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## **Financing Constraints and Fixed-term Employment Contracts: Evidence from the 2008-2009 Financial Crisis**

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# Financing Constraints and Fixed-Term Employment Contracts: Evidence from the 2008-09 Financial Crisis\*

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## Abstract

This paper investigates the effects of financing constraints on employment decisions of firms, when it is possible to choose between permanent and fixed-term workers. We use linked employer-employee data for the universe of private sector firms in Portugal, and the 2008-09 financial crisis as a shock for identification. We find that firms in sectors that intrinsically rely more on external finance increased the share of fixed-term employment and hires after the crisis, while the effect for firms with wider access to buyer-supplier credit is relatively lower. At the worker level, workers in sectors that require significant external financing are more likely to be hired with a fixed-term contract after the crisis, while those in sectors that have wider access to supplier credit are less likely. Our results suggest that the crisis induced financially constrained firms to use the more flexible fixed-term contracts more intensively. Credit from suppliers alleviated this effect by potentially providing an alternative source of funds to credit from financial institutions.

**Key Words:** Financial crisis, Credit constraints, Employment, Fixed-term Contracts

**JEL Classification Numbers:** J2, J41, G20, M51

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# 1 Introduction

The global financial crisis of 2008-09 has sparked renewed interest, both in academic and policy circles, in understanding the cyclicity of employment and, in particular, the link between financial constraints and credit availability and employment. Recent research has shown that financing constraints affect firm level employment decisions (Benmelech et al., 2011) and, in particular, that firms that borrowed from weaker banks or that tightened debt capacity in the period preceding the recent crisis, experienced a significantly larger fall in employment in the aftermath of the financial crisis (see Giroud and Mueller, 2015; Chodorow-Reich, 2014; Greenstone et al., 2014, for evidence on the US, and Bentolila et al., 2013, for evidence on Spain).<sup>1</sup>

This paper investigates how the financial crisis of 2008-09, and the resulting financing constraints imposed on firms, affect firms' decisions in terms of employment composition, when it is possible to choose between temporary and permanent contracts when hiring a worker. This question has received significantly less attention from researchers. Labour market responses to the crisis have been larger in European labor markets, characterized by strict employment protection legislation for regular contracts and by a dual structure, where flexible temporary contracts coexist with the protected permanent contracts. However, evidence on the effects of financial constraints, and in particular of the recent crisis, on firms' decisions regarding the composition of employment and the mix between temporary and permanent workers is limited.

We use employer-employee data for the universe of private sector firms and workers in Portugal, and exploit the 2008-09 crisis as a quasi-natural experiment to study the link between financing constraints and the intensity of fixed-term workers within firms. We also estimate, at the worker level, how financing constraints affect the probability of being hired with a temporary contract after the crisis. Our results complement those in Caggese and Cuñat (2008), who show evidence from survey data for Italy, that firms that self declare as financially constrained have higher shares of fixed-term workers.

Understanding the effects of financial constraints on temporary employment following the crisis is of importance given existing evidence that the increased use of fixed-term contracts, which have lower firing costs, has several adverse effects. These include increased employment volatility, lower wages of temporary workers, as unions tend to protect the interests of permanent workers in the wage bargaining, and lower labour mobility due to

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<sup>1</sup>Exploiting differential financing needs across sectors, Siemer (2014) and Duygan-Bump et al. (2015) show consistent evidence for firms in more financially dependent sectors in the US.

higher uncertainty. Moreover, the increase in worker turnover rates may negatively affect investment in firm-specific human capital and firms' provision of training, with potential negative effects on labour productivity (see e.g., Dolado et al., 2002 and Fialho, 2014).

Our findings of increased intensity of fixed-term employment and hires after the crisis, particularly for firms with higher dependence on external finance, suggest that increased uncertainty following the shock has led firms to increase the use of temporary employment contracts as a way to increase flexibility and save in future firing costs. This is particularly relevant in European labor markets where permanent workers are highly protected while temporary contracts have mild dismissal regulations. These results have important policy implications and are suggestive of potential long-term effects of the crisis with increasingly segmented labour markets, higher exposure to labor market frictions and decrease in the accumulation of human capital, as temporary workers often go through repeated spells of unemployment.

In addition to the availability of employer-employee data, Portugal offers a good setting to study the use of fixed-term contracts, as they represent a significant share of total employment, averaging 15 percent over the period, one of the largest in the EU. The average share of fixed-term hires was above 50 percent over the period. Similar to other European countries, workers with open-end contracts are highly protected against individual dismissal, but specific to the Portuguese labour market is the fact that employment protection regulation is weaker for temporary employment than in other EU countries.<sup>2</sup> The linked employer-employee data (LEED) that we use has unusually detailed information, including the workers' gender, age, education, occupation, and importantly for this study, the type of contract of employment, whether fixed-term or open-ended, as well as the hiring date in the firm, hours of work and earnings. Information for firms includes total sales, total employment, industry, location, number of establishments, legal and ownership structure.

We use industry-level measures of external financial dependence, access to buyer-supplier credit and asset tangibility, following the work of Rajan and Zingales (1998), Braun (2003) and Fisman and Love (2007), to identify credit supply effects. These measures are computed from firms' balance sheet data over the period that precedes the crisis, to avoid changes in firm behavior after the crisis to affect the sector measures of financial vulnerability, and are merged with the LEE data. As discussed in Rajan and Zingales (1998) and Braun (2003), technological differences across industries in their dependence

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<sup>2</sup>Legislation on dismissals and fixed-term contracts was not changed during the sample period. See Varejão and Portugal (2009) for a study of the use of fixed-term contracts in Portugal.

on external finance or asset tangibility reflect intrinsic properties of the sectors and persist across countries and time.<sup>3</sup> By exploiting cross-industry differences in external financial needs, which are intrinsic characteristics of an industry and, as such, exogenously determined from the perspective of individual firms, we circumvent the difficulty in this type of studies, of disentangling supply-side from demand-side changes in the credit market in response to the crisis.<sup>4</sup> We employ a difference-in-difference identification strategy, and estimate differences in the use of temporary employment contracts for firms in industries with intrinsically higher dependence on external finance, or lower access to trade credit, relative to firms in industries with lower financial vulnerability, after the financial crisis, controlling for firm characteristics.

We start by estimating the effect of the crisis on employment within firms and sectors, and find that the crisis is associated with negative effects on employment and with increased employment volatility. The overall employment effects are not significantly different for firms in sectors with higher dependence on external finance or lower access to trade credit. Our main results, on the effects of financial constraints on the intensity of fixed-term employment contracts following the shock, show that firms in industries with higher dependence on external finance increased the share of fixed-term employment, relative to firms with lower external financial needs after the 2008-09 crisis. We account for firms' unobserved characteristics, which absorb any systematic differences across firms with different degrees of financial dependence, and for aggregate trends.

These findings suggest that as a result of financing constraints and increased uncertainty, firms increased demand for the more flexible temporary workers after the crisis, particularly those in more financially dependent sectors. Interestingly, firms in sectors with intrinsically higher access to buyer-supplier credit exhibit relatively lower shares of fixed-term employment and hires, relative to other firms, after the crisis. This suggests that implicit borrowing in the form of trade credit may have provided an alternative source of funds to credit from financial institutions during the crisis (see Fisman and Love, 2003) and alleviated the need to use temporary workers, which potentially have lower productivity (Caggese and Cuñat, 2008). Results are consistent when we define our dependent variable as the share of workers hired with a fixed-term contract in total

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<sup>3</sup>Rajan and Zingales (1998) and Braun (2003) argue that the measures capture sectors innate technological properties, and vary significantly more across sectors than across firms within an industry, or over time. These measures have been extensively used, e.g. by Duygan-Bump et al. (2015) to study the effects of the global crisis, and by Manova (2013) to study credit constraints and international trade, amongst others.

<sup>4</sup>A similar approach was followed by Duygan-Bump et al. (2015) and Siemer (2014), amongst others.

hires within firms, indicating that firms in more financially vulnerable sectors increased the share of hires with temporary contracts after the crisis, relative to firms with lower external financial needs.

We then estimate worker-level specifications for the likelihood of being hired with a fixed-term contract, for the sample of workers hired by firms over the period. We find that after the crisis, workers are more likely to be hired with a temporary contract if employed by firms in sectors with high dependence on external finance, but less likely if hired by firms in industries with higher access to credit from suppliers, controlling for workers' observable and unobservable characteristics.

Since we use the share of fixed-term workers in total employment, and estimate differential effects for firms based on external financial dependence of their sector, computed prior to the crisis, our methodology alleviates identification concerns (in studies of the effect of financial constraints on employment, in particular) that measures of finance availability may be correlated with demand for the firms' goods and hence their demand for labor. To provide an additional test of our identification, we use the 2001 crisis that originated in the ICT sector, and find no statistically significant effects on temporary employment contracts. Our results based on quasi-natural experimental evidence are thus consistent with the role of financial constraints on the intensity of fixed-term employment within firms.

The paper proceeds as follows. The next section reviews the related literature. In Section 3 we describe the data used, the construction of the main variables and the empirical strategy. Section 4 presents the quasi-natural experiment and discusses the results. The last section concludes.

## 2 Related literature

This paper is related to a recent literature that has studied the effects of financial constraints on employment decisions of firms with different degrees of exposure to a financial shock. Chodorow-Reich (2014), uses employment data from the U.S. Bureau of Labor Statistics (BLS) and the borrowing history of firms that accessed the syndicated loan market, to study the effect of bank lending frictions during the 2008-09 crisis on employment. The author finds that firms that had borrowed from less healthy financial institutions before the crisis had lower probability of obtaining a loan after the crisis and reduced employment by more, relative to firms that borrowed from healthier lenders before the crisis.

Greenstone Mas and Nguyen (2014) show consistently that the withdrawal of lending to small firms accounted for statistically significant negative effects on county employment during the recession. These results are consistent with a literature that emphasizes that smaller firms are likely to be more vulnerable to credit supply constraints due to larger asymmetric information, and less transparency (Gertler and Gilchrist, 1994).

Using a similar approach, but focusing on Spain, Bentolila et al. (2013) study employment changes from 2006 to 2010 for firms that obtained a significant share of funding from banks in Spain that were bailed out by the government as a result of the financial crisis, relative to firms that borrowed from healthier banks. The authors find that firms that borrowed from weak banks suffered a significantly larger fall in employment. Benmelech et al. (2011) exploit variation in the amount of maturing debt, bank deregulation in the U.S., and the contraction of loans made by Japanese affiliate banks in the U.S. during the 1990's as quasi-experiments. They show that labor is sensitive to financial constraints and that the provision of bank credit affects unemployment, suggesting that finance plays an important role in firm-level employment decisions.

Giroud and Mueller (2015) use establishment-level data for the U.S. to study the relation between changes in house prices and changes in employment during the recession. The authors split samples based on median values in firm leverage (debt over assets) change between 2002 and 2006, and show that “high-leverage firms” (which tightened debt capacity in the period preceding the crisis) had significantly larger employment declines in response to household demand shocks than “low-leverage firms” (which freed up debt capacity). They also show that all job losses resultant from falling house prices are concentrated among high-leverage firms.

Siemer (2014) and Duygan-Bump et al. (2015) rely on an identification strategy similar to that employed in this paper, exploiting differences across sectors in external finance dependence. Siemer (2014) uses a measure of financial external dependence across sectors, and employment data from the BLS and finds that small and young firms in sectors with high dependence on external finance had lower employment growth than firms in sectors with low dependence on external finance, as a result of the 2008 recession. The author also develops a heterogeneous firm model with endogenous firm entry and financial constraints to study the effect of a financial shock on small and young firms. Duygan-Bump et al. (2015) also use BLS data and exploit industry-level external financial dependence (the proportion of capital expenditures financed with external funds) to study transitions from employment to unemployment at the worker-level. They find that the

probability of becoming unemployed during the financial crisis is larger for workers in industries with high external finance dependence relative to those in industries with low dependence on external finance.

Different from these studies, which all focus on total employment effects of the crisis, we study how the crisis affected the relative use of fixed-term versus permanent workers at the firm-level, and the probability of being hired with a fixed-term (temporary) contract following the crisis, by exploiting differences across industries in external financial needs. The main contribution of this paper is to study how financing constraints affect the decision to hire fixed-term workers in response to financial shocks. This is an important issue given existing evidence that the increased use of fixed-term employment contracts increases overall employment volatility and affects wages, labour mobility and investment in human capital (Dolado et al., 2002).

A branch of the literature has studied the interaction between fixed-term and permanent employment contracts, and the effects of fixed-term contract availability on unemployment. Focussing particularly on European countries, where reforms to labor laws that regulate fixed-term contracts permitted such studies, empirical research has found that fixed-term employment absorbs a higher share of output volatility and increases overall employment volatility, while the effects on unemployment are ambiguous (see e.g., Dolado et al., 2002; Alonso-Borrego et al., 2005; Blanchard and Landier, 2002; Kugler and Pica, 2004).

However, these studies do not address the potential effects of financing constraints on the use of fixed-term contracts by firms. As such, our paper is more closely related to, and complements results in Caggese and Cuñat (2008), who study the interaction between financing constraints and the employment decisions of firms that can choose between fixed-term and permanent workers. The authors develop a model that shows that financing constraints are important in determining the optimal mix between fixed-term and permanent workers, and test this empirically using survey data for a sample of small and medium Italian manufacturing firms from 1995 to 2000. Their measures of financing constraints are constructed from answers to survey questions about whether the firm (1) had a loan application turned down recently, (2) desires more credit at the market interest rate, and (3) would be willing to pay a higher interest rate than the market rate to obtain credit. We instead exploit the crisis of 2008-09 as a quasi-experiment to identify the effects of an exogenous shock that affected firms financing conditions on the intensity of fixed-term contracts, and we use the population of private sectors firms for analysis.



Our paper is also related to studies on the effect of financial imperfections on firms' labour demand. Nickell and Nicolitsas (1999), using UK data find that increased financial pressure has a large negative effect on employment and pay rises. Smolny and Winker (1999) report consistent evidence for Germany, that financing constraints reduce employment and increase employment volatility. Benito and Hernando (2003) show that demand for fixed-term employment is less persistent, more sensitive to wage costs and to financial factors.

## 3 Data and methodology

### 3.1 Data

We investigate how the global financial crisis of 2008-09, and the subsequent financing constraints, affect employment decisions of firms when it is possible to choose between temporary and permanent contracts when hiring a worker. The main data source used in this paper is the Portuguese linked employer employee data *Quadros de Pessoal (QP)*, for the period 2002 through 2012. These data have been collected annually since the 1980s by the Portuguese Ministry of Labour and Social Security. The data include information on all private sector firms that employ at least one wage earner, and on all of their plants and all of their employees. Firms are required by law to answer the survey and to have it publicly available at the workplace. This ensures a high degree of coverage and reliability of the data. The data contains information on 4959547 unique workers and 492623 unique firms, which we trace over time using their unique registration number.

Information on workers includes, for example, the type of contract of employment (fixed-term or permanent), hiring date in the firm, date of last promotion, monthly hours of work (normal and overtime), earnings, gender, age, schooling, level of skill, and occupation. The variable "Type of contract of employment" allows us to identify whether each worker is employed with a permanent or with a fixed-term employment contract; this variable has been collected since 2000. A permanent contract of employment means that the employment relation has no definite duration, that is, the employment contract is open-ended. Fixed-term employment contracts are intended by law to fulfill firms' temporary work needs and hence the timing to the end of the employment relation is specified in the contract when the worker is hired.<sup>5</sup> We use the terms temporary and

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<sup>5</sup>Also, by law, fixed-term employment contracts cannot exceed three years of duration; and can be renewed, at most, three times. If these limits are reached, the firm would need to either layoff the workers or move them to an open-ended contract. The rationale for this is that if a worker is employed for over

fixed-term interchangeably throughout the paper.

Firm level data include, for example, the year of creation, industry, region, total number of workers, number of establishments, sales volume, legal structure and ownership type (equity breakdown among domestic private, public or foreign). Our analysis includes only firms operating in the manufacturing and services sectors.

We merge the matched employer-employee data with measures of financial dependence of the sector the firm belongs to, calculated over the period prior to the crisis. Data to compute these measures is from firms' balance sheets from *Sistema de Contas Integradas das Empresas* (Enterprise Integrated Accounts System, SCIE). This data is collected by the Portuguese Office for National Statistics (INE) and covers the universe of firms in manufacturing and services since 2004. Before starting to collect the SCIE data, the INE implemented the *Inquérito à Empresa Harmonizado* (Harmonized Business Survey, IEH), a representative annual survey covering around 40 000 firms. Together, the SCIE and the IEH provide detailed balance sheet data for firms which we use to construct measures of financial vulnerability, described in more detail below.

[Table 1 about here]

Table 1 reports summary statistics for the firms in our sample, in each year. As shown, fixed-term contracts represent a significant share of total employment within firms in the Portuguese labor market, averaging 15 percent over the period (column 2). As discussed in Portugal and Varejão (2009), in 2003 Portugal had the second largest share of fixed-term employment of the 15 members of the European Union, second only to that of Spain. In a related study about the use of fixed-term contracts, Caggese and Cuñat (2008) report a significantly lower average share of fixed-term workers at the firm-level in Italy, of 4 percent. Table 1 also shows that the proportion of fixed term employment increased during the crisis, and in 2009 it exceeded 17 percent of total employment. Although the share of fixed-term employment decreased in 2010, it started to increase again from 2011 onwards.

To investigate whether there is a differential use of fixed-term workers for financially constrained firms after the crisis, the main dependent variables in our specifications are the share of fixed-term workers in total employment at the firm-year level and, alternatively, the ratio of fixed-term workers over permanent workers, conditional on the existence

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three years at the firm, the firm's requirement would be for a permanent rather than for a temporary worker.

of permanent workers within the firm. In some of our specifications, we focus on the share of hires with fixed-term contracts in total number of workers hired in each year at the firm-level. We identify the permanent and fixed-term hires by combining information on the workers' "type of contract of employment" and the "hiring date" of the worker in the firm. For each firm-year we compute the number of new hires with temporary employment contracts and those with permanent employment contracts. We then obtain the ratio of fixed-term hires over total hires, and the ratio of fixed-term hires over permanent hires. As shown in Table 1, the share of hires with fixed-term contract in total hires (column 4) averaged 51 percent within firms across the years.

To analyze the effects of the crisis, we identify the global financial crisis period by defining a binary variable, *Dcrisis*, that takes the value of 1 from 2008 onwards and zero otherwise. September 2008 has been considered in other studies as the month when the crisis started since it was marked by several major financial institution failures and bailouts, including Lehman Brothers and AIG, that triggered a sharp escalation in the global credit crunch (see e.g. Chor and Manova, 2011). In September 2008 Lehman Brothers filed for bankruptcy after not being able to obtain short-term financing or to find a buyer. The cost of interbank lending soared immediately (see Chodorow-Reich, 2014, for more details).

### **3.1.1 Measures of external finance dependence, asset tangibility and trade credit**

We require measures of financial dependence to identify differential effects for financially constrained firms. In our empirical strategy we exploit differences in the sensitivity to credit availability across sectors and use the global financial crisis of 2008-2009 as a shock to credit supply. Previous research has shown that some sectors are more vulnerable to external finance than others. Two reasons are usually pointed for this. First, firms in some sectors have substantially larger liquidity needs, for example, because of the initial project scale, the requirement for continuing investment, or the cash harvest period (Rajan and Zingales, 1998). Second, firms in sectors that are intrinsically associated with more tangible (harder) assets can borrow more easily (Braun, 2003). As discussed in Rajan and Zingales (1998), the technological differences across industries in their dependence on external finance reflect intrinsic properties of the sectors and persist across countries. Fisman and Love (2003) further highlight the importance of trade credit as an alternative source of funds to borrowing from financial institutions. The amount of trade credit that

firms obtain from their suppliers captures the importance of trade credit in the financing of economic activity.

We construct industry measures of financial vulnerability based on data for Portuguese firms for the period between 1997 and 2006. To construct these measures we use the SCIE and the IEH balance sheet data, for the period that precedes the crisis so that the effect of the financial crisis on firm behavior does not contaminate the measures of the sector's financial vulnerability. We use common proxies for the financial vulnerability of sectors: external finance dependence and asset tangibility; and a third measure for the importance of trade credit. We follow the literature in computing the measures of tangibility and liquidity. We first calculate financial vulnerability at the firm level as an average measure over the 1997-2006 period, for all firms in the SCIE/IEH data. We then use the median value across all firms within a 2-digit ISIC rev 3.1 sector as the sector's measure of external financial dependence (*extfin*), tangible assets (*tang*) and trade credit (*tcred*).<sup>6</sup>

External financial dependence (*extfin*) is measured by the share of total capital expenditure that is not financed by internal cash flows from operations. This measure reflects the firms' dependence on external finance (Rajan and Zingales, 1998). The measure of trade credit (*tcred*) is the ratio of total accounts payable over total cost of goods sold, following Love et al. (2007).<sup>7</sup> This measure reflects access to client-supplier credit, the credit firms receive from their suppliers instead of making up-front payments for supplies (Fisman and Love, 2003). This type of credit reflects short-term operating requirements of credit and could have acted as an alternative to credit obtained from financial institutions during the financial crisis. Fisman and Love (2003) show that industries with higher dependence on trade credit financing have higher growth rates in countries with weaker financial institutions, suggesting that trade credit may provide an alternative source to bank credit.

The measure of asset tangibility (*tang*) is computed as the share of net plant, property and equipment in total book-value assets. This measure reflects firms' ability to use tangible assets as collateral to obtain external finance (Braun, 2003; Claessens and Laeven, 2003). These industry measures are widely regarded as technologically determined characteristics of a sector, intrinsic to the sector and exogenous for a particular firm.

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<sup>6</sup>We also calculate the same measures restricting the analysis to the period 2004-2006 when the SCIE data covers the universe of firms. Results remain robust for these alternative measures. As discussed in the literature, these measures tend to be stable over time, and to show much larger variation across industries than across firms within a given industry.

<sup>7</sup>This measure is computed over 2006-2007 because the data distinguishes firms credit obtained exclusively from suppliers only since 2006.

Table A2 shows summary statistics for these measures.

### 3.2 Empirical strategy

To study the relationship between financing constraints and the employment decisions of firms with respect to the use fixed-term and permanent employment contracts, we implement a difference-in-difference approach. The aim is to investigate whether firms in sectors with high dependence on external finance increase their use of fixed-term contracts disproportionately after the crisis, relative to firms in sectors with low financial vulnerability, since the financial crises reduced the availability of external credit to firms. Hence, we estimate specifications of the form:

$$Y_{jst} = \beta_1 Dcrisis_t \times FIN_s + \beta_2 Dcrisis_t + \beta_3 FIN_s + \theta X'_{jt} + d(.) + \epsilon_{jst}. \quad (1)$$

where the dependent variable,  $Y_{jst}$ , is one of the firm outcomes, such as employment level or volatility and, most importantly, the measures of fixed term-contract intensity: the share of fixed-term employment in total or permanent employment in firm  $j$ , industry  $s$  and year  $t$ .  $Dcrisis_t$  is an indicator that takes the value 1 on and after 2008, and 0 otherwise. September 2008 is generally considered as the onset of the crisis. In July 2007 the interbank market interest rate increased following the announcement by the French bank BNP Paribas of the freezing of three investment funds based on impossibility to value its subprime assets. Other banks followed in freezing their subprime portfolios. In March 2008, the withdrawal of short-term financing to Bear Stearns lead to its sale to J.P. Morgan. Financial conditions then stabilized temporarily, but worsened severely in September 2008 with Lehman Brothers' reports of losses and subsequent bankruptcy after not being able to obtain short-term financing or to find a buyer. The cost of interbank lending soared as a result (see Chodorow-Reich, 2014, for details).

$FIN_s$  is one of the measures of financial dependence for industry  $s$ , external finance dependence (*extfin*), access to trade credit (*tcred*), and collateralizable assets (*tang*), respectively. In addition to the continuous industry measures of financial dependence,  $FIN_s$ , in alternative specifications we use dummy variables that take the value of 1 for industry  $s$ , if that industry is above the median for the respective  $FIN$  measure and zero otherwise,  $I_{above-med}^{FIN_s}$ . The strategy of dividing sectors in two groups, one with below-median sectors in terms of the measures of financial dependence, and the other with above-median sectors in those measures, has been employed in other existing studies (see

e.g. Giroud and Mueller, 2014; Duygan-Bump et al., 2015). In those specifications, the coefficient  $\beta_1$  is interpreted as the differential effect of the crisis for firms in industries above the median of financial dependence relative to firms in industries below the median.

$X'_{jt}$  is a vector containing firm characteristics, such as the lagged log value of sales (in real terms), the legal structure, whether the firm is an exporter, foreign-owned, or multiplant. We also include a set of fixed effects  $d(\cdot)$  to control for general trends, for region and industry fixed effects or, in alternative to industry, for firm time-invariant characteristics. The stand-alone variable  $FIN_s$  is absorbed by industry characteristics and is not included when industry fixed effects are controlled for. Similarly, the stand-alone crisis dummy variable,  $Dcrisis_t$ , is absorbed by year fixed effects, and thus not included when we control for year fixed effects.  $\epsilon_{jst}$  is a random disturbance term.

In all empirical specifications, standard errors are clustered by industry. Given the fixed effects included, the coefficient of interest, on the interaction between the crisis dummy and the financial dependence measures,  $Dcrisis_t \times FIN_s$ , is interpreted as the differential effect of the crisis on the intensity of fixed-term contracts for firms in sectors with high, or above-median external financial dependence, relative to firms in other sectors. We expect the sign of the coefficient to be positive for *extfin*, and negative for *tcred* since firms in sectors that rely more on client-supplier (trade) credit could have used trade credit as an alternative to formal credit from financial institutions, alleviating the effects on fixed-term employment. The sign of the coefficient on *tang* is expected to be negative if firms are able to use tangible assets as collateral to obtain external finance during the crisis.

We also use worker-level data to investigate whether workers hired in the period of analysis in firms within industries with higher financial vulnerability were more likely to be hired with a temporary contract after the crisis, relative to workers hired by firms in industries with lower financial dependence. For that purpose, using the sample of workers that were hired during our sample period, we estimate a linear probability model for the probability of a worker being hired with a temporary employment contract.<sup>8</sup> We estimate the following specification:

$$\Pr[fixed\_term_{ijst}] = \beta_1 Dcrisis_t \times FIN_s + \beta_2 Dcrisis_t + \beta_3 FIN_s + \theta X'_{jt} + \theta Z'_{it} + d(\cdot) + \epsilon_{ijst}. \quad (2)$$

where the dependent variable  $\Pr[fixed\_term_{ijst}]$  is the probability of being hired with a

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<sup>8</sup>Results remain robust to using a probit for estimation.

temporary contract, so  $fixed\_term_{ijst} = 1$  if worker  $i$  was hired by firm  $j$  (in industry  $s$ ) in year  $t$  as a temporary worker (with a fixed-term contract), and zero if hired with a permanent contract.  $Z_{it}$  is a vector of worker ( $i$ ) characteristics, including the workers' gender, age (and its square), level of education attained, potential labor market experience (and its square), level of skill, and occupation.  $X_{jt}$  is a vector of firm characteristics as before. We also include a set of fixed effects  $d(.)$  that control for time, region, firm or industry characteristics. The variables  $Dcrisis_t$  and  $FIN_s$  are as defined as above. The coefficient of interest, on the interaction term  $Dcrisis_t \times FIN_s$  measures the differential effect on the probability of being hired with a fixed-term contract for workers in industries with higher (or above-median) financial dependence, relative to workers in other industries, after the 2008-09 crisis, controlling for all workers and firms characteristics.

## 4 Results

### 4.1 Effect of the crisis on firm total employment

We start by investigating the effect of the 2008-09 crisis on average total employment and employment volatility. We regress the log of employment and a measure of employment volatility at the firm-year level, respectively, on the crisis dummy variable,  $Dcrisis_t$ . We control for region characteristics that may affect employment across firms, and for industry or firm fixed effects to absorb any systematic differences across industries or firms that may affect employment outcomes. Results reported in columns (1) and (2) of Table 2 show that firm level employment declined after the crisis, within firms and across firms within an industry. These results are consistent with other studies that document overall employment decreases after the crisis (e.g. Greenstone et al., 2014). In columns (3) and (4) we investigate the effect on employment volatility. We regress the coefficient of variation of total employment at the firm-level, calculated over a five year window for the periods pre- and post-crisis, for 2003-2007 and 2008-2012, on the  $Dcrisis_t$  variable and the same sets of fixed effects. Results show that after controlling for firm unobserved characteristics, the volatility of total employment increases, on average, after the crisis.

[Table 2 about here]

Next, we assess if there are differential employment effects for firms in sectors with intrinsically higher external financial needs, lower dependence on buyer-supplier trade

credit, or lower shares of collateralizable assets. We estimate a specification similar to Eq. (1) with the same employment dependent variables as in Table 2. Results are reported in Table 3. Odd columns report results using the continuous measures of financial dependence across sectors, and even columns use the indicator variable for whether the sector is above the median for the correspondent measure of financial vulnerability. All columns include region, year and firm fixed effects, thus controlling for any systematic differences across firms in the treatment and control groups, and for region characteristics and global trends. The coefficient of interest is now that on the interaction  $Dcrisis_t \times FIN_s$ , which estimates the differential, if any, in terms of employment outcomes for firms in sectors with higher financial dependence, relative to firms in sectors with lower financial vulnerability. The lower order terms of the interaction are absorbed by the fixed effects included.

We do not obtain significantly different effects of the crisis in terms of employment level (Panel A) or volatility (Panel B) for firms that rely more on external finance or have less access to credit from suppliers.<sup>9</sup> An hypothesis to explain this result is that, in a labor market with strict employment protection legislation for permanent workers and where fixed-term contracts are available with low firing costs, firms in more financially dependent sectors might have used fixed-term contracts as a flexible device to adjust employment. As a result, overall employment effects of the crisis would have been less pronounced. For example, firms might have been more willing to hire workers after the crisis, e.g. those who became unemployed due to the termination of permanent or temporary contracts in their previous job, because they could offer them a fixed-term contract and retain the flexibility to lay them off with lower costs. We find that firms in sectors with tangible asset shares above the median experienced a significantly larger drop in employment and increased employment volatility after the crisis, relative to firms in sectors with lower shares of tangible assets. In the next sections we investigate differential effects of the crisis on the use of fixed-term employment across firms based on their sectorial external financial dependence.

[Table 3 about here]

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<sup>9</sup>We obtain a significant coefficient in column (3) but it is positive rather than negative.



## 4.2 Effect of the crisis on fixed-term employment: firm-level

This section presents the main results of the paper. We are interested in identifying how financial constraints affected firms' decisions to hire fixed-term versus permanent workers after the crisis, and thus the share of fixed term employment and hires within firms. We estimate Eq. (1) and use two alternative dependent variables to measure the intensity of fixed-term employment contracts within firms: the share of fixed-term workers in total employment, and the ratio of fixed-term to permanent employment. We estimate specification (1) by OLS, but results remain robust to using Tobit for estimation. The results are reported in Panels A and B of Table 4, respectively. Given the difference-in-difference identification approach, the coefficient on the interaction term between the crisis dummy and the measure of financial dependence,  $Dcrisis_t \times FIN_s$ , identifies how firms in sectors that are intrinsically more dependent on external finance, or that have wider access to buyer-supplier credit prior to crisis change the share of fixed-term employment after the shock, relative to firms in sectors with lower external finance needs. Odd columns report results when using the continuous measures of  $FIN_s$ , described in section 3.1.1, while even columns use the dummy variable for whether the sector is above the median in terms of the corresponding measure of financial dependence,  $I_{above\_med}^{FinVuln}$ .

We report results that control for year fixed-effects and thus do not include the stand-alone dummy for the crisis period, and for region fixed effects, to control for any regional characteristics that might affect the share of fixed-term employment for all firms. We also control for industry or firm unobserved characteristics alternatively in the columns of the Table, and always include as controls the firm's log sales in the previous year, and dummies for firm ownership, legal structure and multiestablishment. Standard errors are always clustered by industry.

[Table 4 about here]

The results reported in Panel A of Table 4 show that the coefficient on the  $Dcrisis_t \times FIN_s$  interaction is positive and statistically significant for the measure of dependence on external finance. Firms in sectors with substantially larger liquidity needs, in particular those above the median value across sectors, increased the share of fixed-term employment after the crisis, relative to firms operating in sectors with external financial needs below the median. This result is obtained both across firms within a sector and within firms, after the onset of the financial crisis. The effect is also economically sizeable. In particular,

controlling for firm characteristics, the coefficient in column 4 represents an increase of 0.6 percentage points, corresponding to a 4 percent increase relative to the sample mean of 15 percent, in the share of fixed-term employment for firms above the median dependence on external finance after the crisis, relative to firms in sectors with external finance dependence below the median. Results reported in Panel B use the ratio of fixed to permanent employment, and are thus restricted to a sample of firms that employ both types of workers. Results remain consistent although the significance level of the coefficients is smaller.

The finding that firms with more financing constraints increase the share of temporary workers following the crisis, suggests that to deal with increased uncertainty and expectation of further financing constraints, firms use fixed-term workers more intensively, as they offer greater flexibility to adjust employment in the face of negative shocks, given the lower firing costs associated with this type of contracts.

Columns (5) through (8) of Table 4, use the importance of buyer-supplier (trade) credit as the (inverse) measure of  $FIN_s$ . When we use our preferred measure, the dummy variable to separate firms into the two bins of above- or below-median of the sector measure of financial dependence, the estimated coefficient on the interaction  $Dcrisis_t \times I_{above-med}^{FIN_s}$ , is negative and statistically significant. This result suggests that firms in industries that rely more on credit from suppliers experienced a lower effect of the crisis on the intensity of fixed-term employment relative to firms with below-median access to trade credit. An hypothesis to explain this result is that access to trade credit was used as an alternative source of funds to credit from financial institutions. Firms with access to this type of credit would experience lower effects as they need not seek the additional flexibility from fixed-term workers, given that they are likely to be relatively less productive than permanent workers (Caggege and Cuñat, 2008). Results remain robust when we use as dependent variable the ratio of fixed to permanent workers (Panel B). In columns (9)-(12) we consider sectors intrinsically associated with more tangible (harder) assets, relative to those with lower endowment of tangible assets ( $tang$ ) as the (inverse) proxy for financial vulnerability. We do not find statistically significant differences in terms of the mix between fixed-term and permanent employment for firms in above-median sectors in terms of tangibility of assets, relative to those in below-median sectors.

In Table 5, we investigate whether firms that are more financially dependent before the crisis hire a larger proportion of fixed-term workers after the crisis, relative to firms with lower financial vulnerability. To that end, we estimate Eq. (1) but using information

on the new hires within each firm-year, that is, the dependent variable is now the ratio of new workers hired with a fixed-term contract over the total number of new workers hired by the firm each year. This allows us to test the hypothesis that firms in more financially vulnerable sectors hire a larger fraction of fixed-term workers after the crisis than firms in sectors with lower financial vulnerability. This also avoids the potential issue of employment shares being affected by the dismissal rate at the firms during the crisis. Table A1 reports summary statistics for new worker hires in each year during our sample period. Around half a million workers were hired each year, on average, during the period, and around 58 percent of new hires, on average, were employed with a fixed-term contract. We want to investigate the role of financial vulnerability in the intensity of fixed-term hiring contracts after the crisis. The results are conditional on firms hiring fixed-term workers in the periods before and after the crisis. We continue to include the same sets of controls and fixed effects as above.

The estimates obtained for the sample of hires, using the sector-level measure of external financial dependence (*extfin*), are reported in columns (1) through (4) of Table 5. We continue to obtain a positive and statistically significant coefficient on the interaction term between the financial dependence measure and the post crisis dummy,  $Dcrisis_t \times FIN_s$ , for both the continuous measure and the dummy that separates firms in the two bins of above- and below-median of financial vulnerability. That is, we find that after the crisis firms with high dependence on external finance increase the share of hires with fixed-term contract in total hires disproportionately, relative to firms with below-median dependence. This result is obtained when controlling for firm fixed effects, thus absorbing any differential hiring preferences and policies of firms, as well as other unobserved firm characteristics. The magnitude of the coefficient is also economically sizeable, implying a differential increase of 1.4 percentage points, corresponding to a 3 percent increase relative to the sample mean of 51 percent in the share of fixed-term hires, for firms in the above-median group relative to those in the control group (column 4).

The remaining columns of the table report results for the measures of trade credit and asset tangibility to proxy for  $FIN_s$ . We do not find evidence of differential effects of the crisis for firms ranked by these measures in terms of the share of temporary employment contracts for new hired workers by firms. Although for trade credit the coefficients are still negative, they are now statistically insignificant.

[Table 5 about here]

In sum, our results are consistent with the interpretation that financing constraints played a role in the decisions of firms to hire fixed-term workers after the crisis. We find robust evidence that firms in sectors with above-median dependence on external finance increased the share of fixed-term employment contracts after the crisis. Our results have important policy implications given that empirical research has found that fixed-term workers tend to earn lower wages and jump from one contract to another with repeated spells on unemployment. These contracts have been shown to affect mostly young, women or poorly educated workers (see e.g. Portugal and Varejão, 2009; Bentolila and Dolado, 1994). The finding that the use of this type of contracts increased after the crisis uncovers a new cost of the shock with potential long-term effects in terms of exposure to labor market frictions and decrease in the accumulation of human capital for temporary workers. This is particularly relevant in European labor markets, characterized by a dual structure where workers in open-ended contracts are highly protected, while those in temporary contracts are subject to mild dismissal regulations.

### 4.3 Effect of the crisis on fixed-term employment: worker-level

In this section we exploit worker-level information, and investigate whether workers hired in the period of analysis in firms within industries characterized by intrinsically higher financial vulnerability were more likely to be hired with a temporary contract after the crisis, relative to workers hired in industries with low dependence on external funding. For that purpose, we use the sample of workers that were hired during the period of analysis, and estimate a model for the probability of a worker being hired with a temporary employment contract.<sup>10</sup> We estimate Eq. (2), where the dependent variable takes the value of 1 if the worker was hired with a temporary contract in year  $t$ , and zero if hired with a permanent contract. We obtain OLS estimates, since we include firm fixed effects, along with region, and year fixed effects, given concerns of biases resulting from nonlinear estimates with fixed-effects. In alternative specifications, without firm fixed effects, we obtain similar estimates when using Probit for estimation. Our estimates control for the same firm-level variables as before, and additionally for worker characteristics, gender, age, experience and their squares, education level and skill level.

In the columns of Table 6, we report results for the same three measures of financial vulnerability: external finance dependence (*extfin*), access to supplier credit (*tcred*) and

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<sup>10</sup>The QP employer-employee data does not trace workers from unemployment into employment, and so only firm to firm transitions can be analysed.

asset tangibility (*tang*). The coefficients on the interaction between the post-2008 dummy and the measures of financial vulnerability are positive and statistically significant for *extfin*, and show that controlling for workers' observed characteristics, workers hired by firms within industries with above-median external finance dependence are more likely to be employed with a temporary contract after the crisis, relative to workers hired by firms with below-median dependence on external finance. The point estimate of 0.037 in column (2) means that the relative impact of the recession was to increase the probability of a fixed-term contract by 3.7 percentage points for workers in industries with above-median dependence on external funds.

[Table 6 about here]

Columns (3) and (4) report results that show that workers hired in industries that have wider access to credit from suppliers were less likely to be hired on a temporary basis, after the crisis, relative to workers hired by firms in industries with below-median access to trade credit. As discussed above, and consistent with studies that find that access to trade credit may be an alternative source of funds to credit from financial institutions (Fisman and Love, 2003), these results suggest that firms in industries that have credit extended by their upstream suppliers instead of having to make spot payments for supplies had less need to rely on fixed-term workers when hiring. This evidence suggests that trade credit can offer firms a substitute for formal bank loans and alleviate the need to use fixed-term contracts to gain flexibility to adjust employment in the future. For the tangibility measures, we find positive and significant coefficients on the probability of temporary employment contract.

#### 4.4 Robustness checks

Our results reported in the previous sections show that financing constraints affect employment decisions and the mix between fixed-term and permanent workers in the firm. In particular, following the 2008-09 crisis, firms in sectors with higher external finance dependence increased the use of fixed-term employment contracts, potentially to increase flexibility to adjust employment when facing liquidity stocks. Results are thus consistent with the role of shocks to credit supply. To provide additional evidence that our results are driven by differential financial dependence across industries, we follow Duygan-Bump et al. (2015), and perform similar analysis to that reported in previous sections, but using

the 2001 recession, which was triggered by the bursting of the bubble in the information and communications technology (ICT) sector, and did not originate in financial markets.

The 2001 recession did not affect firms access to credit, as the current crisis did, and it serves as a placebo test of our main results if changes in the use of fixed-term employment are not related to the dependence of external finance across industries. Therefore, we should find no significant differential effects for firms in industries with different levels of external finance dependence or access to trade credit, relative to firms in other sectors after the 2001 crisis. That is, we expect the coefficient on the interaction term  $Dcrisis_t \times FIN_s$  to be statistically insignificant for the 2001, ICT-driven crisis. We estimate specifications similar to Eq. (1), but the post-shock dummy,  $Dcrisis_t$ , is now defined for the period after the 2001 crisis. The *Quadros de Pessoal* matched employer-employee data was not collected in 2001, and the variable that distinguishes the workers' contract of employment, whether fixed-term or permanent, was only introduced since 2000, as such we are restricted to using the period from 2000 for the placebo test, and define the  $Dcrisis_t^{2001}$  to take the value of 1 for the years after the 2001 crisis, and zero for 2000.

Results at the firm-level are reported in Table 7. We estimate a specification similar to that reported in Table 4, controlling for the same covariates and fixed effects but for the 2001 crisis. As shown, the coefficient on the interaction term between the Post-2001 dummy and the measures of financial dependence are statistically insignificant, showing that financing constraints are insignificant in explaining employment mix following the 2001 crisis. This provides additional support to our main results, for the 2008-09 financial crisis.

[Table 7 about here]

Table 8 reports results at the worker-level, where, similar to the results reported in Table 6, we regress the probability of a worker being hired with a fixed term contract on the  $Dcrisis_t^{2001} \times FIN_s$  interaction term and all the worker- and firm-level controls and fixed effects, as discussed above. Again, the coefficient on the main variable of interest is not statistically significant for all three proxies for financial vulnerability (or its inverse). This provides further support for the role of financing constraints in the decision of firms to hire fixed-term versus temporary workers.

[Table 8 about here]

## 5 Conclusion

This paper investigates how the financial crisis of 2008-09, and the resulting financing constraints imposed on firms, affects firm's decisions in terms of employment composition, when temporary and permanent contracts are available when hiring a worker. Labor market responses to the crisis have been large in European labor markets, characterized by strict employment protection for regular contracts and by flexible temporary contracts. However, evidence on the effects of financial constraints, and in particular of the recent crisis, on firms decisions regarding the composition of employment, and the mix between temporary and permanent workers is very scant.

We use employer-employee data for the universe of private sector firms and workers in Portugal, and exploit the 2008-09 crisis as a quasi-natural experiment to study the link between financing constraints and the intensity of fixed-term workers within firms. We also estimate at the worker level the effects of financing constraints on the probability of being hired with a temporary contract after the crisis. Credit supply effects are identified by industry-level measures of external financial dependence, following Rajan and Zingales (1998), computed over the period that precedes the crisis, to avoid changes in firm behavior after the crisis to affect the industry-level measures.

We find that firms in industries with higher, or above-median, dependence on external finance increased the share of fixed-term employment and hires after the 2008-09 crisis, relative to firms with lower, or below-median, external financial needs. We account for firms' unobserved characteristics, which absorb any systematic differences across firms and for aggregate trends. Firms in sectors with intrinsically higher access to buyer-supplier credit exhibit relatively lower shares of fixed-term employment and hires, relative to other firms, after the crisis. This suggests that implicit borrowing in the form of trade credit may have provided an alternative source of funds to credit from financial institutions during the crisis, and alleviate the need for increased flexibility by hiring temporary workers, which could be less productive. We also find that workers are more likely to be hired with a temporary contract if employed by firms in sectors with high dependence on external finance, but less likely if hired by firms in industries with higher access to credit from suppliers, controlling for workers' characteristics.

Whilst our findings are based on micro-level data, they have a broader relevance and policy implications. Financial constraints and the availability of credit have been shown to be important determinants of firms' employment decisions, and can potentially magnify employment volatility over the business cycle. Empirical research has also found

that increased use of fixed-term workers tends to increase employment volatility, decrease wages of temporary workers, and reduce labor mobility. Our findings suggest that firms increase the use of temporary contracts following the crisis, as a way to increase flexibility to adjust employment in the face of negative shocks, given the lower firing costs associated with this type of contracts. They uncover a new cost of the crisis, with potential longer-term effects in terms of increasingly segmented labour markets, increased employment volatility, higher exposure to labor market frictions and decrease in the accumulation of human capital and labor productivity.



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## 7 Tables

Table 1: Descriptive statistics, employment shares

Year	Nb. firms (1)	All firms		Hiring Firms	
		FoT (2)	FoP (3)	FoTH (4)	FoPH (5)
2003	196,646	0.127	0.315	0.450	0.838
2004	211,850	0.135	0.342	0.474	0.981
2005	222,544	0.144	0.355	0.484	1.100
2006	232,934	0.147	0.373	0.497	1.178
2007	237,098	0.163	0.423	0.525	1.306
2008	244,546	0.170	0.439	0.551	1.402
2009	246,877	0.172	0.433	0.558	1.188
2010	204,716	0.128	0.294	0.476	0.864
2011	219,888	0.139	0.322	0.524	0.964
2012	211,797	0.144	0.330	0.547	0.903

Source: Own calculations based on Portugal, MTSS (2002-2012). FoT is the share of Fixed-term over total employment; FoP is the share of Fixed-term over permanent employment. FoTH, FoPH relate to the same shares within the sample of hires. Table reports averages across firms.

Table 2: Effect of the crisis on employment and employment volatility

Dependent variable:	$\ln(\text{employment})_{jt}$ (1)	$\ln(\text{employment})_{jt}$ (2)	$\text{CV}(\text{employment})_{jt}$ (3)	$\text{CV}(\text{employment})_{jt}$ (4)
<i>Crisis</i>	-0.047*** (0.011)	-0.069*** (0.011)	-0.001 (0.001)	0.007*** (0.002)
Additional controls	multi-estab., ownership, legal structure			
Region FE	yes	yes	yes	yes
Industry FE	yes		yes	
Firm FE		yes		yes
R <sup>2</sup>	0.567	0.094	0.010	0.005
Nb. Obs.	2,263,084	2,263,084	734,514	734,514

Crisis takes the value of 1 from 2008 to 2012 and zero otherwise. The dependent variable is the ln of employment in cols (1) and (2) and the employment coefficient of variation at the firm level in columns (3) and (4). Two coefficients were computed for each firm, for the periods before and after the financial crisis. t statistics, based on standard errors clustered at the industry level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 3: Effect of the crisis and of financial vulnerability on employment level and volatility

Dependent variable: Fin. Vuln. measure:	Panel A: $\ln(\text{employment})_{jt}$					
	EXTFIN		TCRED		TANG	
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis \times FinVuln$	-0.002 (0.026)		0.009*** (0.003)		-0.055* (0.030)	
$Crisis \times I_{above\_med}^{FinVuln}$		0.019 (0.024)		-0.007 (0.027)		-0.051** (0.022)
Additional controls	ln(sales) <sub>t-1</sub> , multi-establishment, ownership, legal structure					
Year FE	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R <sup>2</sup>	0.102	0.103	0.103	0.102	0.103	0.103
Nb. Obs.	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896

  

Dependent variable: Fin. Vuln. measure:	Panel B: $CV(\text{employment})_{jt}$					
	EXTFIN		TCRED		TANG	
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis \times FinVuln$	0.002 (0.003)		0.001 (0.001)		0.024*** (0.005)	
$Crisis \times I_{above\_med}^{FinVuln}$		0.002 (0.002)		0.007* (0.004)		0.019*** (0.004)
Additional controls	multi-establishment, ownership, legal structure					
Year FE	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R <sup>2</sup>	0.005	0.005	0.005	0.005	0.006	0.005
Nb. Obs.	720,078	720,078	720,078	720,078	720,078	720,078

Crisis takes the value of 1 from 2008 to 2012, and zero otherwise. Financial vulnerability measures are calculated over 1997-2006, pre-dating the crisis. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets.  $I_{above\_med}^{FinVuln}$  takes the value of 1 if the sector is above the median of the corresponding FinVul measure, and zero otherwise. t statistics, based on standard errors clustered at the industry level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 4: Effect of the crisis on the share of fixed-term employment contracts; firm-level

Dependent variable:		Panel A: (Fixed-term employment/Total employment) <sub>jt</sub>											
Fin. Vuln. measure:	EXTFIN			TCRED						TANG			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
<i>Crisis</i> × <i>FinVuln</i>	0.010** (0.004)		0.003 (0.002)		-0.001 (0.001)		-0.000 (0.001)		-0.006 (0.005)		0.005 (0.005)		
<i>Crisis</i> × <i>I<sub>above_med</sub><sup>FinVuln</sup></i>		0.012*** (0.003)		0.006** (0.003)		-0.009** (0.004)		-0.007** (0.003)		-0.002 (0.004)		0.004 (0.003)	
Additional controls		ln(sales) <sub>t-1</sub> , multi-estab., ownership, legal structure											
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes			Yes	Yes			yes	yes			
Firm FE			yes	yes			yes	yes			yes	yes	
R <sup>2</sup>	0.043	0.043	0.013	0.013	0.043	0.043	0.013	0.013	0.043	0.043	0.013	0.013	
Nb. Obs.	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	2,228,896	

  

Dependent variable:		Panel B: (Fixed-term employment/Permanent employment) <sub>jt</sub>											
Fin. Vuln. measure:	EXTFIN			TCRED						TANG			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
<i>Crisis</i> × <i>FinVuln</i>	0.017 (0.018)		0.002 (0.017)		-0.010 (0.008)		-0.011 (0.009)		-0.015 (0.032)		0.017 (0.036)		
<i>Crisis</i> × <i>I<sub>above_med</sub><sup>FinVuln</sup></i>		0.051** (0.021)		0.046* (0.025)		-0.051** (0.023)		-0.062** (0.025)		-0.003 (0.018)		0.018 (0.021)	
Additional controls		ln(sales) <sub>t-1</sub> , multi-estab., ownership, legal structure											
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes			yes	yes			yes	yes			
Firm FE			yes	yes			yes	Yes			yes	yes	
R <sup>2</sup>	0.010	0.010	0.001	0.001	0.010	0.010	0.001	0.001	0.010	0.010	0.001	0.001	
Nb. Obs.	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	1,821,534	

Crisis takes the value of 1 from 2008 to 2012, and zero otherwise. Financial vulnerability measures are calculated over 1997-2006, pre-dating the crisis. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets.  $I_{above\_med}^{FinVuln}$  takes the value of 1 if the sector is above the median of the corresponding FinVul measure, and zero otherwise. t statistics, based on standard errors clustered at the industry level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 5: Effect of the crisis on the share of fixed-term hires; firm-level

Dependent variable:		(Fixed-term hires/Total hires) <sub>jt</sub>											
Fin. Vuln. measure:	EXTFIN			TCRED						TANG			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
<i>Crisis</i> × <i>FinVuln</i>	0.020*** (0.005)		0.013*** (0.005)		-0.003 (0.002)		-0.002 (0.001)		-0.009 (0.011)		-0.001 (0.010)		
<i>Crisis</i> × <i>I<sub>above_med</sub><sup>FinVuln</sup></i>		0.017** (0.008)		0.014** (0.006)		-0.009 (0.009)		-0.007 (0.006)		0.001 (0.009)		0.006 (0.008)	
Additional controls		ln(sales) <sub>t-1</sub> , multi-estab., ownership, legal structure											
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes			yes	yes			yes	yes			
Firm FE			yes	Yes			yes	yes			yes	yes	
R <sup>2</sup>	0.068	0.068	0.011	0.011	0.068	0.068	0.011	0.011	0.068	0.068	0.011	0.011	
Nb. Obs.	771,025	771,025	771,025	771,025	771,025	771,025	771,025	771,025	771,025	771,025	771,025	771,025	

Crisis takes the value of 1 from 2008 to 2012, and zero otherwise. Financial vulnerability measures are calculated over 1997-2006, pre-dating the crisis. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets.  $I_{above\_med}^{FinVuln}$  takes the value of 1 if the sector is above the median of the corresponding FinVul measure, and zero otherwise. t statistics, based on standard errors clustered at the industry level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 6: Effect of the crisis on the probability of fixed-term hiring contract; worker-level

Dependent variable: Fin. Vuln. measure:	Probability of fixed-term hiring contract <sub>it</sub> (LPM)					
	EXTFIN		TCRED		TANG	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Crisis</i> × <i>FinVuln</i>	0.006 (0.009)		-0.012*** (0.003)		0.049*** (0.015)	
<i>Crisis</i> × <i>I<sup>FinVuln</sup><sub>above_med</sub></i>		0.037** (0.015)		-0.042*** (0.015)		0.046*** (0.011)
Additional worker controls	gender, age, age <sup>2</sup> , experience, experience <sup>2</sup> , education, skill-level					
Additional firm controls	ln(sales) <sub>t-1</sub> , multi-estab., ownership, legal structure					
Year FE	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R <sup>2</sup>	0.035	0.035	0.036	0.035	0.035	0.035
Nb. Obs.	3,519,843	3,519,843	3,519,843	3,519,843	3,519,843	3,519,843

Crisis takes the value of 1 from 2008 to 2012, and zero otherwise. Fin. vulnerability measures calculated over 1997-2006, pre-dating the crisis. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets. *I<sup>FinVuln</sup><sub>above\_med</sub>* takes the value of 1 if the sector is above the median of the corresponding FinVul measure, and zero otherwise. t statistics, based on standard errors clustered at the firm level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 7: Effect of the 2001 crisis on the share of fixed-term employment; firm-level

Dependent variable: Fin. Vuln. measure:	Panel A: (Fixed-term employment/Total employment) <sub>jt</sub>											
	EXTFIN			TCRED				TANG				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Crisis</i> × <i>FinVuln</i>	0.003 (0.007)		0.002 (0.005)		-0.001 (0.001)		0.000 (0.001)		-0.013 (0.008)		-0.004 (0.005)	
<i>Crisis</i> × <i>I<sup>FinVuln</sup><sub>above_med</sub></i>		-0.001 (0.009)		0.002 (0.006)		0.008 (0.009)		0.005 (0.005)		-0.012* (0.006)		-0.005 (0.004)
Additional controls	ln(sales) <sub>t-1</sub> , multi-establishment, ownership											
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes			yes	yes			yes	yes		
Firm FE			yes	Yes			yes	yes			yes	yes
R <sup>2</sup>	0.045	0.045	0.016	0.016	0.045	0.045	0.016	0.016	0.045	0.046	0.016	0.016
Nb. Obs.	334,280	334,280	334,280	334,280	334,280	334,280	334,280	334,280	334,280	334,280	334,280	334,280

  

Dependent variable: Fin. Vuln. measure:	Panel B: (Fixed-term employment/Permanent employment) <sub>jt</sub>											
	EXTFIN			TCRED				TANG				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Crisis</i> × <i>FinVuln</i>	-0.004 (0.019)		-0.001 (0.013)		-0.004 (0.007)		-0.006 (0.005)		-0.016 (0.036)		-0.020 (0.026)	
<i>Crisis</i> × <i>I<sup>FinVuln</sup><sub>above_med</sub></i>		-0.002 (0.032)		0.008 (0.019)		0.020 (0.033)		0.006 (0.023)		-0.015 (0.025)		-0.019 (0.018)
Additional controls	ln(sales) <sub>t-1</sub> , multi-establishment, ownership											
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes			yes	yes			yes	yes		
Firm FE			yes	yes			yes	yes			yes	yes
R <sup>2</sup>	0.012	0.012	0.002	0.002	0.012	0.012	0.002	0.002	0.012	0.012	0.002	0.002
Nb. Obs.	271,793	271,793	271,793	271,793	271,793	271,793	271,793	271,793	271,793	271,793	271,793	271,793

Crisis takes the value of 1 in 2002 and 2003, and zero in 2000 (the data distinguishes between fixed-term and permanent worker's contracts since 2000, and the data was not collected in 2001). Financial vulnerability measures are calculated over 1997-2006. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets. *I<sup>FinVuln</sup><sub>above\_med</sub>* takes the value of 1 if the sector is above the median of the corresponding FinVul measure, and zero otherwise. t statistics, based on standard errors clustered at the industry level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 8: Effect of the 2001 crisis on the probability of fixed-term hire; worker-level

Fin. Vuln. measure:	Dependent variable: Probability of fixed-term hiring contract					
	EXTFIN		TCRED		TANG	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Crisis</i> × <i>FinVuln</i>	-0.010 (0.008)		-0.001 (0.004)		0.034 (0.022)	
<i>Crisis</i> × <i>I<sup>FinVuln</sup><sub>above_med</sub></i>		-0.003 (0.018)		0.022 (0.018)		0.021 (0.016)
Additional worker controls	gender, age, age <sup>2</sup> , experience, experience <sup>2</sup> , education, skill-level					
Additional firm controls	ln(sales) <sub>t-1</sub> , multi-estab., ownership					
Year FE	yes	yes	yes	yes	yes	yes
Region FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R <sup>2</sup>	0.036	0.036	0.036	0.036	0.036	0.036
Nb. Obs.	463,325	463,325	463,325	463,325	463,325	463,325

Crisis takes the value of 1 in 2002 and 2003, and zero in 2000 (the data distinguishes between fixed-term and permanent worker's contracts since 2000, and the data was not collected in 2001). Fin. vulnerability measures calculated over 1997-2006. EXTFIN measures the dependence on external finance and is the share of total capital expenditure that is not financed by internal cash flows from operations. TCRED measures access to supplier credit and is the ratio of total accounts payable over cost of goods sold. TANG measures tangible assets and is the share of net plant, property and equipment in total book-value assets. *I<sup>FinVuln</sup><sub>above\_med</sub>* is a dummy=1 if the sector is above the median of the corresponding FinVul measure. t statistics, based on standard errors clustered at the firm level, are reported in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.



## 8 Appendix

Table A1: Descriptive statistics - overall hiring per year and share of fixed term hires

Year	Total hires	% Fixed-term
2003	396,033	55.60
2004	419,740	58.05
2005	506,471	59.26
2006	532,082	59.72
2007	595,640	62.09
2008	617,153	65.10
2009	498,281	64.01
2010	474,961	51.39
2011	439,809	53.03
2012	331,042	54.94

Source: Own calculations based on Portugal, MTSS (2002-2012).

Table A2: Descriptive statistics - firm level means

Dep. Var.	FoT (1)	FoP (2)	FoTH (3)	FoPH (4)
Mean of dep var.	0.148	0.365	0.510	1.084
EXTFIN	0.532	0.517	0.508	0.495
TCRED	2.288	2.244	2.305	2.323
TANG	0.313	0.323	0.340	0.348
$I_{above\_med}^{EXTFIN}$	0.501	0.489	0.476	0.459
$I_{above\_med}^{TCRED}$	0.459	0.454	0.484	0.494
$I_{above\_med}^{TANG}$	0.143	0.157	0.175	0.190
Crisis	0.506	0.506	0.488	0.470
$\ln(\text{sales})_{t-1}$	11.983	12.144	12.677	12.672
Legal nature				
individual name	0.212	0.218	0.138	0.138
uniperson quota society	0.038	0.035	0.037	0.039
anonymous society	0.036	0.042	0.071	0.073
singular person	0.011	0.011	0.005	0.004
other	0.025	0.028	0.036	0.032
Ownership				
public	0.001	0.002	0.003	0.003
foreign	0.046	0.049	0.043	0.041
Multiplicant	0.082	0.092	0.137	0.131
Nb. Obs.	2,228,896	1,821,534	771,025	450,948

Source: Own calculations based on Portugal, MTSS (2002-2012).

Table A3: Descriptive statistics - worker level

Covariate	Mean
Fixed-term contract	0.626
EXTFIN	0.519
TCRED	3.003
TANG	0.324
$I_{above\_med}^{EXTFIN}$	0.434
$I_{above\_med}^{TCRED}$	0.581
$I_{above\_med}^{TANG}$	0.159
Crisis	0.511
Female	0.447
Age	33.231
Experience	16.024
Educational level	
secondary	0.288
high-school	0.246
university	0.122
Skill level	
medium	0.328
high	0.139
$\ln(\text{sales})_{t-1}$	14.784
Legal nature	
individual name	0.048
uniperson quota society	0.026
anonymous society	0.286
singular person	0.001
other	0.048
Ownership	
public	0.014
foreign	0.134
Multiplant	0.413
Nb. Obs.	3,519,843

Source: Own calculations based on Portugal, MTSS (2002-2012).