of CDS Coverage</i>								
	Total Credit Ratio		Total Credit Amount		Credit Amount: CDS Creditors		Credit Amount: Non-CDS Creditors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDS Outstanding	0.249*** (4.53)	0.243*** (4.41)	-0.06 (-0.8)	-0.09 (-1.1)	-0.19** (-2.0)	-0.21** (-2.2)	0.144 (1.33)	0.102 (0.92)
High CDS Coverage ⁺	-0.38** (-2.5)		-1.68*** (-8.9)		-1.67*** (-7.1)		-2.15*** (-7.8)	
Med. CDS Coverage ⁺	-0.17 (-1.4)		-0.31** (-2.0)		-0.29 (-1.5)		-0.80*** (-3.5)	
Low CDS Coverage ⁺	-0.03 (-0.9)		-0.06 (-1.2)		-0.10* (-1.6)		-0.07 (-0.9)	
High CDS Coverage ⁻		0.103 (0.61)		0.202 (0.91)		-0.07 (-0.2)		0.879*** (2.78)
Low CDS Coverage ⁻		0.039 (0.99)		0.066 (1.19)		0.119* (1.74)		0.059 (0.74)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Intercept	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS	CDS	CDS	CDS
R-square	0.569	0.566	0.864	0.852	0.783	0.771	0.772	0.756
N	923	923	945	945	945	945	945	945

This table presents estimates of the effect of creditors' CDS coverage on firm-specific credit exposures in the sample of German non-financial firms. In Models (1) and (2) I use *Total Credit Ratio* which is the firm's total credit amount, scaled by total asset. In Models (3) to (5) I use *Total Credit Amount* which is defined as the natural logarithm of firm-specific credit exposures, as well as *Credit: CDS Creditors* (*Credit: Non-CDS Creditors*) which is the natural logarithm of the credit amount provided by creditors that hold (do not hold) CDS contracts. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. In Panel A, I use the variable *CDS Coverage* which is the total CDS net notional held by the firm's creditors in a given quarter, scaled by the firm's total credit amount. In Panel B, I replace *CDS Coverage* with dummy variables indicating certain CDS coverage levels. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 6
Determinants of creditors' CDS holdings and the residual effect on firm credit

Panel A: Determinants of Creditors' CDS Holdings					
	CDS Outstanding	CDS Outstanding × Net Buyers	CDS Outstanding × Net Sellers	CDS Coverage ⁺	CDS Coverage ⁻
	(1)	(2)	(3)	(4)	(5)
Leverage _{t-1}	3.709*** (0.78)	1.007** (0.46)	2.339*** (0.71)	-0.33*** (-3.2)	0.030* (1.66)
Rating _{t-1}	0.125 (0.07)	0.203*** (0.07)	-0.13* (0.07)	0.009 (0.70)	-0.00 (-0.1)
Z-score _{t-1}	0.023 (0.03)	-0.02 (0.02)	0.090* (0.04)	0.006 (1.07)	0.001 (0.91)
Profitability _{t-1}	8.229 (5.32)	-0.71 (3.26)	1.913 (3.79)	-0.61 (-0.8)	0.119 (0.89)
Short-term Debt _{t-1}	-0.20 (0.56)	0.235 (0.44)	-0.56 (0.54)	0.179* (1.77)	-0.02 (-1.2)
Firm Size _{t-1}	-1.32*** (0.12)	-0.14** (0.06)	-0.70*** (0.08)	0.023* (1.69)	-0.00*** (-2.8)
Intercept	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS
<i>Pseudo R</i> ²	0.413	0.140	0.179	0.086	0.074
<i>N</i>	941	941	941	940	940

Panel B: CDS Coverage Residual						
	Total Credit Ratio		Credit Ratio: CDS Creditors		Credit Ratio: Non-CDS Creditors	
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Coverage ⁺ Residual	-0.03* (-1.2)		-0.03*** (-2.5)		0.003 (0.17)	
CDS Coverage ⁻ Residual		0.370** (2.22)		0.243*** (2.82)		0.126 (1.31)
Controls	Y	Y	Y	Y	Y	Y
Intercept	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS	CDS
<i>R</i> -square	0.726	0.727	0.676	0.676	0.747	0.747
<i>N</i>	894	894	894	894	894	894

This table presents estimates of the effect of measures of firms' credit risk on creditors' CDS holdings and the residual effect on firm-specific credit exposures in the sample of German non-financial firms. In Panel A, I regress measures for creditors' CDS holdings on a set of measures of firms' credit risk, as well as industry FE. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding* × *Net Buyers* (*CDS Outstanding* × *Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The variable *CDS Coverage*⁺ (*CDS Coverage*⁻) is equal to the variable *CDS Coverage* if the firm's creditors are net credit protection buyers (sellers), and zero otherwise. *CDS Coverage* is the total CDS net notional held by the firm's creditors in a given quarter, scaled by the firm's total credit amount. In Panel B, I regress firms' credit ratios on the CDS coverage residual value obtained from the regression analysis from Panel A, Models (4) and (5). The variable *Total Credit Ratio* is the firm's total credit amount, scaled by total asset. *Credit Ratio: CDS Creditors* (*Credit Ratio: Non-CDS Creditors*) is the credit amount provided by creditors that hold (do not hold) CDS contracts, scaled by total asset. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 7
Creditors' CDS positions and debt maturity

	Debt Maturity				Debt Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Firm	0.097 (0.39)	-0.57* (-1.7)	-0.57* (-1.7)	-0.58* (-1.8)		
CDS Outstanding		0.922*** (3.13)	1.116*** (3.38)	0.858*** (2.85)	0.723 (1.58)	0.104 (0.24)
CDS Outstanding \times Net Buyers			-0.29 (-1.3)		-0.66** (-2.3)	
CDS Outstanding \times Net Sellers				0.244 (1.07)		0.671** (2.34)
Industry Debt Maturity	0.490*** (4.26)	0.469*** (4.09)	0.471** (2.38)	0.469** (2.38)	0.471** (2.38)	0.440** (2.23)
Leverage	-1.07* (-1.8)	-0.93 (-1.6)	-0.95* (-1.6)	-0.94* (-1.6)	-2.62* (-1.9)	-2.54* (-1.8)
Firm Size	0.029 (0.37)	0.005 (0.06)	0.000 (0.00)	0.002 (0.02)	0.489 (0.95)	0.487 (0.94)
Cash	2.581** (2.02)	3.335*** (2.58)	3.450*** (2.66)	3.403*** (2.63)	0.354 (0.13)	0.122 (0.04)
Volatility	7.826 (0.29)	11.10 (0.41)	12.11 (0.45)	11.77 (0.43)	15.91 (0.33)	15.20 (0.31)
Profitability	-0.24 (-0.0)	-0.72 (-0.1)	-0.58 (-0.1)	-0.60 (-0.1)	-0.21 (-0.0)	-0.14 (-0.0)
Fixed Assets	0.288 (0.32)	0.797 (0.89)	0.748 (0.83)	0.794 (0.88)	4.192* (1.76)	4.622* (1.94)
Net Working Capital	-2.24 (-1.0)	-2.96 (-1.3)	-3.11 (-1.4)	-3.08 (-1.3)	-1.89 (-0.3)	-1.73 (-0.3)
Capital Expenditure	6.783* (1.94)	7.900** (2.25)	7.997** (2.28)	7.985** (2.27)	14.76** (2.42)	14.76** (2.42)
Dividends	0.091 (0.34)	0.070 (0.26)	0.061 (0.23)	0.062 (0.23)	0.441 (0.98)	0.432 (0.96)
Acquisition Activity	3.957* (1.90)	4.370** (2.11)	4.524** (2.18)	4.496** (2.16)	-0.16 (-0.0)	-0.23 (-0.0)
CP Program	0.349 (1.57)	0.302 (1.36)	0.293 (1.32)	0.292 (1.31)	0.709** (1.99)	0.709** (1.99)
Sovereign Risk	0.548 (0.75)	0.481 (0.66)	0.432 (0.59)	0.438 (0.60)	0.576 (0.71)	0.572 (0.70)
Intercept	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	N	N
Firm FE	N	N	N	N	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y
Sample	Full	Full	Full	Full	CDS	CDS
R-square	0.280	0.285	0.286	0.286	0.293	0.293
N	1566	1566	1566	1566	734	734

This table presents estimates of the effect of creditors' CDS positions on debt maturity in the sample of German non-financial firms. *Debt Maturity* is the average debt maturity of all outstanding debt, weighted by the principal of the debt, and given in years. The variable *CDS Firm* is a dummy equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, industry/ firm and rating fixed effects. The analyses in Models (1) through (4) are conducted in the sample of CDS and non-CDS firms, while the analyses in Models (5) and (6) are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 8
Creditors' CDS positions and short-term versus long-term debt

	Debt Due: 0-1 Yrs		Debt Due: 1-5 Yrs		Debt Due: 5-10 Yrs		Debt Due: 10-30 Yrs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDS Outstanding	0.009 (0.47)	0.000 (-0.1)	-0.04 (-1.4)	0.032 (1.10)	0.029 (1.22)	0.000 (-0.2)	0.017*** (2.72)	0.016*** (2.70)
CDS Outstanding × Net Buyers	-0.02** (-1.9)		0.081*** (3.91)		-0.03* (-2.2)		-0.00 (-0.4)	
CDS Outstanding × Net Sellers		0.014 (1.11)		-0.09*** (-4.3)		0.040** (2.50)		0.000 (0.05)
Industry Debt Maturity	-0.00 (-1.27)	-0.00 (-1.22)	0.002 (0.24)	0.002 (0.23)	0.007 (0.84)	0.007 (0.84)	0.003 (1.56)	0.003 (1.46)
Leverage	0.075 (0.27)	0.066 (0.24)	-0.22 (-0.5)	-0.17 (-0.3)	0.546 (1.60)	0.522 (1.53)	0.369*** (3.93)	0.371*** (3.95)
Firm Size	0.014* (1.66)	0.014* (1.64)	0.061*** (4.26)	0.062*** (4.34)	0.005 (0.52)	0.005 (0.48)	0.010*** (3.63)	0.010*** (3.63)
Cash	1.049*** (8.48)	1.046*** (8.48)	-0.60*** (-2.9)	-0.58*** (-2.8)	0.436*** (2.85)	0.427*** (2.80)	-0.04 (-0.9)	-0.04 (-1.0)
Volatility	2.468 (1.16)	2.478 (1.17)	-4.56 (-1.3)	-4.59 (-1.3)	-2.26 (-0.8)	-2.24 (-0.8)	-0.46 (-0.6)	-0.48 (-0.6)
Profitability	0.382 (1.49)	0.383 (1.50)	0.794* (1.89)	0.786* (1.87)	0.138 (0.43)	0.141 (0.44)	0.035 (0.41)	0.035 (0.40)
Fixed Assets	0.170 (1.60)	0.177* (1.67)	-1.03*** (-5.9)	-1.07*** (-6.1)	0.457*** (3.49)	0.477*** (3.63)	-0.07** (-2.1)	-0.07** (-2.1)
Net Working Capital	-1.06*** (-5.3)	-1.06*** (-5.3)	0.867*** (2.62)	0.858*** (2.60)	0.004 (0.01)	0.008 (0.03)	-0.00 (-0.0)	0 (-0.0)
Capital Expenditure	0.764*** (2.99)	0.767*** (3.00)	-1.66*** (-3.9)	-1.68*** (-4.0)	1.533*** (4.85)	1.540*** (4.87)	-0.00 (-0.0)	0 (-0.0)
Dividends	-0.02 (-1.0)	-0.02 (-1.0)	-0.12*** (-3.8)	-0.12*** (-3.8)	-0.01 (-0.7)	-0.01 (-0.7)	-0.00 (-0.7)	0 (-0.8)
Acquisition Activity	0.212 (1.08)	0.215 (1.09)	-0.39 (-1.2)	-0.4 (-1.2)	0.632*** (2.59)	0.637*** (2.61)	0.022 (0.33)	0.02 (0.30)
CP Program	0.005 (0.35)	0.005 (0.36)	0.067*** (2.62)	0.067*** (2.63)	0.058*** (3.02)	0.058*** (3.02)	0.040*** (7.49)	0.040*** (7.46)
Sovereign Risk	0.096 (0.17)	0.093 (0.17)	-0.30 (-0.3)	-0.29 (-0.3)	-0.05 (-0.0)	-0.06 (-0.0)	0.298 (1.61)	0.299 (1.62)
Intercept	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS	CDS	CDS	CDS
R-square	0.572	0.572	0.531	0.533	0.423	0.424	0.626	0.626
N	945	945	945	945	945	945	945	945

This table presents estimates of the effect of creditors' CDS positions on short-term and long-term debt in the sample of German non-financial firms. *Debt Due: 0-1 Yrs* is the amount of debt that is due within one year, scaled by the sum of current and long-term debt (book value). The definitions for *Debt Due: 2-5 Yrs*, *Debt Due: 5-10 Yrs*, and *Debt Due: 10-30 Yrs* follow the same approach. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding × Net Buyers* (*CDS Outstanding × Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 9
Creditors' CDS positions and the cost and type of debt

<i>Panel A: Interest Payments</i>					
	Interest To Credit			Interest To Credit	
	(1)	(2)	(3)	(4)	(5)
CDS Firm	0.191*** (6.28)	0.191*** (6.28)	0.191*** (6.29)		
CDS Outstanding	-0.17*** (-6.1)	-0.17*** (-5.6)	-0.16*** (-5.8)	-0.01 (-0.6)	-0.01 (-0.6)
CDS Outstanding \times Net Buyers		0.007 (0.34)		0.002 (0.11)	
CDS Outstanding \times Net Sellers			-0.01 (-0.4)		0.000 (-0.4)
Controls	Y	Y	Y	Y	Y
Intercept	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	N	N
Firm FE	N	N	N	Y	Y
Rating FE	Y	Y	Y	Y	Y
Sample	Full	Full	Full	CDS	CDS
<i>R</i> -square	0.307	0.307	0.307	0.606	0.606
<i>N</i>	2212	2212	2212	912	912

<i>Panel B: Bond to Debt Ratio</i>					
	Bond to Debt			Bond to Debt	
	(1)	(2)	(3)	(4)	(5)
CDS Firm	0.096*** (3.10)	0.097*** (3.15)	0.099*** (3.21)		
CDS Outstanding	0.002 (0.07)	-0.03 (-1.1)	0.013 (0.46)	-0.07** (-2.4)	-0.10*** (-3.2)
CDS Outstanding \times Net Buyers		0.055*** (2.67)		-0.02 (-1.1)	
CDS Outstanding \times Net Sellers			-0.04** (-2.0)		0.027 (1.41)
Intercept	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	N	N
Firm FE	N	N	N	Y	Y
Rating FE	Y	Y	Y	Y	Y
Sample	Full	Full	Full	CDS	CDS
<i>R</i> -square	0.598	0.600	0.599	0.673	0.673
<i>N</i>	1880	1880	1880	802	802

This table presents estimates of the effect of creditors' CDS positions on cost and type of debt of German non-financial firms. In Panel A, I use *Interest to Credit* which is the sum of interest and related payments, scaled by the sum of current and long-term debt. In Panel B, I use *Bond to Debt* which is the total amount of bonds outstanding, scaled by the sum of current and long-term debt. *CDS Firm* is a dummy variable equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, industry/firm and rating fixed effects. The analyses in Models (1) through (3) are conducted in the sample of CDS and non-CDS firms, while the analyses in Models (4) and (5) are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table 10
The presence of CDS creditors versus CDS liquidity and firm credit

	Total	Total Credit Amount			
	Credit Amount	Liquid CDS		Illiquid CDS	
	(1)	(2)	(3)	(4)	(5)
CDS Firm	-0.50*** (-5.8)				
CDS Outstanding \times CDS Liquidity	0.158*** (4.81)				
CDS Outstanding	0.036 (1.64)	0.701*** (4.42)	0.570*** (3.92)	0.196* (1.76)	0.053 (0.51)
CDS Outstanding \times Net Buyers		-0.15 (-1.4)		-0.16** (-2.3)	
CDS Outstanding \times Net Sellers			0.104 (0.95)		0.128* (1.80)
Industry Leverage	-0.54 (-0.9)	5.149 (1.62)	5.305* (1.66)	-2.18*** (-3.0)	-2.20*** (-3.0)
Firm Size	0.289*** (14.8)	0.295*** (5.73)	0.293*** (5.68)	0.375*** (5.40)	0.384*** (5.52)
Cash	-2.07*** (-6.3)	-4.72*** (-4.6)	-4.77*** (-4.6)	-2.34*** (-3.2)	-2.42*** (-3.3)
Volatility	-21.3*** (-2.8)	-25.7 (-1.1)	-26.7 (-1.1)	-14.1 (-1.3)	-14.8 (-1.4)
Profitability	0.266 (0.27)	5.092** (2.49)	4.947** (2.42)	5.924*** (2.88)	6.055*** (2.94)
Fixed Assets	-2.23*** (-9.5)	-4.71*** (-10.)	-4.67*** (-10.)	-0.61 (-1.0)	-0.55 (-0.9)
Net Working Capital	0.214 (0.43)	1.480 (0.80)	1.579 (0.85)	0.594 (0.51)	0.617 (0.53)
Capital Expenditure	-0.05 (-0.0)	-6.84*** (-4.1)	-6.91*** (-4.1)	11.19*** (5.11)	11.07*** (5.04)
Dividends	0.139** (2.05)	0.156 (1.02)	0.165 (1.07)	-0.03 (-0.2)	-0.03 (-0.2)
Acquisition Activity	0.512 (0.90)	1.161 (0.77)	1.108 (0.73)	1.805 (1.36)	1.748 (1.32)
CP Program	-0.04 (-0.6)	0.724*** (5.90)	0.720*** (5.86)	0.154** (1.98)	0.149* (1.91)
Sovereign Risk	2.527 (0.77)	0.289 (0.41)	0.289 (0.41)	3.818* (1.74)	3.863* (1.75)
Intercept	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Industry FE	Y	N	N	N	N
Firm FE	N	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y
Sample	Full	CDS	CDS	CDS	CDS
R-square	0.647	0.796	0.796	0.821	0.820
N	2382	473	473	471	471

This table presents estimates of the effect of creditors' CDS holdings and CDS liquidity on firm-specific credit exposures in the sample of German non-financial firms. *Total Credit Amount* is defined as the natural logarithm of firm-specific credit exposures. The variable *CDS Firm* is a dummy equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. The variable *CDS Liquidity* is the average number of outstanding CDS contracts in a quarter and held by the firm's creditors, given in logarithm. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). The analysis in Model (1) is conducted in the sample of CDS and non-CDS firms. In Models (2) through (5) I use the sample of CDS firms and separate firms into samples of firms with *Liquid CDS* and *Illiquid CDS* based upon the average number of CDS contracts held by the firm's creditors. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, industry/ firm and rating fixed effects. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Appendices

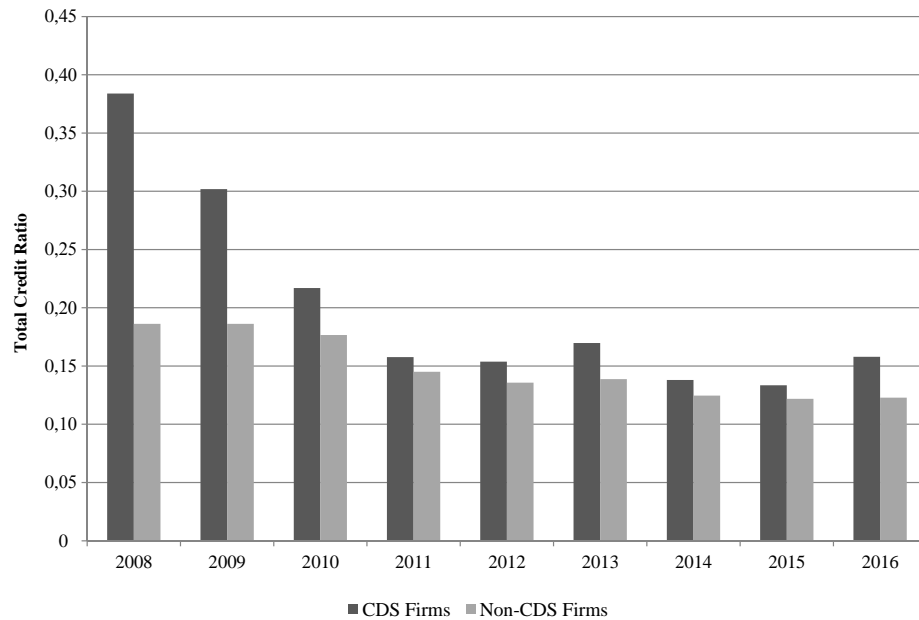


Figure A1
Development in firm-level credit exposures for CDS and non-CDS firms

This figure shows the development in the firm-specific credit exposures for German non-financial firms. *CDS Firms* (solid filled bars) refers to the sample of firms that at some point during the sample period act as CDS reference firms. Likewise, *Non-CDS Firms* (pattern filled bars) refers to the sample of firms that at no point during the sample period act as CDS reference firms. The variable *Total Credit Ratio* is the firm's total credit amount, scaled by total asset, and is based on end-of-quarter observations. The figure outlines the yearly averages of the respective quarterly total credit ratios. The time period is 2008-Q1 to 2016-Q2. The credit registry data is obtained from MiMik (Deutsche Bundesbank) and the CDS positios data is obtained from DTCC (TIW).

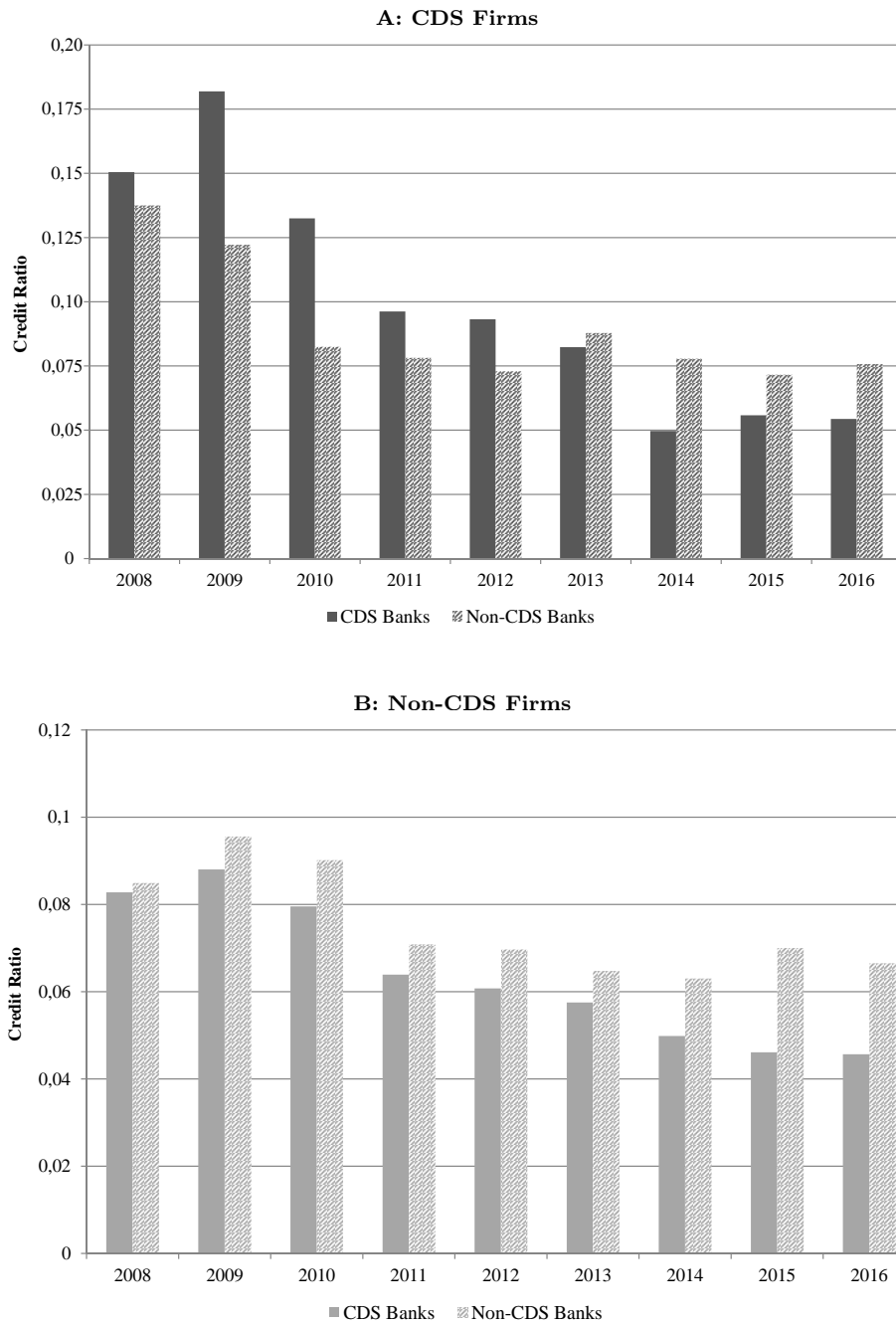


Figure A2
Development in firm-level credit exposures for CDS and non-CDS firms by type of creditor

This figure shows the development in the firm-specific credit exposures for German non-financial firms based upon the type of creditor. *CDS Firms* (Panel A) refers to the sample of firms that at some point during the sample period act as CDS reference firms. Likewise, *Non-CDS Firms* (Panel B) refers to the sample of firms that at no point during the sample period act as CDS reference firms. The development in the firm-specific credit exposure is shown separately for *CDS Banks* and *Non-CDS Banks*, where *CDS Banks* (*Non-CDS Banks*) refers to the creditors of a firm that at some point (at no point) during the sample period holds a CDS contract on one of the sample firms. The variable *Credit Ratio* is the credit amount held by, respectively, *CDS Banks* and *Non-CDS Banks*, scaled by total asset. The figures outline the yearly averages of the respective quarterly credit ratios. The time period is 2008-Q1 to 2016-Q2. The credit registry data is obtained from MiMik (Deutsche Bundesbank) and the CDS positions data is obtained from DTCC (TIW).

Table A1
Description of variables

<i>Dependent Variables</i>		<i>Description</i>
Credit Amount	Log(Firm credit)	The natural logarithm of the firm-level credit exposure. Quarterly firm-level measure. Source: German credit registry (Deutsche Bundesbank).
Credit Ratio	Credit Exposure/ Total Assets	Firm-level credit exposure, scaled by total assets. Quarterly firm-level measure. Source: German credit registry (Deutsche Bundesbank) and Compustat Global.
Leverage	Total Debt/ Total Assets	The sum of current and long-term debt as defined in Compustat (book value), scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Debt Maturity	Principal weighted average debt maturity	The average debt maturity of all outstanding debt, weighted by the principal of the debt, and given in years. Quarterly firm-level measure. Source: Capital IQ.
Debt Due: 0-1 Yr	Debt due within 1 year/ Total Debt	Debt that is due within one year, scaled by the sum of current and long-term debt (book value). The definitions for Debt Due: 2-5 Yrs, Debt Due: 5-10 Yrs, and Debt Due: 10-30 Yrs follow the same approach. Quarterly firm-level measure. Source: Capital IQ and Compustat Global.
Interest To Credit	Interest Payments/ Credit Amount	The sum of interest and related payments, scaled by the firm-level credit exposure. Quarterly firm-level measure. Source: Compustat Global.
Bond To Debt	Outstanding Bonds/ Total Debt	Total amount of bonds outstanding, scaled by the sum of current and long-term debt (book value). Quarterly firm-level measure. Source: Mergent FISD and Compustat Global.
Bank Credit Amount	Log(Firm-bank credit)	The natural logarithm of firm-bank-level credit exposure. Quarterly firm-bank-level measure. Source: German credit registry (Deutsche Bundesbank).
<i>Main Explanatory Variables</i>		<i>Description</i>
CDS Firm	Dummy	Dummy variable equal to one for firms that at some point during the sample period act as a reference firm in a CDS contract. Firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Outstanding	Dummy	Dummy variable equal to one if at least one of the firm's creditors hold a CDS contract on the firm. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
Net Buyers	Dummy	Dummy variable equal to one if the firm's creditors net CDS holding is positive. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
Net Sellers	Dummy	Dummy variable equal to one if the firm's creditors net CDS holding is positive. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Coverage	Total CDS net notional/ Credit Exposure	The sum of CDS notional bought minus the sum of CDS notional sold by all creditors of a firm, scaled by the firm-level credit exposure. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Creditors	Creditors that hold CDSs	Creditors that within the sample period hold a CDS on the firm's debt. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Creditor Ratio	# CDS Creditors/ # Creditors	The number of creditors that hold a CDS on the firm's debt, scaled by the total number of creditors of the firm. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Banks	Banks that trade CDSs	Banks that within the sample period trade CDS contracts. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
CDS Liquidity	Log(# CDS contracts)	The natural logarithm of the average number of outstanding CDS contracts within a given quarter. Quarterly firm-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
Bank CDS Position	Dummy	Dummy variable equal to one if the respective bank is a creditor and holds a CDS contract on the firm's debt. Quarterly firm-bank-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).
Bank CDS Coverage	Bank CDS net notional/ Bank-firm credit exposure	The amount of CDS bought minus the amount of CDS sold by a creditor, scaled by the its credit amount outstanding. Firm-bank-level measure. Source: DTCC (TIW) and German credit registry (Deutsche Bundesbank).

Table A1
Description of variables (cont.)

<i>Other Variables</i>		<i>Description</i>
Industry Leverage	Average leverage across 3-digit SIC-code	The sum of current and long-term debt as defined in Compustat (book value), scaled by total assets, and across three-digit SIC codes. Quarterly industry-level measure. Source: Compustat Global.
Industry Debt Maturity	Average debt maturity across 3-digit SIC-code	The average debt maturity of all outstanding debt, weighted by the principal of the debt, and across three-digit SIC codes. Quarterly industry-level measure. Source: Capital IQ.
Firm Size	Log(Total Assets)	The natural logarithm of total assets. Quarterly firm-level measure. Source: Compustat Global.
Profitability	EBIT/ Total Assets	Total earnings before interest and related expenses, income taxes, and dividends, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Cash	Cash/ Total Assets	Cash holdings including marketable securities, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Volatility	Average volatility across 2-digit SIC-code	Average standard deviation of corporates' cash flow within the same two-digit SIC code (minimum three observations). Quarterly industry-level measure. Source: Compustat Global.
Fixed Assets	Net PPE / Total Assets	Net property plant and equity, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Net Working Capital	(Working Capital - Cash)/ Total assets	The amount of working capital minus cash holdings, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Capital Expenditure	CapEx/Total assets	The amount of total capital expenditure, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Acquisition Activity	Acquisition/ Total Assets	The amount used for merger and acquisition activities, scaled by total assets. Quarterly firm-level measure. Source: Compustat Global.
Dividends	Dummy	Dummy variable equal to one for firms' with positive dividends, and zero otherwise. Quarterly firm-level measure. Source: Compustat Global.
CP Program	Dummy	Dummy variable equal to one for firms with an outstanding commercial paper program, and zero otherwise. Quarterly firm-level measure. Source: Compustat Global.
Rating	Internal Credit Rating	Average of firm-bank specific assigned ratings as defined in the German credit registry data. Rating classes are defined between 1 to 8, with lower values indicating higher likelihood of debt repayment. Quarterly firm-level measure. Source: German credit registry (Deutsche Bundesbank).
Z-score	Altman Z-score	The variable is calculated as the Altman Z-score and based upon firm fundamentals. Quarterly firm-level measure. Source: Compustat Global.
Sovereign Risk	5-year CDS spread	The variable is the end-of-quarter observation of the German 5-year CDS spreads. Source: Markit.

The table provides descriptions of all the variables used in the analyses. All financial variables are winsorized at the 1st and 99th percentiles.

Table A2
The impact of creditors' CDS holding on firm-bank level credit

<i>Panel A: Bank-specific CDS positions</i>		
	Bank Credit Amount	
	(1)	(2)
Bank CDS Position × Net Buyer	0.349*** (9.25)	
Bank CDS Position × Net Seller		0.239*** (7.9)
Controls	Y	Y
Intercept	Y	Y
Time FE	Y	Y
Firm FE	Y	Y
Bank FE	Y	Y
Rating FE	Y	Y
Sample	CDS	CDS
R^2	0.494	0.494
N	70573	70573

<i>Panel B: Bank-specific CDS coverage ratios</i>		
	Bank Credit Amount	
	(1)	(2)
Bank CDS Position	0.467*** (15.49)	0.083 (1.14)
Bank CDS Coverage	-0.001*** (-15.8)	
I{CDS Hedge Ratio > 1}		-1.01*** (-11.92)
I{Bank CDS Coverage ∈]0.5;1[}		1.035*** (10.9)
I{Bank CDS Coverage ∈]0;0.5[}		1.458*** (17.45)
I{Bank CDS Coverage ∈ [-0.5;0[}		1.574*** (20.15)
I{Bank CDS Coverage ∈ [-1;-0.5[}		0.722*** (8.63)
I{Bank CDS Coverage < -1}		-1.46*** (-18.23)
Controls	Y	Y
Intercept	Y	Y
Time FE	Y	Y
Firm FE	Y	Y
Bank FE	Y	Y
Rating FE	Y	Y
Sample	CDS	CDS
R -square	0.497	0.531
N	70573	70573

This table presents estimates of the effect of bank-specific creditor CDS holdings on bank-firm credit exposures in the sample of German non-financial CDS firms. *Bank Credit Amount* is defined as the natural logarithm of the bank-firm-level credit exposure. In Panel A, I use the variable *Bank CDS Position* which is a dummy variable equal to one if the respective bank is a creditor and holds a CDS contract on the firm's debt. Accordingly, *Bank CDS Position* × *Net Buyer* (*Bank CDS Position* × *Net Seller*) is a dummy variable equal to one if the respective bank is a creditor and has bought (sold) a CDS contract on the firm's debt. In Panel B, I use the variable *Bank CDS Coverage* which is the total CDS net notional held by the respective creditor of the firm and in a given quarter, scaled by the bank-firm specific credit exposure. Furthermore, I use dummy variables indicating certain *Bank CDS Coverage* levels. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm, bank and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table A3
Robustness: High versus low presence of CDS creditors

	Total Credit Ratio		Total Credit Ratio	
	High CDS Creditor Ratio	Low CDS Creditor Ratio	High CDS Creditor Ratio	Low CDS Creditor Ratio
	(1)	(2)	(3)	(4)
CDS Outstanding	-0.00 (-0.0)	-0.05 (-0.9)	-0.12 (-1.4)	-0.03 (-0.6)
CDS Outstanding \times Net Buyers	-0.12** (-2.2)	0.016 (0.48)		
CDS Outstanding \times Net Sellers			0.121** (2.06)	-0.02 (-0.8)
Industry Leverage	0.935 (0.54)	1.504** (2.25)	0.851 (0.49)	1.540** (2.29)
Firm Size	-0.12 (-1.4)	0.662*** (5.22)	-0.13 (-1.4)	0.660*** (5.21)
Cash	-2.20*** (-3.8)	-1.91*** (-5.1)	-2.21*** (-3.8)	-1.91*** (-5.1)
Volatility	-3.43 (-0.2)	5.857 (1.10)	-3.78 (-0.3)	5.753 (1.09)
Profitability	4.334*** (4.07)	1.880* (1.87)	4.290*** (4.03)	1.865* (1.86)
Fixed Assets	0.654 (1.34)	0.343 (1.01)	0.736 (1.50)	0.329 (0.97)
Net Working Capital	-0.44 (-0.4)	1.076* (1.91)	-0.41 (-0.4)	1.075* (1.91)
Capital Expenditure	4.045*** (4.35)	1.390 (1.24)	4.075*** (4.36)	1.379 (1.23)
Dividends	0.016 (0.20)	-0.03 (-0.4)	0.017 (0.21)	-0.03 (-0.4)
Acquisition Activity	1.264 (1.64)	1.393** (2.20)	1.253 (1.62)	1.372** (2.16)
CP Program	-0.00 (-0.0)	0.076* (1.85)	-0.00 (-0.0)	0.074* (1.81)
Sovereign Risk	0.201 (0.55)	0.954 (0.90)	0.202 (0.56)	0.968 (0.92)
Intercept	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS
<i>R</i> -square	0.741	0.831	0.741	0.831
<i>N</i>	451	471	451	471

This table presents estimates of the effect creditors' CDS holdings and the relative presence of CDS creditors on firm-level credit exposures in the sample of German non-financial firms. *Total Credit Ratio* is the firm's total credit amount, scaled by total asset. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). In Models (1) and (2), as well as Models (3) and (4), I separate the sample of CDS firms into the samples of *High CDS Creditor Ratio* and *Low CDS Creditor Ratio*, where *High CDS Creditor Ratio* (*Low CDS Creditor Ratio*) refers to firms where the ratio of CDS creditors to total creditors is above (below) the median value. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Table A4
Robustness: High versus low debt capacity

	Debt Maturity		Debt Maturity		Debt Maturity	
	Low Debt Capacity	High Debt Capacity	Low Debt Capacity	High Debt Capacity	Low Debt Capacity	High Debt Capacity
	(1)	(2)	(3)	(4)	(5)	(6)
CDS Outstanding	2.178** (2.28)	-0.44 (-1.21)	2.327*** (2.60)	-0.90** (-2.2)	1.168 (1.36)	-0.60 (-1.5)
CDS Outstanding \times Net Buyers			-1.28** (-2.5)	0.299 (1.13)		
CDS Outstanding \times Net Sellers					1.414*** (2.70)	-0.29 (-1.1)
Industry Debt Maturity	0.401 (0.88)	0.629*** (3.99)	0.294 (0.64)	0.431*** (2.75)	0.324 (0.71)	0.431*** (2.75)
Leverage	-5.47 (-1.08)	-5.53** (-2.16)	-0.62 (-0.1)	-4.92** (-2.0)	-0.71 (-0.2)	-4.92** (-2.0)
Size	-2.57* (-1.8)	1.216*** (3)	-0.06 (-0.1)	-0.28 (-1.0)	-0.06 (-0.0)	-0.28 (-1.0)
Cash	7.422 (1.23)	-6.43** (-2.36)	7.279 (1.28)	-2.40 (-0.8)	7.032 (1.23)	-2.40 (-0.8)
Industry Volatility	201.7* (1.85)	-34.1 (-0.85)	211.9** (2.07)	-107.*** (-2.8)	220.8** (2.15)	-107.*** (-2.8)
Profitability	6.823 (0.58)	-2.08 (-0.41)	15.04 (1.31)	-0.57 (-0.1)	15.41 (1.34)	-0.57 (-0.1)
Fixed Assets	-2.10 (-0.44)	6.525*** (2.8)	-1.64 (-0.4)	-2.71* (-1.7)	-1.21 (-0.3)	-2.71* (-1.7)
Net Working Capital	-5.04 (-0.47)	-1.06 (-0.25)	-10.2 (-1.0)	-6.79 (-1.5)	-10.2 (-1.0)	-6.79 (-1.5)
Capital Expenditure	7.425 (0.73)	12.17 (1.54)	14.35 (1.49)	19.22** (2.35)	14.03 (1.46)	19.22** (2.35)
Dividend Dummy	1.002 (1.17)	0 (-0.02)	0.685 (0.83)	0.022 (0.04)	0.660 (0.80)	0.022 (0.04)
Acquisition Activity	-2.62 (-0.39)	-0.3 (-0.05)	2.311 (0.35)	2.885 (0.48)	2.304 (0.35)	2.885 (0.48)
CP Program	0.765 (0.94)	0.773*** (2.64)	0.723 (0.98)	0.275 (0.91)	0.708 (0.96)	0.275 (0.91)
Sovereign Risk	0.120 (0.3)	0.177 (0.35)	0.159 (0.41)	0.237 (0.44)	0.149 (0.38)	0.237 (0.44)
Intercept	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y	Y	Y
Sample	CDS	CDS	CDS	CDS	CDS	CDS
R-square	0.299	0.564	0.292	0.486	0.294	0.486
N	360	373	359	374	359	374

This table presents estimates of the effect creditors' CDS holdings and debt capacity on the debt maturity of German non-financial firms. *Debt Maturity* is the average debt maturity of all outstanding debt, weighted by the principal of the debt, and given in years. The variable *CDS Outstanding* is a dummy equal to one if at least one of the firm's creditors in the given quarter holds a CDS contract on the firm's debt. Accordingly, the variable *CDS Outstanding \times Net Buyers* (*CDS Outstanding \times Net Sellers*) is a dummy equal to one if the firm's creditors are net credit protection buyers (sellers). In Models (1) through (6), I separate the sample of CDS firms into the samples of *Low Debt Capacity* and *High Debt Capacity*, where *Low Debt Capacity* (*High Debt Capacity*) refers to firms with average leverage ratios above (below) the median. The information for credit and CDS-related measures is based upon credit registry data from MiMik (Deutsche Bundesbank) and CDS position data from DTCC (TIW). In all models, I include base firm-level financial variables, as well as time, firm and rating fixed effects. The analyses are conducted in the sample of CDS firms. The sample period is 2008-Q1 to 2016-Q2, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are t-statistics.)

Chapter 3

Can Central Banks Boost Corporate Investment: Evidence from ECB's Liquidity Injections

with Marti G. Subrahmanyam, Dragon Y. Tang, and Sarah Q. Wang

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Abstract

Can monetary stimulus boost corporate investment? We answer this question by studying ECB's 2011-2012 Longer-Term Refinancing Operations (LTROs), which provided cheap funding to Eurozone banks. We find that, relative to their non-Eurozone counterparts, Eurozone firms invested more after the LTROs. However, riskier banks took more funds from the LTROs, and their uptake is negatively associated with their clients' investment. In other words, firms reduced investment when their banks took cheap LTRO funds from the ECB. Overall, our results highlight the difficulty of boosting investment by injecting liquidity into the banking system, especially with impaired bank balance sheets.

1. Introduction

Central banks all over the world have undertaken a series of both conventional and, more recently, unconventional monetary policy actions, such as injecting liquidity into the banking system since the 2008 credit crisis. These liquidity injections were of significant size and scope. Despite the overwhelming press coverage on central bank liquidity injections, the nascent literature on the topic has primarily focused on the impact of central banks' unconventional monetary policy on the banking sector and its related financial ramifications. However, the important question of whether these liquidity injections have indeed helped the real economy, as intended, remains unanswered. In this paper, we fill this gap in the literature by examining the impact of unconventional liquidity interventions on corporate policies, particularly those relating to investment and employment. Our research is of considerable importance even as many central banks around the world are actively intervening in markets in order to stimulate economic growth.

The Eurozone provides an ideal laboratory to study the impact of unconventional monetary policies due to its unique structure of a monetary union catering to diverse economies from the member states of the Eurosystem. Since 2010, several Eurozone countries experienced severe fiscal difficulties and financial problems. As a reaction to heightened sovereign default risk, the EU, the IMF, and the ECB engineered a series of interventions to improve market liquidity, real output, and employment. The largest of these interventions was the liquidity injected by the ECB into the commercial banks of Eurozone countries through two unconventional Longer-Term Refinancing Operations (LTROs) with a three-year maturity, implemented in December 2011 and February 2012, respectively.¹ However, the efficacy of these measures as prominent examples of unconventional monetary interventions remains hotly debated.

Theoretically, macro-liquidity injections do not always translate into *corporate* liquidity and investment (see, e.g., Christiano (1994)). First, bank lending to corporations may

¹Figure 1 provides a detailed timeline of the ECB's recent unconventional monetary policies, while the details of related ECB interventions are discussed in Appendix Note 1.

respond weakly to the unconventional liquidity interventions. This may be due to banks' precautionary motive to deleverage, particularly when banks hold large amounts of risky sovereign debt (Bocola (2016)), or their incentive to use lender-of-last-resort (LOLR) funding from central banks to take on even more sovereign risk rather than lending it to corporations. In addition, not only the size, but also the persistence of the intervention, i.e., banks' repayment policies with respect to these additional funds, are important factors for the impact on banks' lending policies. To that extent, the liquidity transmission mechanism clearly depends upon bank risk characteristics. Second, unconventional liquidity interventions can also affect the real economy through corporations' own liquidity, financing, and investment policies. Unconventional monetary policies that aim at boosting bank liquidity may make corporations less concerned about future financing and, thereby, stimulating investment. However, corporations may also read the LTRO uptake of their banks as a signal of their quality, with more risk attributed to banks with a higher uptake. Since the corporations' future financing may be in jeopardy, they may borrow as much as possible and reduce their investments due to their concern about the possible lack of continuing financing from their respective banks. Thus, the extent to which macro-liquidity injections are converted into economic output also depends on corporate characteristics, such as reliance on debt financing from the banking sector, as well as economic conditions and fiscal policies, more generally. Overall, it is, thus, unclear whether we would necessarily observe a positive effect of liquidity injections on the real economy.²

We explicitly address this lacuna in the literature and investigate whether particular ECB liquidity injections indeed helped the real economy. Specifically, we examine the impact of macro-liquidity injections on corporate investment and employment policies in the context of the ECB's LTROs I and II as exogenous liquidity shocks in the Eurozone countries. Although prior studies show that *negative* credit supply shocks result in a reduction in corporate investment (e.g., Chava and Purnanandam (2011)), whether or not a *positive* credit supply shock can boost investment is a under-studied open question. Corporations do not base their investment decisions exclusively on their cost of funding; new investments tend to be driven by long-term plans.

We investigate investment and employment policies in a larger sample of Eurozone corporations around the LTRO implementation. We build a comprehensive dataset that combines monetary policy data from the ECB Statistical Data Warehouse, loan information on Eurozone lenders from the Thomson Reuters Loan Pricing Corporation (LPC)

²There is a substantial degree of disagreement among business economists about the real effects of such liquidity injections. For example, the Spanish bank BBVA expresses a more optimistic view and argues that ECB liquidity injections could have boosted Eurozone GDP by between 0.3 percent and 0.5 percent.

DealScan database, corporate fundamental data from Compustat Global and S&P Capital IQ, credit ratings on non-financial corporations from CreditPro[®] by S&P Capital IQ, credit default swaps (CDS) data from Markit, and relevant data from other sources. A unique feature of our research is that we capture the LTRO impact on corporate-specific policies, using both country- and bank-level LTRO uptake information.

Making use of these comprehensive data, we find that corporations in countries with a higher LTRO uptake experienced larger investment cuts, while there is no significant change in their wage payments (payments to employees). Furthermore, corporations associated with banks that had a higher LTRO uptake reduced their investment more than those associated with banks that had a lower LTRO uptake. However, a negative association between the LTRO uptake of banks and corporate investment does not necessarily imply a *causal* relationship. In order to directly address causality, we analyze the determinants of a bank’s LTRO uptake and find evidence that LTRO uptake positively relates to bank risk, which is consistent with Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016). Consequently, we do find that the causal relationship between the LTRO uptake and corporate investment is weak when we account for relevant country, bank, and corporate characteristics, suggesting no causal relationship between the LTRO uptake and the decrease in corporate investment. In fact, we find in counterfactual analyses that the two three-year LTROs halted the deterioration in corporate investment; moreover, as evidenced by the fact that non-Eurozone corporations in Europe experienced even larger investment cuts, post-LTRO.

To better understand the counterintuitive result of lower investment associated with greater liquidity injection, we further explore whether the decrease in corporations’ investments following LTRO liquidity injections relates to corporate, bank and/or country characteristics. First, we explore the exposure and response of corporations to the positive bank liquidity shocks, conditional on the riskiness of their respective bank lenders and home country. In this investigation, we find that corporations with a greater dependence on bank debt, and those with risky bank lenders, experienced greater decreases in their investment when their bank lenders had greater LTRO uptakes. These findings are consistent with the LTRO’s role in the “revelation of bank quality” and underscore corporations’ uncertainty about the real impact of these monetary policy measures. Second, we study the role of the persistence of LTRO interventions for their ultimate transmission to the corporate sector. A noteworthy feature of LTROs is that they allowed banks to repay the ECB’s LTRO loans early, i.e., after just one year and, thus, well before the end of the three-year maturity. We find that the banks’ holding period for the LTRO funds played a significant role in terms of the transmission of the liquidity to the corporate sector as the average corporation in countries where the banks retained the LTRO funds

for a longer period did not decrease its investment. Meanwhile, we find the investment reduction associated with LTROs to be mainly driven by corporations in countries with intermediate levels of LTRO repayments. These findings reveal the interesting distributional effects of unconventional monetary policies, and cast doubt on the real beneficiaries of the liquidity injection, as the countries that were most affected by the Eurozone crisis did not experience an improvement in their respective investments.

Recent discussions of the impact of macroeconomic interventions in the face of anemic economic growth, even after many years of monetary easing, have shifted the debate to the role of fiscal policies. Hence, we also investigate the role of fiscal policies for the effectiveness of the LTROs to investigate the effect of Eurozone-wide monetary policies, conditional on national policies. In a monetary union such as the Eurozone, individual governments can (and often do) undertake different fiscal actions, which are sometimes unrelated to ECB policies. Related to this discussion, we show that when individual national governments cut their corporate taxes or increased their public investments, the LTRO uptake of banks domiciled in those countries is associated with an increase in corporate investment therein. These findings demonstrate the importance of coordinated monetary and fiscal policies for corporate investment, as there are limits to the efficacy of monetary policies taken in isolation.

Existing studies of unconventional monetary policies are mostly in the U.S. setting (e.g., Berger and Roman (2016)). One related contemporaneous work examining the European setting is Acharya, Eisert, Eufinger, and Hirsch (2017). They find evidence of zombie lending by banks, following the announcement of Outright Monetary Transactions (OMT) in the summer of 2012. Our study is distinguished from theirs in that we focus on corporate policies, following the largest real liquidity injection, i.e., three-year LTRO liquidity injections, in which banks from Greece, Ireland, Italy, Portugal, and Spain (the GIIPS countries) and non-GIIPS countries voluntarily participated. We also explore the role of banks' early repayment decisions of their LTRO borrowing on the corporations' decisions, and find that ECB liquidity injections have been ineffective in boosting corporate investment. However, we do *not* argue for a causal relationship between the LTRO uptake of banks and the corporate investment of their clients. Instead, we find that the LTRO uptake amount significantly proxies for bank risk, particularly for non-GIIPS banks. We show in addition, based on a counterfactual analysis, that these liquidity injections may have halted economic deterioration in the Eurozone. Furthermore, we suggest that it is important to consider monetary policies in tandem with fiscal policies. Hence, our results are consistent with the signaling role of banks' LTRO uptake and their subsequent early repayment: Corporations may read their bank lenders' LTRO uptake and early repayment as a signal of their quality and adjust their investment policies accordingly,

particularly in non-GIIPS countries. Our results also imply that unless a bank’s balance sheet becomes healthy, the monetary policy transmission mechanism can be ineffective.

The rest of the paper proceeds as follows. We discuss the related literature in Section 2. Section 3 provides descriptive statistics for our data and specifies the empirical setting for our analysis. In section 4, we investigate the impact of macro-liquidity injections on corporate investment. In section 5, we examine the asymmetries in the LTRO impact across corporations and countries. Section 6 concludes.

2. Related Literature

A substantial body of literature has shown that negative credit supply shocks reduce corporate investment. Chava and Purnanandam (2011) show that U.S. corporate investments declined after the banks were negatively affected by the 1998 Russian default. Amiti and Weinstein (2017) show that supply-side financial shocks had a large impact on corporate investment. Chodorow-Reich (2014) shows that credit market disruptions in 2008/2009 caused a significant decrease in employment. Similarly, Cingano, Manaresi, and Sette (2016) show that the liquidity drought in the interbank market during the 2007 crisis caused a large investment decrease for Italian corporations, while Bottero, Lenzu, and Mezzanotti (2015) show that the investment and employment of small corporations in Italy were negatively affected by the credit crunch that followed the Greek crisis. De Marco (2017) shows that during the European Sovereign Debt Crisis, banks cut their credit supply to borrowers because of their own funding problems, and corporations subsequently decreased their investments. The effect of bank credit tightening during the Sovereign Debt Crisis on corporate investment is confirmed by Buca and Vermeulen (2017). However, there has been little prior research on whether a *positive* credit supply shock can boost corporate investment.³

Central banks play an active and prominent role in the financial markets, and their actions can profoundly affect corporate policies. Therefore, it is fundamentally important to understand the impact of monetary policy. Although there is substantial research on the conventional monetary policies of the U.S. Federal Reserve System (e.g., Gorton and Metrick (2013), and Romer and Romer (2013)), there is little research on unconventional monetary policies, particularly outside the U.S., and their impact on the real economy. After the global financial crisis and the great recession that ensued, fiscal and monetary

³One exception is Kasahara, Sawada, and Suzuki (2016), who show that bank capital injections made by the Japanese government in March 1998/1999 had a negligible impact on the average investment rate of their borrowers. Bergman, Iyer, and Thakor (2017) find a positive effect of cash injection during the Farm Debt Crisis of the 1980s. Foley-Fisher, Ramcharan, and Yu (2016) find that non-financial corporations with a high reliance on longer-term debt increased their investments during the Maturity Extension Program (MEP).

interventions were first initiated by the U.S. government and the Federal Reserve System, leading to several studies examining U.S. data. In general, these studies find some evidence of increased risk-shifting by banks, relaxed corporate financing constraints, but an ineffective impact on households following the interventions. For example, Duchin and Sosyura (2015) and Berger and Roman (2016) focus on the Troubled Asset Relief Program (TARP) and find evidence of regulatory arbitrage by banks and a positive impact on “Main Street” after the program. Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015) find that government interventions aimed at lowering banks’ funding costs are ineffective in terms of stimulating household borrowing and spending. Furthermore, the impact of the interventions on the real economy, e.g., corporate financing constraints and investment, may depend on the characteristics of the intervention. For example, Chakraborty, Goldstein, and MacKinlay (2017) find that the mortgage-backed security purchases (but not Treasury bond purchases) made by the Federal Reserve may crowd out banks’ commercial lending and decrease corporate investment.

The ECB’s introduction of unconventional monetary policies in Europe led to similar studies based on European data. Studies on European policies are particularly important, as Europe has a very different economic governance structure than the U.S., particularly with regard to economic affairs; this implies that the U.S. analysis may not apply in a straightforward way to Europe. The crucial difference lies with regard to the common monetary policy in the Eurozone, even when member countries follow independent fiscal policies. A number of the European studies focus on the sovereign bond market and banks’ risk-taking after either the announcement or the actual implementation of unconventional monetary policies. Eser and Schwaab (2016) find that the SMP helped lower the yield spreads and yield volatilities of European sovereign bonds. Although Acharya, Imbierowicz, Steffen, and Teichmann (2017) do find some announcement effects, they note that it was the actual purchases and not the signaling of the policy that drove the bond yields lower. De Pooter, Martin, and Pruitt (2018) find consistent results demonstrating that the Securities Market Program (SMP) helped lower the sovereign bond liquidity premium. Garcia-de Andoain, Heider, Hoerova, and Manganelli (2016) find that ECB liquidity injections helped stabilize the overnight unsecured interbank market. Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016) find that banks with weaker capitalization borrowed from the ECB and posted riskier collateral to access ECB funding. Also, Acharya and Steffen (2015) document banks’ “carry trade” behavior from 2007 to 2013 and attribute it to risk shifting and regulatory arbitrage motives. Acharya, Pierret, and Steffen (2017) find differing impacts of the LTROs and OMT on banks’ risk-taking; whereas banks’ holding of risky sovereign debt was increased by the LTROs, the OMT reduced sovereign risk and increased banks’ debt holdings.

De Pooter, DeSimone, Martin, and Pruitt (2015) find SMP announcement effects but no actual purchase effect on bond yield spreads.⁴ Pelizzon, Subrahmanyam, Tomio, and Uno (2016) find that a change in sovereign credit risk leads to a change in sovereign bond market liquidity, and that the ECB intervention weakened this adverse dynamic relationship and improved market liquidity. Krishnamurthy, Nagel, and Vissing-Jorgensen (2018) find that the SMP and the OMT on average, decreased yields across Italy, Spain and Portugal, while stock prices increased in both distressed and core countries, suggesting that these policies also had beneficial macro-spillovers.

In addition to the sovereign bond market and banks' risk-taking, an increasing number of papers focus on the impact of unconventional monetary policies on the actual users of capital, i.e., corporations, which are the focus of this study. Acharya, Eisert, Eufinger, and Hirsch (2017) show that banks increased their lending to corporations following the "whatever-it-takes" statement of ECB President, Mario Draghi, and the announcement of the OMT. Acharya, Eisert, Eufinger, and Hirsch (2018) show that the contraction in the loan supply from Eurozone periphery banks that arose during the financial crisis from 2006 to 2012 depressed investment, job creation, and sales among related European borrowers, concluding that borrowers saved more cash out of their free cash flows. Similarly, Chodorow-Reich (2014) documents the negative impact of bank lending frictions on employment outcomes. Acharya, Imbierowicz, Steffen, and Teichmann (2017) find that bank risk impairs the transmission of central bank liquidity to loan spreads, which negatively affects high-risk bank borrowers. In contrast, we emphasize the role of bank risk in determining banks' LTRO uptake and corporate investment. In addition, a few recent country-specific papers have shown that unconventional monetary policies by the ECB can indeed have a positive, moderately sized effect on the supply of bank credit to corporations (see, e.g., Carpinelli and Crosignani (2017), Garcia-Posada and Marchetti (2016), and Andrade, Cahn, Fraisse, and Mésonnier (2018)).

Another related strand of the literature tackles the general determinants of corporate investment, including corporate taxation and other factors. Graham, Leary, and Roberts (2014) study U.S. data and find that government fiscal activities can affect corporate financial and investment policies. Kydland and Zarazaga (2016) show that concerns about higher taxes caused by fiscal challenges depressed investments and slowed the recovery in the U.S. In this paper, we provide additional insights regarding corporations' adjustment of their investments in response to macro-liquidity injections in terms of both the announcement and the excess inflow of liquidity to their lenders through an increase in (cheaper) external funding from central banks. In the following sections, we empirically

⁴Trebesch and Zettelmeyer (2018) investigate the effects of ECB interventions on the Greek government bond market in mid-2010, and find that the bonds purchased by the ECB experienced a much steeper drop in their yields than did other bonds.

examine the impact of macro-liquidity injections on corporate policies in the context of the ECB’s LTRO interventions.

3. Data and Methodology

3.1 Data

We collect data from several databases that contain European data ranging from the 2002 adoption of the euro to 2014, thereby allowing us to look at differences in corporate policies during both normal and distressed periods, along with periods characterized by ECB interventions.⁵ We use data on corporate fundamentals from the Compustat Global database.⁶ From this source, we identify a sample of European corporations and collect all yearly and quarterly corporate financial and stock price data for the period from 2002 to 2014. Since financial and utility corporations often have capital structures that are quite different from the average corporation, we follow the literature and exclude financial corporations (SIC codes 6000 to 6999), utility corporations (SIC codes 4900 to 4999) and corporations for which no SIC code is available. Furthermore, because we are interested in only active corporations, we follow Bates, Kahle, and Stulz (2009) and require corporations to have *both* a non-negative asset value and non-negative sales to be included in a given year (quarter). We supplement the data from Compustat with corporate data from the Capital IQ database. Capital IQ compiles, inter alia, detailed information on corporate debt structure using financial footnotes contained in corporations’ financial reports. Finally, we use CreditPro[®] (S&P Capital IQ) rating data as a proxy for corporate credit risk so that we can estimate the impact of the ECB’s extraordinary liquidity injection, after controlling for such risk.⁷ In addition to the corporate data, we also collect country- and industry-specific data from several other sources, including five-year sovereign CDS spreads from Markit, and measures of a country’s overall exposure to other countries’ economic conditions from the World Bank.

To analyze the impact of the liquidity interventions made by the ECB, we restrict our main sample to corporations located in the Eurozone. This sample includes all corporations located in countries that belong to the Eurosystem (i.e., the Eurozone), and which thereby were directly affected by the ECB’s liquidity interventions. To exclude any potential biases or country-specific reasons for the later adoption of the euro by some

⁵We restrict ourselves to the period after 2002 to ensure alignment with the establishment of the Eurozone.

⁶The advantage of using data from Compustat rather than, for instance, Amadeus, is that we have quarterly rather than only annual data, which allows for greater granularity in our analysis.

⁷To mitigate the effect of outliers, we winsorize the observations for our variables at the 1st and 99th percentiles. Furthermore, we follow the approach in related empirical research and assume that a corporation has no R&D expenditure (or M&A activities), if it is reported as “missing” by Compustat.

countries, we include only corporations from those countries that adopted the euro as a common currency in 1999, and joined the European Monetary System at the time of its inception in January 2001. However, we collect similar data for both Eurozone and non-Eurozone corporations, and use the latter as a control group for some of our subsequent analyses.⁸

To address the impact of liquidity intervention on corporate policies, we use the ECB’s implementation of its unconventional three-year LTROs. These operations were announced in early December 2011, and were implemented on December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II).⁹ In general, as indicated by the steep increase in the amount of outstanding LTRO as presented in Appendix Figure A1, the interventions overall turned out to be of significant size. Since we are particularly interested in whether and how much of the ECB’s liquidity injections flowed to individual banks, we make use of both country-specific aggregate information on the Eurozone banks’ uptake of LTRO I and LTRO II, and bank-level uptake information that is hand-collected from Bloomberg.¹⁰

Table 1 outlines these LTRO uptake numbers within the Eurozone, sorted by country.¹¹ As shown in the table, banks from the periphery countries were highly active because of their actual capital needs, as the LTRO was their only option for accessing medium-term funding. However, for many banks, participation in the unconventional LTROs also provided them with an opportunity to replace their shorter-term borrowing with low-cost three-year borrowing (Fitch Ratings (2012)). Therefore, banks in even highly rated and safe Eurozone countries such as Germany and France participated in the three-year LTRO. In addition, as Table 1 indicates, the participation in, and the uptake from, the two LTROs were quite similar (both at the aggregate and country levels). The aggregate uptake was approximately 918 billion Euro, with Italian and Spanish banks being, by far, the most active in their participation in terms of both the number of participating banks and the amounts borrowed. Together, banks in these two countries had an uptake of approximately 68 percent of the aggregate uptake. In terms of the significance of the ECB liquidity intervention, we can see from the ratio of the total LTRO uptake to central government debt in the country that the liquidity injection was great-

⁸Eurozone countries that are excluded from the analysis are Slovenia (joined in 2007), Cyprus and Malta (joined in 2008), Slovakia (joined in 2009), Estonia (joined in 2011), Latvia and Lithuania (joined in 2015), Poland and the Czech Republic (current applicants), and Luxembourg (missing data). The Non-Eurozone sample includes EU corporations located outside the Eurozone. For details, see Appendix Table A1.

⁹For details of various unconventional programs of ECB, please see Appendix Note 1.

¹⁰We thank Matteo Crosignani for kindly sharing the bank-level LTRO data that he obtained from Bloomberg.

¹¹Appendix Figure A2 provides a graphical presentation of these numbers. It should be noted that although the ECB liquidity injection was available only to Eurozone banks, approximately 5 percent of the total uptake involved non-Eurozone banks that participated through their subsidiaries situated in the Eurozone.

est for countries in the Eurozone periphery, i.e., GIIPS countries. Furthermore, we also see that banks in the GIIPS countries had the highest LTRO borrowings (scaled by the banks' total assets), and that the bank-specific uptake was very similar across the periphery countries. We supplement these intervention-specific data with other Eurozone-wide data that are obtained from National Central Bank (NCB) reports from members of the Eurosystem and the ECB Statistical Data Warehouse, where all published reports and historical data are stored on a monthly or weekly basis, depending on the source.¹²

3.2 Empirical Design

With regard to our investigation of the impact of unconventional LTROs on the real economy, we focus on corporate investment and wage policies. As a proxy for corporations' investments, *Investments*, we follow the literature and use the ratio of capital expenditure to total assets. As shown in Table 2, Panel A, the average corporation in our main sample uses 3.12 percent of its total assets on investment in each quarter. As a proxy for employment compensation, we use *Wages*, which represents the corporations' total salaries and wages, expressed in logarithms. We relate corporate investment and wages to a set of explanatory variables and other controls, including both firm- and time-fixed effects. Our main controls in the investment and employment compensation model specifications are *Cash Flow*, *Market to Book*, *Firm Size*, *Leverage* and *Rated*. *Cash Flow* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, divided by the book value of assets. *Firm Size* is the logarithm of total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. Finally, *Rated* is a dummy variable that is equal to one if the corporation is rated, and zero otherwise. Since investment and employment may also be determined by the lagged ratios of alternative investment measures, e.g., R&D and acquisitions, along with profitability and the degree of competition in the respective industry, we also use these controls in extended specifications.

To capture the liquidity injection impact of the three-year LTROs, we use the measures *Country LTRO Uptake* and *Lender LTRO Uptake*. *Country LTRO Uptake* measures the differences between countries in terms of participation in the three-year LTROs by reflecting the country-specific uptake of liquidity. In particular, *Country LTRO Uptake* is equal to zero until the first unconventional LTRO, Q4-2011, and equals the amount of

¹²Source: <https://sdw.ecb.europa.eu/home.do> and <http://www.ecb.europa.eu/stats/monetary/res/html/index.en.html>. Note that the ECB does not provide data regarding its intervention programs.

each country’s total uptake through LTRO I and II, i.e., the sum of banks’ LTRO uptake in the respective country, scaled by each country’s central government debt holdings in the year 2011. Thus,

$$\text{Country LTRO Uptake}_{t,c} = \frac{\text{Total Country LTRO Uptake}_{t,c}}{\text{Central Government Debt}_{2011,c}} \quad (1)$$

where t indicates the year-quarter and c refers to the country. Hence, this variable measures the country-specific significance of how the unconventional monetary policy implemented by the ECB differentiates between countries that had a high or low uptake. Accordingly, we expect corporations located in countries that received relatively high liquidity injections to have been more heavily affected and to show a stronger reaction in their investment policies.¹³

To provide a deeper investigation of the corporate-level impact of the LTRO uptake by Eurozone banks, we also investigate the lending relationships to banks that participated in the LTROs, *LTRO-bank*, of our corporations in the main sample. To obtain information on each corporation’s LTRO-bank relation, we collect syndicated loan information from the LPC Dealscan database and create a subsample of corporations from our main sample with lender and loan information. In particular, we match the information on LTRO-banks with the lender-share and loan-facility data in LPC DealScan.¹⁴ By using the loan-facility data, we specifically also match the LTRO-banks (as lenders) with a subsample of the Eurozone corporations (as borrowers) and, thus, identify whether those corporations have a relationship with a LTRO-bank. Using this procedure, we match 953 corporations, 476 of which have an LTRO-bank relationship. Table 2, Panel B, shows the summary statistics and confirms that there is no major sample bias induced by our procedure for identifying loan relationships.¹⁵

To explicitly study the impact of corporations’ access to LTRO funds, we define a corporate-specific LTRO exposure measure, *Lender LTRO Uptake*, based upon the hand-collected bank-level uptake from Bloomberg. Similar to the *Country LTRO Uptake* measure, *Lender LTRO Uptake* is equal to zero, until the first round of the unconventional LTROs, Q4-2011. However, thereafter, it equals the average LTRO borrowing amount of related banks (LTRO I and LTRO II), scaled by the size of each related bank, i.e., total assets, as of 2011. The measure is determined as

¹³In robustness tests, we use the ratio of the country-specific LTRO uptake to the country’s GDP as a proxy for the size of each country’s economy. Our main results are robust to this alternative specification.

¹⁴Based upon our sample of LTRO-banks, we identify 89 banks as lenders with syndicated loans covered in LPC Dealscan. We match Dealscan borrowers with Compustat corporations by using the link provided by Chava and Roberts (2008), and by hand-matching corporations by name and country of origin.

¹⁵There is a minor sample bias in terms of corporate size because LPC Dealscan provides loan pricing information on syndicated loans, which are typically made to larger corporations.

$$\text{Lender LTRO Uptake}_{t,i} = \sum_{j=1}^{N_i} \left(\frac{\text{Bank LTRO Borrowing}_{t,j}}{\text{Bank Size}_{2011,j}} \right) / N_i \quad (2)$$

where t indicates the year-quarter, i refers to the corporation, j refers to a related bank and N_i refers to the total number of LTRO-bank relationships the corporation has. A high value of *Lender LTRO Uptake* implies that the LTRO borrowing of banks with which the corporation has an existing lending relationship, compared to the size of the related banks on average, was significant which, all else being equal, makes it more likely that the corporation had access to (and obtained) additional funds stemming from the LTRO liquidity injections. Thus, compared to *Country LTRO Uptake*, *Lender LTRO Uptake* proxies for the corporate-level access to the unconventional LTRO funds, but is only available for the subsample of corporations for which we also have loan-level information.

Since this paper is based upon Eurozone corporations and provides a cross-country study, we also include the natural logarithm of sovereign CDS spreads, *Sovereign Risk*, and the countries' ratios of exports to GDP, *Sovereign Export*, in our model specifications, to control for sovereign credit risk and the diversification of the economy across markets. As outlined in Table 2, Panel C, the median CDS spread over the sample period within the Eurozone is approximately 17.62 bps. The sovereign CDS spread variable shows a large degree of cross-country and time-series variation, which implies that this is a suitable proxy for our study of unconventional monetary policies within the Eurozone. Likewise, we find a large variation in the countries' dependence on exports.¹⁶

In section 4, we analyze the impact of the *Country LTRO Uptake* and *Lender LTRO Uptake* measure on corporate investment and employment compensation. As the transmission of the LTRO liquidity injection by the ECB occurred through the banking sector, and banks' incentives for participating in the LTRO programs are important to understand the transmission efficiency, we also analyze the determinants of banks' usage of LTRO funds. To this end, we also collect bank-level data from Bankscope and Markit and investigate the role of bank, country and borrower characteristics *prior* to the LTRO implementation for banks' borrowings through LTRO I and LTRO II. In section 5, we further investigate the impact of the granularity of the LTROs on corporations' investments. We start from the corporations' reliance on bank debt, and investigate the role of this reliance in determining the impact of the country, as well as lender-specific LTRO uptake measures. Next, we investigate the effect of lender and country characteristics, such as the average risk and size of the corporations' lenders, as well as the role of the banks' overall policies on the repayments of the LTRO and (local) fiscal policies.¹⁷

¹⁶Appendix Table A3 provides summary statistics for the non-Eurozone sample, and shows no general differences between Eurozone and non-Eurozone corporations, except for lower sovereign CDS spreads.

¹⁷Descriptions of all variables presented in this section can be found in Appendix Table A2.

4. Central Bank Liquidity Injections and Corporate Policies

In this section, we investigate the impact of the unconventional liquidity intervention on the real economy. We focus on the effect of the three-year LTROs implemented by the ECB on corporate investment and employment compensation. We first use the non-Eurozone corporations as the counterfactual, and compare corporate policies of Eurozone and non-Eurozone firms following the liquidity injections. We then restrict our analysis in the sample of firms within Eurozone and among LTRO qualified banks/firms. We further investigate the determinants of bank LTRO uptakes and discuss their implications for the real economy.

4.1 Counterfactual Analysis: Eurozone versus Non-Eurozone Countries

We use non-Eurozone corporations as the benchmark to compare corporate investment and employment with and without the influence of the LTRO liquidity injections. Although using non-Eurozone corporations as the benchmark may be challenged based on other fundamental differences between Eurozone and non-Eurozone economies in Europe, the comparison can be considered as a rough “counterfactual analysis” investigating the impact of the ECB’s three-year LTROs.

In Figure 2, we first plot the change in corporate investment around the LTRO interventions for Eurozone and non-Eurozone corporations. Before the LTRO implementation, Eurozone and non-Eurozone corporations generally showed similar trends in their investments, with a slightly greater decrease in investment for Eurozone corporations. However, after the LTRO implementation, Eurozone corporations sustain their investments better than non-Eurozone corporations, particularly during the first year after the LTRO liquidity injections. This finding provides some preliminary evidence that the three-year LTROs may have halted the deterioration in Eurozone corporations’ investments.

We then investigate corporate investment and employment policies after the LTRO intervention occurred in a sample of corporations located in the EU, with non-Eurozone corporations used as the control group for the LTRO effects. Whereas banks in the Eurozone countries may have had access to LTRO liquidity injections during the two rounds of unconventional LTROs, non-Eurozone countries did not have such access.¹⁸ To account for major differences in economic conditions across countries and the corresponding deferred impact, we also match the EU sample countries based upon their sovereign risk when investigating the impact of the LTROs. In particular, we measure country risk

¹⁸This is valid with the exception of non-Eurozone banks with bank subsidiaries located in the Eurozone. Additionally, we do not account for other stimulus measures that may have been implemented in the non-Eurozone countries during the same period, which would be biased against our finding a positive impact of the LTROs in the Eurozone countries relative to the non-Eurozone countries.

using the countries' CDS spreads two years before the LTRO intervention. *Risky* (*Safe*) *Sovereign* is defined as a CDS spread above (below) the median in the pre-intervention and crisis periods (2009 and 2010).

The results are presented in Table 3. In Model (1) of Panels A and B, we use the full sample of corporations. The variable *Post-LTRO* is a time dummy variable equal to one, for year-quarter observations occurring after the ECB had implemented the first three-year LTRO intervention (Q4-2011), and indicates the timing of the LTRO intervention. The variable *Non-Eurozone* is a dummy equal to one, for corporations located in countries that do not belong to the Eurozone. The variable of interest in this counterfactual analysis is $Post-LTRO \times Non-Eurozone$, which is the interaction term between the LTRO intervention and non-Eurozone dummies. The variable equals one, for non-Eurozone corporations in year-quarters following the first LTRO intervention, which captures the effect of the liquidity intervention on corporate policies in non-LTRO countries (the “counterfactual” effect). We find a negative and significant coefficient of the term $Post-LTRO \times Non-Eurozone$ for both the investment and wage analyses. This finding suggests that non-Eurozone corporations may not only have had less access to a substantial financing source, but may also have experienced an even greater decrease in investment than corporations in the Eurozone.

In Models (2) and (3) of Table 3, we further separate our sample of corporations in the EU into high and low sovereign-risk subsamples, based on the risk of the country in which a corporation is located. We then compare corporate policies during the post-LTRO intervention period for the high and low sovereign-risk groups. We find that non-Eurozone corporations in both the high- and low-risk groups experienced a greater decrease in their investments and wages following the unconventional LTROs than did Eurozone corporations. If one takes non-Eurozone corporations (or sovereign risk-matched non-Eurozone corporations) as the “counterfactual” of Eurozone corporations exposed to LTRO liquidity injections, the results in this section suggest that the LTROs helped Eurozone corporations sustain their investments better than corporations elsewhere in Europe at the onset of the European Sovereign Debt Crisis.

4.2 Investment and Employment Compensation of Eurozone Firms

Corporate access to debt markets has an impact on corporations' investments (Harford and Uysal (2014)), and financing frictions do affect investment decisions (Almeida and Campello (2007)). Thus, the availability of debt financing after the LTRO intervention, and the resulting credit supply shock, may have affected corporations' investment policies, such as capital expenditures. Likewise, we expect that the increased availability of debt financing may have increased employment compensation. Both a positive effect

on investment and increased employment compensation would suggest that the LTRO intervention had an ameliorating impact on the real economy. However, corporations may have had a precautionary demand for liquidity because of their own concern about future access to financing. They may have borrowed as much as possible and many even decrease their investments due to concerns about the lack of continued future funding from their banks. If LTRO uptakes were viewed as a signal of bank risk/future liquidity risk, corporations may have even decreased their investments, even when their current access to financing was good.

4.2.1 Country LTRO Uptake and Corporate Investment

To investigate whether the LTRO intervention had an impact on corporate investment and employment decisions, we next present the results of our investigation of proxies for corporate investment and employment compensation. The analysis is conducted based on the sample of all corporations in the Eurozone, and the results are presented in Table 4. We first discuss the results in the models when using *Country LTRO Uptake* as the variable of interest. In Model (1), we use the ratio of capital expenditure to total assets as our proxy for corporate investment. We add only controls that affect the corporate capital expenditure decision. Since investments and employment may also be determined by the lagged ratios of alternative investment measures, e.g., R&D and acquisitions, along with profitability and the degree of competition in the considered industry (see, e.g., Almeida and Campello (2007) and Duchin, Ozbas, and Sensoy (2010)), we use these controls for robustness checks and present the results in Appendix Table A4. As both tables show, after controlling for corporate fundamentals, we find a negative and significant coefficient of the country-specific LTRO uptake measure, which indicates that corporations located in countries with a high uptake of additional liquidity in the banking sector reduced investments following the LTRO intervention; on average, they decreased their investments by 0.32 percent following the LTRO intervention.¹⁹

In Model (3) of Table 4, we provide the same analysis for corporate employment compensation. Recall that, as a proxy for employment compensation, we use corporations' total expenses related to wages (on a logarithmic scale). In this case, we do not find a significant effect for the LTRO uptake measure. Therefore, similar to the case of corporate investment, corporate spending on employees was not positively (or negatively) affected by the introduction of the unconventional LTROs. Our tentative conclusion is that although corporations may have had access to more debt financing, they did not use the proceeds from the additional borrowing to invest in their businesses.

¹⁹The country-specific LTRO uptake typically differs by 25 percent, implying that for such a difference, the investment difference is $25\% \times 1.276\% = 0.32\%$.

4.2.2 Lender LTRO Uptake and Corporate Investment

To further understand the transmission channel, we utilize detailed bank-firm relationship data (from LPC Dealscan) and bank-level LTRO uptake data (from the ECB) to measure the liquidity injection effects at the corporate level. The effectiveness of the liquidity transmission to the corporate sector largely depends on the response of, and the changes in, the lending behavior of banks that participated in the three-year LTROs. Corporations with a relationship to a LTRO-bank should, all else being equal, be more affected by the ECB's LTRO intervention, if it indeed had a significant impact. On the one hand, a corporation's relationship to an LTRO bank establishes a direct link to the injected macro-liquidity. On the other hand, these corporations would also be more exposed to additional risk-taking by the LTRO banks and, thus, more concerned about their future financing.

In Table 4, Models (2) and (4), we provide an analysis of the impact of LTRO liquidity injections on corporate investment and employment compensation in the sample of corporations for which we have lender information from Dealscan. *Lender LTRO Uptake* provides a corporate-specific measure of their bank lenders' LTRO uptake. If LTROs are sufficiently effective, we expect that corporations that had an existing borrowing relationship with banks that obtained a significant amount of the LTRO funds are, in general, more likely to be positively affected by the LTRO credit supply shock. However, as shown in Table 4, rather than a positive impact, we find a *negative* and statistically significant coefficient of *Lender LTRO Uptake* for investment, whereas the coefficient of *Lender LTRO Uptake* is positive but statistically insignificant for wages. The results also suggest that the average corporation did not increase its investment, although, in relative terms it may have had direct access to the additional credit supply provided by the ECB.

4.2.3 Robustness with a Shorter Window

Our baseline analyses are conducted in the sample period from 2002, the date of adoption of the Euro, to 2014. However, there are a number of interventions during the pre-LTRO period. In this section, we use a shorter pre-LTRO window and a more balanced sample period from 2009 to 2014 to conduct the same analysis. The results are presented in Appendix Table A5. Models (1) and (2) show the results for corporate investment using the *Country LTRO Uptake* and *Lender LTRO Uptake* measures, respectively. Similar to the findings in the baseline sample, we find a significant negative coefficient of our LTRO measures. The results confirm that corporations decreased their investments after the LTRO liquidity injections, although the magnitudes of the coefficients are lower than the baseline results. In Models (3) and (4), we further conduct the analysis for wage

payments. While we find some evidence of higher corporate wage payments after the LTROs, when using *Country LTRO Uptake*, the results are not significant when using *Lender LTRO Uptake* to capture the liquidity injection impact. Overall, the evidence in the restricted sample is consistent with the baseline case.

4.3 Determinants of LTRO Uptake

In this section, we analyze the determinants of banks' LTRO uptake to understand the negative investment results. The analysis is conducted on a sample of banks with borrowers located in the Eurozone. Specifically, we make use of loan data from SDC Dealscan and investigate all banks with lending relationships to the Eurozone corporations in our sample. Then, based upon hand-collected information on banks' participation in the LTRO interventions, we capture bank borrowing from the ECB's three-year LTROs using two measures: (1) an indicator variable that is equal to one if the bank participated in one of the LTROs, and (2) the natural logarithm of one plus the bank's total borrowing in billion Euros from LTRO I (Dec-2011) and II (Feb-2012).

Drechsler et al. (2016) find that weakly capitalized banks took out more lender-of-last-resort loans. Thus, we add measures for bank risk as determinants of the LTRO uptake. The variable *High Risk Bank* is equal to one, if at the end of 2010, a bank had a CDS spread above the median CDS spread and zero otherwise. In addition, we add *Bank Size*, which is the bank's total assets at the end of 2010, to capture the potential difference in accessing the liquidity injection because of the size effect. Larger banks may have had sufficient collateral to access the LTRO funds. Also, they may have had better access to liquidity injections because they were "too big to fail." Besides bank characteristics, we also add proxies for borrower risk and country risk, which may affect banks' access to, and usage of, LTRO funds. *Borrower Size* refers to the average size (measured by total assets as a natural logarithm) of the banks' borrowers at the end of 2010. Likewise, *Borrower Leverage*, *Borrower Short-term Debt*, and *Borrower Cash Flow* are the average leverage, short-term debt and cash flow of the banks' borrowers at the end of 2010. *Sovereign Risk* is the countries' CDS spread at end-2010, expressed as a natural logarithm.²⁰

We implement our test in a regression framework and the results are presented in Table 5. Panel A focuses on the probability of a bank participating in LTRO liquidity interventions. Panel B reports the determinants of the amounts of the LTRO uptakes. The results indicate that risky banks (*High Risk Bank*) are more likely to borrow, and

²⁰We collect the bank-level measures from Bankscope as well as Markit, while the borrower-related data are based upon the information in our main sample (for details, see Section 3). After combining all the bank-specific data, we end up with 185 banks with all available information to provide us with a balanced dataset.

borrow a greater amount from the LTRO liquidity injections, relative to low risk banks. We also find that large banks access the LTRO injections that much more, which is consistent with our prediction. In addition, banks in riskier countries borrowed more from the LTROs. Compared to bank and country risk measures, the characteristics of the borrowing corporations are less significant in determining the banks' LTRO borrowing probability and the uptake amount. In Table 5, when we further separate banks into GIIPS and non-GIIPS banks, the implications are generally similar. Interestingly, we find that for non-GIIPS banks, bank risk significantly increases the probability of participating in LTRO liquidity injections as well as the amount of LTRO uptake. Overall, we find evidence that banks' participation in LTRO and their LTRO uptake amounts positively relate to bank risk and country risk. This is consistent with the explanation for the decrease in investment following an LTRO, i.e., that corporations took the LTRO uptake as a signal of risk and, consequently, decreased their investments. We further explore the role of bank and country risk in explaining the decrease in corporate investment in Section 5.

4.4 LTRO Residual Effect on Investment

A negative relationship between a banks' LTRO uptake and the corporate investment of its corporate borrowers does not necessarily imply a causal relationship. There might be observed and unobserved omitted variables that affect both a bank's LTRO uptake decision and its corporate investment. For example, from previous analyses, we do find evidence that bank risk and country risk positively relate to bank LTRO uptake. In this subsection, we conduct additional analyses to better understand this causal relationship between a bank's LTRO uptake and the corporate investment of its borrowers.

In an ideal setting, to establish a causal relationship, we would need to identify a shock or an instrument that affects a bank's LTRO uptake decision, but not its corporate borrowers' investment or employment policies. While this is challenging, we alternatively utilize the determinants of the LTRO uptake results, and use the *Lender LTRO Residual* to capture the LTRO impact and isolate the effects due to of bank, country, and corporate characteristics. Specifically, *Lender LTRO Residual* is zero until Q4-2011, and equal to the average bank-specific LTRO residual value obtained from the determinants of the LTRO uptake model of the corporation's related banks, Model (3) of Panel B in Table 5, thereafter. Then, we investigate the impact of *Lender LTRO Residual* on the investment and wage payment decisions. These results are presented in Table 6. We find some evidence that *Lender LTRO Residual* decreased investment, but this is which is only marginally significant at the 10% level, while the impact on wage payments is not significant. Therefore, the results suggest that the causal relationship between the LTRO

liquidity injections and corporate investment is weak. Instead, other factors such as bank risk and country risk may explain both the LTRO uptake decision and the decrease in corporate investment, which we explore further in Section 5.

5. The Granularity of the LTRO Impact on Investment

Our previous evidence suggests that the unconventional ECB liquidity injections were not sufficient to boost corporate investment, but, as a lower bound, these injections may have halted the decline in investment. In this section, we further understand the decrease in investment and investigate the asymmetries in the impact of the LTRO, particularly the setting in which the two LTROs may have stimulated corporate investment. Corporations may have different reactions to the liquidity injection because of corporation-specific, bank-specific, or local country characteristics. In particular, we explore corporations' exposure to the LTRO liquidity shocks to understand the potential of the LTROs for boosting corporate investment. Then, conditional on corporations' access to the LTRO funding, we study the role of bank risk and country risk, which are significant determinants of the bank LTRO uptake as discussed earlier, in shaping corporate investment following the LTROs. Finally, to understand the role of the persistence and strength of liquidity interventions, we also investigate whether the effect of the LTRO intervention varies across banks' LTRO repayment choices and local fiscal policies.²¹

5.1 The Impact of Bank Debt Reliance

The LTRO liquidity injections are conducted through the banking sector, since the expected transmission channel to the real economy is through bank lending. Corporations with greater dependence on bank debt financing are exposed more to, and may benefit more from, these liquidity injections, which may further stimulate corporate investment. However, corporations may view their lenders' LTRO uptake as a signal of bank risk and future financing uncertainty. Corporations may, therefore, borrow as much as possible and even decrease investment because of their own precautionary demand for liquidity, particularly for those with a greater dependence on bank debt.²²

To test this prediction, we construct a proxy for bank debt dependence based on Capital IQ data. Specifically, we separate corporations into the subsamples *High Bank*

²¹In this section, we mainly focus on corporate investment. In general, similar to the baseline results, there is no significant change in wage payments following LTROs, conditional on various characteristics.

²²In Appendix Table A6 and A7, we find evidence that Eurozone corporations, on average, increased leverage and cash holdings after the LTRO liquidity injections. In Appendix Note 2 we provide a detailed discussion of these related results and document that the macro-liquidity injections translate into corporate liquidity.

Debt and *Low Bank Debt*, based upon their bank debt obligations (*Bank Debt*), one year before the first three-year LTRO intervention, i.e., Q4-2010. Next, we run the same subsample analysis for corporate investment. The results are presented in Table 7. In Models (1) and (2), we use the country-specific LTRO uptake measure, *Country LTRO Uptake*. We find negative and significant coefficients for the LTRO uptake measure in both specifications, and the coefficients are quite similar in magnitude for high and low bank-reliant corporations suggesting that the country-based uptake did not have a differential impact for high versus low bank-reliant corporations. In Models (3) and (4), we use the corporate-specific LTRO uptake measure, *Lender LTRO Uptake*. We find a negative coefficient of *Lender LTRO Uptake* for the subsample of corporations with *High Bank Debt*, whereas the coefficient for corporations in the *Low Bank Debt* sample is insignificant. Thus, we find some evidence that corporations with a relatively high reliance on bank debt invest less if their lenders had a high LTRO uptake. This is in line with our previous analysis and conclusions.

Overall, the investment results, conditional on bank debt dependence, presented in this section provide additional evidence that the LTRO intervention did not boost the investment for the average corporate borrower. Instead, corporations with a greater dependence on bank debt and, thus, more exposed to the positive bank liquidity shock, exhibited greater decreases in their investment when their bank lenders had higher LTRO uptakes. In the next section, we explore the roles of bank risk and country risk in explaining the decrease in investment, following the LTRO liquidity injections and, given the corporations' access to the LTRO interventions.

5.2 Bank Risk, Country Risk, and LTRO Impact

The analysis of the determinants of a bank's LTRO uptake in section 4.2 suggests that bank and country risks are significantly and positively related to banks' usage of the ECB's liquidity injections. If bank and country risks are also negatively related to corporate investment, this may explain the decrease in corporate investment after the LTRO liquidity injections. Therefore, we may expect the decrease in investment to be more significant for corporations with risky lenders, and also those in risky countries. In addition, corporations may take the LTRO uptakes as signals of lenders' risks and future financing constraints and may, accordingly, respond by decreasing investment. The signaling role of LTRO uptakes may be more important for corporations with hitherto safe lenders and those in safe countries.

To investigate the roles of bank risk and country risk, we separate corporations into subsamples of *Risky Lender* and *Safe Lender*, based upon the average CDS Spread of their lenders, *Bank Risk*, one year before the first three-year LTRO intervention, i.e., Q4-2010.

Then we conduct analyses of corporate investment in both subsamples. These results are presented in Models (1) and (2) of Table 8. In Panel A, we employ the country-specific *Country LTRO Uptake* measure, while Panel B focuses on the corporate-specific *Lender LTRO Uptake*. As outlined in the table, we find significant decreases in investment after the LTRO uptakes for both the *Risky Lender* and *Safe Lender* subsamples, with a greater decrease for corporations with risky lenders.

To further explore the interaction of bank risk, country risk, and the LTRO impact, we first separate corporations into subsamples based on country risk, i.e., GIIPS and non-GIIPS. GIIPS countries are most affected by the Sovereign Debt Crisis and have a higher country risk, ex ante. The corporations in each subsample are further separated into groups based on their bank lenders' risk. The results are presented in Models (3) to (6) of Table 8. For corporations in GIIPS countries, we find evidence that corporations with risky lenders experienced a greater decrease in investment after the LTRO uptakes, while the change in investment is not significant for those with safe lenders. However, for corporations in non-GIIPS countries, we find a significant decrease in investment after LTRO for both the *Risky Lender* and *Safe Lender* subsamples. We also find that the decrease is greater for corporations with risky bank lenders, which outlines bank risk as the important measure explaining the decrease in investment after the LTRO uptake. Moreover, the LTRO uptake is not only related to previously known bank risk, but may also signal an incremental risk of those that were regarded hitherto as safe lenders. The significant decrease in investment for safe lenders in safe countries is consistent with the signaling role of the LTRO uptake, particularly, for non-GIIPS countries. Overall, the findings in this section confirm the role of bank risk in explaining the decrease in investment following the LTRO uptake, especially given corporations' access to the LTRO funding through their lending relationships.²³

5.3 The Effect of Early Repayment of LTRO Funds

In terms of the transmission of LTRO liquidity to the corporate sector, the impact may vary across countries due to differences in the persistence of the LTRO liquidity shocks. While the LTROs provided a three-year funding opportunity for Eurozone banks, participating banks were given the option to repay, either in part or in full, the amount of their borrowings after one year, without any penalty in order to increase the attractiveness of the unconventional LTROs. Since banks are closely monitored by financial market participants, it is likely that LTRO-participating banks would have chosen to repay the three-year LTRO funds at the early opportunity, either to signal improvements

²³In Appendix Table A8, we investigate the role of lender size. We find evidence of a decrease in investment following the bank lenders' LTRO uptake for corporations with small lenders.

in their individual funding conditions or because of their decreased funding needs during the process of balance sheet adjustment.²⁴

To investigate the role of early repayment, we rely on the end-of-year country-level LTRO data reported by the NCBs to proxy for country-specific LTRO early repayments by banks. Specifically, we use the percentage changes in the country-level LTRO holdings between 2012 and 2013 as a proxy for early repayments of the three-year LTROs across countries (for details, see Appendix Table A9).²⁵ One interesting observation from this measure is that the bank repayments differ for non-GIIPS (core) and GIIPS (periphery) countries. In general, non-GIIPS countries had high LTRO repayment rates. At one extreme, German banks exhibited a 80 percent decrease in their reliance on LTRO funds from 2012 to 2013. Other non-GIIPS countries in our sample (i.e., Austria, the Netherlands, Belgium, and France) also showed a sharp decrease of approximately 64 percent in their balances of LTRO funding during this period. Among GIIPS countries, there are mixed patterns in the LTRO early repayment, with more modest amounts for banks in Portugal (13 percent), Italy (20 percent), and Greece (29 percent), and larger repayments of approximately 45 percent in Spain and Ireland. Based on our proxy for early LTRO repayments, we separate our sample of corporations into three groups: *Low Early LTRO Repayment* (Portugal and Italy)²⁶, *Medium Early LTRO Repayment* (Spain, Ireland, Austria, the Netherlands, Belgium, and France), and *High Early LTRO Repayment* (Germany). Next, we examine the impact of the LTRO intervention on corporate investment for the three different groups.

The results are presented in Table 9. As seen from the table, the impact of the LTRO intervention on corporate policies differs significantly across the early LTRO repayment groups. The decrease in investment is concentrated in corporations in countries with medium early repayment (Spain, Ireland, Austria, the Netherlands, Belgium, France in Panel B). For those in the low early repayment group (Portugal and Italy in Panel A), the change in investment is not significant. However, the German corporations in the high early repayment group (Panel C) *increased* their investments after their banks' LTRO uptake.

In columns (2) and (3) of Table 9, we further investigate whether the impact of the bank-level LTRO uptake and early repayments differ for large and small corporations, i.e., corporations that are relatively less versus more financially constrained. In general, small corporations rely more on bank debt financing, and have fewer capital market

²⁴See ECB Monthly Bulletin, February 2013.

²⁵The NCBs' country-level LTRO data may contain LTROs with other maturities, i.e., three-month and one-year. However, most of the LTROs were of three-year maturity. As discussed in the 2013 annual report of the Bank of Spain, "Most of the decrease in this balance took place in January when institutions availed themselves of the early redemption option offered by three-year refinancing operations."

²⁶Greece had low early repayment, but is not covered by the analysis due to missing bank LTRO data.

alternatives when their bank lenders are financially constrained. On the one hand, when the LTRO uptake improves the funding condition of banks and relaxes corporate financing constraints, small corporations may respond more positively to the LTRO intervention. On the other hand, when the LTRO uptake signals bank risk, small corporations may respond more negatively to their lenders' LTRO uptake. As seen from the table, we again find more negative results for investment for corporations in countries with medium early repayment. For the low early repayment group in Panel A, while large corporations decreased investment with the *Lender LTRO Uptake*, we observe a significant increase in investment for small corporations following the lenders' LTRO uptake. For the high early repayment group in Panel C, the increase in investment after the lenders' LTRO uptake mainly comes from small corporations.

To obtain a complete picture of the corporate policies following LTRO uptake and early repayment, we report the corresponding results for cash, leverage and wage payment policies in Appendix Table A10. For corporations in countries with relatively low early repayments (i.e., Portugal and Italy (Panel A)), we find that corporations increase their leverage and cash holdings with their lenders' LTRO uptake, which is consistent with the transmission of the LTRO funding to the corporate level, as well as precautionary demand for cash. However, there is no increase in leverage and cash for corporations in countries with medium and high early repayment (Panels B and C). These findings are also intuitive, since we expect a lower transmission of funds for high early repayers of LTRO funds. Overall, the results in this section suggests the role of transmission of LTRO funds to the corporate level for low early repayment banks. Apart from Germany, where corporations increased investment despite having experienced no significant increase in leverage, small corporations in Portugal and Italy did benefit from LTRO funding.

5.4 The Role of Fiscal Policy

Fiscal and monetary policies interact closely in reality, and these interactions can lead to very different outcomes than those predicted by the analysis of each policy in isolation (Dixit and Lambertini (2003)). Whereas the ECB has launched a plethora of expansionary monetary interventions since the onset of the European Sovereign Debt Crisis, many Eurozone member states implemented austerity plans to cut government spending, intending to reduce their fiscal deficits and sovereign debt. One feature of the Eurozone economies is that although the ECB determines the common monetary policy for all member countries, each member state's government decides its own fiscal policy. This feature limits the flexibility of economic policymaking and introduces greater complexity to overall economic policies, with attendant spillover effects on product supply and consumer demand in the Eurozone. In particular, fiscal policies that do not support the

Eurosystem-wide monetary policy may offset the positive liquidity shock created by the ECB, because they may weaken the signaling effect by the banks, and potentially hurt the corporations even more. Therefore, we expect the decrease in investment to be more pronounced when there is a lack of coordination between monetary and fiscal policies, i.e., expansionary monetary policy through the LTROs, accompanied by a contractionary fiscal policy in a particular country. However, when there is closer coordination between monetary and fiscal policies, we expect to observe increased corporate investment following the implementation of the ECB's unconventional monetary policy.

To investigate the role of fiscal policy, we analyze the impact of the country-level changes in corporate tax rates and government investment expenditures, as proxies for the country-specific fiscal policies. Accordingly, contractionary fiscal policies involve increasing corporate taxation, decreasing government spending (investment expenditures), or both. Specifically, we measure the changes in tax policy as the country-specific change in the corporate tax rate from one year before to one year after the first LTRO intervention, i.e., the change from Q4-2010 to Q4-2012. Next, we classify corporations into subsamples based on whether their local national government increased, maintained or decreased its corporate tax rate, and conduct our investment analysis within the subsamples of corporations located in *Increased Corporate Tax*, *Unchanged Corporate Tax* and *Decreased Corporate Tax* countries, respectively.²⁷

To account for governments' spending policies, we again use the country-specific change in the government investment expenditures from one year before, to one year, after the first LTRO intervention, i.e., the change from Q4-2010 to Q4-2012. Specifically, we use the median of the ratio of the quarterly government investment expenditures to GDP for each year to classify corporations into subsamples based on whether their national government increased or decreased the amount of investment expenditures between Q4-2010 to Q4-2012. Next, we conduct our investment analysis within the subsamples of corporations located in *Increased Government Investment*, and *Decreased Government Investment* countries, respectively.

The results of our analysis of fiscal policies are presented in Table 10. In Panel A, the analysis is conducted in the baseline Eurozone sample, with *Country LTRO Uptake* as a proxy for monetary policy. As we can see from Models (1) and (5), we find significant negative coefficients for *Country LTRO Uptake* for corporations in countries that increased their corporate taxes or decreased government investments. These results indicate that in countries with relatively contractionary fiscal policies, corporations decreased their investments following the LTRO liquidity injection. Furthermore, for Models (3) and

²⁷During the period Q4-2010 to Q4-2012, France and Portugal increased, and Finland, the Netherlands and Greece decreased their nominal corporate tax rates. The remaining countries did not change their corporate tax rates.

(4), we find some evidence that when governments adopted accommodative fiscal policies in the face of substantial monetary stimulus, corporations actually *increased* their investment along with their local banks' uptake of the LTRO liquidity injections.

In Panel B, we further investigate the interaction of monetary and fiscal policy in the bank-firm-linked sample, with *Lender LTRO Uptake* as a proxy for monetary policy. We again find some evidence that corporations in countries with accommodative fiscal policies increased or had a smaller decrease in investment following the LTRO liquidity injections. However, the results are not as robust as those for the full sample with the *Country LTRO Uptake* used as a proxy for monetary policy, which may indicate the differential impact of the signaling versus the transmission channels of monetary policy: ECB monetary policy can be transmitted as a positive signal to the corporate level *only* if the local government sends an accommodative signal at the same time. In contrast, the actual transmission effect may still be present, but to a much smaller degree, despite accommodative fiscal policies, so long as it is ensured that the corporations actually have access to the additional funds stemming from the ECB operations. Overall, the results in this section provide additional evidence of the potential for increased corporate investment in countries with coordinated monetary and fiscal policies.

6. Conclusion

In this paper we investigate whether, and how, corporate investment is affected by unconventional monetary interventions by analyzing the largest liquidity injections in history. Focusing on the ECB's three-year LTROs, we find that non-Eurozone firms which are not directly affected by LTROs reduced investments more than Eurozone firms. Such a counterfactual analysis suggests that LTROs helped Eurozone corporations to decelerate their investment decline. However, non-financial corporations in the Eurozone did not increase their investments after these massive liquidity injections. The investment of these corporations are negatively associated with the amount of funds their banks obtained from the ECB. Banks' LTRO uptake amounts are positively related to their own credit risk.

We further investigate the role of bank risk in explaining the decrease in corporate investment following the LTROs. We find that corporations with a greater exposure to bank debt and those with risky lenders exhibit greater decrease in investment following their lenders' LTRO uptakes. The results suggest that bank risk and the signaling role of the banks' LTRO uptake might have impeded the transformation of liquidity injection into real economic outputs. In addition, we find that the negative investment effect of the unconventional LTROs varies across LTRO repayment choices that relate to the

persistence of the LTRO interventions. Smaller corporations whose lenders' held the LTRO funds for a longer period did increase investment following their lenders' LTRO uptake. Furthermore, we find that when governments adopted more accommodative fiscal policies at the same time, corporate investment increased in response to their lenders' LTRO uptakes.

While our results suggest that liquidity injections can decelerate economic decline, our study outlines the significance of bank and country characteristics that impede the effectiveness of unconventional monetary policies in improving real economic output. When bank balance sheets are stressed, it would be difficult to stimulate corporate investment by just injecting liquidity into poorly capitalized banks. Fiscal policies and other unconventional monetary policies, including the more aggressive Targeted LTRO, may have resulted in different outcomes, but they too should be carefully discussed and analyzed. We leave these issues for future study once additional data become available.

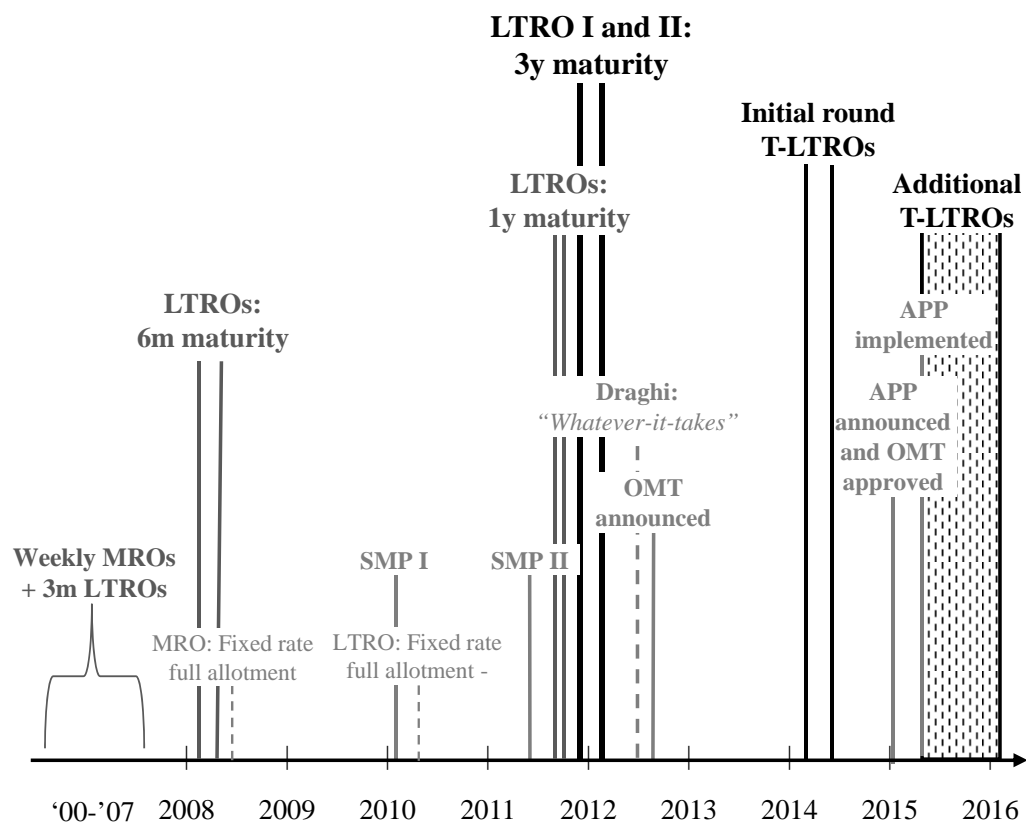


Figure 1
ECB's unconventional monetary policies

This figure outlines the timeline of recent unconventional monetary policies implemented by the European Central Bank (ECB). *MRO* labels the standard Marginal Refinancing Operations that are conducted on a weekly basis. *LTROs* refers to Longer-Term Refinancing Operations, while *TLTROs* refers to the recently introduced Targeted Longer-Term Refinancing Operations. *SMP*, the Securities Markets Program, was more recently replaced by the Outright Monetary Transactions (*OMT*) program. *APP* represents the most recently introduced Asset Purchase Program, that is still under way. The "whatever-it-takes" event refers to a speech made by Mario Draghi, the President of the ECB, at the Global Investment Conference, London, 26 July 2012.

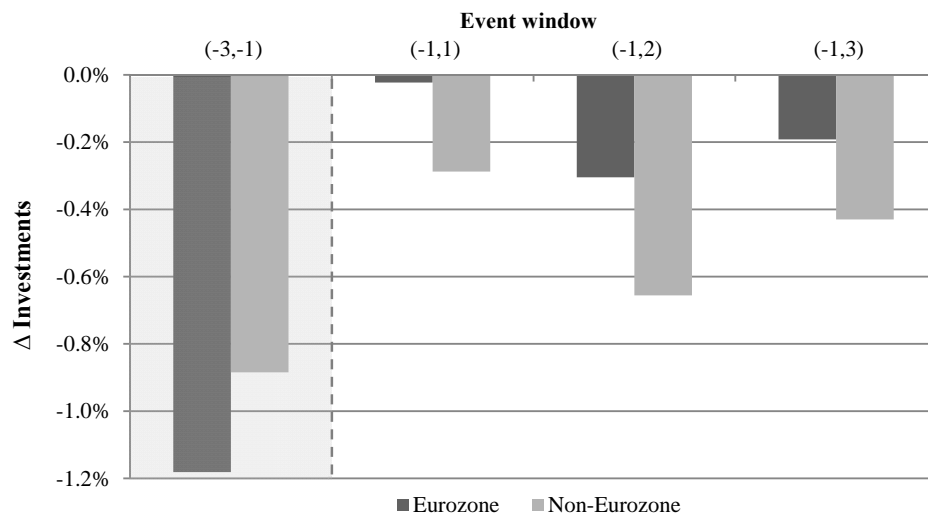


Figure 2
Time series of corporate investment before and after the LTRO intervention in Europe

This figure plots the changes in the investment ratios for Eurozone and non-Eurozone corporations, from before the financial crisis (Q2-2008) before the three-year LTRO interventions (Q2-2011), respectively from before (Q2-2011) to one (Q4-2012), two (Q4-2013) and three (Q4-2014) years after the three-year LTRO interventions. Specifically, the figure outlines the average of corporations' investment ratios. Our measure for corporate investment is *Investments*, which is the corporate capital expenditure, scaled by total assets. The overall sample of corporations is taken from Compustat Global and is restricted to EU countries. For details, please see Appendix Table A1.

Table 1
Liquidity injection from the ECB's three-year Longer-Term Refinancing Operations

	LTRO I: Dec-2011	LTRO II: Feb-2012	Total LTRO Borrowing	Country LTRO Uptake	Bank LTRO Uptake
Country	EUR bn (1)	EUR bn (2)	EUR bn (3)	% of Gov. Debt (4)	% of Bank Size (5)
Austria	3.66	7.83	11.49	4.82	7.10
Belgium	45.28	43.71	88.99	25.02	12.30
France	5.59	6.52	12.12	0.61	3.40
Germany	12.25	13.13	25.38	1.67	6.70
Greece	60.94 [§]	n.a.	60.94	25.54	n.a.
Ireland	21.91	17.62	39.52	22.33	11.50
Italy	172.08	128.11	300.20	15.92	13.40
Netherlands	8.86	1.96	10.81	2.58	9.80
Portugal	24.54	24.76	49.30	29.37	11.80
Spain	153.21	165.53	318.74	51.44	15.70
Total	508.32	409.17	917.49		

This table presents data on the liquidity injections that Eurozone countries obtained from the three-year Longer-Term Refinancing Operations (LTROs) initiated by the European Central Bank (ECB) on December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II), respectively. *Total LTRO Borrowing* refers to the total amount that banks in the respective country obtained through LTRO I and II, with the numbers given in billion EUR. In column 4, we scale the *Total LTRO Borrowing* for each country by the country's central government debt obligations, as of December 2011. In column 5, we report the average LTRO borrowing by banks, scaled by the banks' total assets in 2010, in the respective country. The information about the bank and country-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The data on banks' total assets are obtained from Bankscope and available public financial reports, while the information for government debt by country is obtained from the World Bank Database.

[§]In the case of Greece, we only have information about the total LTRO amount which, besides the three-year LTROs, also includes the standard one-month and three-month LTROs. As we cannot separate the latter, the number is not directly comparable to the uptake numbers for the other countries.

Table 2
Summary statistics

<i>Panel A: Main sample</i>												
Country	DEU	FRA	ITA	GRC	NLD	FIN	ESP	BEL	AUT	IRL	PRT	Total
Investments	3.31	3.05	2.47	2.48	3.11	3.39	3.29	3.85	5.41	2.56	3.16	3.12
Wages	1.85	1.86	2.30	1.19	2.88	2.16	3.30	2.10	3.15	1.30	2.77	2.07
Cash	10.07	10.23	6.96	4.15	6.82	8.06	7.08	8.01	8.85	11.37	4.00	8.29
Leverage	16.40	19.06	27.63	33.97	22.80	23.86	28.33	22.42	22.35	21.28	40.2	22.07
Net Debt	55.58	59.01	64.26	60.54	58.65	57.39	63.95	56.70	55.96	55.04	73.59	59.01
Short-term Debt	0.05	0.06	0.11	0.16	0.05	0.07	0.08	0.05	0.08	0.03	0.14	0.07
Bank Debt	11.36	9.97	20.99	21.78	13.38	15.49	22.47	11.43	14.23	12.56	22.58	14.54
Firm Size	4.53	4.59	5.70	4.84	6.32	4.99	6.42	5.15	5.44	5.69	5.92	5.02
Market to Book	120.0	121.6	114.4	95.2	128.9	125.9	123.4	114.7	114.7	128.9	106.9	117.9
Cash Flow	4.84	3.57	3.07	1.62	5.80	7.21	5.89	4.81	5.36	2.90	2.96	4.10
Industry Sigma	7.61	5.69	3.20	3.07	5.53	4.43	2.59	4.48	3.30	4.55	2.97	4.85
Net Working Capital	6.17	1.90	0.85	5.11	2.13	3.75	-2.08	-0.58	3.38	0.55	-7.76	2.75
R&D/Sales	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00
Acquisition Activity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# N	31333	30712	10825	9810	6594	6000	5443	4939	3376	2519	2392	113943
# Firms	837	837	285	233	190	143	136	124	92	75	57	3009

<i>Panel B: Sample with existing loan information from LPC Dealscan</i>												
Country	DEU	FRA	ITA	GRC	NLD	FIN	ESP	BEL	AUT	IRL	PRT	Total
Investments	3.92	3.34	2.97	3.45	3.25	3.76	3.26	4.06	5.82	2.98	5.61	3.55
Wages	3.10	3.62	3.34	2.35	3.83	3.93	3.96	2.90	3.76	2.01	4.12	3.43
Cash	8.49	8.97	7.36	4.44	6.84	5.41	6.71	6.73	8.20	9.49	4.17	7.65
Leverage	22.0	24.3	30.3	42.6	25.1	27.8	32.6	26.8	26.4	30.2	39.0	26.5
Net Debt	60.7	63.4	69.2	66.4	62.0	60.1	66.9	61.4	55.4	62.5	72.5	62.9
Short-term Debt	0.05	0.05	0.10	0.15	0.04	0.08	0.08	0.05	0.08	0.03	0.08	0.06
Bank Debt	10.3	9.62	21.0	23.0	12.7	13.0	25.3	11.6	17.3	13.6	11.8	13.4
Firm Size	6.32	6.82	6.60	5.90	7.21	6.83	7.09	6.52	6.53	7.18	7.82	6.72
Market to Book	119	120	115	98.5	130	121	118	115	122	143	121	119
Cash Flow	4.93	4.07	3.71	2.12	5.74	6.77	6.08	5.17	5.71	3.12	5.94	4.72
Industry Sigma	6.43	5.04	3.01	2.75	4.50	4.07	2.53	4.76	3.30	2.80	2.78	4.44
Net Working Capital	5.93	-2.3	-0.4	0.43	1.72	3.64	-1.6	-2.6	8.06	0.36	-8.4	1.11
R&D/Sales	0.02	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.43	0.00	0.00	0.00
Acquisition Activity	0.00	0.00	0.00	0.00	0.21	0.03	0.00	0.00	0.00	0.00	0.00	0.00
# N	1076	1000	3700	2015	3816	2473	2993	2039	1084	1232	475	4059
# Firms	245	238	93	43	101	54	70	43	24	32	10	953
# LTRO-Bank Rel.	122	111	57	9	52	18	48	25	11	16	7	476

<i>Panel C: Country-specific measures</i>												
Country	DEU	FRA	ITA	GRC	NLD	FIN	ESP	BEL	AUT	IRL	PRT	Total
Sovereign Risk	10.55	11.71	52.00	56.40	29.95	13.09	50.74	24.96	10.35	27.89	36.86	17.62
Sovereign Export	42.25	27.12	26.21	22.10	69.27	39.08	25.51	76.44	51.00	90.48	29.91	31.12
Corporate Tax	30.17	35.42	31.40	29.00	25.50	26.00	30.00	33.99	25.00	12.50	29.00	34.43
Gov. Investments	8.68	15.81	11.69	19.42	15.69	15.13	16.45	8.65	11.73	13.72	14.80	14.26
Gov. Debt	67.06	67.01	105.9	126.6	50.27	41.69	50.08	101.8	73.17	32.54	69.23	69.88

This table provides sample averages (medians) of corporate characteristics for each country in our samples of Eurozone corporations. Panel A outlines the summary statistics for the main data sample, while Panel B shows the summary statistics for the sample Eurozone corporations, for which we also have loan information from LPC Dealscan. In Panel C, we show summary statistics for country-specific measures used in our analysis. The sample period for each country is 2002-2014, and the variables are based on quarterly observations. For the specific definition of each variable we refer to Appendix Table A3. The corporate fundamental data are obtained from Compustat Global, while country-specific data are obtained from Markit, the World Bank, as well as the ECB Statistical Data Warehouse. For any data unavailable for a specific quarter, we replace the missing values with yearly observations. Ratios are given in percentages.

Table 3
Counterfactual analysis of the LTRO effect: Eurozone versus Non-Eurozone

<i>Panel A: Investments</i>			
	Investments	Investments	
	Full sample (1)	Risky Sovereign (2)	Safe Sovereign (3)
Post-LTRO	-0.491*** (0.09)	-0.345* (0.19)	-0.634*** (0.10)
Post-LTRO × Non-Eurozone	-0.606*** (0.05)	-0.870*** (0.13)	-0.422*** (0.06)
Cash Flow	0.002 (0.00)	0.012*** (0.00)	-0.002** (0.00)
Market to Book	0.004*** (0.00)	0.006*** (0.00)	0.003*** (0.00)
Firm Size	0.086*** (0.02)	0.149*** (0.05)	0.065** (0.02)
Leverage	-0.013*** (0.00)	-0.019*** (0.00)	-0.008*** (0.00)
Rated	0.070 (0.11)	0.203 (0.26)	0.042 (0.12)
Country Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.586	0.525	0.617
<i>N</i>	149798	37088	107834

<i>Panel B: Employment</i>			
	Wages	Wages	
	Full sample (1)	Risky Sovereign (2)	Safe Sovereign (3)
Post-LTRO	-0.096** (0.04)	-0.083 (0.05)	-0.063 (0.06)
Post-LTRO × Non-Eurozone	-0.070*** (0.02)	-0.099*** (0.03)	-0.116*** (0.03)
Cash Flow	-0.006*** (0.00)	-0.010*** (0.00)	-0.005*** (0.00)
Market to Book	0.000*** (0.00)	0.000** (0.00)	0.000*** (0.00)
Firm Size	0.703*** (0.01)	0.736*** (0.02)	0.684*** (0.01)
Leverage	-0.001** (0.00)	-0.002** (0.00)	-0.000 (0.00)
Rated	0.157** (0.06)	0.312*** (0.07)	0.100 (0.07)
Country Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.772	0.832	0.769
<i>N</i>	91049	19222	69184

This table presents estimates of the “counterfactual” effect of the liquidity uptake from the ECB’s three-year Longer-Term Refinancing Operations (LTROs), on corporate policies, in a sample of corporations located in the European Union (EU), both either inside or outside the Eurozone. Our measure for investment is *Investments*, which is the corporation’s capital expenditure, scaled by total assets. The variable *Post-LTRO* is a dummy variable equal to one, for year-quarter observations after the ECB had implemented the first three-year LTRO intervention (Q4-2011). The variable *Post-LTRO* × *Non-Eurozone* is the interaction variable between the non-Eurozone dummies and LTRO intervention and captures the effect of the liquidity intervention on corporate policies in non-LTRO countries (“counterfactual” effect) accordingly, which equals one for non-Eurozone corporations after the first LTRO intervention (for details see Appendix A1). In Model (1), we use the full sample of corporations. In Models (2) and (3), corporations are separated into high and low-risk sovereigns, based on their location and the respective country’s CDS spreads. *Risky* (*Safe*) *Sovereign* is defined as a CDS spread above (below) the median in the pre-intervention and crisis period (2009 and 2010). In Panel A and Panel B, we present the estimates from our analysis of corporate investment and wages, respectively. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 4
LTRO uptake effect on investment and employment: Eurozone firms

	Investments		Wages	
	(1)	(2)	(3)	(4)
Country LTRO Uptake	-1.276*** (0.24)		-0.140 (0.08)	
Lender LTRO Uptake		-0.514*** (0.11)		0.019 (0.05)
Cash Flow	0.009*** (0.00)	0.018*** (0.00)	-0.004*** (0.00)	-0.003* (0.00)
Market to Book	0.004*** (0.00)	0.003*** (0.00)	0.000*** (0.00)	0.001*** (0.00)
Firm Size	0.124*** (0.03)	-0.037 (0.04)	0.677*** (0.01)	0.717*** (0.03)
Leverage	-0.016*** (0.00)	-0.022*** (0.00)	-0.001*** (0.00)	-0.003*** (0.00)
Rated	0.313*** (0.12)	0.507*** (0.12)	0.101* (0.06)	-0.175** (0.08)
Sovereign Risk	-0.301*** (0.03)	-0.298*** (0.03)	0.011 (0.01)	0.066** (0.03)
Sovereign Export	-0.014*** (0.00)	-0.028*** (0.00)	0.003 (0.00)	-0.001 (0.00)
Time FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
<i>R</i> -square	0.568	0.602	0.787	0.713
<i>N</i>	86392	32725	51997	19667

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on corporate investment and employment compensation in a sample of corporations located in the Eurozone. Our measure for investment is *Investments*, which is the corporations' capital expenditure, scaled by total assets. Our measure for employment compensation is *Wages*, which is the corporations' total salaries and wages, given in logarithms. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and is equal to the countries' total LTRO uptake amount, scaled by the countries' central government debt, afterwards. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The loan information data is obtained from LPC Dealscan. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 5
Determinants of banks' LTRO borrowing

<i>Panel A: Bank-specific LTRO borrowing indicator</i>					
	LTRO Borrowing Indicator _{<i>j,11/12</i>}			LTRO Borrowing Indicator _{<i>j,11/12</i>}	
	All Banks (1)	All Banks (2)	All Banks (3)	GIIPS Banks (4)	Non-GIIPS Banks (5)
High Risk Bank _{<i>j,10</i>}	1.237*** (0.358)	1.584*** (0.424)	1.414*** (0.446)	1.053 (0.833)	3.032*** (1.076)
Bank Size _{<i>j,10</i>}	0.174** (0.080)	0.388*** (0.111)	0.538*** (0.134)	1.266*** (0.345)	0.551** (0.264)
Borrower Size _{<i>j,10</i>}		-0.11 (0.264)	-0.18 (0.281)	-0.62 (0.511)	-0.21 (0.704)
Borrower Leverage _{<i>j,10</i>}		0.034 (0.023)	0.016 (0.026)	0.038 (0.050)	-0.01 (0.066)
Borrower Short-term Debt _{<i>j,10</i>}		-7.66 (4.689)	-9.08* (5.284)	-15.3* (9.235)	-49.3* (26.50)
Borrower Cash Flow _{<i>j,10</i>}		-0.26** (0.117)	-0.21* (0.114)	-0.52** (0.231)	0.060 (0.200)
Sovereign Risk ₁₀			1.269*** (0.405)	1.986 (2.787)	0.174 (0.898)
Pseudo <i>R</i> -square	0.085	0.222	0.280	0.501	0.417
<i>N</i>	185	155	155	80	75

<i>Panel B: Bank-specific LTRO borrowing amount</i>					
	Log(1 + Total Bank LTRO Borrowing)			Log(1 + Total Bank LTRO Borrowing)	
	All Banks (1)	All Banks (2)	All Banks (3)	GIIPS Banks (4)	Non-GIIPS Banks (5)
High Risk Bank _{<i>j,10</i>}	0.782*** (0.18)	0.789*** (0.19)	0.621*** (0.19)	0.450* (0.26)	0.502** (0.21)
Bank Size _{<i>j,10</i>}	0.061*** (0.00)	0.174*** (0.03)	0.248*** (0.04)	0.484*** (0.06)	0.099** (0.03)
Borrower Size _{<i>j,10</i>}		-0.138** (0.05)	0.033 (0.06)	-0.028 (0.13)	-0.107 (0.07)
Borrower Leverage _{<i>j,10</i>}		0.012 (0.00)	0.005 (0.00)	0.002 (0.01)	0.006 (0.00)
Borrower Short-term Debt _{<i>j,10</i>}		-2.969** (1.42)	-1.818 (1.38)	-2.797 (1.98)	-3.485* (1.99)
Borrower Cash Flow _{<i>j,10</i>}		-0.045 (0.03)	-0.028 (0.02)	-0.067** (0.03)	0.005 (0.04)
Sovereign Risk ₁₀			0.486*** (0.12)	0.728** (0.28)	-0.023 (0.11)
<i>R</i> -square	0.418	0.447	0.500	0.750	0.293
<i>N</i>	185	155	155	80	75

This table presents estimates of the effect of bank, country and borrower measures on banks' borrowings from the ECB's three-year Longer-Term Refinancing Operations (LTROs) in a sample of banks with borrowers located in the Eurozone. In Panel A, our measure for banks' LTRO borrowings is *LTRO Borrowing Indicator*, which is an indicator that is equal to one, if the bank participated in one of the LTROs. In Panel B, our measure for banks' LTRO borrowings is *Log(1 + Total Bank LTRO Borrowing)*, which is the natural logarithm of 1 plus the banks' total borrowing from LTRO I (Dec-2011) and II (Feb-2012). We regress the bank LTRO borrowing measures on a set of control variables. *High Risk Bank* is a dummy variable equal to one, if the bank at the end of 2010 had a CDS spread above the median CDS spread, and zero otherwise. *Bank Size* is the banks' total assets at the end of 2010, given in natural logarithm. *Borrower Size* refers to the average size (measured by total assets given in natural logarithm) of the banks' borrowers at the end of 2010. Likewise, *Borrower Leverage*, *Borrower Cash Flow* and *Borrower Short-term Debt* is the average leverage, cash flow and short-term debt of the banks' borrowers at the end of 2010. *Sovereign Risk* is the countries' CDS spread at the end of 2010, given in natural logarithm. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 6
Lender LTRO residual effect on investment and employment

	Investments	Wages
	(1)	(2)
Lender LTRO Residual	-0.146* (0.07)	0.021 (0.04)
Cash Flow	0.027*** (0.00)	-0.004 (0.00)
Market to Book	0.004*** (0.00)	0.001*** (0.00)
Firm Size	-0.148** (0.06)	0.647*** (0.04)
Leverage	-0.022*** (0.00)	-0.006*** (0.00)
Rated	0.456*** (0.12)	-0.155* (0.09)
Sovereign Risk	-0.299*** (0.05)	0.095** (0.04)
Sovereign Export	-0.050*** (0.00)	-0.009* (0.00)
Time FE	Y	Y
Firm FE	Y	Y
<i>R</i> -square	0.621	0.680
<i>N</i>	20097	12247

This table presents estimates of the residual effect of lenders' liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on corporate investment and employment compensation in a sample of corporations located in the Eurozone. Our measure for investment is *Investments*, which is the corporations' capital expenditure, scaled by total assets. Our measure for employment compensation is *Wages*, which is the corporations' total salaries and wages, given in logarithms. The variable *Lender LTRO Residual* is zero until Q4-2011, and equal to the bank specific LTRO residual value obtained from the regression analysis from Table 5, Panel B, Model (3), of the corporate-related banks, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The loan information data are obtained from LPC Dealscan. We also include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 7
LTRO effect on Investment: The role of corporations' bank debt reliance

	Investments		Investments	
	High Bank Debt (1)	Low Bank Debt (2)	High Bank Debt (3)	Low Bank Debt (4)
Country LTRO Uptake	-0.812** (0.37)	-0.832** (0.33)		
Lender LTRO Uptake			-0.891*** (0.16)	0.279 (0.17)
Cash Flow	0.014*** (0.00)	0.007*** (0.00)	0.026*** (0.00)	0.015*** (0.00)
Market to Book	0.006*** (0.00)	0.003*** (0.00)	0.004*** (0.00)	0.002*** (0.00)
Firm Size	0.175*** (0.06)	0.086** (0.04)	-0.011 (0.07)	-0.037 (0.06)
Leverage	-0.018*** (0.00)	-0.012*** (0.00)	-0.018*** (0.00)	-0.020*** (0.00)
Rated	0.618** (0.30)	0.136 (0.12)	0.710** (0.27)	0.316** (0.12)
Sovereign Risk	-0.353*** (0.05)	-0.227*** (0.03)	-0.467*** (0.06)	-0.145*** (0.05)
Sovereign Export	-0.012 (0.01)	-0.019*** (0.00)	-0.029** (0.01)	-0.024*** (0.00)
Time FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
<i>R</i> -square	0.525	0.563	0.601	0.594
<i>N</i>	31262	45556	12710	17797

This table presents estimates of the effect of the corporate reliance on bank debt and the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs), on corporate investment, in a sample of corporations located in the Eurozone. Our measure for investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. *Bank Debt* is the debt from bank loans, divided by total assets. In Models (1) and (2), and Models (3) and (4), corporations are separated into those with *High* and *Low Bank Debt* ratios, based upon their bank debt ratios one year before the first three-year LTRO intervention (Q4-2010). The variable *Country LTRO Uptake* is equal to zero, until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate's related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 8
LTRO effect on investment: The role of lender characteristics

<i>Panel A: Country LTRO uptake and lenders' credit risk</i>						
	Investments		Investments			
	Risky Lender (1)	Safe Lender (2)	GIIPS		Non-GIIPS	
			Risky Lender (3)	Safe Lender (4)	Risky Lender (5)	Safe Lender (6)
Country LTRO Uptake	-2.699*** (0.47)	-2.313** (0.93)	-1.721** (0.77)	0.993 (0.77)	-9.994*** (1.67)	-4.540*** (1.37)
Controls	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
<i>R</i> -square	0.617	0.633	0.589	0.619	0.650	0.636
<i>N</i>	9819	10494	3905	965	5914	9529

<i>Panel B: Lender LTRO uptake and lenders' credit risk</i>						
	Investments		Investments			
	Risky Lender (1)	Safe Lender (2)	GIIPS		Non-GIIPS	
			Risky Lender (3)	Safe Lender (4)	Risky Lender (5)	Safe Lender (6)
Lender LTRO Uptake	-0.707*** (0.18)	-0.418*** (0.14)	-0.496* (0.27)	-0.995 (0.27)	-0.874*** (0.24)	-0.433*** (0.14)
Controls	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
<i>R</i> -square	0.616	0.633	0.588	0.619	0.649	0.636
<i>N</i>	9819	10494	3905	965	5914	9529

This table presents estimates of the effect of bank characteristics and the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs), on corporate investment, in a sample of corporations located in the Eurozone. Our measure for investment is *Investments*, which is the corporations' capital expenditure, scaled by total assets. We separate corporations into *Risky* and *Safe Lender*. *Risky (Safe) Lender* is a dummy variable equal to one if the corporations' lenders one year before the first three-year LTRO intervention, i.e., Q4-2010, on average had a CDS spread above (below) the median, and zero otherwise. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 9
LTRO effect on investment: The role of banks' early repayment of LTRO

<i>Panel A: Low early LTRO repayment</i>			
	Investments	Investments	
	Full Sample	Large Corporations	Small Corporations
	(1)	(2)	(3)
Lender LTRO Uptake	-1.006 (1.05)	-2.852*** (0.93)	11.687*** (3.98)
Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.556	0.611	0.535
<i>N</i>	4876	2343	2533
<i>Panel B: Medium early LTRO repayment</i>			
	Investments	Investments	
	Full Sample	Large Corporations	Small Corporations
	(1)	(2)	(3)
Lender LTRO Uptake	-0.537*** (0.11)	-0.405*** (0.12)	-0.626** (0.25)
Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.644	0.687	0.582
<i>N</i>	16900	10006	6894
<i>Panel C: High early LTRO repayment</i>			
	Investments	Investments	
	Full Sample	Large Firms	Small Firms
	(1)	(2)	(3)
Lender LTRO Uptake	10.809** (4.40)	5.338 (5.67)	21.035*** (7.24)
Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.558	0.582	0.548
<i>N</i>	8812	4251	4561

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) by loan-related banks, and LTRO repayment policies on corporate policies, in a subsample of Eurozone corporations with existing loan information in LPC Dealscan. Our measure for corporate investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. In Panels A through Panels C corporations are separated based on their location and the respective country's LTRO repayment policy, compared to the initial *Country LTRO Uptake*. *Low (Medium, High) Early LTRO Repayment* is defined as a LTRO repayment ratio from 2012 to 2013, i.e., at the first possible LTRO repayment date, that is below 30% (between 30% and 70%, above 70%). The sample period is 2002-2014, and based on quarterly observations. In all models, we include base corporate-level financial variables in addition to macro-economic variables. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table 10
LTRO effect on investment: The role of fiscal policy

<i>Panel A: Eurozone sample</i>					
	Investments			Investments	
	Increased Corp. Tax (1)	Unchanged Corp. Tax (2)	Decreased Corp. Tax (3)	Increased Gov. Investment (4)	Decreased Gov. Investment (5)
Country LTRO Uptake	-9.899*** (1.46)	-1.343*** (0.30)	14.115* (9.59)	1.404* (0.72)	-1.797*** (0.29)
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
<i>R</i> -square	0.626	0.554	0.531	0.576	0.562
<i>N</i>	25926	44138	16328	39965	46427

<i>Panel B: Eurozone sample with existing loan information</i>					
	Investments			Investments	
	Increased Corp. Tax (1)	Unchanged Corp. Tax (2)	Decreased Corp. Tax (3)	Increased Gov. Investment (4)	Decreased Gov. Investment (5)
Lender LTRO Uptake	0.182 (0.16)	-1.034*** (0.16)	7.920* (4.43)	-0.409*** (0.14)	-0.569** (0.24)
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
<i>R</i> -square	0.665	0.577	0.604	0.607	0.601
<i>N</i>	9041	17602	6082	13942	18783

This table presents estimates of the effect of fiscal policy and the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on corporate investment. Our measure for corporate investment is *Investments*, which is the corporate capital expenditure, scaled by total assets. Panel A shows the results based upon a sample of corporations located in the Eurozone and using the country-specific LTRO uptake. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. Panel B shows the results based upon a subsample of Eurozone corporations with existing loan information in LPC Dealscan, and using the lender-specific LTRO uptake. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. In Models (1) to (3), corporations are separated into those with increased, unchanged and decreased corporate tax rates (*Increased (Unchanged, Decreased) Corporate Tax*), based on the home countries' (absolute) change of the corporate tax rate between Q4-2010 and Q4-2012, i.e., around the first LTRO. The corporate tax rate data are given on a quarterly basis. In Models (4) and (5), corporations are separated into those with increased and decreased government investments (*Increased (Decreased) Government Investment*), based on the home countries' (relative) change in the government investment expenditures to GDP ratio between Q4-2010 and Q4-2012, i.e., around the first LTRO. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Appendices

Appendix Note 1: Background on ECB's open market operations

The ECB open market operations are aimed “to steer short-term interest rates, to manage the liquidity situation and to signal the monetary policy stance in the euro area” and can be classified into regular open market operations and non-standard monetary policies.²⁸ Regular open market operations consist of main refinancing operations (MROs) and three-month longer-term refinancing operations (three-month LTROs). MROs are the ECB's primary, regular open market operations and refer to regular one-week liquidity-providing reverse transactions. In October 2008, the ECB switched to a fixed-rate full allotment mode such that Eurozone banks were then able to obtain unlimited short-term liquidity at a fixed rate, provided they pledged sufficient eligible collateral. To provide additional, longer-term refinancing, the ECB also offers three-month LTROs which in 2003 amounted to 45 billion EUR (about 20 percent of the overall liquidity provided by the ECB). In recent years, the regular open market operations have been complemented by a set of non-standard monetary policies. On 28 March 2008, the ECB announced two six-month LTROs (allotted on 2 April and 9 July 2008), which were both present for the amount of 25 billion EUR. The three- and six-month LTROs were carried out through a variable-rate standard tender procedure. In June 2010, the ECB Governing Council decided to adopt a fixed-rate tender procedure with full allotment in the regular three-month LTROs (allotted on 28 July, 25 August, and 29 September 2010). On 6 October 2011, the ECB further announced two twelve-month LTROs as fixed-rate tender procedures with full allotment. These were conducted in addition to the regular and special term refinancing operations in October and December 2011, respectively.

On 8 December 2011, to increase the ECB's support for the Eurozone banking sector and to improve the real economy, two three-year LTROs were announced. The LTROs were allotted on 21 December 2011 (LTRO I) and 29 February 2012 (LTRO II) and settled with maturities on 29 January 2015 and 26 February 2015, respectively. The interest rate on the two long-term loans was the average MRO rate over the life of the operation and approximately 1 percent. The three-year LTROs eased credit conditions, not only by allowing banks to borrow unlimited funds for three years (given the provision of eligible collateral) but also by assisting banks with the management of their “gap risk”, i.e., increasing banks' ability to match the tenor of their assets and liabilities. Prior to the LTROs, many banks were only able to secure overnight funding. To increase the attractiveness of the unconventional LTROs, participating banks were given the option to repay part or the full amount of their borrowings after one year without any penalty, i.e., as of 25 January (LTRO I) and 22 February (LTRO II) 2013, respectively. While banks used the LTROs loans to rollover previous and to obtain new central bank borrowing, it was stated, that “there is no limit on what the banks can do with the money”.²⁹

In total, 523 credit institutions participated in LTRO I and were provided with 489.2 billion EUR amounting to a net injection of 210 billion EUR. As outlined by Fitch Ratings (2012), the participants in LTRO I can roughly be divided into two groups. On the one hand, banks from the periphery countries were highly active due to their actual capital needs, as the LTROs provided them with their only option for accessing medium-term funding. On the other hand, the unconventional LTROs simply provided an opportunity to replace shorter-term funds with

²⁸For details about the financial instruments that are used to achieve open market transactions, see <https://www.ecb.europa.eu/mopo/implement/html/index.en.html>.

²⁹Source: http://www.nytimes.com/2011/12/22/business/a-central-bank-doing-what-central-banks-do.html?_r=0.

1 percent three-year borrowing for the banks. Following the ECB, 45.72 billion EUR of the total uptake was used to replace the twelve-month allotment that had taken place in October 2011, and many of the 123 counter-parties were located in highly rated, safe countries such as France and Germany.³⁰ In particular, the banks that placed the highest bids were those that had 1) the highest upcoming rollover needs and 2) the lowest maturity structures. However, it was also claimed that certain banks avoided the LTROs due to concerns that participating banks would be stigmatized as troubled institutions.³¹ Since a considerable portion of the banks' collateral was already pledged at the ECB at the time of the first allotment, the central banks relaxed the collateral requirements to encourage uptake in LTRO II.³² In the end, LTRO II provided a liquidity injection of 529.5 billion EUR (310 billion EUR in net terms) to 800 credit institutions. Table 1 provides the LTRO amounts by country.

In June 2014, to “further ease private sector credit conditions and stimulate bank lending to the real economy”, the ECB announced targeted LTROs (TLTROs) that provide financing to credit institutions with maturity of up to four years. Under the TLTRO, counter-parties are only allowed to borrow an amount that is capped in accordance with their corporate lending. In September and December 2014, the ECB initially introduced two successive TLTROs, in which counterparties were able to borrow in accordance with their initial allowance, at a rate equal to a 10 basis point spread over the MRO rate. In the series of four rounds of TLTRO conducted between March 2015 and June 2016, the ECB eliminated this excess MRO spread. The TLTROs will all mature on 26 September 2018, while the voluntary early repayment depend on the actual settlement dates.

In addition to the refinancing operations, the ECB implemented several outright asset purchase programs (APP) since 2009. Under the expanded APP, the ECB purchases marketable debt instruments from both the public and private sectors to inject liquidity into the banking system, with a monthly purchase target of initially 60, and currently, 80 billion EUR. The active APP consists of the third covered bond (CBPP3), asset-backed securities (ABSPP), and public sector (PSPP) purchase programs that were initiated on 20 October 2014, 21 November 2014, and 9 March 2015, respectively. These programs were intended to be carried out “until the end of March 2017 and in any case until the Governing Council sees a sustained adjustment in the path of inflation that is consistent with its aim of achieving inflation rates below, but close to, 2 percent over the medium term.” Besides the still-active APPs, there have been several terminated APP programs in the past years. CBPP was active from July 2009 to June 2010 and reached a nominal amount of 60 billion Euro. CBPP2 followed from November 2011 to October 2012 with a nominal amount of 16.4 billion Euro. The Securities Market Program (SMP) was started in May 2010 with the aim of “addressing the severe tensions in certain market segments which had been hampering the monetary policy transmission mechanism” and provided liquidity in selected secondary sovereign bond markets. In September 2012, SMP was replaced by outright monetary transactions (OMT), a bailout funding program of the European Stability Mechanism (ESM).³³

³⁰Source: ECB Monthly Bulletin, January 2012.

³¹See, for instance, <http://www.zerohedge.com/contributed/ltro-users-manual>.

³²For instance, the rating threshold was reduced for certain asset-backed securities (ABS), and rated corporate loans were allowed to be used as collateral under given circumstances.

³³Previous the European Financial Stability Facility and European Financial Stabilization Mechanism.

Appendix Note 2: Discussion of LTRO impact on other corporate policies

For the investigation of the effect of the ECB's LTRO intervention on corporate investment, it is important to consider that macro-liquidity injections, such as the ECB's unconventional LTROs, not always translate (directly) into corporate liquidity. Indeed, unconventional liquidity interventions may boost bank liquidity, improve corporations' debt financing conditions and make it less necessary for corporations to hold precautionary cash. If this were the outcome of the liquidity injection, the injection would have achieved the ECB's goal in undertaking the intervention from a corporate liquidity perspective. However, banks may use Lender-Of-Last-Resort funding to take on additional sovereign risk rather than lending to corporations, which may accentuate corporations' precautionary motives for holding cash. If the latter effect dominates, particularly Eurozone corporations situated in countries with a high LTRO uptake, would have higher cash holdings following the LTRO intervention. Furthermore, as the aggregate demand was clearly down at the onset of the European Sovereign Debt Crisis corporations would have been likely to maintain their precautionary motives for holding significant amounts of cash, independent of the supply-side effect.

Table A6 presents the results of an analysis of the LTRO impact for corporate liquidity and debt financing policies in our sample of Eurozone corporations. As a proxy for corporate liquidity we use *Cash*, i.e., cash holdings, scaled by total assets. For corporate debt financing we use *Leverage* (total debt), *Net Debt* (current plus non-current liabilities minus cash holdings), as well as *Short-term Debt* (all current liabilities), all scaled by total assets. As outlined by Model (1), we find a positive and significant coefficient estimate for *Country LTRO Uptake* at the 1% level when investigating corporations' cash holdings.³⁴ Specifically, this result suggests that corporations located in countries in which the excess inflow of liquidity to lenders was high, on average, increased their cash holdings by approximately 0.55 percent, compared to that of other corporations. In unreported results we further find that the impact of the LTROs on cash holdings is amplified for corporations that use bank-related loans and credits as their main source of debt financing and for more risky corporations, i.e., those with a greater precautionary cash holdings.³⁵ We conclude from the results that the LTROs did not mitigate corporate uncertainty about the future (bank) lending supply.

As outlined by Models (2) to (3), we also find positive and significant *Country LTRO Uptake* coefficients when analyzing the LTRO impact on corporations' leverage and net debt ratios. The results suggest that corporations in high LTRO uptake countries were able to increase their leverage ratio by approximately 1.1 percent. In addition, the results in Model (4) regarding corporations' short-term debt holdings suggests that corporations replaced shorter-term with more long-term liabilities, which is in line with the fact that the LTRO intervention for the first time provided longer-term funding opportunities for Eurozone banks.³⁶ In line with the findings by Darracq-Paries and Santis (2015) we conclude that corporations at least were able to refinance existing debt contracts following the macro-liquidity injection. This supports the view that the three-year LTROs can be interpreted as a favorable credit supply shock. However, we emphasize that we cannot exclude other sources of funding responsible for that increase/decrease, respectively.

³⁴We follow Opler, Pinkowitz, Stulz, and Williamson (1999), and Bates, Kahle, and Stulz (2009).

³⁵This is similar to the discussion of precautionary cash holdings of more financially constrained corporations as outlined in Azar, Kagy, and Schmalz (2016) and Bolton, Chen, and Wang (2014)).

³⁶A related discussion based upon French data is given in Andrade, Cahn, Fraisse, and Mésonnier (2018)

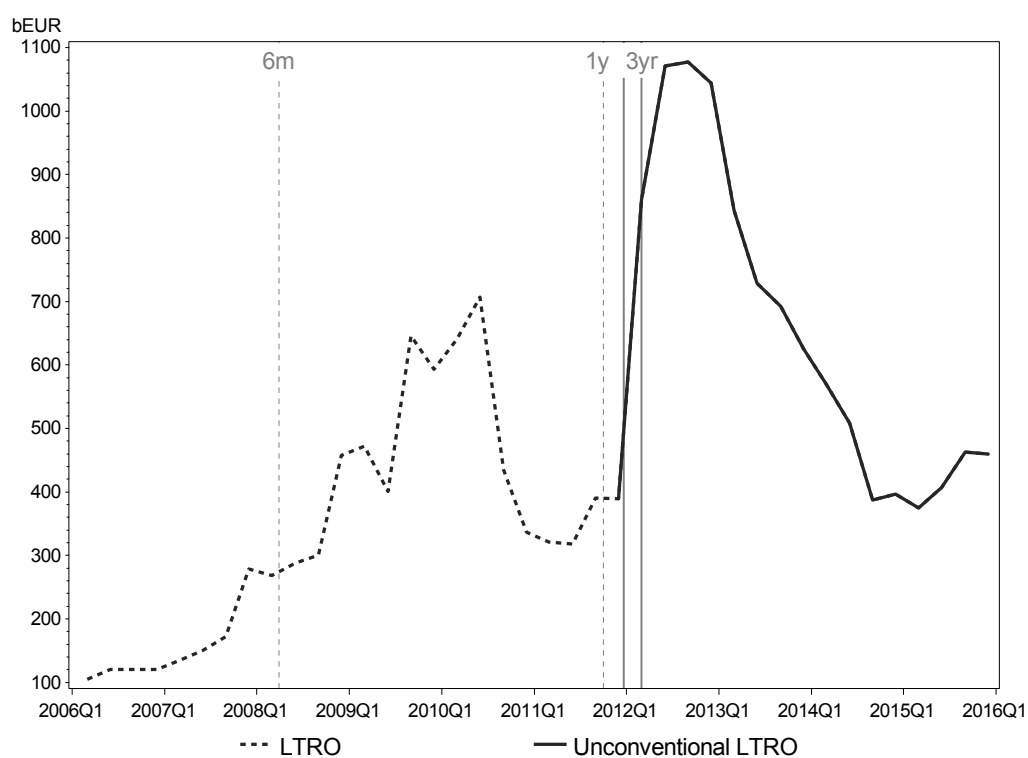


Figure A1
Time series of the ECB's Longer-Term Refinancing Operations

This figure plots the amounts of the ECB's Longer-Term Refinancing Operations (LTROs) for the period 2006 to 2016. The numbers are given in billion EUR. Unconventional LTROs refers to the two three-year LTROs. The data source is the ECB Statistical Data Warehouse, which publishes monthly numbers for the outstanding amounts.

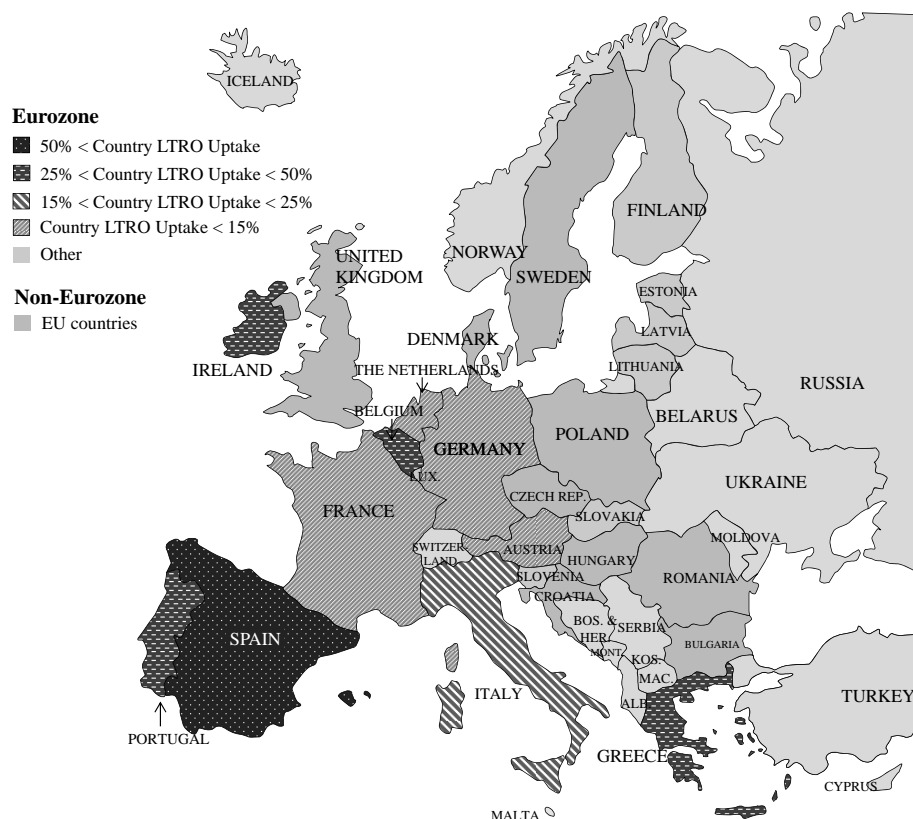


Figure A2
LTRO uptake in the Eurozone

This figure presents the total liquidity injection that countries within the Eurozone obtained from the three-year Longer-Term Refinancing Operations (LTROs), which were initiated by the European Central Bank (ECB) on December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II), respectively. The color shading refers to the respective countries' total LTRO uptake, scaled by the central government debt. The information about the country-specific LTRO uptake is based upon hand-collected data from Bloomberg as well as central bank announcements and public commentaries. The information on central government debt by country is obtained from the World Bank Database. In the case of Greece, we only have information about the total LTRO amount that, besides the three-year LTROs, also includes the standard one-month and three-month LTROs. As we cannot separate the latter, the number is not directly comparable to the uptake numbers for other countries.

Table A1
Sample countries

<i>Panel A: Eurozone</i>					
Country	Country Code	EU Membership	Euro Adoption	Region	Credit Rating (2011)
Austria	AUT	1995	1999	Core	AAA
Belgium	BEL	1995	1999	Core	AA
Finland	FIN	1995	1999	Core	AAA
France	FRA	1995	1999	Core	A
Germany	DEU	1995	1999	Core	AAA
Greece	GRC	1995	2001	Periphery	CCC
Ireland	IRL	1995	1999	Periphery	BB
Italy	ITA	1995	1999	Periphery	BB
Netherlands	NLD	1995	1999	Core	AAA
Portugal	PRT	1995	1999	Periphery	B
Spain	ESP	1995	1999	Periphery	BB

<i>Panel B: Non-Eurozone</i>					
Country	Country Code	EU Membership	Euro Adoption	Region	Credit Rating (2011)
Bulgaria	BGR	2007		Periphery	A
Czech Republic	CZE	2004		Periphery	AA
Denmark	DNK	1995		Core	AAA
Hungary	HUN	2004		Periphery	B
Lithuania	LTU	2004	2015	Periphery	A
Latvia	LVA	2004	2014	Periphery	A
Poland	POL	2004		Periphery	AA
Romania	ROU	2007		Periphery	BB
Sweden	SWE	1995		Core	AAA
United Kingdom	GBR	1995		Core	AAA

This table presents details of the European countries included in our sample. Panel A covers the countries in our Eurozone sample, Panel B those in our non-Eurozone sample. The *Eurozone* sample only includes countries that agreed to use the euro as a common currency in 1999, and adopted the euro right from its introduction in January 2001, and for which data are available. The sample *Non-Eurozone* includes countries that are outside the Eurozone but are part of the European Union (EU). Accordingly, our sample of EU corporates is the combination of the Eurozone and non-Eurozone samples. *EU Membership* shows the year the country becomes a member of the EU. Likewise, *euro Adoption* shows the year in which a given country adopted the euro as its local currency. *Credit Rating* is based on information from Markit Data as of end-2011. The overall sample of corporations is taken from Compustat Global and is restricted to EU countries. For details, please see Section 3.

Table A2
Description of main variables

<i>Dependent Variables</i>		<i>Description</i>
Investments	Capital Expenditures/ Total Assets	Corporate capital spending. Quarterly corporate measure. Source: Compustat.
Wages	Log(Total Wage payments)	The natural logarithm of total expenses related to salaries and wages. Quarterly corporate measure. Source: Compustat.
Cash	Cash/ Total Assets	Corporate cash holdings including marketable securities. Quarterly corporate measure. Source: Compustat.
Leverage	Debt/ Total Assets	The book value of the sum of current and long-term debt, scaled by total assets. Quarterly corporate measure. Source: Compustat.
Net Debt	(Total liabilities - Cash)/ Total Assets	The sum of current and non-current liabilities minus cash holdings, scaled by total assets. Quarterly corporate measure. Source: Compustat.
Short-term Debt	(Debt due in one year)/ Total Assets	Fraction of long-term debt that is due in one year, scaled by total assets. Quarterly corporate measure. Source: Compustat.
<i>Main Explanatory Variables</i>		<i>Description</i>
Country LTRO Uptake	Total Country LTRO Uptake/ Central Government Debt ₂₀₁₁	Total Country LTRO Uptake is the sum of the euro amounts of the two three-year LTROs (LTRO I and II) for each country. Accordingly, the variable is equal to zero until time Q4-2011 (first round of three-year LTRO) and afterwards equal to each country's total uptake, scaled by the central government debt holdings in the year 2011. Quarterly country measure. Source: Bloomberg and the World Bank.
Lender LTRO Uptake	Average (Bank LTRO Uptake/ Bank Size ₂₀₁₁) of related banks	The firm-level average of a related banks' uptake in the two three-year LTROs (LTRO I and II), scaled by the size of the respective bank. Accordingly, the variable is equal to zero until time Q4-2011 (first round of three-year LTRO) and afterwards equal to the average of related banks' total uptake. Quarterly corporate measure. Source: Bloomberg and annual reports.
LTRO-Bank Relation	Dummy	Dummy variable equal to one for corporations that in the five years prior to Q4-2011 (first round of three-year LTRO) had a loan relation to a Eurozone bank that participated in the three-year LTROs as of December 2011 and February 2012. Corporate measure. Source: LPC Dealscan.
Post-LTRO	Dummy	Dummy variable equal to one for the post-intervention period, i.e., Q1-2012 to Q4-2014 (zero otherwise). Quarterly measure. Source: ECB Statistical Data Warehouse.
Non-Eurozone	Dummy	Dummy variable equal to one for corporations located in a EU-country outside the Eurozone, as of 2014 (zero otherwise). Country measure. Details are provided in Appendix A1.
GIIPS	Dummy	Dummy variable equal to one for corporations located in either Greece, Ireland, Italy, Portugal or Spain. Country measure. Source: Compustat.

Description of main variables (cont.)

<i>Other Corporate Variables</i>		<i>Description</i>
Firm Size	Log(Total Assets)	Book value of assets, given in logarithms. Quarterly corporate measure. Source: Compustat.
Market to Book	(Total Liabilities + Market Equity) / Total Assets	Market value of total assets, scaled by book value of total assets. Market equity is the amount of shares outstanding times the share price as of the end of the fiscal quarter/year. Quarterly corporate measure. Source: Compustat.
Cash Flow	EBIT/ Total Assets	Operating income before interest and taxes (after depreciation), scaled by total assets. Quarterly corporate measure. Source: Compustat.
Industry Sigma	Cash-flow risk	Average standard deviation of corporate cash flows within the same two-digit SIC code (minimum 3 observations). Quarterly industry measure. Source: Compustat.
Net Working Capital	(Net working capital - Cash)/ Total Assets	Corporate working capital net of cash holdings, scaled by total assets. Source: Compustat.
R&D/Sales	R&D/ Total Sales	Costs related to research and development, scaled by corporate sales. Quarterly corporate measure. Source: Compustat.
Sales	Log(EBIT)	Operating income before interest and taxes (after depreciation), given in logarithms. Corporate measure. Source: Compustat.
Acquisition Activity	Acquisitions/ Total Assets	The amount used for M&A activities, scaled by total assets. Quarterly corporate measure. Source: Compustat.
Dividends	Dummy	Dummy variable equal to one for corporations with positive dividends in a given quarter/year (zero otherwise). Quarterly corporate measure. Source: Compustat.
Bank Debt	Bank Debt/ Total Assets	Bank debt is the amount of debt from bank loans. Quarterly corporate measure. Source: Capital IQ.
Rated	Dummy	Dummy variable equal to one for corporations with available rating information (zero otherwise). Corporate measure. Source: S&P Capital IQ.
<i>Other Country Variables</i>		<i>Description</i>
Sovereign Risk	Log(5-year Sovereign CDS spread)	End-of-quarter observation of five-year sovereign CDS spreads. Quarterly country measure. Source: Markit.
Early Repayment	LTRO (Δ NCB LTRO Holdings _{2012–2013}) / Country LTRO Uptake _{2011/2012}	The change in National Central Banks' LTRO Holdings from 2012 to 2013, scaled by the total initial LTRO uptake in the respective country. Country measure. Source: National Central Bank Reports and Bloomberg.
Corporate Tax	Corporate tax rate	National corporate tax rates. Quarterly country measure. Source: ECB Statistical Data Warehouse.
Government Investments	Investment expenditures by governments/ GDP	Local government spending on investments, scaled by GDP. Quarterly country measure. Source: ECB Statistical Data Warehouse.
Government Debt	Government debt/ GDP	Total Government debt, scaled by GDP. Quarterly country measure. Source: ECB Statistical Data Warehouse.

This table provides descriptions of all the variables used in the analyses. All financial variables are winsorized at the 1st and 99th percentiles, and in our empirical specifications we use ratios given in percentages.

Table A3
Summary statistics for non-Eurozone corporations

Country	GBR	SWE	POL	DNK	ROU	BGR	LTU	LVA	HUN	CZE	Total
Investments	2.55	1.90	4.04	3.36	4.37	4.66	4.66	4.07	6.77	4.32	2.74
Wages	0.09	2.65	2.17	3.76	1.68	1.44	1.96	0.46	7.75	5.36	1.12
Cash	9.38	8.94	5.23	6.05	1.64	4.07	2.36	2.72	7.74	3.33	7.94
Leverage	13.83	14.21	14.32	22.48	0.84	26.14	27.2	14.58	14.47	13.49	14.43
Net Debt	49.81	52.68	47.08	53.49	34.28	46.86	51.57	37.67	41.59	41.70	49.56
Short-term Debt	0.04	0.06	0.08	0.06	0.11	0.08	0.1	0.06	0.06	0.06	0.05
Bank Debt	11.86	12.91	12.92	17.38	15.22	19.63	23.4	17.41	23.09	7.89	12.99
Firm Size	3.82	5.57	4.72	6.51	5.23	5.29	5.22	2.04	10.43	8.70	4.47
Market to Book	133.1	146.3	118.3	120.5	85.5	98.9	91.9	70.7	108.7	93.7	129.5
Cash Flow	3.04	2.68	2.54	4.42	6.33	6.07	5.18	4.22	5.13	4.96	3.03
Industry Sigma	11.23	13.66	6.17	5.87	4.18	3.33	6.14	5.56	3.12	4.23	9.19
Net Working Capital	-1.62	2.11	6.91	2.96	6.38	5.82	2.32	19.17	8.86	0.02	0.82
R&D/Sales	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acquisition Activity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sovereign Risk	42.11	13.66	79.50	20.08	213.09	180.56	110.20	125.86	45.50	32.00	34.14
Sovereign Export	0.27	0.46	0.39	0.51	0.33	0.52	0.56	0.43	0.75	0.63	0.30
# N	67801	20122	17319	5980	2576	1018	1317	1370	797	420	118720
# Firms	2213	574	461	159	78	30	30	30	22	14	3611

This table provides sample averages (medians) of corporate characteristics for each country in our sample of non-Eurozone corporations. *Cash* is the ratio of cash and short-term investments to total assets. *Investments* is the ratio of capital expenditure to total assets. *Wages* is the total salaries and wages, given in logarithms. *Leverage* is the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is the ratio of current plus non-current liabilities minus cash holdings to total assets. *Short-term Debt* is the ratio of current liabilities to total assets. *Bank Debt* is the amount of debt from bank loans, divided by total assets. *Firm Size* is the total assets, given in logarithms. *Market to Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Cash Flow* is the ratio of the cash flow to total assets, where cash flow is the earnings after interest and related expenses, income taxes, and dividends. *Industry Sigma* is industry cash flow risk, measured by the mean cash flow volatility across two-digit SIC codes. *Net Working Capital* (NWC) is the difference between current assets and current liabilities net of cash, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Acquisition Activity* is the ratio of acquisitions to total assets. *Sovereign Risk* is the five-year sovereign CDS spread for the country. *Sovereign Export* is the country's export-to-GDP ratio. The sample period for each country is 2002-2014, and the variables are based on quarterly observations. For the specific definition of each variable we refer to Appendix Table A3. The corporate fundamental data are obtained from Compustat Global, while country-specific data are obtained from Markit, the World Bank, as well as the ECB Statistical Data Warehouse. For any data unavailable for a specific quarter, we replace the missing values with yearly observations. Ratios are given in percentages.

Table A4

LTRO effect on investment and employment: Controlling for lagged corporate measures

	Investments		Wages	
	(1)	(2)	(3)	(4)
Country LTRO Uptake	-1.075*** (0.25)		-0.113 (0.09)	
Lender LTRO Uptake		-0.260** (0.11)		0.072 (0.05)
Cash Flow	0.005** (0.00)	0.011*** (0.00)	-0.007*** (0.00)	-0.006*** (0.00)
Market to Book	0.003*** (0.00)	0.003*** (0.00)	0.000** (0.00)	0.001** (0.00)
Firm Size	0.224*** (0.04)	-0.188** (0.07)	0.364*** (0.02)	0.407*** (0.04)
Leverage	-0.020*** (0.00)	-0.024*** (0.00)	-0.001 (0.00)	-0.002* (0.00)
Rated	0.318** (0.14)	0.430*** (0.14)	0.136** (0.06)	-0.139 (0.08)
Sovereign Risk	-0.322*** (0.03)	-0.420*** (0.05)	0.038** (0.01)	0.077** (0.03)
Sovereign Export	-0.012** (0.00)	-0.025*** (0.00)	0.003 (0.00)	-0.002 (0.00)
Lagged Dividends	0.110*** (0.04)	0.067 (0.05)	-0.017 (0.01)	0.029 (0.03)
Lagged R&D/Sales	0.568*** (0.13)	-0.057 (0.22)	0.031 (0.05)	-0.061 (0.11)
Lagged Acquisition Activity	-2.413*** (0.36)	-2.602*** (0.46)	-0.480*** (0.15)	-0.476* (0.26)
Industry Sigma	-0.010 (0.00)	0.009 (0.01)	-0.002 (0.00)	0.011* (0.00)
Net Working Capital	-0.007*** (0.00)	-0.005*** (0.00)	-0.000 (0.00)	0.000 (0.00)
Log Sales	0.137*** (0.03)	0.499*** (0.06)	0.359*** (0.01)	0.356*** (0.03)
Competition	0.001 (0.00)	0.006*** (0.00)	-0.005*** (0.00)	-0.005*** (0.00)
Time FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
R-square	0.598	0.635	0.790	0.719
N	64635	25417	47910	18092

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on corporate investment and employment compensation in a sample of corporations located in the Eurozone. Our measure for corporate investment is *Investments*, which is the corporations' capital expenditure, scaled by total assets. Our measure for employment compensation is *Wages*, which is the corporations' total salaries and wages, given in logarithms. Models (1) and (3) include all the base corporate-level financial variables in addition to macro-economic variables. In Models (2) and (4) we include, in addition to basic investment and employment compensation determinants, lagged values of alternative investment measures and other corporate and industry controls. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and is equal to the countries' total LTRO uptake amount, scaled by the countries' central government debt, afterwards. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The loan information data is obtained from LPC Dealscan. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table A5
LTRO effect on investment and employment: Robustness with shorter window

	Investments		Wages	
	(1)	(2)	(3)	(4)
Country LTRO Uptake	-0.765*** (0.20)		0.200** (0.09)	
Lender LTRO Uptake		-0.244*** (0.08)		-0.034 (0.05)
Cash Flow	-0.002 (0.00)	0.004 (0.00)	-0.002** (0.00)	0.004 (0.00)
Market to Book	0.005*** (0.00)	0.006*** (0.00)	0.001*** (0.00)	0.001 (0.00)
Firm Size	0.757*** (0.06)	0.176** (0.08)	0.615*** (0.02)	0.695*** (0.05)
Leverage	-0.006*** (0.00)	-0.017*** (0.00)	-0.001 (0.00)	-0.001 (0.00)
Rated	0.338* (0.19)	0.226 (0.16)	0.057 (0.09)	-0.044 (0.12)
Sovereign Risk	-0.537*** (0.03)	-0.666*** (0.05)	-0.027 (0.02)	-0.036 (0.04)
Sovereign Export	-0.045*** (0.00)	-0.056*** (0.00)	-0.010*** (0.00)	0.004 (0.00)
Time FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
<i>R</i> -square	0.684	0.738	0.827	0.744
<i>N</i>	37934	14552	32950	12458

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on investment policies in a sample of corporations located in the Eurozone. Our measure for corporate investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. Our measure for employment compensation is *Wages*, which is the corporation's total salaries and wages, given in logarithms. Model (1) and (3) show the estimates of the country-based effect of LTRO in our main sample, while Models (2) and (4) show the effect of loan-related banks' LTRO uptake in a subsample of Eurozone corporations with existing loan information in LPC Dealscan. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and is equal to the countries' total LTRO uptake amount, scaled by the countries' central government debt, afterwards. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The loan information data is obtained from LPC Dealscan. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2009-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table A6
LTRO effect on cash and debt financing policies

	Cash	Leverage	Net Debt	Short-term Debt
	(1)	(2)	(3)	(4)
Country LTRO Uptake	1.612*** (0.56)	2.945*** (0.65)	3.118*** (1.15)	-0.016*** (0.00)
Industry Sigma	0.012 (0.01)	0.099*** (0.01)	0.091*** (0.03)	0.001*** (0.00)
Cash Flow	0.002 (0.00)	-0.058*** (0.00)	-0.122*** (0.00)	-0.000** (0.00)
Market to Book	0.014*** (0.00)	0.009*** (0.00)	0.052*** (0.00)	0.000** (0.00)
Firm Size	-0.103 (0.07)	2.642*** (0.09)	-3.250*** (0.18)	0.001 (0.00)
Net Working Capital	-0.123*** (0.00)	-0.301*** (0.00)	-0.631*** (0.00)	-0.005*** (0.00)
Capital Expenditure	-0.120*** (0.00)	-0.171*** (0.01)	-0.236*** (0.01)	-0.001*** (0.00)
Cash	0.000*** (0.00)	-0.229*** (0.00)	-0.549*** (0.00)	-0.002*** (0.00)
Div. Dummy	0.697*** (0.08)	-1.207*** (0.09)	-1.158*** (0.18)	-0.005*** (0.00)
R&D/Sales	0.016*** (0.00)	-0.013*** (0.00)	0.014** (0.00)	-0.000*** (0.00)
Acquisition Activity	-0.022*** (0.00)	0.065*** (0.01)	0.007 (0.01)	-0.000 (0.00)
Sovereign Risk	1.537*** (0.29)	0.098 (0.34)	0.734*** (0.15)	0.004*** (0.00)
Sovereign Export	0.531*** (0.07)	1.162*** (0.08)	-0.038 (0.02)	-0.000 (0.00)
Rated	-0.051*** (0.01)	-0.109*** (0.01)	-1.161* (0.65)	-0.001 (0.00)
Time FY	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
R-square	0.767	0.795	0.778	0.801
N	82053	82053	64040	57166

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) on corporate policies in a sample of corporations located in the Eurozone. *Cash* is defined as cash and cash equivalents, scaled by total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is defined as the ratio of current plus non-current liabilities minus cash holdings, to total assets. *Short-term Debt* is defined as the ratio of current liabilities to total assets. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and is equal to the countries' total LTRO uptake amount, scaled by the countries' central government debt, afterwards. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table A7
Counterfactual analysis of the LTRO effect on cash and debt financing policies

<i>Panel A: Cash holdings</i>			
	Cash	Cash	
	Full Sample (1)	Risky Sovereign (2)	Safe Sovereign (3)
Post-LTRO \times Non-Eurozone	-0.733*** (0.12)	0.680*** (0.24)	-1.187*** (0.15)
Post-LTRO	0.749*** (0.21)	0.397 (0.34)	0.656** (0.27)
Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.751	0.678	0.762
<i>N</i>	143731	35385	103686

<i>Panel B: Leverage</i>			
	Leverage	Leverage	
	Full Sample (1)	Risky Sovereign (2)	Safe Sovereign (3)
Post-LTRO \times Non-Eurozone	-0.619*** (0.13)	-0.363 (0.29)	-1.146*** (0.16)
Post-LTRO	1.230*** (0.22)	1.451*** (0.42)	-0.176 (0.28)
Controls	Y	Y	Y
Time FE	Y	Y	Y
Firm FE	Y	Y	Y
<i>R</i> -square	0.793	0.803	0.790
<i>N</i>	143731	35385	103686

This table presents estimates of the “counterfactual” effect of the liquidity uptake from the ECB’s three-year Longer-Term Refinancing Operations (LTROs), on corporate cash and leverage policies, in a sample of corporations located in the European Union (EU), both inside or outside the Eurozone. *Cash* is defined as cash and cash equivalents, scaled by total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. The variable *Post-LTRO* is a dummy variable equal to one, for year-quarter observations after the ECB had implemented the first three-year LTRO intervention (Q4-2011). The variable *Post-LTRO* \times *Non-Eurozone* is the interaction variable between the non-Eurozone dummies and LTRO intervention and captures, accordingly, the effect of the liquidity intervention on corporate policies in non-LTRO countries (“counterfactual” effect) accordingly, equal to one, for non-Eurozone corporations after the first LTRO intervention (for details see Appendix A1). In Model (1), we use the full sample of corporations. In Models (2) and (3), corporations are separated into high and low risk sovereigns, based on their location and the respective country’s CDS spreads. *Risky* (*Safe*) *Sovereign* is defined as a CDS spread above (below) the median in the pre-intervention and crisis period (2009 and 2010). In Panel A and Panel B we present the estimates from our analysis of corporate investment, and wages, respectively. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. In all specifications, we use controls, as well as firm- and time-fixed effects. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table A8
LTRO effect on investment: The role of lender characteristics

<i>Panel A: Country LTRO uptake and lenders' size</i>						
	Investments		Investments			
	Large Lender (1)	Small Lender (2)	GIIPS		Non-GIIPS	
			Large Lender (3)	Small Lender (4)	Large Lender (5)	Small Lender (6)
Country LTRO Uptake	-3.107*** (0.94)	-2.897*** (0.39)	0.715 (2.31)	-2.451*** (2.31)	-7.011*** (1.41)	-7.154*** (1.62)
Controls	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
R-square	0.631	0.613	0.589	0.599	0.642	0.636
N	10245	10068	1336	3534	8909	6534

<i>Panel B: Lender LTRO uptake and lenders' size</i>						
	Investments		Investments			
	Large Lender (1)	Small Lender (2)	GIIPS		Non-GIIPS	
			Large Lender (3)	Small Lender (4)	Large Lender (5)	Small Lender (6)
Lender LTRO Uptake	-0.439*** (0.15)	-0.584*** (0.17)	-0.322 (0.31)	-2.493*** (0.31)	-0.491*** (0.17)	-0.610*** (0.16)
Controls	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
R-square	0.631	0.612	0.589	0.599	0.641	0.635
N	10245	10068	1336	3534	8909	6534

This table presents estimates of the effect of bank characteristics and the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs), on corporate investment, in a sample of corporations located in the Eurozone. Our measure for corporate investment is *Investments*, which is the corporations' capital expenditure, scaled by total assets. We separate corporations into *Large (Small) Lender*. *Large (Small) Lender* are corporations' whose lenders in Q4-2010 on average had total assets above (below) the median. Panel A shows the results based upon a sample of corporations located in the Eurozone and using the country-specific LTRO uptake. The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. Panel B shows the results based upon a subsample of Eurozone corporations with existing loan information in LPC Dealscan, and using the lender-specific LTRO uptake. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The loan information data is obtained from LPC Dealscan. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

Table A9
Total LTRO holdings by National Central Banks

Country	Total LTRO Holdings				Repayment Ratio
	2010	2011	2012	2013	2012 to 2013
	EUR billion (1)	EUR billion (2)	EUR billion (3)	EUR billion (4)	percentage (5)
Austria	3.49	7.18	15.71	5.87	-62.62
Belgium	4.12	17.97	39.92	14.29	-64.22
France	20.22	123.14	172.88	61.53	-64.41
Germany	33.46	47.11	69.65	13.77	-80.23
Greece	78.38	60.94	1.95	1.39	-28.79
Ireland	56.03	76.29	63.09	34.50	-45.31
Italy	31.01	160.61	268.30	213.71	-20.35
Netherlands	0.92	3.19	24.48	8.81	-63.99
Portugal	22.97	39.03	49.26	42.69	-13.33
Spain	39.66	156.68	315.35	178.06	-43.53
Total	290.26	692.13	1020.58	574.62	-43.70

This table presents the holdings and repayment of Longer-Term Refinancing Operations (LTROs) by National Central Banks (NCB) in the Eurozone. *Total LTRO Holdings* include all Longer-Term Refinancing Operations, i.e., the three-month to the three-year Longer-Term Refinancing Operations initiated by the European Central Bank (ECB) on December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II), respectively, and are end-of year values. In column 5, the table outlines the percentage change in the total LTRO holdings by NBCs from 2012 to 2013. The information about the NCB LTRO holdings is based upon hand-collected data from the NCBs' websites.

Table A10

LTRO effect on employment, cash and debt financing: The role of banks' early repayment of LTRO

<i>Panel A: Low Early LTRO Repayment</i>					
	Wages	Cash	Leverage	Net Debt	Short-term Debt
	(1)	(2)	(3)	(4)	(5)
Lender LTRO Uptake	-0.075 (0.25)	9.365*** (1.79)	20.073*** (2.87)	17.840*** (3.47)	0.025 (0.02)
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
<i>R</i> -square	0.843	0.642	0.756	0.768	0.810
<i>N</i>	2879	4615	4615	3847	3673
<i>Panel B: Medium Early LTRO Repayment</i>					
	Wages	Cash	Leverage	Net Debt	Short-term Debt
	(1)	(2)	(3)	(4)	(5)
Lender LTRO Uptake	0.003 (0.06)	-0.882*** (0.23)	-0.456 (0.33)	0.318 (0.46)	-0.012*** (0.00)
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
<i>R</i> -square	0.683	0.769	0.777	0.812	0.796
<i>N</i>	10769	16001	16001	12636	11981
<i>Panel C: High Early LTRO Repayment</i>					
	Wages	Cash	Leverage	Net Debt	Short-term Debt
	(1)	(2)	(3)	(4)	(5)
Lender LTRO Uptake	1.947 (2.25)	6.991 (11.2)	-25.832** (12.9)	-31.896* (16.4)	-0.200** (0.08)
Controls	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
<i>R</i> -square	0.771	0.717	0.771	0.784	0.736
<i>N</i>	5143	8343	8343	6973	6268

This table presents estimates of the effect of the liquidity uptake from the ECB's three-year Longer-Term Refinancing Operations (LTROs) by loan-related banks, and LTRO repayment policies on corporate policies, in a subsample of Eurozone corporations with existing loan information in LPC Dealscan. Our measure for employment compensation is *Wages*, which is the corporations' total salaries and wages, given in logarithms. *Cash* is defined as cash and cash equivalents, scaled by total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is defined as the ratio of current plus non-current liabilities minus cash holdings, to total assets. *Short-term Debt* is defined as the ratio of current liabilities to total assets. In Panel A through Panel C corporations are separated based on their location and the respective country's LTRO repayment policy, compared to the initial LTRO-country uptake. *Low (Medium, High) Early LTRO Repayment* is defined as a LTRO repayment ratio from 2012 to 2013, i.e., at the first possible LTRO repayment date, that is below 30% (between 30% and 70%, above 70%). The variable *Country LTRO Uptake* is equal to zero until Q4-2011, and is equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The variable *Lender LTRO Uptake* is equal to zero until Q4-2011, and equal to the LTRO uptake amount of the corporate-related banks, scaled by the size of each bank, thereafter. We classify Eurozone banks as related if the corporation in the five years prior to the first LTRO intervention had a loan relation to the bank. The information about the bank-specific LTRO uptake is based upon hand-collected data from Bloomberg, as well as central bank announcements and public commentaries. The loan information data is obtained from LPC Dealscan. In all models, we include base corporate-level financial variables in addition to macro-economic variables. The sample period is 2002-2014, and based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

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