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Firms' Capital Structure and Employment in the Aftermath of the 2008-9 Financial Crisis

Antonio Acconcia*, Daniela Fabbri†, and Anna Maria C. Menichini‡

Abstract

Empirical literature documenting the real costs of financial crises links the surge of unemployment to mainly bank frictions. This paper takes a more comprehensive approach by looking at how bank credit constraints, firm's capital structure and inputs characteristics interact in shaping the firms's response. We document that both the firm's ability to substitute bank with trade credit and the characteristics of the inputs transacted along the supply chain matter in shaping the labor market reaction of Italian corporations to the unfolding of the 2008-9 financial crisis. As bank lending conditions tightened, firms intensively increasing their reliance on trade credit managed to partly mitigate their employment contraction but faced a stronger input bias against labor. Manufacturing firms largely using trade credit to buy differentiated inputs experienced a smaller drop in employment but a stronger input bias than firms buying standardized inputs. Finally, while the labor market recovered quite fast for firms increasing their reliance on trade credit, with the number of employees reaching the pre-crisis level around 2016, the shift toward technologies less intensive in labor showed more persistence, with the input bias even sharpening during 2013-14 and being in 2019 still 6 percentage points higher than the initial 2008 value.

JEL Classification: G32, G33, K22, L14.

Keywords: Bank financing, trade credit, employment, labor share.

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1 Introduction

It is well known that financial crises have negative real effects (Chodorow-Reich, 2014; Duygan-Bump et al., 2015). During a credit crunch, the firm's access to credit is reduced, employment and investment decrease and production shrinks. However, less is known about the actual financial channels through which such real effects may come into place.

In this paper we try to fill this gap by taking a comprehensive approach that looks at how the interplay between different financing instruments impacts on labor market dynamics. We argue that a credit crunch affects not only the total amount of financial resources available to the firm, but also their composition, and, through this, the mix of inputs used in production. In particular, as widely documented (see, for instance, Petersen and Rajan, 1997; Love et al., 2007, among others), following a financial crisis, rationed firms respond to the bank credit disruption by increasing the reliance on trade credit. However, unlike bank credit that can be used to finance all production inputs, trade credit can only be used to finance certain types of capital inputs. Thus, the higher reliance on trade credit could distort the input choice toward the inputs that trade credit finances and certainly away from labor, implying a novel and unexplored link between financing and input choices. We explore this link empirically, exploiting the reaction of a panel of Italian corporations to the 2008-9 credit crunch.

Our empirical investigation is guided by Fabbri and Menichini (2010) who study the interplay between financing and input choices in a theoretical setting in which entrepreneurs optimally and simultaneously choose the combination of both inputs (labor and capital) and external resources (bank and trade credit). Our paper brings some of their novel predictions to the data and provides new evidence on the role of trade credit on the firm's operating choices.

We provide three pieces of new evidence. First, we show that Italian firms facing tighter credit constraints at the eve of the 2008-9 financial crisis cut more on employment in the aftermath of the credit crunch. However, the size and composition of this effect is not homogenous across firms but strongly depends on the firms' ability to resort to trade credit when bank credit is unavailable. This reallocation of resources between bank and trade credit has two distinct effects on the labor market, a *smoothing effect* and a *input substitution effect*. Under the smoothing effect, trade credit allows firms to mitigate the overall downsizing of production driven by the credit crunch. Under the input substitution effect, the use of trade credit also distorts the firm's input combination by pushing firms toward technologies more intensive in capital and less in labor, a change that is potentially less easier to reverse.

Second, we document that the labor market reaction to the unfolding of the crisis depends not only on the availability of trade credit, but also on the characteristics of the inputs transacted, such as liquidity. Manufacturing firms largely using trade credit to buy illiquid inputs, like differentiated ones, experience both a lower drop in employment and a stronger input bias toward capital.

Finally, we show that the use of trade credit also affects the speed of firms' recovery in the aftermath of the financial crisis. For firms strongly increasing their

trade credit reliance, the impact of bank credit constraints on employment is less sizeable during the all sample period due to the smoothing effect of trade credit and it completely disappears towards the end of the sample period. Conversely, the impact of credit constraints on the input mix is rather persistent, as the labor share is on average roughly still 6% points lower at the end of the sample period than in 2007.

Taken together, these findings suggest that firms' heterogeneity in both capital structure and input characteristics is key to explaining the firms' labor dynamics and their recovery in the aftermath of the credit crunch.

Our paper lays at the intersection of two strands of the literature. The first strand is the research on labor and finance, while the second is the literature on trade credit and its role in mitigating financing constraints.

Fuelled by the 2008-9 financial crisis and the subsequent economic recession, the literature on labor and finance has documented the spillover effects that banking sector shocks can have on the corporate economy, finding that financial frictions reduce employment. Using firm-level data from 1970 to 2009, Benmelech et al. (2021) provide evidence that U.S. firms that are more likely to be constrained on bank credit reduce the number of employees. Duygan-Bump et al. (2015) show that financing constraints are among the drivers of the unemployment dynamics during the 2008-9 recession for small U.S. firms (with less than 99 employees) in industries strongly relying on external financing. Similar evidence is provided by Campello et al. (2010) using a survey-based measure of financial constraint. Chodorow-Reich (2014) studies the effect of the supply of bank lending on employment outcomes, finding that in the year following the Lehman bankruptcy firms that have borrowed from less healthy lenders reduce employment more.

The above literature has linked employment dynamics during periods of distress to mainly bank frictions. The only exception is Costello (2020), who investigates how trade credit propagates the effect of a liquidity squeeze along the supply chain and exacerbates the reduction in employment of buyers more exposed to this liquidity spillover (i.e., small firms) during the 2008-9 financial crisis. In line with Costello (2020), we investigate the interplay between bank and trade credit during a credit squeeze. However, our paper takes a very different perspective by showing that trade credit mitigates (rather than propagates) the effect of a credit crunch and may have two distinct effects on firms' labour choices: a *smoothing effect* and an *input substitution effect*.

Our analysis also contributes to the trade credit literature. This literature has sought to explain why agents could prefer to borrow from firms rather than from financial intermediaries. The traditional explanation is that trade credit plays a non-financing role, reducing transaction costs (Ferris, 1981), allowing price discrimination between customers with different creditworthiness (Brennan et al., 1988), fostering long-term relations with customers (Wilson and Summers, 2002), providing a warranty for quality when customers cannot observe product characteristics (Long et al., 1993). Financial theories instead hold that suppliers are at least as good as financial intermediaries in raising funds due to their information advantage (Biais and Gollier, 1997; Burkart and Ellingsen, 2004; Fabbri and Menichini, 2010).

Two predictions of the financial theories are relevant here. The first one argues that trade credit substitutes bank credit when corporations face frictions in financial markets. Evidence in support of bank and trade credit being substitutes is widespread. Petersen and Rajan (1997) for example show that U.S. firms with better access to bank credit have higher levels of accounts receivable. Garcia-Appendini and Montoriol-Garriga (2013) document that U.S. corporations with high liquidity holdings before the 2008-9 crisis increased the amount of trade credit offered to their clients. The main beneficiaries of these liquidity transfers were constrained firms having commercial relations with relatively liquid suppliers. Other studies (Nilsen, 2002; Choi and Kim, 2005; Love et al., 2007) show that the use of trade credit increases when corporations face bank credit constraints during periods of financial distress. Similarly, Boissay and Gropp (2013) show that French firms along the supply chain provide liquidity insurance to each other through trade credit and that this mechanism can mitigate credit constraints. Our analysis not only empirically confirms the above evidence, showing that the reliance of Italian firms on trade credit increased when they faced tighter bank credit constraints. It also makes a step forward by showing that this replacement between bank and trade credit is relevant to explain the dynamics of the labor market triggered by the 2008-9 credit crunch.

The second prediction of the financial theories that is relevant for our analysis argues that the characteristics of the goods traded are important to explain the use of trade credit, in particular when the supplier's lending advantage is due to the more limited diversion opportunities of inputs relative to cash (Burkart and Ellingsen, 2004; Fabbri and Menichini, 2010). The idea here is that different diversion opportunities arise not only when lending concerns inputs rather than cash, but also across different inputs, depending on their degree of liquidity or second-hand market value. Existing evidence (Giannetti et al., 2011) provides empirical support to the inputs diversion story by documenting that the amount of trade credit granted to and taken by customers is higher when the goods traded are differentiated (low liquidity) rather than standardized (high liquidity).

Our empirical analysis makes a step forward by showing that the characteristics of the inputs traded along the supply chain can help rationalizing the firms' labor market dynamics. We document that, in the aftermath of the 2008-9 credit disruption, Italian manufacturing firms largely using trade credit to buy differentiated inputs experienced a *input substitution effect* between labor and capital larger than manufacturing firms buying standardized inputs, leading them to rely on technologies less intensive in labor. This evidence seems to suggest that the intensity of the *input substitution effect* might depend on input characteristics. This last finding brings further empirical support to our idea that firms' heterogeneity in trade credit is a key driver of the labor market dynamics, in line with the theoretical predictions of Fabbri and Menichini (2010). Failing to recognize the role of trade credit may induce an incomplete understanding of the labor market dynamics.

The rest of the paper is organized as follows. Building on the theoretical model of Fabbri and Menichini (2010), Section 2 derives the main testable predictions. Section 3 describes the data. Section 4 shows two pieces of preliminary evidence

on firms' reaction to the unfolding of the financial crisis in Italy: a reallocation of resources from bank to trade credit and a dampening effect of the credit squeeze on employment. Section 5 presents our key empirical results, investigating the effect of such reallocation between bank and trade credit on the labor market dynamics. Section 6 concludes.

2 Theoretical predictions

To guide our empirical investigation we use the analysis in Fabbri and Menichini (2010). This paper fits in the theoretical literature on trade credit, and in particular can be listed among the financial theories of trade credit. These theories share the common idea that suppliers are at least as good as financial intermediaries in raising funds. In Biais and Gollier (1997) and Burkart and Ellingsen (2004), this is ascribed to an information advantage. Having a close relationship with the lender through the sale of inputs, suppliers obtain information about the borrowers which the bank can only obtain at a cost and are willing to offer them credit when banks are not. Fabbri and Menichini (2010) incorporate the supplier's information advantage à la Burkart and Ellingsen (2004) in a setting in which the borrower uses two inputs. This allows them to investigate for the first time how changes in the combination of bank and trade credit affect the optimal allocation of resources between capital and labor, and thus the real effects of a variation in the firm's financial structure.

The main ingredients in Fabbri and Menichini (2010) are the following. An entrepreneur with observable internal wealth needs to finance an investment project that uses two unobservable inputs, capital and labor, relying on the funding provided by competitive banks and/or suppliers. Banks lend cash. Workers provide the labor input, which is fully paid in cash. The supplier of capital sells the input, but can also act as a financier, by delaying the payment for the inputs supplied. Being specialized financial intermediaries, banks have a lower cost of raising funds on the market (r_B) than suppliers (r_S) and thus charge a lower *base* interest rate to their borrowers for each unit of funding ($r_B < r_S$). The entrepreneur faces a moral hazard problem vis-à-vis its financiers that may increase the cost of both financing sources, and in particular the cost of bank credit above that of trade credit.[1] In particular, because of the unobservability of investment to all parties and of input purchase to parties other than the supplier, the entrepreneur faces a moral hazard problem: rather than investing the resources raised, either in cash or in kind, in the venture, he might divert them to private uses, limiting the amount of credit financiers are willing to grant. But due to the lower liquidity of inputs, this diversion opportunity is less profitable for inputs than for cash. Thus, the supplier is less exposed to borrower opportunism than the bank, which translates into a lower agency cost of supplier's financing and makes room for trade credit reliance.[2]

[1] The way of modelling the moral hazard problem follows Burkart and Ellingsen (2004).

[2] In Fabbri and Menichini (2010), capital inputs can also be pledged as a collateral. This introduces a further reason for relying on trade credit, namely, the supplier's advantage in liquidating

In this setting, the firm's actual financing choices depend on the borrowing constraints it faces. Firms with no financing constraints, having access to cheaper bank loans, only rely on bank credit and not on trade credit. Firms facing mild financing constraints need a larger loan and may then be rationed by the bank when the agency problem kicks in.[3] This raises the actual cost of bank financing (base rate r_B + agency cost), the more so the higher the firm's leverage. When the severity of bank credit rationing is such that the actual cost of bank lending (base rate r_B + agency cost) equals the cost of supplier financing (base rate r_S), trade credit enters as an extra financing instrument and can be used to relax borrowing constraints. Indeed, being less vulnerable than banks to borrower's opportunism, suppliers are willing to provide financing when the bank is not. Therefore, an entrepreneur that is rationed on bank credit can use the available trade credit to finance the purchase of capital inputs, thus freeing liquid resources to finance employment. In this way trade credit allows the firm to mitigate the downsizing of both employment and working capital driven by the credit crunch. We call this the *smoothing effect* of trade credit and we represent it in Figure 1.[4] Without access to trade credit, a credit crunch would contract the level of firm production from point A (on the isoquant Q_A) to point B (on the isoquant Q_B) along the expansion path, with a clear reduction of both labor and capital units. The reliance on trade credit allows the firm to *smooth* the initial contraction and reach a higher production level on the isoquant Q_C, therefore keeping the level of employment and capital inputs larger than during a credit crunch without trade credit (isoquant Q_B).

However, this is not the end of the story. Along with the smoothing effect, the adjustment to the credit squeeze comes with a *input substitution effect*, where the input mix becomes distorted toward capital. The reasons are the following. First, binding financing constraints increase the cost of bank credit more than the cost of trade credit, as bank credit is more sensitive to moral hazard than trade credit. Second, the labor input is financed entirely by bank credit, while the capital input is partly financed also by trade credit. It follows that capital inputs becomes relatively cheaper than labor and they are more heavily relied upon.[5] This input substitution effect is represented in Figure 1 by a movement along the

the inputs in case of default. Although empirically relevant (Costello, 2019), we abstract in this paper from the liquidation motive as a determinant of trade credit use.

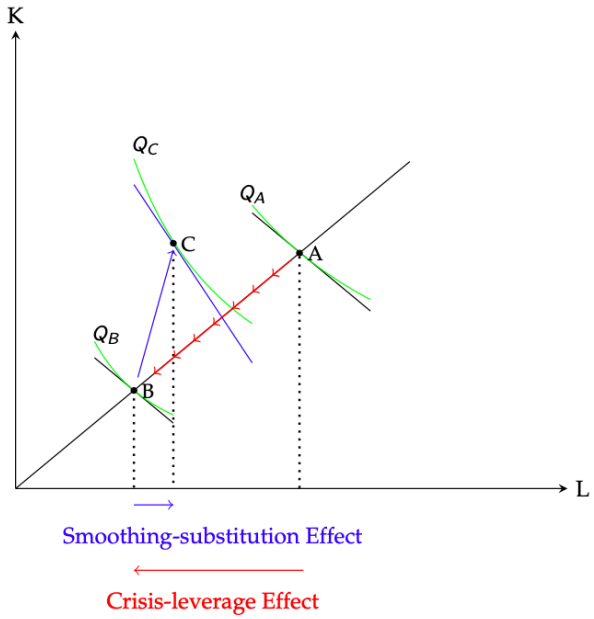
[3]Basically, they cannot be trusted that they will invest, and not divert, the resources raised from financiers, and so they receive lower financing.

[4]An example may help clarify. Suppose the firm uses both capital and labor at unit price 1. Initially it receives a bank loan equal to 100, which is split in the purchase of 50 units of capital and 50 units of labor. Suppose that, due to a credit squeeze, the bank reduces the loan from 100 to 80, making the firm financially constrained. Lacking alternative sources of financing, the firm has to downsize both K and L, to 40 each. However, the availability of trade credit allows the firm to reshuffle the resources among the inputs. If trade credit granted amounts to, say, 10, then, what the firm could do is to allocate these extra resources to buy 10 units of capital inputs, and use the remaining bank credit to buy 35 units of capital and 45 units of labor. This allows the firm to keep the input mix constant and mitigate the impact of the bank credit constraint.

[5]Going back to the previous example, as the severity of financial constraints increases, the firm keeps downsizing production, but tilts the input mix towards capital, using 30 units of labor and 40 units of capital.

isoquant Q_C toward the new equilibrium point C. Notice that point C not only lies on on a higher isoquant than in the credit-crunch without trade credit (Q_B), but it is also located on a steeper isocost and expansion path than points A and B, which implies an input combination more intensive in capital and less in labor.

Figure 1: Input ratio and financing constraints



Notes: Figure 1 depicts the impact of a credit squeeze on employment and input mix when trade credit is used. A credit squeeze determines the scaling down of production (from Q_A to Q_B) leaving unchanged the input mix (crisis leverage effect). However, firms that access trade credit can mitigate the contraction in production, which drops to Q_C rather than Q_B. But because trade credit only finances the purchase of working capital, the new equilibrium (point C) lies on a steeper expansion path than points A and B, which implies an input combination distorted toward capital.

The above discussion leads to the following two testable predictions.

Prediction 1 (smoothing effect). *Credit-constrained firms downsize employment below the level of unconstrained ones, but this contraction is lower for those relying on trade credit.*

Prediction 2 (input substitution effect). *Credit-constrained firms relying more on trade credit use an input combination less (more) intensive in labor (capital) than unconstrained ones.*

The above discussion links the firms operating choices to their financing decisions. In particular, since diverting inputs is less profitable than diverting cash, this favors trade credit reliance. But since trade credit finances capital inputs (and not labor), there is a bias also in the input mix. The extent of such bias depends on input characteristics, namely, their liquidity. The more liquid the inputs, the easier it is to divert them and thus the more severe the moral hazard problem.

This implies a higher cost of supplier financing and a lower use of trade credit, relative to the case in which inputs are very illiquid. Such higher cost translates into a higher cost of capital and an input mix less intensive in capital, again relative to the case in which inputs are very illiquid. If we classify inputs according to their liquidity, we can distinguish between standardized goods and differentiated goods. It is easier to divert standardized goods because they can be easily resold to a different company (high liquidity). Conversely, differentiated inputs, being tailored to the needs of a specific customer, have low second-hand market value (low liquidity). We thus expect that firms using trade credit to purchase differentiated inputs exhibit a stronger smoothing and input substitution effect.

From the above, we can derive the following testable prediction.

Prediction 3. *Manufacturing firms largely using trade credit to purchase differentiated inputs are likely to display a lower decline in employment and a more pronounced bias towards capital inputs than firms buying standardized inputs.*

In the next section, we describe the data used to test the above predictions.

3 Data

Our main source of the data is AIDA who provides yearly balance sheet information for a panel of Italian firms in the period 2007-2019. While information on trade credit is included in our data set, Aida does not provide direct information about credit constraints faced by corporations. To overcome this problem and still be able to test our predictions, consistent with previous literature (Whited (1992), among others), we proxy credit constraints with the firm's leverage ratio. Moreover, since in Italy the financial crisis has spread between late 2008 and early 2009, we treat 2007 as the base pre-crisis year and we look at the firm's leverage accumulated up to 2007 as an indicator of the credit constraints faced by the firm at the eve of the crisis. Hence, the interpretation of our results is based on two hypotheses. First, firms' response to the crisis is affected by the severity of credit rationing faced in 2007. Second, firms are more likely to be credit rationed by banks when entering the financial crisis with higher leverage ratio.

Table 1 reports summary statistics relative to 2007 for our main variables. Employment is defined as the number of total employees at the firm level, while labor share is the wage bill over the total production cost (times 100). We use the labor share (rather than the total labor cost), as it proxies for the input combination, and more precisely for the labor input intensity. Higher labor share implies an input combination tilted toward labor. Notice that our interpretation works under the assumption that input prices do not vary or, if they do, they vary by the same proportion. We measure trade credit received by the suppliers using the amount of payables as a percentage of total liabilities. Leverage is the firm's total amount of bank liabilities as a percentage of total liabilities. Liquidity is the sum of all liquid assets including cash, bank checks, receivables and financial assets as a percentage of total liabilities.

Table 1: Summary statistics 2007

	mean	sd	p25	p50	p75	count
Employment	45.3	302.4	4.0	11.0	31.0	65,198
Labor share	16.9	13.8	7.1	13.3	22.7	65,198
Trade credit	44.7	24.2	26.0	43.2	62.6	65,198
Leverage	27.6	24.7	0.8	24.5	47.0	65,198
Liquidity	21.3	77.7	0.9	5.0	18.8	65,198

Notes: Employment is the number of employees. Labor share is total cost of employment as percentage of total production cost. Trade credit is payables. Leverage is total bank liabilities. Liquidity is the sum of cash, bank checks, receivables, and financial assets. All the variables are expressed as percentage of total debt. All values are relative to 2007.

As we can see from the table, at the onset of the crisis on average firms in our sample had 45 employees and the average labor share was roughly 16% of total production cost. Leverage and trade credit as percentage of total debt were 27% and 44%, respectively. Median values were usually a bit lower than corresponding averages. However, sample distributions of leverage and trade credit were characterized by large standard deviations. In case of leverage, the 75th percentile was about twice the median value, while very low values characterized one fourth of the firms in our sample.

Table 2: Summary Statistics 2007 by Sector

	Manufacturing		Services	
	mean	sd	mean	sd
Employment	56.3	241.0	36.5	343.6
Labor share	19.6	12.6	14.8	14.3
Trade credit	43.8	21.5	45.4	26.2
Leverage	30.3	24.2	25.3	24.9
Liquidity	19.0	59.3	23.1	89.7
Observations	29,018		36,180	

Notes: Employment is the number of employees. Labor share is total cost of employment as percentage of total production cost. Trade credit is payables. Leverage is total bank liabilities. Liquidity is the sum of cash, bank checks, receivables, and financial assets. All the variables are expressed as percentage of total debt. All values are relative to 2007.

Table 2 presents summary statistics relative to the same variables but separately for the manufacturing and services sectors. Significant differences emerge between these two industry groups, with manufacturing having a higher number of employees (approximately 1.5 times higher) and a greater labor share and

bank debt (5 percentage points higher, on average, for each of these two variables) than services. Differences in terms of trade credit were instead less pronounced between these two sectors (less than 2 percentage points).

Figure 2 shows the evolution of employment up to 2019 for firms that decreased their employment during the period 2007-10 (bottom part of the figure), which corresponds to the 35% of our sample. The rest of the sample is shown in the upper part of the figure. The 2007 base year value equals 100. Comparing the employment levels between 2007 and 2010, we can see that approximately one-third of our sample reduced their number of employees by an average of 18%. This contraction persisted over time and remained unchanged at the end of the sample period, indicating that these firms were severely impacted by the credit squeeze and did not recover even after ten years. The situation differs for firms in the upper part of Figure 2: for these firms the average number of employees did not change much between 2007 and 2010 and they even managed to gradually increase employment until reaching a new level in 2019, which was 15% higher than the pre-crisis level.

The severe drop in employment for many firms is not surprising but rather consistent with the evidence for other European countries (Schmitt-Grohé and Uribe, 2013; Uribe and Schmitt-Grohé, 2017), and points to the legal institutional setting in Italy and the nominal downward wage rigidity as possible rationales.[6] Empirical evidence actually shows that during and after the 2008-9 crisis firms tended to reduce working hours and employment rather than wages (Fallick et al., 2020; Kurmann and McEntarfer, 2019; Jo, 2019; Bergin et al., 2012; Kwapil et al., 2010; Bewley, 1999). Similarly, using data from a survey of 14 EU countries, Bertola et al. (2012) found that some 35-40 percent of the responding firms reacted to a shock by reducing employment, mainly temporary.[7]

To look at the labor market dynamics and the effects of the financial crisis, in the following we use the change in employment and labor share relative to 2007. In this way, we also control for unobserved firm-level fixed effects.

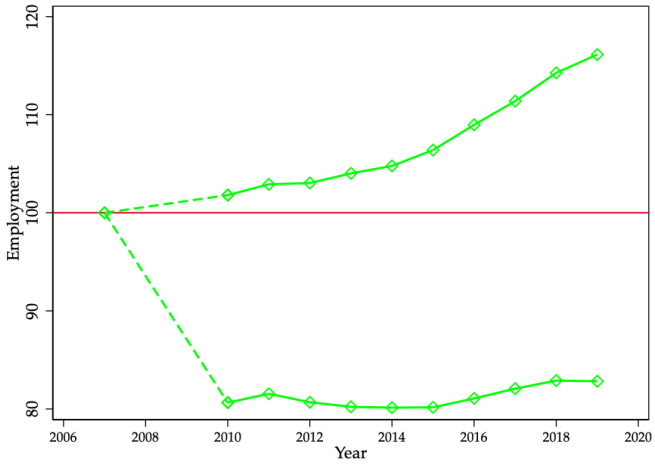
4 Preliminary evidence

The main argument of this paper is that in response to a credit squeeze following a period of financial distress some firms might be forced to increase their reliance on trade credit. This reallocation of financial resources may have potentially interesting and so far unexplored real effects, affecting the mix of inputs. Therefore, as first piece of evidence, in Section 4.1 we show that Italian corporations reacted to the credit crunch by increasing their reliance on trade credit. In Section 4.2, instead, we look at the relation between labor market and credit rationing and show that a tightening of bank credit constraints reduces employment and distorts the input combination against labor.

[6] Wage setting institutions tend to make wages stickier and force adjustment via employees.

[7] The reluctance of firms to cut nominal wages has been also documented in markets for casual labor, where regulation arguably plays a small role: by examining transitory shocks to labor demand across 600 Indian districts, Kaur (2019) concludes that nominal wages increase during positive shocks but do not fall during droughts.

Figure 2: Evolution of Employment



Notes: The figure shows the evolution of employment between 2007 and 2019 for firms that decreased employment during 2007-10 (bottom part of the figure) and for the rest of the sample (upper part of the figure). The 2007 base year value equals 100.

4.1 Bank and trade credit

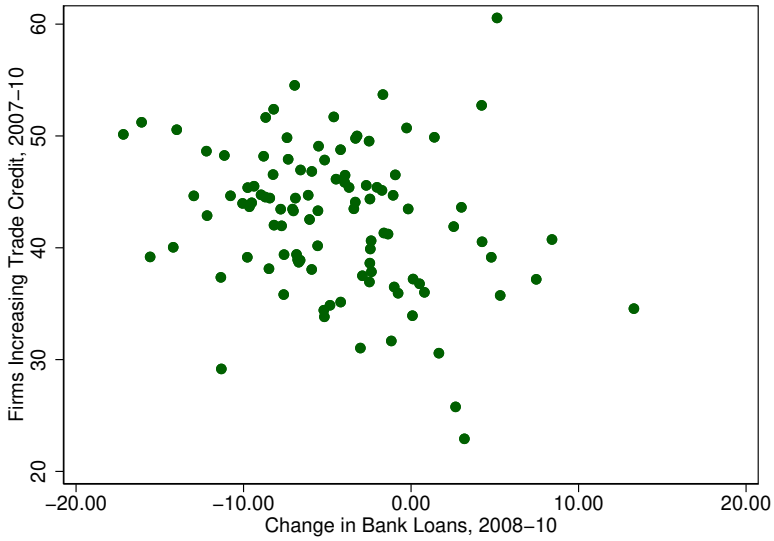
The plot in Figure 3 provides a simple graphical representation of the relationship between bank and trade credit. On the horizontal axis, we report the province-level change of total bank loans granted to Italian firms in the industrial sector (manufacturing and construction) during 2008-10. This variable is provided by the Bank of Italy and only available at the province level. On the vertical axis, we report the province-level, sector-weighted percentage of manufacturing firms that increased the payables-debt ratio over the time interval 2007-10. This variable uses firm balance-sheet information available in AIDA but is calculated at the provincial level to match the information on bank loans provided by the Bank of Italy.

The plot documents a negative correlation between trade and bank credit: in the Italian provinces where bank lending has dropped substantially as a consequence of the financial crisis, firms have increased their reliance on trade credit. Thus, in line with extensive worldwide evidence (for instance, Nilsen, 2002; Choi and Kim, 2005; Love et al., 2007), also in Italy the use of trade credit goes together with a shortage of bank credit.

The negative relation between trade and bank credit is confirmed by the results of the empirical analysis reported in Table 3. Column 1 shows the OLS estimate of the regression line going through the data points of Figure 3, obtained by regressing the number of firms increasing payables against the change in bank loans (Δ Loans 2008-10). The slope of the line is negative and statistically significant, providing further support to the suggestive evidence in Figure 3 that in the Italian provinces where banks cut corporate loans, a higher percentage of firms increased their reliance on trade credit.

We get very similar results by using firm-level data for the dependent variable

Figure 3: Trade Credit and Bank Loans



Notes: The plot shows the province-level, sector-weighted percentage number of industry firms in our sample that increased the payable/debt ratio with respect to the percentage change of total bank loans to industrial firms.

(see columns 2 and 3). In column 2, we use a dummy equal to 100 if the firm increased the payables-debt ratio during 2007-10, and zero otherwise. In column 3, we use the firm payables-debt ratio change during 2007-10. In these last two empirical specifications, we also extend the regression model to include the firm liquidity position (Liquidity 2007), and (not reported) the amount of trade credit in 2007, the change in total assets and industry-level fixed effects. The t-statistics reported in parentheses are now based on clustered province×sector standard errors.

Consistent with our previous evidence, we find that the coefficient of the bank loans variable is negative and statistically significant at 1% level, again suggesting that in the aftermath of the 2008 financial crisis firms located in provinces where corporate loans contracted increased their reliance on trade credit.[8]

4.2 Labor market and bank credit rationing

The second piece of evidence we are interested in is the relation between labor market and credit rationing. In Figure 4, firms are first split into two groups depending on whether their leverage ratio in 2007 is below the median value (group 1, unconstrained firms) or above it (group 2, constrained firms). The bar chart shows the difference in the change of employment and labor share between group 1 and 2 for the period 2010-2019. Notice that at any point in time, the change in labor share is calculated taking 2007 as base year and moving forward

[8]We get similar results if the change in debt loans is calculated over the period 2007-10. However, the number of observations would be lower because of missing data for South Sardinia.

Table 3: Trade Credit and Bank Loans

	(1)	(2)	(3)
Δ Loans 2008-10	-0.292*	-0.246**	-0.087***
	(-2.60)	(-3.09)	(-3.51)
$Liquidity_{2007}$		3.584***	1.580***
		(4.80)	(5.10)
Further control variables	Yes	Yes	Yes
Observations	104	26058	26058

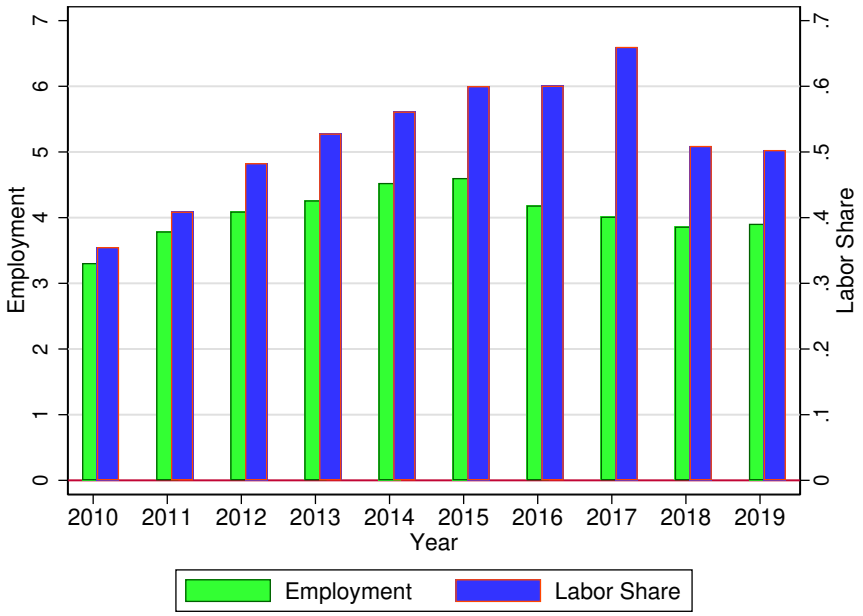
Note: The left-hand side variable is: (i) the province-level sector-weighted percentage number of firms that increased the payable-debt ratio during 2007-10, in the first column; (ii) a dummy with value equals to 100 if the firm increased the payable-debt ratio during 2007-10, in the second column; (iii) the percentage change of payable-debt ratio during 2007-10 in the last column. ΔLoans is the percentage change in total bank loans to industry firms. Empirical models reported in column (2) and (3) also control for TradeCredit, the change in total assets, and industry-specific fixed effects. T-statistics are reported in brackets; clustered Province×Industry standard errors are used in column (2) and (3).

to the end of the time interval, starting from 2010 until 2019.

The evidence suggests that unconstrained firms outperformed the constrained ones in terms of both employment and labor share in the entire sample period. Moreover, the difference in employment between the two groups of firms increases slightly until 2015 and then starts contracting but it is still around 4% at the end of the sample period. Similarly, the difference in labor share between the two groups of firms keeps increasing and only in 2018 it starts contracting reaching 5% in 2019.

The descriptive evidence of Figure 4 shows a negative relation between credit constraints and our two labor market indicators, which is confirmed by the regression analysis shown in Table 4. Here we regress the change in both employment (column 1) and labor share (column 2) between 2007 and 2010 on firm's leverage and liquidity at the eve of the financial crisis. We also control for (not reported) the change in trade credit, the change in total assets, industry fixed effects and province fixed effects. T-statistics are based on Province×Industry clustered standard errors. The coefficient of leverage is negative and statistically significant at the 1% level in both columns, suggesting that firms facing more severe credit constraints experience a larger contraction in employment and an input combination more tilted against labor. In line with existing empirical literature (Chodorow-Reich, 2014; Duygan-Bump et al., 2015; Costello, 2020), the evidence in this section shows that a tightening of bank credit constraints impacts negatively the labor market, by reducing both the employment and the labor share.

Figure 4: Labor Market and Bank Credit Rationing over the 2008 Crisis



Notes: The sample of firms is split into two groups according to the median value of the leverage ratio in 2007. The figure shows the difference between the two groups in the growth rate of employment and the percentage change of labor share over 2007-10.

5 Real effects of the 2008 credit crunch

Section 4 presented two pieces of preliminary evidence. First, Italian firms rely more on trade credit when bank credit becomes unavailable at the beginning of the 2008-9 financial crisis. Second, Italian firms entering the financial crisis with higher leverage reduce employment more than those with lower leverage (in the aftermath of the crisis). Our next step is to show that these two pieces of evidence are part of the same story, in particular, that the labor market reaction of Italian firms to the credit squeeze depends on the extent to which they substitute bank credit with trade credit. We now dig deeper into the labor market dynamics, by testing the predictions 1-3 highlighted in Section 2.

5.1 Empirical model

We firstly estimate an empirical model where the dependent variable is either the change in employment or in the labor share, calculated for the window 2007-10. Then, we re-estimate the model by enlarging the time window one year at a time up to 2019. In this way, we can trace the response function of the labor market to the shocks determined by the 2008 crisis, conditional on the pre-crisis leverage. Hence, for each $t = 2010, \ldots, 2019$, we estimate the following cross-sectional regression:

Table 4: Labor and Bank Leverage

	(1) Employment	(2) Labor Share
Leverage_{2007}	-0.08***	-4.77***
	(-5.82)	(-4.56)
Liquidity_{2007}	-0.02**	0.32
	(-2.62)	(0.56)
Further control variables	Yes	Yes
Observations	26058	26058

Note: The left-hand side variable is the change in employment or labor share between 2007 and 2010 (taken as ratio with respect to the sample mean times 100). Labor share is total cost of employment as percentage of total production cost. Leverage is total bank liabilities as percentage of total debt. Liquidity is the sum of cash, bank checks, receivables and financial assets as percentage of total debt. Control variables consist of the change in total assets, the change in trade credit as percentage of total debt, industry-specific fixed effects and province-specific fixed effects. T-statistics are reported in brackets. Clustered Province×Industry standard errors are used.

$$\begin{aligned} \Delta L_{j,2007-t} = \alpha + \beta\ (\Delta TradeCredit_{j,2007-t} \times Leverage_{j,2007}) + \\ \gamma\ Leverage_{j,2007} + \delta\ Liquidity_{j,2007} + \\ \psi X_{j,2007-t} + \lambda_i + \phi_p + \varepsilon_{j,2007-t} \end{aligned} \tag{1}$$

where $\Delta L_{j,2007-t}$ is the change in either the employment or the labor share of firm j calculated from 2007 to year t, $\Delta TradeCredit_{j,2007-t}$ is the change in payables over total debt, $Leverage_{j,2007}$ is the 2007 bank-to-total debt ratio, $Liquidity_{j,2007}$ is the 2007 liquidity-to-total debt ratio. Our key variable is $\Delta TradeCredit_{j,2007-t} \times Leverage_{j,2007}$, i.e., the interaction term between the leverage ratio and the change in payables. The term $X_{j,2007-t}$ contains other controls at the firm level like the change in total asset and the change in payables, while ψ is a coefficient vector. The terms λ_i (NACE Rev. 2, three digit) and ϕ_p are industry-specific and province-specific fixed effects, respectively. We control for fixed effects and change in total assets to capture systematic differences in the response to the crisis driven by industry and geographical location of the firms as well as changes in their size. Finally, statistical significance is based on robust standard errors at the Province×Industry level. This is done to control either for unobserved cluster effects due to administrative rules common to firms located in the same province or for some correlation in the error terms among firms operating in the same product market. However, the main results also hold when using not-clustered standard errors.

5.2 Results

Table 5 shows the estimates of regression (1) for the manufacturing (columns 1 and 2) and the distribution-services sectors (columns 3 and 4). The dependent variable is the change in employment in columns 1 and 3 and the change in labor share in columns 2 and 4, calculated in the window 2007-10.

Table 5: The Role of Trade Credit, 2007-10

	Manufacturing		Distribution-Services	
	Employment	Labor Share	Employment	Labor Share
Δ TradeCredit $\times$ Leverage_{2007}	0.37***	-33.01***	0.61***	-1.28
	(3.72)	(-3.70)	(5.64)	(-0.18)
Leverage_{2007}	-0.08***	-4.83***	-0.10***	-1.48
	(-5.76)	(-4.62)	(-7.59)	(-1.26)
Liquidity_{2007}	-0.02**	0.36	-0.01*	-0.63
	(-2.63)	(0.64)	(-2.17)	(-1.00)
Further control variables	Yes	Yes	Yes	Yes
Observations	26058	26058	31251	31248

Note: The left-hand side variable is the change in employment or labor share between 2007 and 2010. Leverage is total bank liabilities as percentage of total debt. ΔTradeCredit is the change during 2007-10 in payables as percentage of total debt. Liquidity is the sum of cash, bank checks, receivables and financial assets as percentage of total debt. Control variables consist of the change in total assets, the change in payables as percentage of total debt, industry-specific fixed effects and province-specific fixed effects. T-statistics are reported in brackets and are based on clustered Province$\times$Industry standard errors.

The coefficient of Leverage_{2007} is negative and statistically significant for either sector when the dependent variable is Employment (columns 1 and 3). This finding suggests that both manufacturing and distribution-services firms that enter the financial crisis being highly constrained cut employment more, in line with the evidence for the U.S. on the employment decline driven by the 2008 financial crisis (Chodorow-Reich, 2014). Similarly, the coefficient of Leverage_{2007} is negative when the dependent variable is the Labor Share (columns 2 and 4), though statistically significant only for the manufacturing sector. This evidence suggests that credit constraints not only cause a decline in employment but also a drop in labor/capital input mix, assuming constant input prices. Of course, we cannot dismiss the possibility that also input prices are affected by the crisis. In this case, our interpretation would still hold under the likely assumption that the relative input price did not change at the onset of the financial crisis.

Our key variable is the interaction term, $\Delta TradeCredit_{j,2007-t} \times Leverage_{j,2007}$. In columns 1 and 3, where the dependent variable is Employment, its coefficient is positive and statistically significant, thus suggesting that the contraction in employment driven by the credit squeeze is lower for firms increasing their reliance on trade credit. This is the first novel result of our analysis, in line with Prediction 1. In columns 2 and 4, where the dependent variable is Labor Share, the coeffi-

cient of the interaction term is instead negative, though statistically significant only for the manufacturing sector. Therefore, firms entering the financial crisis being highly leveraged switched to an input combination less intensive in labor, more so the higher was their reliance on trade credit, in line with our Prediction 2.

The message of Table 5 is twofold. First, the positive sign and significance of the interaction terms in columns 1 and 3 suggest that trade credit has a *smoothing effect* for firms in all sectors, in the sense that it allows them to mitigate the initial contraction in employment caused by the credit squeeze, in line with Prediction 1 and Figure 1. Second, the negative sign and significance of the interaction term in columns 2 instead suggest that the use of trade credit goes together with an input bias against labor, in line with Prediction 2 and Figure 1. Notice however that this *input substitution effect* only holds for manufacturing firms, as the coefficient of the interaction term is not statistically significant when the sample is restricted to firms in the distribution and service sector.[9]

The above discussion shows that firms react to the tightening of bank credit constraints by increasing their reliance on trade credit. The size of this shift affects the severity of the detrimental effect of the credit squeeze on the labor market: both employment level and input mix need to readjust.

We now explore in greater detail the firm's reaction to the unfolding of the financial crisis. Two figures are relevant here.

Figure 5 shows the average change in trade credit (as percentage of total liability) between 2007-2019 that corresponds to the 25th, the median, the 75th and 90th percentile of the distribution of trade credit. Notice the huge heterogeneity in the change of trade credit reliance prompted by the credit squeeze: its median value is close to zero in the sample period (orange bar), negative and close to -13% for firms in the lowest percentile (green bar), while it is positive and close to 17% for firms in the highest percentile (red bar). We now link this change in trade credit reliance to the impact of leverage on the firm labor market.

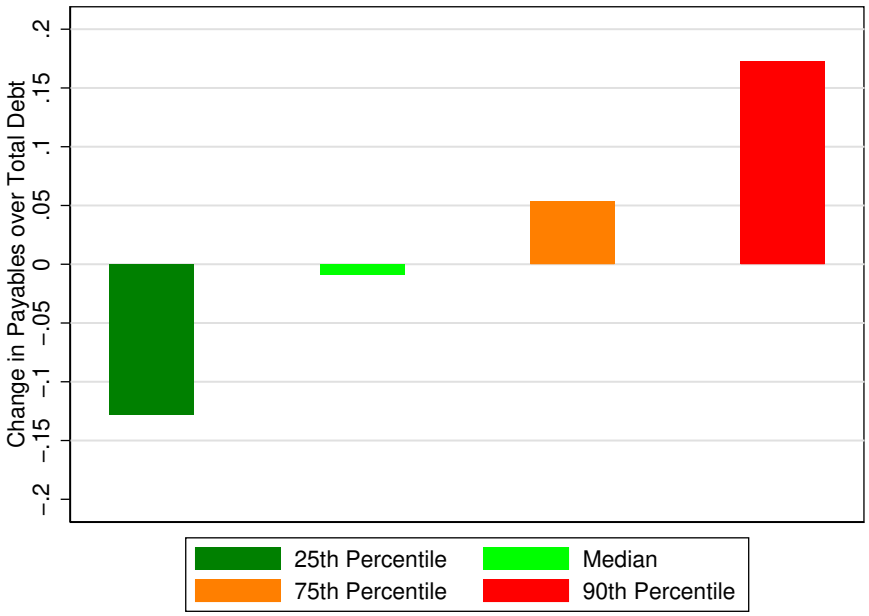
Figure 6 represents the sensitivity of the marginal effect of leverage to trade credit. In particular, it shows how the detrimental effect of the pre-crisis leverage on the labor share (variable on the vertical axis) varies depending on how intense is the firm shift to trade credit (variable on the horizontal axis). More precisely, each bar in Figure 6 represents the estimates of the following term:

$$\gamma + \beta \times \Delta TradeCredit,$$

for four different values of the $\Delta TradeCredit$ distribution, that is the 25th per-

[9] One potential reason for this finding could be the different technologies used in the two sectors: firms in the service-distribution sector have a lower substitutability between inputs relative to firms in the manufacturing sector. For example, consider a supermarket that uses three main inputs: the goods sold, the machineries needed to carry and lift the goods around the premises where the activity is carried out and the labor force needed to drive the forklifts and organize the various items on the shelves. When the financial crisis kicks in, this firm can delay the payment of the goods (i.e., rely on trade credit from its suppliers) and use the recouped cash resources to pay labor units. However, it cannot substitute workers with goods, as the workers are needed to organize the items on sale and can hardly be substituted with those same items or with the forklifts, necessary to move items around.

Figure 5: Change in Trade credit, 2007-19



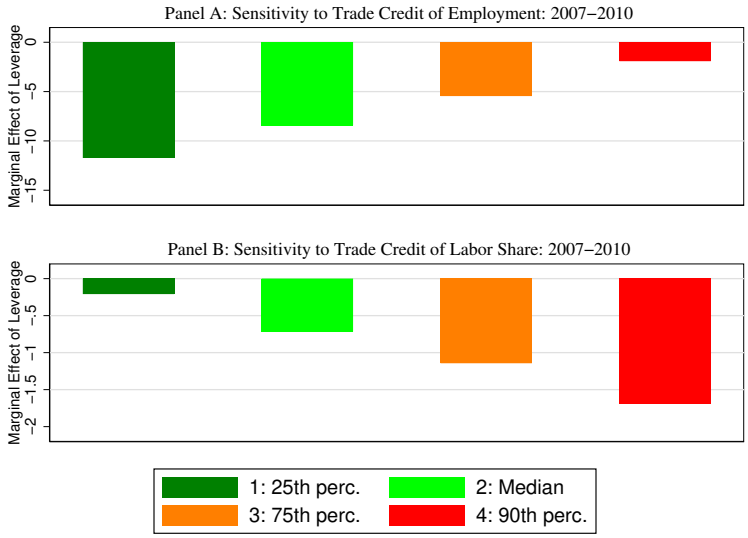
Notes: The figure shows the 25th percentile, median, 75th percentile and 90th percentile of the distribution of the change in trade credit during the period 2007-19. The sample consists of firms in the manufacturing sector.

centile, the median, the 75th percentile, and the 90th percentile of the change in trade credit reliance in the aftermath of the crisis.

To interpret Panel A of Figure 6, we need to remember that the coefficient of the leverage ratio γ is negative while the one of the interaction term β is positive (see columns 1 and 3 of Table 5). These estimates suggest that while the tightening of credit constraints reduces employment, this detrimental effect becomes weaker the higher the firms' reliance on trade credit. In line with this finding, Panel A shows bars becoming smaller and smaller as trade credit use increases. In particular, for those firms that increased very little (or even reduced) their reliance on trade credit (i.e., firms in 25th percentile - green bar), being highly leveraged in 2007 is responsible for a 12% drop in firms' employment in the aftermath of the crisis. Conversely, for those firms that increased substantially their reliance on trade credit (i.e., firms in the 90th percentile - red bar), being highly leveraged in 2007 has almost no effect on firms' employment in the aftermath of the crisis.

The interpretation of Panel B is different from Panel A. Since from Table 5, the coefficient of the leverage ratio γ and that of the interaction term β are both negative, the interpretation of the bar chart is as follows. For those firms that increased very little (or even reduced) their reliance on trade credit as bank credit constraints tightened (i.e., firms in 25th percentile - green bar), the pre-crisis leverage does not explain much of the drop in labor share in the period 2007-10. Conversely, being highly leverage in 2007 is responsible for a 10 percentage point drop in labor share for firms that increased substantially their reliance on trade credit (i.e., firms in the 90th percentile - red bar), or a 7 percentage point drop for

Figure 6: Labor Share and Leverage



Notes: The figure shows the sensitivity of the employment- and labor share-leverage relationship for different values of the trade credit variability. The sample consists of firms in the manufacturing sector.

firms in the 75th percentile of the change in payables (orange bar).

To understand the economic significance of the marginal effect of leverage (and therefore of credit rationing) on the labor market, consider a change in the pre-crisis firm leverage from about 5% to 50%, corresponding to a shift from the 25th to the 75th percentile of the firm leverage distribution. That change would generate a drop of about 6% in employment if the firm belongs to the 25th percentile of the trade credit change distribution, which in turn implies a drop in trade credit by roughly 12%. The same change in leverage would generate, instead, a lower drop in employment—by about 3%—if the firm belongs to the 75th percentile of the trade credit distribution, which is associated with an increase in trade credit by roughly 6%. When evaluated with respect to the mean number of employees, which is about fifty, the former and latter contractions are equivalent to one and half and three employees dismissed, respectively. These numbers suggest that being able to strongly increase the reliance on trade credit after the 2007 credit squeeze allowed the average Italian firm to mitigate the drop in employment by keeping 3 workers that otherwise would have been dismissed in the aftermath of the credit crunch.

The same change in leverage would generate a drop in the labor share of 3% (half percentage point) or 4.5% (a little less than 1 percentage point), depending on whether the firm belongs to the 75th or the 90th percentile of the distribution of trade credit change—respectively, the orange and red bar of panels B of Figure 6. These numbers suggest that being highly leverage would make the input mix less tilted towards labor by 3% or 4.5%, respectively, if the firm increases the reliance on trade credit.

The above evidence suggests that the marginal effect of the pre-crisis lever-

age on the firms' employment decisions is not constant across firms but displays huge heterogeneity depending on how much each firm is able to substitute bank credit with trade credit. Again, this evidence highlights the role of trade credit in explaining the firm employment reaction to the unfolding of the 2007 financial crisis.

5.2.1 The role of input characteristics

In this section, we explore the role of input characteristics. The idea is that what matters in explaining trade credit use is not only the output characteristics (identified by the industry classification) but also some intrinsic characteristics of the inputs, like their liquidity. The higher the input liquidity, the stronger the entrepreneur incentive to divert inputs and therefore the lower the advantage of using trade credit. For example, standardized inputs can be easily resold to a different company. Thus, diverting standardized goods is very profitable because of their high resale value. In contrast, differentiated goods are designed and tailored to the needs of a specific buyer, which reduces their secondary market value. It follows that firms using differentiated inputs have less incentive to divert resources and thus their suppliers are more willing to offer trade credit.

As stated in our third prediction, we expect that firms buying differentiated inputs can more easily switch to trade credit when rationed on bank credit and therefore they rely more on trade credit to mitigate the drop in employment and use an input combination less intensive in labor.

Table 6: Input Characteristics

	Differentiated		Standardized	
	Employment	Labor Share	Employment	Labor Share
Δ TradeCredit $\times$ Leverage$_{2007}$	0.39**	-46.83***	0.36*	-20.38
	(2.94)	(-3.57)	(2.38)	(-1.68)
Leverage$_{2007}$	-0.08***	-3.49*	-0.07***	-6.38***
	(-4.20)	(-2.46)	(-3.88)	(-4.29)
Liquidity$_{2007}$	-0.02	0.98	-0.02	-0.28
	(-1.74)	(1.69)	(-1.87)	(-0.33)
Further control Variables	Yes	Yes	Yes	Yes
Observations	13635	13635	12423	12423

Note: The left-hand side variable is the change in employment or labor share between 2007 and 2010. Leverage is total bank liabilities as percentage of total debt. ΔTradeCredit is the change during 2007-10 in payables as percentage of total debt. Liquidity is the sum of cash, bank checks, receivables and financial assets as percentage of total debt. Control variables consist of the change in total assets, the change in payables as percentage of total debt, industry-specific fixed effects and province-specific fixed effects. T-statistics are reported in brackets and are based on clustered Province$\times$Industry standard errors.

In Table 6, we test the above prediction by re-estimating our empirical model after splitting the sample of manufacturing firms according to the liquidity of

their input into differentiated (low liquidity) in columns 1 and 2 versus standardized (high liquidity) in columns 3 and 4. Following Giannetti et al. (2011), we include among the differentiated input sector those firms that use a share of differentiated goods greater than 40% as inputs. The rest of the sample is part of the standardized input group. The findings of this table mimic the ones in table 5, but are stronger for firms using differentiated inputs. In particular, the coefficient of the interaction term is positive for both differentiated and standardized inputs firms when the dependent variable is employment (columns 1 and 3), although the significance is stronger for the differentiated ones. In contrast, the coefficient of the interaction term is negative as expected and highly statistically significant but only for firms using differentiated inputs (more than twice as big as the one for firms using standardized inputs), when the dependent variable is the labor share (columns 2 and 4).

The above evidence highlights the importance of input characteristics in explaining the firm heterogenous reaction in the labor market during the financial crisis, by showing that manufacturing firms largely using trade credit to buy differentiated inputs experience both a stronger smoothing and a stronger substitution effect than manufacturing firms using standardized inputs.

5.2.2 Long-run effects

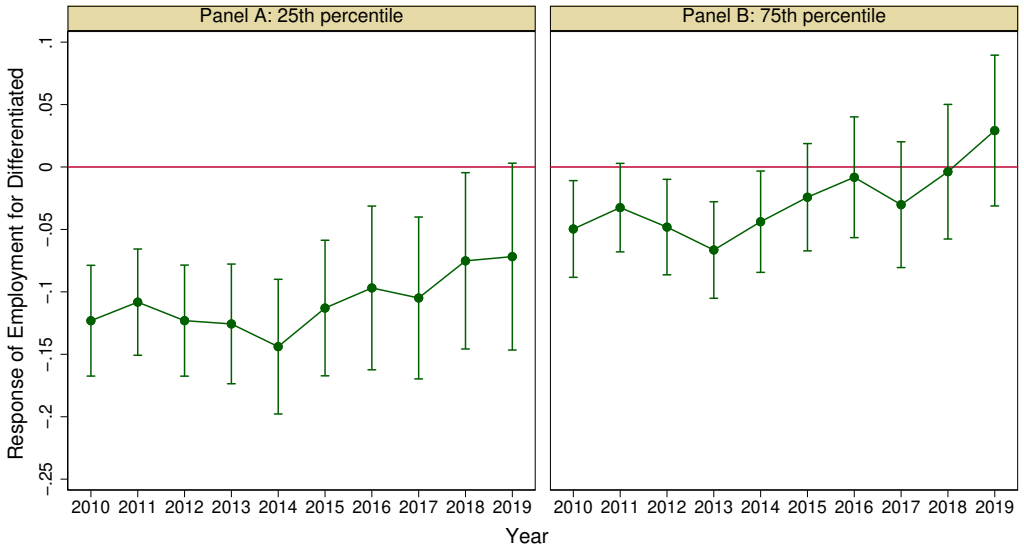
All the previous evidence refers to the estimate of the regression model (1) using the window 2007-2010 in the definition of the dependent variable. We could enlarge our window moving forward the right extreme of the time interval until 2019. Thus, if we consider all possible window options, we end up with nine different empirical specifications, each corresponding to a different time window.

Figure 7 shows the results of this exercise, by extending the analysis reported in Table 5 up to 2019 for the variable Employment. In particular, each point in the figure represents the point estimate (and corresponding confidence intervals) of the coefficient attached to Leverage 2007 in equation (1), when the time window of the cross-sectional regression is expanded one year at a time and the sample is restricted to manufacturing firms using differentiated inputs. As a matter of comparison with previous results, we also show the estimate for the interval 2007-10, already reported in the first column of Table 6.

The plot documents that, for firms that do not increase (or even reduce) their reliance on trade credit (Panel A of Figure 7), the negative impact of bank credit constraints on employment is sizeable and persistent. In 2014, almost seven years after the start of the crisis, bank credit constraints are still responsible for a 10% increase of firm unemployment. Towards the end of the sample period, the contraction of employment is still around 10%, suggesting that for this group of firms the recovery is still not complete after almost eleven years from the start of the credit crunch. Conversely, for firms strongly increasing their reliance on trade credit (Panel B of Figure 7), the impact of bank credit constraints on employment is less sizable during the whole sample period, due to the smoothing effect of trade credit, and it completely disappears towards the end of the sample period.

Figure 8 replicates the same analysis shown in Figure 7 for Labor Share but

Figure 7: Long-run Effects on Employment of the 2008-9 Crisis

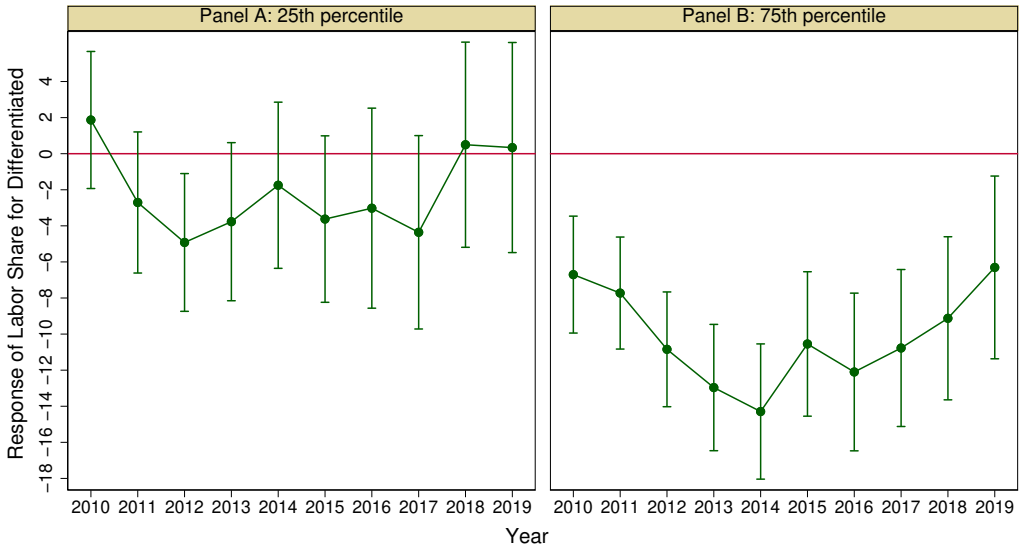


Notes: The figure shows yearly point estimates of the coefficient attached to Leverage 2007 in equation (1), and their confidence intervals, when the sample consists of Differentiated products and the variability of Trade Credit equals the 25th percentile of the sample distribution.

the interpretation is quite different. For firms reducing their reliance on trade credit (Panel A of 8), the effect on the labor share is quite weak and temporary. In fact, it completely disappears at the end of the sample period. In contrast, the impact of the pre-crisis leverage on the labor share is rather persistent and tends to amplify through time, for firms that strongly increased their reliance on trade credit (Panel B of 8). This effect sharpens during 2013-14 (when the point estimate almost doubles in absolute value), and then reverts a bit in the following years. At the end of the sample period (about twelve years after the financial crash), the labor share is on average roughly still 6 percentage points lower than the value in 2007.

The above evidence teaches us a few lessons. First, there is a huge heterogeneity in the firms' response the to the credit crunch that hits the Italian economy in 2008-9. Second, this heterogeneity can be explained by the different firms' ability of adapt their capital structure amid the tightening of bank credit conditions. Third, this ability to switch from bank to trade credit not only shaped the firms' reaction in the labor market but also their speed of recovery in the aftermath of the crisis. Notice that our evidence is based on manufacturing firms surviving the crisis and being still active at the end of our sample period. Defaulting firms are dropping out of our sample. Thus, our analysis is likely to underestimate the long-run impact of the crisis and provides probably a more positive picture of the recovery than what really happened.

Figure 8: Long-run Effects on Labor Share of the 2008-9 Crisis



Notes: The figure shows yearly point estimates of the coefficient attached to Leverage 2007 in equation (1), and their confidence intervals, when the sample consists of Differentiated products and the variability of Trade Credit equals the 75th percentile of the sample distribution.

6 Conclusions

Our analysis teaches a few lessons. Bank credit constraints clearly affect firm labor reaction in the aftermath of the 2008-9 financial crisis, but there are other financial mechanisms at work that have been so far overlooked by the literature. One of these is the firm's reliance on trade credit. Trade credit is key to explain not only the heterogenous reaction of Italian corporations in the labor market but also the speed of their recovery in the aftermath of the credit crunch.

We document that the increased reliance on trade credit prompted by the bank credit crunch has two different effects on labor decisions: on the one hand, by slackening credit constraints, it allow firms to mitigate the downsizing of the production and the negative impact on employment (*smoothing effect*); on the other hand, the shift to trade credit alters the input combination away from labor (*substitution effect*) by pushing firms to use technologies less intensive in labor. Both effects are stronger and quite persistent among manufacturing firms using differentiated inputs. In particular, the employment recovery is very slow (fast) for firms that could not (could) rely on trade credit to mitigate the bank credit constraints. In contrast, the distortive effect on the input combination is more (less) persistent for firms that heavily (mildly) switched to trade credit.

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