On the real effects of financial pressure: Evidence from euro area firm-level employment during the recent financial crisis

Filipa Fernandes, Alexandros Kontonikas, Serafeim Tsoukas*

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Abstract

Using a large panel of unquoted euro-area firms over the period 2003-11, this paper examines the impact of financial pressure on firms' employment. The analysis finds evidence that financial pressure negatively affects firms' employment decisions. This effect is stronger during the 2007-2009 financial crisis, especially for firms in the periphery area compared to their counterparts in the core European economies. We also find that impact of financial pressure on employment is more potent for firms classified as financially constrained and operating in periphery economies during the financial crisis.

Key words: Financial pressure; Firm employment; Euro area; Financial crisis
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*Corresponding author: Serafeim Tsoukas, University of Glasgow, Adam Smith Business School, Economics Subject, Glasgow G12 8QQ. Email: serafeim.tsoukas@glasgow.ac.uk. We thank seminar participants at the University of Sussex, the 2014 Financial Engineering and Banking Society Conference and the 2014 workshop on Emergent Paradigms in Sovereign Debt: Law, Economics and Finance. Any remaining errors are our own.

1 Introduction

The magnitude of the global financial crisis that commenced in late 2007 was exceptional when compared to previous recent episodes of financial distress. At its core, it was a banking crisis highlighting the important links between financial conditions and the real economy (Iyer et al. (2014)). In the euro area, following a period of convergence prior to the crisis, financial market fragmentation intensified and periphery-based firms, especially smaller ones, faced major problems in accessing external finance. This has important economic implications since the weight of smaller firms in the European economy is considerable, with Small and Medium Enterprises (SMEs) contributing around 60% of the value added and 70% of employment (Artola and Genre (2011)). In a recent speech, Draghi (2014) highlighted the negative effects of financial fragmentation, pointing out that euro area credit conditions remain very heterogeneous, with credit weakness contributing to economic weakness in the stressed countries. Furthermore, it has been argued that the high prevalence SMEs in the periphery economies rendered them vulnerable to the tightening of credit during the financial crisis and is crucial for the slow pace of economic recovery (Klein (2014)). Consequently, an intense debate has developed regarding the appropriate policy measures to be adopted by the European Central Bank (ECB) to restore the flow of credit to financially fragile firms in the periphery.[1]

As Campello et al. (2011) point out, while unfortunate, the crisis provides academics and policymakers with a unique opportunity to get important insights on firm behaviour. This draws upon a rich existing literature since the examination of the impact of financial market imperfections on firms' real decisions has been at the top of the research agenda for quite sometime. Since the seminal work of Fazzari et al. (1988), who provided evidence that firms which are more likely to face financial constraints display a high sensitivity of investment to

[1] In line with the "funding for lending" policy, on 5 June 2014 the ECB confirmed its commitment to lend to euro area banks up to €400 billion with the main condition being that they should improve their record in lending to private firms and households. Nevertheless, doubts exist regarding the potential of "funding for lending" to release sufficient funds for the pressured SMEs in periphery (Klein (2014)).

cash flow, several pre-crisis studies have highlighted the importance of financing constraints on firms' real behavior such as fixed investment, inventory investment, employment and R&D activities (see Hubbard (1998) for a survey). Motivated by the crisis, a number of recent studies re-examined the impact of financial factors on firm investment behavior, commonly identifying a strong effect for financially constrained firms, especially for the US (see e.g. Campello et al. (2010) and Duchin et al. (2010)).[2] Considerably less in known, however, about the role of financial pressure during the recent crisis. The few studies that consider the above link are Nickell and Nicolitsas (1999) and Benito and Hernando (2008), who find a strong and negative relationship between employment and financial pressure. Yet, these studies do not extend to the recent financial crisis and use single-country data-sets which makes it difficult to draw conclusions about the euro area as a whole, or to obtain crisp comparisons on the experience of periphery versus non-periphery countries.

Our study attempts to fill this gap by examining the impact of financial pressure on employment using a comprehensive panel of euro area firm-level data, the majority of which are unquoted. We capture financial pressure using a firm-specific interest rate variable, namely the interest burden. Our analysis will shed light on the stability of the link between euro area employment and financial pressure, accounting at the same time for possible differences between core and periphery economies. In other words, we will examine whether the impact of financial pressure on employment has strengthened during the financial crisis and whether it is more pronounced in the periphery of the euro area. Furthermore, we will investigate whether the link is stronger for financially constrained firms and SMEs. Such evidence is important for understanding the mechanism through which financing constraints affect firms' employment and can be used to better inform euro area policy makers and firm managers.

The remainder of the paper is structured as follows. Sections 2 presents an overview of the related literature. Sections 3 and 4 contain our methodology and data-set description, respectively. Section 5 presents the empirical results, while Section 6 explains the robustness

[2]Other prominent studies that focus on the link between financial constraints and employment in the US include Duygan-Bump et al. (2010) and Chodorow-Reich (2014).

checks that we undertook. Section 7 provides conclusions and policy implications.

2 Related literature

Most models of firm finance assume that firms require some external finance, from either banks or financial markets, to pursue investment projects and that is available subject to minimum standards of creditworthiness in the eyes of the lender. If creditworthiness grows with size and age then this might suggest that there is simply a life-cycle effect that influences a firm's decision to access external finance, and if this were the case, in an asymmetric information world, net worth would be an important determinant of that decision. The path-breaking empirical work of Fazzari et al. (1988) suggests that corporate financial decisions will be affected by constraints arising from the availability and cost of external finance to firms, and will differ in relation to the observable characteristics used by lenders to determine their creditworthiness. The degree of financial constraints faced by firms is a critical determinant of real responses to financial market imperfections.

The literature on the relationship between financial constraints and employment is not as voluminous as that on investment, but the general consensus that emerges is that financial constraints can play an important role in firm-level employment decisions. As Benmelech et al. (2011) point out, theoretically, the cost and availability of external finance may affect firm-level employment both directly and indirectly through a number of channels. A direct effect can arise in the presence of a mismatch between labour payments and cash flow generation that induces firms to finance labour activity throughout production. Hence, a negative shock in the capacity to finance working capital should lead to lower employment.[3] An indirect effect can arise through investment. Capital market imperfections imply that internal funds' availability places constraints on investment, and given labour-capital com-

[3]Chodorow-Reich (2014) also argues that for firms that use working capital to finance labour or other production inputs, an increase in the interest cost of borrowing operates like a cost-push shock implying lower output and labour demand. At the limit, firms may give up working capital and finance production out of retained earnings only or may be subject to credit rationing.

plementarity, employment should decline in line with the fall in capital. In the theoretical work of Arnold (2002), the combination of uncertain profits and fixed future debt payments implies that firms face the risk of financial distress. His model implies that firms' labour demand will fluctuate in response to changes in their balance-sheet position, with weaker financial position being associated with lower demand due to higher risk of future financial distress.

The previous empirical studies that are most closely related to our analysis are Nickell and Nicolitsas (1999) and Benito and Hernando (2008). Both papers provide evidence for a significantly negative relationship between employment and financial pressure within single-country firm-level panels focusing on the ratio of interest payments to cash flow, the interest burden, as the key financial variable. As Nickell and Nicolitsas (1999) point out, interest burden is a flow measure of financial pressure capturing the premium on borrowing costs or the probability of credit being completely rationed. Finally, they show that the sensitivity of employment to the interest burden is greater in the case of fixed-term employment contracts (Benito and Hernando (2008)) and for firms that are under greater long-term financial pressure (Nickell and Nicolitsas (1999)).[4]

More recent studies that examine the firm-level impact of the financial crisis typically consider the US and find that financially constrained firms were hit the hardest (see e.g. Campello et al. (2010)).[5] Duygan-Bump et al. (2010) find that US workers in small firms in industries with high external financing needs were more likely to become unemployed during the 2007-2009 crisis. They view these findings as being supportive of the credit constraints hypothesis according to which smaller firms are highly reliant on bank financing; hence, disruptions in the flow of bank lending are expected to have important real economic

[4]Nickell and Nicolitsas (1999) employ three measures of long-term financial constraints using a sample of quoted firms: size (number of employees), dividend payout relative to assets, and debt to capital ratio. The firms are overall fairly large (average number of employees is 4574). High debt firms exhibit a significantly stronger employment response to the interest burden while the difference is insignificant in the case of size and dividend payout classification schemes.

[5]Campello et al. (2010) use data on ex ante investment decisions based on surveys of CFOs and find that credit availability had strong effects on firms' spending plans, with constrained firms planning deeper cuts in employment, technology and capital spending.

effects primarily through smaller firms. Chodorow-Reich (2014) constructs a data-set that incorporates information on banking relationships and employment for non-financial US firms during 2008-2009. His results indicate an important interplay between lender health and firm-level employment behaviour as well as a role for financial frictions related to asymmetric information in the lending market. Following the Lehman bankruptcy, small and medium firms that had pre-crisis relationships with less healthy lenders experienced a lower likelihood of obtaining a loan as well as lower employment. Iyer et al. (2014) and Bentolila et al. (2013) provide similar evidence for Portugal and Spain, respectively.[6]

3 Empirical specifications and methodology

3.1 Baseline specification

To examine the sensitivity of firms' employment decisions to financial pressure we estimate a quadratic adjustment cost employment model that has been augmented to account for financial factors. This model has also been employed by Nickell and Nicolitsas (1999) and Benito and Hernando (2008).

$$n_{it} = \alpha_1 + \beta_1 n_{it-1} + \beta_2 w_{it-1} + \beta_3 \Delta w_{it} + \beta_4 k_{it} + \beta_5 \delta_{it} + \beta_6 IB_{it-1} + \epsilon_{it} \tag{3.1}$$

where $i = 1,2,\ldots, N$ indexes firms and $t = 1,2,\ldots, T$ indexes years. n is the log of the number of employees. w is the log of the real wage at the firm, while Δw represents its growth rate. k is the log of the capital stock normalised on the price of investment goods. δ is the growth of real sales, capturing demand shocks.[7]

The interest burden (IB) is the key explanatory variable for our analysis, accounting for the role of financial pressure on employment. Following Nickell and Nicolitsas (1999)

[6]The findings of Iyer et al. (2014) suggest that the reduction in credit supply was stronger for smaller firms, with weaker banking relationships. These firms were unable to perfectly substitute credit from crisis-affected banks with other sources of finance, such as loans from less affected banks or trade credit. Bentolila et al. (2013) find that firms attached to weaker banks, that were eventually bailed out by the Spanish government, suffered a larger fall in employment.

[7]See Table A1 in the Appendix for the definition of the variables in our data-set.

and Benito and Hernando (2008), this variable is measured as the ratio of interest payments to cash-flow. There is a large and growing literature that explores the impact of interest burden on several firms' real decisions (see e.g. Benito and Whitley (2003), Spaliara (2009) and Chen and Guariglia (2009)). It is expected that an increase in firms' interest burden should lead to lower levels of employment.

The error term ϵ_{it} comprises a firm-specific time-invariant component, encompassing all time-invariant firm characteristics likely to influence employment, as well as the time-invariant component of the measurement error affecting any of the regression variables; a time-specific component accounting for possible business cycle effects; and an idiosyncratic component. We control for the firm-specific time-invariant component of the error term by estimating our equation in first-differences, and for the time-specific component by including time dummies (in addition to the time dummies interacted with industry dummies) in all our specifications (see Brown et al. (2009)). We also add country dummies to control for institutional differences between countries.

3.2 The effect of the recent financial crisis

In order to investigate whether, controlling for other factors, the response of employment to interest burden is stable across crisis and more tranquil years, we augment Equation (3.1) with a financial crisis dummy ($Crisis_t$), which takes value 1 over the period 2007-2009, and 0 otherwise.

$$\begin{aligned} n_{it} = \alpha_1 + \beta_1 n_{it-1} + \beta_2 w_{it-1} + \beta_3 \Delta w_{it} + \beta_4 k_{it} + \beta_5 \delta_{it} + \\ + \beta_6 IB_{it-1} * Crisis_t + \beta_7 IB_{it-1} * (1 - Crisis_t) + \epsilon_{it} \end{aligned} \tag{3.2}$$

In the presence of structural change, the effect of interest burden on employment during crisis (β_6) and non-crisis years (β_7) should be significantly different. In fact, we would expect changes in the interest burden to exert a stronger impact on firms' employment as we move on to the crisis period ($|\beta_6| > |\beta_7|$).

3.3 Core versus periphery economies

Next, we explore the extent to which, controlling for the effect of the crisis, changes in debt serving costs affect firms' employment disproportionately in periphery versus non-periphery euro area economies. We argue that firms that operate in the periphery group are likely to be more responsive to the interest burden during the crisis given the tighter credit conditions and limited access to external finance that they faced.[8] To test this hypothesis, we further augment the model in equation (3.2) with interactive terms related to the periphery dummy $Periphery_i$ which is equal to 1 if the firm is operating in periphery economies (Ireland, Italy, Portugal and Spain) and 0 otherwise.[9]

$$\begin{aligned} n_{it} = \alpha_1 + \beta_1 n_{it-1} + \beta_2 w_{it-1} + \beta_3 \Delta w_{it} + \beta_4 k_{it} + + \beta_5 \delta_{it} + \beta_6 IB_{it-1} * Crisis_t * Periphery_i + \\ + \beta_7 IB_{it-1} * (1 - Crisis_t) * Periphery_i + \beta_8 IB_{it-1} * Crisis_t * (1 - Periphery_i) + \\ + \beta_9 IB_{it-1} * (1 - Crisis_t) * (1 - Periphery_i) + \epsilon_{it} \end{aligned} \quad (3.3)$$

If the coefficient of the periphery dummy interacted term during the crisis dominates the corresponding term outside it ($|\beta_6| > |\beta_7|$) then an additional response of employment to interest burden for periphery economies during the crisis is detectable compared to more tranquil years.

3.4 Financial constraints

Finally, we take into account firm-level heterogeneity by investigating the role of financial constraints in determining firms' employment during crisis and non-crisis years. To do so, we utilise interactions between the interest burden, crisis/tranquil times and constrained/unconstrained firms. Following the established literature on financial constraints and to ensure robustness, we employ three alternative measures of financial constraints: bank dependency, size and the coverage ratio. In keeping with the standard practice in the literature, we use the median of the distribution of these measures as a cut-off point to clas-

[8] The descriptive statistics in Table 1 show that firms in the periphery face a higher interest burden.

[9] Greece would have been a legitimate candidate for the Periphery group, but due to missing data on wages it was dropped from the analysis.

sify firms into financially constrained versus non constrained. The classification takes place each year, hence we allow firms to transit between classes. The resulting dummy variable $Constrained_{it}$ is equal to 1 if the firm is classified as financially constrained within each industry at year t and 0 otherwise. The econometric model is as follows.

$$n_{it} = \alpha_1 + \beta_1 n_{it-1} + \beta_2 w_{it-1} + \beta_3 \Delta w_{it} + \beta_4 k_{it} + + \beta_5 \delta_{it} + \beta_6 IB_{it-1} * Crisis_t * Constrained_{it} + \\ + \beta_7 IB_{it-1} * (1 - Crisis_t) * Constrained_{it} + \beta_8 IB_{it-1} * Crisis_t * (1 - Constrained_{it}) + \\ + \beta_9 IB_{it-1} * (1 - Crisis_t) * (1 - Constrained_{it}) + \epsilon_{it} \quad (3.4)$$

This specification captures the impact of financial constraints on the response of employment to the interest burden during crisis and non-crisis periods. We would expect changes in the interest burden to exert a stronger impact on employment in the case of financially constrained firms, especially more so as we move on to the crisis period ($|\beta_6| > |\beta_7|$).

3.5 Estimation methodology

All models are estimated in first-differences, to control for firm-specific, time-invariant effects. Given the possible endogeneity of our regressors, we use a system Generalized Method of Moments (GMM) approach (Arellano and Bover (1995) and Blundell and Bond (1998)). This estimator combines in a system the relevant equation in first difference and in levels. It makes use of values of the regressors lagged twice or more as instruments in the differenced equation, and of differences of the regressors lagged once in the levels equation. The system GMM estimator is preferred to the simple first-difference GMM estimator when instruments are likely to be weak (Blundell and Bond (1998)).

We employ two different criteria to verify whether the model is well specified. First, we use the Sargan test (also known as J test), which is a test for overidentifying restrictions. Under the null of instrument validity, it is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters. Second, we check for the existence of nth-order serial correlation in the differenced of the residuals using the m(n) test, which is asymptotically distributed as a standard normal under the null of no serial correlation of the differenced residuals. We note that the former test is sometimes

relatively weak in large samples. Specifically, Blundell et al. (2001) demonstrate using Monte Carlo experiments that this test tends to over-reject the null hypothesis of valid instruments for the system GMM, especially for large samples. Chen and Guariglia (2013) confirm this finding using a large panel of Chinese firms.

4 Data

4.1 Data description

The dataset is drawn from the annual accounting reports taken from the 2012 version of AMADEUS (Analyse Major Database from European Sources) database, distributed by Bureau Van Dijk (BvDEP). The database comprises financial information on 19 million public and private firms across European countries. We cover the time period 2003 through 2011.[10] Our data-set spans the following eleven European countries that belong in the euro area: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. In addition, only firms with unconsolidated statements are considered to avoid double counting. As a result, this approach ensures that the majority of the firms in the sample are small. In fact, approximately 70% of the firms which are included in the data-set are not listed in the stock market.

Following standard selection criteria in the literature, observations with negative sales and assets are dropped. In order to control for the potential influence of outliers, observations in the one percent tail for each of the regression variables are also excluded. In addition, firms with less than 3-years of consecutive observations are also dropped from the sample.[11] By allowing for entry and exit of firms the use of an unbalanced panel partially mitigates potential selection and survivorship bias. The final panel covers 150,268 firms (corresponding

[10] A maximum of 10 years of complete data history can be downloaded at once. Our data-set was downloaded in 2012 allowing us to have information for 9 years, since year 2012 was poorly reported at that time.

[11] See Tables A2 and A3 in the on-line appendix for the structure of the panel.

to 1,048,028 observations) which operate in the manufacturing sector.[12]

4.2 Descriptive analysis

Tables 1 presents summary statistics (mean and standard deviation) for our data-set. Comparing columns 2 and 3, we can see that between 2007-2009 average firm-level employment declined (see also Figure 1), while wage growth and sales growth also slowed down highlighting the deteriorating economic environment. The statistics in Table 1 indicate significant heterogeneity across periphery and non-periphery firms. Firms operating in the periphery of the euro area face a higher and more volatile interest burden and have less employees as compared to firms in non-periphery countries (columns 5 and 6). Figure 2 plots the average interest burden for periphery and non-periphery firms and indicates that the positive gap between the former and the latter expanded during the financial crisis. Finally, Figure 3 shows that SMEs were exposed to significantly higher financial pressure during the financial crisis with the interest rate burden peaking in 2008.

5 Results

5.1 Interest burden and the role of the crisis

This section investigates the role of interest burden in the level of employment, taking into account the most recent global financial crisis. Table 2 shows the estimation results for equations (3.1) and (3.2). From column 1 it is clear that the interest burden (IB) exerts a negative and highly significant impact on firms' level of employment. The finding is not statistically but also economically important. Specifically, the coefficient of - 0.120 implies an elasticity of employment with respect to interest burden, evaluated at sample means of

[12]Following Blundell et al. (1992) and based on a two-digital NACE classification, firms are allocated according to one of the following nine industrial sectors: metal and metal goods; other minerals and mineral products; chemical and man made fibres; mechanical engineering; electrical and instrument engineering; Moto vehicles and parts; other transport equipment; food, drink tobacco; textiles, clothing, leather and footwear; and others.

-0.035. A 10 percent increase of interest burden reduces the level of employment by 0.35 percent. These findings suggest that among euro area firms there are significant effects from financial factors on employment consistent with the interpretation of Benito and Hernando (2008) that financing constraints affect labour demand.

Turning to the coefficients on the control variables we note that they have the expected signs. Specifically, w and Δw have a negative and highly significant effect on firms' employment. On the other hand, δ and k have a positive and significant effect. These findings are consistent with previous work by Nickell and Nicolitsas (1999) and Benito and Hernando (2008), notes these effects using panels of UK and Spanish manufacturing firms, respectively.

Column 2 of Table 2 presents the interactions between interest burden and the crisis terms in order to explore to what extent the differential impact of the 2007-2009 crisis affects the level of employment of European firms. The coefficient of interest burden is negative and statistically significant only for the crisis period. In other words, the results reinforce the idea that during the crisis, financial pressure is more important in determining firms' employment. When comparing the role of the interest burden during and outside of the crisis, employment is more sensitive to the changes of firms' servicing debt during the former period. The economic impact across the two periods is clear: a 10 percent change of interest burden affects the level of employment by only 0.08 percent during the tranquil period and by 0.32 percent during the turmoil period. The p-values for the differences between the two coefficients indicate that they are significantly different from each other. Finally, regarding the control variables, we find that they have the expected signs and are highly important determinants of firms' employment.

The diagnostic tests do not generally indicate significant problems with the choice of our instruments and the specification of our model.[13]

[13]As we explain in sub-section (3.5), the Sargan test tends to over-reject the null in the case of large samples. Confirming this, when we perform regressions on a selected country-by-country basis (results available upon request) we get larger p-values for the Sargan test.

5.2 Core versus periphery economies during the crisis

Our estimates thus far document the differential role of interest burden in determining firms' employment decisions during crisis and non-crisis periods. In this sub-section we are able to assess whether the characterisation of core/periphery is an important dimension in the determination of firms' employment, particularly during extreme economic events.

In Table 3 we present the estimates of equation (3.3). The results show that there is a significantly different response of firms' employment to interest burden during the crisis period with respect to periphery economies. In particular, when the interest burden is interacted with the periphery dummy we find significant effects for the crisis period, while the interaction between periphery and tranquil times is insignificant and quantitatively unimportant. Put differently, this finding suggests that firms in the periphery group react differently to debt-servicing costs during cyclical fluctuations. This is a novel result which documents the impact of the interest burden on firms' employment during the recent global financial crisis. To ascertain the economic importance, a 10 percent rise in the interest burden decreases firms' workforce by only 0.07 percent during non-crisis times and by 0.28 percent during the crisis period. The p-values for the equality of the coefficients show a statistically significant difference between the two point estimates.

Turning to the remaining interaction terms, the interest burden does not seem to exert any significant effect on the core firms during both tranquil and turmoil periods. The p-value reveals that the coefficients are not statistically different from each other. Finally, when comparing the interactions of the interest burden between the crisis period for core and periphery groups, we find, as expected that the coefficients are significantly higher for the latter group. This finding lends support to the story that firms' levels of employment in the periphery group are affected significantly more during the financial crisis.

With reference to the remaining control variables, we find that they remain highly significant and behave as conjectured. Moreover, the Sargan and m3 tests do not indicate any problems with the specification of the model and the choice of the instruments.

5.3 The role of financial constraints

We now explore the impact of financial constraints on the response of employment to interest burden during crisis and tranquil times for both core and periphery economies, as shown in Equation (3.4). Therefore, comparing across columns in Table 4 allows us to investigate the specific influence of each measure of being constrained (based on the bank dependency, size and the coverage ratio) on each of the interactions in the rows.

To begin with the interactions between the interest burden and financially constrained firms, we observe that the point estimates are negative and highly significant during the crisis period. This finding suggests that financially constrained firms, for whom access to external finance is limited or prohibitively expensive, are more responsive to changes in the debt servicing costs during adverse economic events. In addition, this new result extends the finding of Nickell and Nicolitsas (1999) that the borrowing ratio is more important in determining employment decisions for firms with high debt compared to firms with lower debt levels.

Turning our attention to the interactions of interest burden for unconstrained firms, we find that there is no significantly difference response. Hence, for unconstrained firms an increase in debt serving costs has no impact on employment compared to constrained firms, whose employment is significantly more responsive during the crisis period.

As a final test we consider the role of financial constraints in firms' employment decisions distinguishing core and periphery economies. The results in Table 5 encapsulate an important finding regrading the impact of financial constraints. We find that the differential response of interest burden is stronger for constrained firms in the periphery area compared to the same group of firms in the core European economies. As for unconstrained firms, these remain largely unaffected irrespective of the location.

To summarise, our results show that it is the constrained firms, by any definition we used, that show greater sensitivity to the interest burden, especially during the recent global financial crisis. Several authors found that capital market imperfections are important in

influencing firms' real activities such as investment, inventory, employment and firm survival (Guariglia (2008), Carpenter and Guariglia (2008), Guariglia and Mateut (2010) and Tsoukas (2011)). We find that firms' employment is more sensitive to changes in the debt servicing costs for constrained firms during the crisis than for unconstrained firms. This is a new result that complements the earlier work by Nickell and Nicolitsas (1999) and Benito and Hernando (2008) and highlights the role of capital market imperfections in several European economies during the crisis period. In addition, the greater sensitivity for constrained firms may result from the greater information asymmetries in the periphery economies compared to their core counterparts.

5.4 Differentiating between SMEs and non-SMEs

Finally, we estimate an alternative model to check the differential response of SMEs.[14] *A priori* it is expected that changes in firms' financial conditions can make SMEs more vulnerable during the crisis, since they are associated with a higher degree of information asymmetry and generally face higher costs of borrowing (Darvas (2013)). In order to investigate this hypothesis, we re-estimate Equations (3.1), (3.2) and (3.3) splitting our firms into SMEs and non-SMEs. Following the definition by the European Commission, SMEs are defined as those firms with less than 250 employees and a total revenue equal or less than €50 million. Results are reported in Tables 6 and 7.

Starting with Table 6, we observe that the firm-specific interest rate exerts a negative and significant impact on SMEs' employment decisions during the crisis. On the other hand, interest burden is statistically insignificant for their larger counterparts during and outside of the crisis. These results confirm that during the crisis SMEs are more responsive to changes in the debt servicing costs on employment.

In Table 7, we take into account the periphery/core distinction. Similar patterns are observed for SMEs in the euro area periphery. In other words, financial pressure has a

[14] See Table A4 in the on-line appendix for the distribution of SMEs within our sample.

negative effect on periphery SMEs during the turmoil period. The impact of interest burden on employment decisions is statistically insignificant for larger firms (periphery or not). This is in line with our expectations and confirms evidence presented by other studies (see Artola and Genre (2011) and Iyer et al. (2014)).

6 Robustness tests

A series of robustness tests were conducted for the results presented in the previous Section. The results of these checks, which are not reported in the interest of space, are summarised below and can be found in the on-line Appendix.

6.1 Additional control variables

To begin with, we examine whether our main results remain unchanged when we employ an additional set of firm-specific and country-specific macroeconomic variables to control for firms' overall balance sheet position and aggregate pressure, respectively. Our results confirm that this modification did not alter our findings. We find that the firm-specific interest burden remains negative and statistically significant determinant of employment during the crisis. Balance sheet variables (with the exception of liquidity) have no impact on firms' employment decisions, whereas the 10-year government bond yield and the national unemployment rate have a negative and statistically significant relation with firm-specific employment. To sum up, we show that the link between employment and financial pressure is robust to adding a number of firm-specific and macroeconomic control variables.

6.2 Alternative definitions of the crisis dummy

Thus far, we used years 2007-2009 to define the crisis period. As a robustness check, we re-estimate Equation (3.2) using a narrower definition of the crisis period, with the crisis dummy taking the value 1 during 2008-2009, and 0 otherwise. We find that the interest burden's

effect on employment during the crisis remains negative and statistically significant. As a final check, we take into account two different phases of the crisis related to the earlier credit crisis and the later debt crisis. Thus, we define two crisis period dummies: Credit_t and Debt_t taking the value 1 over the period of 2008-2009 and 2010-2011, respectively and 0 otherwise. We find that employment in periphery-based firms is more sensitive to changes in the interest burden during both the credit and debt crisis periods, than outside them. In sum, we can conclude that the results remain robust to altering the dating of the crisis period.

6.3 Alternative definition of interest burden

Next, we employ a different definition of interest burden, the ratio of interest payments to total debt (implicit interest rate) based on work by Benito and Whitley (2003). In doing so, we take a three year moving average of the total debt data, centred on the current year and use this as the relevant denominator. We find that during the crisis, the effect of the implicit interest rate on employment is negative and statistically significant. Thus, our results are robust to using an alternative measure of the interest burden.

6.4 Alternative cut-off points for financial constraints' classification

In our baseline results, we used a 50% cut-off point to classify firms into constrained and unconstrained. To ensure that our results are not driven by this classification scheme, we employ a different cut-off point. Specifically, we classify as financially constrained the firms that exhibit bank dependency (size, coverage) at the top (bottom) 75% of the distribution of all firms. Our results indicate that the impact of interest burden on employment is negative and statistically significant only for financially constrained firms operating in the periphery during the crisis. Thus, our findings are robust to the use of an alternative cut-off point for financial constraint's classification.

7 Conclusion

This paper examines the impact of financial pressure on employment using a firm-level panel data-set for the euro area. We find a significant negative impact of financial pressure on employment. This effect is stronger for firms in the periphery of the euro area during the 2007-2009 financial crisis. Within the periphery group, we find that the sensitivity of employment to financial pressure is stronger for financially constrained firms and SMEs. Our results are robust to a comprehensive sensitivity check. Our findings have important policy implications. They suggest that policy initiatives aimed towards enhancing credit availability and relaxing the financial constraints that smaller firms in the periphery face, are essential to support the economic recovery of the euro area.

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8 Appendix

Table A1: Variables description

Variable	Definition
n_{it}	Logarithm of number of employees.
IB_{it}	Ratio of interest payments to cash flow.
w_{it}	Employment costs divided by number of employees and deflated by the GDP deflator.
Δw_{it}	Log difference of wage.
δ_{it}	Log difference of real sales (total sales divided by the GDP deflator).
k_{it}	Logarithm of fixed assets minus depreciation and working capital less provisions normalised on the price index of capital.
$Crisis_t$	Dummy variable equal to 1 over the period 2007-2009, and 0 otherwise.
$Periphery_i$	Dummy variable equal to 1 if the firm is operating in periphery economies (Ireland, Italy, Portugal and Spain) and 0 otherwise.
$Constrained_{it}$	Dummy variable equal to 1 if the firm is classified as financially constrained and 0 otherwise. Financially constrained firms exhibit BankDep (Size, Coverage) at the top (bottom) 50% of the distribution of all firms operating in the same industry at a given year. BankDep is the ratio of short-term debt to total liabilities. Size indicates total assets. Coverage is the ratio of cash-flow to interest payments.

Table 1: Summary statistics

	Full sample	Non-crisis	Crisis	Diff.	Non-periphery	Periphery	Diff.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
n (Employment)	3.24	3.26	3.22	0.000	3.47	3.10	0.000
	(1.07)	(1.06)	(1.09)		(1.14)	(1.00)	
IB (Interest Burden)	0.30	0.29	0.31	0.000	0.16	0.37	0.000
	(0.68)	(0.65)	(0.74)		(0.49)	(0.76)	
Δw (Wage Growth)	0.02	0.03	2.4ϵ-3	0.000	0.01	0.02	0.000
	(0.20)	(0.19)	(0.205)		(0.17)	(0.21)	
δ (Sales Growth)	0.05	0.06	0.027	0.000	0.04	0.05	0.000
	(0.26)	(0.25)	(0.28)		(0.27)	(0.26)	
w (Wage)	3.48	3.48	3.48	0.073	3.68	3.37	0.000
	(0.39)	(0.38)	(0.40)		(0.30)	(0.39)	
k (Capital Stock)	6.32	6.30	6.35	0.000	6.03	6.57	0.000
	(1.62)	(1.61)	(1.64)		(1.65)	(1.55)	
Observations	434,261	233,156	201,105		147,628	286,633	

Notes: The numbers in this Table are means, with standard deviations in parentheses. *Crisis* period is 2007–09. *Periphery* refers to firms operating in Ireland, Italy, Portugal and Spain. Diff. is the p-value of the test statistic for the equality of means between crisis and non-crisis periods (column 4), and periphery and non-periphery economies (column 7). See Table A1 in the Appendix for the definition of the variables.

Table 2: Employment, financial pressure and the crisis

	Baseline	Crisis
	(1)	(2)
n_{it-1}	0.986***	0.965***
	(106.78)	(94.81)
IB_{it-1}	-0.120**	
	(-2.23)	
IB_{it-1}*Crisis$_t$		-0.204***
		(-2.83)
IB_{it-1}*(1-Crisis$_t$)		-0.058
		(-0.78)
Δw_{it}	-1.342***	-0.869***
	(-10.56)	(-4.72)
δ_{it}	0.799***	0.832***
	(9.45)	(9.02)
w_{it-1}	-0.101**	-0.088*
	(-2.38)	(-1.76)
k_{it}	0.017***	0.020***
	(2.86)	(2.81)
Observations	399,948	399,948
Firms	94,395	94,395
Sargan (p-value)	0.020	0.001
m1 (p-value)	0.000	0.000
m3 (p-value)	0.692	0.220
F-test of equality (p-value)		
IB crisis vs. non-crisis		0.004

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3: Periphery, non-periphery and the crisis

n_{it-1}	1.008***
	(54.97)
IB_{it-1}*$Crisis_t$*$Periphery_i$	-0.209***
	(-3.31)
IB_{it-1}*(1-$Crisis_t$)*$Periphery_i$	-0.061
	(-0.83)
IB_{it-1}*$Crisis_t$*(1-$Periphery_i$)	0.260
	(1.00)
IB_{it-1}*(1-$Crisis_t$)*(1-$Periphery_i$)	0.139
	(0.55)
Δw_{it}	-1.390***
	(-7.86)
δ_{it}	0.952***
	(8.09)
w_{it-1}	-0.175***
	(-3.84)
k_{it}	0.015**
	(2.02)
Observations	399,948
Firms	94,356
Sargan (p-value)	0.135
m1 (p-value)	0.000
m3 (p-value)	0.517
F-test of equality (p-value)	
IB crisis periph. vs. non-crisis periph.	0.035
IB crisis non-periph. vs. non-crisis non-periph.	0.443
IB non-crisis periph. vs. non-crisis non-periph.	0.480
IB crisis periph. vs. crisis non-periph.	0.062

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4: Financing constraints and the crisis

	Constrained= BankDep (1)	Constrained= Size (2)	Constrained= Coverage (3)
n_{it-1}	1.031***	0.958***	0.963***
	(62.29)	(51.69)	(78.00)
IB_{it-1}*$Crisis_t$*$Constrained_{it}$	-0.146***	-0.221***	-0.235***
	(-2.73)	(-3.40)	(-3.04)
IB_{it-1}*(1-$Crisis_t$)*$Constrained_{it}$	-0.088	-0.126**	-0.208***
	(-1.44)	(-2.31)	(-3.17)
IB_{it-1}*$Crisis_t$*(1-$Constrained_{it}$)	0.020	-0.009	0.594
	(1.07)	(-0.16)	(1.61)
IB_{it-1}*(1-$Crisis_t$)*(1-$Constrained_{it}$)	0.004	0.010	-0.113
	(0.17)	(0.34)	(-0.51)
Δw_{it}	-1.282***	-1.011***	-1.007***
	(-9.77)	(-9.08)	(-7.27)
δ_{it}	0.687***	0.585***	0.948***
	(7.13)	(5.34)	(8.83)
w_{it-1}	-0.339***	-0.110***	-0.141***
	(-3.43)	(-4.29)	(-3.34)
k_{it}	0.007	0.007	0.024***
	(0.78)	(1.48)	(3.50)
Observations	399,948	399,948	399,948
Firms	94,395	94,395	94,395
Sargan (p-value)	0.025	0.001	0.001
m1 (p-value)	0.000	0.000	0.000
m3 (p-value)	0.936	0.719	0.225
F-test of equality (p-value)			
IB crisis constr. vs. non-crisis constr.	0.085	0.010	0.656
IB crisis non-constr. vs. non-crisis non-constr.	0.366	0.704	0.113
IB non-crisis constr. vs. non-crisis non-constr.	0.205	0.037	0.671
IB crisis constr. vs. crisis non-constr.	0.008	0.003	0.041

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5: Periphery, non-periphery and financing constraints

	Periphery			Non-periphery		
	Constrained= BankDep	Constrained= Size	Constrained= Coverage	Constrained= BankDep	Constrained= Size	Constrained= Coverage
	(1)	(2)	(3)	(4)	(5)	(6)
n_{it-1}	0.999***	0.975***	0.958***	0.859***	0.898***	0.903***
	(59.54)	(55.27)	(55.59)	(16.40)	(23.99)	(25.01)
IB_{it-1}*$Crisis_t$*$Constrained_{it}$	-0.249***	-0.159***	-0.202**	-0.014	-0.243	-0.034
	(-2.73)	(-2.72)	(-2.35)	(-0.21)	(-1.06)	(-0.73)
IB_{it-1}*(1-$Crisis_t$)*$Constrained_{it}$	-0.117	-0.110**	-0.158**	-0.063	-0.443	-0.013
	(-0.89)	(-2.38)	(-2.38)	(-0.83)	(-1.37)	(-0.22)
IB_{it-1}*$Crisis_t$*(1-$Constrained_{it}$)	0.038	-0.041	0.841	-0.008	0.074	-0.339
	(0.60)	(-0.63)	(1.53)	(-0.15)	(0.37)	(-1.16)
IB_{it-1}*(1-$Crisis_t$)*(1-$Constrained_{it}$)	-0.058	-0.008	0.253	-0.009	0.124	-0.013
	(-0.62)	(-0.36)	(0.97)	(-0.13)	(1.01)	(-0.07)
Δw_{it}	-0.972***	-0.979***	-0.743***	0.081	-0.134	0.044
	(-5.09)	(-7.79)	(-3.66)	(0.71)	(-0.74)	(0.38)
δ_{it}	1.282***	0.647***	1.202***	0.337***	0.615***	0.539***
	(5.93)	(3.84)	(7.49)	(2.22)	(4.34)	(4.12)
w_{it-1}	-0.048	-0.104***	-0.121***	-0.105	-0.258	-0.129
	(-1.05)	(-4.46)	(-2.79)	(-1.02)	(-1.12)	(-0.65)
k_{it}	0.016	0.003	0.026***	0.023***	0.017**	0.024***
	(1.27)	(0.59)	(2.72)	(3.25)	(1.99)	(3.12)
Observations	278,245	278,245	278,245	121,703	121,703	121,703
Firms	63,124	63,124	63,124	31,271	31,271	31,271
Sargan	0.066	0.000	0.110	0.445	0.252	0.288
m1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
m3 (p-value)	0.520	0.975	0.463	0.928	0.812	0.737
F-test of equality (p-value)						
IB crisis constr. vs. non-crisis constr.	0.063	0.187	0.587	0.435	0.423	0.669
IB crisis non-constr. vs. non-crisis non-constr.	0.017	0.585	0.352	0.992	0.697	0.350
IB non-crisis constr. vs. non-crisis non-constr.	0.741	0.058	0.138	0.590	0.163	0.999
IB crisis constr. vs. crisis non-constr.	0.017	0.062	0.079	0.952	0.277	0.297

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 6: Baseline and crisis models for SMEs and non-SMEs

	SMEs		Non-SMEs	
	Baseline	Crisis	Baseline	Crisis
	(1)	(2)	(3)	(4)
n_{it-1}	0.973***	0.979***	0.997***	1.051***
	(89.84)	(88.21)	(32.58)	(15.48)
IB_{it-1}	-0.241***		-0.039	
	(-3.29)		(-0.65)	
IB_{it-1}*$Crisis_t$		-0.199***		-0.128
		(-3.29)		(-1.08)
IB_{it-1}*(1-$Crisis_t$)		-0.047*		0.036
		(-1.66)		(0.51)
Δw_{it}	-1.449***	-1.115***	-0.470*	-0.567*
	(-9.87)	(-8.41)	(-1.76)	(-1.88)
δ_{it}	0.797***	0.563***	0.163	0.143
	(7.73)	(3.78)	(1.50)	(1.06)
w_{it-1}	-0.168***	-0.093***	-0.061	-0.136
	(-3.04)	(-2.73)	(-0.39)	(-0.85)
k_{it}	0.027***	0.011**	0.018	8.9ϵ-5
	(3.50)	(2.07)	(1.10)	(0.00)
Observations	376,959	376,959	22,989	22,989
Firms	88,872	88,872	8,060	8,060
Sargan (p-value)	0.412	0.065	0.614	0.726
m1 (p-value)	0.000	0.000	0.000	0.000
m3 (p-value)	0.788	0.150	0.401	0.252
F-test of equality (p-value)				
IB crisis vs. non-crisis		0.001		0.263

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Small and Medium Enterprises (SMEs) are firms that have less than 250 employees and a total revenue equal or less than €50 million. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 7: Periphery, non-periphery, SMEs and non-SMEs

	SMEs (1)	Non-SMEs (2)
n_{it-1}	1.021***	1.007***
	(44.27)	(18.22)
IB_{it-1}*$Crisis_t$*$Periphery_i$	-0.159**	0.024
	(-2.08)	(0.23)
IB_{it-1}*(1-$Crisis_t$)*$Periphery_i$	-0.049	-0.025
	(-0.98)	(-0.15)
IB_{it-1}*$Crisis_t$*(1-$Periphery_i$)	0.343	-0.012
	(1.17)	(-0.16)
IB_{it-1}*(1-$Crisis_t$)*(1-$Periphery_i$)	0.208	0.027
	(1.33)	(0.49)
Δw_{it}	-1.378***	-0.520**
	(-6.13)	(-2.08)
δ_{it}	0.814***	0.110
	(4.75)	(0.89)
w_{it-1}	-0.100*	-0.026
	(-1.90)	(0.27)
k_{it}	-0.015	0.013
	(-0.93)	(0.58)
Observations	376,959	22,989
Firms	88,872	8,060
Sargan (p-value)	0.510	0.124
m1 (p-value)	0.000	0.000
m3 (p-value)	0.558	0.439
F-test of equality (p-value)		
IB crisis periph. vs. non-crisis periph.	0.042	0.719
IB crisis non-periph. vs. non-crisis non-periph.	0.467	0.610
IB non-crisis periph. vs. non-crisis non-periph.	0.166	0.748
IB crisis periph. vs. crisis non-periph.	0.095	0.769

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Small and Medium Enterprises (SMEs) are firms that have less than 250 employees and a total revenue equal or less than €50 million. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Figure 1: This figure presents the average log employment over the period 2003-2011 across a sample of euro area countries (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

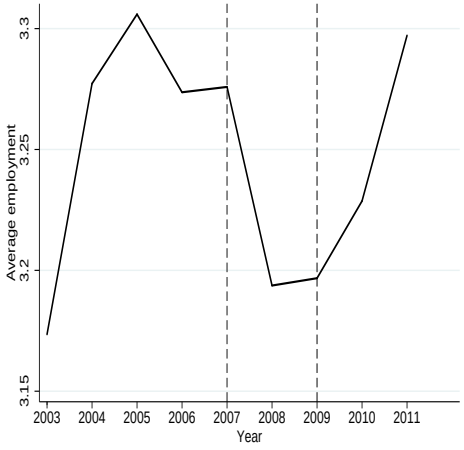


Figure 2: This figure presents average firm-level interest burden (ratio of interest payments to cash flow) over the period 2003-2011 across a sample of euro area countries, separating periphery (Ireland, Italy, Portugal and Spain) from non-periphery economies (Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands).

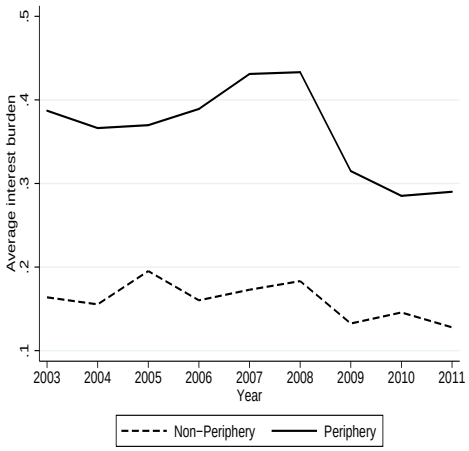
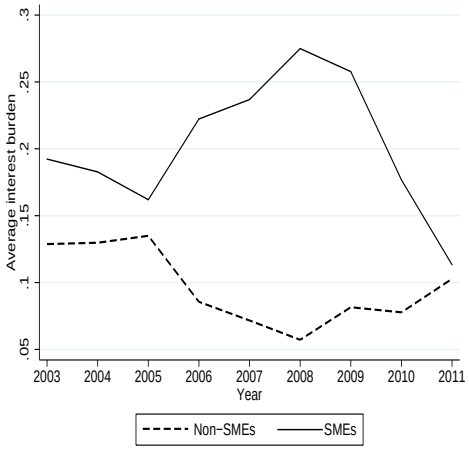


Figure 3: This figure presents average interest burden (ratio of interest payments to cash flow) over the period 2003-2011 across SMEs and non-SMEs.

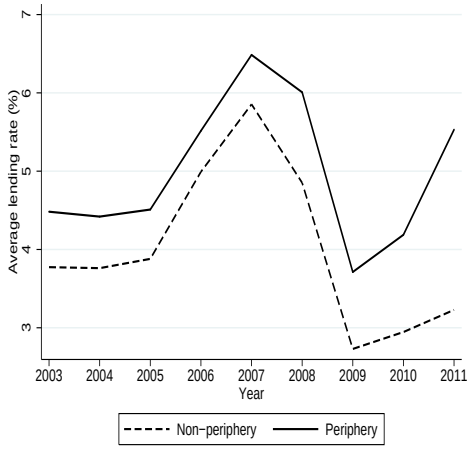


Online Appendix

Online appendix:

On the real effects of financial pressure: Evidence from euro area firm-level employment during the recent financial crisis

Figure A1: This figure presents resident monetary and financial institutions average lending rates for non-financial corporations over the period 2003-2011 across a sample of euro area countries, separating periphery (Ireland, Italy, Portugal and Spain) from non-periphery economies (Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands).



A2: Structure of the unbalanced panel

Number of obs. per firm	Number of observations	Percent	Cumulative
3	22,170	2.12	2.12
4	35,792	3.41	5.53
5	84,650	8.08	13.61
6	135,792	12.96	26.56
7	155,232	14.81	41.37
8	283,784	27.08	68.45
9	330,714	31.55	100.00
Total	1,048,134	100.00	

Year	Number of observations	Percent	Cumulative
2003	82,740	7.89	7.89
2004	96,115	9.17	17.06
2005	114,864	10.96	28.02
2006	130,683	12.47	40.49
2007	136,128	12.99	53.48
2008	139,869	13.34	66.82
2009	140,154	13.37	80.20
2010	135,769	12.95	93.15
2011	71,812	6.85	100.00
Total	1,048,134	100.00	

A3: Structure of the unbalanced panel by country

Number of obs. per firm	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
3	630	360	417	2,358	6,540	78	7,965	12	717	906	2,187
4	1,440	444	596	3,620	11,568	144	12,016	44	1,100	1,324	3,496
5	4,065	605	750	5,125	48,405	155	15,635	140	1,665	2,070	6,035
6	6,666	840	942	8,964	73,956	432	24,126	138	2,646	3,852	13,230
7	6,692	1,498	1,680	20,055	33,390	1,155	49,231	168	4,781	9,415	27,167
8	1,800	6,776	3,832	40,568	20,328	2,840	108,696	480	15,208	7,208	76,048
9	135	21,690	11,853	96,327	6,363	1,332	144,018	9	13,374	15,066	20,547
Total	21,428	32,213	20,070	177,017	200,550	6,136	361,687	991	39,491	39,841	148,710

Year	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain
2003	152	3,412	1,829	18,265	4,074	701	30,391	93	3,971	2,873	16,979
2004	1,623	3,478	1,950	18,887	6,850	733	37,844	94	4,171	3,056	17,429
2005	1,881	3,554	2,050	19,483	19,822	763	39,744	107	4,464	5,027	17,969
2006	2,972	3,643	2,141	20,091	31,224	773	41,678	136	4,681	4,758	18,586
2007	3,327	3,701	2,323	20,670	32,225	785	44,380	139	4,908	4,902	18,768
2008	3,454	3,749	2,445	21,128	33,944	790	45,254	146	5,046	4,991	18,922
2009	3,333	3,779	2,515	21,161	33,400	762	46,217	140	5,046	4,947	18,854
2010	3,391	3,754	2,493	20,295	32,122	626	45,542	130	4,848	4,909	17,659
2011	1,295	3,143	2,324	17,037	6,889	203	30,637	6	2,356	4,378	3,544
Total	21,428	32,213	20,070	177,017	200,550	6,136	361,687	991	39,491	39,841	148,710

Table A4: Proportion of SMEs by country

	Number of firms	Proportion(total)	Number of SMEs	Proportion of SMEs
Austria	3,690	0.02	698	0.19
Belgium	3,963	0.03	1,625	0.41
Finland	2,631	0.02	2,132	0.81
France	22,849	0.15	22,279	0.98
Germany	35,097	0.23	2,583	0.07
Ireland	833	0.01	21	0.03
Italy	49,429	0.33	30,765	0.62
Luxembourg	151	$1.0\epsilon - 3$	2	0.01
Netherlands	5,358	0.04	365	0.07
Portugal	5,609	0.04	625	0.11
Spain	20,685	0.14	17,780	0.86
Total	150,295	1	78,875	0.52

Notes: Small and Medium Enterprises (SMEs) are firms that have less than 250 employees and a total revenue equal or less than €50 million. The sample period is 2003-2011.

Table A5: Baseline model with additional control variables

	Cflow	Liq	Netdebt	Bondy	Unem
	(1)	(2)	(3)	(4)	(5)
n_{it-1}	0.975***	0.971***	0.975***	0.981***	0.945***
	(84.50)	(93.74)	(84.76)	(110.49)	(64.70)
IB_{it-1}	-0.074*	-0.129***	-0.086*	-0.109**	-0.151*
	(-1.80)	(-2.89)	(-1.66)	(-2.37)	(-1.79)
$Cflow_{it-1}$	0.001				
	(0.06)				
Liq_{it-1}		0.012*			
		(1.74)			
$Netdebt_{it-1}$			-2.162		
			(-1.03)		
$Bondy_{t-1}$				-0.711**	
				(-2.37)	
$Unem_t$					-0.516***
					(-6.23)
Δw_{it}	-1.052***	-1.167***	-1.110***	-1.211***	-1.305***
	(-9.91)	(-10.50)	(-7.02)	(-11.65)	(-7.24)
δ_{it}	0.722***	0.710***	0.742***	0.688***	0.748***
	(9.77)	(8.68)	(8.00)	(7.42)	(5.27)
w_{it-1}	-0.090***	-0.162***	-0.115**	-0.114***	-0.135***
	(-3.03)	(-4.31)	(-2.57)	(-3.10)	(-2.73)
k_{it}	0.016**	0.033***	0.001	0.021***	0.031***
	(2.37)	(3.92)	(0.06)	(3.47)	(3.54)
Observations	372,109	367,345	305,761	373,651	373,651
Firms	90,786	90,631	81,461	91,037	91,037
Sargan (p-value)	0.000	0.014	0.000	0.029	0.950
m1 (p-value)	0.000	0.000	0.000	0.000	0.000
m3 (p-value)	0.338	0.660	0.146	0.388	0.413

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Cflow is defined as the ratio of cash-flow to capital stock. Liq is measured as cash and equivalents normalised on capital stock. Ndebt is defined as liabilities plus long term debt normalised on capital stock minus cash and equivalent divided by capital stock. Bondl is the 10 year sovereign bond yield of the country. Unem is the annual average unemployment rate of the country. *, **, and ** indicate

statistical significance at the 10 %, 5 %, and 1 % level, respectively.

Table A6: Crisis model with additional control variables

	Cflow	Liq	Ndebt	Bondy	Unem
	(1)	(2)	(3)	(4)	(5)
n_{it-1}	0.964***	0.955***	0.988***	0.968***	0.973***
	(79.01)	(71.50)	(74.65)	(86.27)	(114.69)
IB_{it-1}*$Crisis_t$	-0.126***	-0.157***	-0.156*	-0.178***	-0.101***
	(-2.81)	(-3.54)	(-1.70)	(-3.67)	(-2.32)
IB_{it-1}*(1- $Crisis_t$)	-0.031	-0.029	-0.027	-0.030	0.037
	(-1.21)	(-1.11)	(-0.79)	(-1.35)	(0.88)
$Cflow_{it-1}$*$Crisis_t$	0.012				
	(0.29)				
$Cflow_{it-1}$*(1- $Crisis_t$)	0.027				
	(0.86)				
Liq_{it-1}*$Crisis_t$		0.016			
		(1.23)			
Liq_{it-1}*(1- $Crisis_t$)		0.016			
		(1.32)			
$Ndebt_{it-1}$*$Crisis_t$			1.789		
			(1.50)		
$Ndebt_{it-1}$*(1- $Crisis_t$)			0.870		
			(1.08)		
$Bondy_{jt-1}$*$Crisis_t$				3.000	
				(1.36)	
$Bondy_{t-1}$*(1-$Crisis_t$)				0.286	
				(1.00)	
$Unem_t$*$Crisis_t$					-0.272***
					(-4.72)
$Unem_t$*(1-$Crisis_t$)					-0.466***
					(-3.74)
Δw_{it}	-1.061***	-1.086***	-1.075***	-1.095***	-0.983***
	(-9.86)	(-9.61)	(-4.89)	(-8.95)	(-8.84)
δ_{it}	0.570***	0.651***	-0.820***	1.047***	0.813***
	(5.26)	(6.45)	(5.80)	(11.38)	(16.54)
w_{it-1}	-0.103***	-0.123***	-0.116**	-0.075***	-0.071**
	(-3.65)	(-3.81)	(-2.16)	(-2.85)	(-2.32)
k_{it}	0.028***	0.040***	0.022*	0.016***	0.018***
	(3.24)	(3.58)	(1.84)	(3.02)	(3.71)
Observations	372,109	367,345	305,761	373,651	373,651
Firms	90,786	90,631	81,461	91,037	91,037
Sargan	0.005	0.015	0.010	0.000	0.000
m1 (p-value)	0.000	0.000	0.000	0.000	0.000
m3 (p-value)	0.758	0.608	0.580	0.975	0.989
F-test of equality (p-value)					
IB crisis vs. non-crisis	0.009	0.001	0.066	0.001	0.000
Cflow crisis vs. non-crisis	0.352				
Liq crisis vs. non-crisis		0.939			
Ndebt crisis vs. non-crisis			0.149		
Bondy crisis vs. non-crisis				0.226	
Unem crisis vs. non-crisis					0.041

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. *, **, and ** indicate statistical significance at the 10 %, 5 %, and 1 % level, respectively.

Table A7: Crisis model with alternative definition of crisis period

n_{it-1}	0.976***
	(106.48)
IB_{it-1}*Crisis$_t^n$	-0.139*
	(-1.79)
IB_{it-1}*(1-Crisis$_t^n$)	-0.038
	(-0.48)
Δw_{it}	-1.111***
	(-8.89)
δ_{it}	0.841***
	(9.13)
w_{it-1}	-0.034
	(-0.59)
k_{it}	0.016**
	(2.16)
Observations	399,948
Firms	94,395
Sargan (p-value)	0.001
m1 (p-value)	0.000
m3 (p-value)	0.793
F-test of equality (p-value)	
IB crisis vs. non-crisis	0.041

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Crisis$_t^n$ is a dummy variable equal to 1 over the period 2008-2009, and 0 otherwise. *, **, and ** indicate statistical significance at the 10 %, 5 %, and 1 % level, respectively.

Table A8: The two phases of the crisis

n_{it-1}	0.995***
	(54.71)
IB_{it-1}*$Debt_t$*$Periphery_i$	-0.221**
	(-2.55)
IB_{it-1}*$Credit_t$*$Periphery_i$	-0.139**
	(-2.48)
IB_{it-1}*$Debt_t$*(1-$Periphery_i$)	0.416
	(1.38)
IB_{it-1}*$Credit_t$*(1-$Periphery_i$)	0.352
	(1.31)
IB_{it-1}*(1-$Debt_t$-$Credit_t$)*$Periphery_i$	-0.210
	(-1.30)
IB_{it-1}*(1-$Debt_t$-$Credit_t$)*(1-$Periphery_i$)	0.488
	(1.36)
Δw_{it}	-1.374***
	(-7.70)
δ_{it}	0.913***
	(5.87)
w_{it-1}	-0.150**
	(-2.49)
k_{it}	0.015
	(1.47)
Observations	399,948
Firms	94,395
Sargan	0.009
m1 (p-value)	0.000
m3 (p-value)	0.573
F-test of equality (p-value)	
IB debt crisis periph. vs. credit crisis periph.	0.031
IB debt crisis non-periph. vs. credit crisis non-periph.	0.654
IB credit crisis periph. vs. credit crisis non-periph.	0.076
IB debt crisis periph. vs. debt crisis non-periph.	0.049

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. $Credit_t$ and $Debt_t$ indicate dummy variables representing the two phases of the financial crisis. The former takes the value of 1 in the years 2008-2009 and 0 otherwise. The latter takes the value of 1 in the years 2010-2011 and 0 otherwise. *, **, and ** indicate statistical significance at the 10 %, 5 %, and 1 % level, respectively.

Table A9: Alternative definition of interest burden

	Baseline	Crisis
	(1)	(2)
n_{it-1}	1.002***	0.981***
	(75.74)	(76.01)
IB^d_{it-1}	-0.047*	
	(-1.85)	
IB^d_{it-1}*Crisis$_t$		-0.061**
		(-2.44)
IB^d_{it-1}*(1-Crisis$_t$)		-0.011
		(-0.41)
Δw_{it}	-0.834***	-0.791***
	(-4.94)	(-4.85)
δ_{it}	0.318	0.162
	(1.29)	(0.72)
w_{it-1}	-0.031	-0.014
	(-0.96)	(-0.46)
k_{it}	-0.008	-0.004
	(-1.07)	(0.52)
Observations	363,932	363,932
Firms	86,636	86,636
Sargan (p-value)	0.374	0.129
m1 (p-value)	0.000	0.000
m3 (p-value)	0.656	0.399
F-test of equality (p-value)		
IB crisis vs. non-crisis		0.021

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. IB^d_{it} is the ratio of interest payments to 3-year moving average of total debt. *, **, and ** indicate statistical significance at the 10 %, 5 %, and 1 % level, respectively.

Table A10: Alternative classification for financing constraints

	Constrained= BankDep (1)	Constrained= Size (2)	Constrained= Coverage (3)
n_{it-1}	1.033***	0.962***	0.913***
	(52.71)	(55.33)	(7.09)
IB_{it-1}*$Crisis_t$*$Constrained_{it}$	-0.151***	-0.165***	-0.455**
	(-2.67)	(-3.07)	(-2.25)
IB_{it-1}*(1-$Crisis_t$)*$Constrained_{it}$	0.023	-0.085**	-0.170
	(0.31)	(-2.24)	(-0.81)
IB_{it-1}*$Crisis_t$*(1-$Constrained_{it}$)	0.180	0.030	1.014
	(0.97)	(0.37)	(1.57)
IB_{it-1}*(1-$Crisis_t$)*(1-$Constrained_{it}$)	0.224	0.031	0.398
	(1.15)	(0.79)	(0.40)
Δw_{it}	-1.111***	-1.008***	-1.331***
	(-6.90)	(-8.00)	(-4.11)
δ_{it}	0.698***	0.576***	1.420***
	(5.51)	(4.66)	(4.06)
w_{it-1}	-0.113	-0.119***	-0.180
	(-1.60)	(-4.40)	(-1.06)
k_{it}	0.010	0.009*	0.085
	(0.98)	(1.79)	(0.69)
Observations	399,948	399,948	399,948
Firms	94,395	94,395	94,395
Sargan (p-value)	0.014	0.003	0.876
m1 (p-value)	0.000	0.000	0.000
m3 (p-value)	0.841	0.924	0.083
F-test of equality (p-value)			
IB crisis constr. vs. non-crisis constr.	0.017	0.027	0.045
IB crisis non-constr. vs. non-crisis non-constr.	0.531	0.989	0.531
IB non-crisis constr. vs. non-crisis non-constr.	0.339	0.050	0.619
IB crisis constr. vs. crisis non-constr.	0.069	0.012	0.060

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Financially constrained firms exhibit BankDep (Size, Coverage) at the top (bottom) 75% of the distribution of all firms operating in the same industry at a given year. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table A11: Periphery, non-periphery and alternative classification for financing constraints

	Periphery			Non-periphery		
	Constrained= BankDep	Constrained= Size	Constrained= Coverage	Constrained= BankDep	Constrained= Size	Constrained= Coverage
	(1)	(2)	(3)	(4)	(5)	(6)
n_{it-1}	1.009***	0.967***	0.822***	0.924***	0.898***	0.920***
	(58.67)	(72.48)	(12.69)	(30.22)	(23.99)	(22.73)
IB_{it-1}*Crisis$_t$*Constrained$_{it}$	-0.116*	-0.093**	-0.191*	0.014	-0.243	-0.202
	(-1.80)	(-2.11)	(-1.71)	(0.24)	(-1.06)	(-1.37)
IB_{it-1}*(1-Crisis$_t$)*Constrained$_{it}$	0.028	-0.060**	-0.129***	0.024	-0.443	0.006
	(0.40)	(-2.05)	(-3.15)	(0.43)	(-1.37)	(0.07)
IB_{it-1}*Crisis$_t$*(1-Constrained$_{it}$)	0.194	-0.087	-0.208	-0.050	0.074	-1.478*
	(1.23)	(-1.25)	(-0.53)	(-0.49)	(0.37)	(-1.78)
IB_{it-1}*(1-Crisis$_t$)*(1-Constrained$_{it}$)	0.050	0.002	-0.484	-0.085	0.124	-0.745
	(0.32)	0.06	(-1.23)	(-0.98)	(1.01)	(-1.34)
Δw_{it}	-1.236***	-0.965***	-0.984***	0.046	-0.134	0.153
	(-7.14)	(-9.13)	(-7.41)	(0.48)	(-0.74)	(0.95)
δ_{it}	1.094***	0.792***	0.780***	0.586***	0.615***	0.515***
	(6.15)	(7.32)	(4.10)	(4.95)	(4.34)	(3.37)
w_{it-1}	-0.123*	-0.056**	-0.134***	0.034	-0.258	0.155
	(-1.67)	(-2.12)	(-2.69)	(0.55)	(-1.12)	(0.60)
k_{it}	0.028***	0.016***	0.158***	0.018**	0.017**	0.023**
	(2.71)	(2.61)	(2.87)	(2.53)	(1.99)	(2.57)
Observations	278,245	278,245	278,245	121,703	121,703	121,703
Firms	63,124	63,124	63.124	31,271	31,217	31,271
Sargan	0.000	0.000	0.000	0.065	0.252	0.222
m1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
m3 (p-value)	0.600	0.876	0.957	0.986	0.812	0.875
F-test of equality (p-value)						
IB crisis constr. vs. non-crisis constr.	0.076	0.406	0.465	0.858	0.424	0.360
IB crisis non-constr. vs. non-crisis non-constr.	0.081	0.137	0.645	0.708	0.697	0.329
IB non-crisis constr. vs. non-crisis non-constr.	0.907	0.914	0.361	0.321	0.163	0.728
IB crisis constr. vs. crisis non-constr.	0.037	0.191	0.973	0.633	0.277	0.228

Notes: All specifications are estimated using a system GMM estimator. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Country, industry, time dummies, and time dummies interacted with industry dummies are included. Instruments include all regressors lagged two times or more. Sargan is a test of over-identifying restrictions, distributed as chi-square under the null of instrument validity. m1 (m3) is a test for first (third) order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. Financially constrained firms exhibit BankDep (Size, Coverage) at the top (bottom) 75% of the distribution of all firms operating in the same industry at a given year. *, **, and ** indicate statistical significance at the 10%, 5%, and 1% level, respectively.