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ABSTRACT

Heterogeneous Effects of Credit Constraints on SMEs' Employment: Evidence from the Great Recession*

This paper takes advantage of access to detailed matched bank-firm data to investigate whether and how employment decisions of SMEs have been affected by credit constraints in the wake of the Great Recession. Variability in banks' financial health following the 2008 crisis is used as an exogenous determinant of firms' access to credit. Findings, relative to the Belgian economy, clearly highlight that credit matters. They show that SMEs borrowing money from pre-crisis financially less healthy banks were significantly more likely to be affected by a credit constraint and, in turn, to adjust their labour input downwards than pre-crisis clients of more healthy banks. These results are robust across types of loan applications that were denied credit, i.e. applications to finance working capital, debt or new investments. Yet, estimates also show that credit constraints have been essentially detrimental for employment among SMEs experiencing a negative demand shock or facing strong product market competition. In terms of human resources management, credit constraints are not only found to foster employment adjustment at the extensive margin but also to increase the use of temporary layoff allowances for economic reasons. This outcome supports the hypothesis that short-time compensation programmes contribute to save jobs during recessions.

JEL Classification: C35, C36, D22, G01, G21, J21, J23

Keywords: SMEs, banks' financial health, credit constraints, employment, short-time compensation programmes, Great Recession, matched bank-firm data

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1. Introduction

Small- and medium-sized enterprises (SMEs) constitute the core of the European economy. In 2013, they totalled more than 99% of all active European firms and employed roughly 70% of the overall labour force (Muller et al., 2014). Therefore, questions related to the performance of SMEs have attracted a large share of attention in debates concerning the post-2008 crisis and the consequent economic recovery. The focus has notably been on the challenges that SMEs face in terms of credit constraints and especially on how these constraints may potentially initiate consequences on broader economic outcomes.

A growing literature suggests that credit constraints are detrimental for employment (Bentolila et al., 2018; Berton et al., 2018; Fabiani et al., 2015; Gerlach-Kristen et al. 2017; Izquierdo et al., 2017; Linehan et al., 2015 ; Siemer, 2015). Yet, caution is required as: i) adequately controlling for the endogeneity of credit constraints remains challenging, and ii) existing studies do not always rely on direct information to identify whether firms are credit-constrained or not. Furthermore, many important questions regarding the nexus between credit shortages and employment still deserve to be investigated. The role of moderating factors (such as product demand and competition) in explaining the labour demand decisions of credit-constrained firms is notably quite under-researched. Also very little is known regarding the various strategies that might be implemented by firms to adjust employment when credit is lacking. Finally, most studies focus on all firms independently of their size, though some studies suggest that employment effects of credit shortages are likely to be stronger among SMEs.

Our paper takes advantage of access to detailed matched bank-firm data to investigate whether and how employment decisions of small- and medium-sized enterprises (SMEs) have been affected by different types of credit constraints in the wake of the Great Recession. More precisely, we combine data from the third wave of the Belgian Wage Dynamics Survey, covering the period 2010-2013, with confidential data from the Central Corporate Credit Register from the National Bank of Belgium (NBB). Variability in banks' financial health, following the Great Recession, is used as an exogenous determinant of firms' access to credit. Our prior is that firms borrowing money from pre-crisis less healthy banks had a higher likelihood to be affected by a credit constraint during the crisis, and as a consequences, had to reduce employment more substantially than clients of more healthy banks.

Belgium is a particularly interesting case study. Indeed, while this country has been severely hit by the 2008 financial crisis (e.g. three of the country's largest banks – Fortis,

Dexia and KBC – were bailed out, sold off and/or nationalised), the drop in employment was of relatively limited scope compared with neighbouring countries such as France, the Netherlands and also with the EU average (Cornille, 2015). Put differently, though business funding has been under considerable pressure (Bonnet et al., 2005, 2016; Piette and Zachary, 2015), employment has been fairly resilient. Hence, it deserves to be investigated whether credit constraints among SMEs have had any significant employment effects in this specific context. Moreover, since the preservation of employment in Belgium has been attributed to various flexibility mechanisms (such as temporary lay-off allowances[1]), focusing on the various channels by which credit-constrained SMEs may have had adjusted their labour input is of particular interest (Abraham et al., 2014).

Our data enable us to estimate and compare the employment effects of different types of credit constraints. More precisely, we test whether employment effects vary according to: i) the type of loan application that was denied (i.e. loans to finance working capital, investments and/or debt), and ii) whether firms faced 'quantitative' or 'cost' credit constraints (i.e. whether credit was not available or whether the conditions to borrow money were too onerous). We also add to the literature by examining the role of two moderating factors, namely demand shocks and product market competition. Theoretically, we expect employment consequences of credit constraints to be stronger among SMEs operating in strong competitive environments and/or hit by a negative demand shock. Finally, we investigate in greater depth the different strategies that might be implemented by credit-constrained firms to adjust employment. We first distinguish between the adjustment of labour at the extensive and intensive margins. Next, we study the different channels that can be used by firms to procure these adjustments.

The remainder of this paper is organised as follows. A literature review is provided in the next section. Sections 3 and 4 describe our data and estimation strategy. Descriptive statistics and econometric results are presented in sections 5 and 6. The last section concludes.

[1] These are short-time working allowances, also known under the heading 'chômage temporaire' (i.e. 'temporary unemployment'). "These allowances (…) provide a framework in which employers can adjust employees' working time in response to a variety of external circumstances including economic reasons, with the state mitigating the impact on employee remuneration via the state unemployment benefit system. (…) Additional allowances that further cushion the pay of employees on short-time work feature in collective agreements at company and industry level." (Hurley, 2010) Eligibility for these allowances, traditionally restricted to blue-collar workers, has been extended to white-collars in the Law of 19 June 2009 as part of a series of anti-crisis measures.

2. Review of the literature

A large literature examines the economic consequences of financial constraints. Interest in this issue has become particularly critical since 2008. The Great Recession indeed increased the need to better understand how firm's real decisions are affected by a financial crisis and the role of firms' access to credit in boosting economic recovery. Given that the crisis sparked a huge increase in unemployment rates among many advanced economies, a growing number of papers focuses on the extent to which firms' credit constraints and employment policies have been interconnected during the Great Recession.

Empirical contributions examining the employment consequences of credit constraints with data from *before* the Great Recession include most notably Hernando and Martinez-Carrascal (2008). Relying on balance sheet data relative to Spanish firms over the period 1985-2001, their GMM-system estimates show that firms facing high financial pressure (assed through firms' debt burden, indebtedness and profitability) have substantial lower employment growth rates. The authors control for the endogeneity of firms' financial position using internal instruments (i.e. lagged values of explanatory variables in levels and first-differences, respectively). Nickell and Nicolitsas (1999) also examined the impact on employment of increases in firm-level financial pressure. Using accounts data for a sample of U.K. manufacturing companies over the period 1972-1986, they find that the ratio of interest payment to cash flow (i.e. financial pressure) has a large negative effect on employment. This effect is identified using as an instrument firms' lagged debt burden interacted with the current shift in the yield on Treasury bills. Also focusing on balance sheet data from U.K. manufacturing companies, but for the 1994-2004 period, Spaliara (2009) finds that the capital-labour ratio is sensitive to firm-specific characteristics (i.e. cash flow, leverage, collateral and interest burden), especially in firms that are more likely to face a financing constraint. Accordingly, the authors conclude that U.K. authorities should help constrained firms to avoid shortage of credit (especially during bad economic times) so as to preserve jobs. This conclusion is drawn on the basis of a GMM first-differenced estimator. Endogeneity is thus controlled for using internal instruments (lagged levels of explanatory variables).

A growing literature examines the impact of credit constraints on corporate employment decisions *in the wake of* the Great Recession, i.e. using post-2008 data. Campello et al. (2010), for instance, surveyed 1,050 Chief Financial Officers (CFOs) in the U.S., Europe and Asia to assess whether or not their corporations were credit-constrained in 2008 and, in

turn, to study if these financial constraints had any real corporate effects, notably on employment. Using a matching estimator approach, i.e. pairing-up constrained and unconstrained companies facing similar economic circumstances, they find that financially constrained firms planned to cut more employment relative to financially unconstrained firms during the crisis. Although quite appealing, their matching approach applied to survey data may not be completely 'bullet-proof' to potential endogeneity issues. Indeed, 'CFOs may by themselves not be able to separate economic from financial effects when responding to a survey' (Campello et al., 2010: 471). Duygan-Bump et al. (2015) investigated the link between small business lending and unemployment during the Great Recession in the U.S.. Combining information from the Current Population Survey with firms' financial data for 2007-2009, they find that workers in small firms were more likely to lose their jobs than their opposite numbers in large firms, but only if they were employed in more financially distressed industries. Identification of credit supply effects is achieved through the use of industry-level measures of external finance dependence. Siemer (2014) also suggests, on the basis of detailed firm-level panel data for 2007-2009, that financial constraints in the U.S. were more detrimental to employment growth in smaller firms. As in Campello et al. (2010), his identification strategy relies on the comparison of estimates for sectors with high and low external finance dependence. The study of Fabiani et al. (2015), based on harmonised data for 9 European countries for 2007-2009, shows that permanent and temporary employees' likelihood to be dismissed was significantly bigger among credit-constrained firms. Endogeneity of credit constraints is not explicitly addressed in their analysis.

Our paper is more closely related to the relatively few existing studies employing matched bank-firm data to investigate how shocks to bank balance sheets affected firms' employment decisions during the Great Recession. The latter notably include the study of Chodorow-Reich (2014) for the U.S.. The author shows that credit-constrained SMEs were significantly more likely to reduce employment than their non-credit-constrained counterparts. In contrast, they find no significant effect of credit constraints on employment among larger firms. Firm credit constraints are instrumented by lenders' financial health, i.e. the change in the loan supply to each of their borrowers before and after the Great Recession. The analysis of Popov and Rocholl (2018), based on detailed German data, shows that employment decline has been significantly stronger among firms (especially smaller ones) that have been hit by a credit constraint. Their instrument for firm credit constraints is a dummy indicating whether or not the firm had a credit relationship with a bank affected by the U.S. subprime mortgage crisis. Gerlach-Kristen et al. (2015) also find a significant

negative effect of credit constraints on the employment level of SMEs in the Irish economy. Their instrumental variables for credit constraints include: i) two binary indicators for the ownership of the bank, and ii) a dummy taking the value one if the firm believed – on the basis of factors not related to her own experience – such as media reports, lobby groups or business peers – that banks were not lending. Finally, the studies of Bentolila et al. (2018) and Berton et al. (2018), based respectively on detailed bank-firm data for Spain and the Veneto region in Italy, also show that the 2008 credit crunch led to a significant drop in employment, while controlling for various econometric issues including endogeneity. Estimates in the former study indicate that 24% of job losses in firms that, before the crisis, were clients of financially weak banks are due to this exposure. According to the latter, one quarter of total employment reduction is due to the contraction in credit supply.

In sum, a growing number of papers suggest that the 'sharpest credit shortage in nearly a century' (Campello et al., 2010: 486) has been quite harmful for employment. Yet, current evidence leaves the door open for further developments. Besides the fact that adequately controlling for the endogeneity of credit constraints remains challenging, a first important avenue for research but also for policy boils down to get a better understanding of moderating factors, and especially of how the nexus between credit shortage and employment is affected by product market demand and competition. Another under-researched issue refers to the channels through which credit-constrained firms might adjust their labour input, e.g. at the extensive or intensive margin. This is an important question for policymakers as adjustment at the intensive margin (e.g. through the various short-time and temporary layoff schemes that have been made available to firms in many advanced economies during the crisis) contributes to mitigate job destruction. The objective of this paper is to improve our comprehension of these key issues taking advantage of access to detailed matched bank-firm data, for a representative sample of SMEs in Belgium, which: i) include direct information on several types of credit constraints and employment adjustment strategies, alongside various covariates for workforce composition, firm characteristics and other aspects of the economic environment, and ii) enable us to instrument firms' access to credit by the variability in banks' financial health following the Great Recession.

3. Data

Our empirical analysis is based on a Belgian firm-level survey undertaken within the Wage Dynamics Network (WDN) of the ESCB (i.e. the European System of Central Banks). This

survey (i.e. the so-called 3rd wave of the Belgian WDN survey) has been conducted by the National Bank of Belgium (NBB) in June and September 2014. It includes questions on firms' perception of the nature of the changes in the economic environment that have resulted from the sovereign debt crisis, their reactions to these changes and the role of financial constraints.[2] More precisely, it broaches the changes that occurred in the economic environment during the course of the 2010-2013 period, by identifying the type and intensity of the shocks that might have affected companies. It also provides detailed information on the structure and adaptation of labour forces in the companies questioned.

The WDN survey was sent out by surface mail, with the option of using an electronic format version. In total, 991 firms participated in the survey, giving a response rate of 21%. Given the length of the questionnaire, this can be considered as satisfactory. In terms of response behaviour by questions, the response rate is on average higher than 95% and varies between 100% and 83%. The answers are consistent with information from other sources (Cornille, 2015). Our final sample, excluding 136 firms due to missing replies, contains 855 firms. It is representative of all firms employing at least 5 workers and less than 250 workers[3] in the manufacturing and building industries, trade and business services.[4] Sectors covered by the survey together account for 52% of employment in Belgian firms (excluding self-employed).

To identify the effect of credit constraints on employment, endogeneity issues have to be addressed. Therefore, we rely on two-stage least squares (2SLS) and bivariate probit models. Following existing research (Bentolila, 2018; Chodorow-Reich, 2014), our instruments are drawn from the characteristics of the firms' main bank (see next section for more details). This information is not available in the WDN survey. Therefore, the latter has been merged with data from the Central Corporate Credit Register (CCCR) from the NBB. This merger reduces the number of firms in our sample by approximately one-third, i.e. from 855 to around 522 firms. This drop in sample size derives from the fact that a certain number of firms have no bank credit at all, have only bank credits outside Belgium, or are part of bigger corporations which have their own bank credits. The magnitude of the attrition is coherent with more aggregate evidence from credit register data and the distribution of firm

[2] A copy of the questionnaire can be found on the NBB's website (see www.nbb.be/en/wage-dynamics-network-wdn-3).

[3] Although the sample design did not contain an explicit upper threshold for firm size, in practice almost 99% of firms that were surveyed employed less than 250 workers. Given our focus on SMEs, firms employing 250 workers or more (i.e. about 10 firms in the initial sample) have been dropped.

[4] To make results representative of the total population of sectors considered, statistics (reported in the next sections) are computed using employment-adjusted weights. For more details on the sample design and its representativeness see Cornille (2015).

size in our sample (Piette and Zachary, 2015). The impact of attrition on the composition of our sample and hence on its representativeness is very limited. Indeed, as discussed below, descriptive statistics remain remarkably stable after sample reduction.

4. Estimation strategy

4.1. Baseline specification

Our empirical investigation is made of two steps. First, we test the employment consequences of credit constraints with a linear probability model (LPM). More precisely, we estimate by ordinary least squares (OLS), the following firm-level equation:

$$Employment_i = \alpha + \beta\ CC_i + \lambda\ X_i + \varepsilon_i \quad (1)$$

The dependent variable in equation (1) is a dummy taking the value 1 if the firm *i* needed to significantly reduce its labour input or to alter its composition between 2010 and 2013[5], and 0 otherwise. The main explanatory variable CC_i is a binary variable taking the value 1 if the firm has been affected by a quantitative credit constraint between 2010 and 2013 (namely, if the firm declared that credit was not available to finance working capital, to finance a new investment or to refinance its debt) and 0 otherwise.

Firm-level covariates are contained in the vector X_i. In selecting these covariates, we draw on existing research which suggests to control for workforce composition, firm characteristics and other aspects of the economic environment (Fabiani, 2016, Gerlach-Kirsten et al., 2015). Accordingly, X_i includes the share of the workforce within firm *i* that has at most 5 years of tenure; the proportion of high-skilled workers among both blue- and white collars (i.e. ISCO codes 1-3 and 7-8); the sectoral affiliation (4 dummies), age (in years) and size (i.e. the total number of employees) of the firm; a dummy taking the value 1 if the degree of competition on the market for the firm's main product/service is very severe, and 0 otherwise (i.e. if it is severe, moderate or weak); and a binary variable taking the value 1 if the level of demand for the firm's products/services has been decreasing moderately or strongly during 2010-2013, and 0 otherwise (i.e. if it remained unchanged or increased).

[5] Put differently, if the firm had to adjust its labour force at the extensive and/or intensive margin.

OLS estimates of qualitative response models, such as equation (1), are generally considered to be less reliable than those obtained by probit, especially when predicted probabilities are not close to 0.5 (Wooldridge, 2002). This is because the underlying conditional expectation function (CEF) is only roughly linear in the middle. Moreover, LPM estimates are limited by the fact that they are not bounded to the unit interval. More precisely, Horrace and Oaxaca (2006) demonstrate that the potential bias associated to the LPM is proportional to the share of LPM predicted probabilities that fall outside the unit interval. Hence, to check the robustness of our results, we examine the concordance of LPM estimates with marginal effects from a probit model.

4.2. Instrumental variables and exclusion restrictions

When studying the employment consequences of credit constraints, an important econometric issue that has to be addressed is endogeneity. This issue may notably derive from reverse causality. Indeed, firms might reduce their labour input because they faced a credit constraint. However, it is also possible that firms don't get the required funding because they have financial difficulties, which led them in first instance to lay off workers. To control for potential endogeneity, we first rely on two-stage least-squares (2SLS). This method consists in finding instrumental variables (IV), which are at the same time highly correlated with the endogenous variable (i.e. credit constraints) and uncorrelated with firm-level changes in employment. Our main IV is the % change in the number of loans made by the firm's *i* main bank to all borrowers other than firm *i* before (i.e. October 2005 – June 2007) and after (i.e. October 2008 – June 2011) the crisis.[6] This instrument, similar to the one used by Chodorow-Reich (2014), reflects the financial health of the firm's main bank. The bigger, i.e. the more positive, the value of this variable, the healthier the lender is expected to be. We thus use the variability in lender's health as an exogenous determinant of the firm's access to credit. Our prior is that firms borrowing money from pre-crisis less healthy lenders had a higher likelihood to be affected by a credit constraint during the crisis, and as a consequence, had to reduce their labour input more substantially than clients of more healthy banks. Moreover, to account for potential non-linearities, we also include the inverse value of this IV in the first step of our estimation procedure. Finally, to further capture the financial health of the lender, we also included dummies identifying the main bank of each firm.

[6] To take bank size into account, this % change is normalised by the number of loans made by the firm's main bank before the crisis.

Various diagnoses tests are performed when running 2SLS regressions. The latter explore respectively the acuteness of the endogeneity issue in our data and the quality of our instruments. More precisely, we first compute the Kleibergen-Paap statistic for weak identification. It is a Wald *F* statistic testing whether the excluded instruments are sufficiently correlated with the endogenous regressor. The null hypothesis is that the instruments are weak. Next, we examine the validity of our instruments with Hansen test of overidentifying restrictions. Under the null hypothesis the instruments are valid, i.e. uncorrelated with the error term. Finally, we compute an endogeneity test with the null hypothesis that the credit constraint can actually be considered as exogenous. The test is based on the difference of two Sargan-Hansen statistics: one for the equation in which the credit constraint is treated as endogenous, and one in which it is treated as exogenous. If the null hypothesis of this test cannot be rejected, then instrumentation is actually not necessary.

The traditional approach to control for endogeneity is the 2SLS estimation. However, since both the dependent variable and the potentially endogenous variable are binary the use of 2SLS might be criticized. Therefore, we also use a bivariate probit model to check the robustness of our results. The relevance of the bivariate model compared to the single probit model is verified with a Wald test examining whether the correlation of the error terms of the two probit regressions is significantly different from zero. If the test rejects the null hypothesis of no correlation between the two error terms, the bivariate probit is recommended.

4.3. Heterogeneous employment effects

To gain a better understanding of the potentially heterogeneous effects of credit constraints on the adjustment of employment within firms, a series of complementary tests are performed.

Our benchmark specification, i.e. equation (1), focusses on the employment effects of quantitative credit constraints, i.e. whether credit was available to a firm or not. Yet, the WDN survey also contains information on cost constraints, i.e. whether credit was available but the conditions (interest rates and other contractual terms) were too onerous (*Cost constraint*$_i$). A first complementary test thus aims to examine if the employment consequences of quantitative and cost constraints are comparable in terms of magnitude and significance.

The literature suggests a number of channels through which credit constraints may affect the employment decisions of firms (Nickell and Nicolitsas, 1999; Spaliara, 2009). A

first channel is credit availability to finance working capital. As working capital loans are meant to finance everyday expenses related to the daily operation of a business (e.g. to cover unexpected costs, pay employee wages), they are very likely to have a direct impact on the firm's employment decisions. Another channel is credit to finance investments. If a company cannot borrow as much as she wants to invest in capital goods, she is likely to recruit less workers to complement the new fixed asset. This is the expected outcome if one assumes that capital and labour are complementary inputs, i.e. that the capital-labour ratio remains relatively stable. For higher degrees of substitutability between labour and capital, the outcome may be different. Indeed, the firm could than choose to decrease its capital-labour ratio by hiring more workers than initially planned as a compensation strategy. A third channel is credit availability to refinance debt. Firms willing to refinance their debt may want to take advantage of a better interest rate (reduced monthly payment or term) or to reduce/alter the risk relative to their debt (e.g. by switching from a variable-rate to a fixed-rate loan). However, it may also be a strategy for financial distressed borrowers to restructure their debt, i.e. to free up cash (e.g. by negotiating lower monthly payments for a longer term). Most firms that are denied credit to refinance their debt are probably in the second situation. Hence, the employment consequences of this type of credit constraint are likely to be negative. To sum up, our second complementary test aims to examine how these different channels of credit constraints affect firms' employment responses. To do so, we break down WDN data on quantitative constraints by type of loan application that was denied credit, focusing on applications for working capital, new investments and debt refinancing.

Next, we investigate two potentially important moderators. On the one hand, we examine the role of demand shocks. More precisely, we test whether firms experiencing credit constraints had to adjust employment more substantially when they were hit concomitantly by a negative demand shock. To do so, we re-estimate equation (1) separately for: i) firms reporting a moderate or strong decrease in the demand for their main product/service, and ii) those whose demand remained unchanged or increased between 2010 and 2013. Clearly, we expect employment consequences of credit constraints to be stronger among the former group of firms. On the other hand, we test the moderating role of firms' product environment. To do so, we re-estimate equation (1) separately for: i) firms facing very severe competition on their main product/service market, and ii) those facing weak, moderate or severe competition. Traditional bargaining models, e.g. 'right-to-manage' or 'efficient bargaining' (Cahuc and Zylberberg, 2014), suggest that employment adjustment should increase with the elasticity of labour demand and the price elasticity of demand in the product market. Accordingly, we

expect employment responses to be stronger among firm operating in more competitive markets. [7]

Finally, we investigate in greater depth the different strategies that can be implemented by firms to adjust employment following a credit constraint. We first distinguish between the adjustment of labour at the extensive and intensive margins. Next, we study the different channels that can be used by firms to procure these adjustments. For the extensive margin, we focus in turn on: collective layoffs, individual layoffs, adjustment of temporary employment and early retirement. As regards the intensive margin, we examine respectively temporary layoffs (for economic reasons) and reductions of working hours (subsidised or not).

5. Descriptive statistics

Table 1 presents summary statistics for all variables included in our econometric analysis. Results show that 33% of firms in our sample reduced their labour input or had to alter its composition between 2010 and 2013. 31% of firms declared they adjusted labour at the extensive margin, while 21% did so at the intensive margin. As regards channels to adjust labour at the extensive margin, 28% of firms reported that they relied on individual layoffs and 17% on temporary employment adjustment. Collective layoffs and early retirement schemes have been used by a much smaller proportion of firms (respectively, 1 and 8%). To adjust labour at the intensive margin, firms heavily relied on temporary layoffs (17%). In contrast, only 8% of firms decided to reduce working hours.

About credit constraints, 27% replied that they faced a quantitative constraint (i.e. credit was not available) and 23% a cost constraint (i.e. credit was available but the conditions – interest rate and other contractual terms – were too onerous). In addition, 16% of firms responded they were denied credit to finance working capital or to refinance their debt, while 22% could not borrow money to make a new investment. Concerning workforce characteristics, results indicate that firms in our sample have on average 37% of workers with at most 5 years of tenure and 43% of high-skilled workers (among both white and blue collars). On average, firms employ 35 workers and have been established around 36 years

[7] Theoretically, *wage* responses to credit constraints are also expected to be stronger in more competitive markets. Although this issue is beyond the scope of our paper, descriptive statistics from the WDN survey show that between 2010 and 2013 (a period characterised by near-zero inflation) only 0.6% (1.6%) of firms cut basic wages (flexible wage components), while 33% of firms reduced their labour input. Overall, this suggests that if credit constraints have had any impact on the labour force in Belgium, it should be in terms of quantity rather than in terms of prices. This conclusion is not surprising in light of earlier findings showing the prevalence of strong real downward wage rigidity in Belgium (du Caju et al., 2012).

ago. The sectoral distribution of firms is as follows: business activities (37%), trade (29%), manufacturing (16%), construction (14%) and financial intermediation (3%). Regarding other aspects of the economic environment, statistics indicate that 52% of firms experienced a moderate or strong decrease in the demand for their products/services between 2010 and 2013, while 52% faced very severe competition on their main product/service market.

[Insert Table 1 about here]

To address potential endogeneity, the WDN survey has been merged with data from the CCCR. As highlighted in section 3, this merger reduces the number of firms from 855 to 522. The impact of this attrition on the composition of our sample and hence on its representativeness is very limited. Indeed, most descriptive statistics reported in Appendix 1 remain remarkably stable. This said, a few differences can be highlighted. First, we find that firms are slightly smaller in the merged sample (the average number of employees decreases from 35 to around 30). Second, the share of firms that have experienced a quantitative credit constraint becomes somewhat bigger (it increases from 27 to 33%). Finally, the share of firms operating in the financial intermediation sector drops from 3 to 0%.[8] As highlighted in section 3, our sample is representative of firms employing between 5 and 250 workers in the manufacturing and building industries, trade and business services.

6. Regression analysis

6.1. Benchmark estimates

OLS estimates of equation (1) are reported in the second column of Table 2. They show that quantitative credit constraints have had a significant positive effect on the likelihood of firms to reduce their labour input between 2010 and 2013.[9] The regression coefficient stands at 0.099. This implies that firms facing credit constraints were *ceteris paribus* 10% more likely to adjust their workforce downwards than their opposite numbers not facing such constraints. As a robustness test, we computed marginal effects from a probit regression. The latter, reported in the third column of Table 2, lead to the same conclusion. The magnitude and

[8] Descriptive statistics for the instrumental variables (excluding restrictions) used in the 2SLS (bivariate probit) regressions are reported in Appendix 2.
[9] The dependent variable in Table 2 is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or to alter its composition between 2010 and 2013, and 0 otherwise.

significance of the employment effects are indeed very similar when applying the OLS or probit estimator. Regression coefficients associated to covariates are also generally found to be significant. As anticipated, they notably show that firms experiencing a decrease in the demand for their product or facing strong competition on their market were more likely to reduce their labour force. Moreover, while the probability to adjust labour downwards appears to be significantly bigger among firms employing a larger share of workers with less than 5 years of tenure, the opposite outcome is observed (in the probit regression) for firms with more high-skilled workers. These results are compatible with the idea that firms can more easily lay off workers when adjustment costs are lower, i.e. when workers' tenure and/or skills are more limited.

Yet, these estimates should be taken with caution as endogeneity (due e.g. to reverse causality) could be an issue. To address this potential issue, we first re-estimated equation (1) with 2SLS using as instruments variables reflecting the financial health of firms' main bank (see section 4.2). Results are reported in the second column Table 3. The *p*-value associated to the endogeneity test is equal to 0.06. This suggests that the null hypothesis of no endogeneity can be rejected at traditional probability levels, i.e. 2SLS estimates should be preferred to those obtained by OLS. Furthermore, we find that the test statistic for weak identification is statistically significant, which implies that our instruments are not weak. This is also illustrated by our first stage regression. Estimates, reported in the second column of Appendix 3, indeed show that most instruments are significant with the expected sign. More precisely, we find that the percentage change in the loan supply of the main bank of a firm (before and after the crisis)[10] decreases significantly the probability of that firm to be effected by a credit constraint. Put differently, results indicate that firms borrowing money from more healthy lenders before the Great Recession (i.e. banks whose loan supply was least affected by the crisis) had a lower likelihood to be credit constrained after the crisis. We also find that many bank dummies are statistically significant. This again suggests that firms' difficulties to borrow money were at least partly driven by the severity of the financial distress of their main bank. Concerning the quality of our instruments, we further find that the *p*-value associated to the Hansen's *J* overidentification test (see the second column columns of Table 3) is equal to 0.66. This implies that our instruments are valid, i.e. we cannot reject the exogeneity of the latter.

[10] As noted in section 4.2., the exact definition of this variable is as follows: % change in the number of loans made by the firm's *i* main bank to all borrowers other than firm *i* before (i.e. October 2005 – June 2007) and after (i.e. October 2008 – June 2011) the crisis, normalized by the number of loans made by the firm's *i* main bank before the crisis.

As regards 2SLS regression coefficients, they again show that credit constraints have had a highly significant and positive effect on the probability that firms adjusted their labour input downwards between 2010 and 2013. More precisely, they indicate that firms facing credit constraints were *ceteris paribus* 51% more likely to reduce their labour input. This estimate is bigger than the one obtained by OLS. Accordingly, it appears that employment effects of credit constraints are under-estimated when endogeneity is not controlled for. A similar finding is reported by Chodorow-Reich (2014: 41) using U.S. data.

This said, caution is required as it is generally admitted that bivariate probit estimates of qualitative response models are more reliable than those obtained by 2SLS, especially when predicted probabilities are not close to 0.5. Hence, as a robustness test, we re-estimated our benchmark equation with a bivariate probit estimator using the same covariates and excluding restrictions (i.e. instruments) as in our 2SLS regression. Results, reported in the third column of Table 3, first show that bivariate probit estimates should be preferred to simple probit ones. The Wald test statistic is indeed highly significant (*p*-value equal to 0.00). Furthermore, estimates confirm the positive and significant effect of credit constraints on employment adjustment. The marginal effect from our bivariate probit regression is equal to 0.40, which is relatively close to our 2SLS estimate.

In sum, our regression analysis clearly highlights that credit matters. We find indeed that firms borrowing money from pre-crisis less healthy banks were more likely to be affected by a credit constraint and, in turn, to adjust their labour input downwards than pre-crisis clients of more healthy lenders.

6.2. Heterogeneity of employment effects

In this section, we test the sensitivity of our findings by: i) examining the employment effects of cost rather than quantitative credit constraints, ii) differentiating quantitative constraints by type of loan application that has been denied credit, iii) investigating the moderating role of demand shocks and product market competition, and iv) exploring the different strategies that have been implemented by credit-constrained firms to adjust employment (see discussion in section 4.3).

Results in Table 4 show probit and bivariate probit estimates relative to cost credit constraints, namely a dummy variable taking the value one if the firm declared that credit was available between 2010 and 2013 but that the conditions (interest rates and other contractual terms) were too onerous, and zero otherwise. Independently of the estimator adopted,

regression coefficients associated to this variable are always found to be insignificant at standard probability levels. This outcome suggests that firms that had to cope with more stringent credit conditions (i.e. to face cost credit constraints) were still able to borrow enough money, at sufficiently good terms and conditions, so as to keep employment unaffected. It thus appears that cost constraints have had a much less detrimental impact on employment than quantitative constraints.

Regressions examining the employment effects of quantitative credit constraints according to the type of loan application that was denied (i.e. loans to finance working capital, new investments and debt, respectively) are reported in Table 5. Bivariate probit estimates (which, according to Wald χ^2 statistics, should be preferred to simple probit ones) indicate that firms that have had a credit constraint were, depending on the type of denied credit, between 41 and 49% more likely to adjust their workforce downwards than their opposite numbers not affected by such constraint. The relative size of employment effects thus appears to be quite similar across types of loan applications. Yet, marginal effects are found to be significantly, though modestly, bigger for credit shortages associated in turn to debt refinancing, working capital and new investments.

In order to test the role of demand shocks in explaining employment effects of credit constraints, we re-estimated equation (1) according to whether or not firms reported a decrease in the demand for their products/services between 2010 and 2013. Probit and bivariate estimates, reported in Table 6, reveal that credit constraints are only statistically significant among firms that experienced a negative demand shock. More precisely, we find that credit constrained firms, affected by a decrease in their demand, were *ceteris paribus* 46% more likely to adjust their labour input downwards. On the opposite, estimates show that credit constraints had no significant employment effects among firms with a stable or increasing demand. Hence, we may conclude that access to credit is mostly important for employment when demand is falling.

Moreover, to examine the role of firms' product environment, we re-estimated equation (1) according to whether or not firms were facing very severe competition on their main product/service market between 2010 and 2013. Estimates, shown in Table 7, clearly indicate that credit constraints had a substantially stronger impact on employment among firms operating in very competitive markets. We find indeed that credit-constrained firms were *ceteris paribus* 36% more likely to reduce their labour input than not credit-constrained ones when facing very severe competition. In contrast, credit constraints are found to have a non-significant effect on employment among firms operating in more weakly competitive

markets. In line with theoretical expectations, our findings thus suggest that credit constraints matter for employment especially among firms facing strong product market competition.

Finally, we explored the different strategies that have been implemented by credit-constrained firms to adjust employment. To do so, we first re-estimated equation (1) using as outcome variable employment adjustment along the extensive and intensive margins, respectively. When focusing on the extensive margin, the dependent variable is a dummy taking the value 1 for firms that relied (marginally, moderately or strongly) on i) collective layoffs, ii) individual layoffs, iii) non-renewal of temporary contracts at expiration and/or reduction of agency work, and/or iv) early retirement schemes between 2010 and 2013; and 0 otherwise. When exploring employment adjustment along the intensive margin, the dependent variable is a dummy taking the value 1 for firms that relied (marginally, moderately or strongly) on i) temporary layoffs (for economic reasons), and/or ii) subsidised and/or non-subsidised reduction of working hours (including reduction of overtime) between 2010 and 2013; and 0 otherwise. To get a better understanding of credit-constrained firms' strategies to reduce their labour input, equation (1) has also been re-estimated using as outcome variable each of these (extensive and intensive) adjustment channels separately.

Estimates regarding employment adjustment at the extensive margin are reported in columns 2 and 3 of Table 8. Bivariate probit estimates (which, according to the Wald test should be preferred to single probit ones) indicate that credit-constrained firms were *ceteris paribus* 40% more likely to adjust employment at the extensive margin than non-constrained firms. Among the various channels that can be used to attain this goal, results reported in Table 9, show that credit-constrained firms essentially relied on individual layoffs, early retirement schemes and reduction of temporary employment. In contrast, we find no significant effect of credit constraints on collective layoffs.

The impact of credit constraints on employment adjustment along the intensive margin is shown in columns 4 and 5 of Table 8. Estimates are found to be highly significant. However, their magnitude is lower than in the extensive margin regressions. Indeed, the marginal effect associated to the bivariate probit regression (which should be preferred to single probit one) stands at 0.30. Results in Table 10 provide more details on the policies that have been implemented by credit-constrained firms to adjust employment at the extensive margin. They show that the latter were significantly more likely to rely on temporary layoffs (for economic reasons) than their non-constrained opposite numbers. In contrast, firms' likelihood to reduce working hours appears unrelated to whether or not they had a credit constraint.

7. Conclusion

While the outbreak of the Great Recession caused much economic hardship, it also provided a unique opportunity to gain a better understanding of how corporate employment decisions are affected by credit shortages in bad economic times. This paper takes advantage of access to detailed matched bank-firm data to investigate whether and how employment decisions of SMEs have been affected by different types of credit constraints in the wake of the Great Recession. To do so, we combined detailed data from the third wave of the Belgian Wage Dynamics Survey, covering the period 2010-2013, with confidential data from the Central Corporate Credit Register from the National Bank of Belgium.

Our regression analysis clearly shows that credit matters. Two-stage least squares (2SLS) and bivariate probit estimates indeed suggest that SMEs borrowing money from pre-crisis financially less healthy banks were significantly more likely to be affected by a credit constraint and, in turn, to adjust their labour input downwards than pre-crisis clients of more healthy banks. More precisely, we find that credit-constrained SMEs were *ceteris paribus* 40% more likely to reduce their workforce than their opposite numbers not facing such constraints. This outcome, associated to quantitative credit constraints, is robust across types of loan applications that were denied credit (i.e. applications to finance working capital, debt or new investments). Cost constraints, on the opposite, are found to have had little impact on firms' employment decisions.

Furthermore, estimates show that employment consequences of quantitative credit shortages are strongly contingent on the environment in which firms operate. Results indeed indicate that credit constraints have been essentially detrimental for employment among SMEs experiencing a negative demand shock or facing very severe product market competition. This outcome is in line with traditional bargaining models predicting that employment adjustment increases with the elasticity of labour demand and the price elasticity of demand in the product market.

Finally, our estimates uncover the strategies that have been adopted by credit-constrained firms to adjust their labour input. Despite the fact that aggregate employment has been fairly resilient in Belgium following the 2008 financial crisis, our results clearly show that credit shortage has been a key factor pushing SMEs to reduce their workforce at the extensive margin, and in particular to rely on individual layoffs, early retirement schemes and reduction of temporary employment. However, estimates also show that credit-constrained SMEs have been significantly more likely to adjust employment at the intensive margin,

especially through the use of temporary layoff allowances, than their non-constrained counterparts. This outcome is quite interesting as it suggests that temporary layoff schemes have played a significant role in mitigating the employment effects of the financial crisis in Belgium. Put differently, it adds to a growing literature indicating that short-time compensation, i.e. pro-rated unemployment benefits for workers whose hours are reduced for economic reasons, may effectively contribute to save jobs during recessions (Abraham and Houseman, 2014; Hurley, 2010).

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Table 1: Firm-level descriptive statistics, sample associated to LPM and probit regressions

Variables	Mean	Std. Dev.
Type of adjustment measure:		
Labour input reduction [a]	0.33	0.47
Extensive margin:	0.31	0.46
Collective layoffs	0.01	0.12
Individual layoffs	0.28	0.45
Temporary employment adjustment	0.17	0.38
Early retirement	0.08	0.27
Intensive margin:	0.21	0.41
Temporary layoffs (for economic reasons)	0.17	0.38
Reduction of working hours (subsidised or not)	0.08	0.27
Type of credit constraint:		
Quantitative constraint:	0.27	0.44
To finance working capital	0.16	0.37
To finance new investment	0.22	0.42
To refinance debt	0.16	0.37
Cost constraint:	0.23	0.42
Firm characteristics:		
Share of workers with tenure ≤ 5 years	0.37	0.25
Share of high-skilled workers	0.43	0.33
Firm age (years)	35.7	24.8
Firm size (total number of employees)	35.2	122.0
Industry:		
Manufacturing	0.16	
Construction	0.14	
Trade	0.29	
Business activities	0.37	
Financial intermediation	0.03	
Decrease in demand for firm's products/services	0.52	0.50
Very strong competitive pressure for firm's main product/service	0.52	0.50
Number of observations [b]	855	

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Except for the 'Cost constraint' variable for which the number of observations is equal to 854. Weighted descriptive statistics.

Table 2: The impact of credit constraints on labour input reduction [a], LPM estimates and marginal effects from probit regressions

	LPM	Probit
Quantitative credit constraint [b]	**0.099*** **	**0.100*** **
	(0.034)	(0.005)
Covariates:		
Firm age (in years)	0.000	0.000***
	(0.001)	(0.000)
Firm size (total number of employees)	0.000	0.000***
	(0.000)	(0.000)
Industry:		
Manufacturing	Reference	Reference
Construction	-0.112**	-0.115***
	(0.055)	(0.007)
Trade	-0.064	-0.075***
	(0.047)	(0.006)
Business services	-0.113**	-0.119***
	(0.047)	(0.006)
Financial intermediation	-0.010	-0.013
	(0.095)	(0.013)
Decrease of demand for firm's products/services	0.314***	0.320***
	(0.031)	(0.004)
Strong competitive pressure for firm's main product/service	0.099**	0.134***
	(0.040)	(0.005)
Share of workers with tenure ≤ 5 years	0.002**	0.002***
	(0.001)	(0.000)
Share of high-skilled workers	-0.000	-0.000***
	(0.000)	(0.000)
R-squared	0.16	
Pseudo R-squared		0.13
Number of observations	855	855

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. Weighted regressions. Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 3: The impact of credit constraints on labour input reduction [a], 2SLS estimates and marginal effects from bivariate probit regressions [b]

	2SLS	Bivariate probit
Quantitative credit constraint [c]	**0.509***** (0.152)	**0.402***** (0.003)
Covariates [d]:	YES	YES
Weak identification test statistic [e]	13.3***	
Overidentification test, p-value [f]	0.66	
Endogeneity test, p-value [g]	0.06	
Wald test χ^2, p-value [h]		0.00
R-squared	0.37	
Number of observations	522	522

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Instruments for the 2SLS and bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable, and dummies for firms' main bank. [c] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [d] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), change in demand for firm's products/services (1 dummy), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [e] Weak identification test reports Kleibergen-Paap rk Wald F statistic. [f] Overidentification test reports p-value of Hansen J statistic. [g] Endogeneity test shows probability that endogenous regressors can actually be treated as exogenous. [h] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions. Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 4: The impact of cost credit constraints on labour input reduction [a], marginal effects from probit and bivariate probit regressions [b]

	Probit	Bivariate probit[b]
Cost credit constraint to [c]:	0.013	-0.154
	(0.054)	(0.265)
Covariates [d]:	YES	YES
Pseudo R-squared	0.15	
Wald test χ^2, p-value [e]		0.38
Number of observations	854	521

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable, and dummies for firms' main bank. [c] Dummy variable taking the value 1 if the firm faced a cost credit constraint between 2010 and 2013, i.e. declared that credit was available but that the conditions (interest rates and other contractual terms) were too onerous, and 0 otherwise. [d] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), change in demand for firm's products/services (1 dummy), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. Weighted regressions. Robust standard errors reported between parentheses. [e] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 5: The impact of quantitative credit constraints on labour input reduction, according to the type of loan application made [a], marginal effects from bivariate probit regressions [b]

	Bivariate probit[b]		
Quantitative credit constraint to [c]:			
Finance working capital	**0.452***** (0.004)		
Finance new investment		**0.407***** (0.004)	
Refinance debt			**0.494***** (0.004)
Covariates [d]:	YES	YES	YES
Wald test χ^2, p-value [e]	0.00	0.00	0.00
Number of observations	521	521	524

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable, and dummies for firms' main bank. [c] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [d] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), change in demand for firm's products/services (1 dummy), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. Weighted regressions. Robust standard errors reported between parentheses. [e] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 6: The impact of credit constraints on labour input reduction[a], according to changes in demand for firms' products and/or services, marginal effects from probit and bivariate probit [b] regressions

	Δ demand < 0 [c]		Δ demand ≥ 0 [d]	
	Probit	Bivariate probit	Probit	Bivariate probit
Quantitative credit constraint [e]	**0.222***** (0.007)	**0.461***** (0.005)	-0.050 (0.058)	-0.170 (0.266)
Covariates [f]:	YES	YES	YES	YES
Pseudo R-squared	0.08		0.07	
Wald test χ^2, p-value [g]		0.00		0.66
Number of observations	434	278	421	263

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable (except for Δ demand < 0), and dummies for firms' main bank (except for Δ demand < 0). [c] Sample of firms that have experienced a decreasing demand for their products and/or services between 2010 and 2013. [d] Sample of firms that have experienced an unchanged or increasing demand for their products and/or services between 2010 and 2013. [e] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [f] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [g] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions. Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 7: The impact of credit constraints on labour input reduction[a], according to the degree of competition on firm's main product/service market, marginal effects from probit and bivariate probit [b] regressions

	Stronger competition[c]		Weaker competition[d]	
	Probit	Bivariate probit	Probit	Bivariate probit
Quantitative credit constraint [e]	**0.090***** (0.007)	**0.364***** (0.024)	0.115 (0.008)	-0.184 (0.831)
Covariates [f]:	YES	YES	YES	YES
Pseudo R-squared	0.07		0.24	
Wald test χ^2, p-value [g]		0.00		0.00
Number of observations	449	266	406	275

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable, and dummies for firms' main bank. [c] Sample of firms experiencing very severe competition on their main product/service market. [d] Sample of firms experiencing severe, moderate or weak competition on their main product/service market. [e] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [f] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [g] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions. Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively

Table 8: The impact of credit constraints on the extensive[a] and intensive[b] margins, marginal effects from probit and bivariate probit [c] regressions

	Extensive margin[a]		Intensive margin[b]	
	Probit	Bivariate probit	Probit	Bivariate probit
Quantitative credit constraint [d]	**0.090***** (0.005)	**0.403***** (0.003)	**0.052***** (0.004)	**0.292***** (0.015)
Covariates [e]:	YES	YES	YES	YES
Pseudo R-squared	0.12		0.13	
Wald test χ^2, p-value [f]		0.00		0.00
Number of observations	855	522	842	522

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm relied (marginally, moderately or strongly) on collective layoffs, individual layoffs, non-renewal of temporary contracts at expiration, early retirement schemes and/or reduction of agency workers between 2010 and 2013, and 0 otherwise. [b] The dependent variable is a dummy taking the value 1 if the firm relied (marginally, moderately or strongly) on temporary layoffs (for economic reasons), subsidised reduction of working hours and/or non-subsidised reduction of working hours (including reduction of overtime) between 2010 and 2013, and 0 otherwise. [c] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable, and dummies for firms' main bank. [d] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [e] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [f] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions. Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 9: The impact of credit constraints on different components of the extensive margin [a], marginal effects from probit and bivariate probit [c] regressions

	Collective layoff s[a]		Individual layoffs [a]		Adjustment temporary employment [a]		Early retirement [a]	
	Probit	Bivariate probit	Probit	Bivariate probit	Probit	Bivariate probit	Probit	Bivariate probit
Quantitative credit constraint [d]	-0.003 (0.003)	-0.024 (0.045)	**0.115*** (0.005)	**0.401*** (0.003)	**0.010*** (0.003)	**0.282*** (0.009)	**0.044*** (0.002)	**0.300*** (0.008)
Covariates [e]:	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R-squared	0.19		0.12		0.17		0.20	
Wald test χ^2, p-value [f]		0.80		0.00		0.00		0.00
Number of observations	842	522	855	522	855	522	855	542

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm relied (marginally, moderately or strongly) respectively on: i) collective layoffs, ii) individual layoffs, iii) non-renewal of temporary contracts at expiration and/or reduction of agency workers, and iv) early retirement schemes between 2010 and 2013, and 0 otherwise. . [c] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable (except for early retirement), and dummies for firms' main bank. . [d] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [e] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [f] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions (weights taken from WDN survey, i.e. variable wb). Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Table 10: The impact of credit constraints on different components of the intensive margin [a], marginal effects from probit and bivariate probit [c] regressions

	Temporary layoffs (for economic reasons)[a]		Reduction of working hours[a]	
	Probit	Bivariate probit	Probit	Bivariate probit
Quantitative credit constraint [d]	**0.075***** (0.004)	**0.352***** (0.066)	-0.034 (0.022)	0.025 (0.141)
Covariates [e]:	YES	YES	YES	YES
Pseudo R-squared	0.17		0.12	
Wald test χ^2, p-value [f]		0.01		0.71
Number of observations	842	551	842	522

Notes: [a] The dependent variable is a dummy taking the value 1 if the firm relied (marginally, moderately or strongly) respectively on: i) temporary layoffs (for economic reasons), ii) subsidised reduction of working hours and/or non-subsidised reduction of working hours (including reduction of overtime) between 2010 and 2013, and 0 otherwise. [c] Instruments for bivariate probit regressions include (in addition to covariates contained in the vector X_i of equation (1)) the change in firms' main bank loan supply, the inverse value of this variable (except for temporary layoffs), and dummies for firms' main bank (except for temporary layoffs). [d] Dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [e] Covariates include the size and age of the firm, sectoral affiliation (4 dummies), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [f] If the Wald test rejects the null hypothesis of no correlation between the error terms of the two probit regressions, the bivariate probit is recommended. Weighted regressions (weights taken from WDN survey, i.e. variable wb). Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.

Appendix 1: Firm-level descriptive statistics, sample associated to 2SLS and bivariate probit regressions

Variables	Mean	Std. Dev.
Type of adjustment measure:		
Labour input reduction [a]	0.29	0.46
Extensive margin:	0.27	0.45
Collective layoffs	0.02	0.13
Individual layoffs	0.25	0.43
Temporary employment adjustment	0.17	0.37
Early retirement	0.03	0.18
Intensive margin:	0.20	0.40
Temporary layoffs (for economic reasons)	0.18	0.38
Reduction of working hours (subsidised or not)	0.08	0.27
Type credit constraint:		
Quantitative constraint:	0.33	0.47
To finance working capital	0.23	0.42
To finance new investment	0.29	0.45
To refinance debt	0.18	0.39
Cost constraint:	0.31	0.46
Firm characteristics:		
Share of workers with tenure ≤ 5 years	0.37	0.25
Share of high-skilled workers	0.44	0.32
Firm age (years)	36.4	22.7
Firm size (total number of employees)	30.4	135.1
Industry:		
Manufacturing	0.20	0.40
Construction	0.18	0.38
Trade	0.27	0.44
Business activities	0.36	0.48
Financial intermediation	0.00	0.00
Decrease in demand for firm's products/services	0.51	0.50
Very strong competitive pressure for firm's main product/service	0.48	0.50
Number of observations [b]	522	

Notes: [a] Dummy taking the value 1 if the firm needed to significantly reduce its labour input or alter its composition between 2010 and 2013, and 0 otherwise. [b] Except for the 'Cost constraint' variable for which the number of observations is equal to 526. Weighted descriptive statistics.

Appendix 2: Firm-level descriptive statistics of instruments, sample associated to 2SLS and bivariate probit regressions

Variables	Mean	St. Dev.
% change in firm's main bank loan supply before and after the crisis (MBLS) [a]	2.07	0.54
Inverse of MBLS	0.50	0.35
Firm's main bank dummies		
Bank 1	0.000	
Bank 2	0.011	
Bank 3	0.001	
Bank 4	0.022	
Bank 5	0.030	
Bank 6	0.002	
Bank 7	0.007	
Bank 8	0.434	
Bank 9	0.017	
Bank 10	0.002	
Bank 11	0.012	
Bank 12	0.002	
Bank 13	0.000	
Bank 14	0.009	
Bank 15	0.237	
Bank 16	0.213	
Number of observations	522	

Notes: [a] The exact definition of this variable is as follows: % change in the number of loans made by the firm's *i* main bank to all borrowers other than firm *i* before (i.e. October 2005 – June 2007) and after (i.e. October 2008 – June 2011) the crisis, normalized by the number of loans made by the firm's *i* main bank before the crisis. Weighted descriptive statistics.

Appendix 3: Determinants of quantitative credit constraints, i.e. first-stage of 2SLS and bivariate probit regressions for labour input reduction

	First-stage estimates of:	
	2SLS	Bivariate probit
	(1)	(2)
Instrumental variables:		
% change in firm's main bank loan supply before and after the crisis (MBLS) [b]	**-0.276****	**-0.802*****
	(0.131)	(0.039)
Inverse of MBLS	-0.065	**-0.180*****
	(0.070)	(0.028)
Firm's main bank dummies:		
Bank 1	**-0.923*****	-8.032
	(0.188)	(26,594.15)
Bank 2	**-0.526*****	-6.840
	(0.147)	(28,16.24)
Bank 3	**-0.430*****	-6.673
	(0.081)	(13,120.89)
Bank 4	**-0.328*****	-5.945
	(0.076)	(1,013.92)
Bank 5	0.051	**0.388*****
	(0.290)	(0.041)
Bank 6	**-0.435*****	-6.645
	(0.101)	(7,400.11)
Bank 7	**-0.350*****	**-1.075*****
	(0.120)	(0.099)
Bank 8	*Reference*	*Reference*
Bank 9	0.474	**1.160*****
	(0.360)	(0.054)
Bank 10	**-0.368***	-0.045
	(0.202)	(0.171)
Bank 11	-0.315	**-0.968*****
	(0.199)	(0.071)
Bank 12	**0.650*****	7.647
	(0.120)	(8,889.05)
Bank 13	**-0.458*****	-6.898
	(0.105)	(41,146.4)
Bank 14	-0.099	**-0.491*****
	(0.237)	(0.073)
Bank 15	-0.059	-0.005
	(0.084)	(0.017)
Bank 16	-0.019	**0.038****
	(0.101)	(0.017)
Other covariates [c]:	YES	YES
Sanderson-Windmeijer (SW) multivariate F-test of excluded instruments [d]	13.33***	
Number of observations	522	522

Notes: [a] The dependent variable is a dummy variable taking the value 1 if the firm faced a quantitative credit constraint between 2010 and 2013, i.e. declared that credit was not available. [b] The exact definition of this variable is as follows: % change in the number of loans made by the firm's *i* main bank to all borrowers other than firm *i* before (i.e. October 2005 – June 2007) and after (i.e. October 2008 – June 2011) the crisis, normalized by the number of loans made by the firm's *i* main bank before the crisis. [c] Regressions also control for firm age and size, sectoral affiliation (4 dummies), change in demand for firm's products/services (1 dummy), competitive pressure for firm's main product/service (1 dummy), share of workers with at most 5 years of tenure, and share of high skilled workers. [d] Given that there is a single endogeneous regressor (i.e. the credit constraint), the SW statistic is identical to the Kleibergen-Paap rk Wald statistic for weak identification (as the robust option has been requested in Stata). Robust standard errors reported between parentheses. ***, **, * significant at 1, 5 and 10 percent levels, respectively.