TRADE CREDIT AND CREDIT CRUNCHES: EVIDENCE FOR SPANISH FIRMS FROM THE GLOBAL BANKING CRISIS

Juan Carlos Molina Pérez [*]

(*) Juan Carlos Molina completed a masters degree in Economics and Finance run by the Center for Monetary and Financial Studies (CEMFI). This article is based on the dissertation he wrote as the final part of his masters. The author would like to thank Samuel Bentolila and Javier Suárez for their comments and suggestions as well as the Banco de España for the availability of the data.
This article is the exclusive responsibility of the author and does not necessarily reflect the opinion of the Banco ce España.

TRADE CREDIT AND CREDIT CRUNCHES: EVIDENCE FOR SPANISH FIRMS FROM THE GLOBAL BANKING CRISIS

This article uses data from 1994-2010 to analyse the patterns and determinants of the trade credit received and given by Spanish firms for a wide period of time that includes the financial crisis. Additionally, following García-Appendini and Montoriol-Garriga (2011), I will use a differences-in-differences approach to identify whether firms with a better liquidity position (higher external financial dependence) prior to 2007 increased their extension (use) of trade credit to compensate the effect of the contraction in the supply of bank credit in the first years of the crisis.

1 Introduction

The banking sector plays a key role in most economies transferring funds from savers to borrowers. Banks provide funds to firms and households, so that investment and consumption can be made without exclusively relying on internal funds. Although it is not the only source of external finance, bank credit is one of the most important ones. But, what happens when banks cannot fulfil this important function? What happens when firms are not able to borrow from banks due to an external shock that it is not related to the former?

To be able to find evidence of a bank credit crunch, our main variable of interest is one close substitute for bank credit, trade credit. This type of credit is the one that is given by suppliers to their clients in the form of the deferment of the payment for the delivered goods by the supplier. Thus, firms can pay for the goods to their suppliers after they receive them. Despite the fact that this form of financing is much more expensive than bank credit [Wilner (2000)], it is widely used by firms. In Spain in 2010, trade credit extended ("Accounts Receivable") accounted for almost 30% of the firms' financial total assets, whereas trade credit used ("Accounts Payable") accounted for almost 20% of the financial total liabilities.

We will focus on two aspects in this paper. The first one is to study the evolution and patterns of trade credit in Spain in the last 15 years. Specifically, we will try to understand how the aspects of trade credit taken and extended have evolved during this period, which ends with the global banking crisis. Moreover, we will also study the most important determinants for both trade credit extended and trade credit taken by Spanish firms. The second aspect we focus on is to understand how firms react to an external shock that presumably affected banks' lending capacity in the first place, the 2007 financial crisis.

It is important to notice that we study both aspects of trade credit separately because there could be different forces, which could be not related at all, that determine trade credit extended and trade credit taken and if we aggregate both, we would not be able to distinguish them and misunderstand the results we obtain.

Our data comes from the Central de Balances, a data base collected by the Bank of Spain and consists of 33,321 Spanish firms for the period 1993-2010. We perform some filters to clean our data from outliers and some inconsistencies, which will be detailed in the Data Section. We will work with two samples: one for trade credit extended and another one for trade credit taken. After having performed all filters, our final samples have 11,483 and 10,061 firms respectively.

The hypothesis tested in the paper is that the variable Accounts Receivable over Sales (AR) and the variable accounts payable over purchases (AP) depend on a variable, different for each one, that measure the financial slack of the firm granting or receiving trade credit. Moreover, since the financial crisis limits the access to banks' finance, we hypothesize that the volume of trade credit granted or received will be more sensitive to the financial slack variable in the years of the financial crisis than in the years before. The empirical model explains the dependent variables AR and AP as a function of the slack variable and other control variables, including year and industry or firm dummy variables. We also interact the financial slack variable by the time dummy variables of years 2008-2010.

For the first regression, AR, the financial slack variable is Liquidity, measured as Cash over Total Assets. The hypothesis is that firms might react in a different manner when the crisis arrives depending on the level of liquidity that they had the year before. Regarding this slack variable, we find two results: first, the estimated coefficient of liquidity is negative, meaning that firms with higher levels of liquidity extend less trade credit than the less liquid ones. Second, the interaction terms between liquidity and the crisis years have positive estimated coefficients, which indicate that although liquidity has a negative effect on AR, this negative effect becomes less negative during the crisis. In other words, the increase (decrease) in AR is higher (lower) for more liquid firms. We also provide robustness results presenting separate estimates for small and for large firms.

For the second regression, AP, the financial slack variable is External Finance Dependence (EFD), defined as the proportion of the investments that are not covered by the cash flow generated by the firm. In this case, the estimated coefficients of EFD and of the interaction of EFD with the years of the crisis are either not statistically significant or significant but with an estimated coefficient close to zero. The results are robust to other definitions of the financial slack variable. Over all, the explanatory power of the model is much lower than in the AR case, so at this point of the research it is unclear what the determinants of trade credit received by firms are, although we provide some tentative explanation of this result.

The structure of the paper is as follows: in section 2, we will review the previous literature regarding trade credit, commenting on the classic papers and on the most recent ones that are very close to this one and the contribution of this work. Then, in section 3, we will describe the empirical strategy we are going to use, define our main variables and the regression equations that we are going to perform. After that, in section 4, we will describe the data and the filters we have applied. In section 5 we start describing our Accounts Receivable results and we do the same for our Accounts Payable results in section 6. Finally, section 7 concludes with a brief summary of the paper, the comparison with the papers of the trade credit literature and the most important conclusions.

2 Previous literature

Trade credit is an important source of finance, especially for medium and small firms. The literature about trade credit is vast and always starts by asking the same question: why does trade credit exist when there are specialized institutions for this particular purpose (i.e. banks)? The answer relies on its advantages over other sources of finance and, most notably, over bank finance: information acquisition, monitoring the buyer and greater efficiency in liquidation [Petersen and Rajan (1997)]. Firstly, suppliers are better at monitoring their customers than banks are since, over the course of the relationship between supplier and customer, the former is very likely to know how good or bad is the business' condition of the latter [Smith (1987)]. Secondly, suppliers can threaten firms to stop providing goods if debts are not paid. This threat is more credible if the supplier has more clients than this particular firm. The stronger the relationship between supplier and client is, the more

harmful would be the loss experienced by the firm if the supplier stops providing the goods [Cuñat (2007)]. Lastly, in the case of default, the supplier may have an advantage in recovering its debt from the debtor either by repossessing unused inventory or by his access to an industry network where he could sell the liquidated assets of his former client.

The financial crisis that started in 2007 has provided a new perspective of analysing the degree of substitutability between bank lending and other sources of external finance. It is commonly admitted that the crisis has provoked a bank credit crunch and several researchers are using the start of the crisis (or some of its landmarks) as an exogenous and unexpected shock to bank credit supply. Ivashina and Scharfstein (2010) show that new lending in 2008 was significantly lower than new lending in 2007 and that the decline in new loans accelerated during the banking panic (fourth quarter of 2008). Becker and Ivashina (2011) consider bonds as substitutes for bank lending. They find that conditioning on the issuance of new debt, an abnormal number of firms switched from bank loans to bonds, which is consistent with a bank credit supply contraction.

There are two papers that are closely related to this one. García-Appendini and Montoriol-Garriga (2011) study how trade credit varies with the credit crunch originated by the financial crisis. They focus on large US firms and use a differences-in-differences estimation strategy to find whether firms with higher (lower) liquidity positions before the crisis increased (decreased) the trade credit extended to other firms. They exclude firms with market capitalization less than $50 million or whose book value of assets is less than $10 million and those displaying asset or sales growth exceeding 100%. The other related paper is by Carbó-Valverde, Rodríguez-Fernández and Udell (2012), who study whether during the financial crisis trade credit provided an alternative source of external finance to SMEs in Spain. All firms they use for their analysis are below 40€ million in total assets. They use a disequilibrium model to identify firms that are credit constrained and find that they make greater use of trade credit ("Accounts Payable") in the crisis. Our paper will integrate the both sides of trade credit: the trade credit extended and trade credit taken. Additionally, we will use a sample of small, medium and large Spanish firms from 1994 to 2010. We will follow García-Appendini and Montoriol Garriga in using a differences-in-differences approach in order to identify variation of trade credit extended and taken by firms depending on the respective financial slack variable when the crisis arrives, as detailed in the next section.

When we compare our work with these two papers, we can see that: firstly, regarding García-Appendini and Montoriol-Garriga paper, our main conclusion is the same as theirs: at the start of the crisis, trade credit extended increases more (or decreases less) for firms holding more liquidity. This fact can be seen in the interaction coefficient between liquidity and the year 2008, the start of the crisis. Regarding the second paper, the one by Carbó-Valverde et al., we cannot say the same: there is no clear evidence for which trade credit taken increases during the crisis years, as there is no significant interaction coefficient between a slack variable (we have tried many). One could think that this happens because we do not split the sample by size for trade credit extended, since the second paper studies SME, but we should keep in mind that more than 85% of our sample consists of small and medium firms, so had we split the sample by size, we would have probably got the same results.

3 Empirical strategy

We will measure the trade credit given by firms as Accounts Receivable and trade credit taken by firms as Accounts Payable and will scale them by Sales and Purchases respectively so as to facilitate the comparisons across firms of different sizes. Thus, these two ratios, Accounts Receivable over Sales (AR) and Accounts Payable over

Purchases (AP), will be our dependent variables. Our two baseline equations will be as follows:

$$AR_{it} = \alpha_0 + \alpha_1' X_{it} + \sum_{S=1994}^{2010} \gamma_s^{AR} y_{st} + \sum_{S=2008}^{2010} \delta_s^{AR} FS_{it}^{AR} y_{st} + \varepsilon_{it}$$

$$AP_{it} = \beta_0 + \beta_1' Z_{it} + \sum_{S=1994}^{2010} \gamma_s^{AP} y_{st} + \sum_{S=2008}^{2010} \delta_s^{AP} FS_{it}^{AP} y_{st} + \omega_{it}$$

where $y_{st} = \begin{cases} 1 \text{ if } t = s \\ 0 \text{ if } t \neq s \end{cases}$

In the first equation, α_0 is the intercept; α_1 is a vector of coefficients associated with the vector of control variables X_{it}, vector which includes, among other variables, industry and size dummies (unless the equation is estimated with fixed effects). The variable y_{st} is a year dummy that takes value one for the year we are analysing (t = s). The year dummies coefficients are γ_s^{AR} and coefficients of the interaction terms between the crisis years and our financial slack variable for AR, FS_{it}^{AR}, are δ_s^{AR}. Similarly for the second regression, these terms are β_0, which is the intercept, β_1, the vector of coefficients associated with the vector of control variables Z_{it}, γ_s^{AP}, the crisis dummy year coefficients and δ_s^{AP}, the coefficients of the interaction terms between the crisis years and our financial slack variable for AP, FS_{it}^{AP}.

The financial slack variable is a proxy for how tied the financial constraint for each firm and it is interacted with the crisis years (2008, 2009 and 2010). This interaction allows for the possibility that firms might react in a different manner when granting or receiving trade credit when the crisis arrives, presumably in 2008, depending on the financial position of the firm in the year before. Several variables will be considered for both equations, but we have one good variables will be considered for both equations, but we have one preferred candidate for each equation: Liquidity for the AR regression and External Finance Dependence (EFD) for the AP regression.

Regarding the first equation, the hypothesis is that firms with higher liquidity might react differently than firms with lower liquidity and thus the trade credit extended by these two types of firms might be different when the crisis arrives. If trade credit is a substitute for bank finance, we expect that the increase in trade credit extended for firms with more levels of liquidity just before the crisis is higher than this increase for firms with less liquidity. For the second equation, we consider the variable EFD. This variable measures the shortage of internally generated funds in financing new investments. Firms with more EFD might react differently when taking trade credit when the crisis arrives. As before, if trade credit is a substitute for bank finance, we expect that the increase of trade credit taken is higher for firms with more needs of external finance than this increase for firms with less need of external finance in the crisis years.

Finally, we will estimate both regressions with two different estimation methods: Ordinary Least Squares (OLS) and Fixed Effects (FE). Even though we perform and report the results under both methods of estimation, we will comment on the results concerning only FE. We will assume unobserved heterogeneity among firms, since there could be some factors that vary for each firm and we do not observe, like for instance how good or bad the firm is being managed, but could be important and influence some of our results. We will not use regressors with no or very little variation over time (size and industry sector dummies). All the controls will be lagged one period in order to reduce multicollineality and reverse causality problems.

4 Data

The data we will use is from the Central de Balances, a data base elaborated by the Bank of Spain and that contains the accounting statements (balance sheet and income statement) voluntarily provided every year by Spanish non financial firms. We have data from 1993 to 2010.

Our initial sample consists of 163,481 observations from 33,321 firms for the period 1993-2010. The panel data is incomplete so firms that only appear in the data base before the crisis period but do not appear in the years of the crisis are kept in the data base. We perform several filters to clean the data from inconsistencies and outliers. We exclude public utilities, i.e., those firms in Water Transportation, Water Services, Gas Services and Electric Services industries. This is done because these types of firms are usually heavily regulated. Additionally, we eliminate observations of firms with negative or zero Assets, negative or zero Operating Revenues, negative or zero Cash and Short Term Financial Assets, and observations where the sum of Short Term Financial Assets and Cash is higher than the Assets.

Then we eliminate observations where the growth rate of Assets is more than one, since these are most likely to correspond to firms that have merged or experienced other significant restructuring. We also eliminate observations where the growth rate of total Assets or the growth rate of Sales is less than –0.8 since these are most likely to be firms in the process of liquidation or division of Assets.

From this point, we will work with two different samples: one for AR and one for AP. For the first sample, we eliminate observations where AR is negative or more than one. When applying the last filter, we drop about 1% of the observations that we had in the sample at that time. For the second sample, we eliminate observations where AP is negative or more than five, filter which eliminates also the 1% of the remaining observations when that filter was applied.

Next, for each sample we also eliminate observations for years in which we directly know that firms have experienced a merge, split or cession. We also drop observations where the ratio between Equity and Assets is less than –1 because we want to eliminate firms that are about to become bankrupt. When we apply this filter for the both samples, we eliminate 0.3% of the observations. If we had applied the filter using –0.5 instead of –1, the percentage of deleted observations would have been 0.6%.[1]

We eliminate firms with missing information on their industrial classification and firm-observations for which year t – 1 data are not available (since the explanatory variables are lagged on period the value of the explanatory variable would not be available for these firms). Finally, we eliminate firms with less than three valid observations over the whole period of analysis.

Our final sample for AR consist of 93,091 observations from 11,483 firms for the period 1994-2010, whereas for AP consist of 82,393 observations from 10,061 firms for the same period.

1 One could argue that the filter should be 0, instead of –1 or –0.5, but applying this filter would have eliminated almost 3% of the observations. First, deleted observations would have been too many for this filter, and most importantly, we would have dropped observations where we would not have been taking into account the future value of the firm. There could be firms whose future Equity value is positive and thus are worth being kept in our samples. Although this filter can be easily criticised, the important aspect that we should look at is the fact that results do not change substantially when we perform this filter using –1 or 0.

5 Accounts receivable

In this section, we will describe all the results concerning the first regression, where AR is the dependent variable. The equation in section 3 constitutes our baseline regression. After this, we will expand this equation and will include more explanatory variables. Specifically, we will include the interaction between our financial slack variable (liquidity), the crisis years and a size dummy (that takes value one for large firms and zero for small firms) and we will interact these three terms first two by two and then the three of them simultaneously. We define small and medium firms as firms with less than 250 employees and large firms as firms with 250 or more employees. Finally in this section, we will split the sample in two, according to size: one sample will consist of small and medium firms and the other of large firms.

The list of variables used in the analysis, together with the definition of each of them, appears in Table 1.

5.1 BASELINE RESULTS

Columns 1 and 2 of Table 2 describe our baseline results. In column 1 we use an OLS estimation method, whereas in column 2 we use a Fixed Effect estimation method. The explanatory variables in the FE estimation exclude all the variables without time variability, such as the size dummy variables. As explained above, we will only comment the FE results.

Chart 1 shows the pattern of AR according to size, with the 95% confidence intervals. We can see that small firms give more trade credit than large firms. The coefficients we see in Chart 1 are the dummy year coefficients obtained in our first regression using a FE estimation. Trade credit extended by firms increases with size up to firms that have between 50 and 99 employees. From this point, trade credit decreases with size. Thus, it is clear that large firms extend less trade credit than small firms and that medium size firms are the ones that extend the most trade credit of all.

Now let us look at the estimated coefficients of the year dummies. Chart 2, which has the estimated coefficients of the year dummies using a FE estimation, shows that the evolution of these coefficients is stable over time and they increase only from year 2008 indicating that the crisis starting in 2008 has had some effect on the provision of trade credit given by firms.

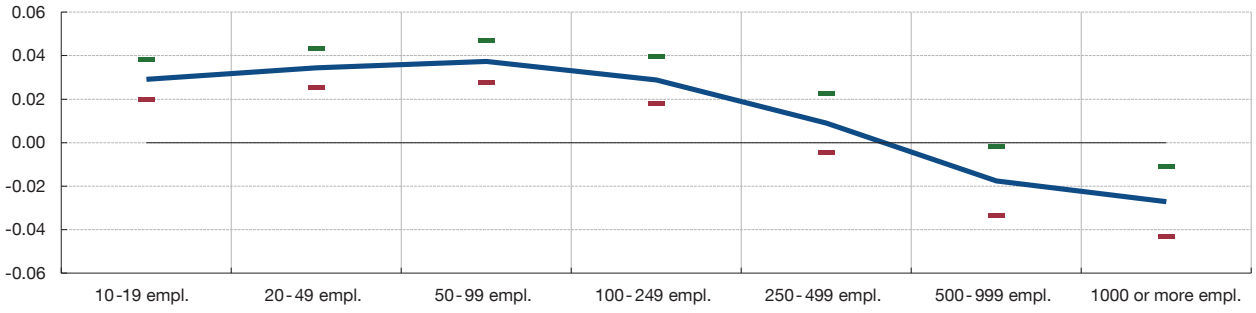
VARIABLES AND DEFINITIONS

TABLE 1

Variable	Definition
AR	Accounts receivable / Sales
AP	Accounts payable / Purchases
LIQ	(Cash + Short term financial assets) / Total assets
Age	Actual year – First year of the firm
Net profit margin	EBIDTA / Total operating revenues
Sales growth	Growth rate of sales
Assets growth	Growth rate of total assets
Long term liabilities over assets	Long term liabilities / assets
Equity over assets	Equity / Total assets
EFD	[(Capital assets at t – Capital assets at t – 1) – EBIDTA] / Capital assets at t
Short term bank borrowings	Short term bank debt / Total assets
Long term bank borrowings	Long term bank debt / Total assets
Financial Expenses	Financial expenses (incl. Interest payments) / Total assets

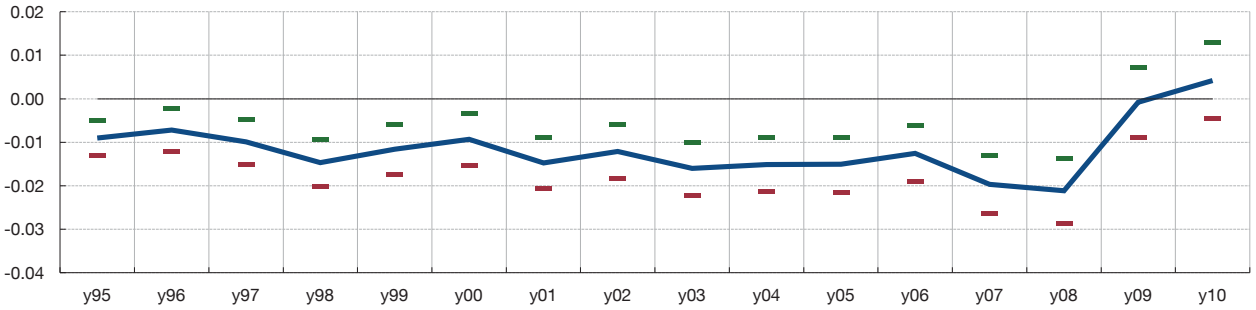
SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.

SIZE COEFFICIENTS AND CONFIDENCE INTERVALS AT 95% FOR TRADE CREDIT EXTENDED CHART 1



SOURCE: Author's caculations based on data from Banco de España's Central Balance Sheet Data Office.

YEAR DUMMY COEFFICIENT AND CONFIDENCE INTERVALS AT 95% FOR TRADE CREDIT EXTENDED CHART 2



SOURCE: Author's calculations based on data from Banco de España's Cantral Balance Sheet Data Office.

Regarding the regressors, we see that we only have two statistically significant ones: Sales growth and Liquidity. Firstly, we see that the estimated coefficient of Sales growth is statistically significant, with an estimated coefficient of –0.0062, whereas Liquidity has an estimated coefficient of –0.0463, meaning that firms with high sales growth and more liquid firms extend less trade credit: an increase in Sales growth in 10% reduces AR by 0.06%, while an increase in 10% of Liquidity reduces AR by 0.46%. We have also that the estimated coefficient of the dummy variable for large firm is statistically significant and negative, meaning that large firms extend less trade credit than small firms, fact that is confirmed by Chart 2.

The negative estimated coefficients of Sales growth and Liquidity indicate that firms with high sales growth and firms with high liquidity extend less trade credit than firms with low sales growth or low liquidity. Regarding the first variable, Sales growth, we could think that firms that grow at higher rates can afford to select their customers, and thus selling to the ones that need less trade credit. Regarding the second regressor, firms with high liquidity might want to preserve it, maybe because they want to do investments projects that require a lot of trade credit, because they are in a sector that demands lots of liquidity or because they demand liquidity to protect themselves against negative external shocks. Alternatively, we could have in this case a reverse causality issue: firms with high trade credit have lower liquidity because they finance their customers.

Now let us analyse the interaction terms. We see that only the estimated coefficient for the interaction term between liquidity and the year 2008 is statistically significant. This means that, although liquidity has a negative effect on AR, this negative effect becomes less negative during the first year of the crisis, 2008. Also we know this year has had a positive effect on AR, but this effect is higher for more liquid firms. Thus, the increase in trade credit

extended is higher for firms with more liquidity. For example, the interaction coefficient for 2008 is –0.0163. This means that if firm A has 10% more liquidity than firm B, the former will increase (decrease) their trade credit extended by 0.16% more (less) than the latter will do in 2008. This finding is consistent with the hypothesis that firms with high levels of pre-crisis liquidity act as substitutes for banks when the crisis arrives. But is this positive effect of liquidity on AR when the crisis arrives, in 2008, high enough to offset the total negative effect? To see the answer, we have to look at the marginal effect of liquidity on AR during 2008. In the years previous to the start of the crisis, where we do not have any interaction terms, this effect is –0.0463. When the crisis arrives in 2008, this effect becomes less negative, –0.03. Hence, liquidity still has a negative impact on AR, even in 2008. But this negative effect is less intense during this year. This negative effect decreases by 36% in 2008. However, the same does not happen during the next two years of the crisis, 2009 and 2010. One reason could be that suppliers are willing to extend more trade credit at the beginning of the crisis, thinking that this crisis is going to be temporary, but when they see how deep the crisis is, they possibly decide to stop behaving like banks and thus they go back to act like they were acting before the crisis. So there is no effect of the years 2009 and 2010 in the provision of trade credit.

Now we move to column 4 of Table 2, which show the results of the regression when we interact liquidity, which is our financial slack variable, the crisis years and a size dummy, which takes value 1 for large firms. As explained above, we have interacted liquidity with

TRADE CREDIT EXTENDED BY FIRMS

TABLE 2

	1		2		3		4	
Constant	0.2396***	(14.86)	0.2525***	(24.55)	0.2695***	(17.05)	0.2237***	(57.62)
Age	0.0006***	(7.26)	0.0001	(-0.44)	0.0005***	(7.03)	0.0000	(-0.51)
Sales growth	-0.0126***	(-7.67)	-0.0062***	(-4.51)	-0.0134***	(-8.08)	-0.0063***	(-4.58)
Net profit margin	0.0009***	(3.28)	0.0001	(0.85)	0.0010***	(3.23)	0.0001	(0.80)
Long term liabilities / Assets	-0.1294***	(-15.43)	0.0017	(0.24)	-0.1397***	(-16.64)	0.0032	(0.47)
Equity / Assets	-0.0314***	(-5.00)	0.0111	(1.62)	-0.0337***	(-5.31)	0.0143	(2.16)
Liquidity	-0.1535***	(-18.54)	-0.0463***	(-7.05)	-0.1536***	(-16.73)	-0.0409***	(-5.49)
Large firm (size dummy)			-0.0075***	(-2.81)	-0.0158***	(-3.76)	0.0015	(0.33)
Liquidity * large firm	-	-	-	-	-0.0446**	(-2.39)	-0.0257**	(-2.06)
Liquidity * year 2008	0.0553***	(4.37)	0.0163*	(1.62)	0.0670***	(4.50)	0.0216*	(1.80)
Liquidity * year 2009	0.0434***	(3.19)	0.0073	(-0.66)	0.0472***	(2.99)	-0.0101	(-0.76)
Liquidity * year 2010	0.0501***	(3.37)	0.0060	(-0.49)	0.0525***	(3.11)	-0.0047	(-0.33)
Year 2008 * large	-	-	-	-	0.0202***	(3.38)	0.0210***	(4.40)
Year 2009 * large	-	-	-	-	0.0072	(1.05)	0.0083	(1.57)
Year 2010 * large	-	-	-	-	0.0019	(0.23)	0.0113	(1.86)
Liquidity * year 2008 * large	-	-	-	-	-0.0115	(-0.42)	-0.0028	(-0.13)
Liquidity * year 2009 * large	-	-	-	-	0.0196	(0.65)	0.0278	(1.16)
Liquidity * year 2010 * large	-	-	-	-	0.0193	(0.56)	0.0077	(0.30)
Estimation method	OLS		FE		OLS		FE	
R-squared	0.1445		0.0003		0.1368		0.0057	
Observations	79,125		79,125		79,125		79,125	
Firms	11,843		11,843		11,483		11,483	

SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.
NOTE: This table presents estimates from an unbalanced panel regressions explaining firm-level annual trade credit provided for the period 1994-2010. The dependent variable is Accounts Receivable over Sales. The first and third columns show the estimates using OLS and the second and fourth ones using FE. Liquidity is calculated as the sum of Cash and Short term financial assets scaled by Total assets. All controls are lagged one period. Standard errors in parenthesis, next to the coefficients. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

the crisis years because more liquid firms might react differently from less liquid firms, extending more or less trade credit, when the crisis arrives. Using the same argument, we can think of this size dummy as a way to capture the fact that large firms might react differently depending on liquidity when the crisis arrives. It is claimed that large firms are likely to have access to more sources of finance than small firms. Specifically we will find out whether large liquid firms extend more or less trade credit than small liquid firms and how this varies when the crisis arrives.

Regarding the explanatory variables, in column 4 we can see that again results do not change compared to column 2. The estimated coefficients of Liquidity and Sales Growth are the only ones that are statistically significant and have the same sign and magnitude as the baseline results: –0.0063 and –0.0409 respectively. However, the estimated coefficient of the size dummy for large firms, which was statistically significant in the previous specification, is no longer statistically significant. Interpretations of these two statistically significant regressors are the same ones that we gave above.

Now we turn to the interaction terms between our slack variable and the crisis years: only the estimated coefficient of liquidity and the year 2008 is statistically significant, as in the baseline results. This coefficient, however, is higher: 0.0216, meaning that in this specification the negative effect of liquidity on AR will be more reduced since we have higher interaction coefficient for the year 2008.

Now we will analyse the new interaction terms. Out of them, only two are statistically significant: the estimated coefficient of the interaction between liquidity and size and the estimated coefficient of the interaction between the crisis year 2008 and size. How do we interpret these coefficients? First, the estimated coefficient of the interaction term between liquidity and size is negative. We know that liquidity has a negative effect on AR. How does this effect vary when the firm is large? As this term is negative, large firms have a more negative effect of liquidity on trade credit than small firms. This is consistent with the fact that both liquidity and large size have a negative effect on AR and that in Chart 1 we saw that large firms extend less trade credit. Second, the estimated coefficient of the interaction term between the crisis year and the size large dummy is positive. How do we interpret this effect? We know that the year start of the crisis, 2008, has a positive effect on AR. This effect is reinforced if the firm is large. That is, the crisis in 2008 has a more positive effect on the extension of trade credit for large firms than for small firms.

5.2 RESULTS BY SIZE

Now we split the sample in two subsamples: the first has firms with less than 250 employees, which constitutes 87% of the original sample, while the second subsample has firms with 250 or more employees. Table 3 shows us the results for both subsamples using the OLS and the FE methods. As mentioned above, the idea of splitting the sample by size is that large liquid firms might react differently from small liquid firms when the crisis arrives. Also, this distinction is important because in general large firms have less financial constraints than small firms since the former can rely on sources of external finance that the latter cannot.

Regarding the explanatory variables, we see that Sales growth and Liquidity remain statistically significant for both subsamples. The negative effect of these two variables is slightly stronger for large firms (coefficients are more negative or higher in absolute value). Thus, the difference of trade credit extended between large firms whose sales are growing (large firms with high liquidity) and large firms that have low sales growth (low liquidity) is higher that this same difference in small firms. Additionally, we have a new explanatory

TRADE CREDIT EXTENDED BY FIRMS (according to size) TABLE 3

	Small firms				Large firms			
	1		2		3		4	
Constant	0.2339***	(14.19)	0.2197***	(52.56)	0.2249***	(4.13)	0.2379***	(28.34)
Age	0.0005***	(6.25)	0.0000	(-0.60)	0.0006***	(4.39)	0.0002**	(2.09)
Sales growth	-0.0117***	(-7.02)	-0.0053***	(-3.75)	-0.0179***	(-3.09)	-0.0092***	(-3.82)
Net profit margin	0.0009***	(2.98)	0.0001	(0.74)	-0.0150	(-0.71)	-0.0127	(-1.53)
Long term liabilities / Assets	-0.1268***	(-14.25)	0.0067	(0.89)	-0.0732***	(-2.95)	-0.0180	(-1.16)
Equity / Assets	-0.0224***	(-3.37)	-0.0214***	(-2.95)	-0.0413**	(-2.37)	-0.0353**	(-2.22)
Liquidity	-0.1526***	(-17.51)	-0.0445***	(-6.35)	-0.1925***	(-8.65)	-0.0475**	(-2.55)
Liquidity * year 2008	0.0626***	(4.54)	0.0215*	(1.92)	-0.0022	(-0.07)	-0.0198	(-0.97)
Liquidity * year 2009	0.0434***	(2.98)	-0.0117	(-0.95)	0.0503	(1.40)	0.0229	(0.96)
Liquidity * year 2010	0.0447***	(2.83)	-0.0081	(-0.61)	0.0790**	(2.03)	0.0193	(0.67)
Estimation method	OLS		FE		OLS		FE	
R-squared	0.1392		0.0029		0.3089		0.0357	
Observations	69,000		69,000		9,461		9,461	
Firms	10,325		10,325		1,531		1,531	

SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.
NOTE: This table presents estimates from an unbalanced panel regressions explaining firm-level annual trade credit provided for the period 1994-2010 according to size. Small firms are those with less than 250 employees and large firms are those with 250 or more employees. The dependent variable is Accounts Receivable over Sales. The first and third columns show the estimates using OLS, for small and large firms respectively, and the second and fourth ones using FE. Liquidity is calculated as the sum of Cash and Short term financial assets scaled by Total assets. All controls are lagged one period. Standard errors in parenthesis, next to the coefficients. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

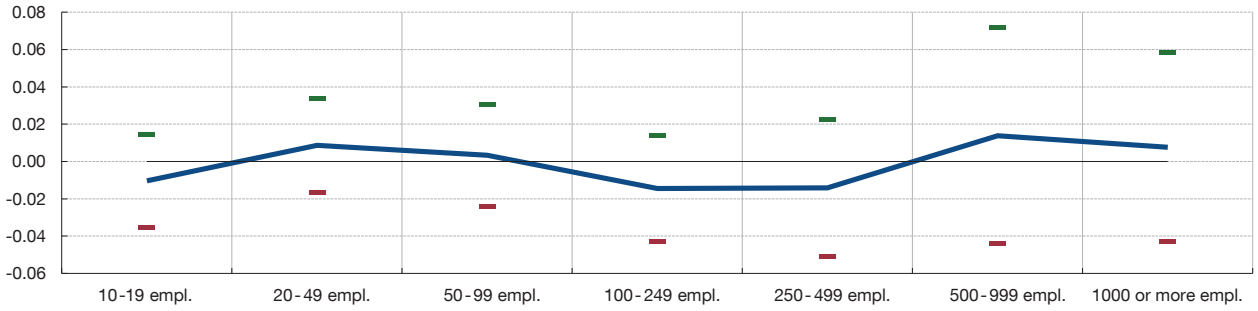
variable whose estimated coefficient becomes statistically significant under this specification: Equity, whose estimated coefficient is negative. This implies that firms with high equity extend less trade credit.

When we look at the interaction terms in both samples, we see that results found in the previous part only hold for the small subsample, since the coefficients are quite similar and have the same significance. This does not happen for the large subsample. Why could the baseline results be only applied to small firms and not to large ones? One possible interpretation could be this one: let us consider the case of a large firm that is a supplier. If this firm has a small firm as a client, the supplier will have more bargaining power, since it is large and it is less dependent on its client than its client is on the supplier. On the other hand, the small firm has little bargaining power and does not have too many options and thus it has to accept the conditions of the large firm. Now, if the large supplier firm has another large firm as a client, what would happen when the supplier does not want to provide trade credit but the client wants to take it? It will depend on the bargaining power of the firms, but assuming that the provider does not want to extend trade credit, as the client is a large firm, it can have access to other sources of external finance. However, this situation does not happen when we consider a small or medium firm as a supplier. As they do not have many clients, they could be more dependent on their clients than large firms are. Thus, when the client is a large firm, the supplier has to extend more trade credit even it does not want to.

6 Accounts payable

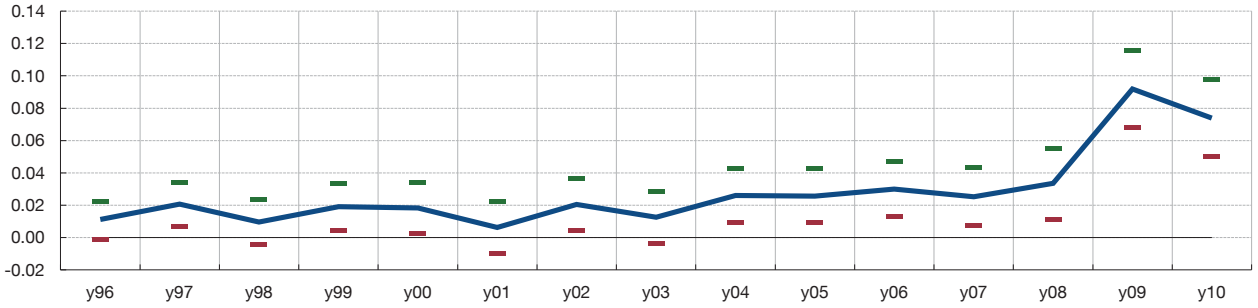
Now we will analyse trade credit taken by firms. In this case, our dependent variable is AP and we will regress it on some controls, year dummies, our financial slack variable and the interaction between this slack variable and the crisis years. All controls, as always, are lagged one period to reduce a possible multicollineality problem. Our financial slack variable, EFD, is defined as the difference of capital expenditures and cash flow scaled by capital assets. That is, the proportion of new investments that are not covered by the cash

SIZE COEFFICIENTS AND CONFIDENCE INTERVALS AT 95% FOR TRADE CREDIT TAKEN CHART 3



SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.

YEAR DUMMY COEFFICIENT AND CONFIDENCE INTERVALS AT 95% FOR TRADE CREDIT TAKEN CHART 4



SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.

flow over the actual capital assets. We define capital expenditures as the increase in capital assets from the previous to the actual year.

Unlike Accounts Receivable, Accounts Payable does not vary significantly with size. There is not a clear pattern of how AP varies according to the size of the firm. In Chart 3, similar to Chart 1 but for AP, we can see this feature of the data. In Chart 4 we can see the coefficients of the year dummies of trade credit taken during the last years: they are very stable until the arrival of the crisis: from 2008 to 2010 they increase 0.048. However, the biggest increase is from 2008 to 2009: 0.0583, whilst from 2009 to 2010 it decreases a little bit. Hence, we can say that the arrival of the crisis has had an impact of the use of trade credit.

Column 2 of Table 4 shows the results for AP using EFD as slack variable. All controls, but Age and EFD, are statistically significant. We have that the control variables that affect the use of trade credit are Sales Growth, Net Profit Margin, Long Term Debt, Equity and the large size dummy, all of them negatively. Now let us turn to the interpretation of these coefficients. Firstly, firms with high sales growth are likely to be expanding and growing and that type of firms is not short of funds. It is logical then that these firms take less trade credit, since the more you growth, the more liquidity you should have and then the less trade credit you should need to take. Secondly, firms with high net profit margin probably have more liquidity, since they earn more for their economic activity and thus the reason they take less trade credit is the same one as firms with high sales growth. We also have that suppliers might not want to extend trade credit to firms that have too much long term debt. So there is a clear negative relationship between long term debt and use of trade credit, mainly because suppliers will not provide trade credit to this type of firms. Regarding Equity, firms with high Equity might have capacity to retain earnings, and thus, increase

TRADE CREDIT TAKEN BY FIRMS

TABLE 4

	1		2	
Constant	0.5301***	(10.36)	0.4905***	(11.33)
Age	0.0004	(1.44)	-0.0001	(-0.08)
Sales growth	-0.0250***	(-2.88)	-0.0249***	(-2.80)
Net profit margin	-0.0013	(-0.25)	-0.0076**	(-2.11)
Long term liabilities / Assets	-0.1873***	(-6.64)	-0.0871***	(-3.51)
Equity / Assets	-0.3251***	(-17.65)	-0.1546***	(-7.56)
EFD	0.0036**	(2.12)	0.0010	(0.72)
Large firm (size dummy)			-0.0196*	(-1.89)
EFD * year 2008	-0.0050	(-1.02)	0.0003	(0.06)
EFD * year 2009	-0.0026	(-0.38)	-0.0028	(-0.55)
EFD * year 2010	-0.0022	(-0.38)	0.004	(0.83)
Estimation method	OLS		FE	
R-squared	0.1739		0.0119	
Observations	55,705		55,705	
Firms	9,602		9,602	

SOURCE: Author's calculations based on data from Banco de España's Central Balance Sheet Data Office.
NOTE: this table presents estimates from an unbalanced panel regressions explaining firm-level annual trade credit taken for the period 1994-2010. The dependent variable is Accounts Payable over Purchases. The first column shows the estimates using OLS and the second using FE. EFD is calculated as the proportion of capital expenditures that are not financed with the cash flow. To see a exact definition of EFD, see Table 1. All controls are lagged one period. Standard errors in parenthesis, next to the coefficients. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Reserves. These reserves can be used when the firm needs finance and, in this situation, instead of recurring to their suppliers to ask for trade credit, these firms just use their reserves. Finally, the estimated coefficient of the large size dummy is negative as well, meaning that large firms take less trade credit than small firms, ceteris paribus. As we know, large firms can have access to other sources of external finance, and thus it is pretty straightforward that they will take less trade credit than small firms.

We see in Table 4 that the estimated coefficients of the interaction terms between our slack variable and the crisis years are not statistically significant. As this happens, we change the specification and perform the same regression as before, using other variables as the financial slack variable. We use the following variables as financial slack variable for AP: Short term bank debt, Long term bank debt and financial expenses. The logic for which we have chosen these variables is the same as explained before: firms with too much bank debt in the short run might want to increase their trade credit taken when the crisis arrives, because in the crisis banks are not willing to extend more credit to them, as they have already too much debt. The same logic applies to the other two variables. However, after we perform the regressions with these three variables, results do not change compared to the EFD case: the estimated coefficients for the interaction terms are not statistically significant, suggesting that there are no variables that make firms take more or less trade credit when the crisis arrives. Thus, there is a big puzzle in Accounts Payable, because of the absence of a variable that changes the willingness to take trade credit when the crisis arrives, unlike Accounts Receivable in which we do have this variable. One possible explanation for this fact is that in the trade credit market, supply dominates demand in the sense that when a provider is willing to give trade credit, the client is going to accept it, but the opposite is not necessarily true. Clients with needs of trade credit are not necessarily going to be able to take trade credit, since the supplier might be reluctant to extend it. Even more, the mere willingness to take more trade credit might be a negative signal to the supplier, since this could be interpret as if the firm were doing badly in the market. This effect that happens normally is reinforced in the crisis, in which banks are more reluctant to give credit and firms need it more.

7 Conclusion

What happens when banks cannot lend due to an external shock in their credit supply? This is one of the two concerns of the paper and to be able to study it, we analyse one close substitute for bank credit, trade credit. This type of credit is the credit given by suppliers to customers in the form of the deferment of the payment for the delivered goods, so that firms pay their supplier some time after they have received the goods. The other important aspect that we want to analyse is the determinants, patterns and evolution of trade credit in Spain during the last 15 years.

For the AR results, we can say that firms with more liquidity and higher sales growth extend less trade credit than others. Regarding the first result, we can think of this as the fact that firms that have more liquidity do not want to extend too much trade credit because they want to protect themselves against negative shocks that might arise. This is consistent with one of Keynes' motives for demand of liquidity, that says that *firms demand liquidity to provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases, and also to hold an asset of which the value is fixed in terms of money to meet a subsequent liability fixed in terms of money, are further motives for holding cash*.[2] This interpretation is consistent with the fact that the estimated fixed effect coefficient of liquidity in negative, which tells us that the same firm reduces their trade credit extended when it has more liquidity than before. Alternatively, we could have a reverse causality problem in this case: firms that extend too much trade credit have low levels of liquidity.

About the second result, firms with higher sales growth extend less trade credit. We could interpret sales growth as a proxy for past performance: the higher the sales growth is, the better the performance of the firm. Thus, if the clients of the firm are doing very well in their activities, the firm is probably going to sale more to them. And since the clients are doing very well too, they are not going to need much trade credit, since they will prefer to pay at the moment of the transaction if they can. Thus, with a good past performance of the firm and its clients, trade credit is going to decrease with sales growth. Another possible interpretation is that firms that have high sales growth have more growth opportunities as well. Thus, firms with more growth opportunities will be able to choose who to supply to, since they have a wide variety of clients where to choose from. And the supplier will choose firms that tend to pay with cash, instead of firms that use trade credit.

Finally, our last important result is the interaction coefficient between liquidity and the year 2008. This estimated coefficient of this regressor is statistically significant and positive. One possible interpretation of this result could be that firms, at the start of the crisis, decide to extend more trade credit than before if they have lots of liquidity, thinking that this crisis is going to be temporary and thus they do not mind increasing their trade credit provision. However, as the crisis becomes deeper and firms get to know that it is going to last very long, they decide to stop acting as bank substitutes and that is why they do not do the same in the following years, 2009 and 2010.

Finally, in the last section, we perform our regression and use External Finance Dependence as our financial slack variable. Regarding the controls, we find that the estimated coefficients of Sales Growth, Net Profit Margin, Long Term Liabilities and Equity are negative and statistically significant. Firstly, firms with high sales growth are likely to be expanding and growing and these firms have liquidity and thus take less trade credit. The same happens for firms with high net profit margin. Regarding long term debt, suppliers

2 J. Keynes (1936), *The General Theory of Employment, Interest and Money,* c. 15

might not want to extend trade credit to firms that have too much long term debt. Firms with high equity might not need to increase their trade credit taken since, as they have high equity, they could increase their reserve and use them when they need finance. In this same regression, no estimated coefficient of the interaction terms between our slack variable, EFD, and the crisis years is statistically significant, and we proceed to change our financial slack variable. After considering several variables as candidates for the financial slack variable, results do not change, since the estimated coefficients of the interaction terms remain being not statistically significant.

The big puzzle in Accounts Payable is the absence of a variable that changes the willingness to take trade credit when the crisis arrives, unlike Accounts Receivable in which we do have this variable. One possible explanation for this fact is that in the variation seen in trade credit market with the arrival of the crisis, supply dominates demand in the sense that when a provider is willing to give trade credit, the client is going to accept it, but the opposite is not necessarily true. Clients with needs of trade credit are not necessarily going to be able to take more trade credit, since the supplier might be reluctant to extend it. Even more, the mere willingness to take trade credit might be a negative signal to the supplier, since this could be interpret as if the firm were doing badly in the market.

In this paper, we have studied both dimensions of trade credit: trade credit extended and taken. We have been more successful in the first one, since we have found that depending on a variable (liquidity), firms respond differently regarding extending trade credit when the crisis arrives. However, this does not happen for trade credit taken. Of course, there are other perspectives that could be taken to analyse trade credit. In this paper, we have ignored the joint decision of taken and given trade credit, which could lead to other important results, as well as the fact that firms might decide on bank and trade credit jointly. This paper could be a first step in analysing with more detail the demand of trade credit and could be complemented with future research that might take different perspectives and approaches, as the ones given above, in analysing the trade credit market to improve the already vast existing literature about trade credit.

REFERENCES

BECKER, B., and V. IVASHINA (2011). *Cyclicality of Credit Supply: Firm Level Evidence,* Harvard Business School Working Paper no. 10-107, August.

CARBÓ-VALVERDE, S., F. RODRÍGUEZ-FERNÁNDEZ, and G. UDELL (2012). "Trade Credit, the Financial Crisis, and Firm Access to Finance", Mimeo, Universidad de Granada.

CUÑAT, V. (2007). "Trade Credit: Suppliers as Debt Collectos and Insurance Providers", *Review of Financial Studies,* 20, pp. 491-527.

GARCÍA-APPENDINI, E., and J. MONTORIOL-GARRIGA (2011). *Firms as Liquidity Providers: Evidence from the 2007-2008 Financial Crisis,* Carefin, Università Bocconi Working Paper no. 5/11, June.

IVASHINA, V., and D. SCHARFSTEIN (2010). "Bank lending during the Financial Crisis of 2008", *Journal of Financial Economics,* 97, pp. 319-338.

PETERSEN, M., and R. RAJAN (1997). "Trade Credit: Theories and Evidence", *Review of Financial Studies,* 10, pp. 661-691.

RAJAN, R., and L. ZINGALES (1998). "Financial Dependence and Growth", *American Economic Review,* 88, pp. 559-586.

SMITH, J. (1987). "Trade Credit and Informational Asymmetry", *Journal of Finance,* 4, pp. 863-872.

WILNER, B. (2000). "The Exploitation of Relationships in Financial Distress: The Case of Trade Credit", *Journal of Finance,* 55, pp. 153-178.