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Filipa Da Silva Fernandes, Alexandros Kontonikas, and Serafeim Tsoukas

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

Filipa Da Silva Fernandes[*], Alexandros Kontonikas[†], and Serafeim Tsoukas[‡]

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Abstract

Using a large panel of mainly 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 euro area-crisis (2010-11), especially for firms in the periphery compared to their counterparts in non-periphery European economies. When we introduce firm-level heterogeneity, we show that financial pressure appears to be both statistically and quantitatively more important for bank-dependent, small and privately held firms operating in periphery economies during the crisis.

Key words: Financial pressure; Firm employment; Financing constraints; Euro area; Financial crisis

JEL: G32; D22; E22; E44

Number of words: 12,526

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[*]University of Aberdeen, Business School, Aberdeen AB24 3QY, UK; Tel:+44(0) 122 427 3417**;** Email: filipaalexandra.dasilvafernandes@abdn.ac.uk

[†]University of Essex, Essex Business School, Colchester C04 3SQ; Tel:+44 141 330 6866; Email: a.kontonikas@essex.ac.uk

[‡]Corresponding Author: Serafeim Tsoukas, University of Glasgow, Adam Smith Business School, Glasgow G12 8QQ; Tel:+44 141 330 6325; Email: serafeim.tsoukas@glasgow.ac.uk

1 Introduction

The magnitude of the global financial crisis that commenced in late 2007 was exceptional when compared to previous 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. Early 2010 witnessed the transformation of the global financial crisis into a sovereign debt crisis in the euro area. The crisis originated in Greece but gradually spread to other periphery economies. With their government bond yields soaring, and following a series of credit rating downgrades, Greece, Ireland and Portugal were forced in 2010–2011 to resort to bailout schemes organised by the European Union, the European Central Bank (ECB) and the International Monetary Fund. Moreover, in the second half of 2011, Spanish and Italian government bonds came under significant market pressure. Given the important connection between sovereign and banking sector creditworthiness (Acharya and Steffen, 2015), banks in the euro-area periphery faced severe stress levels and responded by shedding assets. In Europe, financial pressure, as measured by the ratio of corporate interest payments relative to cash flow, rose as the global financial crisis began in 2008, and remained at high levels until 2012 (Benito, 2017). This suggests that financial pressure was particularly severe during the global financial crisis, and the ensuing sovereign debt crisis reflected elevated interest rate expenses.

The present paper aims to provide new evidence on how employment responds to finance

ECB policymakers frequently highlighted the negative effects of financial fragmentation. The rise in euro-area financial fragmentation along core and periphery lines is well-documented in the existing literature. See, for instance, Mayordomo et al. (2015) for evidence on interbank money markets, and Rughoo and Sarantis (2014) for retail banking deposit and lending rates.

Several studies highlight the role of the banking risk in transforming the global financial crisis into the sovereign debt crisis, and the nexus between banking risk and sovereign risk. See, among others, Alter and Schüler (2012), De Bruyckere et al. (2013), Acharya et al. (2014), Delatte et al. (2017) and Afonso et al. (2018).

As Acharya and Steffen (2015) highlight, in 2011 only, European banks on average lost 40% of their market value and shed billions of euros in assets in order to raise regulatory capital ratios.

pressure, focusing on the euro-area. More specifically, we investigate the following new questions. Has firms' employment reacted to financial pressure during the recent European sovereign debt crisis? Has financial pressure had differing effects on firms operating in periphery euro-area economies (such as Italy, Spain, Portugal, and Ireland) compared to their counterparts in the core euro-area economies? Is the link between employment decisions and financial pressure more potent for financially constrained firms compared to unconstrained firms? To answer the above questions, we capture the effect of financial pressure using a firm-specific interest rate variable, the so-called interest burden. There is evidence suggesting that employment, as well as other company decisions, such as investment and dividend payments, are sensitive to financial pressure (see Nickell and Nicolitsas, 1999; Benito, 2005; Benito and Young, 2007; Benito and Hernando, 2008). Yet these studies do not extend to the recent sovereign debt crisis, and use single-country datasets, 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 is motivated by the recent developments in the euro area, but there is also theoretical rationale for expecting an effect of financial pressure on employment. Firms typically require some external finance, from either banks or financial markets, to pursue investment projects, and this is available subject to minimum standards of creditworthiness in the eyes of the lender. Theoretical models, reviewed in Section 2, suggest that the cost and availability of external finance can affect firm-level employment through several channels. As Vermeulen (2002) notes, the effects of financial constraints are more likely to affect small firms than large firms and indeed firms that are weaker on other criteria c.f. Bougheas et al.

Recent studies using structural models show that there is a strong link between financial frictions and labour market performance. For instance, Mumtaz and Zanetti (2015) provide evidence that shocks to technology and the job separation rate are key factors in explaining adjustment costs. Jermann and Quadrini (2012) find that financial shocks affect US firms' capacity to borrow, as firms' financial conditions to borrow tightened during 2008. Similarly, Mumtaz and Zanetti (2016) show that the link between financial frictions and the labour market becomes more potent for monetary policy, technology and entrepreneurial wealth shocks. Finally, Zanetti (2017) demonstrates that financial shocks lead to considerable effects on debt and wages, while shocks to the job destruction rate have an important role in explaining changes in unemployment levels.

(2006) and Bucă and Vermeulen (2017).

We provide five main contributions to the existing literature. First, we investigate whether the link between financial pressure and employment was more prominent during the sovereign debt crisis of 2010-2011. Considering the evidence that higher levels of interest payments negatively affect fixed investment, employment and other decisions at the firm-level prior to the crisis, we investigate this relationship after the large credit tightening generated by the joint bank and sovereign crisis that hit the EU between 2010 and 2012.

Second, we examine whether the impact of financial pressure on employment is more pronounced in the periphery of the euro area. In doing so, we allow for the fact that different type of businesses, mainly smaller and less-diversified businesses that are more dependent on bank financing operate in periphery economies.

Third, we account for the role of firm-level heterogeneity in examining the impact of financial pressure on firms' employment by distinguishing between more and less financially constrained firms. Following the seminal work of Fazzari et al. (1988), several pre-crisis studies have highlighted the importance of financial constraints on firms' real behaviour such as fixed investment, inventory investment and R&D (see Hubbard, 1998, for a survey). A number of recent studies have re-examined the impact of financial factors on investment, commonly identifying a strong effect for financially constrained firms, especially in the US (Campello et al., 2010; Duchin et al., 2010). Focusing on financially constrained companies allows us therefore to provide a sharper analysis of the effects of recent financial crisis on employment than previously done in the literature.

Fourth, we employ a much broader sample of firms than other studies. Our data-set is made up mainly of unlisted companies. A negative shock to financial pressure is expected to profoundly affect Small and Medium Enterprises (SMEs) which are more vulnerable due to their strong dependence on bank finance. This has important economic implications, since the weight of smaller firms in the European economy is considerable, with SMEs contributing around 60% of the value added and 70% of employment (Artola and Genre, 2011). The

president of the ECB (Draghi, 2014) highlighted the negative effects of fragmentation in euro-area credit market conditions, pointing out that SMEs in periphery countries faced especially strong supply constraints, with credit weakness contributing to economic weakness.

Finally, in a robustness test we match our firm-level data with a syndicated loan database to construct an alternative debt-servicing burden. Acharya et al. (2018) show that the bank lending contraction during the Sovereign debt crisis led to significant and real effects of the borrowing of firms in Europe. Hence, the matched database allow us to strengthen our identification and to control for credit demand and productivity shocks (Berton et al., 2018).

Previewing our main results, we find evidence that the interest burden has a negative and significant effect on firms' employment. The effect is stronger during the 2010-2011 crisis period. Moreover, the effect is more potent for firms that operate in periphery economies and financially constrained firms. Our findings are robust to several sensitivity checks.

The remainder of the paper is structured as follows. Section 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 checks undertaken. Section 7 provides conclusions and policy implications.

2 Economic background

The pathbreaking empirical work of Fazzari et al. (1988) suggests that corporate financial decisions are affected by constraints arising from the availability and cost of external finance to firms, and differ according 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. For instance, Byoun and Xu

Draghi's argument is supported by several recent studies that examine the impact of the euro area sovereign debt crisis on the availability of credit for SMEs. For example, Ferrando et al. (2015) find that during the sovereign debt crisis SMEs in stressed countries (Greece, Ireland, Italy, Portugal and Spain) were more likely to be credit rationed, both in quantity and in price dimension. Coeuré (2013) points out that during 2010-2011 SMEs in countries where sovereign debt was under market pressure had on average a 20% higher chance of being credit constrained than their German counterparts.

(2015) find that during the recent financial crisis, firms that depend more on external finance became more vulnerable, decreasing their level of investment. Bucă and Vermeulen (2017) show that following a credit tightening bank-dependent firms reduce investment more compared to their counterparts.

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. An indirect effect can arise through investment.

Capital market imperfections imply that internal funds' availability places constraints on investment, and given labour-capital complementarity, 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 fluctuates in response to changes in their balance-sheet position, with a weaker financial position being associated with lower demand due to a 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 of a significantly negative relationship between employment and financial pressure within single-

It has been argued that the high prevalence of SMEs in periphery European 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).

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.

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).

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 Campello et al., 2010). Duygan-Bump et al. (2015) 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 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.

There is also evidence suggesting that bank-lending shocks exert an impact on European firms' real decisions. Focusing on the 2007-09 crisis, Bentolila et al. (2017) find that Spanish firms associated with weaker banks decreased their level of employment. Cingano et al. (2016) and Popov and Rocholl (2016) provide similar evidence for Italian and German firms,

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 (the average number of employees is 4,574). 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.

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.

respectively. In particular, the findings of the former study show that credit shocks have reduced firms' value added, employment and intermediate inputs purchases. The latter study demonstrates that less-healthy banks led firms to decrease their employment and wage levels. Dwenger et al. (2018) document that firm-bank relationships in Germany have suffered from banks' losses from trading activities. This led to a reduction in firm-level decisions (i.e., investment and employment). A handfull of studies investigate the effect of the European sovereign debt crisis on firms' corporate policies. For instance, Acharya et al. (2018) find that firms which experience higher (lower) bank dependence on periphery banks are more (less) financially constrained, and as a result they face a decrease (increase) in investment, employment and sales. Using firm-bank data from Italy, Bottero et al. (2015) document that the sovereign shock transmitted was transmitted through the lending channel and has had a negative effect on small firms, as they cut their investments disproportionally more than larger ones. Finally, Balduzzi et al. (2017) explore the effect of the European crisis on Italian firms and conclude that increases (decreases) in banks' CDS spreads (equity valuations) led to a fall in investment and employment for younger and smaller firms.

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).

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

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.

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) and Benito and Hernando (2008), this variable is measured as the ratio of interest payments to cash flow. The aim of this variable is to capture the increase in interest rates that a firm pays out of its loans due to banks' credit tightening. This is thought to be an efficient index since it directly captures the impact of interest rate changes on firms' financial position. There is a large and growing literature that explores the impact of interest burden on several firms' real decisions. For example, Benito and Whitley (2003) demonstrate that the average interest rate on financial debt in the UK has a negative effect on firms' financial health. Chen and Guariglia (2009) find a significant inverse relation between the level of employment of Chinese firms and the level of interest burden, coverage and borrowing ratio. Spaliara (2009) provides evidence of a direct effect of firm-specific interest rate on the capital-labour ratio. Recently, Guariglia et al. (2016) show that the ratio of interest payments to total debt affects UK firms' chances of survival. 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 spec-

See Table A1 in the appendix for the definitions of the variables in our data-set.

All tables report the m1 test for first-order serial correlation of the differenced residuals. In most cases the absence of second-order serial correlation under the m2 test is rejected, suggesting that the error term in the empirical specification displays first-order serial correlation.

ifications (see Brown et al., 2009). We also add country dummies to control for institutional differences between countries.

3.2 The effect of the euro-area crisis

The chronology of the euro-area sovereign debt crisis is well documented in previous studies (e.g. Arghyrou and Kontonikas, 2012). It is commonly accepted that the most severe phase of the crisis occurred during 2010-2011. The crisis period includes developments such as soaring government bond yields in the periphery of the euro area, downgrades by credit rating agencies, and the initiation of a systemic response through bailouts, the purchase of distressed bonds by the ECB within the Securities Markets Programme and the commencement of the three-year Long-Term Refinancing Operations at the end of 2011. By 2012, the worst was over, with bond yields declining, especially after Mario Draghi's announcement in July of that year that the ECB was ready to do whatever it took to preserve the euro.

In order to investigate whether, controlling for other factors, the response of employment to interest burden is different during the euro-area sovereign debt crisis period, Equation (3.1) is augmented with a crisis dummy variable (Crisis_t), which takes a value of one over the period 2010-2011, and zero otherwise.

$$n_{it} = \alpha_1 + \beta_1 n_{it-1} + \beta_2 IB_{it-1} * Crisis_t + \beta_3 IB_{it-1} * (1 - Crisis_t) + \tag{3.2}$$

$$+\beta_4 \Delta w_{it} + \beta_5 \delta_{it} + \beta_6 w_{it-1} + \beta_7 k_{it} + \epsilon_{it}$$

In the presence of a structural change, the effect of interest burden on employment during crisis (β_2) and non-crisis years (β_3) should be significantly different. In fact, we would expect changes in the interest burden to exert a stronger impact on firms' employment as the crisis period deepened ($|\beta_2| > |\beta_3|$).

Instead of estimating the models for different sub-samples (i.e. crisis vs non-crisis), we interact the interest burden variable in all our specifications with dummy variables indicating different time periods or groups of firms. This approach allows us to avoid problems of endogenous sample selection; gain degrees of freedom; and take into consideration the fact that firms can transit between groups.

3.3 Non-periphery versus periphery economies

The periphery of the euro area faced significant credit constraints during the sovereign debt crisis. As we see in Figures 1 and 2, both the pricing and the quantity of lending deteriorated in periphery countries over 2010-2011. Motivated by these developments, we next explore the extent to which, controlling for the effect of the crisis, changes in debt servicing 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 sovereign debt crisis given the tighter credit conditions and limited access to external finance that they faced.

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 one if the firm is operating in periphery economies (Ireland, Italy, Portugal and Spain) and zero otherwise. This classification scheme is fairly standard in the literature on European economics. For instance, Bris et al. (2008) classify Ireland, Italy, Spain and Portugal as the weak euro area members on the basis of their currency performance versus the German Mark in the pre-euro period. Moreover, Arghyrou and Tsoukalas (2011) consider the aforementioned economies as the periphery countries experienced significant deterioration in the value of fundamentals crucial for ensuring long-term EMU membership since the introduction of the euro in 1999.

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

If the coefficient of the periphery dummy interacted term during the crisis dominates the corresponding term outside it ($|\beta_2| > |\beta_3|$), then an additional response of employment to

Other studies that adopt similar classification methodology include Afonso et al. (2014). Finally, Greece would have been a legitimate candidate for the periphery group, but due to missing data on wages it was dropped from the analysis. This is a common procedure in the literature, i.e., firms that do not have complete records on the main variables of interest are dropped from the data-set (see Carpenter and Guariglia, 2008).

interest burden for periphery economies during the crisis is detectable compared to more tranquil years.

3.4 Firm-level heterogeneity

Finally, we take into account the impact of firm-level heterogeneity on the relationship between employment and financial pressure. In order to ensure robustness, we focus on three dimensions of firm heterogeneity: bank dependence, size and firms' legal status. Bank-dependent firms rely heavily on bank finance and have limited access to long-term debt. As banks significantly cut credit to firms during the crisis, we expect that more bank-dependent firms suffered more (see Santos, 2011; Byrne et al., 2016). Similarly, smaller firms are associated with higher levels of information asymmetry (Spaliara, 2009). Thus, they are likely to suffer more from capital markets imperfections than their larger counterparts. On the other hand, private firms have more difficulties in accessing external finance and rely more on their own internal finance compared with their public counterparts (Gao et al., 2013). If access to external funds is limited, these firms are more constrained in their ability to respond to changes in the financial conditions than public firms.

The splitting criteria are based on firms' quantitative and qualitative information. In keeping with standard practice in the literature, we use the median of the distribution of bank dependence and size measures as a cut-off point to classify firms into more and less bank-dependent, as well as small and large. The classification takes place each year; hence, we allow firms to transit between classes. Regarding the information on legal status, we sort firms into private and public. To sum up, the resulting dummy variable $Dummy_{it}$ is equal to one if the firm is classified as bank dependent/small/private within each industry at year t and zero otherwise. The econometric model is as follows.

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

This specification captures the impact of firm-level heterogeneity 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 bank-dependent/small/private firms, especially in the crisis period ($|\beta_2| > |\beta_3|$).

3.5 Estimation methodology

We estimate our models with a system-Generalised Method of Moments (GMM). This estimator combines in a system the relevant equation in first differences and in levels (Arellano and Bover, 1995; Blundell and Bond, 1998). The system-GMM estimator is preferred to the simple first-difference GMM estimator when instruments are likely to be weak (Blundell and Bond, 1998).

In our specification models, we control for the possibility of endogeneity of the regressors. To instrument the interest burden, we consider euro-area monetary policy shocks, which by construction, are exogenous to economic developments, while at the same time are expected to affect firm borrowing costs. Specifically, we use quarterly data over 1999-2016 and estimate a Taylor rule type of specification, where the policy rate of the ECB (main refinancing operations rate) is regressed on a constant, its lag, euro-area inflation and euro area output gap. The latter is measured using deviations of actual output (euro-area real GDP) from the Hodrick-Prescott trend. The residuals from these regressions, aggregated to annual frequency through summation, provide estimates of the monetary policy shocks. In a recent study, Paligorova and Santos (2017) use a similar residuals-based approach to measure monetary policy shocks. They are less likely to be driven by changes in economic conditions and are

therefore "cleaner" instruments for the interest burden. For all other firm-specific variables, we rely on values of the regressors lagged four or more as instruments in the differenced equation, and of differences of the regressors lagged three times or more in the levels equation.

To evaluate whether our instruments are legitimate and our model correctly specified, we use the Sargan test (also known as J test), which is a test for over-identifying restrictions, and the test for nth-order serial correlation in the differenced of the residuals using the $m(n)$ test. Under the null of instrument validity, the former test is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters. Where the number of over-identifying restrictions is large, the Sargan test may have less power to reject the null hypothesis (Blundell and Bond, 2000). Hence, we also report the difference-in-Sargan test, which examines the validity of the additional moment conditions imposed in the levels equation by the system-GMM estimator under the null of instrument validity.

The system GMM is consistent if there is no third order serial correlation in the error term of the first differenced equation. We note that the Sargan 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. The $m(n)$ test is asymptotically distributed as a standard normal under the null of no n-th order serial correlation of the differenced residuals.

In all specification models we use the full set of collapsed instruments to improve the efficiency of our results (see Roodman, 2009). Moreover, it is generally accepted that lagged variables (which are often referred to as 'internal'instruments) are distributed independently of the error process and that they are sufficiently correlated with the included endogenous regressors. Hence they are frequently used as instruments in the literature. See for example Almeida et al. (2010) who show that IV estimators that make use of 'internal' instruments are very effective in controlling for measurement error in the regressors.

If there is evidence of serial correlation of order 2 in the differenced residuals, the instrument set needs to be restricted to lags 3 and deeper. The latter instruments are valid in the absence of serial correlation of order three in the differenced residuals (Roodman, 2007; Brown et al., 2009). Note that neither the Sargan test nor the test for n-th order serial correlation in the differenced residuals allows for discrimination between poor instruments and model specification.

Finally, we present two statistics to test for under-identification (Kleibergen and Paap, 2006) and weak instruments (Cragg and Donald, 1993). As in Bazzi and Clemens (2013), we do not rely on the individual first-stage GMM regressions; rather, we employ the Kleibergen-Paap and the Cragg-Donald matrix versions of the Wald statistic to test whether the instruments jointly explain enough variation in the multiple endogenous regressors.

4 Data

4.1 Data description

The data-set is drawn from the annual accounting reports taken from the 2012 version of the AMADEUS (Analyse Major Database from European Sources) database, distributed by Bureau Van Dijk (BvDEP). The database comprises financial information in standardised financial format for 19 million public and private firms across European countries. The local source for these data is generally the office of the Registrar of Companies. We cover the time period 2003 through 2011. Our data-set spans the following eleven European countries that belong in the euro area: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. The database is made up not only of listed firms but, more importantly, also covers unlisted companies. In fact, approximately 70% of the firms, included in our data-set, are not listed on the stock market.

To ensure comparability with previous studies, we set a number of restrictions on the dataset. First, we consider only firms that have unconsolidated accounts. This filtering process ensures comparability across our sample as not all European countries require consolidation of accounts for all firms. Using unconsolidated statements also avoids double-

Following Zhang et al. (2009), Garcia-Appendini and Montoriol-Garriga (2013) and Chen et al. (2017), we report the corresponding tests in the Tables of results.

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

The majority of the firms in the AMADEUS report unconsolidated statements, while consolidated statements are provided when available.

Limited coverage of financial information may still occur in AMADEUS as the degree of firms' accounts

counting firms, ensuring that the majority of the firms in the data-set are relatively small.

Second, following standard selection criteria in the literature, observations with negative sales and assets are dropped to eliminate observations when there are inputting mistakes. 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. This is aimed at removing any extraordinary firm shocks or coding errors. In addition, firms with less than three years of consecutive observations are also dropped from the sample to minimise potential selection bias. 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 to 1,048,028 observations) which operate in the manufacturing sector.

5 Results

5.1 Interest burden and the role of the crisis

We begin our enquiry by estimating a baseline model without interaction terms, which corresponds to Equation (3.1). This model is aimed at assessing the direct effect of interest burden on firms' employment. Next, we augment the baseline model with interactions between the interest burden and the financial crisis period, as shown in Equation (3.2). Our goal is to assess the differential impact of the 2010–2011 crisis on European firms' employment decisions. The results of the regressions are reported in Table 1 in successive columns.

filing and publication requirements are different across countries. For instance, in Germany many firms decide not to file detailed annual reports preferring to pay a non-reporting fee (Ferrando et al., 2014).

In our paper, we are unable to make a distinction between the proportion of interest payments which refer to existing and new debt, due to data constraints. Specifically, there is no clear distinction in the available data between interest rates on new and existing loans (see Bell and Young, 2010, who make a similar point).

Table A2 in the appendix reports summary statistics for the variables used in the estimations. Also, see Tables A3 and A4 in the appendix for the structure of the panel.

Following Blundell et al. (1992) and based on a two-digit NACE classification, firms are allocated 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; motor vehicles and parts; other transport equipment; food, drink and tobacco; textiles, clothing, leather and footwear; and others.

The evidence points to a strong direct effect of interest burden on employment, as shown in Column 1. This suggests that among euro-area firms there are significant effects from financial pressure on employment, consistent with the interpretation of Benito and Hernando (2008) that financing constraints affect labour demand. In addition, we find that the impact of the interest burden is larger during the European sovereign debt crisis (see Column 2). This finding reinforces the idea that during the crisis, financial pressure is more important in determining firms' employment.

The above findings are not only statistically but also economically important. Specifically, the coefficient of -0.146 implies an elasticity of employment with respect to interest burden, evaluated at sample means of -0.031. A ten percent increase in interest burden leads therefore to a 0.31 percent reduction in employment. With respect to the model with interaction terms, taking the point estimate at face value, our estimation suggests that the elasticity of employment with respect to interest burden is -0.023 for the crisis period. Thus, a ten percent increase in interest burden during the crisis period implies a 0.23 percent decline in employment.

Turning to the coefficients on the control variables, we note that they attain the expected signs and are mostly statistically significant. Specifically, wage w and growth in wage Δw exert a negative and highly significant effect on firms' employment. In addition, growth in sales δ and capital stock k have a positive and significant impact on employment.

Finally, the diagnostic tests do not generally indicate problems with the choice of instruments and the specification of our model. The Sargan tests suggests the exogeneity of the instruments while there is no sign of third-order serial correlation in the error term of the first differenced equation. As for the Kleibergen-Paap and Cragg-Donald tests, they both

We decompose the interest burden ratio to gauge the evolution of the numerator and the denominator separately. We find that the higher interest burden during the crisis is driven by an increase in interest payments, rather than by a decline in cash flow. Specifically, according to our data, the mean value of interest payments is €115,389 during the crisis period, and €97,681 during the tranquil period. The difference between these two mean values is statistically significant at the 1% significance level (p-value = 0.000). However, the mean values of cash flow are very similar during and outside of the crisis (€558,825 and €568,174 respectively), and their difference is not statistically significant (p-value = 0.479).

As we explain in Sub-section (3.5), the Sargan test tends to over-reject the null in the case of large

suggest that our model is well identified. Overall, the tests show that the instruments are valid and that there is no sign of mis-specification in the model.

5.2 Non-periphery versus periphery economies during the crisis

Our estimates thus far document the differential role of interest burden in determining firms' employment decisions during and outside of the crisis. In this sub-section we set out to investigate whether the characterisation of non-periphery/periphery is an important dimension in the determination of firms' employment, particularly during extreme economic events. In Table 2 we present the estimates of Equation (3.3). We document a significantly different response of firms' employment to interest burden during the crisis period, with respect to periphery economies. In other words, 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 sovereign debt crisis.

To ascertain the economic importance, we focus on the interaction between the interest burden, the periphery dummy and the crisis period. The elasticity of employment with respect to non-crisis years is relatively small at -0.01. Hence, a ten percent rise in the interest burden decreases firms' workforce by only 0.10 percent during non-crisis times. However, the elasticity of employment with respect to interest burden in the crisis period, evaluated at sample means, is -0.030. Therefore, a ten percent increase in the interest burden reduces firms' employment by 0.30 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 non-periphery firms during both tranquil and turmoil periods. The

samples. Confirming this, when we perform regressions on a selected country-by-country basis (results available upon request) we obtain larger p-values for the Sargan test.

The diagnostics on weak instruments using the Cragg and Donald (1993) Wald test are acceptable, when compared to the reported critical values from Stock and Yogo (2005) for the bias of the instrumental variable estimates greater than 30 percent of the OLS bias.

p-value reveals that the coefficients are not statistically different from each other. Finally, when comparing the interactions of the interest burden between non-periphery and periphery groups, during the crisis period, we find, as expected, that the coefficients are significantly higher for the latter group. This finding lends support to our hypothesis 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 diagnostics do not indicate any problems with the specification of the model or the choice of the instruments.

5.3 The role of firm-level heterogeneity

We now explore the extent to which the link between employment and interest burden varies for different types of firms during crisis and tranquil times for both periphery and non-periphery economies, as shown in Equation (3.4). Therefore, comparing across columns in Table 3 allows us to investigate the specific influence of each of these dimensions (bank dependence, size, and privately held vs publicly traded firms) on each of the interactions in the rows.

The results bring to the fore an important dimension of firm heterogeneity. We find that financially constrained firms show larger sensitivity with respect to interest burden during the crisis period. This finding suggests that 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

It should be noted that Ireland is dropped from the estimation when we consider the private/public criterion, hence the smaller number of observations compared to the other measures. This is due to the fact that public firms in Ireland are dropped after the cleaning process.

Importantly, we show that the results are robust to the inclusion of firms legal status (privately held vs. publicly traded) as a measure of firm heterogeneity.

Our findings are also related to the literature that shows that capital market imperfections are important in influencing firms' real activities, such as investment, inventory, employment and firm survival (Carpenter and Guariglia, 2008; Guariglia, 2008; Guariglia and Mateut, 2010; Tsoukas, 2011).

attention to the interactions of interest burden for less bank-dependent/large/public firms, we find that there is no significantly different response. Hence, our results imply that for less financially fragile, firms an increase in debt serving costs has no impact on employment compared to financially fragile firms, whose employment is significantly more responsive during the crisis period.

As a final test, we consider the role of heterogeneity in firms' employment decisions, distinguishing between non-periphery and periphery economies. The results in Table 4 encapsulate an important finding regarding the impact of firm-level heterogeneity. We show that the differential response of interest burden is stronger for bank dependent/small/private firms in the periphery area compared to the same group of firms in non-periphery European economies. As for their counterparts, these remain largely unaffected, irrespective of location.

6 Robustness tests

A series of robustness tests were conducted for the results presented in the previous section.

6.1 Alternative identification strategy

To strengthen our identification, we supplement our detailed firm-level data with bank-firm relationships in Europe. This data allow us to identify the bank-lending channel at firm level and to control for credit demand and productivity shocks (Berton et al., 2018).

We rely on Thomson Reuters LPC's Dealscan to extract comprehensive information on the syndicated loan market. As noted in Acharya et al. (2018), syndicated loans are an important channel of financing for European non-financial firms. As such, we collect information on syndicated loans and combine the data with firm-specific information from Amadeus. We end up with a smaller sample compared to the one that we use in our main

As in Acharya et al. (2018), we have to hand–match firms in Amadeus and Dealscan because they do not share a common identifier.

regressions, but it is representative of the aggregate EU manufacturing.

To test for the effect of debt servicing costs on firms' employment decisions, the following model is estimated:

$$\Delta n_{it} = \alpha_1 + \beta_1 \Delta Spread_{it} + \beta_2 \Delta w_{it} + \beta_3 \delta_{it} + \beta_4 w_{it-1} + \beta_5 k_{it} + \sigma_i + \\ + (\gamma_{s(i)} \times \tau_t) + (\eta_{c(i)} \times \tau_t) + (\theta_{p(i)} \times \tau_t) + \epsilon_{it} \quad (6.1)$$

where Δn_{it} is the change in employment. $\Delta Spread_{it}$ denotes the spreads on loans used by the banking system for firm i over year t. This is a key variable, which measures the cost of financing using the Dealscan variable *AllinSpreadDrawn* (AISD). It is defined as the annual spread paid over LIBOR for each euro drawn down from the loan plus facility fees (see Ivashina and Scharfstein, 2010; Berg et al., 2016). We rely on this interest rate spread as an alternative debt servicing burden. Following Berton et al. (2018), we measure the changes in employment and loan spread as $\frac{X_1 - X_0}{0.5*X_1 + 0.5*X_1}$, where X_0 and X_1 correspond to the values of employment and loan spreads at years t and t-1, respectively. We augment the model with a number of fixed effects in subsequent columns. First, we include firm fixed effects ($\gamma_{s(i)}$) to saturate the model from unobserved time–invariant firm heterogeneity. Second, to capture different aggregate demand fluctuations in our sample countries and/or in particular industries within our sample countries, we add interactions between industry×year ($\eta_{c(i)} \times \tau_t$) fixed effects and country×year ($\theta_{p(i)} \times \tau_t$) fixed effects. These fixed effects are aimed at removing the possibility of spurious results due to time-varying shocks to an industry in a given country that may have affected the credit demand of borrowing firms as well as their employment decisions. Third, we incorporate firm-cluster*time fixed effects to absorb time-varying borrower characteristics and initiatives (or, more broadly, demand shocks) that might affect firms' employment decisions (e.g. Jiménez et al., 2012; Jiminez et al., 2014).

In untabulated statistics, we show that our sample is reasonably representative of the Amadeus sample used in the main regressions. We also take care to ensure that our sample is representative of a broader aggregate.

We also add firm-level control variables to capture other determinants of firms' corporate policies.

Table 5 reports results for different specifications and confirms the previous findings regarding the negative effect of the loan spread on employment. We find that in all models the cost of borrowing has a highly significant and economically important effect on the change in employment at the firm level. The point estimate on Column 3 is -0.053 and implies that a ten percent increase in the cost of borrowing translates into a 5.3 percent reduction in employment.

6.2 Additional control variables

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 demand, respectively. We apply a set of firm-specific characteristics such as cash flow (calculated as cash flow to capital stock), liquidity (measured as cash and equivalents to capital stock) and net indebtedness (calculated as the ratio of liabilities plus long-term debt minus cash and equivalent capital stock). By including these financial ratios, we are still able to capture the impact of a change in firm-specific interest rate and better control for firms' networth. More importantly, we can test whether firm-specific characteristics add any explanatory power to the standard employment equations (see Benito and Hernando, 2008). Moreover, we enrich our specification with standard empirical proxies that should capture demand properties of the business cycles using the economic sentiment. The economic sentiment index is a weighted average of five sectoral indexes, whose scores are gathered from surveys stating agents' assessment of the current economic situation and their expectations about future developments. As such, the sentiment index is used in the literature as a forward-looking variable capturing growth expectations (Dewachter et al., 2015; Afonso et al., 2018). This variable is measured at the country-specific level. Results in Table 6 confirm that the above modification does not alter our findings. We find that the firm-specific interest burden remains a significant determinant of employment. Balance sheet variables (with the exception of liquidity) have no impact on firms' employment decisions,

whereas the interaction of interest burden with the sentiment variable has a negative and statistically significant impact on firm-specific employment.

6.3 Alternative definition for 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. Table 7 indicates 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

In our baseline results, we use a 50% cut-off point to classify firms as financially fragile or less fragile. To ensure that our results are not driven by the way we sort firms, we employ a different cut-off point. Specifically, we define as bank-dependent (small) firms whose bank dependency (total assets) falls in the top (bottom) 75% of the distribution of all firms. The results in Tables 8 and 9 indicate that the impact of interest burden on employment is negative and statistically significant only for more financially fragile firms operating in the periphery during the crisis. Thus, our findings are robust to the use of an alternative cut-off point for the classification of firms.

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

We also experiment with additional variables capturing labour market flexibility, and our results remain robust.

crisis. Within the periphery group, we find that the sensitivity of employment to financial pressure is stronger for financially fragile firms and SMEs. Our results are robust to a several sensitivity checks. Our findings have important policy implications. They suggest that policy initiatives aimed at enhancing credit availability and relaxing the financial constraints faced by smaller firms in the periphery, are essential to support the economic recovery of the euro area.

References

Acharya, V., I. Drechsler and P. Schnabl (2014), 'A pyrrhic victory? Bank bailouts and sovereign credit risk', *The Journal of Finance* **69**, 2689–2739.

Acharya, V. and S. Steffen (2015), 'The "greatest" carry trade ever? Understanding euro bank risks', *Journal of Financial Economics* **115**, 215–236.

Acharya, V. V., T. Eisert, C. Eufinger and C. W. Hirsch (2018), 'Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans', *The Review of Financial Studies* **31**, 2855–2896.

Afonso, A., M. G. Arghyrou and A. Kontonikas (2014), 'Pricing sovereign bond risk in the european monetary union area: An empirical investigation', *International Journal of Finance and Economics* **19**, 49–54.

Afonso, A., M. G. Arghyrou, M. D. Gadea and A. Kontonikas (2018), '"Whatever it takes" to resolve the European sovereign debt crisis? Bond pricing regime switches and monetary policy effects', *Journal of International Money and Finance* **86**, 1–30.

Almeida, H., M. Campello and A. F. Galvao (2010), 'Measurement errors in investment equations', *Review of Financial Studies* **23**, 3279–3328.

Alter, A. and Y. S. Schüler (2012), 'Credit spread interdependencies of European states and banks during the financial crisis.', *Journal of Banking and Finance* **36**, 3444–3468.

Arellano, M. and O. Bover (1995), 'Another look at the instrumental variable estimation of error-components models', *Journal of Econometrics* **68**, 29–51.

Arghyrou, M. G. and A. Kontonikas (2012), 'The EMU sovereign-debt crisis: Fundamentals, expectations and contagion', *Journal of International Financial Markets, Institutions and Money* **22**, 658–677.

Arghyrou, M. G. and J. Tsoukalas (2011), 'The Greek debt crisis: Likely causes, mechanics and outcomes', *The World Economy* **34**, 173–191.

Arnold, L. G. (2002), 'Financial market imperfections, labour market imperfections and business cycles', *The Scandinavian Journal of Economics* **104**, 105–124.

Artola, C. and V. Genre (2011), 'Euro area SMEs under financial constraints: Belief or reality?', *Working paper number 3650, Monetary Policy and International Finance Center for Economic studies and Ifo Institute* .

Balduzzi, P., E. Brancati and F. Schiantarelli (2017), 'Financial markets, banks' cost of funding, and firms' decisions: Lessons from two crises', *Forthcoming in Journal of Financial Intermediation* .

Bazzi, S. and M. A. Clemens (2013), 'Blunt instruments: Avoiding common pitfalls in identifying the causes of economic growth.', *American Economic Journal: Macroeconomics* **5**, 152–186.

Bell, V. and G. Young (2010), 'Understanding the weakness of bank lending', *Bank of England Quarterly Bulletin* .

Benito, A. (2005), 'Financial pressure, monetary policy effects and inventories: Firm-level evidence from a market-based and a bank-based financial system', *Economica* **72**, 201–224.

Benito, A. (2017), 'How does monetary policy affect labor demand and labor productivity?', *Institute for the Study of Labor (IZA)* pp. 1–9.

Benito, A. and G. Young (2007), 'Financial pressure and balance sheet adjustment by firms', *Oxford Bulletin of Economics and Statistics* **69**, 581–602.

Benito, A. and I. Hernando (2008), 'Labour demand, flexible contracts and financial factors: Firm-level evidence from Spain', *Oxford Bulletin of Economics and Statistics* **70**, 283–301.

Benito, A. and J. Whitley (2003), 'Implicit interest rates and corporate balance sheets: An analysis using aggregate and disaggregated UK data', *Working paper number 193, Bank of England* .

Benmelech, E., N. K. Bergman and A. Seru (2011), 'Financing labor', *Working paper number 17144, National Bureau of Economic Research* .

Bentolila, S., M. Jansen, G. Jiménez and S. Ruano (2017), 'When credit dries up: Job losses in the great recession', *Forthcoming in Journal of the European Economic Association* .

Berg, T., A. Saunders and S. Steffen (2016), 'The total cost of corporate borrowing in the loan market: Don't ignore the fees', *The Journal of Finance* **71**, 1357–1392.

Berton, F., S. Mocetti, A. F. Presbitero and M. Richiardi (2018), 'Banks, firms, and jobs', *Forthcoming in Review of Financial Studies* .

Blundell, R. and S. Bond (1998), 'Initial conditions and moment restriction in dynamic panel data models', *Journal of Econometrics* **87**, 115–143.

Blundell, R. and S. Bond (2000), 'GMM estimation with persistent panel data: An application to production functions', *Econometric Reviews* **19**, 321–340.

Blundell, R., S. Bond and F. Windmeijer (2001), *Estimation in dynamic panel data models:* I*mproving on the performance of the standard* GMM *estimator, in Baltagi B. H., Fomby T. B. and Hil, R. C. (ed.), Nonstastionary Panels,Panel Cointegration, and Dynamic Panels, Advances in Econometrics, Volume 15, 53-99*, Emerald Group Publishing Limited.

Blundell, R., S. Bond, M. Devereux and F. Schiantarelli (1992), 'Investment and Tobin' s Q: Evidence from company panel data', *Journal of Econometrics* **51**, 233–257.

Bottero, M., S. Lenzu and F. Mezzanotti (2015), 'Sovereign debt exposure and the bank lending channel: Impact on credit supply and the real economy.', *Working paper number 1032, Bank of Italy* .

Bougheas, S., P. Mizen and C. Yalcin (2006), 'Access to external finance: Theory and evidence on the impact of firm-specific characteristics', *Journal of Banking and Finance* **30**, 199–227.

Bris, A., Y. Koskinen and M. Nilsson (2008), 'The euro and corporate valuations', *Review of Financial Studies* **22**, 3171–3209.

Brown, J. R., S. M. Fazzari and B. C. Petersen (2009), 'Financing innovation and growth: Cash flow, external equity, and the 1990s R&D boom', *Journal of Finance* **64**, 151–185.

Bucă, A. and P. Vermeulen (2017), 'Corporate investment and bank-dependent borrowers during the recent financial crisis', *Journal of Banking and Finance* **78**, 164–180.

Byoun, S. and Z. Xu (2015), 'Product market competition and financial decisions during a financial crisis', *Financial Management* **1-24**.

Byrne, J., M. E. Spaliara and S. Tsoukas (2016), 'Firm survival, uncertainty, and financial frictions: is there a financial uncertainty accelerator?', *Economic Inquiry* **54**, 375–390.

Campello, M., J. R. Graham and C. R. Harvey (2010), 'The real effects of financial constraints: Evidence from a financial crisis', *Journal of Financial Economics* **97**, 470–487.

Carpenter, R. E. and A. Guariglia (2008), 'Cash flow, investment and investment opportunities: New tests using UK panel data', *Journal of Banking and Finance* **32**, 1894–1906.

Chen, J., W. S. Leung and M. Goergen (2017), 'The impact of board gender composition on dividend payouts', *Journal of Corporate Finance* **43**, 86–105.

Chen, M. and A. Guariglia (2009), 'Do financial factors affect firms' employment decisions? Evidence from Chinese manufacturing firms', *Mimeo, University of Nottingham* .

Chen, M. and A. Guariglia (2013), 'Internal financial constraints and firm productivity in China: Do liquidity and export behavior make a difference?', *Journal of Comparative Economics* **41**, 1123–1140.

Chodorow-Reich, G. (2014), 'The employment effects of credit market disruptions: Firm-level evidence from the 2008-9 financial crisis', *The Quarterly Journal of Economics* **129**, 1–59.

Cingano, F., F. Manaresi and E. Sette (2016), 'Does credit crunch investment down? New evidence on the real effects of the bank-lending channel', *The Review of Financial Studies* **29**, 2737–2773.

Coeuré, B. (2013), 'SME financing: A euro area perspective', *Speech by Benoît CIJuré, Member of the Executive Board of the ECB, at the Conference on Small Business Financing jointly organised by the European Central Bank, Kelley School of Business at Indiana University, Centre for Economic Policy Research and Review of Finance, Frankfurt am Main, 13 December 2012* .

Cragg, J. G. and S. G. Donald (1993), 'Testing identifiability and specification in instrumental variable models', *Econometric Theory* **9**, 222–240.

De Bruyckere, V., M. Gerhardt, G. Schepens and R. Vander Vennet (2013), 'Bank/sovereign risk spillovers in the European debt crisis', *Journal of Banking and Finance* **37**, 4793–4809.

Delatte, A. L., J. Fouquau and R. Portes (2017), 'Regime-dependent sovereign risk pricing during the euro crisis', *Review of Finance* **21**, 363–385.

Dewachter, H., L. Iania, M. Lyrio and M. de Sola Perea (2015), 'A macro-financial analysis of the euro area sovereign bond market', *Journal of Banking and Finance* **50**, 308–325.

Draghi, M. (2014), 'Monetary policy in a prolonged period of low inflation', *Speech by Mr Mario Draghi, President of the European Central Bank, at the ECB Forum on Central Banking, Sintra, Portugal, 26 May 2014* .

Duchin, R., O. Ozbas and A. B. Sensoy (2010), 'Costly external finance, corporate investment, and the subprime mortgage credit crisis', *Journal of Financial Economics* **97**, 418–435.

Duygan-Bump, B., B., A. Levkov and J. Montoriol-Garriga (2015), 'Financing constraints and unemployment: Evidence from the great recession', *Journal of Monetary Economics* **75**, 89–105.

Dwenger, N., F. M. Fossen and M. Simmler (2018), 'Firms' financial and real responses to credit supply shocks: Evidence from firm-bank relationships in Germany', *Forthcoming in Journal of Financial Intermediation.* .

Fazzari, S., G. Hubbard and B. Petersen (1988), 'Financing constraints and corporate investment', *Brookings Papers on Economic Activity* **2**, 141–195.

Ferrando, A., A. Popov and G. F. Udell (2015), 'Sovereign stress, unconventional monetary policy, and SME access to finance', *Working paper number 1820, European Central Bank* .

Ferrando, A., M. T. Marchica and R. Mura (2014), 'Financial flexibility across the euro area and the UK', *Working paper number 1630, European Central Bank* .

Gao, H., J. Harford. and K. Li (2013), 'Determinants of corporate cash policy: Insights from private firms', *Journal of Financial Economics* **109**, 623–639.

Garcia-Appendini, E. and J. Montoriol-Garriga (2013), 'Firms as liquidity providers: Evidence from the 2007-2008 financial crisis', *Journal of Financial Economics* **109**, 272–291.

Guariglia, A. (2008), 'Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms', *Journal of Banking and Finance* **32**, 1795–1809.

Guariglia, A., M. Spaliara and S. Tsoukas (2016), 'To what extent does the interest burden affect firm survival? Evidence from a panel of UK firms during the recent financial crisis', *Oxford Bulletin of Economics and Statistics* **78**, 576–594.

Guariglia, A. and S. Mateut (2010), 'Inventory investment, global engagement, and financial constraints in the UK: Evidence from micro data', *Journal of Macroeconomics* **32**, 239–250.

Hubbard, R. G. (1998), 'Capital-market imperfections and investment', *Journal of Economic Literature* **36**, 193–225.

Ivashina, V. and D. S. Scharfstein (2010), 'Bank lending during the financial crisis of 2008', *Journal of Financial Economics* **97**, 319–338.

Iyer, R., J. L. Peydró, S. da-Rocha-Lopes and A. Schoar (2014), 'Interbank liquidity crunch and the firms credit cruch: Evidence from the 2007-2009 crisis', *Review of Financial Studies* **27**, 347–372.

Jermann, U. and V. Quadrini (2012), 'Macroeconomic effects of financial shocks', *American Economic Review* **102**, 238–271.

Jiménez, G., S. Ongena, J-L. Peydró and J. Saurina (2012), 'Credit supply and monetary policy: Identifying the balance-sheet channel with loan applications', *American Economic Review* **102**, 2301–2326.

Jiminez, G., A. R.Mian, J.-L. Peydró and J. Saurina Salas (2014), 'The real effects of the bank lending channel', *Working paper* .

Kleibergen, F. and R. Paap (2006), 'Generalized reduced rank tests using the singular value decomposition', *Journal of econometrics* **133**, 97–126.

Klein, N. (2014), 'Small and medium size enterprises, credit supply shocks, and economic recovery in europe', *Working paper number 14/98, IMF* .

Mayordomo, S., M. Abascal, T. Alonso and M. Rodriguez-Moreno (2015), 'Fragmentation in the European interbank market: Measures, determinants, and policy solutions.', *Journal of Financial Stability* **16**, 1–12.

Mumtaz, H. and F. Zanetti (2015), 'Factor adjustment costs: A structural investigation.', *Journal of Economic Dynamics and Control* **51**, 341–355.

Mumtaz, H. and F. Zanetti (2016), 'The effect of labor and financial frictions on aggregate fluctuations', *Macroeconomic Dynamics* **20**, 313–341.

Nickell, S. and D. Nicolitsas (1999), 'How does financial pressure affect firms?', *European Economic Review* **43**, 1435–1456.

Paligorova, T. and J. A. Santos (2017), 'Monetary policy and bank risk-taking: Evidence from the corporate loan market', *Journal of Financial Intermediation* **30**, 35–49.

Popov, A. and J. Rocholl (2016), 'Do credit shocks affect labor demand? Evidence for employment and wages during the financial crisis', *forthcoming in Journal of Financial Intermediation.* .

Roodman, D. (2007), 'A short note on the theme of too many instruments', *Working paper number 125, Center for Global Development* .

Roodman, D. (2009), 'A note on the theme of too many instruments', *Oxford Bulletin of Economics and Statistics* **71**, 135–158.

Rughoo, A. and N. Sarantis (2014), 'The global financial crisis and integration in European retail banking', *Journal of Banking and Finance* **40**, 28–41.

Santos, J. A. (2011), 'Bank corporate loan pricing following the subprime crisis', *Review of Financial Studies* **24**, 1916–1943.

Spaliara, M-E. (2009), 'Do financial factors affect the capital-labour ratio? Evidence from UK firm-level data', *Journal of Banking and Finance* **33**, 1932–1947.

Stock, J. H. and M. Yogo (2005), 'Testing for weak instruments in linear iv regression. in identification and inference for econometric models: Essays in honor of Thomas Rothenberg',

edited by Donald W. K. Andrews and James H. Stock, 80Ű108. New York: Cambridge University Press .

Tsoukas, S. (2011), 'Firm survival and financial development: Evidence from a panel of emerging Asian economies', *Journal of Banking and Finance* **35**, 1736–1752.

Vermeulen, P. (2002), 'Business fixed investment: Evidence of a financial accelerator in Europe', *Oxford Bulletin of Economics and Statistics* **64**, 217–235.

Zanetti, F. (2017), 'Financial shocks, job destruction shocks, and labor market fluctuations', *Macroeconomic Dynamics* pp. 1–29.

Zhang, C., D. R. Osborn and D. H. Kim (2009), 'Observed inflation forecasts and the New Keynesian Phillips Curve', *Oxford Bulletin of Economics and Statistics* **71**, 375–398.

Table 1: Employment, financial pressure and the crisis

	Baseline (1)	Crisis (2)
n_{it-1}	0.990***	0.929***
	(104.99)	(20.33)
IB_{it-1}	-0.146**	
	(-2.41)	
IB_{it-1}*Crisis$_t$		-0.179**
		(-2.45)
IB_{it-1}*(1-Crisis$_t$)		0.188
		(0.96)
Δw_{it}	-1.372***	-1.450***
	(-10.48)	(-5.89)
δ_{it}	0.791***	0.778***
	(8.50)	(4.54)
w_{it-1}	-0.133***	-0.059
	(-2.97)	(-1.00)
k_{it}	0.019***	0.059*
	(2.86)	(1.71)
Observations	399,948	399,948
Firms	94,395	94,395
Sargan (p-value)	0.686	0.105
Difference-Sargan (p-value)	0.057	0.332
m1 (p-value)	0.000	0.000
m2(p-value)	0.000	0.000
m3 (p-value)	0.726	0.618
Kleibergen-Paap LM Test (level)	0.052	0.021
Kleibergen-Paap LM Test (Diff)	0.033	0.056
Cragg-Donald (F statistic) level	43.234	82.32
Cragg-Donald (F statistic) Diff	8.940	5.720
F-test of equality (p-value)		
IB crisis vs. non-crisis		0.020

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more. The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 2: Periphery, non-periphery and the crisis

n_{it-1}	0.970***
	(57.87)
IB_{it-1}*$Crisis_t$*$Periphery_i$	-0.224***
	(-3.57)
IB_{it-1}*(1-$Crisis_t$)*$Periphery_i$	-0.088
	(-1.13)
IB_{it-1}*$Crisis_t$*(1-$Periphery_i$)	0.235
	(0.85)
IB_{it-1}*(1-$Crisis_t$)*(1-$Periphery_i$)	0.106
	(0.37)
Δw_{it}	-1.420***
	(-8.26)
δ_{it}	0.907***
	(7.85)
w_{it-1}	-0.192***
	(-4.25)
k_{it}	0.017**
	(2.29)
Observations	399,948
Firms	94,395
Sargan (p-value)	0.060
Difference-Sargan (p-value)	0.082
m1 (p-value)	0.000
m2 (p-value)	0.000
m3 (p-value)	0.576
Kleibergen-Paap LM Test (level)	0.062
Kleibergen-Paap LM Test (Diff)	0.048
Cragg-Donald (F statistic) level	33.761
Cragg-Donald (F statistic) Diff	6.731
F-test of equality (p-value)	
IB crisis periph. vs. non-crisis periph.	0.069
IB crisis non-periph. vs. non-crisis non-periph.	0.442
IB non-crisis periph. vs. non-crisis non-periph.	0.548
IB crisis periph. vs. crisis non-periph.	0.084

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more. The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3: Firm-level heterogeneity and the crisis

	Dummy= BankDep (1)	Dummy= Size (2)	Dummy= Private (3)
n_{it-1}	0.872***	0.913***	0.934***
	(14.38)	(25.55)	(41.70)
IB_{it-1}*$Crisis_t$*$Dummy_{it}$	-0.263***	-0.426***	-0.306***
	(-2.59)	(-3.57)	(-3.51)
IB_{it-1}*(1-$Crisis_t$)*$Dummy_{it}$	0.027	-0.308***	-0.160
	(0.21)	(-3.63)	(-1.62)
IB_{it-1}*$Crisis_t$*(1-$Dummy_{it}$)	-0.029	0.006	-0.068
	(-0.37)	(0.06)	(-0.50)
IB_{it-1}*(1-$Crisis_t$)*(1-$Dummy_{it}$)	-0.063	0.017	0.198
	(-0.047)	(0.31)	(1.35)
Δw_{it}	-1.347***	-1.100***	-0.895***
	(-6.28)	(-7.58)	(-5.59)
δ_{it}	0.594***	0.437***	0.549***
	(3.42)	(2.95)	(8.68)
w_{it-1}	-0.095*	-0.107***	-0.128**
	(-1.72)	(-2.98)	(-2.30)
k_{it}	0.090**	0.014	0.036***
	(2.02)	(0.96)	(7.13)
Observations	399,948	399,948	321,294
Firms	94,395	94,395	74,010
Sargan (p-value)	0.575	0.011	0.019
Difference-Sargan (p-value)	0.143	0.054	0.051
m1 (p-value)	0.000	0.000	0.012
m2 (p-value)	0.000	0.000	0.703
m3 (p-value)	0.548	0.604	0.000
Kleibergen-Paap LM Test (level)	0.047	0.063	0.041
Kleibergen-Paap LM Test (Diff)	0.100	0.089	0.102
Cragg-Donald (F statistic) level	22.032	19.021	30.289
Cragg-Donald (F statistic) Diff	10.035	8.302	7.033
F-test of equality (p-value)			
IB crisis Dummy vs. non-crisis Dummy	0.008	0.005	0.051
IB crisis 1-Dummy. vs. non-crisis 1-Dummy	0.823	0.829	0.052
IB non-crisis Dummy. vs. non-crisis 1-Dummy	0.652	0.004	0.019
IB crisis Dummy. vs. crisis 1-Dummy	0.057	0.014	0.099

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. The variable Dummy indicates in turn Bank-dependent, small and private firms. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three (two) times or more in column 1 and 2 (3). The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4: Periphery, non-periphery and financing constraints

	Periphery			Non-periphery		
	Dummy= BankDep	Dummy= Size	Dummy= Private	Dummy= BankDep	Dummy= Size	Dummy= Private
	(1)	(2)	(3)	(4)	(5)	(6)
n_{it-1}	0.975***	0.999***	0.957***	0.875***	0.895***	0.892***
	(31.06)	(53.28)	(60.06)	(13.96)	(24.29)	(22.91)
IB_{it-1}*$Crisis_t$*$Dummy_{it}$	-0.717***	-0.691***	-0.185**	-0.150	-0.339	-0.029
	(-3.62)	(-2.89)	(-2.28)	(-1.03)	(-1.01)	(-0.19)
IB_{it-1}*(1-$Crisis_t$)*$Dummy_{it}$	-0.326	-0.010	-0.169***	-0.088	-0.293	0.091
	(-1.56)	(-0.04)	(-2.61)	(-0.52)	(-1.37)	(0.76)
IB_{it-1}*$Crisis_t$*(1-$Dummy_{it}$)	-0.022	0.083	0.501	0.158	0.109	-0.488
	(-0.08)	(0.23)	(1.09)	(0.81)	(0.97)	(-1.51)
IB_{it-1}*(1-$Crisis_t$)*(1-$Dummy_{it}$)	0.130	-0.229	0.315	-0.217	-0.012	-0.164
	(0.58)	(-1.40)	(1.28)	(-0.99)	(-0.07)	(-0.57)
Δw_{it}	-1.733***	-1.689***	-0.806***	0.144	-0.113	0.090
	(-8.29)	(-6.44)	(-4.32)	(0.86)	(-0.69)	(0.61)
δ_{it}	0.798***	1.043***	1.155***	0.339*	0.601***	0.626***
	(4.83)	(5.05)	(8.12)	(1.69)	(4.36)	(4.28)
w_{it-1}	-0.190***	-0.155	-0.129***	-0.036	-0.217	0.017
	(-2.65)	(-1.49)	(-2.97)	(-0.28)	(-1.03)	(0.07)
k_{it}	0.039**	0.040**	0.027***	0.023**	0.018**	0.025***
	(2.08)	(2.45)	(3.03)	(2.39)	(2.29)	(2.76)
Observations	278,245	278,245	228,584	121,703	121,703	92,710
Firms	63,124	63,124	50,699	31,271	31,271	23,311
Sargan	0.750	0.789	0.040	0.735	0.218	0.210
Difference-Sargan (p-value)	0.128	0.243	0.082	0.025	0.264	0.821
m1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
m2 (p-value)	0.000	0.000	0.841	0.000	0.000	0.026
m3 (p-value)	0.585	0.558	0.000	0.751	0.947	0.000
Kleibergen-Paap LM Test (level)	0.072	0.065	0.089	0.027	0.123	0.102
Kleibergen-Paap LM Test (Diff)	0.106	0.078	0.141	0.167	0.282	0.182
Cragg-Donald (F statistic) level	23.332	24.098	42.322	26.402	22.087	40.013
Cragg-Donald (F statistic) Diff	10.202	9.034	8.022	9.863	7.023	12.131
F-test of equality (p-value)						
IB crisis Dummy vs. non-crisis Dummy	0.016	0.0680	0.092	0.730	0.849	0.231
IB crisis 1-Dummy vs. non-crisis 1-Dummy	0.360	0.554	0.727	0.013	0.335	0.126
IB non-crisis Dummy vs. non-crisis 1-Dummy	0.115	0.277	0.172	0.292	0.275	0.564
IB crisis Dummy vs. crisis 1-Dummy	0.070	0.093	0.067	0.632	0.343	0.173

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. The variable Dummy indicates in turn Bank Dependent, Small firms and Private firms. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three (two) times or more in column 1 to 2 (3) and 4 to 5 (6). The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5: Alternative identification strategy

	(1)	(2)	(3)	(4)
Spread_{it}	-0.065***	-0.071***	-0.053***	-0.027***
	(-13.04)	(-14.11)	(-3.06)	(-4.83)
Δw_{it}				-0.375***
				(-9.96)
δ_{it}				0.150***
				(10.56)
w_{it-1}				-0.294***
				(-2.82)
k_{it}				0.046***
				(5.76)
Observations	2,518	2,518	2,518	1,796
Firms	103	103	103	88
R-squared	0.500	0.335	0.503	0.714
Firm fixed effects	Yes	Yes	Yes	Yes
Industry*year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	No	No	No
Country*year fixed effects	No	Yes	Yes	Yes
Firm cluster* year fixed effects	No	No	Yes	Yes

Notes: All specifications are estimated using OLS. The dependent variable is the change in employment. Spread measures the cost of financing using the DealScan variable AllinSpreadDrawn (AISD). The figures in parentheses report robust t-statistics. The standard errors are clustered at the bank level.

Table 6: Additional control variables

	Cflow	Liq	Netdebt	Sentiment
	(1)	(2)	(3)	(4)
n_{it-1}	0.968***	0.970***	0.962***	0.850***
	(78.50)	(96.05)	(96.72)	(18.43)
IB_{it-1}	-0.091*	-0.128***	-0.092*	-0.492**
	(-1.95)	(-2.66)	(-1.67)	(-2.11)
$Cflow_{it-1}$	0.022			
	(0.94)			
Liq_{it-1}		0.010*		
		(1.73)		
$Netdebt_{it-1}$			0.521	
			(0.45)	
$IB_{t-1}*Sent_t$				0.053***
				(3.22)
Δw_{it}	-1.128***	-1.128***	-1.051***	-1.113***
	(-9.78)	(-9.65)	(-5.38)	(-6.29)
δ_{it}	0.784***	0.769***	0.767***	0.453***
	(8.03)	(8.00)	(6.56)	(4.52)
w_{it-1}	-0.117***	-0.154***	-0.106**	-0.272***
	(-3.25)	(-3.87)	(-2.17)	(-3.51)
k_{it}	0.025***	0.032***	0.022*	0.132***
	(2.67)	(3.78)	(1.83)	(3.16)
Observations	372,109	367,345	305,761	373,651
Firms	90,786	90,631	81,461	91,037
Sargan (p-value)	0.023	0.058	0.005	0.027
Difference-Sargan (p-value)	0.015	0.037	0.010	0.049
m1 (p-value)	0.000	0.000	0.000	0.000
m2 (p-value)	0.000	0.000	0.000	0.572
m3 (p-value)	0.402	0.668	0.181	0.000
Kleibergen-Paap LM Test (level)	0.021	0.012	0.009	0.025
Kleibergen-Paap LM Test (Diff)	0.106	0.008	0.010	0.045
Cragg-Donald (F statistic) level	20.602	10.023	23.022	56.231
Cragg-Donald (F statistic) Diff	6.036	5.082	10.023	28.320

Notes: All specifications are estimated using a system GMM estimator. Cflow is the ratio of cash flow to capital stock. Liq is cash and equivalents to capital stock. Netdebt is the ratio of liabilities plus long-term debt minus cash and equivalent to capital stock. Sent is a weighted average of five sectoral indexes, whose scores are gathered from surveys stating agents' assessment of the current economic situation and their expectations about future development. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more (column 1 to column 3) and two times or more (column 4). The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 7: Alternative definition of interest burden

	Baseline (1)	Crisis (2)
n_{it-1}	0.965***	0.978***
	(77.85)	(73.88)
IB^d_{it-1}	-0.015*	
	(-1.89)	
IB^d_{it-1}*Crisis$_t$		-0.064**
		(-2.51)
IB^d_{it-1}*(1-Crisis$_t$)		-0.011
		(-0.042)
Δw_{it}	-1.130***	-0.743***
	(-6.88)	(-4.49)
δ_{it}	0.961***	0.113
	(4.70)	(0.50)
w_{it-1}	0.036	-0.005
	(1.17)	(-0.16)
k_{it}	0.006	-0.004
	(0.72)	(-0.62)
Observations	363,932	363,932
Firms	86,636	86,636
Sargan (p-value)	0.032	0.117
Difference-Sargan (p-value)	0.010	0.052
m1 (p-value)	0.000	0.000
m2 (p-value)	0.000	0.000
m3 (p-value)	0.252	0.516
Kleibergen-Paap LM Test (level)	0.018	0.085
Kleibergen-Paap LM Test (Diff)	0.102	0.098
Cragg-Donald (F statistic) level	18.032	17.033
Cragg-Donald (F statistic) Diff	8.032	6.025
F-test of equality (p-value)		
IB crisis vs. non-crisis		0.011

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. IB is is defined as the ratio of interest payments to a three-year moving average of total debt. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more. The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 8: Alternative classification for firm-level heterogeneity

	Dummy= BankDep (1)	Dummy= Size (2)
n_{it-1}	0.968***	0.962***
	(32.88)	(55.33)
$IB_{it-1}*Crisis_t*Dummy_{it}$	-0.160***	-0.165***
	(-2.87)	(-3.07)
$IB_{it-1}*(1\text{-}Crisis_t)*Dummy_{it}$	0.042	-0.085**
	(0.60)	(-2.24)
$IB_{it-1}*Crisis_t*(1\text{-}Dummy_{it})$	0.181	0.030
	(1.05)	(0.37)
$IB_{it-1}*(1\text{-}Crisis_t)*(1\text{-}Dummy_{it})$	0.225	0.031
	(1.35)	(0.79)
Δw_{it}	-1.124***	-1.008***
	(-8.40)	(-8.00)
δ_{it}	0.690***	0.576***
	(9.08)	(4.66)
w_{it-1}	-0.105	-0.119***
	(-1.53)	(-4.40)
k_{it}	0.003	0.009*
	(0.26)	(1.79)
Observations	399,948	399,948
Firms	94,395	94,395
Sargan (p-value)	0.019	0.006
Difference-Sargan (p-value)	0.102	0.053
m1 (p-value)	0.000	0.000
m2 (p-value)	0.000	0.000
m3 (p-value)	0.691	0.924
Kleibergen-Paap LM Test (level)	0.012	0.053
Kleibergen-Paap LM Test (Diff)	20.052	0.012
Cragg-Donald (F statistic) level	9.052	40.023
Cragg-Donald (F statistic) Diff	6.023	6.021
F-test of equality (p-value)		
IB crisis Dummy vs. non-crisis Dummy	0.003	0.027
IB crisis 1-Dummy. vs. non-crisis 1-Dummy	0.475	0.989
IB non-crisis Dummy. vs. non-crisis 1-Dummy	0.338	0.012
IB crisis Dummy. vs. crisis 1-Dummy	0.048	0.050

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. The variable Dummy indicates in turn Bank-dependent and small firms. Classification is based on bank dependence (size) at the top (bottom) 75% of the distribution of all firms operating in the same industry at a given year. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more. The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 9: Periphery, non-periphery and alternative classification for firm-level heterogeneity

	Periphery		Non-periphery	
	Dummy= BankDep	Dummy= Size	Dummy= BankDep	Dummy= Size
	(1)	(2)	(4)	(5)
n_{it-1}	0.081*	0.978***	0.909***	0.891***
	(1.78)	(66.11)	(24.15)	(22.06)
IB_{it-1}*Crisis$_t$*Dummy$_{it}$	-0.139**	-0.109**	-0.024	-0.128
	(-2.30)	(-2.51)	(-0.13)	(-0.79)
IB_{it-1}*(1-Crisis$_t$)*Dummy$_{it}$	0.028	-0.050***	-0.013	-0.095
	(0.40)	(-3.11)	(-0.16)	(-0.73)
IB_{it-1}*Crisis$_t$*(1-Dummy$_{it}$)	0.198	-0.001	-0.243	0.002
	(1.25)	(-0.02)	(-0.87)	(0.01)
IB_{it-1}*(1-Crisis$_t$)*(1-Dummy$_{it}$)	0.035	0.008	0.029	0.098
	(0.22)	(0.35)	(0.11)	(0.79)
Δw_{it}	-1.269***	-0.886***	0.146	0.032
	(-7.83)	(-7.19)	(1.04)	(0.20)
δ_{it}	1.063***	0.550***	0.612***	0.618***
	(8.43)	(3.86)	(4.10)	(4.44)
w_{it-1}	-0.134*	-0.092***	0.049	-0.072
	(-1.82)	(-4.35)	(0.60)	(-0.34)
k_{it}	0.029***	0.004	0.017**	0.017**
	(2.96)	(0.71)	(1.96)	(2.17)
Observations	278,245	278,245	121,703	121,703
Firms	63,124	63,124	31,271	31,271
Sargan	0.056	0.081	0.163	0.066
Difference-Sargan (p-value)	0.014	0.032	0.152	0.058
m1 (p-value)	0.000	0.000	0.000	0.000
m2 (p-value)	0.0000	0.000	0.000	0.000
m3 (p-value)	0.629	0.212	0.163	0.949
Kleibergen-Paap LM Test (level)	0.121	0.081	0.166	0.082
Kleibergen-Paap LM Test (Diff)	0.022	0.142	0.052	0.178
Cragg-Donald (F statistic) level	12.014	51.012	61.023	39.000
Cragg-Donald (F statistic) Diff	6.023	7.012	9.014	11.892
F-test of equality (p-value)				
IB crisis Dummy vs. non-crisis Dummy	0.029	0.094	0.950	0.840
IB crisis 1-Dummy vs. non-crisis 1-Dummy	0.031	0.048	0.133	0.402
IB non-crisis Dummy vs. non-crisis 1-Dummy	0.970	0.884	0.872	0.340
IB crisis Dummy vs. crisis 1-Dummy	0.023	0.087	0.404	0.424

Notes: All specifications are estimated using a system GMM estimator. Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. Classification is based on bank dependence (size) at the top (bottom) 75% of the distribution of all firms operating in the same industry at a given year. The variable Dummy indicates in turn Bank-dependent and small firms. 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. We instrument IB with the euro area monetary policy shock. Instruments include all other regressors lagged three times or more. The Sargan statistic is a test of the over-identifying restrictions, distributed as chi-square under the null of instrument validity. Difference-Sargan is a Sargan test of the validity of the additional moment conditions associated with the level equations. Mj is a test of jth-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Kleibergen-Paap LM is a test of under-identification, distributed as chi-square under the null of under-identification. The Cragg-Donald Wald statistic is a weak-instrument test distributed as F-test, under the null of weak instruments with assumption of identically and independently distributed errors (i.i.d.). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

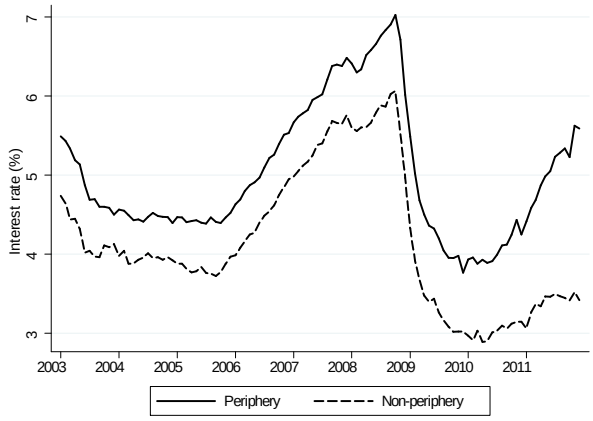

Figure 1: This figure presents the average interest rate on new loans below 1 million euro to non-financial corporations over the period 2003-2011 across a sample of euro area countries, separating periphery (Ireland, Italy, Portugal and Spain) from non-periphery economies (Austria , Belgium, Finland, France, Germany, Luxembourg and Netherlands).

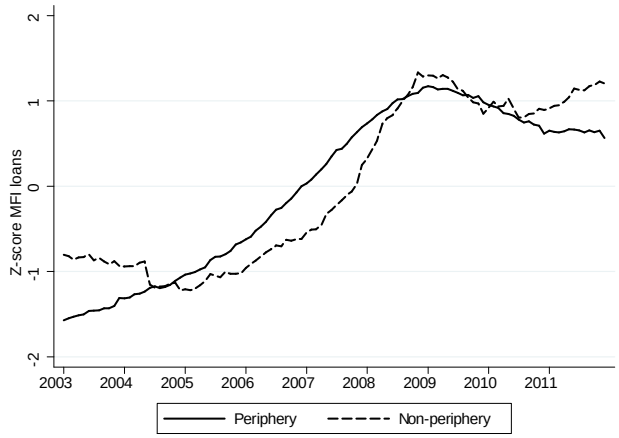

Figure 2: This figure presents the average standardised (z-score) level of loans to non-financial corporations over the period 2003-2011 across a sample of euro area countries, separating periphery (Ireland, Italy, Portugal and Spain) from non-periphery economies (Austria , Belgium, Finland, France, Germany, Luxembourg and Netherlands).

On-line Appendix for "On the real effect of financial pressure: Evidence from firm-level employment during the euro-area crisis"

Filipa Da Silva Fernandes[*], Alexandros Kontonikas[†], and Serafeim Tsoukas[‡]

September 6, 2018

Abstract

Using a large panel of mainly 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 euro area-crisis (2010-11), especially for firms in the periphery compared to their counterparts in non-periphery European economies. When we introduce firm-level heterogeneity, we show that financial pressure appears to be both statistically and quantitatively more important for bank-dependent, small and privately held firms operating in periphery economies during the crisis.

Key words: Financial pressure; Firm employment; Financing constraints; Euro area; Financial crisis

JEL: G32; D22; E22; E44

[*]University of Aberdeen, Business School, Aberdeen AB24 3QY, UK; Tel:+44(0) 122 427 3417**;** Email: filipaalexandra.dasilvafernandes@abdn.ac.uk

[†]University of Essex, Essex Business School, Colchester C04 3SQ; Tel:+44 141 330 6866; Email: a.kontonikas@essex.ac.uk

[‡]Corresponding Author: Serafeim Tsoukas, University of Glasgow, Adam Smith Business School, Glasgow G12 8QQ; Tel:+44 141 330 6325; Email: Serafeim.Tsoukas@glasgow.ac.uk

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 one over the period 2010-2011, and zero otherwise.
$Periphery_i$	Dummy variable equal to one if the firm is operating in periphery economies (Ireland, Italy, Portugal and Spain) and zero otherwise.
$Dummy_{it}$	Dummy variable equal to 1 if the firm is classified as bank-dependent/small/ private and 0 otherwise. This classification is based on the BankDep (Size) 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. Private corresponds to firms' legal status which assumes the value of one for private and zero otherwise.
$Cflow_{it}$	Ratio of cash flow to capital stock.
Liq_{it}	Ratio of cash and equivalent to capital stock.
$Netdebt_{it}$	Ratio of liabilities plus long-term debt minus cash and equivalent to capital stock.
$Sent_t$	Weighted average of five sectoral indexes, whose scores are gathered from surveys stating agents' assessment of the current economic situation and their expectations about future developments.
IB^d_{it}	Ratio of interest payments to three-year moving average of total debt.

Table A2: Summary statistics

	Full sample	Non-crisis	Crisis	Diff.	Non-periphery	Periphery	Diff.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
n_{it}	3.24	3.26	3.24	0.000	3.47	3.10	0.000
	(1.07)	(1.05)	(1.08)		(1.14)	(1.00)	
IB_{it}	0.30	0.24	0.31	0.000	0.16	0.37	0.000
	(0.68)	(0.63)	(0.70)		(0.49)	(0.76)	
Δw_{it}	0.02	0.03	0.01	0.000	0.01	0.02	0.000
	(0.20)	(0.17)	(0.21)		(0.17)	(0.21)	
δ_{it}	0.05	0.05	0.05	0.135	0.04	0.05	0.000
	(0.26)	(0.27)	(0.24)		(0.27)	(0.26)	
w_{it}	3.48	3.51	3.47	0.073	3.68	3.37	0.000
	(0.39)	(0.41)	(0.38)		(0.30)	(0.39)	
k_{it}	6.32	6.30	6.39	0.000	6.03	6.57	0.000
	(1.62)	(1.61)	(1.63)		(1.65)	(1.55)	
Observations	434,261	233,156	201,105		147,628	286,633	

Notes: Crisis is 2010-11. Periphery is a dummy equal to one if the firm is operating in periphery economies, and zero otherwise. The numbers in the tables represent means and the figures in parentheses report standard deviations. Diff is the p-value of the test statistic for the equality of means between non-crisis and crisis periods (column 4) and non-periphery and periphery economies (column 7). See Table A1 in the Appendix for the definition of the variables.

A3: 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	

A4: 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