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INFLUENCE OF THE SPANISH CREDIT CRISIS ON CORPORATE DECISIONS ABOUT LEVERAGE, DEBT PROVIDERS AND INVESTMENT

INFLUENCIA DE LA CRISIS CREDITICIA ESPAÑOLA EN LAS DECISIONES EMPRESARIALES SOBRE ENDEUDAMIENTO, PROVEEDORES DE DEUDA E INVERSIÓN

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A mi madre

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RESUMEN

MOTIVACIóN Y PROPóSITO

Los tres artículos que componen la tesis se centran en evaluar el impacto de la crisis crediticia y bancaria española de 2012 sobre tres variables importantes de las finanzas corporativas: el nivel de endeudamiento empresarial, la elección de unos u otros proveedores de deuda y la inversión. Se trata por tanto de comprender mejor los efectos de las crisis crediticias sobre dos decisiones fundamentales para cualquier compañía: la financiación (origen de los fondos) y la inversión (aplicación de los fondos).

Si los mercados de capitales fueran perfectos y no existieran fricciones tales como asimetrías de información, costes de agencia o *shocks* crediticios, sólo los factores de demanda afectarían al nivel de endeudamiento, la elección de las fuentes de financiación y la inversión. Sin embargo, son varios los autores, como Fazzari et al. (1988) y Leary (2009), que anticipan que dichas imperfecciones y fricciones sí afectan las decisiones de endeudamiento e inversión.

Los tres trabajos que integran la tesis pretenden determinar si efectivamente la crisis afectó las decisiones empresariales en torno a las tres variables mencionadas, de forma que cada artículo se centra en una de dichas variables.

Respecto a la primera, la proporción entre los fondos propios y ajenos en la financiación corporativa, es éste un asunto ampliamente estudiado en la literatura empírica, que ha tratado de evaluar durante más de 35 años la validez de dos importantes teorías como el Trade-off (Bradley, Jarrell y Kim, 1984) y el Pecking Order (Myers y Majluf, 1984). Sin embargo, estos trabajos empíricos se han centrado, en su inmensa mayoría, en estudiar la influencia de las variables de demanda en el endeudamiento corporativo, ninguneando las variables de oferta. El primer artículo pretende abordar esta limitación de la literatura y estudiar el impacto de las variables de oferta en el apalancamiento empresarial.

La mayor parte de la literatura se ha centrado en el análisis de la primera variable y sorprendentemente se ha prestado escasa atención al estudio de los fondos ajenos y sus principales características. Teniendo en cuenta que la deuda es la principal fuente de financiación corporativa, extraña que asuntos como la elección entre deuda a largo o corto

plazo, la opción por deuda *senior* o *junior*, los *covenants* crediticios y la elección entre unos u otros prestamistas estén relativamente poco estudiados. Es por ello que el segundo artículo se centra en uno de estos temas, concretamente la elección entre deuda bancaria y deuda cotizada.

La influencia de las características empresariales en dicha elección está poco estudiada en la literatura, como señalan Faulkender y Petersen (2005), pero menos aún el efecto del entorno bancario y macroeconómico. Es precisamente en este *gap* de investigación en el que incide el segundo trabajo.

Por último, respecto a la tercera variable, el tercer artículo permite entender mejor la influencia de las crisis crediticias en la economía real, concretamente en la inversión empresarial. Los escasos estudios al respecto se centran, en su inmensa mayoría, en la crisis del 2008 en Estados Unidos y Reino Unido, como es el caso de Akbar et al. (2013), Almeida et al. (2012), Duchin et al. (2010) y Kahle y Stulz (2013). En esta ocasión, el tercer trabajo contribuye a evaluar la influencia de una crisis crediticia en un entorno diferente como el español y de esta forma aumenta la validez externa de los estudios previos, que puede ser limitada al utilizar métodos de tipo experimental que no utilizan la aleatorización para la conformación de los grupos de tratamiento y control.
El contexto español en el periodo comprendido entre 2008 y 2015 resulta muy apropiado a los efectos de esta tesis por la intensa reestructuración de su sector bancario, el endurecimiento de las condiciones de crédito y las elevadas pérdidas que experimentó el sector. Concretamente, el periodo comienza con la crisis internacional de 2008, incluye el estallido de la burbuja inmobiliaria española y el consiguiente despegue de la morosidad bancaria, los años de fusiones y rescates bancarios, la crisis de deuda soberana de 2012, los Reales Decretos de ese mismo año que introducen medidas extraordinarias de provisiones y deterioro de activos bancarios y por último, el inicio de la recuperación a partir de 2013 y hasta 2015.

Simplemente a efectos ilustrativos y por contextualizar la gran magnitud de la crisis, el ratio de morosidad bancaria creció desde el 0,9% en 2007 hasta el 13,6% en 2013[1], año cuando comenzó a descender. Igualmente, el tipo de la deuda española a 10 años alcanzó un máximo de 5,83%[2] en 2012 y los Reales Decretos de ese mismo año supusieron un

[1] Boletín Estadístico, Banco de España

[2] Boletín Estadístico, Banco de España

saneamiento del sector bancario que alcanzó los 80.000 millones de euros y redujo la rentabilidad sobre el activo (ROA) hasta un -1,4%[3].

SíNTESIS Y ESTRUCTURA DE LA TESIS

Esta tesis está organizada en tres artículos de investigación independientes. Se presentan a continuación cada uno de los artículos, así como el *gap* de investigación que pretende abordar cada uno y un breve resumen de los resultados.

Respecto al primero, *"The impact of supply-side factors on corporate leverage"*[4], debido a que las teorías predominantes sobre la estructura de capital asumen que la oferta es perfectamente elástica y que el apalancamiento sólo viene determinado por la demanda de deuda de las empresas, la gran mayoría de los artículos de investigación sólo se centra en los factores de demanda. Hay muy pocos estudios sobre los factores de oferta y, en concreto, apenas se ha estudiado el efecto de las crisis crediticias en el apalancamiento corporativo. Éste es el *gap* de investigación que aborda el artículo.

Su objetivo consiste en determinar si las condiciones de crédito tal y como se miden por la encuesta (*Bank Lending Survey*) del Banco Central Europeo y el acceso a los mercados de renta fija influyen en el endeudamiento empresarial, utilizando como variables de control los tradicionales factores de demanda (tangibilidad del activo, rentabilidad operativa, riesgo operativo, concentración de la propiedad, oportunidades de crecimiento y tasa impositiva). El trabajo analiza también el efecto en el endeudamiento de la interacción entre las condiciones crediticias y el acceso a los mercados de deuda.

Los resultados muestran que las compañías que tienen acceso a los mercados de renta fija tienen un apalancamiento mayor y que las condiciones de crédito son una variable significativa en la explicación del endeudamiento. Además, la principal contribución se centra en el efecto diferencial de las condiciones de crédito sobre el endeudamiento de las compañías, según éstas tengan o no acceso a los mercados de deuda.

[3] Boletín Estadístico, Banco de España

[4] Rodríguez-García, R., Budría, S., 2019. The impact of supply-side factors on corporate leverage. International Review of Financial Analysis, 64, 262-272. (JCR Impact factor 5.373).

El segundo trabajo, *"The influence of the banking and macroeconomic environments on debt sourcing"*, explica la influencia de la crisis bancaria y de deuda soberana en la elección que hacen las empresas entre la deuda bancaria y la cotizada, así como en la sustitución entre ambas. La influencia de las características empresariales en la decisión sobre el tipo de deuda está poco estudiada en la literatura, pero menos aún el efecto del entorno bancario y macroeconómico en dicha decisión. Este trabajo incide en la influencia de las variables económicas y bancarias, asunto que sólo se ha estudiado en detalle por Becker e Ivashina (2014, 2018), Cantillo y Wright (2000) y Fernández et al. (2018) y tiene un doble objetivo. Por un lado, determinar si tras un shock bancario, las compañías dependientes de la financiación bancaria sustituyen ésta por deuda cotizada con más intensidad que otras empresas que tienen acceso al mercado de renta fija. Por otro lado, determinar si el tipo de interés, la rentabilidad bancaria y la morosidad crediticia, influyen en la probabilidad de que las compañías emitan deuda en los mercados de capitales y en la proporción entre deuda bancaria y cotizada en sus balances.

Atendiendo a los resultados, se observa que la crisis bancaria afectó significativamente a la composición de la deuda corporativa, sobre todo en el caso de las empresas dependientes de la banca. Por otro lado, los tipos de interés y la rentabilidad y morosidad bancarias resultan ser variables significativas en la elección del tipo de deuda, por lo que dicha elección no se ve sólo afectada por las características de las empresas, sino también por las fricciones en los mercados de crédito.

Por último, el tercer trabajo, *"Corporate investment and the Spanish banking crisis of 2012"*, pretende determinar si las compañías con restricciones financieras redujeron más la inversión que el resto durante la crisis bancaria de 2012. Si la financiación externa fuera un sustituto perfecto de los fondos generados internamente, las decisiones de inversión serían independientes de la situación financiera de las empresas, como mencionan Fazzari et al. (1988). Sin embargo, los costes de agencia y las asimetrías de información pueden suponer que ambas fuentes de financiación no sean perfectamente sustitutivas, en cuyo caso la inversión empresarial puede depender de la situación financiera de las empresas y el funcionamiento de los mercados de crédito. Éste es el objeto de estudio del tercer artículo, que permite entender mejor los mecanismos de transmisión de las crisis crediticias a la economía real.

Se trata por tanto de determinar la influencia de la situación financiera de las empresas a la hora de aliviar o exacerbar el impacto de la crisis crediticia sobre la inversión. Se

emplean siete diferentes medidas para identificar a las compañías más débiles y se analiza el impacto de la crisis en cada una de estas siete categorías. El artículo es más completo que la literatura en el sentido que combina tres métodos econométricos con siete *proxies* diferentes y obtiene de esta forma una mayor robustez en los resultados del análisis causal. El trabajo muestra que las empresas más pequeñas y las más endeudadas redujeron su inversión aproximadamente el 10% en comparación con los grupos de control durante la crisis bancaria.

Las técnicas econométricas utilizadas son muy diferentes entre los tres artículos. En el primero se utiliza una regresión múltiple con datos de panel para explicar el comportamiento del apalancamiento en función de variables de oferta y las tradicionales variables de demanda. Además, frente a la mayor parte de la literatura, que ignora el problema de la correlación contemporánea en los datos de panel, el artículo lo afronta recurriendo a las técnicas introducidas por Beck y Katz (1995) y Driscoll y Kraay (1998), que proporcionan errores estándar robustos ante esta problemática.

En el segundo artículo, se trata de entender la influencia de la crisis bancaria en las fuentes de deuda utilizadas por las empresas, distinguiendo entre si éstas son o no dependientes de la banca. Un segundo objetivo consiste en entender la elección de las compañías entre deuda bancaria y deuda cotizada, así como la proporción de ambos tipos de deuda en sus balances. Por ello, se recurre a métodos de *Matching Estimators* para el primer objeto de estudio y a modelos de elección discreta y censurados tipo Tobit para el segundo análisis. Se utilizan extensamente técnicas de datos de panel, en contraste con los escasos artículos similares, que básicamente usan datos de corte transversal y datos agrupados.

Por último, en el tercer artículo, donde se trata de determinar si las compañías con limitaciones financieras redujeron la inversión más que el resto durante la crisis, se recurre a los métodos de Diferencias en diferencias, Puntuación de Propensión y *Pair Matching* (Abadie et al., 2004).

Los tres artículos utilizan como base de datos para los respectivos estudios econométricos la constituida por las compañías no financieras cotizadas en el Mercado Continuo español a finales del año 2015, excluyendo los vehículos de inversión y las promotoras inmobiliarias. También se excluyen las compañías de muy reciente constitución que no tenían una suficiente serie histórica de datos. Las observaciones son anuales en todos los casos y las principales fuentes de información son la Comisión Nacional del Mercado de Valores (CNMV), la Bolsa de Madrid, las Cuentas Anuales consolidadas IFRS de las

compañías, el Banco de España, el Banco Central Europeo y, por último, Capital IQ y Afi Research para los ratings crediticios.

Como conclusión, los resultados de los tres estudios mencionados contribuyen a la literatura de finanzas corporativas permitiendo conocer mejor los efectos de las crisis crediticias sobre los prestatarios, tanto sobre sus decisiones de financiación como de inversión. Se confirma igualmente que ambas decisiones se ven influidas por factores de oferta y no sólo por variables de demanda.

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Peer Reviewed International Journals

1. Rodríguez-García, R., Budría, S., 2019. The impact of supply-side factors on corporate leverage. International Review of Financial Analysis, 64, 262-272. https://doi.org/10.1016/j.irfa.2019.06.005 (See section 2)

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The contribution of the doctoral student to the three articles consisted of the study conception and design, data collection and analysis. The first draft of the papers was written by the doctoral student and the director commented on the first and subsequent versions of the manuscripts.

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1. INTRODUCTION

1.1. MOTIVATION AND PURPOSE

The three articles contained herein focus on the impact of the 2012 Spanish credit and banking crisis upon three key Corporate Finance variables: leverage, debt provider choice and investment. Therefore, the purpose of the thesis is to understand the effect of credit crises on two key decisions for any company: funding - sources of funds - and investment - uses of funds -.

If capital markets were perfect and there were not any frictions such as information asymmetries, agency costs and credit shocks, only demand factors would influence leverage, debt choice and investment. However, several authors such as Fazzari et al. (1988) and Leary (2009) anticipate that such imperfections and frictions may affect leverage and investment decisions.

The three papers contained herein intend to determine whether the crisis influenced corporate decisions on the three variables mentioned above, so that each article focuses on each of these variables.

Regarding the first variable, the relationship between equity and debt, this is a widely researched topic in the empirical literature, which has tested the validity of two important theories such as the Trade-off (Bradley, Jarrell & Kim, 1984) and the Pecking Order (Myers & Majluf, 1984) for over 35 years. However, these empirical papers have mainly focused on studying the influence of demand-side variables on corporate leverage, paying no attention to supply-side factors. The first paper attempts to approach this gap in the literature and studies the influence of supply-side factors on corporate leverage.

Most of the literature has focused on the first variable and quite surprisingly scarce attention has been paid to the topic of debt funding and its main characteristics. Since debt is the main funding source for most companies, it seems odd that issues like the choice between short and long-term debt, senior and junior debt, debt covenants and the selection among various debt providers are poorly researched. This is the reason why the second paper studies one of these topics, specifically the choice between bank debt and traded debt.

The influence of company intrinsic characteristics upon debt provider choice has received limited attention in the literature, as highlighted by Faulkender and Petersen (2005), and the impact of the banking and macroeconomic environments has been mostly neglected. This is precisely the research gap addressed by the second paper.

Lastly, regarding investment, the third paper sheds light on the impact of credit shocks on the real economy, specifically upon corporate investment. Research in this area is quite limited and focuses on the 2008 crisis in the USA and the UK (Akbar et al.,2013; Almeida et al., 2012; Duchin et al., 2010; and Kahle and Stulz, 2013). The paper helps understand the effects of a credit shock in a different environment such as the Spanish market, and thus increases the external validity of previous studies, which may be limited given the use of experiment-type methodologies with treatments that are not assigned randomly.

The Spanish background in the period between 2008 and 2015 is very appropriate to conduct the analysis given the intense restructuring of the banking sector, the tightening of credit standards and the very significant losses incurred by Spanish banks. The period under study begins with the 2008 international crisis, includes the bursting of the domestic real estate bubble and the resulting increase in non-performing loans, the restructuring of the banking sector, the 2012 Sovereign debt crisis, the extraordinary provisions and impairments introduced by the 2012 Royal Decrees and finally, the first signs of recovery in 2013 and the consolidation of such upturn until 2015.

Only for illustrative purposes, with the sole objective of highlighting the severity of the crisis, the non-performing loan ratio increased from 0.9% in 2007 to 13.6% in 2013[5], when it began to decline. Similarly, the 10-yr Spanish Treasury yield reached a maximum of 5.83%[6] in 2012 and the 2012 Royal Decrees enforced an intense clean-up of the banking sector which amounted to 80 billion Euros and thus reduced Return on Assets (ROA) to -1.4%[7].

[5] Boletín Estadístico, Banco de España

[6] Boletín Estadístico, Banco de España

[7] Boletín Estadístico, Banco de España

1.2. OUTLINE AND STRUCTURE OF THE THESIS

This thesis comprises three independent research papers. The three articles are briefly discussed below, as well as the *gaps* addressed and an overview of the results.

Regarding the first paper, *"The impact of supply-side factors on corporate leverage"*[8], most research on capital structure only focuses on demand-side factors, since the dominant theories assume that supply is perfectly elastic and leverage is only determined by companies' demand for debt. There are very few papers dealing with supply-side factors and more specifically, the effect of credit shocks on leverage has been widely neglected. This is the research gap addressed by the first paper.

Its objective is to determine whether credit conditions as measured by the ECB's Bank Lending Survey and access to fixed income markets influence corporate leverage, employing traditional demand factors like asset tangibility, operating profitability, operating risk, ownership concentration, growth opportunities and the tax rate as control variables. Furthermore, the impact on leverage of the interaction between credit conditions and access to the fixed-income markets is particularly addressed.

The results show that companies with access to the fixed-income markets have higher leverage and that credit conditions are a significant explanatory variable. The main contribution reflects the different impact of credit conditions on leverage, depending on whether companies have access to the fixed-income markets.

The second paper, *"The influence of the banking and macroeconomic environments on debt sourcing"*, explains the influence of the banking and sovereign debt crises on the choice between bank and public debt, as well as the substitution between them. The influence of firm characteristics on this debt sourcing decision has received limited attention in the literature, and the impact of the banking and macroeconomic environment has hardly received any attention at all, with the exceptions of Becker and Ivashina (2014, 2018), Cantillo and Wright (2000) and Fernández et al. (2018). The paper has a double objective, the first one being to determine whether companies reliant on bank funding

[8] Rodríguez-García, R., Budría, S., 2019. The impact of supply-side factors on corporate leverage. International Review of Financial Analysis, 64, 262-272 (JCR Impact factor 5.373).

substitute bank debt with traded debt more intensely than otherwise similar firms following a banking shock. The second objective is to ascertain whether interest rates, bank profitability and the amount of non-performing loans explain the probability that companies raise debt in the fixed-income markets and the mix between bank and public debt in their capital structures.

According to the results, the banking crisis significantly impacted the mix of corporate debt, especially in the case of bank-dependent companies. Furthermore, interest rates and banks' profitability and credit quality turn out to be significant explanatory variables of debt choice, which confirms that such selection is not only influenced by firm characteristics but also by frictions in the credit markets.

Finally, the third paper, *"Corporate investment and the Spanish banking crisis of 2012"*, aims to determine whether constrained firms reduced capital expenditures more than unconstrained firms during the 2012 banking crisis. If external funds could perfectly replace internally generated funds, investment decisions would be independent of companies' financial situation, as mentioned by Fazzari et al. (1988). However, agency costs and information asymmetries may entail that both funding sources are not perfectly interchangeable, in which case corporate investment may depend on firms' financial situation and the functioning of credit markets. This is the area of focus of the third paper, which allows to understand the transmission mechanisms between credit shocks and the real economy.

Therefore, the objective is to explore the role of firms' financial situation in relieving or exacerbating the impact of the credit crisis on investment. Seven different proxies are employed to identify the weakest companies and the impact of the crisis on each of these firm categories is analyzed. This paper is more comprehensive than the rest of the literature on this topic since it combines three econometric methods with seven different proxies and thus warrants better causal inference. The article shows that smaller and more levered companies reduced investment by approximately 10% relative to their control groups.

The range of econometric methods employed across the three papers is quite diverse. The first one resorts to a linear regression model with panel data to explain the behavior of leverage as a function of supply-side variables and the traditional demand-side variables. Moreover, contrary to most of the literature, which ignores the problem of contemporaneous correlation in panel data, the paper addresses this issue by resorting to

the techniques introduced by Beck and Katz (1995) and Driscoll and Kraay (1998), which provide robust standard errors in this situation.

The first objective of the second paper is to study the influence of a banking crisis event on how companies change their debt funding structure, with a distinction between bank-dependent and non-bank dependent firms. The second objective deals with understanding corporate choices between bank debt and public debt, as well as the mix of both types of debt in the Balance Sheet. Matching estimators are employed to address the first analysis and binary and censored models are used to address the second objective. Panel data is used throughout the article, contrary to many of the few papers on this topic, which employ cross-section and pooled data.

The third article, which focuses on whether constrained firms reduced investment more than others during the crisis, employs Difference-in-Differences, Propensity-Score Matching and Pair Matching (Abadie et al., 2004).

The database employed is common to the three papers and comprises the non-financial firms which were listed on the Spanish *Mercado Continuo* as of the end of 2015, excluding investment vehicles and real estate developers. Companies which had been set-up very recently and consequently had no track record were excluded from the database. Annual observations are sourced from the Comisión Nacional del Mercado de Valores (CNMV), Bolsa de Madrid, the consolidated IFRS Annual Accounts, the Bank of Spain and the European Central Bank. Capital IQ and Afi Research are used to source credit ratings.

As a conclusion, in terms of their contribution to the corporate finance literature, the three papers provide insight into the effects of credit crises on borrowers, both in their funding and investment decisions. Evidence is found that both decisions are also influenced by supply-side factors and not only by demand variables.

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2. THE IMPACT OF SUPPLY-SIDE FACTORS ON CORPORATE LEVERAGE

Abstract

This paper studies publicly traded Spanish firms with the objective to determine whether credit conditions and access to fixed-income markets influence corporate leverage. The case of Spain has been selected because the intense restructuring of its banking sector and the subsequent credit crunch experienced by the country between 2009 and 2012 provide an ideal setting to test the impact of supply-side variables. Based on a 8-year panel dataset, a linear regression model is proposed and the problem of cross-sectional correlation is tackled by resorting to the methods developed by Beck and Katz (1995) and Driscoll and Kraay (1998), in addition to the traditional Rogers or clustered standard errors. According to our results, credit conditions and access to public debt markets turn out to be significant determinants of leverage after controlling for the usual demand factors. Furthermore, the negative effect of tightening credit conditions on market leverage doubles in the case of firms without access to public debt markets.

Keywords: capital structure, leverage, credit conditions, bond market access.

JEL codes: G31, G32

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2.1. Introduction

Because dominant theories of capital structure assume that the supply of capital is perfectly elastic and leverage is only determined by firms' demand for debt, there is ample empirical work as regards the demand factors determining capital structure and much less extensive research into the supply factors. In particular, very few studies have examined the effect of credit supply shocks on firms' leverage.

Recent empirical literature supports the view that supply-side factors are also important determinants of leverage. For instance, Faulkender and Petersen (2005) and Judge and Korzhenitskaya (2012) conclude that firms with access to public debt markets are more highly levered. Additionally, Leary (2009) uses an experimental design to investigate supply shocks and their impact on leverage of firms with and without access to public debt markets.

This article focuses on supply-side variables, which have become particularly interesting in the context of the last global crisis. Specifically, we attempt to understand whether

credit conditions as measured by the ECB Bank Lending Survey and access to fixed-income markets influence leverage, after controlling for the usual demand factors. To this purpose we use data on all non-financial firms listed on the Spanish "Mercado Continuo" over the 2008-2015 period. Spain is a suitable environment because the credit crunch experienced by the country as a result of the savings banks' crisis provides an ideal setting to test the influence of supply-side factors on leverage. We believe this analysis to be of interest to international firms since it may help clarify the importance of having various debt funding sources available during periods of tightening bank credit conditions.

Relative to earlier, similar research this paper presents some differences. Faulkender and Petersen (2005) only examine whether the firms that have access to public debt markets are more highly levered. Judge and Korzhenitskaya (2012) go one step further and use pooled OLS with clustered standard errors to investigate whether changing credit conditions in the UK affect corporate leverage differently depending on whether British firms have access to public debt markets. Leary (2009) pursued a similar objective with a different methodology, based on a difference-in-differences specification around the 1961 emergence of the US market for certificates of deposit and the 1966 credit crunch in the US.

Our analysis not only looks at the interaction between credit conditions and access to debt markets but also focuses in greater detail on the impact of a continuous variable like changing credit conditions on leverage. Furthermore, we do not define debt market access with weak proxies like firm size or being rated, but instead accurately document the source of each firm's debt by reviewing each firm's Annual Report, which enables us to correctly classify the observations with public debt and no rating.

Our paper also resorts to a wider econometric toolkit which includes not only pooled OLS but also panel data regressions. In addition, contrary to most of the finance literature which vastly neglects the cross-sectional dependence of the residuals, we have approached this issue in a detailed manner by resorting to the techniques proposed by Beck and Katz (1995) and Driscoll and Kraay (1998), which yield standard error estimates that are robust to contemporaneous correlation.

Finally, to the best of our knowledge, this paper is the first to consider supply-side factors in the context of the recent Spanish banking crisis. There are a number of issues which

are outside the scope of this paper, such as alternative functional forms, dynamic effects and adjustment models.

We find that tightening bank credit conditions affect the capital structure of borrowers, even in the context of large and highly transparent listed firms. Furthermore, we confirm the conclusions reached by Judge and Korzhenitskaya (2012) and Leary (2009) in UK and US settings, whereby capital structures are more sensitive to credit conditions in the case of firms without access to the debt markets. Relative to these earlier papers, our results shed additional light on the differential effect that credit conditions have among firms with and without access to public debt. Specifically, we find that the negative effect of tightening credit conditions on market leverage doubles in the case of firms without access to public debt markets.

The remainder of the article is organized as follows: Section 2.2 provides a literature review; the case of Spain from an international viewpoint is analyzed in Section 2.3 and credit conditions in the Spanish market over the 2008-2015 period are explained in Section 2.4; a description of the data and the empirical approach are provided in Sections 2.5 and 2.6; results are outlined in Section 2.7; and Section 2.8 concludes.

2.2. Theoretical background

2.2.1. Demand factors determining capital structure

The main demand factors identified over the last thirty-five years are summarized below within the context of the Trade-off (Bradley et al., 1984) and Pecking Order (Myers and Majluf, 1984) theories.

2.2.1.1 Tax deductibility of interest payments.

This is one of the main variables behind the Trade-off theory, which predicts that in order to take advantage of higher tax shields, firms will issue more debt when tax rates are higher. However, this variable is quite difficult to assess in practice, given the uncertainty as regards the firm's effective tax rate in the future. Additionally, as reflected by Miller (1977), the corporate tax advantages of debt can be partially offset by the tax treatment to individual investors. Finally, non-debt tax shields like tax deductions for depreciation (De Angelo and Masulis, 1980) complicate the analysis even further.

2.2.1.2 Operating profitability.

Profitable companies face lower expected bankruptcy costs and benefit from greater tax shields, so they should be more levered according to the static Trade-off theory. However, according to the Pecking Order theory, more profitable companies will not need as much external finance and will therefore be less levered. Most of the empirical evidence is consistent with the Pecking Order Theory, with authors like Frank and Goyal (2009), Jong et al. (2008), Rajan and Zingales (1995) and Titman and Wessels (1988) concluding a negative relationship between operating profitability and leverage.

2.2.1.3 Tangibility of assets.

According to the Trade-off theory, a higher degree of asset tangibility implies lower agency costs with creditors and should thus imply higher leverage - tangible assets may be used as collateral to back debt finance-. The Pecking Order theory is more ambiguous in this respect. Chung (1993), Frank and Goyal (2009), Jong et al. (2008) and Rajan and Zingales (1995) find a positive relation between asset tangibility and leverage, consistently with the Trade-Off theory.

2.2.1.4 Growth potential.

According to the Trade-off theory, the better the growth prospects, the lower the leverage, since managers' incentives to misspend cash flow will not be as high and there will be no need to resort to debt as a disciplinary tool. Likewise, the model developed by Leland and Toft (1996) predicts that firms with greater growth prospects should have less debt in their optimal capital structure.

Similarly, Barclay et al. (2001) demonstrate that the debt capacity of growth options is negative. More growth options raise the underinvestment costs of debt while reducing the benefits of debt in terms of controlling the free cash flow problems.

However, according to the Pecking Order theory, for a given level of profitability, better growth prospects entail a greater need of external finance.

Empirical evidence from Barclay et al. (2001), Bathala et al. (1994), Chung (1993), Frank and Goyal (2009), Jong et al. (2008) and Rajan and Zingales (1995) is consistent with the Trade-Off theory.

2.2.1.5 Size.

According to the Trade-off theory, larger and more mature companies should have higher leverage given lower expected bankruptcy costs and lower agency costs as a result of a more established reputation. Additionally, Leary (2009) argued that larger companies may face public debt issue costs better, which may explain the positive relationship between size and leverage. On the other hand, as mentioned by Frank and Goyal (2009), the role of firm size does not easily flow from the basic logic of the Pecking Order theory.

Authors like Chung (1993), Frank and Goyal (2009), Rajan and Zingales (1995) and Titman and Wessels (1988) conclude a positive relation between size and leverage.

2.2.1.6 Operating risk.

According to the Trade-off theory, more volatile cash flows entail higher expected bankruptcy costs and a lower chance to completely benefit from tax shields, so leverage should be lower.

Similarly, Leland and Toft (1996) conclude that the optimal leverage ratios of riskier firms will always be less than those of less risky firms. Bathala et al. (1994) and Chung (1993) also find a negative relation between risk and leverage.

According to the Pecking Order theory, firms with more volatile cash flows may require more external finance and consequently should have higher leverage.

2.2.1.7 Type of ownership.

Higher ownership concentration should lead to lower agency costs between management and shareholders, so lower leverage would be required as a disciplinary tool. Bathala et al. (1994) show that as institutional ownership and monitoring increases, firms utilize lower levels of debt to control agency conflicts.

Anderson et al. (2001) point out that families show concern over reputation and often pass their holdings on to future generations, so they anticipate that family ownership reduces agency conflicts with creditors. Additionally, family firms may be reluctant to issue equity so as to avoid dilution and hold control. In this respect, Anderson et al. (2001) and Morresi and Naccarato (2016) find that family firms are more indebted than non-family counterparts.

2.2.2. Supply factors determining capital structure

The implicit assumption over a long time was that a firm's leverage was completely determined by the firm's intrinsic characteristics. As pointed out by Faulkender and Petersen (2005, p.46) it was assumed that "the supply of capital is infinitely elastic at the correct price, and the cost of capital depends only on the risk of the firm's projects". In other words, if there are no market frictions, firms can borrow as much as they wish and the observed level of leverage reflects the demanded level.

The importance of supply-side factors and market frictions has become paramount since the beginning of the last financial crisis in the latter half of 2007, with major banks facing severe solvency problems and drastically reducing the granting of new loans before being finally bailed-out by Western governments.

In a general sense, results from Demirguc-Kunt et al. (2015) and Iqbal and Kume (2014) show that the 2008 global crisis had a significant impact on leverage ratios of firms across various countries, even after controlling for firm characteristics.

More specifically, the question of whether the firms that have access to public debt markets are more highly levered, was addressed by Faulkender and Petersen (2005) and Judge and Korzhenitskaya (2012). The former examined publicly traded firms, used whether each firm had a rating as a measure of access to the public bond markets and concluded that even after the inclusion of the firm characteristics, firms with a debt rating are significantly more levered. Judge and Korzhenitskaya (2012) reached the same conclusion looking at public UK firms and more importantly, found that the impact on leverage of having a credit rating varies over time with the effect being greatest when credit market conditions are tightest.

Similarly, Cursio and Baek (2016) show that the magnitude of capital structure adjustments increases as credit ratings deteriorate and is larger during higher credit spread environments.

Credit conditions and the performance of the banking sector seem to be relevant for capital structure choice according to authors like Jiménez et al. (2011), Leary (2009), Paravisini (2008) and Rahman (2017).

Paravisini (2008) shows that in the context of emerging markets, changes in the availability of external financing to banks affect lending and borrowers actually expand leverage when their lenders' external financing increases.

Leary (2009) studied the effect on corporate leverage of two changes in bank funding capacity, the 1961 emergence of the US market for certificates of deposit and the 1966 credit crunch in the US. He showed that following expansions (contractions) in the availability of bank loans, leverage ratios of bank-dependent firms significantly increase (decrease) relative to firms with public market access.

Jiménez et al. (2011) find that banks' financial strength does matter in crisis times, when banks with lower capital ratios or more doubtful loans are less likely to grant loans. Therefore, we may infer that a widespread banking crisis might impact corporate leverage.

From a dynamic capital structure standpoint, the relationship between credit conditions and leverage adjustment has been examined recently by Rahman (2017), who shows that higher credit supply leads firms to adjust their capital structure faster.

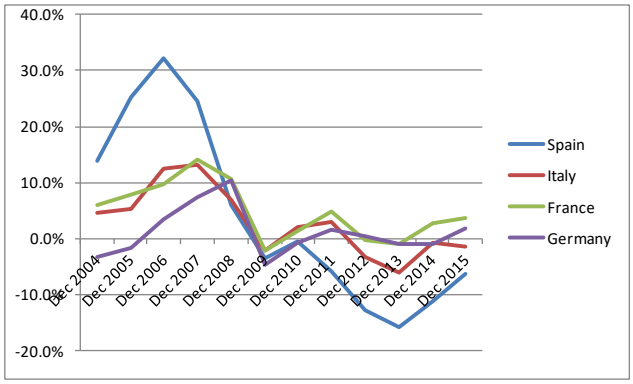
2.3. The case of Spain in an international context

As mentioned in Section 2.2, recent literature recognizes credit supply conditions to be an important determinant of corporate leverage. Key to the credit supply chain are commercial banks, which are the main funding source in the Euro- area. Spain is not an exception and its ratio of bank funding over total financing amounts to 53.16%, above the average of 45.31% for the European Union as a whole[9].

Figure 1 below shows the annual growth rates in outstanding loans to Euro-area non-financial corporations in Germany, France, Italy and Spain. As can be seen, the steep decline in 2008 was more intense in the case of Spain, but the main difference between Spain and its counterparts is the prolonged deleveraging process, which was especially acute in years 2012 and 2013, with annual declines exceeding 12%. Loan developments began to stabilize in mid-2013 and improved markedly since then.

[9] Source: Investment and investment finance in Europe 2013, European Investment Bank.

Figure 1. Annual growth rates in outstanding loans to NFCs



Source: ECB – Statistical Data Warehouse. Figure 1 shows the annual growth rates in outstanding loans to non-financial firms in Germany, France, Italy and Spain and indicates that between 2009 and 2013, the average growth rate in Spain was -7.7%, against -0.6% for the other three countries as a whole.

As suggested by the Deutsche Bundesbank[10], the factors influencing loan dynamics in Spain were demand-side (debt overhangs accumulated in the past) and supply-side (the strains which the financial, real estate and sovereign debt crises caused in the banking system led banks to tighten their credit standards).

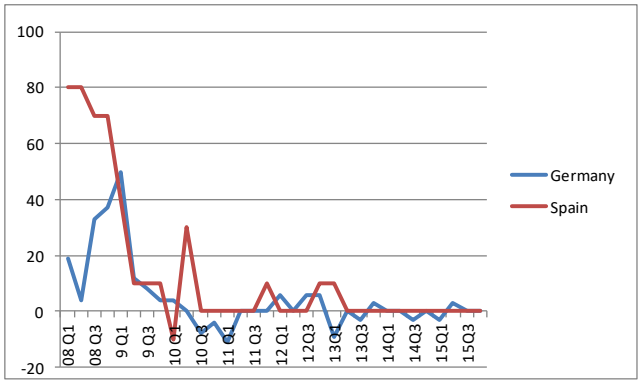
The Deutsche Bundesbank performed an analysis comparing actual with hypothetical loan developments, the latter being derived from correlations observed in the past between loans and economic conditions. According to such analysis, loan growth in Germany and France between 2008 and 2015 was largely in line with past regularities, but the decline in lending in Spain went beyond correcting the existing loan overhang.

The tightening in lending standards on loans to enterprises is well reflected by the quarterly Euro area Bank Lending Survey conducted by the ECB among a representative sample of Euro area banks. According to such survey, Spanish, Italian and French banks reported that the sovereign debt crisis had led them to tighten their credit standards in 2010-12, whereas in Germany credit standards remained basically unchanged.

Figure 2 shows a comparison of credit standards for the approval of corporate loans between Spain and Germany. As can be seen, not only credit tightening was much more severe in Spain in 2008, but also remained significant throughout the 2009-2013 period. Only after 2013 credit standards in Spain were not tightened, as in Germany.

[10] Deutsche Bundesbank, Monthly Report, September 2015.

Figure 2. Credit standards for the approval of corporate loans in Spain and Germany (Net Percentage)



Source: ECB – Statistical Data Warehouse. Figure 2 shows the evolution of credit standards for the approval of corporate loans. Credit standards are measured as the "Net percentage" ratio, i.e. the difference between the sum of the percentages for "tightened considerably" and "tightened somewhat" and the sum of the percentages for "eased somewhat" and "eased considerably", as per the ECB Bank Lending Survey. A positive sign means tightening standards and a negative sign means easing. The Spanish average for the period 2008-2012 was 20.5, against 8.3 in Germany.

As a conclusion, we believe that the long and intense deleveraging process experienced by Spain, mainly due to the severe tightening in credit standards until 2013, is a strong reason to argue that the case of Spain provides an ideal setting to test the influence of supply-side factors on capital structure.

2.4. Credit market conditions in Spain

Between 2000 and 2008 the Spanish market was characterized by very strong credit growth, mainly driven by the real estate sector. In fact, corporate loans outstanding grew 118% between 2004 and 2008[11]. The magnitude of this real estate frenzy can be better ascertained by looking at the proportion of real estate financing over total financing, which increased from 23.2% in 2004 to 32.2% in 2007[12]. This credit bubble burst in 2008, when the ratio of real estate non-performing loans increased from less than 1% to 6%[13]. In this context of sharply growing non-performing loans and falling real estate asset prices, banks' capital was beginning to erode.

In addition to the domestic real estate crisis, the international financial crisis which originated in the United States in the latter half of 2007 hampered banks' access to capital markets, so Spanish banks faced not only solvency problems but also liquidity constrains. This difficulty to access market financing contributed to tightening credit standards

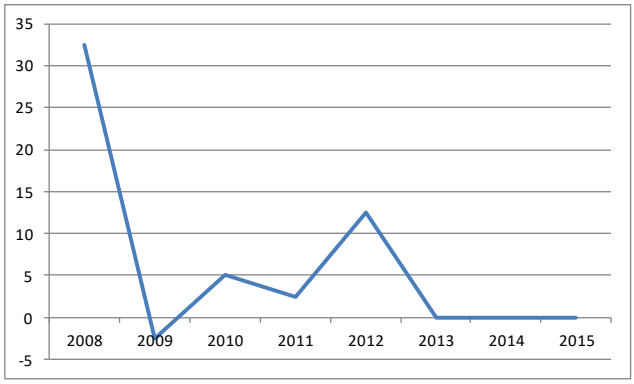
[11] Source: *Boletín Estadístico*, Bank of Spain.

[12] Source: *Boletín Estadístico*, Bank of Spain.

[13] Source: *Boletín Estadístico*, Bank of Spain.

between 2008 and 2012, as corroborated by the Bank Lending Survey and depicted on Figure 3 below.

Figure 3. Contribution of the "ability to access market financing" to changes in credit standards for corporate loans (Net Percentage)



Source: ECB – Statistical Data Warehouse. Figure 3 shows the contribution of the ability to access market financing to changes in credit standards, measured as a "Net percentage" ratio, i.e. the share of banks reporting that the factor has contributed to tightening minus the share of banks reporting that it has contributed to easing, as per the ECB survey. The ratio reached a maximum of 32.5 in 2008 and then climbed again to 12.5 in 2012, in the midst of the Spanish sovereign debt crisis.

The increased contribution of the difficulty to access market financing to tightening credit standards between 2011 and 2012 is explained by the aggravated Spanish sovereign debt crisis in this period, which was in turn the result of a growing imbalance in public finances due to the bailout of many savings banks by the government. The Spanish credit rating was downgraded to BBB- in October 2012 and the 10-yr bond yield rose sharply to a maximum of 5.83%, coinciding with the bailout of Bankia[14] by the government. Banks' funding costs at the peak of the sovereign debt crisis raised above those of 2008 and 2009.

As a result of the situation explained so far, the need for banks to clean-up their balance sheets was obvious, even if the process was not forced by the Spanish government until February 2012, when strong impairment and provisioning measures amounting to 80 billion Euros were introduced. Subsequently, the Spanish banking sector incurred aggregate losses of 14.7 and 73.7 billion Euros in 2011 and 2012, respectively[15]. Profitability began to improve when legacy loan portfolios were transferred to a resolution agency at the turn of 2012-13.

[14] Bankia was the largest financial institution rescued by the Spanish government. Bankia received 22 billion Euros of state aid in 2012.

[15] Source: *Boletín Estadístico*, Bank of Spain.

Our sample period includes the year when the credit bubble burst (2008), the subsequent years of credit tightening until 2013 and the recovery years that followed the restructuring of the Spanish savings bank sector.

2.5. The data

The analysis is based on all non-financial firms listed on the Spanish "Mercado Continuo" at the end of 2015, excluding investment vehicles and real estate developers. We have also left out firms that had been set up very recently and consequently had no track record, as well as those highly distressed firms with negative book equity.

The database consists of a strongly balanced panel of 84 firms with annual observations from 2008 to 2015. Historical data corresponding to seven companies which were established in 2010 and 2011 are missing for the two and three-year periods prior to their establishment. A description of the panel is shown in Appendix 2.1.

We have decided to look only at listed companies because, as mentioned by Faulkender and Petersen (2005, pg51), "Since the firms we examine are publicly traded, they should in theory be less sensitive to credit rationing than the private firms".

The data have been mainly sourced from the "Comisión Nacional del Mercado de Valores" (the Spanish Exchange regulator) and "Bolsa de Madrid" (the Madrid Stock Exchange). All the accounting, market and ownership data required are available on a standard and fully consistent basis across companies at these two sources. Additionally, the Consolidated IFRS Annual Accounts have been reviewed in detail to accurately document the source of each of the firm's debt issuances. Finally, credit conditions are proxied with the credit standard index for approving corporate loans in Spain as per the ECB Bank Lending Survey.

2.6. Empirical Approach

The proposed leverage equation for firm *i* is:

$$LEV_{it} = \alpha_0 + X_{it} * \beta + \Upsilon' * Tax_t + \delta * CC_t + \varepsilon_{it}, \quad i=1, \ldots,84; t= 1, \ldots,8 \qquad (1)$$

Our model defines leverage as the dependent variable, measured on both book and market value terms. Book leverage (*BLEV*) is defined as the ratio of the book value of long-term and short-term debt over the book value of total assets. Market leverage (*MKLEV*) is

defined as the ratio of the book value of long-term and short-term debt divided by book value of total debt plus market value of equity.

In the literature, it is common to find claims that the main results generally hold irrespectively of leverage definitions, so we expect our results to be largely robust to the choice among the two measures of leverage.

X is a vector of independent variables which include asset tangibility (*TAN*), operating profitability (*PROF*), risk (*RK*), ownership concentration (*OC*), growth opportunities (*G*) and access to public debt markets (*PM*).

In the literature, access to fixed income markets is often proxied with firm size (Leary, 2009) or being rated (Faulkender and Petersen, 2005). To ensure that our results are not driven by the way we define access (being rated, large size or other imperfect proxies), we have verified access to public debt markets on a firm-by-firm basis by reviewing each firm's Annual Report in detail.

However, measuring access to the debt markets as a dummy variable for those firms that have done so can introduce a selection bias, since some firms may choose not to access the market even if they can. To tackle this, we have sourced Standard and Poor's and Moody's credit rating data from Capital IQ and Afi Research and found that out of 533 firm-year observations in our dataset, 141 (26.5%) have a credit rating and among these 101 (18.9%) are investment grade. The correspondence between having an investment grade rating and having public debt outstanding is extremely high. Only two firm-year observations out of 101 with an investment grade rating do not have market debt, so the concern of selection bias is mitigated. Additionally, there are 83 firm-year observations in our dataset with public debt outstanding and no rating. These observations would be incorrectly classified as not having access to the fixed-income markets if the debt rating were used as a proxy.

CC is a time-series firm-invariant measure capturing credit conditions as per the ECB Bank Lending Survey. *CC* ranges from 0.75 in 2008 (tightened conditions) to 0 in 2015 (normal conditions). Following a similar approach to the one used by Judge and Korzhenitskaya (2012), the *PM* and *CC* variables are interacted to ascertain the impact of access to public debt markets on firms' leverage during a period of credit tightening.

The five firm characteristics and the statutory tax rate are intended to control for demand factors, with any remaining variability which is explained by access to public debt markets and credit conditions accounting for supply factors.

Size (*SZ*) is not included given its high correlation with *PM*, but its effect is nevertheless considered when we investigate the robustness of results under alternative specifications. A detailed definition of these variables is contained in Appendix 2.2.

Panel datasets often violate the standard Ordinary Least Squares (OLS) assumptions about the error process. Usually, errors are not only serially correlated and heteroscedastic but also contemporaneously correlated, which leads to inconsistent standard error estimates (Hoechle, 2007).

According to Petersen (2009), usual approaches for estimating standard errors in finance panel datasets include the Newey-West procedure and Rogers or clustered standard errors. While these techniques are robust to certain violations of the model assumptions, they do not consider cross-sectional correlation.

Over the last thirty years, several models have been developed to account for heteroscedasticity as well as for temporal and contemporaneous correlation in the residuals. Feasible Generalised Least Squares (FGLS) cannot be used if the panel's time dimension is smaller than its cross-sectional dimension, as in our case (T=8; N=84). Alternatively, Beck and Katz (1995) suggested relying on OLS parameter estimates with panel-corrected standard errors (PCSE), which they claim provides accurate standard error estimation. Finally, Driscoll and Kraay (1998) also introduced a method which yields standard error estimates that are robust to general forms of spatial and temporal dependence.

Both PCSE and Driscoll and Kraay methods rely on large T asymptotics, although as mentioned by Beck (2001, pg 272), "there is no strict lower limit to the number of repeated observations". In this regard, Hoechle (2007) performs simulations with time dimensions ranging between 5 and 25 periods and concludes that coverage rates of OLS and Rogers standard errors are dominated by those of the Driscoll and Kraay estimator when cross-sectional correlation is present.

Considering the above, we have analyzed whether our panel dataset encounters the problems of heteroskedasticity, serial and cross-sectional correlation. We performed the

Wald and Wooldridge tests for heteroskedasticity and autocorrelation and conclude the existence of both problems. Additionally, we have performed the Pesaran test for the presence of cross-sectional dependence and the average absolute correlation value of the residuals amounts to 0.45, which is high and hence provides evidence suggesting the presence of cross-sectional dependence.

Based on these results and given how important the choice of the covariance matrix estimator is for the validity of conclusions, we have used models which account for heteroscedasticity as well as for temporal and spatial dependence in the residuals.

2.7. Results

2.7.1 Univariate analysis

The descriptive statistics of the panel are presented on Table 1.

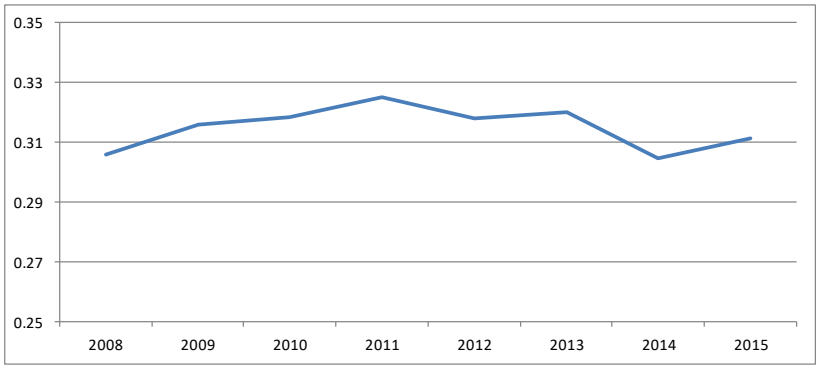
Table 1. Descriptive statistics

	Mean	Standard Deviation
BLEV	31.5%	17.6%
MKLEV	39.5%	24.8%
TAN	32.4%	22.1%
PROF	8.6%	9.8%
OC	56.7%	23.1%
G	2.2	4.2

As may be seen on Table 1, average ownership concentration amounts to 56.7%, which is a distinctive feature of the Spanish market, characterized by many family-controlled firms. As discussed by Miguel and Pindado (2001), there are two differentiated patterns of ownership, the Anglo-American model where firms have diffused ownership and the Continental European pattern where ownership is highly concentrated.

As regards the evolution of leverage, if we compute average leverage ratios across companies for each year, we see on Figure 4 that book leverage increases between 2008 and 2011 and then goes down to 31.1% in 2015, a similar level to that of 2008.

Figure 4. Evolution of book leverage



Source: Own data. Figure 4 shows the evolution of book leverage, defined as the ratio of the book value of long-term and short-term debt over the book value of total assets. Average leverage ratios have been calculated across companies for each year between 2008 and 2015.

Moving on to the main explanatory variables, Table 2 shows the pair-wise correlation matrix for all the variables. The matrix does not suggest any serious concern for multicollinearity, even if the correlation between size (SZ) and access to public debt markets (PM) is quite high.

Table 2. Correlation matrix

	BLEV	TAN	PROF	SZ	G	OC	CC	RK	PM
BLEV	1.00								
TAN	0.23*	1.00							
PROF	-0.31*	-0.02	1.00						
SZ	0.05	0.13*	0.02	1.00					
G	-0.12*	-0.11*	0.27*	-0.05	1.00				
OC	0.02	-0.05	0.00	-0.20*	-0.11*	1.00			
CC	-0.02	0.02	0.06	0.00	0.00	0.03	1.00		
RK	0.02	-0.02	-0.09*	-0.06	-0.05	0.01	-0.02	1.00	
PM	0.26*	0.23*	-0.06	0.54*	-0.06	-0.16*	-0.07	-0.05	1.00

*indicates statistical significance at 5% level

We finally proceed to examine differences in leverage according to four variables: access to public debt markets, growth potential, sector of activity and family ownership. Table 3 reports the results of tests for differences in the mean leverage. As can be seen, differences in leverage between firms with and without debt market access are highly significant, which is consistent with the results from Faulkender and Petersen (2005) and Judge and Korzhenitskaya (2012).

Differences are also highly significant when we distinguish between high and low growth firms. In this regard, we have split firms into two groups, depending on whether G is above or below the average. As may be seen on Table 3, leverage is higher for low growth firms, especially if leverage is measured at market value, a result consistent with the Trade-off theory.

As regards the sector of activity, regulated industries (telecoms, electric and gas utilities) are among the most highly levered according to authors like Bradley et al. (1984) and Chung (1993). More recently, Andritzky (2003) showed that the pharma and IT industries have negative influence on leverage while sectors like water and construction have a positive impact on the debt ratio in most countries. Consequently, two groups have been established, the first one including firms in the construction, renewable energy, telecoms and utilities sectors and the second including all other firms in the dataset. As may be observed on Table 3, we find that average leverage is higher in the first group of firms.

However, contrary to Morresi and Naccarato (2016) and Anderson et al. (2001), we do not reach a conclusive evidence that family firms are clearly more levered.

Table 3. Differences in leverage between firms

	MKLEV	**BLEV**
According to debt market access		
Mean of firms without access	33.84%	28.28%
Mean of firms with access	49.93%	37.87%
Mean difference	-16.09%	-9.59%
T-stat	-8.75	-7.48
According to growth potential		
Mean of low-growth firms	46.92%	32.67%
Mean of high-growth firms	20.48%	29.08%
Mean difference	26.44%	3.59%
T-stat	14.80	2.26
According to sector of activity		
Mean of regulated and construction firms	57.86%	42.28%
Mean of other firms	32.66%	27.61%
Mean difference	25.20%	14.67%
T-stat	12.49	11.37
According to family ownership		

Mean of non-family firms	37.55%	32.11%
Mean of family firms	42.25%	30.57%
Mean difference	-4.70%	1.54%
T-stat	-2.25	1.08

2.7.2 Multivariate analysis

First, we run a pooled OLS regression and then we proceed to fit panel-data models.

The results of our pooled OLS regressions are depicted on Table 4 below and show that profitability and public market access are statistically significant at 1% regardless of whether we measure leverage at book or market values. The role of operating profitability is consistent with the Pecking Order theory and the empirical literature. Additionally, access to public debt markets is a significant variable even after the inclusion of firm characteristics, in agreement with the results from Faulkender and Petersen (2005) and Judge and Korzhenitskaya (2012).

When leverage is measured at market values, the tax rate and credit conditions are significant too. The positive sign of the tax parameter is consistent with the Trade-off theory while the negative relationship between credit conditions and market leverage means that market leverage decreases when credit market conditions become tighter.

Table 4. Determinants of Leverage. Pooled OLS regressions

Variables	MKLEV		BLEV	
TAN	0.1328	(0.0883)	0.1404**	(0.0711)
PROF	-1.1562*	(0.2001)	-0.6428*	(0.1195)
RK	0.0010**	(0.0005)	0.0000	(0.0003)
OC	0.0819	(0.0882)	-0.0036	(0.0666)
G	-0.0080	(0.0045)	0.0002	(0.0021)
Tax	1.9787**	(0.7416)	0.1146	(0.6981)
PM	0.1404*	(0.0330)	0.0836*	(0.0289)
CC	-0.2751**	(0.1336)	0.0304	(0.0999)
Intercept	-0.2027	(0.2249)	0.2574	(0.2061)
R-squared	0.3812		0.2334	
F /Prob > F	13.45 / 0.0000		8.23 / 0.0000	
Observations	533		533	

The variables are defined in Appendix 2.2.
Clustered standard errors are reported in parentheses.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

The usual statistical tests indicate that there are significant individual firm-level effects, so pooled OLS is not appropriate. Consequently, we fit two panel-data models, one with the cluster option, which only accounts for heteroscedasticity and autocorrelation and a PCSE model which also reflects contemporaneous correlation. Table 5 shows two panels, for the PCSE and clustered options, and two columns within each panel, one for each of the two different debt ratios we examine.

Table 5. Determinants of Leverage. Panel-data PCSE and clustered regressions

	PCSE model				**Clustered model**			
Variables	MKLEV		BLEV		MKLEV		BLEV	
TAN	0.2466*	(0.0405)	0.1968*	(0.0526)	0.3666*	(0.0969)	0.3171*	(0.0785)
PROF	-0.5769*	(0.0956)	-0.2558*	(0.0605)	-0.6095*	(0.1366)	-0.2429**	(0.1072)
RK	0.0003	(0.0003)	0.0002***	(0.0001)	0.0004	(0.0003)	0.0000	(0.0002)
OC	0.0743	(0.1122)	-0.0180	(0.0760)	-0.0342	(0.0828)	-0.0364	(0.0780)
G	-0.0025	(0.0018)	-0.0005	(0.0017)	-0.0028	(0.0021)	-0.0016	(0.0016)
Tax	0.7591*	(0.1752)	-0.1759	(0.1427)	2.1242*	(0.6597)	0.1773	(0.5499)
PM	0.0681*	(0.0163)	0.0558*	(0.0191)	0.0327	(0.0243)	0.0109	(0.0161)
CC	-0.4514*	(0.0330)	-0.0275	(0.0576)	-0.3834*	(0.1153)	-0.0203	(0.0895)
Intercept	0.0783	(0.0524)	0.3123*	(0.0859)	-0.2727	(0.2015)	0.2021	(0.1549)
R-squared	0.7181		0.6519		0.2529		0.1298	
Wald chi2 /	403.52/		748.88/		76.87/		30.64/	
Prob > Chi2	0.0000		0.0000		0.0000		0.0001	
Observations	533		533		533		533	

The variables are defined in Appendix 2.2.
Panel corrected and clustered standard errors are reported in parentheses.
The clustered model is a random-effects GLS regression.
The PCSE model produces Prais-Winsten estimates of the parameters given autocorrelation of the form AR(1) within panels and assuming that the coefficient of the AR1 process is specific to each panel.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

As can be seen on Table 5, irrespectively of the model and whether we use market or book leverage as dependent variables, asset tangibility and profitability are statistically significant. The role of tangibility is consistent with the Trade-off theory and previous empirical literature, while the role of profitability is in line with the Pecking Order theory. When leverage is measured at market values, the tax rate also becomes significant under both models.

Even after the inclusion of the firm characteristics and irrespectively of the model we use, there is a significant negative relationship between credit conditions and market leverage, which means that market leverage decreases when credit market conditions become tighter. Additionally, the significance of access to public debt markets under a PCSE model is in agreement with the results from Faulkender and Petersen (2005). Although they measure access to public debt markets using an eligibility criterion (having a debt rating) and not as effective access, their results are very similar to ours, with point estimates ranging from 0.041 to 0.090.

We next proceed to interact credit conditions with access to public debt markets, following a similar approach to the one used by Judge and Korzhenitskaya (2012). The coefficient on PM*CC indicates whether access to public debt markets becomes more important during the periods of tighter credit conditions. The results are displayed on Table 6.

Table 6. Determinants of Leverage interacting PM with CC. PCSE and clustered regressions

	PCSE model				**Clustered model**			
Variables	MKLEV		BLEV		MKLEV		BLEV	
TAN	0.2262*	(0.0467)	0.1852*	(0.0529)	0.3538*	(0.0929)	0.3122*	(0.0769)
PROF	-0.5881*	(0.0978)	-0.2550*	(0.0588)	-0.6177*	(0.1361)	-0.2462**	(0.1069)
RK	0.0003	(0.0003)	0.0002**	(0.0001)	0.0004	(0.0002)	0.0000	(0.0002)
OC	0.0828	(0.1107)	-0.0096	(0.0770)	-0.0380	(0.0819)	-0.0376	(0.0778)
G	-0.0025	(0.0017)	-0.0005	(0.0017)	-0.0028	(0.0021)	-0.0016	(0.0016)
Tax	0.7352*	(0.1613)	-0.1971	(0.1406)	2.0553*	(0.6736)	0.1532	(0.5589)
PM	0.0531*	(0.0184)	0.0458**	(0.0194)	0.0200	(0.0256)	0.0067	(0.0175)
CC	-0.5384*	(0.0505)	-0.0882**	(0.0379)	-0.4892*	(0.1333)	-0.0569	(0.1166)
PM*CC	0.3004**	(0.1294)	0.2032***	(0.1199)	0.3531	(0.2494)	0.1225	(0.1691)
Intercept	0.0957***	(0.0566)	0.3221*	(0.0833)	-0.2411	(0.2053)	0.2132	(0.1583)
R-squared	0.7533		0.6610		0.2598		0.1324	
Wald chi2 Prob > Chi2	3658.34/ 0.0000		11287.89/ 0.0000		80.11/ 0.0000		32.10/ 0.0002	
Observations	533		533		533		533	

The variables are defined in Appendix 2.2.
Panel corrected and clustered standard errors are reported in parentheses.
The clustered model is a random-effects GLS regression.
The PCSE model produces Prais-Winsten estimates of the parameters given autocorrelation of the form AR(1) within panels and assuming that the coefficient of the AR1 process is specific to each panel.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

As can be observed from Table 6, the interaction is significant under a PCSE model. This conclusion is consistent with Leary (2009), who showed that the capital structure of bank-dependent firms is more sensitive to the availability of bank loans than firms which have access to public markets. Consequently, the impact on total leverage depends on the ability of firms to tap other credit sources. If other sources are accessible, the effect of bank credit tightening is attenuated.

Unlike Judge and Korzhenitskaya (2012), we keep the independent effect of credit conditions in the estimation equation. This allows us to check the relative importance of credit conditions among firms with and without access to public debt. Specifically, we find that the negative effect of tightening credit conditions on market leverage is halved when the firm has access to fixed-income markets. In the case of book leverage, the interaction term more than offsets the negative effect of credit conditions.

Finally, we have run fixed-effect regressions on the same explanatory variables with two different models: a clustered fixed-effects regression that considers both heteroscedasticity and autocorrelation and a fixed-effects regression with Driscoll and Kraay standard errors which are heteroscedasticity consistent and robust to general forms of cross-sectional and temporal dependence. The results are displayed on Table 7.

Table 7. Determinants of Leverage. Fixed-effects regressions

	Driscoll and Kraay standard errors				**Clustered standard errors**			
Variables	MKLEV		BLEV		MKLEV		BLEV	
TAN	0.5452*	(0.0848)	0.4474*	(0.0451)	0.5452*	(0.1602)	0.4474*	(0.1435)
PROF	-0.5351*	(0.0688)	-0.1929*	(0.0570)	-0.5351*	(0.1605)	-0.1929	(0.1363)
RK	0.0004	(0.0003)	0.0000	(0.0001)	0.0004	(0.0003)	0.0000	(0.0002)
OC	-0.0978**	(0.0498)	-0.0406	(0.0223)	-0.0978	(0.1053)	-0.0406	(0.1069)
G	-0.0022*	(0.0007)	-0.0016*	(0.0006)	-0.0022	(0.0017)	-0.0016	(0.0016)
Tax	2.1547*	(0.7774)	0.2391*	(0.0812)	2.1547*	(0.6823)	0.2391	(0.5562)
PM	0.0174	(0.0269)	0.0051	(0.0196)	0.0174	(0.0264)	0.0051	(0.0186)
CC	-0.4143*	(0.1321)	-0.0425***	(0.0250)	-0.4143*	(0.1113)	-0.0425	(0.0917)
Intercept	-0.3049	(0.2171)	0.1397*	(0.0288)	-0.3049	(0.2093)	0.1397	(0.1491)
R-squared	0.1713		0.0902		0.1642		0.0988	
F / Prob > F	192.98/		249.21/		6.18/		2.27/	
	0.0000		0.0000		0.0000		0.0301	
Observations	533		533		533		533	

The variables are defined in Appendix 2.2.
D-K and clustered standard errors are reported in parentheses.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

As shown on Table 7, asset tangibility and profitability are significant regardless of the model used and how leverage is measured. Growth expectations turn out to be significant with the expected negative sign when standard error estimates are obtained using the Driscoll-Kraay technique. This is consistent with the theory and our univariate analysis. The tax rate is also significant with the expected positive sign when standard error estimates are obtained using the Driscoll-Kraay technique. Finally, a significant negative relationship between market leverage and credit conditions is found again, regardless of how standard errors are obtained.

As a conclusion, results from the leverage equation are broadly consistent and show that the impact of supply-side factors is significant, especially when leverage is measured at market value terms.

2.7.3 Robustness of results to alternative specifications

In this section we investigate the robustness of the relations analyzed to four alternative specifications: i) verifying whether the supply-side influence is confined to the peculiarities of the property and construction industry or to the peculiarities of the 2008 recession, ii) measuring long-term leverage only, iii) fitting the model to a sample which excludes seven companies with missing data and iv) adding size as an additional control.

As regards the first robustness test, we have run the results for the PCSE panel regression leaving out the ten construction firms to see if there is any remaining influence of the supply-side factors and have verified that indeed credit conditions and access to debt markets continue to be significant explanatory variables of market leverage, with coefficient estimates of -0.446 and 0.059 respectively. Additionally, a time dummy for 2008 has been added to the specification to see if supply-side variables still have an impact when the 2008 year influence is kept constant. Supply-side factors continue to be significant in this case too, which allows us to conclude that supply-side influence is not confined to a particular sector or time period.

Our leverage variable includes both short-term and long-term debt. Quite often capital structure studies use long-term debt only, so as a second robustness test we have verified whether our results hold in this case by resorting to PCSE and fixed-effects Driscoll-Kraay models to regress long-term leverage on the same explanatory variables as before.

When we fit a PCSE model to regress long-term book leverage, asset tangibility, profitability and public market access continue to be significant, but risk is no longer significant. In the case of a fixed-effects regression with Driscoll and Kraay standard errors, asset tangibility and growth expectations remain significant, but profitability is no longer significant. However, credit conditions and public market access become significant. These results are shown on Table 8 below.

If long-term market leverage is being regressed with a PCSE model, tangibility, profitability, public market access and credit conditions are still significant with the same signs. In the case of a fixed-effects regression with Driscoll and Kraay standard errors, the significant variables are the same as when total leverage was regressed, with the exception of ownership concentration.

Likewise, if credit conditions were interacted with access to public debt markets, such interaction would be significant under a PCSE model when leverage is measured both at book and market values.

Table 8. PCSE and Driscoll and Kraay long-term leverage regressions

	PCSE				**Fixed-effects with D-K standard errors**			
	MKLEV		BLEV		MKLEV		BLEV	
TAN	0.2048*	(0.0665)	0.1437*	(0.0349)	0.5916*	(0.1212)	0.3649*	(0.0523)
PROF	-0.4510*	(0.1229)	-0.1417**	(0.0633)	-0.2969*	(0.0578)	0.0216	(0.0590)
RK	-0.0001	(0.0002)	-0.0003	(0.0002)	-0.0001	(0.0005)	-0.0002	(0.0002)
OC	0.1266	(0.0683)	0.0290	(0.0518)	-0.0654	(0.0468)	-0.0292	(0.0213)
G	-0.0029	(0.0019)	-0.0004	(0.0017)	-0.0018*	(0.0006)	-0.0010*	(0.0002)
Tax	0.2868	(0.2840)	-0.6609*	(0.1492)	1.1014**	(0.5192)	-0.6123*	(0.1840)
PM	0.0992*	(0.0184)	0.0871*	(0.0116)	0.0407	(0.0246)	0.0393*	(0.0150)
CC	-0.3843*	(0.1069)	-0.0507	(0.0655)	-0.4221*	(0.0965)	-0.0778*	(0.0095)
Intercept	0.1458*	(0.0414)	0.3484*	(0.0496)	-0.1304	(0.1507)	0.2838*	(0.0416)
R-squared	0.5777		0.5676		0.1203		0.0779	
Wald Chi2 (F) / Prob > Chi (F)	421.68/ 0.0000		675.61/ 0.0000		104.96/ 0.0000		6266.28 / 0.0000	
Observations	533		533		533		533	

The variables are defined in Appendix 2.2.
D-K and Panel corrected standard errors are reported in parentheses.
The PCSE model produces Prais-Winsten estimates of the parameters given autocorrelation of the form AR(1) within panels and assuming that the coefficient of the AR1 process is specific to each panel.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

As we explained when describing the data, seven companies were established in 2010 and 2011 and therefore their data are missing for the two and three-year periods prior to their establishment. A potential concern is that these firms, incorporated in a different moment of the cycle, may contaminate the global results. We examine this question in Table 9 by dropping them from the analysis and fail to detect relevant differences relative to the benchmark results.

Table 9. Leverage regressions with sample of 77 firms

	PCSE				**Fixed-effects with D-K standard errors**			
Variables	MKLEV		BLEV		MKLEV		BLEV	
TAN	0.2637*	(0.0425)	0.1928*	(0.0591)	0.5444*	(0.0855)	0.4500*	(0.0454)
PROF	-0.6833*	(0.1209)	-0.2871*	(0.0838)	-0.5363*	(0.0671)	-0.2003*	(0.0562)
RK	0.0003	(0.0003)	0.0002	(0.0001)	0.0004	(0.0003)	0.0000	(0.0001)
OC	0.0712	(0.1143)	-0.0189	(0.0815)	-0.0976**	(0.0505)	-0.0418***	(0.0221)
G	-0.0026	(0.0019)	-0.0005	(0.0018)	-0.0022*	(0.0007)	-0.0016*	(0.0006)
Tax	0.9415*	(0.2221)	0.0290	(0.0848)	2.2758*	(0.7854)	0.2873*	(0.0876)
PM	0.0750*	(0.0158)	0.0637*	(0.0188)	0.0187	(0.0283)	0.0055	(0.0204)
CC	-0.4638*	(0.0308)	-0.0249	(0.0401)	-0.4187*	(0.1306)	-0.0435	(0.0250)
Intercept	0.0227	(0.0431)	0.2509*	(0.0720)	-0.3394	(0.2191)	0.1272*	(0.0304)
R-squared	0.7140		0.6338		0.1716		0.0919	
Wald Chi2 (F) / Prob > Chi (F)	1155.38/ 0.0000		2194.15/ 0.0000		191.35/ 0.0000		286.17/ 0.0000	
Observations	516		516		516		516	

The variables are defined in Appendix 2.2.
D-K and Panel corrected standard errors are reported in parentheses.
The PCSE model produces Prais-Winsten estimates of the parameters given autocorrelation of the form AR(1) within panels and assuming that the coefficient of the AR1 process is specific to each panel.
*, ** and *** indicate statistical significance at 1%, 5% and 10% respectively.

Our last robustness test has to do with firm size (SZ). This control was not included in the previous models given its high correlation with PM but its effect has nevertheless been considered for robustness purposes. Consistently with the Trade-off theory, we have found a positive relationship between size and market leverage and what is more important, our conclusions as regards the other variables would hold if size were included as a regressor.

Finally, in terms of structural stability, we test whether the parameters are stable over two groups: firms with and without access to fixed-income markets. In this respect, we apply a Chow test to examine whether parameters of one group are equal to those of the other

group. At a 5% significance level, we accept the null hypothesis of equal parameters when market leverage is being regressed. However, when book leverage is the dependent variable, the null hypothesis of model stability is rejected.

2.8. Conclusions

The existing literature focuses primarily on demand factors affecting leverage and generally overlooks supply factors, which have only been analyzed recently by authors like Faulkender and Petersen (2005), Judge and Korzhenitskaya (2012) and Leary (2009). This is the reason why we decided to investigate the impact on leverage of supply-side factors such as public market access and credit conditions.

For this purpose, we have selected the case of Spain because the sharp tightening in credit standards faced by the country between 2008 and 2013 allows us to adequately test the impact of supply-side variables. The observation period between 2008 and 2015 captures the whole cycle since the credit bubble burst until the stabilization of credit conditions.

Our main contribution shows that financial constraints of banks affect the capital structure of borrowers. In fact, we have found strong evidence that there is an economically and statistically significant negative relationship between credit conditions and market leverage, which means that market leverage decreases when credit market conditions become tighter. Consequently, the current paper shows that even in the situation of large and highly transparent publicly listed firms, which should in theory be less sensitive to credit rationing, their capital structure decisions are constrained by credit conditions. This conclusion slightly contradicts the results of Demirguc-Kunt et al. (2015), who found only weak evidence of a decline in leverage among firms listed on stock exchanges during the 2008-2011 crisis.

Additionally, there is a clear relationship between leverage and access to public debt markets whereby firms with access to fixed-income markets are significantly more levered, as shown by Faulkender and Petersen (2005) and Judge and Korzhenitskaya (2012). Finally, consistently with Judge and Korzhenitskaya (2012) and Leary (2009), the estimated coefficient on the interaction term between public bond market access and credit conditions is positive, which means that the capital structure of bank-dependent firms is more sensitive to the availability of bank loans than firms which have access to public debt markets. More precisely, we find that the negative effect of tightening credit conditions on market leverage doubles in the case of firms without access to public debt

markets. These results are robust to alternative specifications, such as defining leverage with long-term debt only.

The demand-side factors identified by previous studies to be related to leverage seem to be robust in our case too, as we have found that asset tangibility and operating profitability are significant determinants of leverage, no matter whether the latter is measured at book or market values. This is consistent with the recent paper from Hang et al. (2018), which applies meta-regression analysis on data from 100 studies and reveals that tangibility (positive sign) and profitability (negative sign) are among the most significant determinants of leverage.

In terms of practical implications for international firms, this paper shows how important it is to diversify the sources of finance. Otherwise, firms can find themselves constrained in the amount of debt they can raise during a banking crisis, since switching to alternative sources of debt like fixed-income markets is costly and takes significant time.

Finally, as an idea for further research it would be worthwhile to conduct a similar study among smaller Spanish private firms over the same time period. The authors believe this topic to be interesting given that very few studies have focused on private firms within the context of the recent financial crisis. Since the firms with no access to the equity markets are less transparent, the impact of credit tightening on their capital structures may be greater. This type of analysis would allow us to verify whether worsening credit conditions affect leverage of private firms more intensely, thus further testing the recent evidence provided by Demirguc-Kunt et al. (2015).

2.9 Appendices

Appendix 2.1.

Table A1. Companies in the database

Sector	Number of companies	Companies
Engineering	5	Duro Felguera, Fluidra, INYPSA, Técnicas Reunidas, APPLUS
Construction	10	ACS, CLEOP, FCC, Ferrovial, OHL, SACYR, San José, Cementos Portland, Coemac, Acciona
Minerals and metals	7	Acerinox, APERAM, Arcelor, Cie Automotive, Lingotes Especiales, Tubacex, Tubos Reunidos
Textile and apparel	3	DOGI, Inditex, Adolfo Domínguez
Paper	6	Ence, Miquel Costas, Ercros, Iberpapel, Reno Medici, Unipapel
Transport and distribution	4	Aena, AIG, Logista, Abertis
Pharma and biotechnology	9	Almirall, Biosearch, Grifols, PRIM, Reig Jofré, ROVI, Bayer, Pharmamar, FAES
Software and electronics	3	Amadeus, Indra, Tecnocom
Manufacturing and capital equipment	6	Elecnor, Gamesa, Nicolás Correa, Talgo, Zardoya Otis, Airbus
Food and drinks	9	Barón de Ley, Bodegas Riojanas, DEOLEO, DIA, Ebro foods, Natra, Naturhouse, Viscofán, Vidrala
Other services	3	Baviera, Funespaña, Prosegur
Telecoms	3	Ezentis, Telefónica, Euskaltel
Leisure and hotels	3	Meliá, NH Hoteles, EDREAMS
Utilities and oil and gas	6	Enagas, Endesa, Gas Natural, Iberdrola, Repsol, REE
Media	4	ATRESMEDIA, MEDIASET, Vocento, Prisa
Renewable energies	3	ENEL GP, FERSA, Solaria

The 84 companies in our analysis were allocated to 16 subsectors of activity according to the classification used by Bolsa de Madrid.

Appendix 2.2.

Table A2. Variable definitions

Variable	Type	Definition
Book Leverage (BLEV)	Continuous	Ratio of the book value of long-term and short-term debt over the book value of total assets. Debt includes bank loans, leasing, bonds, preference shares, convertibles, ECP and EMTN.
Market leverage (MKLEV)	Continuous	Book value of total debt (long term plus short term) divided by book value of total debt plus market value of equity.
Asset tangibility (TAN)	Continuous	Ratio of fixed tangible assets to total assets.
Operating profitability (PROF)	Continuous	Ratio of Ebitda to total assets.
Risk (RK)	Continuous	The standard deviation of Ebitda divided by its mean, over three-year periods on a rolling basis. A similar volatility measure was used as a proxy of risk by Bathala et al. (1994).
Size (SZ)	Continuous	Logarithm of sales.
Growth opportunities (G)	Continuous	G is proxied with the market to book ratio, as in Barclay, Morellec and Smith (2001).
Ownership concentration (OC)	Continuous	Percentage of shares held by owners of 3% or more of the equity, either institutional investors, parent companies or family members. Additionally, stakes held by board members and treasury stock are also computed, even if they are below 3%. Institutional investors include mutual and pension funds, private and government-owned investment companies, banks and insurers.
Tax (Tax)	Continuous, firm-invariant	Defined as the top statutory tax rate, following Frank and Goyal (2009).
Family-owned (FAM)	Dummy	FAM takes value 1 if the company is family-controlled, i.e. if the largest shareholder is a group of people linked by kinship that holds at least 30% of the voting rights, as in Moressi and Naccarato (2016).
Access to debt markets (PM)	Dummy	PM takes value 1 if the company has outstanding debt trading in public markets, such as bonds, convertibles, preference shares, ECP and EMTN.
Credit conditions (CC)	Continuous, firm-invariant	The credit standard index for approving corporate loans to all companies in Spain as per the ECB Bank Lending Survey. The annual index is calculated as the average of each year's four quarters.

In the case of twelve companies which went public during the observation period, the G data is not available for the years prior to listing.

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3. THE INFLUENCE OF THE BANKING AND MACROECONOMIC ENVIRONMENTS ON DEBT SOURCING

Abstract

The influence of firm characteristics on lender choice has been studied in the literature, but the impact of the macroeconomic and banking environments has received less attention. This paper attempts to fill this gap and studies publicly traded Spanish firms to answer two questions. Firstly, do bank-dependent firms substitute bank debt with traded debt after a bank supply shock more intensely than companies with access to the fixed-income markets? Secondlly, do interest rates and bank earnings and non-performing loans influence the probability to tap debt markets by companies and the mix of public and bank debt in their capital structures? The intense restructuring of the Spanish banking sector in 2012 and the resulting sovereign debt crisis provide an ideal setting to conduct our analysis. Based on a 8-year panel dataset, matching estimators, binary response and censored and linear models are used to address our research objectives. We show that the 2012 banking crisis significantly affected the composition of corporate debt, mainly for bank-dependent firms. Furthermore, macroeconomic and banking variables are significant explanatory factors of debt sourcing, so debt choice is not determined solely by firm intrinsic factors but also by supply frictions in the credit markets.

Keywords: bank debt, traded debt, banking crisis, macroeconomic variables, banking variables.

JEL codes: G30; G32; C31; C34; C35

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3.1. Introduction

Most of the capital structure literature has focused on the choice between debt and equity, with less attention being paid to important aspects of debt like maturities, priority structure, covenants and placement choice. In this regard, most studies treat debt as uniform and thus overlook its different properties. This relatively sparse attention to debt characteristics is particularly surprising since debt financing is the dominant source of external funds for companies.

This paper deals with lender choice, a debt property which has received limited attention in the literature. This gap was identified by Faulkender and Petersen (2005), who stressed

the scarcity of empirical work describing why some firms choose to or may borrow from the bond market while others rely only on private lenders. In fact, we go one step further and investigate whether changes in the banking and macroeconomic environments also influence lender choice, in addition to the more commonly studied firm-intrinsic factors. Specifically, our paper attempts to answer two questions. Firstly, we investigate whether bank-dependent firms substitute bank debt with traded debt after a bank supply shock and whether they do it more intensely than firms with access to public debt. Secondly, we study whether interest rates and bank earnings and non-performing loans influence the probability to tap debt markets by companies and the mix of public and bank debt in their capital structures, controlling for company intrinsic characteristics.

We believe this topic to be relevant for the finance literature because it allows to better understand the effects of credit supply frictions on borrowers. In fact, several studies have found small firm investment to be more influenced by credit supply fluctuations than large firm investment, probably because small firms rely on bank debt. Therefore, it is important to understand what intrinsic characteristics explain debt sourcing and what external factors drive firms to favor certain sources during the cycle. Understanding lender choice may shed light on the investment behavior of firms and, as a result, help explain the impact of credit shocks on economic growth.

To our knowledge, only Becker and Ivashina (2014, 2018), Cantillo and Wright (2000) and Fernández et al. (2018) have approached this topic in detail. However, this paper presents some important differences.

Becker and Ivashina (2014, 2018) suggest that substitution from bank credit to traded debt is indicative of a contraction in bank credit supply. Their methodology can only be used for large firms with access to the bond market and, by design, implies that firms in their sample are able to alleviate scarce loan supply by easily substituting into the public market. Therefore, their analysis overlooks firms without access to public debt markets, which can behave very differently during a banking crisis. In the present paper we provide a more differentiated view on the subject by using data for both types of firms. This allows us to identify significant differences between issuers and non-issuers during a banking crisis.

Cantillo and Wright (2000) find that certain macroeconomic variables have a significant effect on lender choice but do not investigate the effect of banks' risk-bearing capacity

on the overall weight of bank financing. In the present paper, we approach this issue by introducing the non-performing loan ratio of the banking sector as an explanatory variable in one of the regression models.

Fernández et al. (2018) have recently performed a similar study to ours by analyzing the effect of a bank credit shock on corporate debt structure. While their data from 34 countries makes it difficult to precisely define the date of the crisis, which varies across countries, our focus on Spain allows us to clearly identify 2012 as the year of the domestic banking crisis. Furthermore, they used a Difference-in-differences (DD) regression, which does not adequately address the fact that issuers and non-issuers are very different in terms of size, thus introducing bias. However, our employment of matching estimators allows us to reduce sample selection bias.

We perform our analysis on 85 non-financial firms listed on the Spanish "Mercado Continuo" over the 2008-2015 period (i.e., a panel of 612 firm-year observations). Spain is a suitable environment because the intense restructuring process experienced by its banking sector in 2012 had a very negative impact on intermediary earnings and sovereign bond values. In fact, banks' Return on Assets (ROA) ranges from a minimum of -1.4% to a maximum of 0.4% over the observation period, with similar variability observed in the Treasury yield, which ranges between 1.8% and 5.8%. Consequently, we believe that Spain provides a good setting to ascertain the influence of macroeconomic and banking variables on lender choice.

We rely on matching estimators to evaluate the effect of the 2012 banking crisis on the composition of corporate debt, with a distinction between issuers and non-issuers. Panel-data Probit and Logit models have been fit to ascertain the probability of a firm making use of public fixed-income. Lastly, censored and linear models have been fit to evaluate the ratios of public and bank debt outstanding to total corporate debt. Contrary to prior studies, which mainly resort to cross-sectional and pooled regressions, we have used panel-data models extensively.

We show that after the onset of the crisis, non-issuers increased their ratio of public to total debt more than otherwise similar firms with traded debt. This result suggests that even bank-dependent firms can compensate for a reduction in bank loan supply with public debt, thus reducing the negative real effects of a banking crisis. Additionally, the paper shows that i) the probability of tapping public debt markets by companies and the

proportion of public debt in their capital structures increase with lower rates and bank profitability and ii) the proportion of bank debt increases as banks' risk bearing capacity improves.

The remainder of the article is organized as follows: Section 3.2 provides a literature review; the restructuring of the Spanish banking sector is analyzed in Section 3.3; a description of the data and the empirical approach are provided in sections 3.4 and 3.5; results are outlined in Section 3.6 and Section 3.7 concludes.

3.2. Theoretical framework

In this section we review the literature on lender choice and the role of micro and macroeconomic factors in determining the composition of debt.

3.2.1. The choice between bank debt and traded debt

Lender choice has been found to be sensitive to a variety of factors, including information asymmetries and agency costs between lenders and borrowers, monitoring costs, renegotiation capabilities and transaction costs.

There is consensus on the idea that private debt reduces agency costs stemming from information asymmetries. However, monitoring costs may outweigh the benefits of lower agency costs. If asymmetries are large and / or credit quality is low, the benefits of lower agency costs will outweigh the monitoring costs.

The link between lender choice, information asymmetries and monitoring costs dates back to Diamond (1989, 1991), who highlighted the importance of the borrower's reputation in terms of lender choice. According to Diamond (1989), incentive problems between borrowers and lenders are most severe for borrowers with short track-records and become less severe for borrowers who acquire a good reputation. His model suggests that firms with short histories will gain reputation by borrowing from intermediaries, while long-standing firms will borrow in the open market to save on monitoring costs. Based on the theoretical premise that bank lenders have superior monitoring ability, Datta et al. (1999) performed an empirical test of Diamond's reputation argument and conclude that bank monitoring indeed lowers the agency costs associated with public debt, reflected through lower at-issue yield spreads.

Rajan (1992) presented a model comparing various debt providers on the basis of their benefits and costs for the firm, highlighting the trade-off between bank debt and market

debt. He explains that the bank reduces the agency costs associated with lending but also adversely affects the owner's incentive to exert effort by influencing the division of surplus between itself and the firm. Hence, he stresses the cost of bank finance that arises from the monitoring and control function the bank performs. However, market debt provides neither the benefits nor the costs of bank debt.

A capital market equilibrium model built by Bolton and Freixas (2000) generated predictions broadly consistent with the conclusions mentioned above. Their model establishes that, for a positive intermediation cost, safer firms turn to bond financing, in line with Diamond's suggestion that long-standing firms will borrow in the open market.

As regards renegotiation and refinancing capabilities, Chemmanur and Fulghieri (1994) presented a model comparing various debt providers on the basis of their ability to manage borrowers' financial distress situations. While Diamond (1989, 1991) focused on reputation acquisition by borrowers, Chemmanur and Fulghieri model reputation acquisition by banks, in a similar way to Sharpe (1990). It is the banks' longer horizon and the subsequent desire to gain a reputation for making better renegotiation versus liquidation decisions (compared to bondholders) which results in their devoting more resources to evaluating firms. An implication is that firms with a high probability of distress find it optimal to use bank loans, a conclusion also reached by Berlin and Mester (1992). The idea that banks treat differently borrowers in distress situations because they are long term players is further supported by De Fiore and Uhlig (2005), who developed a closed economy dynamic general equilibrium model to characterize the optimal choice of firms among various instruments.

Finally, as regards transaction costs, public debt issues are only cost effective above a certain size given their fixed cost element, which means that smaller firms find public debt markets to be cost ineffective as compared to private debt. In addition to issuance costs, the costs of providing the information required by public markets are also sizeable for small firms, as argued by Fama (1985).

3.2.2. Firm-specific factors affecting lender choice according to empirical studies

Based on the theories outlined above, a limited number of empirical studies has shown that firms' choice of lenders depends on variables such as firm size -reflecting transaction costs and information asymmetries-, profitability and tangibility –revealing information

asymmetries-, ownership concentration -reflecting monitoring costs- and growth opportunities -related to agency and refinancing costs.

For instance, Adrian et al. (2013), Cantillo and Wright (2000), Denis and Mihov (2003), Johnson (1997) and Krishnaswami et al. (1999) report a positive relationship between firm size and access to public debt markets. Analyst coverage of smaller firms is not as widespread and regular, so information asymmetries in this case are larger and hence bank debt prevails. As mentioned by Hoyos and De la Torre (2014), liquidity is key to investors and directly related to the size of an issue, so large firms with sizable issues are at an advantage over small firms in terms of market access.

Similarly, profitable firms with a high proportion of tangible assets tap the public market directly because they rarely default and need little monitoring. This is consistent with Diamond and Rajan's conclusions that higher quality firms prefer market rather than bank financing and has found empirical support in Cantillo and Wright (2000) and Denis and Mihov (2003).

Saona and Vallelado (2003) find a significant and positive relationship between ownership concentration and bank debt. This supports the idea that banks prefer to finance companies with low agency conflicts between shareholders and managers in order to minimize the monitoring cost.

Finally, maintaining a close and flexible relationship with lenders may reduce the underinvestment problem, which means that firms with higher growth opportunities will in principle prefer bank debt to public debt. Renegotiation is more difficult and costly in public debt agreements because of the disperse nature of public bondholders. Consequently, firms with attractive growth opportunities and/or higher ex-ante probability of default will prefer private debt. This conclusion is shared by Krishnaswami et al. (1999), Nieto and Tribó (2000) and Saona and Vallelado (2003).

3.2.3. Influence of the macroeconomic and banking environments

In addition to firm-specific factors, it is interesting to explore whether the evolution of the macroeconomic environment also affects lender choice. Theoretically, Diamond (1991) showed that firms consider economic conditions when issuing debt. His model implied that highly rated firms prefer public debt, but they switch to bank debt if interest rates are high.

Bolton and Freixas (2000) concluded that firms' choice of capital providers may vary considerably with the cost of intermediation, which in their model was taken to be banks' costs of raising equity to meet capital requirements. Consequently, in their model, banks' equity base -including internally generated funds- was a key variable in influencing the total supply of bank loans.

Cantillo and Wright (2000) showed that macroeconomic variables have a significant effect on how firms choose their lenders and such selection process in turn varies during business cycles. According to their study, a drop in intermediary earnings or riskless rates favors market financing. Similarly, Leary (2009) shows that following a shock to loan supply, firms turn more heavily to public debt markets. This substitution effect was also analyzed recently by Adrian et al. (2013) and Becker and Ivashina (2014).

Adrian et al. (2013) showed that bond financing surged during the crisis period, making up most of the lost credit due to the contraction of bank loans. Controlling for demand factors, they found that the 2007 to 2009 crisis reduced the probability of obtaining a bank loan and concluded that a contraction in banks' risk-bearing capacity reduces the probability of loan issuance.

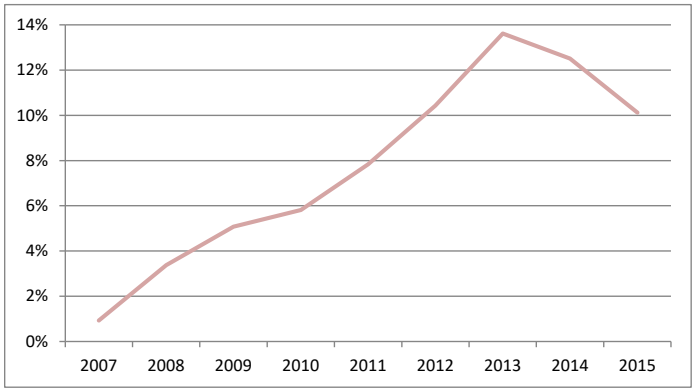
Becker and Ivashina (2014) model the choice between bank and public debt as a function of bank credit availability, a variable that is proxied by lending standards from the Federal Reserve Senior Loan Survey and a weighted average of banks' ratio of non-performing loans. After controlling for firm-specific factors, they found that a tightening in lending standards was predicted to decrease the probability that a firm gets a loan conditional upon receiving new debt financing, corroborating the evidence in Adrian et al. (2013). More recently, Becker and Ivashina (2018) apply a similar methodology to investigate the substitution between loans and bonds for European non-financial firms, with a particular focus on the Euro-area sovereign debt crisis. Their analysis suggests that the increase in corporate bond issuance was incentivized by the contraction in bank credit supply, in turn explained by banks' increase in exposures to domestic sovereign bonds, but also by the increase in non-performing loans.

Finally, Fernández et al. (2018) identified the effect of the bank credit shock of the 2007-2009 crisis on corporate debt structure using firm-level data in 34 countries and found that nonbank credit partially substitutes bank loans in bank-dependent firms after the onset of the crisis.

3.3. Restructuring of the Spanish banking sector

The Spanish market was characterized by very strong credit growth between 2000 and 2008, mainly driven by a booming real estate sector. In fact, corporate loans outstanding grew 118% between 2004 and 2008 according to the Bank of Spain's Boletín Estadístico. This credit bubble burst in 2008, when the non-performing loan ratio increased from 0.9% to 3.4%, as shown on Figure 5. This evolution is consistent with the idea that a key predictor of a banking crisis is the scale of the preceding credit boom (Gourinchas and Obstfeld, 2012).

Figure 5. Evolution of the banking sector non-performing loan ratio between 2007 and 2015



Source: *Boletín Estadístico*, Bank of Spain

In this context of sharply growing non-performing loans and falling real-estate asset prices, the need to restructure the financial sector became obvious even if the process was conducted slowly and was not completed until the end of 2012. Such restructuring process was characterized by many mergers, followed by several bailouts and a strong impairment and provisioning effort.

The impairment and provisioning measures were introduced by Royal Decrees 2/2012 and 18/2012 and amounted to 80 billion Euros, with a very negative impact on the profitability of the Spanish banking sector, which incurred aggregate losses of 14.7 and 73.7 billion Euros in 2011 and 2012, respectively[16]. Profitability began to improve when legacy loan portfolios were transferred to a resolution agency at the turn of 2012-13, as can be seen on Figure 6.

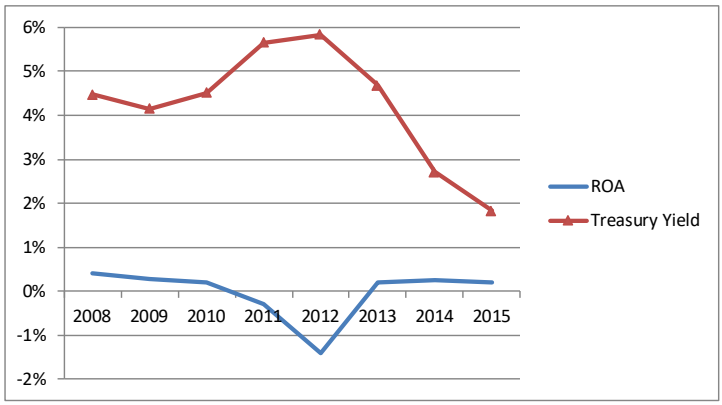
[16] Source: *Boletín Estadístico*, Bank of Spain.

Bailouts to the financial system caused a growing imbalance in public finances and a subsequent increase in Treasury yields, which started to decline only in 2013, once the bank restructuring was completed and profitability began to improve. In fact, in May 2012 credit rating agencies downgraded the long-term debt ratings for a large number of Spanish banks, explaining this action with the rapid asset-quality deterioration and the reduced creditworthiness of the Spanish sovereign. Figure 6 provides a clear picture of this perverse relationship between a banking crisis and country risk. In fact, the correlation coefficient between banks' ROA and the 10-year Spanish Treasury yield amounts to -0.59 and is statistically significant at a 5% level.

This intertwined relationship between banking crises and country risk was confirmed by Reinhart and Rogoff (2011), whose main results indicate that banking crises often precede or accompany sovereign debt crises. Similarly, Mody and Sandri (2012) and Acharga et al. (2014) show that not only did financial sector stress raise sovereign spreads, but sovereign weakness also transmitted thereafter to the financial sector.

The decline in the Treasury yield initiated in 2013 was further fueled by the European Central Bank (ECB)'s decision in January 2015 to launch an aggressive acquisition program of financial assets, including bonds issued by Euro-area governments.

Figure 6. Evolution of the average marginal rate of 10-year Spanish Treasuries and the banking sector ROA between 2008 and 2015



Source: *Boletín Estadístico*, Bank of Spain

Overall, this historical perspective highlights the importance of the business cycle. An appealing feature of our database is that it includes the year when the credit bubble burst (2008), the subsequent years of credit tightening and intermediary losses until 2013 and the recovery period characterized by an improvement in banks' profitability and lower Treasury yields.

3.4. Data description

We restrict our analysis to non-financial firms listed on the Spanish "Mercado Continuo" at the end of 2015, excluding investment vehicles and real estate developers. We have also left out firms that had been set up very recently and consequently had no track-record, as well as highly distressed firms with negative book equity.

The database consists of 85 firms analyzed from 2008 to 2015 (a panel of 612 firm-year observations). A description of the database is shown in Appendix 3.1. Historical data corresponding to seven companies which were established in 2010 and 2011 are missing for the two and three-year periods prior to their establishment.

Annual firm data have been sourced from the "Comisión Nacional del Mercado de Valores" ("CNMV", the Spanish Exchange regulator) and "Bolsa de Madrid" (the Madrid Stock Exchange). All the accounting, market and ownership data required are available on a standard and fully consistent basis across companies at these two sources. Additionally, the Consolidated IFRS Annual Accounts have been reviewed in detail to accurately document the source of each of the firms' debt holdings. Macroeconomic data, mainly the banking sector's ROA and non-performing loan ratio as well as the Treasury yield and the spread on corporate bonds, have been sourced from the Bank of Spain and the CNMV.

We believe that the restructuring and subsequent losses experienced by the Spanish banking system provide an appropriate setting to test the influence of banks' performance on lender choice. We have selected the 2008-2015 period to capture the whole cycle, from the collapse of most Spanish savings banks and the subsequent restructuring of the system to the final recovery of credit and bank earnings.

3.5. Empirical approach

3.5.1. The effect of the 2012 banking crisis on the composition of corporate debt

Our first research question aims to ascertain whether after a bank supply shock, bank-dependent firms substitute bank debt with public debt more intensely than otherwise similar firms with debt trading in the fixed-income market. The peculiar episode of the Spanish banking crisis and restructuring was not ex-ante related to the corporate bond market, but instead was largely due to losses on real estate lending. This is why such crisis is used as an identification strategy to evaluate the impact of a banking shock on the composition of corporate debt.

The composition of our sample allows us to differentiate between issuers and non-issuers. Given the significant differences between them in terms of size (see Section 3.6.1), we rely on matching estimators to ensure that treatment and comparison units are as similar as possible, thus reducing sample selection bias.

The outcome variable is the change in public debt measured as the difference between the average public debt ratio (*PUBDEBT*) of 2012-2015 and the average of 2008-2011, discriminating between bank-dependent firms (the treatment group) and non-bank-dependent firms (the control group). We classify a firm as bank-dependent if it relied exclusively on bank financing before the crisis. From the population of non-treated observations, we look for control units that best match the treated ones in terms of size.

The years 2008 to 2015 provide a balanced timeframe around the event date (2012, when the Royal Decrees were passed). In Section 3.6.3 we test the robustness of the results to a change in the length of the crisis period.

Asymptotic properties of matching estimators have been examined but there are few studies dealing with their finite sample properties. Frölich (2004) found that in challenging simulation designs like ours (small sample size, large differences in the characteristics of treatment and control units and a small number of control observations), kernel propensity-score matching usually performed worse than pair-matching. Similarly, Busso et al. (2014) found that in data generating processes where overlap is poor, bias-corrected matching with a fixed number of neighbors is particularly effective.

As a result, we resort to the matching approach combined with the bias adjustment developed by Abadie et al. (2004), which allows controls to serve as matches more than once. Matching with replacement is particularly helpful and can decrease bias where there are few controls comparable to the treated individuals, as mentioned by Zhao (2004) and Stuart (2010).

In any case, given the poor overlap in our design, we follow Busso et al. (2014)'s suggestion to present results from a variety of approaches and thus employ propensity-score matching as well. In fact, a simulation study by Pirracchio et al. (2012) on propensity-score methods revealed that even if small samples lead to biased estimators, relative bias remains lower than 10%, even with small samples down to 40 units.

3.5.2. Probability of tapping the debt market – a binary response model

Next, we ask whether interest rates and bank earnings influence the probability to tap debt markets. To this purpose, we rely on binary response models.

There are only eight firm-year observations without any bank debt in our sample, so it is not suitable to fit a binary-choice model to predict the probability that a firm resorts to bank debt, since this is almost certain. Consequently, we focus on the probability of a firm tapping fixed-income capital markets with Logit and Probit models whose dependent variable PM_{it} takes value 1 if the firm i employs public debt at time t, and takes value 0 otherwise. A firm resorts to traded debt if its ratio of public debt outstanding to total debt (*PUBDEBT*) is higher than zero. This can be defined as:

$$PM_{it} = \begin{cases} 1 \text{ if } PUBDEBT_{it} > 0 \\ 0 \text{ if } PUBDEBT_{it} = 0 \end{cases} \qquad \text{(Model 1)}$$

where

$$PUBDEBT_{it} = X'_{it}\,\beta + \Upsilon' * ROA_t + \delta * Yield_t + \varepsilon * Spread_t + u_{it,}\ \text{i=1, …,85; t= 1, …,8.}$$

Vector *X* contains a set of explanatory variables, including firm intrinsic characteristics like asset tangibility (*TAN*), operating profitability (*PROF*), ownership concentration (*OC*), growth opportunities (*G*) and size (*SZ*). The model also contains three firm-invariant variables, banks' *ROA*, the Treasury yield (*Yield*) and the spread on corporate bonds (*Spread*). A detailed definition of these variables is contained in Appendix 3.2. Finally, u_{it} denotes a standard error term.

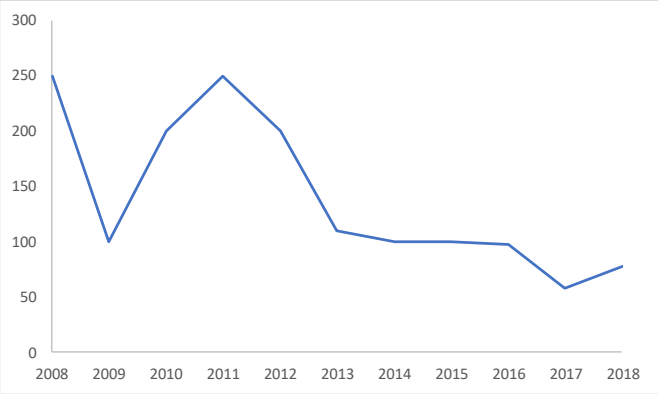
Debt issuance is the result of both supply and demand factors operating in the fixed income market. Supply factors capture preferences or characteristics of issuer firms, while the demand factors capture investor choices. In this respect, it is important to mention that the main event affecting investor demand in corporate bonds lies outside our observation period and hence does not impact our results. Purchases under the Corporate Sector Purchase Programme (CSPP) launched by the ECB started in June 2016 and were carried out by six Eurosystem national central banks in primary and secondary markets[17].

Even if the CSPP clearly falls outside our observation period, it could be argued that the low interest rate environment since 2013 may have spurred investors to search for higher yields, thus increasing their demand for corporate bonds. This is the reason why we

[17] Under the CSPP, corporate bond acquisitions across Europe had amounted to Eur 132 billion as of December 2017, with 11% of that corresponding to Spanish NFCs. Source: CNMV Bulletin

control for investor demand by using corporate bond spreads (Spread) as a proxy. Figure 7 shows the decrease in spreads since 2013 as a result of stronger investor demand. Such decline is more pronounced since 2016 as a result of the CSPP.

Figure 7. Risk premium of bonds issued by Spanish NFCs



Source: CNMV Bulletin

Population-averaged and Random-effects Probit and Logit models are employed and results are reported on summary tables to see whether conclusions are consistent. The main benefit of the Random-effects Logit model against its Probit counterpart is the possibility to attain a consistent estimator of β without any assumptions about how u_{it} is related to $X_{it.}$ The magnitudes of the coefficients are not comparable across the models, but their signs should be the same and the same variables should be statistically significant, as discussed by Pendergast et al. (1991).

3.5.3. Percentage of traded debt and bank debt - censored and linear models

A limitation of Model 1 is that a firm shows a dependent variable equal to 1 in a given year if it has some market debt outstanding, no matter whether the bond was issued that year or in a previous year. Corporate bonds have maturity periods of several years and even if issuers may hold call options, it is quite likely that they will maintain the debt funding until the maturity date of the bond. If so, the explanatory variables in year *t* would be used to explain the outstanding debt in year *t*, which in fact could be based on the issuances in year *t-n*. In this way, the estimated relationship might link previous debt issuances with current firm characteristics or country-level factors, so current variables would be used to explain also funding decisions taken in the past.

Our next model addresses this concern by focusing on the ratios of public and bank debt outstanding to total debt (*PUBDEBT* and *BANKDEBT*, respectively). *PUBDEBT* is either

zero if the firm has no debt trading or a positive percentage if it taps the fixed-income markets. The corresponding specification is a Tobit model, which allows to address corner solution problems:

$$PUBDEBT_{it} = \begin{cases} PUBDEBT_{it}^* \text{ if } PUBDEBT_{it}^* > 0 \\ 0 \text{ otherwise} \end{cases} \quad \text{(Model 2)}$$

where

$$PUBDEBT_{it}^* = X'_{it}\,\beta + \Upsilon^* ROA_t + \delta^* Yield_t + \varepsilon^* Spread_t + v_{it,}\ \text{i=1, …,85; t= 1, …,8.}$$

Model 2 allows us to mitigate the limitation discussed in Model 1, since yearly variations in firm characteristics and country-level factors are contemporaneous to variations in *PUBDEBT*. In Model 2, v_{it} follows a normal homocedastic distribution and *X* contains the same regressors as in Model 1. We fit a Random-effects regression with the necessary number of integration points to assure stability.

Tobit estimates are biased and inconsistent if the individual error term v_{it} is not normally distributed, so it is important to perform a bootstrap LM test of the Tobit specification to compute the LM-statistic against the alternative hypothesis of a model that contains an error term that can be heteroskedastic and non-normally distributed. Critical values for such test are obtained from a parametric bootstrap with 500 repetitions. A rejection of the null hypothesis would suggest that the Tobit specification is not suitable.

Finally, since 99% of the observations have bank debt and data is thus uncensored in this case, we propose a linear regression model to explain *BANKDEBT* as follows:

$$BANKDEBT_{it} = \alpha_0 + X'_{it}{}^* \beta + \Upsilon^* ROA_t + \delta^* NPLratio_t + \varepsilon^* Yield_t + u_{it,}\ \text{i=1, …,85;}$$

$$\text{t= 1, …,8} \quad \text{(Model 3)}$$

Model 3 includes the non-performing loan ratio of the banking sector (*NPLratio*) as an additional explanatory variable, with the objective to test the impact of banks' risk-bearing capacity on *BANKDEBT*.

As will be explained in section 3.6.3, it may be argued that the level of bank lending may have been influenced by external factors during the period under review, such as the introduction of the new Basel capital requirements and the European Stability Mechanism (ESM) support program for Spanish banks. We control for these effects in our robustness tests in section 3.6.3.

3.5.4. Interpretation of results with binary and censored models

Due to the non-linearity of these models, estimated coefficients do not indicate the size of the effect on the dependent variable of a unit change in an independent variable, even if their signs do indicate the directional effect on the probability of the outcome. This is why we compute marginal effects, whose size depends on the values of all other variables. Specifically, we compute average marginal effects, that is, the average of each firm's marginal effect.

As regards the goodness of fit, the McFadden pseudo-R^2 shows whether the explanatory variables fail to increase likelihood -indicated by 0- or alternatively perfectly predict each observation -indicated by 1-. We also calculate the proportion of correct predictions, which involves computing the predicted probability for each firm and then comparing it to some threshold probability, usually 50%. If the predicted probability exceeds the threshold probability, then the prediction is that $PM = 1$. The predicted choice is then compared to the actual choice and the proportion of correct predictions is calculated.

3.6. Results

3.6.1. Descriptive statistics

Table 10 shows that bank financing represents the main debt source by far -74.23%, against 13.36% of public debt-. Other minor sources are subsidized leverage (i.e. lending at rates below market by government agencies and supra-national institutions), lending by finance companies and intra-group funding.

Table 10. Descriptive statistics

	Mean	Standard Deviation
PM	33.79%	47.33%
PUBDEBT	13.36%	24.19%
BANKDEBT	74.23%	30.23%
TAN	32.79%	22.26%
PROF	8.64%	9.82%
OC	56.20%	23.26%
G	2.32	4.37
SZ	14.33	2.09
ROA	-0.023%	0.55%
NPLratio	8.59%	3.43%

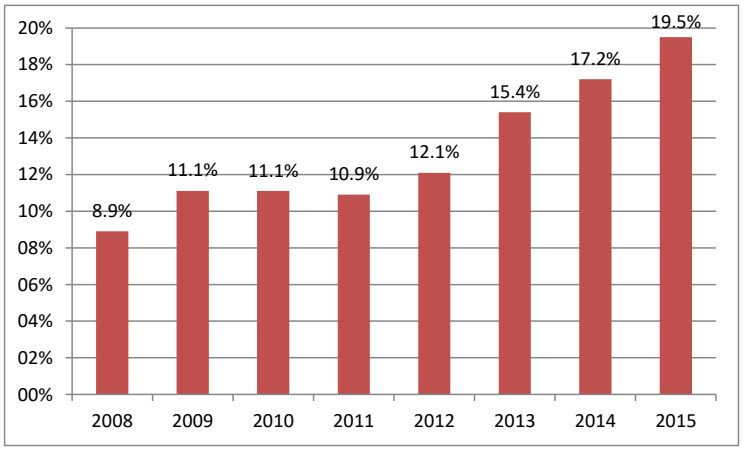
Yield	4.23%	1.27%
Spread	1.64%	0.64%

The variables are defined in Appendix 3.2.

The frequent joint use of traded and bank debt found by Johnson (1997) also applies to our dataset, since 99% of firm-year observations with public debt outstanding also use bank debt. We interpret this as evidence that certain benefits of bank debt such as monitoring and easier renegotiation may remain important even for firms with access to public debt.

As regards the diversification trend towards public markets, the ratio of public debt to total debt across companies increased from 8.97% in 2008 to 19.56% in 2015, as can be observed on Figure 8. In parallel, the ratio of bank debt to total debt decreased from 79.48% to 64.57% over the same period. On a similar ground, the proportion of firms with outstanding debt trading in the fixed-income markets increased from 26.92% in 2008 to 44.05% in 2015. Between 2013 and 2015, twelve new issuers tapped the market for the first time[18].

Figure 8. Annual ratio of public debt to total debt outstanding between 2008 and 2015



Source: Own data

Similarly, Table 11 shows how the proportion of public debt over total debt evolves during the observation period for the whole dataset as well as for issuers and non-issuers. The comparisons are based on cross-sectional averages of firm-level time-series averages over the years before and after the 2012 crisis. The overall proportion of public debt grows

[18] These twelve companies were Dia, Prosegur, Elecnor, Acerinox, San José, Tubacex, Tecnocom, Almirall, Ence, Indra, NH and Pharmamar.

from 10.82% before the banking crisis to 16.16% after the crisis. This pattern applies to issuers and non-issuers, but the difference is only significant in the case of non-issuers.

Table 11. PUBDEBT before and after the banking crisis

Firm category	Before crisis	After crisis	Mean difference	t-Statistic
Whole dataset	10.82%	16.16%	5.34%	1.52
Issuer firms	31.30%	38.09%	6.79%	0.98
Non-issuer firms	0.00%	4.60%	4.60%	2.95

Before crisis refers to the period 2008-11. After crisis refers to the period 2012-2015.
To be included in the analysis, a firm must have data both before and after the crisis.

Moving on to the main explanatory variables, Table 12 shows the pair-wise correlation matrix for the main variables. The figures do not suggest concerns for multicollinearity. Still, we detect a relatively large negative correlation between *ROA* and *Yield*, which reflects the perverse link between sovereign risk and banking crises discussed in section 3.3. Finally, given the definition of *PM* and *PUBDEBT*, the correlation between them is obviously very high. Both are used as dependent variables in our regression models.

Table 12. Correlation matrix

	PM	PUBDEBT	TAN	PROF	SZ	OC	ROA	NPLratio	Yield	Spread
PM	1.00									
PUBDEBT	0.77*	1.00								
TAN	0.24*	0.20*	1.00							
PROF	-0.05	0.02	-0.01	1.00						
SZ	0.64*	0.57*	0.19*	0.02	1.00					
OC	-0.18*	-0.22*	-0.07	-0.01	-0.05	1.00				
ROA	0.01	0.02	0.01	0.05	-0.01	-0.03	1.00			
NPLratio	0.08*	0.11*	-0.03	-0.03	0.01	-0.06	-0.24*	1.00		
Yield	-0.08*	-0.11*	0.01	-0.05	0.01	0.09*	-0.59*	-0.21*	1.00	
Spread	-0.07	-0.11*	0.00	0.02	0.01	0.07	-0.32*	-0.54*	0.68*	1.00

*indicates statistical significance at the 5% level. The variables are defined in Appendix 3.2.

Finally, we examine the differences in size between firms that use only private debt and those that also use public debt. The former have a mean size of 13.36, while the average size of the latter is 16.22, which implies a highly significant difference with a t-statistic of -21.64.

3.6.2. Multivariate results

3.6.2.1. Matching estimators

As explained in Section 3.5.1, our matching estimator analysis is designed so that bank dependence can be deemed as a treatment. The test matches firms expected to be more susceptible to the negative effects of a banking crisis with control firms whose debt is

trading in the fixed-income markets. We employ the matching approach with the bias adjustment developed by Abadie at al. (2004) as well as kernel propensity-score matching. In the latter case, we perform the calculations with and without a restriction to the common support of the propensity score for treated and control groups.

Table 13 reports the bias-corrected matching estimator of the average effect of the treatment on the treated (ATT). The ATT difference for non-issuers ranges between 41.3 and 42.5 percentage points depending on the number of matches per treated firm and is statistically significant at 1%.

Table 13. Average treatment effect for the treated. Bias-adjusted matching estimator

	One match per treated firm	Two matches per treated firm
Coefficient	41.35%	42.47%
Std. Error	5.16%	5.10%
Z	8.01***	8.32***

There are 55 treated firms and 29 non-treated firms. The total (84) differs from the number of companies in our dataset (85) since one firm was not established until 2012.
Bias-corrected matching estimators have been used following Abadie et al. (2004).
Errors are heteroskedasticity-consistent.
*** indicates statistical significance at the 1% level.

Table 14 reports results of the kernel propensity-score analysis, with and without a restriction to those firms in the region of common support. As may be observed, the results are similar between the two options and the overall conclusion does not differ from the analysis based on Abadie et al. (2004)'s matching estimator.

Table 14. Average treatment effect for the treated. Kernel propensity-score matching

	Not restricted to the Common Support	Restricted to the Common Support
Coefficient	24.64%	24.73%
Std. Error	11.27%	11.86%
T	2.19**	2.08**

There are 55 treated firms and 29 controls distributed across an optimal number of five blocks where the mean propensity score is not different for treated and controls. Additionally, it has been verified that the balancing hypothesis is satisfied too.
If the experiment is restricted to the region of common support, 14 controls are used instead.
Bootstrapped standard errors have been used.
** indicates statistical significance at the 5% level.

Given the similarity between firms in the treatment and control groups in terms of size, the evidence presented in this section is indicative of a causal effect of bank dependence on debt sourcing after the crisis. These results are robust to a different length of the crisis period, as will be shown in Section 3.6.3.

Our conclusions are in line with Fernández et al. (2018), who report a reduction in the ratio of bank debt to total debt in more bank-dependent firms after the onset of the crisis. They found this substitution effect in firms both with and without a long-term public debt rating, though rated firms experienced a greater increase in nonbank debt ratios. However, contrary to them, our study reveals that non-issuers increase their ratio of public debt more than issuers, despite the fact that it should be easier for the latter to replace bank debt with bonds.

3.6.2.2. Binary response models

Next, we turn to the determinants of the probability to have public debt outstanding. We first assess the goodness of fit of the binary model by examining the proportion of correct predictions in Table 15. The model's specificity and sensitivity amount to 91.75% and 72.64% respectively. The proportion of observations correctly classified overall is 85.13%. Additionally, the Pseudo R2 is 47.85%. Overall, these figures suggest that the set of explanatory variables used in the paper are highly relevant.

Table 15. Proportion of correct predictions

		Predicted choice		
		Tapping the market	Not tapping the market	Total
Actual choice	Tapping the market	154 (82.35%)	58 (13.65%)	212
	Not tapping the market	33 (17.65%)	367 (86.35%)	400
	Totals	187	425	612

The threshold probability used is 50%. If we used a threshold probability equal to the actual proportion of observations for which *PM*=1, the percent of correct predictions would be 81.86%.

Table 16 depicts the results of our Panel-data population-averaged and Random-effects Probit and Logit models. The likelihood-ratio tests reported in the bottom part of the table compare the panel estimator with the pooled estimator and conclude that the panel estimator is most appropriate.

Additionally, as mentioned in Section 3.5.2, we employ the *Spread* variable to control for fixed-income demand by investors, so it seems evident that the developments observed

in debt sourcing are indeed driven by the funding decisions of issuer firms, after controlling for demand-side factors.

Table 16. Panel-data Probit and Logit results

	Probit model				Logit model			
	Population-Averaged		Random-effects		Population-Averaged		Random-effects	
TAN	0.597	(0.516)	0.787	(1.026)	1.113	(0.898)	1.417	(1.889)
PROF	-1.474	(1.138)	-2.813	(1.965)	-2.270	(1.966)	-4.841	(3.464)
SZ	0.581***	(0.078)	1.229***	(0.209)	1.007***	(0.151)	2.250***	(0.398)
G	-0.015	(0.019)	-0.026	(0.030)	-0.034	(0.037)	-0.045	(0.055)
OC	-1.811***	(0.618)	-3.816***	(1.171)	-3.052***	(1.058)	-6.960***	(2.125)
ROA	-17.639*	(10.138)	-39.289*	(22.675)	-30.489*	(18.191)	-67.176*	(39.890)
Yield	-18.813***	(6.548)	-35.484***	(12.407)	-33.204***	(11.634)	-62.927***	(22.666)
Spread	-2.337	(9.230)	-10.034	(22.024)	-4.374	(16.986)	-15.864	(39.638)
Wald Chi2 / Prob>chi2	86.03/ 0.0000		47.38/ 0.0000		65.54/ 0.0000		43.60/ 0.0000	
LR chi2 / Prob>chi2			94.97/ 0.000				95.66/ 0.000	
Number of observations	612		612		612		612	

The variables are defined in Appendix 3.2.
The population-averaged (GEE) models assume equal correlation within panels and standard errors in parenthesis are robust.
The number of integration points in the Random-effects models has been increased to 24, until stability has been reached, i.e. changes in the relative differences of the coefficients below 1%.
*** and * indicate statistical significance at 1% and 10% respectively.

Size is statistically significant at the 1% level with the sign predicted by the theory. The fact that larger firms are more likely to tap the public debt markets is also consistent with the earlier empirical work surveyed in Section 3.2.2. Similarly, the role of ownership concentration is in line with the literature and supports the notion that banks prefer to finance companies with low agency conflicts in order to minimize monitoring costs.

However, contrary to the evidence in Adrian et al. (2013), Cantillo and Wright (2000) and Denis and Mihov (2003), we do not find operating profitability and tangibility to be attributes which can predict the probability of tapping the debt markets. In contrast, the non-significant relation between growth opportunities and financing sources is broadly consistent with their estimates.

In terms of macroeconomic and banking variables, interest rates are significant at the 1% level with a negative sign, which suggests that lower rates favor market financing, as already indicated by Cantillo and Wright (2000). Finally, the banking sector's *ROA* turns out to be significant at 10%, which is consistent with the idea that a reduction in banks' profitability increases the probability of public market access by companies. This finding is also in agreement with the conclusion reached by Cantillo and Wright (2000).

To ease the comparability of the probit and logit estimates, Table 17 reports the corresponding average marginal effects and retains only significant variables. We find, for instance, that an increase of one percentage point of the Treasury yield reduces the probability of market access by some 3.9%. Likewise, an increase in *ROA* of one percentage point decreases the probability of tapping the debt markets by 3.6% approximately.

Table 17. Probit and Logit average marginal effects

	Probit marginal effect		Logit marginal effect	
SZ	0.120	(0.008)	0.119	(0.008)
OC	-0.375	(0.128)	-0.360	(0.123)
ROA	-3.648	(2.101)	-3.599	(2.181)
Yield	-3.891	(1.313)	-3.919	(1.323)

The variables are defined in Appendix 3.2.
Robust standard errors in parenthesis.

Additionally, it is illustrative to examine the relationship between the probability of tapping the fixed income market and combinations of the significant variables – size, ownership concentration, banks' *ROA* and interest rates-. We plot profiles in Appendix 3.3 of the response of size by levels of the three other significant covariates and as can be observed, the probability of tapping the debt market is higher for larger companies with more fragmented ownership structures during periods of lower bank profitability and interest rates. The profiles also show that the role of ownership concentration, banks' ROA and interest rates is more relevant among firms with average sizes.

3.6.2.3. Censored and linear models

Finally, we examine the proportion of public to total debt and the ratio of bank debt to total debt, with a double objective. First, we intend to ascertain whether the effect of firm characteristics and macroeconomic variables on both ratios is consistent with the theory

and secondly, to further investigate the impact of banks' risk bearing capacity on the fraction of credit that is sourced from banks.

Table 18 shows the determinants of the public to total debt ratio from the Random-effects Tobit regression. As shown by the Likelihood-ratio test, the panel estimator is preferred to the pooled model. We find that size, ownership concentration, banks' *ROA* and the yield are statistically significant. These results are fully consistent with our previous analysis of the probability to tap debt markets.

Table 18. Random-Effects Tobit regression for PUBDEBT

	RE Tobit	
TAN	0.012	(0.255)
PROF	-0.458	(0.417)
SZ	0.183***	(0.035)
G	-0.001	(0.011)
OC	-0.529***	(0.197)
ROA	-4.039*	(2.410)
Yield	-4.987***	(1.729)
Spread	-3.316	(2.568)
F (Wald Chi2)/ Prob>F (Chi2)	96.76/ 0.0000	
LR chi2/ Prob>chi2	151.80/ 0.000	
Number of observations	612	

The variables are defined in Appendix 3.2.
The Pseudo R2 is 50.96%.
Model calculated with a quadrature of 16 evaluation points, which assure the stability of results.
Figures in parenthesis represent bootstrap standard errors.
*** and * indicate statistical significance at 1% and 10% respectively.

Given the bias and inconsistency of Tobit estimates in the case of non-normality of the residuals, it is crucial to perform a test of the Tobit specification. A bootstrap LM test has been implemented and delivers a LM statistic of 2.09, a value that is well below the 5% bootstrap critical value of 4.59. Consequently, the null hypothesis that the Tobit model is suitable is accepted.

Regarding the relationship between bank debt and total debt, the linear model results are depicted on Table 19. We have verified the existence of heteroskedasticity and

autocorrelation as well as the fact that a pooled regression is inappropriate, so fixed-effects and random-effects models with clustered standard errors are fit.

Table 19. Linear regression with BANKDEBT as the dependent variable

	Fixed-effects		Random-effects	
TAN	0.119	(0.128)	-0.021	(0.085)
PROF	0.003	(0.129)	-0.047	(0.113)
SZ	-0.008	(0.036)	-0.048***	(0.012)
G	0.000	(0.002)	0.000	(0.002)
OC	0.301***	(0.113)	0.260***	(0.081)
ROA	1.361	(0.978)	1.470	(0.978)
NPLratio	-0.762***	(0.252)	-0.812***	(0.255)
Yield	3.069***	(0.745)	3.259***	(0.736)
F (Wald Chi2)/ Prob>F (Chi2)	4.21 / 0.000		54.77 /0.000	
R2	7.72%		25.54%	
Number of observations	611		611	

The variables are defined in Appendix 3.2.
Figures in parenthesis represent clustered standard errors.
*** indicates statistical significance at 1%.

As may be observed on Table 19, size and ownership concentration are corporate characteristics with a significant influence on the proportion of bank debt. The negative relationship between size and bank debt is consistent with the theory, since information asymmetries are larger in the case of smaller firms and consequently bank debt prevails as a result of banks' more effective monitoring. The positive relationship between ownership concentration and bank debt is in agreement with Cantillo and Wright (2000) and Saona and Vallelado (2003) and hence further confirms the idea that banks prefer to finance companies with low agency conflicts between management and shareholders to minimize monitoring costs.

The positive relationship between interest rates and the proportion of bank debt is in agreement with the model proposed by Diamond (1991), which states that in periods of high present interest rates the demand for bank loan monitoring increases, which implies a higher fraction of bank loans.

Finally, an interesting new conclusion from the table is the significant negative relationship between the non-performing loan ratio and the proportion of bank to total debt. This pattern is in line with the evidence reported by Adrian et al. (2013) and Becker

and Ivashina (2014), who found that a contraction in banks' risk-bearing capacity reduces the probability of obtaining a bank loan.

3.6.3. Robustness of results to alternative specifications

In this section we investigate the robustness of the relations analyzed to three alternative specifications.

Firstly, we consider a narrower length of the post-crisis period and employ the same definitions of treatment and control groups which were used for our benchmark results. In this case, the 2012-2014 period is compared to the years between 2009 and 2011. As expected, reducing the time interval and hence the macroeconomic disparities between two adjacent periods, results into lower point estimates, as depicted on Table 20. In this case, the ATT ranges between 22% and 38% and is significant at the 5% and 1% levels respectively.

Table 20. ATT – alternative definition of crisis length

	Bias-adjusted matching	Kernel propensity-score matching
Coefficient	37.81%	21.70%
Std. Error	5.82%	11.00%
Z / t	6.49***	1.96**

***, ** indicate statistical significance at the 1% and 5% levels.

As a second test, we expanded all the regression models to include year fixed effects. It may be argued that the level of bank lending was subject to external factors like the introduction of the new Basel capital requirements in 2010 and the ESM support program between 2012 and 2013. The more stringent Basel capital regulation with a required Common Equity Capital Ratio increasing from 2% to 4.5% could have led to a reduction in lending capacity within the banking sector and therefore to a different mix of public and bank debt. Similarly, the ESM made available to Spain €41.3 billion in assistance to restructure its banking sector, which could have led to an upturn in banks' lending capacity. The inclusion of year dummies is intended to factor out these and other temporal effects. However, we found in computations not reported here that the coefficients for all years are jointly equal to zero across the various models in our analysis and that the coefficients of the relevant variables remain practically unaltered.

Finally, in the last robustness test, gas and electric utilities are excluded from the regression models since these companies are highly regulated and are likely to have higher proportions of public debt (Krishnaswami et al. 1999). We have verified that our Probit, Logit, Tobit and linear regression estimates in this sample are very similar to our benchmark results. If any, we detected a slight decrease in the level of significance, but this observation may be attributed to the smaller sample size resulting from this analysis[19].

3.7. Discussion and conclusions

This paper used data from publicly traded Spanish firms over the 2008 to 2015 period to answer two questions: firstly, whether bank-dependent firms substitute bank debt with public debt after a bank supply shock more intensely than other firms; and secondly, whether interest rates and bank earnings and non-performing loans influence debt placement choice.

As regards the first question, little attention has been paid to the substitution between bank and non-bank debt as a way for firms to compensate for a reduction in bank loan supply. Only Becker and Ivashina (2014, 2018) and Fernández et al. (2018) have approached this topic in detail.

By investigating how and to what extent changes in the macroeconomic environment influence lender choice, this paper contributes to fill long-standing gaps identified by Denis and Mihov (2003) and Faulkender and Petersen (2005). The paper places the focus on banking and macroeconomic conditions as potential factors for the choice to tap bond markets, while most empirical papers tend to focus on firm-specific characteristics. Three main country-level characteristics are considered in the analysis: interest rates and, as measures of financial performance and soundness of the banking system, the average return on assets and the ratio of non-performing loans.

The evidence from our paper points to the importance of the role played by the banking and macroeconomic environments in the composition of credit. We showed that after the onset of the crisis, non-issuers increased their ratio of public to total debt more than otherwise similar firms with traded debt. As a second finding, lower rates and intermediary earnings favor market financing, while there is a negative relationship between banks' non-performing loan ratios and the weight of bank debt. Therefore, we

[19] Utilities account for 7% of firms in the original sample.

can confirm that lower costs of market funding and higher constrains in banks' financial situation support market financing and discourage bank debt.

The paper complements previous research on the topic in several ways. Adrian et al. (2013) and Becker and Ivashina (2014) selected firms that have access to both bank and public debt funding and address the substitution effects between the two by examining new debt raisings. However, we do not constrain our sample to firms which have access to public debt markets. Furthermore, they only ascertain the impact of bank credit supply, but do not take macroeconomic variables like interest rates into account.

Unlike Becker and Ivashina (2018), who explore the variation in macroeconomic and banking conditions not only across time but also across countries, our paper focuses on one single country and hence is not subject to unobserved heterogeneity across geographies. On the other hand, our focus on Spain allows us to more precisely identify a specific event affecting the national banking sector and having potential implications on debt sourcing. Furthermore, the inclusion of non-issuer firms in our sample enables us to study the ex-post effects of the crisis on debt sourcing, while discriminating between issuers and non-issuers. We believe that this comparative analysis provides an interesting contribution to the literature.

Fernández et al. (2018) relied on firm-level data in 34 countries, which forces them to define the onset of the crisis as 2007 for the UK and the US and 2008 for the remaining countries. In our view, the large number of countries considered makes it very difficult to accurately define the date of the crisis and in fact, as is explained in Section 3.3, we do not believe that 2008 may be regarded as the crisis year for the Spanish banking system. Our focus on one single country allows us to more precisely identify the crisis event. Furthermore, they abstract from differences between issuers and non-issuers, which entails considerable sample selection bias. We believe that our employment of a non-parametric method like matching estimators tackles this issue adequately.

Cantillo and Wright (2000) investigated which companies finance themselves through intermediaries and which borrow directly from the debt market. However, they analyze only the probability of having bonds outstanding and the percent of debt held in publicly traded instruments, thus disregarding the relationship between banks' risk-bearing capacity and the fraction of total debt which is sourced from banks. Additionally, they relied on debt ratings as a proxy of tapping the debt market, the implicit assumption being

that a bond rating is equivalent to having bonds outstanding. Contrary to them, we do not use debt ratings as a proxy but instead accurately document the source of each firm's debt by reviewing each firm's Annual Report. There are 88 firm-year observations in our dataset with public debt outstanding and no rating, so these observations would be incorrectly classified if the debt rating were used as a proxy.

While most prior studies resort to pooled and cross-sectional regressions, this paper relied on panel-data models. As an additional refinement, the paper employs the 2012 Spanish banking crisis as an identification strategy to evaluate the impact of a banking shock on the composition of corporate debt. The results are robust to alternative specifications such as using a different length of the period under study, including time-dummies in the regression models and excluding utilities from the dataset.

Finally, as an idea for further research in the area of debt placement choice, it would be interesting to explore the impact of the macroeconomic and banking environments on the evolution of non-bank private debt. This analysis would shed light on the differences between bank and private non-bank debt and ascertain to what degree and under what circumstances they are used as substitutes. Non-bank private debt has grown considerably over the recent years, partly due to players like debt funds. In this new context, extending previous research by Arena (2011) and Carey at al. (1998) is, to our eyes, a compelling task.

3.8 Appendices

Appendix 3.1.

Table A3. Companies in the database

Sector	Number of companies	Companies
Engineering	5	Duro Felguera, Fluidra, INYPSA, Técnicas Reunidas, APPLUS
Construction	10	ACS, CLEOP, FCC, Ferrovial, OHL, SACYR, San José, Cementos Portland, Coemac, Acciona
Minerals and metals	7	Acerinox, APERAM, Arcelor, Cie Automotive, Lingotes Especiales, Tubacex, Tubos Reunidos
Textile and apparel	3	DOGI, Inditex, Adolfo Domíngez
Paper	6	Ence, Miquel Costas, Ercros, Iberpapel, Reno Medici, Unipapel
Transport and distribution	4	Aena, IAG, Logista, Abertis
Pharma and biotechnology	9	Almirall, Biosearch, Grifols, PRIM, Reig Jofré, ROVI, Bayer, Pharmamar, FAES
Software and electronics	3	Amadeus, Indra, Tecnocom
Manufacturing and capital equipment	6	Elecnor, Gamesa, Nicolás Correa, Talgo, Zardoya Otis, Airbus
Food and drinks	9	Barón de Ley, Bodegas Riojanas, DEOLEO, DIA, Ebro foods, Natra, Naturhouse, Viscofán, Vidrala
Other services	3	Baviera, Funespaña, Prosegur
Telecoms	4	Ezentis, Telefónica, Euskaltel, Jazztel
Leisure and hotels	3	Meliá, NH Hoteles, Edreams
Utilities and oil and gas	6	Enagas, Endesa, Gas Natural, Iberdrola, Repsol, REE
Media	4	ATRESMEDIA, MEDIASET, Vocento, Prisa
Renewable energies	3	ENEL GP, FERSA, Solaria

The 85 companies in our database are allocated to 16 subsectors of activity according to the classification used by Bolsa de Madrid.

Appendix 3.2.

Table A4. Variable definitions

Variable	Type	Definition
PM	Dummy	PM takes value 1 if the company has outstanding debt trading in public markets, such as bonds, convertibles, preference shares, ECP and EMTN.
PUBDEBT	Continuous	The ratio of public debt outstanding to total debt.
BANKDEBT	Continuous	The ratio of bank debt outstanding to total debt.
TAN	Continuous	Asset tangibility: ratio of fixed tangible assets to total assets.
PROF	Continuous	Operating profitability: ratio of Ebitda to total assets.
SZ	Continuous	Size, proxied by the logarithm of sales.
G	Continuous	G proxies growth opportunities and is defined as the market to book ratio, as in Krishnaswami et al. (1999).
OC	Continuous	Ownership concentration: percentage of shares held by owners of 3% or more of the equity, either institutional investors, parent companies or family members. Additionally, stakes held by board members and treasury stock are also computed, even if they are below 3%. Institutional investors include mutual and pension funds, private and government-owned investment companies, banks and insurers.
ROA	Continuous, firm-invariant	Financial Institutions' Return on Assets as reported by the Bank of Spain's *Boletín Estadístico.*
NPLratio	Continuous, firm-invariant	Financial Institutions' Non-Performing Loan ratio as reported by the Bank of Spain's *Boletín Estadístico.*
Yield	Continuous, firm-invariant	Average marginal rate of 10-year Spanish Treasury bonds.
Spread	Continuous, firm-invariant	Spread of Spanish corporate bonds, measured as the simple average of the 5-year CDS.

The G data is not available in the case of ten companies which went public during the observation period for the years prior to listing.

Appendix 3.3. Probability of tapping the debt market

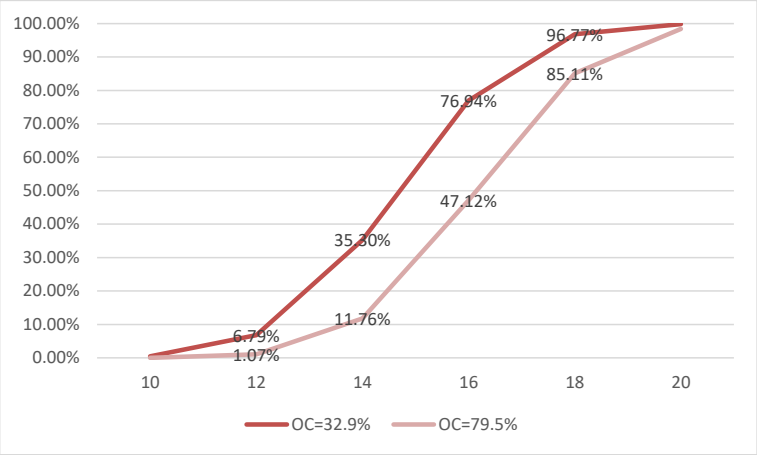


Figure A1. Probability of tapping the debt markets according to size and ownership concentration. Source: Own data

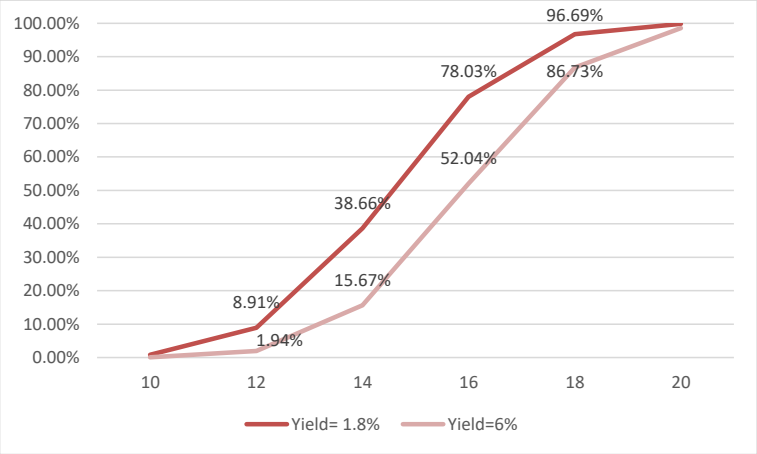


Figure A2. Probability of tapping the debt markets according to size and the Treasury yield. Source: Own data

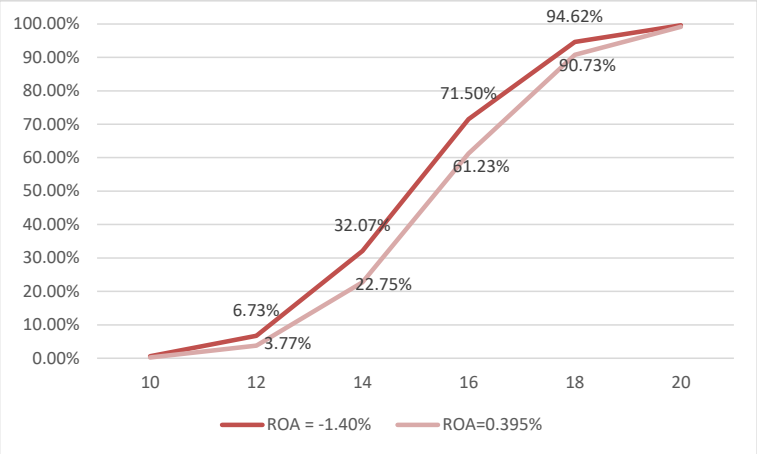


Figure A3. Probability of tapping the debt markets according to size and banks' ROA. Source: Own data

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4. CORPORATE INVESTMENT AND THE SPANISH BANKING CRISIS OF 2012

Abstract

This paper studies publicly traded Spanish firms with the objective of determining whether constrained firms cut capital expenditures more than unconstrained firms during the domestic banking crisis of 2012. We thus test the theories of impaired access to capital in a country other than the US and the UK, which allows us to increase the external validity of previous causal studies. Seven different criteria for identifying constrained firms are employed and the impact of the crisis on each of these categories is analyzed by applying difference-in-differences (DD), kernel propensity-score matching and covariate matching. This combination of proxies and methods warrants better causal inferences than those of most previous studies. The obtained results are highly consistent regardless of the technique employed and reveal that small and highly levered firms decreased investment by approximately 10% relative to their control groups. Several robustness tests suggest that these results are not confounded with other factors. Therefore, the evidence presented is supportive of a causal effect of credit shocks on investment.

Keywords: corporate investment, banking crisis, credit supply, difference-in-differences, matching methods.

JEL codes: G31

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

4.1. Introduction

If external funds are believed to be a perfect substitute for internal capital, then a firm's investment decisions are independent of its financial position, as indicated by Fazzari et al. (1988). However, external and internal capital may not be perfect substitutes for reasons such as agency problems and information asymmetries, in which case corporate investment may depend on financial factors such as internal resources or the functioning of credit markets.

Regarding credit markets, the magnitude of the 2008 financial crisis highlighted the importance of understanding the impact of capital supply shocks on the real economy. Financing frictions such as adverse selection (Stiglitz and Weiss, 1981) and moral hazard

(Holmstrom and Tirole, 1997) together with fluctuations in the supply of capital can impact corporate investment.

In this paper, we explore whether constrained firms cut capital expenditures more than unconstrained firms during the Spanish banking crisis of 2012. We employ seven different criteria to identify constrained firms and analyze the impact of the domestic banking crisis on each of these firm categories. We thus place our focus on the role of firms' characteristics in relieving or exacerbating the impact of the crisis on investment.

Many other cases have illustrated this relationship between the financial and real sectors of the economy. The major banking crisis occurring in Scandinavia in the 1990s followed a boom in lending and asset prices, mainly for real estate. The burst of the bubble caused large drops in output. Similarly, the collapse of the US real estate bubble in 2007 led to the default of a number of US financial institutions followed by a massive bailout from the US government (Brunnermeier and Oehmke, 2012). Nonetheless, the bursting of the bubble caused a deep recession.

Relatively few empirical studies have examined the effect of credit supply shocks on firms' investment decisions. Recent papers on this topic mostly focus on the 2008 crisis in the US and the UK (Akbar et al., 2013; Almeida et al., 2012; Duchin et al., 2010; and Kahle and Stulz, 2013), and only a few examine other geographies and credit shocks, such as Carvalho et al. (2015) and Chava and Purnanandam (2011).

This paper contributes to the literature in four dimensions. First, the paper shifts the focus from the 2008 financial crisis in the US and the UK to the 2012 Spanish banking crisis and thus helps to uncover the role of credit supply in a different environment. We thus enhance the general applicability of the conclusions reached by previous US and UK studies, which mainly use experiment-type methodologies with treatments not assigned randomly and that hence cannot justify generalization to a given category.

Almeida et al. (2012) and Lemmon and Roberts (2010) admitted to this limitation on the external validity of their studies and expressed concerns about the generalization of their results to the full universe of firms across different settings and times. As stated by Cook and Shadish (1994), Jiménez-Buedo and Miller (2010) and Lucas (2003), accumulating knowledge by performing an array of different yet related experiments allows for better probes of causal relationships, and this is precisely one of the main objectives of our paper.

The case of Spain provides an appropriate setting from which to conduct this analysis since the country was affected by an unusually extreme shock to the financial health of its banking system, mainly determined by its exposure to real estate assets rather than by the performance of corporate loans. In 2012, Spanish financial institutions had to impair assets and book provisions for an amount of 80 billion Euros as a result of Royal Decrees 2/2012 and 18/2012, and the sovereign rating was downgraded to BBB-.

Second, most papers on the topic employ either two econometric methods and only one proxy for constrained firms (Almeida et al., 2012) or a single method and several measures of financing constraints (Duchin et al., 2010). Other works such as Chava and Purnanandam (2011) and Carvalho et al. (2015) only examine the impact of banking shocks on bank-dependent firms by simply resorting to multivariate regressions.

A contribution of this paper is to provide a more comprehensive approach by combining three econometric methods with seven different proxies for "constrained" status. The use of kernel propensity-score matching and covariate matching in addition to traditional difference-in-differences (DD) allows us to correct for sample selection bias due to observable differences between the treatment and control groups and thus reinforces the robustness of the results. As Cook and Shadish (1994) noted, causal inference is better warranted the more closely the comparison groups are matched and the more robust the results generated from multiple statistical analyses are.

Third, we employ board independence and family ownership as treatment variables and thus examine the role played by corporate governance, which has been largely overlooked by most studies on credit crises and investment.

Finally, the accumulated evidence on the relationship between credit supply shocks and firms' investment decisions is not conclusive (Akbar et al., 2013). This paper intends to shed additional light on the discrepancies reported in the literature and finds evidence supportive of what seems to be a broad consensus that small firms are more affected by a crisis. We also find leverage to be a significant variable but contradict other authors with regard to the roles played by debt maturity, liquidity, access to debt markets and family ownership.

The remainder of the article is structured as follows. Section 4.2 provides a literature review. An overview of the Spanish banking crisis is provided in section 4.3. Sections 4.4

and 4.5 review the data and methodologies employed, respectively. The results are shown in section 4.6, and section 4.7 concludes.

4.2. Theoretical framework

4.2.1. Credit markets and corporate investment

Changes in the supply of capital together with imperfections in the capital markets may hamper investment if firms lack sufficient financial flexibility.

The supply of capital may influence firm behavior through credit rationing, as anticipated by Stiglitz and Weiss (1981). The authors presented a model wherein raising interest rates could increase the riskiness of a bank's loan portfolio by discouraging safer borrowers (the adverse selection effect). For this reason, the bank's expected return could decrease beyond a certain point (the optimal interest rate), and banks would not lend to borrowers offering to pay a rate higher than the optimal. Under these conditions, credit restrictions limit the number of loans granted, and thus investment is affected not through interest rates but rather through credit availability.

Regarding capital market imperfections, information asymmetries hinder investors' perceptions about companies and their projects, so access to finance may be impaired, as explained by the broad credit channel theory (Oliner and Rudebusch, 1996). This theory stresses that all forms of external finance are imperfect substitutes for internal capital and that information asymmetries imply a cost premium for external funds. These asymmetries are more severe for small firms, and the cost premium increases as leverage grows.

Holmström and Tirole (1997) and Kiyotaki and Moore (1997) also anticipate more severe impacts on corporate investment in the case of financially constrained firms. Similarly, the financial accelerator theory developed by Bernanke et al. (1996) implies that borrowers facing significant agency costs -small firms or firms with weak balance sheets- should experience reduced access to credit and decrease their activity more than others experiencing a macroeconomic shock.

Kiyotaki and Moore (1997) concluded that a fall in the prices of collateralized assets affects the behavior of constrained firms, whose net worth drops and, as a result, they have to cut investment. Borrowers' credit limits are affected by the value of collateralized assets, and these prices are in turn affected by the size of credit limits.

This interaction between asset and credit markets becomes richer when both sides are affected by changes in the price of their collateralized assets. One framework that combines frictions on the borrower and lender sides is Holmström and Tirole's (1997) model, which assumes that both banks and companies face a moral hazard problem. According to this model, firms with weaker balance sheets can raise funding only if they are monitored by banks. Because moral hazard forces banks to hold a minimum stake in each firm they finance, the number of firms that can receive bank financing depends on the amount of capital in the banking system. A weakening of bank balance sheets can have negative effects on real activity, and poorly capitalized firms will be the first to lose their financing in a capital squeeze.

4.2.2. Empirical research

Regarding the empirical literature, Dell' Ariccia et al. (2008) perform their analysis at an aggregate level, analyzing forty-eight banking crises across forty-one countries from 1980 to 2000 and confirming that the growth rate of sectors that rely more heavily on external finance is relatively more affected in crisis years than in sectors that rely less on external finance. The authors interpret this result as evidence that there is indeed a cost to banking crises.

There are many more microlevel studies on the subject, and most were conducted in the years following the 2008 financial crisis. Most of these papers reach a conclusion in line with the survey of corporate managers conducted by Campello et al. (2010), who found that firms cancelled or postponed their investment plans as a result of the crisis and that these changes were more pronounced for financially constrained firms.

The definition of "constrained" varies among authors, and the proxies used are as diverse as referring to low cash, high leverage, being private, having no access to fixed-income markets, and encountering short-term refinancing needs.

Akbar et al. (2013), Almeida et al. (2012), Duchin et al. (2010) and Lins et al. (2013) examine the impact of the 2008 crisis on corporate investment and reach somehow similar conclusions that constrained firms cut capital expenditures more than unconstrained firms.

Akbar et al. (2013) found that the inability of private firms to obtain external credit caused these firms to cut back their investment. Almeida et al. (2012) show that firms with a substantial proportion of their long-term debt maturing immediately after the third quarter

of 2007 reduced investment relative to other similar firms. Duchin et al. (2010) find that firms with low cash reserves, with high net short-term debt or that are financially constrained experience a greater decrease in investment in the first year of the crisis than other firms. Finally, Lins et al. (2013) studied whether family control affects corporate decisions and found that family-controlled firms reduce investment more than other firms.

Related papers that do not focus on the 2008 crisis include Lemmon and Roberts (2010) and Chava and Purnanandam (2011). The former work examines the effects of a contraction in the supply of junk bonds as a result of the collapse of Drexel Burnham Lambert on risky firms' investment and shows that such contraction significantly altered the investment behavior of below-investment grade firms.

Chava and Purnanandam (2011) explore an event-window occurring around the Russian banking crisis of 1998 and study its impact in a different way by examining the effect of the crisis on corporate valuation. Based on the hypothesis that the lack of funds from banks results in suboptimal investment decisions by bank-dependent firms, with negative valuation consequences, the authors investigate whether such firms experience relatively large negative returns during the Russian banking crisis. The authors find that bank-dependent firms certainly earn significantly lower returns than firms with access to public debt markets. Additionally, the authors establish that higher levels of financial flexibility weaken the effect of bank-dependence on firm valuation.

Carvalho et al. (2015) also base their analysis on a valuation angle and find that bank distress is associated with lower equity returns and investment cuts to borrowers with the strongest lending relationships with banks. Furthermore, as anticipated by Chava and Purnanandam (2011), these losses are concentrated in firms with the weakest financial positions. However, contrary to Chava and Purnanandam (2011), the authors find no evidence of different effects of main bank distress between firms with and without access to fixed-income markets.

In sharp contrast with the evidence set forth above, Kahle and Stulz (2013) reach different conclusions. Contrary to the findings of Chava and Purnanandam (2011), the authors conclude that bank-dependent firms do not decrease capital expenditures more than matching firms in the first year of the crisis or in the two quarters after Lehman Brothers' bankruptcy. Additionally, contrary to Duchin et al. (2010), the authors found that firms that were unlevered before the crisis decreased capital expenditures during the crisis as much as matching firms. Therefore, contrary to most of the literature, Kahle and Stulz

(2013) find a decrease in capex that does not depend on the financial characteristics of firms.

4.3. The Spanish banking crisis

Between 2000 and 2008, the Spanish market was characterized by very strong credit growth, mainly driven by the real estate sector. The magnitude of this real estate frenzy can be better ascertained from two indicators: the ratio of real estate financing to total financing increased from 23.2% in 2004 to 32.2% in 2007[20] and the number of annual housing starts increased from 200-400 thousand in the 1980s and early 1990s to 716,000 in 2005[21].

This credit bubble burst in 2008, when the ratio of real estate nonperforming loans increased from less than 1% to 6%[22]. In this context of sharply growing nonperforming loans and falling real estate asset prices, banks' capital was beginning to erode.

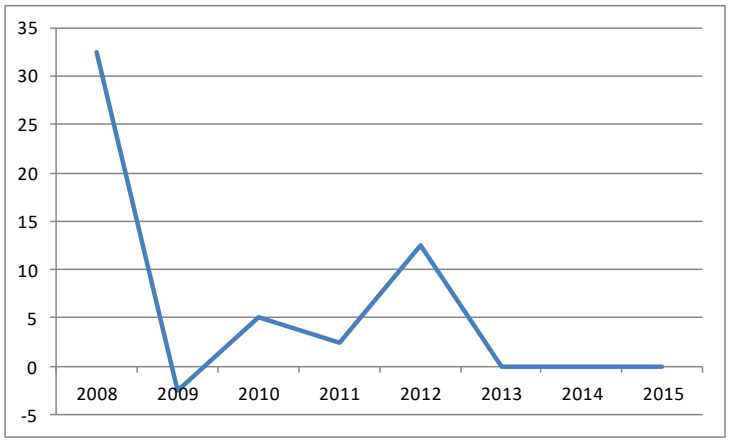
In addition to the domestic real estate crisis, the international financial crisis which originated in the US in the latter half of 2007, hampered banks' access to capital markets, so Spanish banks faced not only solvency problems but also liquidity constraints. This difficulty in accessing market financing contributed to tightening credit standards between 2008 and 2012, as corroborated by the ECB Bank Lending Survey and depicted in Figure 9 below.

[20] Source: *Boletín Estadístico,* Bank of Spain.

[21] "Visados de obra nueva, ampliación y/o reforma." Estadísticas y Publicaciones del Ministerio de Fomento. ("Number of licenses for new real estate developments, expansion and remodeling works", Ministry of Public Works and Infrastructure).

[22] *Boletín Estadístico,* Bank of Spain.

Figure 9. Contribution of the "ability to access market financing" to changes in credit standards for corporate loans (Net Percentage)



Source: ECB – Statistical Data Warehouse. This figure shows the contribution of the ability to access market financing to changes in credit standards, measured as a "Net percentage" ratio, i.e., share of banks reporting that the factor has contributed to tightening minus the share of banks reporting that it has contributed to easing. The ratio reached a maximum of 32.5 in 2008 and then climbed again to 12.5 in 2012, in the midst of the Spanish sovereign debt crisis.

The increased contribution of the difficulty of accessing market financing to tightening credit standards in 2012 is explained by the aggravated Spanish sovereign debt crisis occurring that year, which was in turn the result of a growing imbalance in public finances due to the bailout of many savings banks by the government. The Spanish credit rating was downgraded to BBB-, and the 10-year Treasury yield rose sharply in 2012, coinciding with the government's bailout of Bankia[23]. Banks' funding costs at the peak of the sovereign debt crisis increased above those of 2008 and 2009.

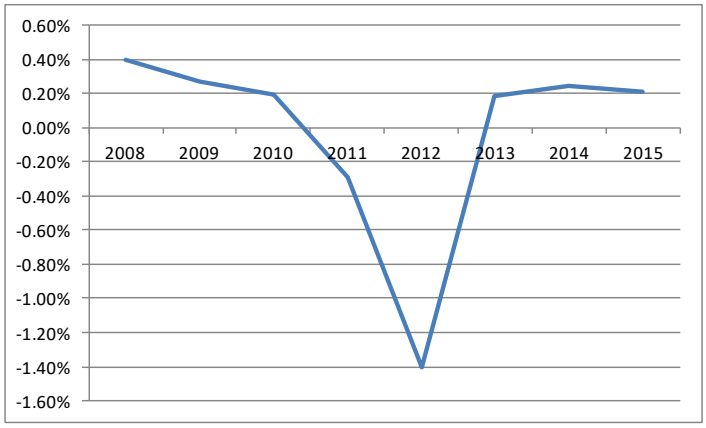
As a result of this situation, the need for banks to clean-up their balance sheets was obvious, though the process was not enforced by the Spanish government until 2012, when strong impairment and provisioning measures amounting to 80 billion Euros were introduced by Royal Decrees 2/2012 and 18/2012. The first Decree was issued in February and intensified provisioning requirements for real estate substandard and nonperforming loans to coverage ratios of 65% to 80%. Royal Decree 18/2012 was issued in May and increased provisioning requirements for performing real estate loans.

Subsequently, the profitability of the Spanish banking sector deteriorated sharply, and aggregate losses of 14.7 and 73.7 billion Euros were incurred in 2011 and 2012,

[23] Bankia was the largest financial institution rescued by the Spanish government. Bankia received 22 billion Euros of state aid in 2012.

respectively[24]. Profitability began to improve when legacy loan portfolios were transferred to a resolution agency at the turn of 2012-13, as shown in Figure 10.

Figure 10. Spanish banks' Return on Assets



Source: Boletín Estadístico, Bank of Spain. This figure shows the evolution of the banking sector ROA between 2008 and 2015. In 2012, the ROA decreased to a minimum of -1.4% as a result of the provisioning measures introduced by Royal Decrees 2/2012 and 18/2012.

In summary, the Spanish banking crisis meets the conditions of a systemic crisis according to the criteria outlined by Demirguc-Kunt and Detragiache (1998): the government took emergency measures, the fiscal cost of bank rescue exceeded 2% of GDP and nonperforming loans (NPLs) exceeded 10%.

This evidence supports the idea that there was a fall in the availability of credit mainly due to events related to the real estate sector that subsequently affected financial institutions. The legal enforcement of impairment and provisioning measures through Royal Decrees 2/2012 and 18/2012 may not be regarded as a response to an anticipated decline in investment opportunities by companies, so this environment provides an appropriate setting from which to identify the effects of credit contractions on corporate policies.

4.4. The data

We restrict our analysis to nonfinancial firms listed on the Spanish "Mercado Continuo" at the end of 2015, excluding investment vehicles and real estate developers. Firms that had been established very recently and consequently had no track record, have also been left out.

[24] Source: *Boletín Estadístico*, Bank of Spain.

The final database consists of a panel of 93 firms with annual data analyzed from 2008 to 2015. Historical data corresponding to seven companies that were established in 2010 and 2011 are missing for the two- and three-year periods prior to their establishment. A description of the database is shown in Appendix 4.1.

The years 2008 to 2015 were chosen to have a balanced timeframe around the event date (2012, when the Royal Decrees were passed). Consequently, the precrisis period is defined as the period before 2012, and the postcrisis period is defined as the period after 2012.

The data were mainly sourced from the "Comisión Nacional del Mercado de Valores" (the Spanish Exchange regulator) and "Bolsa de Madrid" (the Madrid Stock Exchange). All accounting, market, board and ownership data required are available on a standard and fully consistent basis across companies from these two sources. Additionally, the Consolidated IFRS Annual Accounts were reviewed in detail to accurately document the source of each firm's debt issuances, and Capital IQ and Afi Research were used to source credit rating data.

4.5. Empirical Approach

4.5.1. Introduction

Our variable of interest is firm investment, defined as annual capital expenditures minus depreciation and, divided by lagged assets (in percentage points). Theories on the impact of impaired access to capital on the real economy do not imply that some firms reduce investment while others do not, but rather that some firms are more affected than others because of their characteristics. Consistent with this principle, we propose that the investment of firm i at time t (INV_{it}) is a function of whether the firm is financially constrained and of the occurrence of a banking crisis. With this setting, we aim to estimate the direction and magnitude of the banking crisis' impact on firm investment.

For this purpose, we employ three different approaches: traditional DD regression, kernel propensity-score matching and covariate matching. As discussed by Dehejia and Wahba (2002), the estimate of a causal effect obtained by comparing a treatment group to a nonexperimental comparison group can be biased due to observable differences between the two groups. Such bias is reduced when the comparison uses treated and control units that are as similar as possible. The matching process removes any meaningful differences

between the two groups, which is why we use kernel propensity-score matching and pair matching as complements to DD testing.

Much of the debate on the DD approach usually focuses on the possible endogeneity of the intervention itself. In this regard, it is important to determine the exogeneity of the event with respect to two dimensions: in relation to corporate investment and with respect to which companies are financially constrained.

For the first concern, identifying a clear-cut relationship between the supply of capital and corporate investment is always challenging because of the potential simultaneity between supply and demand. As indicated by Kahle and Stulz (2013), demand for goods may have in part decreased during the crisis due to the decline in housing prices, since the main assets of most households are their houses. A decrease in demand would reduce capital expenditures by firms as growth opportunities vanish and lower corporate investment would in turn lead to lesser financing needs. Having said this, we do not believe that the enforcement of the 2012 Royal Decrees may be regarded as a response to an anticipated decline in corporate investment. Such enforcement was more likely an emergency measure intended to ensure the sustainability of part of the banking sector, which had been severely affected by a profound real estate crisis.

As in Duchin et al. (2010) and Kahle and Stulz (2013), we address the second endogeneity concern by determining the classification of firms before the crisis, so we only use the firms' positions for the period between 2008 and 2011. Within-firm time-series averages for the 2008-2011 period are calculated, and then firms in the top quartile are selected as constrained (treated).

In this respect, seven treatment-control comparisons are employed on the basis of accounting variables of size, leverage, cash reserves and net short-term debt; corporate governance variables of board independence and family ownership; and bank dependence.

For the size, cash and board independence measures, we sort firms from low to high and select those at the top quartile as the treatment group. For the net short-term debt and leverage measures, firms are sorted from high to low, and those in the top quartile are selected as the treatment group. Table 21 below shows the cutoff levels for these five treatment variables.

Table 21. Cutoff levels per treatment variable

	Cutoff level
Size (sales)	< € 197 million
Cash reserves	<2.8%
Board independence	<26.7%
Leverage	> 46.5%
Net short-term debt/Assets	>10.1%

The variables are defined in Appendix 4.2

With respect to family ownership, family control is assumed if the largest shareholder is a group of people linked by kinship that holds at least 30% of the voting rights, as in Moressi and Naccarato (2016).

Finally, we employ two alternative classifications of bank dependence. The first criterion discriminates firms according to whether they were relying only on bank financing before the crisis. However, using the absence of traded debt as a proxy for bank dependence raises a data selection question, since a firm without public debt may be rationed by the market or may have chosen not to rely on debt markets even if it could have accessed them. Hence, we also use a second criterion, according to which a company is bank-dependent if it is not rated by Standard & Poor's or Moody's. For this purpose, Standard & Poor's and Moody's credit rating data were sourced from Capital IQ and Afi Research, and we found that out of 93 firms, 19 (20.4%) had a credit rating before the 2012 banking crisis. These 19 firms had outstanding public debt, so there is exact correspondence between being rated and having debt trading in fixed-income markets. However, there were 31 companies with public debt in total, implying that 12 of them had issued debt in fixed-income markets without being rated. Consequently, depending on the definition of bank dependence used, there are either 62 or 74 bank-dependent firms in the dataset.

4.5.2. Difference-in-differences

Annual firm investment (*INV*) is regressed on a dummy variable identifying the treated firms (*X*) and the interaction between this variable and an indicator variable for whether the year in question is after the 2012 crisis (*T*). The model is as follows:

$$INV_{it} = \beta_0 + \beta_1 X_i + \beta_2 T_t + \beta_3 X_i T_t + \varepsilon_{it},\ i=1\ldots93;\ t=1\ldots8 \quad (1)$$

where X_i is a dummy variable taking a value of 1 if the firm is in the treatment group and 0 if it is in the control group. The test is designed such that constrained firms, which are believed to be more prone to the negative effects of the banking crisis, are assigned to the treatment group. T_t is a dummy taking a value of 1 in the postcrisis period and 0 in years before 2012. The difference between the treated and control firms before and after 2012 is contrasted, providing a DD estimator (β_3) of the crisis impact.

Following the terminology used by Lee and Kang (2006), our panel dataset is of the "no-mover" type, with neither dropouts nor new entries, where each company is observed in the same group (either the treatment or control group) twice. As a consequence of using this type of data, the baseline difference $E(INV_{00}, X=1) \neq E(INV_{00}, X=0)$ is allowed.

As studied by Bertrand et al. (2004), because serial correlation is commonly found in panel datasets, conventional DD standard errors may understate the standard deviation of the estimated treatment effects. The authors show that bootstrapping solves this problem, and we thus use bootstrap errors with 50 replications in the analysis.

It may be argued that variables other than the treatment affect investment. To partially mitigate this concern and capture additional sources of heterogeneity, we run additional regressions including growth opportunities and operating profitability as controls. The role of these variables in determining investment decisions was highlighted by Cleary (1999). However, adding these controls to our DD regression does not address the fact that the groups being compared may have different characteristics, as mentioned by Heckman et al. (1998). This problem is addressed in sections 4.5.3 and 4.5.4 with the use of matching techniques.

Finally, the validity of the DD estimator is based on the assumption that the underlying trend of the outcome variable is the same for the treatment and control groups. Only in this case can differences in the posttreatment period be ascribed to the treatment itself. If this is not the case, the DD method will not consistently estimate the treatment effect. Consequently, a concern relates to whether the investment path of treatment and control firms followed similar trends before 2012. This parallel trend assumption is tested by comparing mean annual growth rates (relative to total assets) for investment during the precrisis period between the treatment and control groups.

The t-statistics of the differences in means found when the treatment variables are size, leverage, board independence, family ownership and bank dependence -regardless of the

definition used- range from -0.74 to 1.63. In other words, there is no significant difference between the treatment and control groups in terms of mean annual growth rates. However, when cash reserves and net short-term debt are the treatment variables, the t-statistics for the 2010 growth rate are 2.03 and 2.09, respectively, so the parallel trend assumption is not met in these two cases.

4.5.3. DD combined with propensity-score matching

A limitation to the implementation of matching methods concerns the dimensionality of the space of the matching variables, which increases exponentially with the number of variables considered, making it difficult to find a match for each observation within a finite sample. Propensity-score matching addresses this problem by matching on the probability of participation given the set of pretreatment characteristics. Any probability model can be used to estimate the propensity score.

There are several methods to assign nontreated units to each treated unit based on the propensity score. Nearest neighbor matching assigns a weight of one to the nontreated unit with the closest propensity score and a weight of zero to all others. However, we here employ kernel matching, which uses all control observations and not just the closest one. By using more observations per treated, kernel weights reduce the variability of the estimator compared to nearest neighbor matching (Blundell and Dias, 2009).

The DD treatment-effects estimation can be combined with kernel propensity-score matching following Heckman et al. (1997) and Blundell and Dias (2009). The observed covariates allow us to estimate the propensity score (the likelihood of being treated) using the treated and controls. This method matches treated and control units according to their propensity scores and once matching has been done, the reweighted sample is used to compute the treatment effect using DD.

We estimate each of the propensity scores with some of the eight variables listed in the first column of Table 22. The determinants of each treatment variable are marked with an asterisk and have been selected based on previous empirical studies, as will be explained in section 4.6.3.

Table 22. Variables used to estimate the propensity scores

	Size	Leverage	Cash reserves	Short-term debt
Growth opportunities		*	*	*
Operating profitability		*		
Asset tangibility		*		
Bank dependence		*	*	*
Leverage	*		*	*
Net short-term debt	*			
Family ownership	*			
Size			*	*

There is a positive relationship between size and access to public debt markets according to authors such as Denis and Mihov (2003) and Johnson (1997). The bank-dependent variable perfectly predicts the probability of being small in our dataset and thus is dropped from the probit model.

4.5.4. Covariate matching

When control variables have poor distributional overlap, the estimation can be improved by resorting to nonparametric methods such as covariate matching, which looks for control observations that best match the treated ones along certain covariates. It is thus assumed that in the absence of treatment, the treated firms would have behaved similarly to the control firms. We resort to the matching approach combined with the bias adjustment developed by Abadie et al. (2004), which allows control units to serve as matches more than once and which estimates the average effect of the treatment on the treated.

The variables selected to match similar firms include one discrete covariate -the sector of activity, as in Almeida et al. (2012) and Kahle and Stulz (2013)- and continuous covariates such as operating profitability, growth opportunities, tangibility and leverage. As mentioned by Almeida et al. (2012), matching within the same sector ensures that differences in firms' underlying business conditions, such as product demand, do not explain the results.

The dependent variable in this case is the change in firm investment, calculated for each company as the difference between the average annual investment of 2012-2015 and the average annual investment of 2009-2011.

4.6. Results

4.6.1. Summary statistics

Table 23 shows how investment as a percentage of assets evolves during the observation period for the whole dataset and for different subsamples. The comparisons are based on cross-sectional averages of firm-level time-series averages for the years before and after the crisis. The subsamples are built by sorting firms into quartiles based on their attributes, as explained in section 4.5.1.

We find that overall investment drops from 3.97% before the banking crisis to -1.07% after the crisis. This reduction in investment is a common feature across all firm categories, but the decline is statistically significant only for small firms, companies with high leverage and firms without access to debt markets.

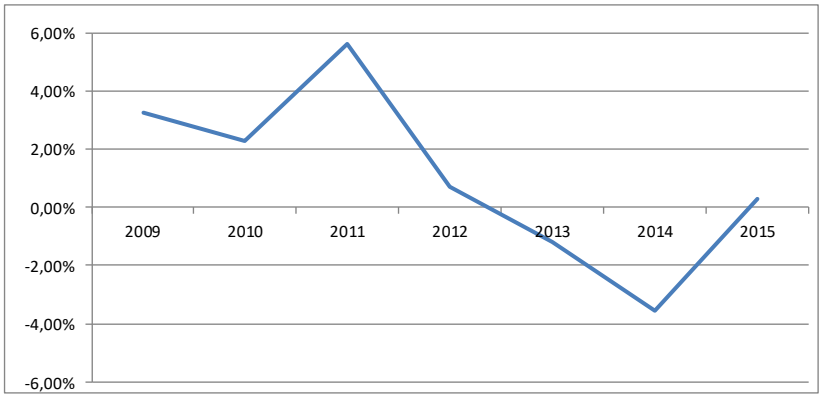
Table 23. Investment before and after the banking crisis

Firm category	Before crisis	After crisis	Mean difference	t-Statistic
Whole dataset	3.97%	-1.07%	-5.04%	-2.34
Smaller firms	2.62%	-7.71%	-10.33%	-1.82
High leverage	5.25%	-6.23%	-11.48%	-1.78
Low cash reserves	0.98%	-0.53%	-1.51%	-0.54
High net short-term debt	0.00%	-7.93%	-7.93%	-1.44
Bank dependent (no traded debt)	2.98%	-1.66%	-4.64%	-1.70
Bank dependent (not rated)	2.71%	-1.84%	-4.55%	-1.88
Low board independence	3.33%	-3.28%	-6.61%	-1.49
Family owned	3.20%	-2.12%	-5.32%	-1.51

Before crisis refers to the period of 2009-11. After crisis refers to the period of 2012-2015. To be included in the analysis, a firm must have investment data for both before and after the crisis. The variables are defined in Appendix 4.2

Figure 11 shows the annual evolution of investment as a percentage of assets from 2009 to 2015. Two periods can be clearly distinguished. Investment amounts to an average of 3.7% in the 2009-2011 period and drops to an average of -0.95% from 2012 to 2015. In the next section, these patterns are investigated more deeply using multivariate regressions.

Figure 11. Annual evolution of capex as a percentage of assets



Source: Own data. This figure shows the annual evolution of capex over the observation period. Capex ranges from a maximum of 5.6% of assets in 2011 to a minimum of -3.6% in 2014.

Finally, Table 24 shows the distribution of the covariates for the treatment and control groups and tests whether differences between the two are significant. As may be observed, the control firms are significantly different from the treatment firms; hence, a comparison of treatment firms to control firms as a whole may not provide an accurate estimate of the impact of the banking crisis. As mentioned in section 4.5.1, we resort to matching techniques that remove any meaningful differences between the two groups.

Table 24. Comparability of the treatment and control groups

	Mean Treated	Mean Control	Mean difference	t-Statistic
Treatment = Size (small firms)				
Operating profitability	5.6%	9.6%	-4.0%	3.52
Growth opportunities	2.43	2.45	-0.02	0.03
Asset tangibility	30.8%	34.2%	-3.4%	1.31
Leverage	29.2%	33.7%	-4.5%	2.11
Family ownership	56.5%	37.7%	18.8%	3.20
Bank dependent (no traded debt)	100%	55.1%	44.9%	8.64
Bank dependent (not rated)	100%	72.9%	27.1%	5.84
Treatment = Leverage (highly levered firms)				
Operating profitability	6.9%	9.1%	-2.1%	1.81
Growth opportunities	2.83	2.33	0.50	0.92
Asset tangibility	34.6%	32.9%	1.7%	0.62
Family ownership	43.5%	42.5%	1.0%	0.17
Bank dependent (no traded debt)	43.5%	74.7%	-31.2%	5.73
Bank dependent (not rated)	56.5%	88.1%	-31.6%	6.99

Size	14.02	13.61	0.41	1.66
Treatment = Cash reserves (lower reserves)				
Operating profitability	7.7%	8.8%	-1.1%	0.95
Growth opportunities	1.48	2.75	-1.27	2.37
Asset tangibility	38.6%	31.6%	7.0%	2.63
Leverage	33.6%	32.2%	1.5%	0.68
Family ownership	39.1%	43.5%	-4.3%	-0.73
Bank dependent (no traded debt)	73.9%	63.8%	10.1%	1.79
Bank dependent (not rated)	82.6%	78.6%	4.0%	0.83
Size	13.00	13.94	-0.94	3.94
Treatment = Net short-term debt (higher NST debt)				
Operating profitability	4.7%	9.9%	-5.2%	4.67
Growth opportunities	1.49	2.79	-1.30	2.50
Asset tangibility	27.1%	35.5%	-8.4%	3.24
Family ownership	52.2%	39.1%	13.1%	2.20
Bank dependent (no traded debt)	82.6%	60.9%	21.7%	3.89
Bank dependent (not rated)	100%	72.9%	27.1%	5.84
Size	12.67	14.06	-1.39	6.11
Treatment = Board independence (low indep)				
Operating profitability	7.0%	8.9%	-1.9%	1.66
Growth opportunities	2.22	2.54	-0.32	0.62
Asset tangibility	31.0%	34.6%	-3.6%	1.37
Leverage	36.7%	30.8%	5.9%	2.78
Family ownership	47.8%	43.5%	4.3%	0.70
Bank dependent (no traded debt)	69.6%	64.5%	5.1%	0.87
Bank dependent (not rated)	91.3%	74.2%	17.1%	3.48
Size	13.44	13.81	-0.37	1.55
Treatment = Family control				
Operating profitability	8.0%	9.0%	-1.0%	0.93
Growth opportunities	1.60	3.13	-1.53	3.36
Asset tangibility	31.1%	35.0%	-3.9%	1.69
Leverage	31.9%	33.0%	-1.1%	0.62
Bank dependent (no traded debt)	71.8%	62.3%	9.5%	1.92
Bank dependent (not rated)	84.6%	75.5%	9.1%	2.15
Size	13.54	13.84	-0.30	1.46

Treatment = Bank dependent firms (no traded debt)				
Operating profitability	8.4%	8.8%	-0.4%	0.40
Growth opportunities	2.67	1.99	0.67	1.38
Asset tangibility	28.4%	43.4%	-15.0%	6.52
Leverage	27.1%	43.5%	-16.4%	9.18
Family ownership	45.9%	35.5%	10.4%	1.92
Size	12.86	15.43	-2.57	14.74
Treatment = Bank dependent firms (not rated)				
Operating profitability	8.0%	10.8%	-2.8%	2.29
Growth opportunities	2.56	1.99	0.57	1.00
Asset tangibility	30.7%	43.7%	-13.0%	4.72
Leverage	29.9%	42.5%	-12.6%	5.69
Family ownership	45.2%	31.6%	13.6%	2.15
Size	13.11	16.01	-2.90	13.99

The variables are defined in Appendix 4.2

4.6.2. Multivariate analysis using DD

As mentioned in section 4.5.2, the parallel trend assumption is not met when net short-term debt and cash reserves are used as treatment variables. Consequently, we only run DD regressions for the other five variables, namely, size, leverage, board independence, family control and bank dependence. Table 25 only presents estimates from panel regressions explaining firm-level annual investment as a function of size and leverage, since the DD estimator turns out not to be significant when board independence, family control and bank dependence are used as treatment variables, as shown for reference purposes in Appendix 4.3.

Regarding board independence, a lower proportion of independent directors should increase information asymmetry and agency costs (Kanayaretnam et al., 2007), affecting investment (Liu et al., 2015). However, we do not find that firms with less independent boards reduce investment more than their control peers during the crisis.

Our results also contradict Lins et al. (2013), whose finding that family-controlled firms reduce investment more than others points toward a conflict of interest between family shareholders and outside investors during a crisis, as the former may engage in selfish behaviors at the expense of minority shareholders.

The conclusion on bank dependence is consistent with Carvalho et al. (2015) but contradicts Chava and Purnanandam (2011), whose results highlight the importance of corporate bond markets during a banking crisis.

Regarding size, Column 1 of Table 25 shows that the decline in annual investment is greater for small firms. The coefficient estimates imply a 10.8% decline in investment for a small firm and a 2.7% decline for a control firm. The DD estimate amounts to -8.1% and is statistically significant at the 10% level. This result is consistent with Bernanke et al. (1996), Chava and Purnanandam (2011), Duchin et al. (2010) and Gertler and Gilchrist (1991), who found that small firms reduce their activity more than large firms in response to macroeconomic shocks, possibly because information asymmetry is higher in small firms. Column 2 controls for growth expectations and operating profitability, and the estimated DD coefficient fails to be statistically significant in this case.

When leverage is used as the treatment variable, Column 1 shows that the decline in annual investment is greater for highly levered firms. The coefficient estimates imply a 12.2% decline in investment for a highly levered firm and a 2.2% decline for a control firm. The DD estimate is -10.0% and statistically significant at the 5% level. Column 2 controls for growth expectations and operating profitability, and the estimated DD coefficient remains statistically significant. This result is consistent with the findings of Carvalho et al. (2015), Chava and Purnanandam (2011) and Lemmon and Roberts (2010).

Table 25. DD analysis - Investment before and after the banking crisis

	(1)	(2)
Treatment = Size		
Decline for small firms	-10.8%	-7.8%
Decline for control firms	-2.7%	-2.7%
DD estimate	-8.1%	-5.1%
DD standard error	4.80%	3.70%
t-statistic	-1.70***	-1.38
Number of observations	630	599
Treatment = Leverage		
Decline for highly levered firms	-12.2%	-9.7%
Decline for control firms	-2.2%	-2.2%
DD estimate	-10.0%	-7.5%
DD standard error	4.8%	4.3%

t-statistic	-2.07**	-1.73***
Number of observations	630	599

Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2. Column 2 controls for growth expectations and operating profitability.
** and *** indicate statistical significance at the 5% and 10% levels, respectively.

4.6.3. Combination of DD with kernel propensity-score matching

Table 26 presents the results of the probit model used to estimate the propensity scores for the precrisis period.

When size is the treatment variable, leverage, net short-term debt to assets and family ownership are significant determinants of the probability of being small. More levered firms are less likely to be small, consistent with the trade-off theory of capital structure, which states that larger and more mature companies should have more leverage given their lower agency costs (Frank and Goyal, 2009; Rajan and Zingales, 1995).

Second, agency cost explanations suggest that a firm's debt maturity decreases the smaller its size is, which is consistent with the positive relationship found between net short-term debt and the probability of being small.

Finally, family-owned firms tend to be smaller, as corroborated by a statistically significant estimate of 0.42. The specification has reasonable predictive ability, as indicated by a pseudo-R^2 of 7.19%.

The second set of results shows that profitability and bank dependence are significant predictors of firm leverage. More profitable firms are less likely to be highly levered, which is consistent with the Pecking-Order theory and ample empirical research on capital structure. Likewise, bank-dependent firms are less likely to be highly levered, in line with Faulkender and Petersen (2005). These results do not change if the absence of a rating is used as a proxy for bank dependence. With a pseudo-R^2 of 16.57%, the specification has good predictive ability.

When low cash is the treatment variable, growth opportunities appear to be a significant explanatory factor. According to the estimate, firms with higher growth potential are less likely to hold low cash levels. This is the case because high- growth firms hold cash to ensure their ability to face investment expenditures when capital is difficult to access (Opler et al.,1999; Ozkan and Ozkan, 2004). The significant negative relationship between bank dependence and low cash is also consistent with the findings of Opler et al.

(1999), who showed that firms with credit ratings tend to hold less cash. Again, these results do not change when bank dependence is proxied by the absence of traded debt.

Finally, the bottom section of Table 26 focuses on high net short-term debt. In this case, size is a significant explanatory variable, implying that larger companies are less likely to have high short-term debt, consistent with agency cost explanations suggesting that larger firms have longer debt maturity structures (Hoven et al., 1996; Barclay and Smith, 1995). Moreover, the positive relationship between bank dependence and short-term debt is in agreement with Demirguc-Kunt and Maksimovic (2002), who showed that the banking sector is more related to the availability of short-term financing, while securities markets are more related to long-term financing.

Table 26. Probit regression results

	Coefficient (Std. Error)	Goodness of fit
Explained variable = Small		
Leverage	-1.68* (0.59)	
Net short-term debt	2.56* (0.69)	
Family ownership	0.42** (0.17)	
Pseudo R^2		7.19%
LR chi2/Prob > chi2		21.28/0.00
Number of observations		259
Explained variable = High leverage		
Operating profitability	-3.42*(1.26)	
Tangibility	-0.54 (0.49)	
Bank dependent (no traded debt)	-1.33*(0.22)	
Growth opportunities	0.04*** (0.02)	
Pseudo R^2		16.57%
LR chi2/Prob > chi2		45.08/0.00
Number of observations		248
Explained variable = Low cash		
Size	-0.25*(0.06)	
Growth opportunities	-0.13**(0.06)	
Bank dependence (not rated)	-0.59***(0.32)	
Leverage	-0.09 (0.59)	
Pseudo R^2		9.69%
LR chi2/Prob > chi2		26.36/0.00

Number of observations		248
Explained variable = High net short-term debt		
Size	-0.18**(0.07)	
Growth opportunities	-0.13* (0.04)	
Leverage	4.25*(0.77)	
Bank dependence (no traded debt)	1.04*(0.33)	
Pseudo R^2		24.93%
LR chi2/Prob > chi2		71.65/0.00
Number of observations		248

The variables are defined in Appendix 4.2.
*, ** and *** indicate statistical significance at the 1%, 5% and 10% levels, respectively.

In Table 27, the first-stage propensity scores are used to match each treatment firm to the control firms. The table presents the results of the DD estimation using the matched sample.

Small and highly levered firms decreased investment by approximately 10% relative to a propensity-score matched control group, and this decline is statistically significant. These findings confirm the DD results and mitigate the concern that precrisis differences in firm characteristics may explain the reduction in investment by smaller and highly levered firms.

The results are not significant for high net short-term debt firms, and somewhat surprisingly suggest that firms with low cash holdings decrease investment less than their control firms, which contradicts our working assumption and previous results from Duchin et al. (2010).

Table 27. Propensity-score matching - Investment before and after the banking crisis

Treatment = Size	
Decline for small firms	-10.8%
Decline for control firms	-0.1%
DD estimate	-10.7%
DD standard error	5.0%
t-statistic	-2.14**
Number of observations	630
Treatment = Leverage	
Decline for highly levered firms	-12.2%
Decline for control firms	-2.5%

DD estimate	-9.7%
DD standard error	5.7%
t-statistic	-1.72***
Number of observations	630
Treatment = Cash reserves	
Decline for low cash firms	-1.2%
Decline for control firms	-7.4%
DD estimate	+6.2%
DD standard error	3.7%
t-statistic	1.68***
Number of observations	630
Treatment = Net short-term debt	
Decline for firms with high net short-term debt	-8.3%
Decline for control firms	-6.1%
DD estimate	-2.2%
DD standard error	4.7%
t-statistic	-0.48
Number of observations	630

Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2. ** and *** indicate statistical significance at the 5% and 10% levels, respectively.

4.6.4. Covariate matching

Finally, we report complementary evidence based on Abadie et al.'s (2004) matching estimator. Two different sets of results are produced, depending on whether one or two matched controls per treated firm are employed.

Table 28 reports the bias-corrected matching estimator of the average effect of the treatment on the treated (ATT). The ATT difference for small firms ranges from -9.77% to -11.09%, depending on the number of matches per treated firm, whereas the ATT difference for highly levered firms ranges from -9.44% to -10.64%. Given the similarities between firms in the treatment and control groups, these results highlight a causal effect of size and leverage on investment and provide further support for the conclusions drawn from the previous methods.

Last, the results are not significant when cash reserves and net short-term debt are used as treatment variables, as shown for reference purposes in Appendix 4.4.

Table 28. Average treatment effect for the treated

	One match per treated firm	Two matches per treated firm
Treatment = Size		
Coefficient	-11.09%	-9.77%
Std. Error	6.41%	5.67%
Z	-1.73***	-1.72***
Treatment = Leverage		
Coefficient	-10.64%	-9.44%
Std. Error	4.71%	4.72%
Z	-2.26**	-2.00**

When small firms are the treated firms, covariates used for matching include the sector, operating profitability and leverage. When highly levered firms are the treated firms, covariates used for matching include the sector, asset tangibility and growth opportunities. There are 23 treated firms and 70 nontreated firms. Bias-corrected matching estimators are used following Abadie et al. (2004). Errors are heteroskedasticity-consistent. ** and *** indicate statistical significance at the 5% and 10% levels, respectively.

4.6.5. Robustness tests

In this section, we investigate the robustness of the roles played by size and leverage. For this purpose, we consider four alternative specifications: measuring gross rather than net investment, assigning to the treatment group firms within the top tercile rather than the top quartile of financial constraints, considering a different length of the crisis period and analyzing the impact of a noncrisis placebo year on investment.

First, we examine whether the conclusions hold when gross investment, instead of net investment, is used as the dependent variable. The results listed in Table 29 show that the DD estimates and their standard errors do not differ much from the benchmark specification.

Table 29. Robustness test with gross investment

	DD regression	Propensity score matching
Treatment = Size		
Decline for small firms	-10.8%	-10.8%
Decline for control firms	-3.1%	-0.5%
DD estimate	-7.7%	-10.3%
DD standard error	3.9%	4.7%
t-statistic	-1.97**	-2.20**

Number of observations	630	630
Treatment = Leverage		
Decline for highly levered firms	-12.0%	-12.0%
Decline for control firms	-2.7%	-1.5%
DD estimate	-9.3%	-10.5%
DD standard error	5.1%	6.2%
t-statistic	-1.82***	-1.68***
Number of observations	630	630

Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2. ** and *** indicate statistical significance at the 5% and 10% levels, respectively.

Second, we examine the sensitivity of the results observed when we use a more demanding cutoff to define the treatment group. For this purpose, we use the top tercile instead of the top quartile as a classification criterion. As a result, smaller firms are found to be those with sales of less than 394 million Euros, and highly levered firms are those with a leverage ratio higher than 41.8% instead of 46.5%. The results are reported on Table 30.

As expected, the differences between the treatment and control groups decrease after allowing larger and less levered firms to enter the treatment group. With these new thresholds, a DD analysis shows that small firms decrease investment by 3.5% relative to control firms, though the coefficient is not statistically significant. However, with the more demanding leverage cutoff of 41.8%, the DD estimate is -6% and remains statistically significant. When kernel matching is used, the DD estimate is -6.3% and statistically significant at 10%. Last, we use covariate matching and reach the same conclusion, with an ATT difference for highly levered firms of -5.6% found, significant at 10%.

Table 30. Robustness test with new cutoffs

	DD regression	Propensity score matching
Treatment = Size		
Decline for small firms	-7.0%	-7.0%
Decline for control firms	-3.5%	-3.5%
DD estimate	-3.5%	-3.5%
DD standard error	4.1%	3.7%
t-statistic	-0.83	-0.91
Number of observations	630	630

Treatment = Leverage		
Decline for highly levered firms	-8.7%	-8.7%
Decline for control firms	-2.7%	-2.4%
DD estimate	-6.0%	-6.3%
DD standard error	3.6%	3.8%
t-statistic	-1.68***	-1.68***
Number of observations	630	630

Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2. *** indicates statistical significance at the 10% level.

Third, we consider a shorter crisis period, from 4 to 3 years. In this case, the crisis dummy variable takes a value of 1 for the crisis inception year and the two following years. The results, reported in Tables 31 and 32, present small variations relative to the benchmark estimates, regardless of the estimation technique used.

Table 31. Robustness test with different crisis period length: DD regression and propensity-score matching

	DD regression	Propensity score matching
Treatment = Size		
Decline for small firms	-11.2%	-11.2%
Decline for control firms	-3.1%	-1.5%
DD estimate	-8.1%	-9.7%
DD standard error	4.8%	4.6%
t-statistic	-1.70***	-2.09**
Number of observations	539	539
Treatment = Leverage		
Decline for highly levered firms	-11.7%	-11.7%
Decline for control firms	-2.9%	-1.7%
DD estimate	-8.8%	-10.0%
DD standard error	5.3%	5.8%
t-statistic	-1.66***	-1.72***
Number of observations	539	539

In this case, the crisis period refers to the years running from 2012 to 2014. Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2.** and *** indicate statistical significance at the 5% and 10% levels, respectively.

Table 32. Robustness test with different crisis period length: Covariate matching

	One match per treated firm	Two matches per treated firm
Treatment = Size		
Coefficient	-12.30%	-10.94%
Std. Error	6.40%	5.75%
Z	-1.92***	-1.90***
Treatment = Leverage		
Coefficient	-9.69%	-8.57%
Std. Error	4.61%	4.61%
Z	-2.10**	-1.86***

In this case, the crisis period refers to the years running from 2012 to 2014. When small firms are the treated firms, covariates used for matching include the sector, operating profitability and leverage. When highly levered firms are the treated firms, covariates used for matching include the sector, asset tangibility and growth opportunities. There are 23 treated firms and 70 nontreated firms. Bias-corrected matching estimators are used following Abadie et al. (2004). Errors are heteroskedasticity-consistent. ** and *** indicate statistical significance at the 5% and 10% levels, respectively.

Finally, similar effects of financial constraints on investment during noncrisis periods should not be expected. We verify whether this is true for 2014 and perform the test using the same sampling criteria and definitions for treatment and control groups used for the 2012 crisis. Table 33 shows that there is no significant difference in investment between the treatment and control firms for this placebo crisis of 2014. Covariate matching is also used, and the same conclusions are reached, as depicted in Table 34.

Table 33. Robustness test for a placebo crisis in 2014: DD regression and propensity-score matching

	DD regression	Propensity score matching
Treatment = Size		
Decline for small firms	-7.0%	-7.0%
Decline for control firms	0.6%	-3.8%
DD estimate	-7.6%	-3.2%
DD standard error	7.8%	7.4%
t-statistic	-0.96	-0.42
Number of observations	368	368
Treatment = Leverage		
Decline for highly levered firms	-5.1%	-5.1%
Decline for control firms	-0.2%	-0.7%
DD estimate	-4.9%	-4.4%

DD standard error	7.2%	5.7%
t-statistic	-0.69	-0.76
Number of observations	368	368

In this case, the crisis period refers to the years running from 2014 to 2015. Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2.

Table 34. Robustness test for a placebo crisis in 2014: Covariate matching

	One match per treated firm	Two matches per treated firm
Treatment = Size		
Coefficient	-4.46%	-6.18%
Std. Error	8.86%	8.21%
Z	-0.50	-0.75
Treatment = Leverage		
Coefficient	2.53%	1.79%
Std. Error	3.53%	3.23%
Z	0.72	0.55

In this case, the crisis period refers to the years running from 2014 to 2015. When small firms are the treated firms, covariates used for matching include the sector, operating profitability and leverage. When highly levered firms are the treated firms, covariates used for matching include the sector, asset tangibility and growth opportunities. There are 23 treated firms and 70 nontreated firms. Bias-corrected matching estimators are used following Abadie et al. (2004). Errors are heteroskedasticity-consistent.

4.7. Conclusions and discussion

Few empirical studies have examined the effect of credit crises on corporate investment decisions, with most of them centered around the 2008 financial crisis in the US and the UK. Instead, this paper studies publicly traded Spanish firms to explore whether the 2012 domestic banking crisis affected corporate investment and particularly constrained firms. The paper uncovers the role played by credit supply in a different environment, hence enhancing the external validity of the causal relationships claimed in previous US and UK experiment-type settings. Therefore, this paper allows us to accumulate robust knowledge on the causal relation between financial crises and investment and tests the theories of impaired access to capital in a different setting.

Earlier papers tend to employ either two econometric methods and only one proxy for constrained firms (Almeida et al., 2012) or a single method and several measures of financing constraints (Duchin et al., 2010). This paper addresses the issue in a more comprehensive way by combining traditional DD regressions with matching methods and

seven different proxies for “constrained” status. This approach reduces the bias of the estimation of treatment effects and thus reinforces the robustness of the results.

Additionally, we employ board independence and family ownership as treatment variables and thus study the role played by corporate governance, which has been overlooked by most studies on credit crises and investment.

The paper reveals that the Spanish banking crisis had significant implications for the investment behavior of constrained firms. Regardless of the techniques employed, either traditional DD regressions or matching methods, smaller and highly levered firms decreased investment by approximately 10% relative to their control peers. These results are robust to various alternative specifications such as different treatment cutoffs, a narrower crisis window and a noncrisis placebo year.

Our findings are consistent with the broad credit channel theory (Oliner and Rudebusch, 1996), which states that information asymmetries imply a higher cost of external finance to compensate lenders for their monitoring of borrowers and their investment projects. This cost increases as leverage grows and particularly affects small firms.

Our results are also consistent with the theoretical studies of Kiyotaki and Moore (1997) and Bernanke et al. (1996), who anticipated that a credit shock would affect corporate investment more severely for financially constrained firms.

However, our results seem to contradict the lending view of monetary-policy transmission, which suggests that the investment declines that follow a monetary contraction should be concentrated among bank-dependent firms (i.e., firms with scarce cash reserves and without access to public bond markets). In fact, we find no evidence of differences in the effect of the banking crisis between firms with and without access to public debt markets. Similarly, our results do not suggest that liquidity, either in the form of high cash reserves or small short-term obligations, plays a role in easing the cost of banking crises.

Regarding the crucial firm characteristics that matter in a banking crisis according to this study, small firms may be more affected by a crisis in part due to the stronger information asymmetries and agency costs faced by these companies. Even when companies in the analysis are traded in the public equity market, analyst coverage of smaller firms is not as widespread, so information asymmetries in this case are undoubtedly more pronounced.

The other relevant firm characteristic according to this analysis is leverage, which forces managers to service debt commitments and therefore reduces available liquidity, which otherwise would be allocated to investment projects. Furthermore, as discussed by Fazzari et al. (1988), because creditors are aware of the conflicts of interest between themselves and borrowers, they require covenants, which may limit management's choices of investment opportunities and the capacity to finance such opportunities. Hence, higher leverage and lower net worth increase agency costs for creditors and may lead to a debt overhang and a decrease in capital expenditures.

The results of the paper have interesting policy implications and show that banks need support in times of crisis since smaller and financially weak companies may otherwise have to reject profitable investment opportunities, with resulting harmful impacts on the real economy. Such an impact is exacerbated because most companies operating in any economy fall within the "small" category. The financial status of banks is thus of paramount importance to economics because it may have consequences for business activity.

Consequently, bank regulators should carefully consider the cost to the real economy when designing both preventive solvency and risk management policies and reactive bailout plans to stabilize the sector in the midst of a crisis. Interventions should be designed to ensure that distressed banks do not negatively affect economic activity and that the costs of interventions are offset by the overall benefits to the economy.

Finally, as an avenue for further research, given the limited number of studies that have focused on private firms, it may be worth conducting a similar analysis comparing publicly listed to privately owned firms to explore whether the latter are more affected by a banking crisis due to higher agency costs.

4.8. Appendices

Appendix 4.1.

Table A5. Description of the dataset

Sector	Number of Companies	Companies
Engineering	7	D. Felguera, Fluidra, INYPSA, T. Reunidas, APPLUS, GAM, Abengoa
Construction	10	ACS, CLEOP, FCC, Ferrovial, OHL, SACYR, San José, Cementos Portland, Coemac, Acciona
Minerals and metals	7	Acerinox, APERAM, Arcelor, Cie Automotice, Lingotes Especiales, Tubacex, Tubos Reunidos
Textiles and apparel	3	DOGI, Inditex, Adolfo Dominguez
Paper	7	Ence, Miquel Costas, Ercros, Iberpapel, Reno Medici, Unipapel, Sniace
Transport and distribution	4	Aena, AIG, Logista, Abertis
Pharmaceuticals and biotechnology	9	Almirall, Biosearch, Grifols, PRIM, Reig Jofré, ROVI, Bayer, Pharmamar, FAES
Software and electronics	3	Amadeus, Indra, Tecnocom
Manufacturing and capital equipment	7	Elecnor, Gamesa, Nicolás Correa, Talgo, Zardoya Otis, Airbus, CAF
Food and drinks	10	Barón de Ley, Bodegas Riojanas, DEOLEO, DIA, Ebro Foods, Natra, Naturhouse, Viscofán, Vidrala, Pescanova
Other services	4	Baviera, Funespaña, Prosegur, Service Point
Telecommunications	4	Ezentis, Telefónica, Euskaltel, Jazztel
Leisure and hotels	4	Meliá, NH Hoteles, Edreams, Codere
Utilities and oil and gas	6	Enagas, Endesa, Gas Natural, Iberdrola, Repsol, REE
Media	5	ATRESMEDIA, MEDIASET, Vocento, Prisa, Vertice
Renewable energy	3	ENEL GP, FERSA, Solaria

Table A5 lists the 93 companies included in the dataset, allocated to 16 subsectors of activity according to the classification used by Bolsa de Madrid.

Appendix 4.2.

Table A6. Variable definitions

Variable	Type	Definition
Investment	Continuous dependent variable	Capital expenditures minus depreciation (as reflected in the Cash Flow Statement) divided by lagged assets (in percentage points).
Leverage	Continuous treatment variable	Ratio of the book value of long and short-term debt over the book value of total assets. Debt includes bank loans, leasing, bonds, preference shares, convertibles, ECP and EMTN.
Size	Continuous treatment variable	Logarithm of sales.
Net short-term debt/Assets	Continuous treatment variable	Ratio of the book value of short-term debt minus cash and equivalents over the book value of total assets.
Cash reserves	Continuous treatment variable	Ratio of cash and equivalents to total assets.
Board independence	Continuous treatment variable	Percentage of independent directors on the board.
Family ownership	Dummy treatment variable	Family ownership takes a value of 1 if the largest shareholder is a group of people linked by kinship that holds at least 30% of the voting rights, as in Morresi and Naccarato (2016).
Bank dependent	Dummy treatment variable	This variable is measured in two different ways: • Bank dependent takes a value of 1 if the company relies exclusively on bank financing. • Bank dependent takes a value of 1 if the company is not rated by S&P or Moody's.
Asset tangibility	Continuous control variable	Ratio of fixed tangible assets to total assets.
Operating profitability	Continuous control variable	Ratio of Ebitda to total assets.
Growth opportunities	Continuous control variable	This variable is proxied with the market to book ratio, as in Barclay, Morellec and Smith (2006). The ratio is not available for ten companies that went public during the observation period for the years prior to listing.

Appendix 4.3.

Table A7. DD analysis with board independence, family ownership and bank dependence as treatment variables

Treatment = Board independence	
Decline for firms with low independence	-6.7%
Decline for control firms	-3.3%
DD estimate	-3.4%
DD standard error	3.9%
t-statistic	-0.87
Number of observations	587
Treatment = Family ownership	
Decline for family-owned firms	-5.6%
Decline for control firms	-4.1%
DD estimate	-1.5%
DD standard error	4.00%
t-statistic	-0.38
Number of observations	627
Treatment = Bank dependent (no traded debt)	
Decline for bank dependent firms	-4.8%
Decline for control firms	-4.8%
DD estimate	0.0%
DD standard error	3.5%
t-statistic	-0.01
Number of observations	627
Treatment = Bank dependent (not rated)	
Decline for bank dependent firms	-4.1%
Decline for control firms	-6.9%
DD estimate	+2.8%
DD standard error	4.5%
t-statistic	0.64
Number of observations	630

Bootstrapped standard errors are used following Bertrand et al. (2004). The variables are defined in Appendix 4.2. If the absence of traded debt is used as a proxy for bank dependence, there are 420 and 207 treatment and control observations, respectively. If the absence of a rating is used as a proxy, the number of treatment and control observations is 500 and 130, respectively.

Appendix 4.4.

Table A8. Matching estimator analysis with net short-term debt and cash reserves as treatment variables

	One match per treated firm	Two matches per treated firm
Treatment = Net short-term debt		
Coefficient	1.64%	1.64%
Std. Error	4.10%	4.56%
Z	0.40	0.36
Treatment = Cash reserves		
Coefficient	-0.58%	2.39%
Std. Error	3.40%	3.05%
Z	-0.17	0.78

Covariates used for matching include the sector, operating profitability and growth opportunities. There are 23 treated firms and 70 nontreated firms. Bias-corrected matching estimators are used following Abadie et al. (2004). Errors are heteroskedasticity-consistent.

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5. FINAL CONCLUSIONS

5.1. ACADEMIC CONTRIBUTIONS

This section begins by describing the objectives and results of each paper and finalizes with a unified analysis which bundles the conclusions from the three articles and reflects upon the contribution of the thesis to the academic literature.

The purpose of the first paper is to ascertain whether credit conditions and access to the fixed income market impact corporate leverage, using traditional demand factors such as asset tangibility, operating profitability, operating risk, ownership concentration, growth opportunities and the tax rate as control variables. The paper also studies the impact on leverage of the interaction between credit conditions and access to the public debt market.

Results prove that companies with access to the fixed-income market have higher leverage, as shown by Faulkender and Petersen (2005). Credit conditions also turn out to be a significant explanatory variable of leverage, in a way that tightened conditions entail lower leverage, even in the case of publicly traded firms with a high degree of public scrutiny. Lastly, as anticipated by Judge and Korzhenitskaya (2012) and Leary (2009), the paper proves that capital structure is more sensitive to credit conditions in the case of companies without access to the fixed-income market.

In fact, the paper's main contribution deals with the differential impact of credit conditions on companies, depending on whether they have access to the fixed-income market. The paper shows that the negative effect of tightened credit conditions on leverage doubles when companies do not have access to the public debt market.

Regarding demand-side factors, which have been more widely studied in the literature, results are aligned with the dominant capital structure theories. Consequently, a positive relationship between asset tangibility and leverage is observed, in line with the *Trade-off* theory. Consistently with the *Pecking Order* theory, the paper finds evidence of a negative relationship between operating profitability and leverage.

The limited amount of research on debt sourcing focuses on the influence of company-intrinsic characteristics and vastly neglects external variables dealing with the

macroeconomic environment and the financial shape of the banking system. Only Becker and Ivashina (2014, 2018), Cantillo and Wright (2000) and Fernández et al. (2018) approached this topic.

Therefore, the second paper focuses on this research gap with a double objective. Firstly, to understand whether bank-dependent firms replace bank debt with traded debt after a bank credit shock more intensely than firms with access to the fixed-income markets. As a second objective, the paper intends to determine whether macroeconomic variables and bank performance indicators such as interest rates, return on assets and the ratio of non-performing loans impact the probability that companies have public debt outstanding and the mix of public and bank debt in their Balance Sheets. Variables such as asset tangibility, operating profitability, ownership concentration, growth opportunities and size are employed as controls.

According to the results, bank-dependent firms increase public debt more than otherwise similar firms after a banking crisis, so the evidence presented is indicative of a causal effect of bank dependence on debt sourcing after the crisis.

In another respect, lower interest rates and bank returns have been found to favor public debt financing, a conclusion consistent with Cantillo and Wright (2000). It has been observed that an increase of 100 basis points in the Treasury Yield reduces the probability to access the debt market by 3.9%. Similarly, an increase in banks' ROA of 100 basis points decreases the probability to tap the public debt market by 3.6%. Finally, the paper finds a negative relationship between the non-performing loan ratio of the banking system and the weight of bank debt. As a conclusion, lower financing costs and a greater weakness of the banking sector entail higher access to the public debt market and lower reliance on bank debt.

Regarding the control variables, which have been studied in greater detail in the literature, firm size and ownership concentration are significant explanatory variables of the choice between bank and public debt. However, contrary to other papers, no evidence is found that operating profitability and growth opportunities influence such choice.

The third paper explores whether financially constrained companies reduced investment more than others as a result of the 2012 banking crisis and thus tests the theories of impaired access to capital. Seven proxies are used to identify financially constrained companies on the basis of accounting variables -size, leverage, short-term debt and cash

reserves-, corporate governance variables -Board independence and family ownership- and bank dependence.

The literature on this subject has focused on the 2008 crisis in the USA and the UK, so by addressing the 2012 Spanish credit crisis, the third paper increases the external validity of the causal relationships claimed in previous experiment-type settings with treatments not assigned randomly. Furthermore, published papers employ either a single econometric method and several proxies to identify constrained firms, or two methods and a single proxy. The third paper provides a more comprehensive approach by combining three econometric methods with seven different *proxies*. Therefore, results are more robust since the use of kernel propensity-score matching and Pair Matching in addition to traditional Difference-in-Differences allows to correct for sample selection bias due to observable differences between the treatment and control groups.

The obtained results are highly consistent regardless of the technique employed and reveal that the banking crisis had significant implications for the investment behavior of small and highly levered firms, which decreased investment by approximately 10% relative to their control groups. These results are consistent with the theories of Bernanke et al. (1996) and Kiyotaki and Moore (1997), which state that a credit shock affects corporate investment more severely in the case of financially constrained firms. Conclusions are also consistent with the empirical studies of Carvalho et al. (2015) and Gertler and Gilchrist (1991) and clearly contradict Kahle and Stulz (2013), who found no evidence that credit-dependent firms are affected differently by a banking crisis.

Beyond size and leverage, the paper finds no evidence that factors such as the lack of access to public debt markets, lower liquidity, family ownership and low Board independence negatively affect investment. In this respect, the paper contradicts previous results from Chava and Purnanandam (2011), Duchin et al. (2010) and Lins et al. (2013).

The reason why smaller firms are more affected by the crisis may be the stronger information asymmetries and agency costs faced by these companies. Even when the companies in our study are traded in the public equity market, analyst coverage of smaller firms is more limited and hence information asymmetries are more pronounced.

The other relevant firm characteristic is leverage, which forces managers to service debt commitments and therefore reduces available liquidity, which otherwise would be allocated to investment projects. Furthermore, higher leverage and lower net worth

increase agency costs for creditors and may lead to a debt overhang and a decrease in capital expenditures.

The third paper has clear practical implications and shows that banks need support in times of crisis since smaller and financially weak companies may otherwise have to reject profitable investment opportunities, with the resulting harmful impact on the real economy.

Finally, this section proceeds to deliver a unified analysis which bundles the conclusions from the three articles and reflects upon the contribution of the thesis to the academic literature. The three papers provide evidence that the credit crisis affected three key corporate finance variables such as leverage, the choice of debt providers and investment, after controlling for other factors in the econometric models. It has been proved that the dependent variables under study are not only affected by firm-intrinsic characteristics such as size, asset tangibility, cash-flow generation and ownership structure, but also by supply-side and macroeconomic factors such as credit conditions, access to the debt market and interest rates.

Therefore, contrary to classic assumptions about perfect markets and a perfectly elastic supply of capital, which imply that only demand-side factors matter, the papers show that supply-side variables also impact leverage and debt choice. This conclusion is aligned with previous research by Leary (2009), but the methods employed and the environment under study are very different.

Similarly, in a context of no market imperfections, companies would always obtain the necessary funds to undertake investment projects with a positive net present value. However, due to information asymmetries which hinder investors' perception about the quality of the companies and their projects, access to finance may be impaired and consequently investment and financing decisions may become intertwined. In this respect, the third paper provides evidence that the functioning of credit markets does impact corporate investment and in fact small and highly levered companies are the ones most affected by credit frictions. These results are consistent with the *Broad Credit Channel* theory (Oliner and Rudebusch, 1996), according to which information asymmetries imply a higher cost of external finance to compensate lenders for the cost incurred in analyzing and monitoring borrowers and their investment projects. This cost of external funds increases as leverage grows and particularly affects small companies.

As a conclusion, this thesis has shed light on the effects of credit crises on borrowers, both on their financing and investment decisions.

5.2 FUTURE RESEARCH LINES

As an avenue for further research regarding the leverage and investment variables, it would be worth conducting new studies among smaller private firms. This would be interesting because very few papers have focused on private firms within the context of a financial crisis, despite that private companies represent a very significant part of any economy.

Since the firms with no access to the equity market are less transparent, the impact of credit tightening on their capital structures may be greater. This type of analysis would allow us to verify whether worsening credit conditions affect leverage of private firms more intensely, thus further testing the recent evidence provided by Demirguc-Kunt et al. (2015).

Likewise, it may be worth extending the methodology employed in our third paper to a dataset which also includes private firms, to ascertain whether their investment is more affected by a banking crisis than that of public firms, due to higher agency costs.

Finally, as an idea for further research on debt placement choice, it would be interesting to explore the impact of the macroeconomic and banking environments on the evolution of non-bank private debt, which has grown considerably over the recent years with players like debt funds. This analysis would allow to improve the understanding of the differences between bank and private non-bank debt and ascertain to what degree and under what circumstances they are used as substitutes. To our knowledge, only Arena (2011), Carey et al. (1998), Denis and Mihov (2003) and Johnson (1997) have studied non-bank private debt, but only accounting for firm-intrinsic characteristics.

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RAFAEL RODRÍGUEZ GARCÍA
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1.- SUMMARY

Rafael Rodríguez García is Bupa's M&A Director for Continental Europe and Latin America, so he is responsible for Bupa's inorganic expansion (mergers, acquisitions, joint-ventures, etc.) in these two geographies.
He has worked in the financial sector for 25 years, both in investment banks such as JP Morgan and Credit Suisse and Audit firms such as KPMG.
In 2012, he began lecturing, and in 2015, started his PhD program at ICADE (Universidad Pontificia Comillas), where he has specialized in capital structure and corporate investment topics in the context of a financial crisis. His publications are focused on this area.

2.- ACADEMIC BACKGROUND

• PhD in Economics and Business (Universidad Pontificia Comillas), current.
• MSc in Finance, London Business School, 1999-2000.
• BSc in Economics and Business (Universidad Pontificia Comillas), 1990-1995.

3.- ACADEMIC PRODUCTION

Academic publications

Rodríguez-García, R., Budría, S., 2019. The impact of supply-side factors on corporate leverage. International Review of Financial Analysis, 64, 262-272.
Impact Factor: 5.373, 2019 Journal Citation Reports (Clarivate Analytics, 2020)
https://doi.org/10.1016/j.irfa.2019.06.005

Rodríguez-García, R., 2013. La reforma financiera y la reestructuración del sector español de bancos y cajas de ahorros. Revista ICADE, 89, 11 - 31. ISSN 1889-7045.

Conference papers

Title: How do companies choose between bank debt and public debt? Impact of firm-specific and macroeconomic factors
Conference: XXVIII th ACEDE Conference
City: Valladolid, Spain
Date: 24/06/2018 - 26/06/2018
Organizer: Universidad de Valladolid

Title: A comprehensive approach to capital structure determinants with a focus on supply factors
Conference: XXVIII th ACEDE Conference
City: Valladolid, Spain
Date: 24/06/2018 - 26/06/2018
Organizer: Universidad de Valladolid

4.- ATTENDANCE AT SCIENTIFIC CONFERENCE

Conference: XXIV Finance Forum, AEFIN
City: Madrid, Spain
Date: 07/07/2016 - 08/07/2016
Organizer: CUNEF

5.- TEACHING EXPERIENCE

Undergraduate official teaching experience

Teaching language: English
Name of the course: Mercados Financieros
Type of course: Compulsory
Start date: 28/01/2012 **End date:** 14/01/2018
Total ECTS credits: 32.5
Academic organization: Universidad Pontificia Comillas
Faculty: Faculty of Economics and Business

Teaching language: Spanish
Name of the course: Análisis financiero
Type of course: Compulsory
Start date: 13/01/2014 **End date:** 12/01/2015
Total ECTS credits: 10
Academic organization: Universidad Pontificia Comillas
Faculty: Faculty of Economics and Business

Teaching language: Spanish
Name of the course: Fusiones y Adquisiciones
Type of course: Compulsory
Start date: 02/09/2013 **End date:** 12/01/2014
Total ECTS credits: 5
Academic organization: Universidad Pontificia Comillas
Faculty: Faculty of Economics and Business

Graduate official teaching experience

Teaching language: English
Name of the course: Corporate Finance
Start date: Feb 2016 **End date:** Feb 2020
Academic organization: Universidad Carlos III

6.- NON-ACADEMIC PROFESIONAL EXPERIENCE

Position: Director of M&A, Europe and Latin America
Company: Bupa
Location: Madrid, Spain
Start date: March 2018 **End date:** current

Position: Director
Company: Montalbán Atlas Capital
Location: Madrid, Spain
Start date: March 2010 **End date:** March 2018

Position: Senior Manager, Corporate Finance
Company: KPMG
Location: Madrid, Spain
Start date: Feb 2002 **End date:** March 2010

Position: Associate, Corporate Finance
Company: Credit Suisse
Location: London, UK
Start date: June 2000 **End date:** Feb 2002

Position: Analyst, Corporate Finance
Company: JP Morgan
Location: Madrid, Spain
Start date: June 1995 **End date:** June 1999