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Credit constraints, firm investment and growth: evidence from survey data

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Abstract

We assess the impact of credit constraints on investment, inventories and other working capital and firm growth with a large panel of small and medium-sized enterprises from 12 European countries for the period 2014-2016. The data come from the Survey on the access to finance of enterprises (SAFE), a survey that is especially designed to analyse the problems in the access to external finance of European SMEs. The key identification challenge is a potential reverse-causality bias, as firms with poor investment and growth opportunities may have a higher probability of being credit constrained. We implement several strategies to overcome this obstacle: proxies for investment opportunities, lagged regressors, random effects and instrumental variables. Our findings suggest that credit constraints, both in bank financing and other financing (e.g. trade credit), have strong negative effects on investment in fixed assets, while the impact on firm growth and working capital is less robust.

Keywords: investment, firm growth, working capital, ordered probit, instrumental variables.

JEL Classification: G30, G31, G32.

Non Technical Summary

According to the Modigliani-Miller theorem (1958), under certain conditions, a firm's capital structure is irrelevant to its value. This implies that, in frictionless perfect capital markets, a firm's financing decisions are independent from its investment decisions because internal and external funds are perfect substitutes. In practice, however, factors such as transaction costs, tax advantages, costs of financial distress, agency costs and asymmetric information lead to an imperfect substitutability between internal and external funds, so that the cost of external finance is higher than the opportunity cost of internally generated funds. In this context, financial constraints may have an important (negative) effect on real variables such as investment, working capital and firm growth, especially for firms with insufficient internal funds (cashflows and retained earnings).

The purpose of this research is to test this theoretical prediction. We do so with a panel of about 5,000 small and medium-sized enterprises (SMEs) from 12 European countries for the period 2014-2016. The firm-level data come from the Survey on the access to finance of enterprises (SAFE), a survey that is run jointly by the European Central Bank and the European Commission every six months since 2009. The survey, initiated in the middle of the Great Recession, was especially designed to analyse the problems in the access to external finance faced by European SMEs, so it constitutes an ideal source of information about the credit constraints experienced by those firms.

In line with previous studies on the SAFE, we develop several survey-based indicators of credit constraints, distinguishing between constraints in the access to bank finance (bank loans, bank overdrafts, credit lines) and in the access to other finance (trade credit, leasing, factoring, debt and equity securities, etc). While bank finance is the predominant source of external funds for SMEs in Europe, Casey and O'Toole (2014) find that bank-constrained SMEs substitute trade credit, informal lending and loans from other companies for bank credit. Hence, it is crucial to take into account all sources of external finance when assessing firms' financial constraints.

Following the existing literature, our measures of credit constraints encompass the following circumstances: a) a firm's application to external financing got rejected; b) a firm only received a limited part of what it applied for (i.e., quantity rationing); c) a firm refused the lender's proposal for external financing because the borrowing costs were

too high (i.e., price rationing); d) a firm did not apply for external financing because it feared its application would be rejected (i.e., discouraged borrowers). Nevertheless, we check the robustness of our results to an alternative measure of financial constraints that is based on firms' perceptions about access to finance.

Our main findings suggest that credit constraints, both in bank financing and other financing, have important effects in investment in fixed assets, inventories and other working capital and firm growth. According to our baseline estimates, a firm that is constrained in bank financing has 2.1 percentage point (pp) higher probability of decreasing investment and a 2.8 pp lower probability of increasing it. Likewise, a firm that is constrained in other financing has 3.4 pp higher probability of decreasing investment and a 4.5 pp lower probability of increasing it. Notice that these effects are additive, implying that a firm that is constrained in all sorts of financing face a 5.5 pp greater likelihood of cutting down investment and a 7.3 pp lower likelihood of raising it. The effects on firm growth (measured in terms of employment) are of similar magnitude, but only credit constraints in bank financing have a significant effect. In particular, being bank-constrained raises 2.9 pp the probability of decreasing employment and reduces 4.1 pp the probability of increasing it. Regarding inventories and other working capital, it is interesting to notice that only credit constraints in other financing have a significant impact, probably capturing the crucial role of trade credit in customer-supplier relationships. Specifically, a firm that is constrained in other financing has 4.9 pp higher probability of decreasing working capital and a 5.7 pp lower probability of increasing it.

In addition, we find that the impact of credit constraints on firm-level outcomes is broad-based and is largely independent of firm size, age or ownership structure. A remarkable exception is the case of micro firms, which seem largely unaffected by credit constraints. This finding may be explained by the fact that micro firms rely more on internal funds (cashflows and retained earnings) to fund their investment projects, making them less sensitive to access to external funds, in spite of being more likely to be financially constrained due to asymmetric information problems. Finally, notice that these results are conservative measures of the total impact of credit constraints in the real economy, as our analysis ignores the extensive margin, i.e., those businesses that shut down because of a lack of credit and those firms that do not enter the market because they do not obtain financing to undertake their investment projects.

1. Introduction

According to the Modigliani-Miller theorem (1958), under certain conditions, a firm's capital structure is irrelevant to its value. This implies that, in perfect capital markets, a firm's financing decisions are independent from its investment decisions. In this case, internal and external funds are perfect substitutes, and real firm decisions, motivated by the maximisation of shareholders' claims, are independent of financial factors such as internal liquidity, debt leverage or dividend payments. In practice, however, factors such as transaction costs, tax advantages, costs of financial distress, agency costs and asymmetric information lead to an imperfect substitutability between internal and external funds[2], leading to the external finance premium.[3] In this context, financial constraints may have an important (negative) effect on real variables such as investment, working capital and firm growth, especially for firms with insufficient internal funds (cashflows and retained earnings).

The purpose of this research is to test this theoretical prediction. We do so with a panel of about 5,000 small and medium-sized enterprises (SMEs) from 12 European countries for the period 2014-2016. The firm-level data come from the Survey on the access to finance of enterprises (SAFE), a survey that is run jointly by the European Central Bank and the European Commission every six months since 2009.[4] The survey, initiated in the middle of the Great Recession, was especially designed to analyse the problems in the access to external finance faced by European SMEs, so it constitutes an ideal source of information about the credit constraints experienced by those firms.

In line with previous studies on the SAFE[5], we develop several survey-based indicators of credit constraints, distinguishing between constraints in the access to bank finance (bank loans, bank overdrafts, credit lines) and in the access to other finance (trade credit, leasing, factoring, debt and equity securities, etc). While bank finance is the predominant source of external funds for SMEs in Europe, Casey and O'Toole (2014) find that bank-constrained SMEs substitute trade credit, informal lending and loans

[2] See Fazzari *et al.* (1988) and Schiantarelli (1996) for a review of the theoretical research in this area.
[3] See, for instance, Bernanke and Gertler (1995).
[4] We limit our sample to the rounds 11 to 15 of SAFE (from April-September 2014 to April-September 2016) because of the availability of some key variables.
[5] See, *inter alia*, Casey and O'Toole (2014), Ferrando and Mulier (2015b), Ferrando *et al.* (2017), Ferrando and Mulier (2015b), Ferrando and Griesshaber (2011), Artola and Genre (2011).

from other companies for bank credit.[6] Hence, it is crucial to control for all sources of external finance when assessing firms' financial constraints to avoid an omitted variable bias. Following the existing literature[7], our measures of credit constraints are dummy variables that equal one if any of the following circumstances took place: a) a firm's application to external financing got rejected; b) a firm only received a limited part of what it applied for (i.e., quantity rationing); c) a firm refused the lender's proposal for external financing because the borrowing costs were too high (i.e., price rationing); d) a firm did not apply for external financing because it feared its application would be rejected (i.e., discouraged borrowers). Nevertheless, we check the robustness of our results by using an alternative measure of financial constraints based on firms' perceptions about access to finance.

Our goal is to identify the causal effect of credit constraints on investment, inventories and other working capital and firm growth. The key identification challenge we face is a potential reverse-causality bias, as we expect firms with poor investment/growth opportunities to have a higher probability of being credit constrained. We implement several strategies to overcome this obstacle. First, we proxy investment opportunities with a measure of enterprise-specific outlook[8], as in Ferrando and Mulier (2015b). We also control for traditional determinants of investment opportunities such as firm size and age (Petersen and Rajan, 1994) and include changes in firm's turnover as in empirical investment models based on the "acceleration principle" (Abel and Blanchard, 1986).[9] Second, in all our regressions we include country-industry-time fixed effects to control for time-varying country-specific and industry-specific investment and growth opportunities. Third, to avoid the potential *contemporaneous* endogeneity between investment dynamics, firm growth and credit constraints, we exploit the panel nature of our data and include lagged values of the credit constraint dummies, as well as lagged values of the time-varying controls.

In robustness, we also carry out two other strategies. First, we control for firm-level unobserved heterogeneity with a random-effects ordered probit model, which may

[6] By contrast, they do not find that bank-constrained SMEs apply for, or use, market finance (issued debt or equity).
[7] See, for instance, Ferrando *et al*. (2017), Ferrando and Mulier (2015a) and Artola and Genre (2011).
[8] In particular, the firm is asked to assess the evolution of its own outlook, with respect to its sales and profitability or business plan, i.e., whether it has improved, remained unchanged or deteriorated over the past six months.
[9] Those models link the demand for capital goods to changes in firms' output or sales.

capture the time-invariant component of investment/growth opportunities and help us mitigate the omitted variable bias.

Second, as we cannot perfectly control for firms' investment and growth opportunities, we use an instrumental variable to isolate the exogenous part of credit constraints. The proposed instrument is *adjusted credit standards*, a variable that measures the supply-only component of bank credit standards of each country in each round of the SAFE. The variable comes from the ECB's Bank Lending Survey (BLS), a survey that asks euro area banks about developments in their respective credit markets. According to the BLS, credit standards are the internal guidelines or loan approval criteria of a bank. However, credit standards may not be a valid IV because they may be correlated with aggregate demand effects: for instance, countries likely have tighter credit standards when banks have lower expectations about employment growth, investment, etc. To derive a correct instrumental variable we use another question of the BLS that asks banks about the supply and demand factors that determine the evolution of their credit standards. Hence, in a second step we regress credit standards on their demand factors. The residuals of those regressions are *adjusted credit standards*, i.e., the supply-only component of credit standards.

Our main findings suggest that credit constraints, both in bank financing and other financing, have important effects in investment in fixed assets, inventories and other working capital and firm growth. According to our baseline estimates (with a pooled ordered probit model), a firm that is constrained in bank financing has 2.1 percentage point higher probability of decreasing investment and a 2.8 pp lower probability of increasing it.[10] Likewise, a firm that is constrained in other financing has 3.4 pp higher probability of decreasing investment and a 4.5 pp lower probability of increasing it. Notice that these effects are additive, implying that a firm that is constrained in all sorts of financing face a 5.5 pp greater likelihood of cutting down investment and a 7.3 pp lower likelihood of raising it. The effects on firm growth (measured in terms of employment) are of similar magnitude, but only credit constraints in bank financing have a significant effect. In particular, being bank-constrained raises 2.9 pp the probability of decreasing employment and reduces 4.1 pp the probability of increasing

[10] One of the advantages of ordered probit models, relative to binary choice models such as probit or logit, is that we can allow for asymmetric effects, i.e., the effect on the probability of increasing investment and the effect on the probability of decreasing it do not necessarily have the same size.

it. Regarding inventories and other working capital, it is interesting to notice that only credit constraints in other financing have a significant impact, probably capturing the crucial role of trade credit in customer-supplier relationships. Specifically, a firm that is constrained in other financing has 4.9 pp higher probability of decreasing working capital and a 5.7 pp lower probability of increasing it. Things change little when we add random effects to the model, and the results with an alternative measure of credit constraints confirm their importance. The IV estimations suggest that overall credit constraints have strong negative effects on investment in fixed assets, while the impact on firm growth and working capital is less robust.

In addition, we analyse heterogeneous effects by computing average marginal effects for different types of firms (size, age, ownership structure). A remarkable result is that micro firms (less than 10 employees) are largely unaffected by credit constraints, probably because those firms rely more on internal funds (cashflows and retained earnings) to fund their investment projects, making them less sensitive to access to external funds. This result complements those of Beck *et al.* (2005), who find that small and medium-sized enterprises (SMEs) face greater financial, legal and corruption obstacles compared to large firms and the constraining impact of obstacles on firm growth is inversely related to firm size. However, Beck *et al.* (2005) compare SMEs with large firms, while we compare micro, small and medium-sized firms.[11] Hence, the effect of credit constraints on firm investment and growth may be a non-monotonic (concave) function of firm size. Moreover, the negative effect of credit constraints on firm growth seems to be mainly driven by the impact on family businesses and on sole traders, while most of the other ownership categories (e.g. listed companies, firms owned by other enterprises) are largely unaffected, which is consistent with asymmetric information problems.

The rest of the paper is organised as follows. Section 2 reviews related literature and explains this paper's contribution. Section 3 describes the sample and the construction of the variables used for the empirical analysis. Section 4 explains the econometric techniques and the identification strategy. Section 5 describes the baseline results. Section 6 displays several robustness tests. Finally, section 7 concludes. Some

[11] Beck *et al.* (2005) compare small (5-50 employees), medium-sized (51-500) and large firms (more than 500 employees), while we compare micro (1-9 employees), small (10-49 employees) and medium-sized firms (50-249 employees) and we do not have large firms in our sample.

descriptive statistics, technical details and additional results are displayed in several appendices.

2. Related literature and contribution.

Most previous research on financial constraints is based on financial statement data. In this literature, the standard approach is to use indirect measures of financial constraints such as dividend pay-out behaviour, association with business groups, size, age, ownership form and credit ratings to test whether the sensitivity of investment to cashflows is greater in the group of firms that are more likely to be constrained.[12] For instance, the seminal work of Fazzari *et al.* (1988) classified US firms according to their dividend pay-out ratio. The intuition is that, if the cost disadvantage of external finance is small, retention practices should reveal little or nothing about investment, as firms will simply use external funds to smooth investment when internal finance fluctuates. By contrast, if the cost disadvantage is significant (i.e., large external finance premium) firms that retain and invest most of their income (i.e., those with a low pay-out ratio) may have no low-cost source of investment finance, and their investment should be driven by fluctuations in cash flows. Consistent with this hypothesis, the authors find that the investment of firms that exhaust all their internal finance is more sensitive to fluctuations in cash flow than that of high-dividend firms. Nevertheless, a standard criticism of the studies on investment-cash flow sensitivities is that liquidity proxies for other unobservable determinants of investment such as the profitability of investment. High liquidity signals that the firm has done well and is likely to continue doing well. Thus, more liquid firms have better investment opportunities, and it is not surprising that they tend to invest more. Although one can use the Tobin's q to control for investment opportunities, Tobin's q is difficult to measure in practice and may well differ from the marginal q firms use to make their investment decisions. In addition, this strand of the literature has been challenged by Kaplan and Zingales (1997), who provide theoretical reasons and empirical evidence that a greater sensitivity of investment to cash flow is not a reliable measure of financing constraints.[13]

[12] See Schiantarelli (1996) for a review of this vast literature.

[13] Kaplan and Zingales (1997) undertake an in-depth analysis of the 49 low dividend firms that Fazzari *et al.* (1988) identify as financially constrained by examining managers' views on their firms' access to credit (gleaned from managers' statements filed in corporate 10-Ks), complemented with some

Given the limitations of those studies, there is a new emerging strand of the literature that attempts to assess the impact of financial constraints on real variables using survey data. The key idea is to obtain direct measures of financial constraints by asking firms about potential problems in their access to credit markets. Campello *et al*. (2010) do so with two samples, a cross-section of 1,050 very large corporations[14] from US, Europe and Asia in the fourth quarter of 2008 and a smaller rotating panel of US companies in the 2007Q3-2008Q4 period. Using the first dataset, they find that constrained firms planned, on average, deeper cuts in technology expenditures, capital expenditures, marketing expenditures, employment, cash holdings and dividend payments than unconstrained firms. In addition, recognising that comparisons of means may be confounded by systematic differences between constrained and unconstrained firms in other dimensions, they undertake matching techniques on several observable characteristics with their sample of US companies, finding significant differences between the two groups. Nevertheless, a limitation of their identification strategy is the potential endogeneity of financial constraints. If a firm's poor performance (e.g. lower spending in technology or capital) increases the likelihood of being credit constrained, then the matching estimators will fail to deliver the causal impact of financial constraints on investment and growth.[15]

Another study, very much in the spirit of this paper, is Ferrando and Mulier (2015b), in which they analyse the effect of being a discouraged borrower (i.e., firms that do not apply for a bank loan because they fear that their application will be rejected) on firm investment and growth. To do so they use a unique database that matches firms' answers to the SAFE with their financial statements for 9 euro area countries from the second quarter of 2010 until the first quarter of 2014. To take into account the endogeneity between discouragement and investment/growth, they use two-stage least squares and instrument their dummy for discouraged borrowers with a firm-level

quantitative data and public news. On this basis, they rank the extent to which the firms are financially constrained. Strikingly, they find that those firms classified as less financially constrained exhibit a significantly greater investment-cash flow sensitivity than those firms classified as more financially constrained.

[14] For instance, they categorise as "small" those firms with total gross sales amounting to less than $1 billion or with less than 500 employees. By contrast, according to the European Commission, small and medium sized firms are those with turnover less than $50 million and less than 250 employees.

[15] This is acknowledged by the authors: "Yet another concern is whether uncontrolled firm heterogeneity could confound our inferences. Consider, for example, a company that performs poorly even before the crisis. It would not be surprising to find that this firm might both do worse during the crisis (e.g., invest less) and find less available credit" (page 471).

financial constraints indicator, namely a dummy that equals 1 if the firm considers access to finance as the most pressing problem. However, such an instrument is likely to be invalid if lenders observe a firm's lack of investment/growth opportunities and in turn decide to restrain credit, making access to credit the firm's most pressing problem. To put it differently, their endogenous regressor is a financial constraints indicator, "discouraged borrowers", and their instrumental variable is another financial constraints indicator, "access to finance as most pressing problem", which is likely to be endogenous as well. Nevertheless, their estimates suggest that there is a negative and strong correlation between credit constraints, firm investment and growth.

In addition, Beck *et al.* (2005) use data on 4,000 firms from 54 countries from a cross-sectional survey conducted by the World Bank in 1999-2000, the World Business Environment Survey (WEBS), to analyse the effect of financial, legal and corruption obstacles on firm growth. For instance, in the case of financial obstacles, the survey includes questions that require, as an answer, a rating from 1 (no obstacle) to 4 (major obstacle) on factors such as collateral requirements, bank paperwork and bureaucracy, high interest rates and access to long-term loans. These are *perceived* financial *obstacles*, rather than *actual* financing *constraints*, as the formulation of the questions does not allow knowing if firms were denied credit. The authors find a negative correlation between those obstacles and firm growth. They also find that the negative impact of the obstacles on firm growth is a decreasing function of firm size (i.e., the smallest firms are consistently the most adversely affected by all obstacles) and it is inversely related to institutional development (i.e., financial and institutional development weakens the constraining effects of financial, legal and corruption obstacles.) Nevertheless, the lack of firm-level measures of investment opportunities and the potential endogeneity of the firm-level obstacles (firms that are not growing because of internal problems systematically shift blame to the legal and financial institutions and report high obstacles) cast some doubts on the causal interpretation of their estimates.[16] In a similar fashion, Coluzzi *et al.* (2015) study the impact of financial obstacles on firm growth in five euro area countries[17] using the WEBS and the

[16] Aware of the potential revere-causality bias, the authors carry out some sensitivity analyses in which the financial, legal and corruption obstacles are instrumented by measures of institutional development, namely, the development of the financial system, the legal system and the country's level of corruption. It is not clear, however, that the proposed instruments satisfy the exclusion restriction, as in previous regressions of firm growth on obstacles and institutions they are used as explanatory variables.

[17] France, Germany, Italy, Portugal, Spain.

Amadeus database. Identification of the causal impact of financial obstacles on firm growth relies on the estimation via the GMM-system estimator, in which all the regressors are instrumented with their lagged values. While the estimations deliver a negative coefficient on the financial obstacles variable in four out of the five countries, the Sargan-Hansen test rejects the null hypothesis of validity of overidentifiying restrictions in most cases, casting some doubts on the results.

Our paper contributes to the existing literature on the real effects of credit constraints in several ways.[18] First, it extends the work of Ferrando and Mulier (2015b) on discouraged borrowers to both "formal" and "informal" credit constraints (discouragement, quantity rationing, price rationing, rejected applications) and assesses the role of *all* sources of financing, not only bank loans, in shaping business decisions. It also covers a larger number of countries and analyses the recovery period of the European economy (2014-2016), unlike previous studies that have focused on the last recession. This is particularly interesting as the Eurozone prepares itself for monetary policy normalisation, which could influence on firms' investment via the so-called balance sheet channel (Bernanke and Gertler, 1995) and the external finance premium paid by credit constrained firms.[19] It also looks at the impact of financial constraints on inventories and other working capital, an aspect that has traditionally been overlooked in the literature, with few exceptions (Fazzari and Petersen, 1993). Finally, it attempts to establish a causal link between credit constraints and firm investment, inventories and growth by exploiting the panel nature of the data and by making use of an instrumental variable to isolate the exogenous part of credit constraints.

3. Data description and construction of variables.

[18] In addition, there are several papers that use quasi-experimental techniques to estimate the real effects of credit supply shocks. See, *inter alia*, Jiménez *et al.* (2017), Alfaro *et al.* (2016), Greenstone *et al.* (2014), Chodorow-Reich (2014), Acharya *et.al* (2016), Balduzzi *et al*. (2016). See also Buca and Vermeulen (2017) for the effect of bank credit tightening on firm investment.

[19] The balance sheet channel theorises that the size of the external finance premium is inversely related to the borrower's net worth (liquid assets plus the collateral value of illiquid assets). Hence, an increase in the interest rate will work not only through the traditional impact on the user cost of capital, but also through the adverse impact on the present value of collateralizable net worth, leading to a widening of the wedge between the cost of external and internal finance and, therefore, to a reduction in investment and production.

The data source for our analysis is the firm-level Survey on the Access to Finance of Enterprises (SAFE), which is run jointly by the ECB and the European Commission since 2009. The sample contains only non-financial firms and excludes firms in agriculture, public administration and financial services. Some of the firms are interviewed only once in the survey but there is a rotating panel of enterprises that are re-surveyed in subsequent rounds, which is the dataset we use for our analyses. We do not use answers by large firms[20] because the anonymised micro dataset does not provide information on the sector of activity of those companies to protect the confidentiality of the answers, and the industry of activity is an important control variable in our regression analysis. We also limit our sample to the rounds 11 to 15 of SAFE (from April-September 2014 to April-September 2016) because of the availability of some key variables.[21] After applying these filters, we end up with a sample of 7,162 non-missing observations[22] corresponding to 4,880 small and medium-sized enterprises (SMEs) from 12 European countries.[23]

Most of the information of the SAFE is qualitative, implying that most of the variables in the sample are categorical. Table 1 lists the names of the variables and the values they can take. A first set of variables contains information on the general characteristics of the firms such as country, industry, size (measured by the number of employees[24] or by turnover volume), age (in intervals of years), legal form (whether the firm is an autonomous enterprise or a subsidiary/branch of another enterprise), ownership structure (whether the firm is owned by a single natural person, by a family, by public shareholders, etc) and export activity.[25]

A second set of variables comprises several measures of credit constraints in bank financing (bank loans and credit lines) and in trade credit and other financing (equity and debt securities, leasing, factoring, intercompany loans, etc). Our preferred measures

[20] Defined as those companies with 250 employees or more.
[21] The SAFE questionnaire has been amended in several occasions, which provokes breaks in some series. In addition, some of the questions, which belong to a more comprehensive questionnaire, are only asked every one or two years in the rounds that are run in cooperation with the European Commission.
[22] The actual number of observations used in the estimations varies according to the dependent variable and the selected measure of credit constraints. Here we present descriptive statistics for the sample used for the baseline regressions of investment growth, as presented in Table 6
[23] Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Slovakia.
[24] Micro firms: 1-9 employees; small firms: 10-49 employees; medium firms: 50-249 employees.
[25] A firm is an exporter if any percentage of the company's turnover is accounted for by exports of goods and services.

are the so-called wide indicators of credit constraints, which combine formal and informal credit constraints, a strategy that is standard in the literature since the seminal work of Jappelli (1990). Following the existing literature[26], those variables equal one if, for each type of financing, any of the following circumstances took place: a) a firm's application to external financing got rejected; b) a firm only received a limited part (i.e., less than 75%) of what it applied for (i.e., quantity rationing); c) a firm refused the lender's proposal for external financing because the borrowing costs were too high (i.e., price rationing); d) a firm did not apply for external financing because it feared its application would be rejected (i.e., discouraged borrowers).[27] As in Ferrando *et al*. (2017) and Casey and O'Toole (2014), we build a single credit constraints indicator for bank loans and credit lines (*cc_bank*), assuming that a firm is constrained in bank financing if it is constrained in at least one of the two.[28] Hence, we are implicitly assuming that bank loans and credit lines are imperfect substitutes. This seems a plausible assumption, as loans are more likely to be used to fund large investments in fixed assets and credit lines are more commonly used to finance working capital. In analogous fashion, we build a single credit constraints indicator for trade credit and other financing (*cc_other*), assuming that a firm is constrained in non-bank financing if it is constrained in at least one of the two. In some of our analyses we merge *cc_bank* and *cc_other* into a single variable, *cc_all*, which equals 1 if the firm is constrained in at least one of the two financing sources (i.e., *cc_bank*=1 and/or *cc_other*=1) and 0 if the firm is constrained in none of them (i.e., *cc_bank*=*cc_other*=0).

In addition, we carry out robustness analyses with an alternative measure of credit constraints, *problem_access_finance*, which is a variable that indicates how important the problem "access to finance" is to the firm. In particular, the firm is asked to assess the importance of a series of problems (finding customers, competition, access to finance, costs of production or labour, availability of skilled staff, regulation, other) using a scale of 1-10, where 1 means it is not at all important and 10 means it is extremely important. Hence, this variable captures "perceived financing constraints",

[26] See, for instance, Ferrando *et al*. (2017), Ferrando and Mulier (2015a) and Artola and Genre (2011).
[27] The indicator is based on questions Q7A and Q7B of SAFE. Those questions are asked only to those firms that consider each source of financing (e.g. bank loans) relevant, as determined in question Q4. This is the main reason why there is a non-negligible number of missing values in the variable.
[28] We follow this strategy to maximise sample size. For instance, if a firm is constrained (unconstrained) in bank loans and has missing information on credit lines, we assume the firm is constrained (unconstrained) in bank financing.

while the wide indicator of credit constraints measures "actual financing constraints", as distinguished by Ferrando and Mulier (2015a).

A third set of variables indicates changes in the economic and financial situation of the firm. In particular, firms must answer whether a set of indicators, such as investment, working capital, employment, interest expenses or debt to assets have decreased, remained unchanged or increased over the last six months before the survey.[29] Finally, a fourth set of variables indicates whether some factors, such as the enterprise-specific outlook, the firm's own capital and the firm's credit history, have improved, remained unchanged or deteriorated.

Table A1 of Appendix A shows the breakdown of observations by country. It can be seen that the survey contains more observations for the larger economies in order to be sufficiently representative for these countries. France, Germany, Italy and Spain each account of about 10-15% of the firms in the sample. Around 50% of observations belong to the "vulnerable countries"[30], i.e., the euro area countries at the epicentre of the sovereign debt crisis (2009-2012). Table A2 of Appendix A shows the breakdown of observations by the main firm characteristics. Around one third of the observations belong to the industry sector[31], around ten percent to the construction sector, one fourth to wholesale or retail trade and 30% to the rest of services. Micro, small and medium firms each account for around one third of the sample. Most firms are more than 10 years old (85%), autonomous enterprises (89%) and owned by a family (55%) or sole traders (30%). Nearly half of them are exporters.

Table 2 shows weighted descriptive statistics, constructed with sampling weights[32], for the dependent variables of the analysis, the measures of credit constraints and the rest of controls. Concerning the dependent variables, a significant proportion of the firms report no changes in investment, working capital and employment, and the percentage of firms that report an increase in those variables is higher than the percentage that report a decrease. With respect to the indicators of credit constraints, sixteen per cent of

[29] The question of SAFE is Q2."Have the following company indicators decreased, remained unchanged or increased over the past six months?" Answers on some indicators, such as investment, working capital and number of employees are only available since round 11 of SAFE, when the question was extended.
[30] Vulnerable countries are Portugal, Italy, Ireland, Greece, Spain, Slovenia and Cyprus.
[31] Industry includes manufacturing, mining and electricity, gas and water supply.
[32] As the sample is stratified by country, enterprise size class and economic activity, we use sampling weights in all our statistical analyses. The weights restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity and country.

firms are constrained in bank finance (*cc_bank*=1), ten per cent are constrained in trade credit or other financing (*cc_other*=1) and nineteen per cent are constrained in some source of financing (*cc_all*=1). The average value of *problem_access_finance* is 5.7 and its standard deviation is 2.9, which means that the average firm considers access to finance to be a relatively important problem.

Table 3 shows pairwise correlations among the different measures of credit constraints. As the correlations among the wide indicators (*cc_bank*, *cc_other*, *cc_all*) and the measure of perceived financial constraints (*problem_access_finance*) are moderate, the analysis can benefit from using different measures of credit constraints. In addition, the relatively high correlation between *cc_bank* and *cc_other* (about 0.5) highlights the importance of controlling for credit constraints in trade credit and other financing when assessing the impact of credit constraints in bank finance on investment, working capital and firm growth. In similar fashion, Table 4 shows the value of the Cramer's V, which is a measure of association between two categorical variables that ranges between 0 and 1, for each pair of dependent variables. All values are between 0.2 and 0.3, indicating a moderate association among the variables.

To inspect a possible link between financial constraints and the dependent variables of our analysis (investment, working capital and employment), Figure 1 shows the distribution of those variables conditional on the values of *cc_bank*, as well as the statistic and p-value of the Pearson's chi-squared test of independence and the value of the Cramer's V. The picture that emerges is quite similar in the three variables. In each case, we can observe that the percentage of firms that report a decrease in the variable is substantially larger (at least 10 percentage points) in the group of financially constrained firms (*cc_bank*=1), while the percentage of firms that report an increase in the variable is substantially larger (at least 5 percentage points) in the group of firms without credit constraints (*cc_bank*=0). The percentage of firms whose investment remained unchanged is also slightly lower in the group of constrained firms. These differences are also statistically significant, as we reject the null hypothesis of independence in the Pearson's chi-squared test for a 1% significance level. The values of the Cramer's V, between 0.1 and 0.2, also suggest meaningful relationships. Same qualitative results are found for credit constraints in other financing (Figure 2) although the values of the Cramer's V are slightly lower, suggesting somewhat weaker relationships.

Finally, constrained and unconstrained firms may differ in their main characteristics. This is inspected in Table 5 for the case of credit constraints in bank financing. Consistent with the literature that finds a negative relationship between the probability of experiencing financial constraints and size[33], an 18% of micro firms are constrained, while this figure goes down to 14% and 9% in the case of small and medium firms, respectively. The same is true when firms are categorised in terms of their turnover. Likewise, there is a monotonic decreasing relation between the proportion of credit constraints and firm age, with mature firms (10 or more years) being 5 pp less likely to experience constraints than new ones (less than 2 years), in line with previous studies.[34] Also consistent with the literature that suggests that belonging to a business group relaxes financial constraints[35], the proportion of constrained firms that are subsidiary or branches is significantly lower (10%) than that of autonomous enterprises (15%). Ownership structure also matters, as sole traders and family businesses are more likely (15% in both cases) to being constrained than publicly-listed firms (9%). There is also a significant proportion of constrained firms among those owned by venture capital enterprises (16%), as venture capital tends to fund new and risky projects for which bank finance is often not available. Exporting firms are less likely to be financially constrained than non-exporting (although the difference is quite small) because the former tend to be more competitive and productive (Correa-López and Doménech, 2012). Finally, the proportion of credit constrained firms is higher in vulnerable (19%) than in less vulnerable countries (12%). All these differences highlight the importance of controlling for those factors when attempting to establish a causal link between financial constraints and firms' real outcomes.

4. Empirical methods and identification strategy

To identify the causal impact of credit constraints on investment and working capital an ordered probit model has been used. For brevity of exposition, let us focus on the dependent variable investment growth, ΔI. The order probit model is specified in terms of a continuous latent variable, latent investment growth ΔI^*:

[33] See, *inter alia*, Beck *et al*. (2005), Beck *et al.* (2006), Artola and Genre (2011) and Schiantarelli (1996) for a review of many other studies.

[34] Beck *et al.* (2005), *Beck et al.* (2006), Artola and Genre (2011), Ferrando and Griesshaber (2011), Ferrando and Mulier (2015b).

[35] Hoshi *et al.* (1991), Schiantarelli and Sembenelli (1995), Cho (1995), Elston and Albach (1995), Schaller (1993) and Chirinko and Schaller (1995).

$$\Delta I^*_{ijct} = X_i'\beta + \alpha_{jct} + \varepsilon_{ijct} \quad (1)$$

where *i* is firm, j is industry, *c* is country, *t* is wave, X_i' is a vector of variables that includes a set of credit constraints and firm-level controls, α_{jct} are country-industry-time fixed effects and ε_{ijct} is a disturbance that follows a N(0,1). The sign of the regression parameters β can be immediately interpreted as determining whether the latent variable I^*_{ijct} increases with the regressor or not.

Observed investment growth ΔI, as reported to the SAFE, is then related to latent investment growth ΔI^* in the following way:

$\Delta I_{ijct} =$ "$decrease$"$(k = 0)$ if $\Delta I^*_{ijct} \leq \mu_1$

ΔI_{ijct} = "remain unchanged" $(k = 1)$ if $\mu_1 < \Delta I^*_{ijct} \leq \mu_2$

ΔI_{ijct} = "$increase$" $(k=2)$ if $\Delta I^*_{ijct} > \mu_3$

where the parameters μ_1, μ_2, μ_3 are thresholds to be jointly estimated with the slope parameters. See Appendix B for details about the estimation.

Our goal is to identify the causal effect of credit constraints on firm investment, working capital and firm growth. The key identification challenge we face is a potential reverse-causality bias, as we expect firms with poor investment/growth opportunities to have a higher probability of being credit constrained. To tackle this problem our identification strategy relies in the use of a comprehensive set of fixed effects, together with many firm-level covariates, to control for firms' investment opportunities.

Hence, in all our regressions we include country-industry-time fixed effects (i.e., a dummy for each country-industry-wave combination) to eliminate variation in the dependent variable that is specific to a particular country in a particular industry during a particular period of time (e.g., construction in Spain during the housing bust). This large set of dummies controls for time-varying country-specific and industry-specific investment and growth opportunities.

Our favourite measure of investment opportunities is *enterprise outlook*, an indicator for changes in the enterprise-specific outlook, also used by Ferrando and Mulier (2015a). In particular, the firm is asked to assess the evolution of its own outlook, with respect to its sales and profitability or business plan, i.e., whether it has improved, remained

unchanged or deteriorated over the past six months. We also include an indicator for changes in firm's turnover (i.e., whether it has increased, remained unchanged or decreased over the past six months) as a proxy for growth opportunities, as in Gomes (2001).[36] Regarding the rest of firm-level controls, size and age, together with the firm's industry, are traditional determinants of investment opportunities (Petersen and Rajan, 1994). In addition, they are correlated with credit constraints, as discussed in the previous section. We also control for the degree of autonomy of the firm (whether the firm is an autonomous enterprise or a subsidiary/branch of another enterprise), and include ownership structure (whether the firm is owned by a single natural person, by a family, by public shareholders, etc) in our regressions, as those factors are likely to influence investment decisions, and we include a dummy that equals 1 if the firm is an exporter. In addition, there is a vast literature that studies the impact of firms' financial position on investment and employment decisions.[37] To control for it, we follow Casey and O'Toole (2014) and include indicators for changes in firms' profits, capital positions, debt to asset ratios, interest expenses and credit histories. We also include indicators for changes in labour costs and other costs as measures of trading quality and production risk.

An identification challenge is the potential contemporaneous endogeneity between investment dynamics, firm growth and credit constraints. For example, within the six month windows that we observe in our data, a firm may experience a negative shock in its investment/growth opportunities (for instance, the entry into the market of a new competitor or some adverse regulatory change) and lenders, observing such a shock, may decide to cut their supply of credit to the firm. In this case, the shock in investment opportunities would be driving the probability of being credit constrained and therefore the relationship would be endogenous. To identify the causal relationship correctly and rule out any such endogeneity, we exploit the panel nature of our data and include lagged values of the credit constraint dummies, as well as lagged values of the time-varying controls. In robustness, we also control for firm-level unobserved heterogeneity with a random-effects ordered probit model. This technique may capture the time-

[36] The growth rate of sales is also used in empirical investment models based on the "acceleration principle", which links the demand for capital goods to the change in a firm's output or sales (see, *inter alia*, Abel and Blanchard, 1986).
[37] See Herranz and Martínez-Carrascal (2017) for a review and an application to the Spanish economy.

invariant component of investment/growth opportunities (i.e., firms with high/low investment opportunities) and help us mitigate the omitted variable bias.

Nevertheless, a potential caveat to the previous approach is that we cannot perfectly control for firms' investment and growth opportunities, implying that the error term may be correlated with the credit constraint indicator. Hence, in a second approach, we use an instrumental variable to isolate the exogenous part of the key regressors. The proposed instruments, *adjusted credit standards*, are ordinal variables that measure the supply-only component of credit standards of each country in each round of the SAFE. The variables come from the ECB's Bank Lending Survey (BLS), a quarterly survey that asks euro area banks about developments in their respective credit markets since 2003. According to the BLS, "credit standards are the internal guidelines or loan approval criteria of a bank…Credit standards specify the required borrower characteristics (e.g. balance sheet conditions, income situation, age, employment status) under which a loan can be obtained..."

In particular, the BLS asks banks to describe the current level of their credit standards relative to the range of the bank's credit standards between the second quarter of 2010 and the moment the question is formulated, and the participant bank must select an answer out of eight possible options, ranging from very loose to very tight. The same question is asked for five different loan categories (overall loans to enterprises, loans to SMEs, loans to large firms, loans to households for house purchase, loans for consumer credit and other lending). To construct the variable, we first compute the level of credit standards of each bank by assigning values from 1 to 7 to each possible option, with higher values indicating tighter credit standards. We do so for the segment of loans to SMEs and for the segment of loans to large firms. We then calculate the average of credit standards for each country in each wave of the SAFE for each of segment.

However, the resulting instrumental variables, credit standards, may not satisfy the independence assumption because they may be correlated with aggregate demand effects. For instance, countries likely have tighter credit standards when banks have lower expectations about employment growth, investment, etc. To derive correct instrumental variables we use another question of the BLS that asks banks about the factors that determine the evolution of credit standards. In particular, each quarter banks are required to answer whether several factors have contributed to tightening of credit

standards, to keeping credit standards basically unchanged or easing of credit standards over the past three months. Those factors are:

A) Cost of funds and balance sheet constraints.

-Costs related to the bank's capital position.

-Bank's ability to access market financing.

-Bank's liquidity position.

B) Pressure from competition.

-Competition from other banks.

-Competition from non-banks

-Competition from market financing.

C) Perception of risk.

-General economic situation and outlook.

-Industry or firm-specific situation and outlook / borrower's creditworthiness.

-Risk related to the collateral demanded.

D) Bank's risk tolerance.

While A), B) and D) are supply factors, it is clear that C) comprises demand factors. Hence, in a second step we regress the variables credit standards on the factors "general economic situation", "industry or firm-specific situation" and "risk related to the collateral demanded". The residuals of those regressions are the variables *adjusted credit standards*, i.e., the supply-only components of credit standards for large firms and SMEs. We expect these instrumental variables to satisfy the independence assumption because they should be uncorrelated with firms' investment and growth opportunities and aggregate demand effects. However, to rule out that the instruments are just proxying the economic cycle and in turn the economy-wide investment opportunities, we include, as an additional regressor, the detrended level of real GDP. Similar results are found when proxying the economic cycle with the unemployment rate. In addition, we include other country-level determinants of investment demand

such as the European Commission's consumer confidence indicator (to measure expectations) and the ten-year government bond yield (to proxy financial conditions).

Table C1 of Appendix C shows a set of auxiliary estimations in which adjusted credit standards are regressed on the economic cycle (proxied by GDP or unemployment rate), the consumer confidence indicator, the ten-year government bond yield and the aggregate investment growth. The regressions also include country and time fixed effects. Columns (1) and (2) show the regressions for *adjusted credit standards* to SMEs and columns (3) and (4) display the regressions for *adjusted credit standards* to large firms. In columns (1) and (3) the coefficient on GDP is significant and with the expected sign, implying that higher GDP is associated with easier credit standards. The rest of coefficients are generally insignificant. These results illustrate the need to control for the economic cycle, as proxied by the country's real GDP, in our main regressions, so that the instruments satisfy the independence assumption.

Finally, we use cluster-robust standard errors to allow for potential heteroscedasticity and serial correlation across groups in the error structure. The selection of the clustering groups is specific to the particular regression undertaken and is indicated in the regression output.

5. Empirical results

5.1 Overall effects

Tables 6-8 display the estimation of pooled ordered probit models in which the dependent variables are, respectively, investment growth, working capital growth and employment growth. Column (1) shows the regression coefficients and columns (2)-(4) the marginal effects of the measures of credit constraints (*cc_bank* and *cc_other*) on the probability of each alternative (decrease, remain unchanged, increase). In terms of the base categories for the firm controls, micro firms with turnover less than €500,000 is the omitted category for the size dummies, more than 10 years for the age dummies, subsidiary/branch for legal form and publicly-listed firms for ownership structure. As in Casey and O'Toole (2014), standard errors are clustered at the country-wave level to

allow for heteroscedasticity and serial correlation of the errors across firms in the same country in a given wave of the SAFE.[38]

Let us start with Table 6. In column (1) the sign of the regression parameters indicates whether the latent variable increases or decreases with each regressor. Credit constraints in bank financing (*cc_bank*) and credit constraints in other financing (*cc_other*) are negatively correlated with latent investment growth. Regarding the controls, small and medium firms invest more than micro firms, relatively mature firms (between 5 and 10 years) invest more than rest of firms and sole traders invest more than the rest. Interestingly, firms whose outlook deteriorated or remained unchanged invest less than those whose outlook improved, confirming that the enterprise-specific outlook is a good proxy for investment opportunities. In order to ascertain the size of these effects, we turn our attention to the marginal effects in columns (2)-(4). A credit constrained firm in bank financing (*cc_bank*=1) has a 2.1 percentage point (pp) larger probability of decreasing investment (column (2)) and a 2.8 pp lower probability of increasing investment (column (4)). The marginal effects of *cc_other* are somewhat larger. Specifically, a credit constrained firm in other financing (*cc_other*=1) has a 3.4 percentage point (pp) larger probability of decreasing investment (column (2)) and a 4.5 pp lower probability of increasing investment (column (4)). Notice that these effects are additive, implying that a firm that is constrained in all sorts of financing (*cc_bank*= *cc_other*=1) faces a 5.5 pp greater likelihood of cutting down investment and a 7.3 pp lower likelihood of raising it.

Interestingly, column (1) of Table 7 reveals that *cc_bank* has no significant correlation with latent working capital growth, while *cc_other* is negatively correlated with that variable, which may be explained by the crucial role of trade credit in customer-supplier relationships. Regarding the controls, firms with turnover greater than € 2 million experience larger increases in working capital than the rest of companies, relatively mature firms (between 5 and 10 years) experience larger increases in working capital than the rest and autonomous enterprises invest more in liquid assets than subsidiaries or branches, probably because of a precautionary savings strategy, as they cannot rely on intra-group financing in the event of additional liquidity needs. In addition, firms

[38] Alternatively, we have computed standard errors that are two-way clustered at the firm and at the country-wave level, to allow for correlation of the error within firms across years and across firms in the same country in a given wave. The results, available upon request, are very similar.

whose outlook deteriorated or remained unchanged invest less in working capital than those whose outlook improved. According to columns (2) and (4), a credit constrained firm in other financing (*cc_other*=1) has a 4.9 pp larger probability of decreasing working capital and a 5.7 pp lower probability of increasing it, while the marginal effects of *cc_bank* are not statistically different from zero.

A similar picture emerges when we examine the effect of credit constrains on firm growth (Table 8). According to Table 8, a firm that is constrained in bank financing has a 2.9 pp larger probability of decreasing employment and a 4.1 lower probability of increasing it, while the marginal effects of *cc_other* are not statistically different from zero. Regarding the controls, small and medium firms experience higher growth than micro firms and middle-aged firms (between 2 and 10 years) experience higher growth than the rest. A deteriorated business outlook has a negative impact on firm growth.

5.2 Heterogeneous effects

Given that SMEs are a very heterogeneous group of firms, and to provide a more granular insight into the real effect of credit constraints, we have estimated the marginal effects of the credit constraints variables using the previous model for different values of some firm characteristics. Beck *et al.* (2006) find that, for SMEs, firm age, size and ownership are important determinants of firm financing constraints. We therefore estimate the marginal effects for different firm groups using these key characteristics.[39] In particular, we interact the credit constraint variables with the size dummies (micro, small and medium), the age dummies (10 years or more, 5 to 9 years, 2 to 4 years, less than 2 years) and the ownership dummies (listed company, family business, firm owned by another enterprise[40], sole trader, other). We then regress each dependent variable (investment, working capital, employment) on the control variables, the lagged measures of credit constraints, the size/age/ownership dummies and the interactions between those variables and the measures of credit constraints. The marginal effects of the interactions may differ because the impact of credit constraints can depend on firm size, age or ownership structure. The vector of firm-level controls and country-industry-time dummies is the same as in previous estimations.

[39] Casey and O'Toole (2014), in their study of the effects of credit constraints on alternative finance usage with the SAFE database, also compute marginal effects for those variables.
[40] Due to the low number of observations, the category "owned by venture capital enterprise or business angel" has been merged with the category "owned by another enterprise".

In Table 9 we present the marginal effects of the interactions between the size dummies and the credit constraint measures on the probability that the dependent variable increases. The omitted category is micro firms. The lower part of the table shows linear combinations of the marginal effects to know the impact of credit constraints for small and medium firms. In column (1), in which the dependent variable is investment, most interactions are insignificant, except for cc_bank*small: small bank constrained firms have a 5.3 pp lower probability of increasing investment than otherwise similar micro firms. No interaction is significant in column (2), in which the dependent variable is working capital. Finally, in column (3), in which the dependent variable is employment, most interactions are insignificant, except for cc_other*small: small constrained firms have an 8.1 pp lower probability of increasing employment than otherwise similar micro firms. In addition, notice that the marginal effects on cc_bank and cc_other are almost always insignificant, which means that the impact of credit constraints on firm outcomes is null in the case of micro firms. Hence, Table 9 suggests that most of the impact of credit constraints on real variables is driven by small and medium firms.

In Table 10 we present the marginal effects of the interactions between the age dummies and the credit constraint measures on the probability that the dependent variable increases. The omitted category is old firms (10 years or more). Most interactions are insignificant, suggesting that the effects of credit constraints are quite homogeneous and do not depend on firm age. Finally, Table 11 displays the marginal effects of the interactions between the ownership structure dummies and the credit constraint measures. According to the table, the negative effect of credit constraints on employment growth seems to be mainly driven by the impact on family businesses and on sole traders, while the rest of ownership categories (e.g. listed companies, firms owned by other enterprises) are largely unaffected, which is consistent with asymmetric information problems.

The main upshot of the previous analyses is that the impact of credit constraints on firm-level outcomes is broad-based and is largely independent of firm size, age or ownership structure. A remarkable exception is the case of micro firms, which seem largely unaffected by credit constraints. This finding may be explained by the fact that micro firms rely more on internal funds (cashflows and retained earnings) to fund their investment projects, making them less sensitive to access to external funds, in spite of

being more likely to be financially constrained (as shown in Table 5) due to asymmetric information problems.

6. Robustness analyses

6.1 Random effects

We may also control for firm-level unobserved heterogeneity with a random-effects[41] ordered probit model. This technique may capture the time-invariant component of investment/growth opportunities (i.e., firms with high/low investment opportunities) and help us mitigate the omitted variable bias. Tables 12-14 present the estimations of these models, where the same set of firm-level controls and fixed effects are included. Comparing Tables 6 and 12 (impact on investment), the coefficient on *cc_bank* and *cc_other* are still statistically significant, but the marginal effects are somewhat smaller than those estimated in the baseline specification. When comparing Tables 7 and 13 (impact on working capital), we see that the coefficients and marginal effects are remarkably similar. Finally, the comparison of Tables 8 and 14 (impact on employment growth) shows that the coefficient of *cc_bank* keeps their statistical significance and that the associated marginal effects are of similar magnitude, while those of *cc_other* now become significant. Finally, notice that the estimated panel-level variances (i.e., the variances of the random effects) in Tables 12-14 are large and statistically significant, which suggests that there is enough variability between firms to model a random-effects ordered probit, rather than a pooled ordered probit.

6.2 Subsample of applications and alternative measures of credit constraints

So far, in order to maximise sample size, our measures of credit constraints have been dummy variables that equal 1 for firms that are rejected, quantity rationed, price rationed or discouraged from applying (constrained firms), and equal 0 for the rest of firms (unconstrained firms). However, the latter is a heterogeneous group that comprises both firms that have successfully applied for a loan and firms that have not applied because they do not need it. In particular, firms may not apply for a loan because they have sufficient internal funds and because they do not have attractive

[41] Firm fixed effects have not been included because of the limited time variation of the measures of credit constraints in such a short panel (2 years).

investment opportunities.[42] As our aim is to establish a meaningful relationship between access to external finance, investment and growth, in robustness we only keep in the group of unconstrained firms those that have actually obtained a loan.

The results, presented in Tables 15-17, are very interesting when compared with the baseline results (Tables 6-8). The coefficients on *cc_bank* are no longer significant, while the coefficients and marginal effects of *cc_other* are always significant and larger than in the baseline regressions. For instance, according to Table 15, a firm that is constrained in other financing (*cc_other*=1) has a 4.3 percentage point (pp) larger probability of decreasing investment (column (2)) and 5.2 pp lower probability of increasing it (column (4)), effects somewhat larger than those reported in Table 6. According to Table 16, a firm that is constrained in other financing has a 5.7 percentage point (pp) larger probability of decreasing working capital (column (2)) and a 5.7 pp lower probability of increasing it (column (4)), effects slightly larger than those reported in Table 7. Finally, according to Table 17, a firm that is constrained in other financing has a 6.3 percentage point (pp) larger probability of reducing employment (column (2)) and 7.4 pp lower probability of increasing it (column (4)), while previously those effects were not significant (Table 8). More generally, the results corroborate the negative impact of credit constraints on investment, inventories and other working capital and employment dynamics.

In addition, we use an alternative measure of credit constraints, *problem_access_finance*, a variable that indicates how important the problem "access to finance" is to the firm. In particular, the firm is asked to assess the importance of a series of problems (finding customers, competition, access to finance, costs of production or labour, availability of skilled staff, regulation, other) using a scale of 1-10, where 1 means it is not at all important and 10 means it is extremely important.[43] Table 18-20 reports the estimation of ordered probit models in which *problem_access_finance* is the regressor of interest. In the three tables the coefficients and marginal effects are significant at the 1% level, although the overall impact is somewhat smaller than with the other measures. To assess the economic significance of

[42] Question Q7A of SAFE distinguishes between firms that applied for external financing, did not apply because of possible rejection, did not apply because of sufficient internal funds and did not apply for other reasons.

[43] This question is asked to all firms, unlike the questions used to construct the baseline measure of credit constraints, which are only asked to those firms that consider each source of financing relevant. This is the reason why the estimation sample is larger.

the effect, let us consider that a constrained firm is the one whose value for *problem_access_finance* is the 75th percentile (8) while an unconstrained firm is the one with value equal to the 25th percentile (3), so that the size of the effect is the marginal effect times the interquartile range (5). Hence, a constrained firm has a 1.5 pp higher probability of decreasing investment and a 2 pp lower probability of increasing it than an unconstrained one. Likewise, a constrained firm has a 2.5 pp higher probability of decreasing working capital and a 3 pp lower probability of increasing it than an unconstrained one. Similar figures are found for employment growth (Table 20). Thus, "perceived financing constraints", as measured through firms' self-assessment of the barriers for access to finance, also help explain firm's investment, liquid assets and growth.

6.3 Instrumental variables

So far our identification strategy has relied on the use of an extensive set of country-industry-wave effects and firm-level covariates to control for firms' investment and growth opportunities. However, if we are not perfectly controlling for investment opportunities, then the error term will be correlated with our credit constraint dummies. Hence, in robustness, we use an instrumental variable to isolate the exogenous part of the key regressors.[44] The proposed instrument, *adjusted credit standards*, is an ordinal variable that measures the supply-only component of credit standards of each country in each round of the SAFE. The variable comes from the ECB's Bank Lending Survey (BLS), a quarterly survey that asks euro area banks about developments in their respective credit markets since 2003.[45]

In order to implement the IV strategy we first transform our ordinal dependent variables, investment growth, working capital growth and employment growth, into

[44] Ferrando and Mulier (2015b), in their study of the impact of discouragement on investment and firm growth, also follow an IV strategy. Specifically, they instrument their dummy for discouraged borrowers with a firm-level financial constraints indicator, namely a dummy that equals 1 if the firm considers access to finance as the most pressing problem. However, such an instrument is likely to be invalid if lenders observe a firm's lack of investment opportunities and in turn decide to restrain credit, making access to credit the firm's most pressing problem. To put it differently, they instrument a financial constraints indicator, "discouraged borrowers", with another financial constraints indicator, "access to finance as most pressing problem".

[45] Currently the sample comprises more than 140 banks from 19 euro area countries, with a coverage of around 60% of the amount outstanding of loans to the private non-financial sector in the euro area. For information about the survey see Köhler-Ulbrich, Hempell and Scopel (2016).

dummies that equal 1 if investment/working capital/employment has increased and 0 if it has decreased or it has remained unchanged. The reason for carrying out such transformation is to be able to use standard models for binary dependent variables with endogenous regressors such as two-stage least squares (linear probability model). Second, we merge our two key regressors, *cc_bank* and *cc_other*, into a single variable, *cc_all*, which equals 1 if the firm is constrained in at least one of the two financing sources (i.e., *cc_bank*=1 and/or *cc_other*=1) and 0 if the firm is constrained in none of them (i.e., *cc_bank*=*cc_other*=0). The reason for such transformation is that, as Angrist and Pischke (2009) argue, models with multiple endogenous variables are hard to identify and the results can be hard to interpret, so we prefer to estimate a regression model with a single endogenous covariate.

Table 21 presents the results of linear probability models estimated by OLS and instrumental variable methods, in which the dependent variable is investment growth. All time-varying controls are lagged one period, while the endogenous regressor *cc_all* and the instruments *adjusted credit standards* are included contemporaneously (at time t). All specifications include country, industry and time dummies.[46] We also report the first-stage F-statistic, the Sargan-Hansen J test of over-identifying restrictions and two endogeneity tests on *cc_all*, one based on the first-stage residuals, as suggested by Wooldridge (2003)[47], and another one based on the difference of two Sargan statistics.[48]

Column (1), estimated by Ordinary Least Squares (OLS), shows a negative and strong correlation between *cc_all* and *investment growth*. However, to establish a causal relationship we need to make use of our instrumental variables. First we use a single instrumental variable, *adjusted credit standards* in loans to SMEs. The first-stage is strong. According to column 2, a unit increase in the level of credit standards (i.e., tightening) increases the likelihood of being credit constrained by around 10 percentage points, and the effect is statistically significant at a 1% level. The instrument does not

[46] Very similar results are found if we use country-sector and sector-time dummies.

[47] Wooldridge's (2003) endogeneity test is carried out by including the first-stage residuals in the structural equation and testing their significance via a t-test. If they are significant, we reject the null hypothesis of exogeneity. See Wooldridge (2003), pages 506-507.

[48] The endogeneity test is defined as the difference of two Sargan-Hansen statistics: one for the equation with the smaller set of instruments, where the suspect regressors are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous. Under the null hypothesis the specified endogenous regressors can actually be treated as exogenous. Under conditional homoskedasticity, this endogeneity test statistic is numerically equal to a Hausman test statistic; see Hayashi (2000, pp. 233-34).

seem to be weak, as the value of the first-stage F-statistic is 11.7, well above 10, the reference value suggested by Staiger and Stock (1997). The reduced form is also strong, implying that the instrument has a significant effect on the outcome variable. According to column 3, a unit tightening in the level of credit standards reduces the probability that investment increases by 6.6 pp. The Two-Stage Least Squares (2SLS)[49] estimates that result from the estimation of the first-stage and the reduced form are displayed in column (4). According to those estimates, the presence of credit constraints reduces by 67 pp the probability of increasing investment, but the effect is estimated imprecisely and it is only statistically significant at 10%. The two endogeneity tests reject the null hypothesis of exogeneity of *cc_all*, suggesting that we need to pay more attention to the IV estimates, as OLS is likely to be inconsistent. To increase the precision of the estimates we follow two approaches. First, we include random effects by estimating the structural equation by Generalised Two-Stage Least Squares (G2SLS). The results are displayed in column (5). As expected, the standard error decreases somewhat, while the coefficient increases substantially: the presence of credit constraints reduces by 88 pp the probability of increasing investment, and the effect is significant at 1%. Second, we add a second instrumental variable, the adjusted credit standards in loans to large firms, and estimate the over-identified model via 2SLS. The result, displayed in column (6), is a very strong and precise effect: credit constraints reduce the probability of an increase in investment by 92 pp, and the coefficient is significant at 5%. Notice that the Sargan-Hansen J-test cannot reject the validity of the over-identifying restrictions.[50]

The IV estimate is remarkably larger than the OLS estimate, suggesting that the latter underestimate the casual effect of credit constraints on investment growth. Notice that, following Imbens and Angrist (1994), we can interpret the IV estimate as the Local Average Treatment Effect (LATE). The LATE is the average treatment effect on the subpopulation of compliers, who are the individuals whose treatment status changes when the value of the instrumental variable changes as well. IV methods are uninformative for always-takers (the ones that always receive the treatment, irrespective of the value of the IV) and never-takers (the ones that never receive the treatment)

[49] We prefer to estimate linear probability models via 2SLS, rather than an IV Probit, because the endogenous regressor is a binary variable, implying that the joint normality assumption of the IV Probit would be violated. See Wooldridge (2004), pages 472-477.

[50] However, Parente and Santos Silva (2012) argue that this test cannot be used to check the exogeneity of the instruments because the validity of the overidentifying restrictions is neither sufficient nor necessary for the validity of the moment conditions implied by the underlying economic model.

because the instrument is unrelated to their treatment status.[51] In our empirical application, compliers are the firms that become financially constrained (unconstrained) when credits standards are tightened (eased), always-takers are the firms that are always financially constrained, regardless of the levels of credit standards, and never-takers are the firms that are never financially constrained.[52] Our estimates suggest a very strong causal effect on the subpopulation of complier firms, which is expected to differ from the average causal effect for the entire treated population (the treatment effect on the treated) because of the existence of always-takers.

The impact of credit constraints on working capital growth is displayed in Table 22. The OLS estimates (column 1) are significant at 1%, suggesting a strong correlation between credit constraints and working capital. However, the reduced form (column 3) shows no impact of the instrument on working capital. In turn, the estimation of the structural equation by 2SLS (column 4) reveals no effect. The same is true when we add random effects to the model and estimate it by G2SLS (column 5). We do not report the results with the over-identified model because the first-stage F-test falls below 10, but the conclusion is similar. Nevertheless, the two endogeneity tests fail to reject the null hypothesis of exogeneity of *cc_all* (p-values around 0.5). This means that both the OLS results and the IV results are likely to be valid. Hence, we can conclude that the effect of credit constraints on working capital is either null (as suggested by the IV estimates) or quite small (as suggested by the OLS estimates).

The impact of credit constraints on firm growth is presented in Table 23. According to the OLS estimates (column 1), a credit constrained firm has a 6 pp lower probability of increasing employment than an otherwise identical firm, and the effect is statistically significant at 1%. By contrast, the estimation of the structural equation by 2SLS (column 4) shows no statistically significant effect of credit constraints on employment growth. The effect becomes significant, but only at the 10% level, when we add random effects to the model and estimate it by G2SLS (column 5). As the two endogeneity tests fail to reject the null hypothesis of exogeneity of *cc_all* (p-values above 0.4), both the OLS and the IV estimates are likely to be valid. Therefore, we can conclude that the

[51] The distinction between compliers, always-takers and never-takers is detailed in Angrist *et al.* (1996).
[52] In principle, there could be a fourth category, defiers, which would be the firms that become credit constrained as credit standards are eased and unconstrained as credit standards are tightened. However, this seems unlikely, implying that our empirical application satisfies the so-called monotonicity assumption. This assumption, together with the exclusion restriction and a nonzero first stage, ensures the identification of the LATE. See Imbens and Angrist (1994) for details.

effect of credit constraints on employment growth is either null (as suggested by the IV estimates) or quite small (as suggested by the OLS estimates).

Therefore, the results of this section suggest a strong causal impact of overall credit constraints on firm investment, while the effects on firm growth and working capital are weaker and less robust.

7. Conclusions

In frictionless perfect capital markets, the Modigliani-Miller theorem (1958) implies that a firm's financing decisions are independent from its investment decisions because internal and external funds are perfect substitutes. In practice, however, several factors lead to an imperfect substitutability between internal and external funds[53], so that financial constraints may have important effects on real variables such as investment, inventories and other working capital and firm growth. The purpose of this research is to test this empirical prediction. We do so with the Survey on the access to finance of enterprises (SAFE), a survey that is especially designed to analyse the problems in the access to external finance faced by European SMEs. In particular, we use a panel of about 5,000 small and medium-sized enterprises (SMEs) from 12 European countries for the period 2014-2016. In line with previous studies on the SAFE, we develop several survey-based indicators of credit constraints, distinguishing between constraints in the access to bank finance (bank loans, bank overdrafts, credit lines) and in the access to other finance (trade credit, leasing, factoring, debt and equity securities, etc).

Our goal is to identify the causal effect of credit constraints on investment, inventories and other working capital and firm growth. The key identification challenge we face is a potential reverse-causality bias, as we expect firms with poor investment/growth opportunities to have a higher probability of being credit constrained. We implement several strategies to overcome this obstacle: proxies for investment opportunities, lagged regressors, random effects and instrumental variables. Our findings suggest that credit constraints, both in bank financing and other financing, have strong negative effects on investment in fixed assets, while the impact on firm growth and working capital is less robust.

[53] See Fazzari *et al.* (1988) and Schiantarelli (1996) for a review of the theoretical research in this area.

In addition, we analyse heterogeneous effects by estimating average marginal effects for different types of firms. A remarkable result is that micro firms (less than 10 employees) are largely unaffected by credit constraints, probably because those firms rely more on internal funds (cashflows and retained earnings) to fund their investment projects, making them less sensitive to access to external funds, in spite of being more likely to be financially constrained due to asymmetric information problems. This result complements those of Beck *et al.* (2005), who find that small and medium-sized enterprises (SMEs) face greater financial, legal and corruption obstacles compared to large firms and the constraining impact of obstacles on firm growth is inversely related to firm size. However, Beck *et al.* (2005) compare SMEs with large firms, while we compare micro, small and medium-sized firms. Hence, the effect of credit constraints on firm investment and growth may be a non-monotonic (concave) function of firm size.

Our paper contributes to a new emerging strand of the literature that uses survey data to construct *direct* measures of financial constraints (Campello *et al.*, 2010, Ferrando and Mulier, 2015b). First, it extends the work of Ferrando and Mulier (2015b) on discouraged borrowers to both "formal" and "informal" credit constraints (discouragement, quantity rationing, price rationing, rejected applications) and assesses the role of *all* sources of financing, not only bank loans, in shaping business decisions. It also covers a larger number of countries and analyses the recovery period of the European economy (2014-2016), unlike previous studies that have focused on the last recession. It also looks at the impact of financial constraints on inventories and other working capital, an aspect that has traditionally been overlooked in the literature. Finally, it attempts to establish a causal link between credit constraints and firm investment, inventories and growth by exploiting the panel nature of the data and by making use of an instrumental variable to isolate the exogenous part of credit constraints.

Finally, notice that our results are conservative measures of the total impact of credit constraints in the real economy, as our analysis ignores the extensive margin, i.e., those businesses that shut down because of a lack of credit and those firms that do not enter the market because they do not obtain financing to undertake their investment projects.

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Table 1: variables description

Variable	Possible values
country	12 European countries
sector	industry, construction, wholesale or retail trade, other services
size_employment	1 (micro), 2 (small), 3 (medium)
size_turnover	1(<= € 500,000), 2 (€500,000 - €1 million), 3 (€ 1 million - € 2 million) 4 (€ 2 million - €10 million), 5 (€10 million - €50 million), 6 (> € 50 million)
age	>=10 years, >=5 and <10 years, >=2 and <5 years, <2 years
legal form	subsidiary or branch, autonomous entreprise
ownership structure	public shareholders, family or entrepreneurs, other entreprises, venture capital entreprises, one owner only, other
exporter	0,1
cc_all	0,1
cc_bank	0,1
cc_other	0,1
problem_access_finance	1-10
investment growth	decreased, remain unchanged, increased
working capital growth	decreased, remain unchanged, increased
employment growth	decreased, remain unchanged, increased
turnover	decreased, remain unchanged, increased
profits	decreased, remain unchanged, increased
labour_costs	decreased, remain unchanged, increased
other_costs	decreased, remain unchanged, increased
interest_expenses	decreased, remain unchanged, increased
debt_to_assets	decreased, remain unchanged, increased
enterprise_outlook	improved, remain unchanged, deteriorated
enterpise_capital	improved, remain unchanged, deteriorated
credit_history	improved, remain unchanged, deteriorated

Table 2: descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
investment growth: decrease	19,989	0.16	0.37	0	1
investment growth: unchanged	19,989	0.56	0.50	0	1
investment growth: increase	19,989	0.28	0.45	0	1
working capital growth: decrease	19,989	0.18	0.38	0	1
working capital growth: unchanged	19,989	0.60	0.49	0	1
working capital growth: increase	19,989	0.22	0.42	0	1
employment growth: decrease	19,989	0.16	0.36	0	1
employment growth: unchanged	19,989	0.58	0.49	0	1
employment growth: increase	19,989	0.26	0.44	0	1
Credit constraints variables					
cc_all	19,989	0.19	0.39	0	1
cc_bank	19,989	0.16	0.36	0	1
cc_other	19,989	0.10	0.31	0	1
problem_access_finance	19,845	5.69	2.91	1	10
Other controls					
turnover: decrease	19,989	0.24	0.43	0	1
turnover: unchanged	19,989	0.33	0.47	0	1
turnover: increase	19,989	0.42	0.49	0	1
profits: decrease	19,989	0.34	0.47	0	1
profits: unchanged	19,989	0.34	0.47	0	1
profits: increase	19,989	0.32	0.47	0	1
labour_costs: decrease	19,989	0.07	0.25	0	1
labour_costs: unchanged	19,989	0.40	0.49	0	1
labour_costs: increase	19,989	0.54	0.50	0	1
other_costs: decrease	19,989	0.10	0.30	0	1
other_costs: unchanged	19,989	0.42	0.49	0	1
other_costs: increase	19,989	0.48	0.50	0	1
interest_expenses: decrease	19,989	0.27	0.44	0	1
interest_expenses: unchanged	19,989	0.50	0.50	0	1
interest_expenses: increase	19,989	0.24	0.43	0	1
debt_to_assets: decrease	19,989	0.29	0.45	0	1
debt_to_assets: unchanged	19,989	0.49	0.50	0	1
debt_to_assets: increase	19,989	0.21	0.41	0	1
enterprise outlook: improved	19,989	0.34	0.47	0	1
enterprise outlook: unchanged	19,989	0.44	0.50	0	1
enterprise outlook: deteriorated	19,989	0.21	0.41	0	1
enterprise_capital: improved	19,989	0.31	0.46	0	1
enterprise_capital: unchanged	19,989	0.55	0.50	0	1
enterprise_capital: deteriorated	19,989	0.14	0.34	0	1
credit_history: improved	19,989	0.32	0.47	0	1
credit history: unchanged	19,989	0.57	0.50	0	1
credit history: deteriorated	19,989	0.12	0.32	0	1

Table 3: correlations among measures of financial constraints

	problem access_finance	cc_all	cc_bank	cc_other
problem_access_finance	1.00			
cc_all	0.36	1.00		
cc_bank	0.35	0.91	1.00	
cc_other	0.27	0.76	0.52	1.00

Table 4: Cramer's V among the dependent variables

	investment growth	working capital growth	employment growth
investment growth	1.00		
working capital growth	0.25	1.00	
employment growth	0.20	0.22	1.00

Table 5: credit constraints in bank financing conditional on firm characteristics

	Percent	
	cc_bank=0	cc_bank=1
sector		
Industry	86.80	13.20
Construction	83.47	16.53
Wholesale or retail trade	84.80	13.92
Other services	86.13	13.37
size_employment		
Micro	81.67	18.33
Small	86.28	13.72
Medium	91.00	9.00
size_turnover		
1	79.89	20.11
2	83.81	16.19
3	84.37	15.63
4	88.30	11.70
5	91.52	8.48
6	95.06	4.94
age		
>=10 years	86.12	13.88
>=5 and <10 years	84.24	15.76
>=2 and <5 years	82.06	17.94
<2 years	81.17	18.83
legal form		
Subsidiary or branch	90.16	9.84
Autonomous enterprise	85.18	14.82
ownership structure		
Public shareholders	90.77	9.23
Family or entrepreneurs	85.10	14.90
Other entreprises	90.65	9.35
Venture capital enterprise	84.14	15.86
Sole trader	84.56	15.44
Other	89.72	10.28
exporter		
0	85.05	14.95
1	86.28	13.72
country		
less vulnerable	87.96	12.04
vulnerable	81.05	18.95

Table 6: impact of credit constraints on investment, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	investment growth	P(investment=decrease)	P(investment=unchanged)	P(investment=increase)
cc_bank (t-1)	-0.095**	0.021**	0.007**	-0.028**
	(0.041)	(0.009)	(0.003)	(0.012)
cc_other (t-1)	-0.151***	0.034***	0.012***	-0.045***
	(0.058)	(0.013)	(0.004)	(0.017)
size_employment_2	0.127***			
	(0.045)			
size_employment_3	0.161**			
	(0.065)			
size_turnover_2	-0.011			
	(0.048)			
size_turnover_3	0.001			
	(0.066)			
size_turnover_4	0.080			
	(0.057)			
size_turnover_5	0.000			
	(0.072)			
size_turnover_6	0.136			
	(0.091)			
>=5 and <10 years	0.125*			
	(0.068)			
>=2 and <5 years	0.037			
	(0.094)			
<2 years	0.515			
	(0.337)			
autonomous enterprise	-0.012			
	(0.077)			
family or entrepreneurs	0.201			
	(0.125)			
other enterprises	0.173			
	(0.143)			
venture capital enterprises	-0.004			
	(0.221)			
sole trader	0.263**			
	(0.112)			
other	0.354**			
	(0.173)			
exporter	-0.020			
	(0.032)			
outlook: unchanged	-0.104***			
	(0.029)			
outlook: deteriorated	-0.260***			
	(0.058)			
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	NO	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	7,162	7,162	7,162	7,162
Pseudo-R2	0,0519			

Dependent variable: investment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 7: impact of credit constraints on working capital, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	working capital growth	P(working capital=decrease)	P(working capital=unchanged)	P(working capital=increase)
cc_bank (t-1)	-0.001	0.000	0.000	-0.000
	(0.053)	(0.012)	(0.002)	(0.014)
cc_other (t-1)	-0.213***	0.049***	0.008***	-0.057***
	(0.080)	(0.018)	(0.003)	(0.021)
size_employment_2	-0.027			
	(0.048)			
size_employment_3	-0.059			
	(0.058)			
size_turnover_2	-0.032			
	(0.058)			
size_turnover_3	0.044			
	(0.069)			
size_turnover_4	0.213***			
	(0.056)			
size_turnover_5	0.316***			
	(0.072)			
size_turnover_6	0.359***			
	(0.136)			
>=5 and <10 years	0.123***			
	(0.041)			
>=2 and <5 years	0.088			
	(0.071)			
<2 years	-0.080			
	(0.174)			
autonomous enterprise	0.077*			
	(0.047)			
family or entrepreneurs	0.102			
	(0.115)			
other enterprises	0.099			
	(0.132)			
venture capital enterprises	0.182			
	(0.254)			
sole trader	0.086			
	(0.125)			
other	0.124			
	(0.162)			
exporter	0.026			
	(0.037)			
outlook: unchanged	-0.143***			
	(0.038)			
outlook: deteriorated	-0.217***			
	(0.063)			
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	NO	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	7,232	7,232	7,232	7,232
Pseudo-R2	0,0644			

Dependent variable: working capital growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 8: impact of credit constraints on employment, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	employment growth	P(employment=decrease)	P(employment=unchanged)	P(employment=increase)
cc_bank (t-1)	-0.141***	0.029***	0.012***	-0.041***
	(0.048)	(0.010)	(0.004)	(0.014)
cc_other (t-1)	-0.092	0.019	0.008	-0.027
	(0.072)	(0.015)	(0.006)	(0.021)
size_employment_2	0.186***			
	(0.041)			
size_employment_3	0.370***			
	(0.047)			
size_turnover_2	0.001			
	(0.041)			
size_turnover_3	-0.006			
	(0.050)			
size_turnover_4	0.052			
	(0.054)			
size_turnover_5	0.017			
	(0.082)			
size_turnover_6	-0.102			
	(0.112)			
>=5 and <10 years	0.123***			
	(0.043)			
>=2 and <5 years	0.281***			
	(0.068)			
<2 years	-0.018			
	(0.337)			
autonomous enterprise	0.131**			
	(0.061)			
family or entrepreneurs	0.042			
	(0.104)			
other enterprises	-0.016			
	(0.108)			
venture capital enterprises	0.402			
	(0.272)			
sole trader	0.121			
	(0.115)			
other	0.053			
	(0.143)			
exporter	0.004			
	(0.030)			
outlook: unchanged	-0.019			
	(0.044)			
outlook: deteriorated	-0.191***			
	(0.061)			
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	NO	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	7,318	7,318	7,318	7,318
Pseudo-R2	0,0728			

Dependent variable: employment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 9: marginal effects of credit constraints for different size categories

	P(DEPENDENT VARIABLE=INCREASE)		
	(1)	(2)	(3)
DEP. VARIABLE	investment	working_capital	employment
cc_bank	-0.006	0.001	-0.035
	(0.017)	(0.024)	(0.022)
cc_bank*small	-0.053*	0.022	-0.000
	(0.032)	(0.038)	(0.028)
cc_bank*medium	-0.021	-0.037	-0.021
	(0.030)	(0.030)	(0.045)
cc_other	-0.051*	-0.045	0.003
	(0.031)	(0.031)	(0.025)
cc_other*small	0.028	-0.045	-0.087**
	(0.049)	(0.038)	(0.036)
cc_other*medium	-0.013	0.014	-0.016
	(0.042)	(0.044)	(0.039)
Observations	7,162	7,232	7,318
cc_bank + cc_bank*small	-0.059***	0.022	-0.036
cc_bank + cc_bank*medium	-0.027	-0.036	-0.057
cc_other + cc_other*small	-0.023	-0.090***	-0.084***
cc_other + cc_other*medium	-0.064**	-0.032	-0.013

Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying variables are lagged once (t-1). Country-industry-time dummies included in all specifications.
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
The omitted category is micro firms.

Table 10: marginal effects of credit constraints for different age categories

	P(DEPENDENT VARIABLE=INCREASE)		
	(1)	(2)	(3)
DEP. VARIABLE	investment	working_capital	employment
cc_bank	-0.045***	-0.007	-0.050***
	(0.014)	(0.017)	(0.015)
cc_bank*(5 to 9 years)	0.113**	0.037	0.055
	(0.052)	(0.035)	(0.047)
cc_bank*(2 to 4 years)	0.041	0.010	0.014
	(0.065)	(0.073)	(0.070)
cc_bank*(Less than 2 years)	0.021	0.081	0.033
	(0.175)	(0.115)	(0.145)
cc_other	-0.035*	-0.063***	-0.023
	(0.019)	(0.022)	(0.023)
cc_other*(5 to 9 years)	-0.090	0.010	-0.054
	(0.059)	(0.039)	(0.048)
cc_other*(2 to 4 years)	0.079	0.039	-0.019
	(0.078)	(0.071)	(0.114)
cc_other*(Less than 2 years)	0.025	0.381	0.359
	(0.117)	(0.247)	(0.312)
Observations	7,162	7,232	7,318

Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying variables are lagged once (t-1). Country-industry-time dummies included in all specifications.
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
The omitted category is firms with 10 years or more.

Table 11: marginal effects of credit constraints for different ownership categories

	P(DEPENDENT VARIABLE=INCREASE)		
	(1)	(2)	(3)
DEP. VARIABLE	investment	working_capital	employment
cc_bank	-0.042	-0.004	-0.048
	(0.119)	(0.132)	(0.144)
cc_bank*(Family or enterpreneurs)	0.022	-0.019	0.012
	(0.122)	(0.132)	(0.145)
cc_bank*(Other enterprises)	-0.018	-0.046	-0.005
	(0.127)	(0.135)	(0.150)
cc_bank*(Sole trader)	0.011	0.041	0.005
	(0.121)	(0.137)	(0.144)
cc_bank*(Other)	-0.059	0.175	-0.032
	(0.170)	(0.181)	(0.184)
cc_other	0.067	-0.033	0.192
	(0.104)	(0.091)	(0.129)
cc_other*(Family or enterpreneurs)	-0.115	-0.013	-0.223*
	(0.107)	(0.094)	(0.128)
cc_other*(Other enterprises)	-0.132	-0.014	-0.133
	(0.115)	(0.118)	(0.147)
cc_other*(Sole trader)	-0.100	-0.030	-0.247**
	(0.114)	(0.098)	(0.124)
cc_other*(Other)	-0.149	-0.177	-0.134
	(0.147)	(0.123)	(0.159)
Observations	7,162	7,232	7,318

Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying variables are lagged once (t-1). Country-industry-time dummies included in all specifications.
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
The omitted category is listed firms.

Table 12: impact of credit constraints on investment (random effects)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	investment growth	P(investment=decrease)	P(investment=unchanged)	P(investment=increase)
cc_bank (t-1)	-0.074***	0.014***	0.005***	-0.019***
	(0.022)	(0.004)	(0.002)	(0.006)
cc_other (t-1)	-0.130*	0.025*	0.009*	-0.034*
	(0.076)	(0.015)	(0.005)	(0.020)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Panel-level variance component	0.369***			
	(0.050)			
Observations	7,162	7,162	7,162	7,162
Number of firms	4,880	4,880	4,880	4,880

Dependent variable: investment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter. Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once.
Estimator: random effects ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country. *** p<0.01, ** p<0.05, * p<0.1

Table 13: impact of credit constraints on working capital (random effects)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	working capital growth	P(working capital=decrease)	P(working capital=unchanged)	P(working capital=increase)
cc_bank (t-1)	0.008	-0.002	-0.000	0.002
	(0.054)	(0.010)	(0.002)	(0.012)
cc_other (t-1)	-0.246**	0.048**	0.008**	-0.056**
	(0.120)	(0.022)	(0.004)	(0.026)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Panel-level variance component	0.384***			
	(0.057)			
Observations	7,232	7,232	7,232	7,232
Number of firms	4,911	4,911	4,911	4,911

Dependent variable: working capital growth.Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter. Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once.
Estimator: random effects ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country. *** p<0.01, ** p<0.05, * p<0.1

Table 14: impact of credit constraints on employment (random effects)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	employment growth	P(employment=decrease)	P(employment=unchanged)	P(employment=increase)
cc_bank (t-1)	-0.141***	0.025***	0.011***	-0.036***
	(0.048)	(0.008)	(0.004)	(0.012)
cc_other (t-1)	-0.091**	0.016**	0.007**	-0.023**
	(0.037)	(0.006)	(0.003)	(0.009)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Panel-level variance component	0.349***			
	(0.052)			
Observations	7,318	7,318	7,318	7,318
Number of firms	4,966	4,966	4,966	4,966

Dependent variable: employment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter. Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once.
Estimator: random effects ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country. *** p<0.01, ** p<0.05, * p<0.1

Table 15: impact of credit constraints on investment growth

(subsample of applications)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	investment growth	P(investment=decrease)	P(investment=unchanged)	P(investment=increase)
cc_bank (t-1)	-0.110	0.026	0.005	-0.031
	(0.080)	(0.018)	(0.004)	(0.022)
cc_other (t-1)	-0.187**	0.043**	0.009**	-0.052**
	(0.079)	(0.018)	(0.004)	(0.022)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	1,895	1,895	1,895	2,136
Pseudo-R2	0.1208			

Dependent variable: investment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 16: impact of credit constraints on working capital

(subsample of applications)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	working capital growth	P(working capital=decrease)	P(working capital=unchanged)	P(working capital=increase)
cc_bank (t-1)	0.059	-0.015	0.000	0.015
	(0.098)	(0.025)	(0.000)	(0.025)
cc_other (t-1)	-0.226**	0.057**	-0.000	-0.057**
	(0.098)	(0.025)	(0.000)	(0.024)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	1,913	1,913	1,913	1,913
Pseudo-R2	0.1189			

Dependent variable: working capital growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 17: impact of credit constraints on employment growth

(subsample of applications)

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	employment growth	P(employment=decrease)	P(employment=unchanged)	P(employment=increase)
cc_bank (t-1)	0.032	-0.007	-0.001	0.008
	(0.066)	(0.015)	(0.003)	(0.017)
cc_other (t-1)	-0.279***	0.063***	0.011***	-0.074***
	(0.089)	(0.020)	(0.004)	(0.024)
COUNTRY-INDUSTRY-TIME DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	1,929	1,929	1,929	1,929
Pseudo-R2	0.1391			

Dependent variable: employment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 18: impact of problems in access to finance on investment, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	investment growth	P(investment=decrease)	P(investment=unchanged)	P(investment=increase)
problem_access_finance (t-1)	-0.014***	0.003***	0.001***	-0.004***
	(0.004)	(0.001)	(0.000)	(0.001)
COUNTRY-INDUSTRY-WAVE DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	10,588	10,588	10,588	10,588
Pseudo-R2	0,0403			

Dependent variable: investment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form,ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1)
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 19: impact of problems in access to finance on working capital, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	working capital growth	P(working capital=decrease)	P(working capital=unchanged)	P(working capital=increase)
problem_access_finance (t-1)	-0.023***	0.005***	0.001***	-0.006***
	(0.005)	(0.001)	(0.000)	(0.001)
COUNTRY-INDUSTRY-WAVE DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	10,698	10,698	10,698	10,698
Pseudo-R2	0,0612			

Dependent variable: working capital growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1)
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 20: impact of problems in access to finance on employment, coefficients and marginal effects

	COEFFICIENTS	MARGINAL EFFECTS		
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	employment growth	P(employment=decrease)	P(employment=unchanged)	P(employment=increase)
problem_access_finance (t-1)	-0.024***	0.005***	0.002***	-0.007***
	(0.005)	(0.001)	(0.000)	(0.001)
COUNTRY-INDUSTRY-WAVE DUMMIES	YES	YES	YES	YES
CONTROLS	YES	YES	YES	YES
OTHER CONTROLS	YES	YES	YES	YES
Observations	10,843	10,843	10,843	10,843
Pseudo-R2	0,0673			

Dependent variable: employment growth. Controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1)
Estimator: ordered probit. Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1

Table 21: impact of credit constraints on investment

(OLS and IV estimates)

	Structural equation	First-stage	Reduced form	Structural equation	Structural equation	Structural equation
	(1)	(2)	(3)	(4)	(5)	(6)
DEPENDENT VARIABLE	investment growth	cc_all (t)	investment growth	investment growth	investment growth	investment growth
cc_all (t)	-0.096***			-0.668*	-0.878***	-0.917**
	(0.019)			(0.387)	(0.338)	(0.360)
credit standards sme (t)		0.099***	-0.066**			
		(0.029)	(0.029)			
ESTIMATOR	OLS	OLS	OLS	2SLS	G2SLS	2SLS
INSTRUMENTS				credit standards sme	credit standards sme	credit standards sme credit standards large
COUNTRY DUMMIES	YES	YES	YES	YES	YES	YES
INDUSTRY DUMMIES	YES	YES	YES	YES	YES	YES
TIME DUMMIES	YES	YES	YES	YES	YES	YES
MACRO CONTROLS	YES	YES	YES	YES	YES	YES
FIRM CONTROLS	YES	YES	YES	YES	YES	YES
OTHER FIRM CONTROLS	YES	YES	YES	YES	YES	YES
F-TEST (FIRST-STAGE)		11.711		11.711		11.510
P-VALUE TEST OF OVERIDENTIFICATION RESTRICTIONS		Exactly identified				0.291
P-VALUE ENDOGENEITY TEST (RESIDUALS)				0.004		
P-VALUE ENDOGENEITY TEST (DIFFERENCE IN SARGAN)				0.100		
Observations	7,506	7,506	7,506	7,506	7,506	7,506
Number of firms	4,863	4,863	4,863	4,863	4,863	4,863

The instrumental variables are adjusted credit standards in loans to SMEs and adjusted credit standards in loans to large firms.
Macro controls are detrended real GDP, consumer confidence indicator and the 10 year government bond yield.
Firm controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other firm controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
F-test (first-stage) is the Kleibergen-Paap Wald rk F statistic.
The test of overidentification restrictions is the Sargan-Hansen J-test.
The endogeneity test (residuals) is carried out by including the first-stage residuals in the structural equation and testing their significance via a t-test. If they are significant, we reject the null hypothesis of exogeneity.
The endogeneity test (difference in Sargan) is defined as the difference of two Sargan-Hansen statistics: one for the equation with the smaller set of instruments, where the suspect regressors are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous. Under the null hypothesis the specified endogenous regressors can actually be treated as exogenous.

Table 22: impact of credit constraints on working capital

(OLS and IV estimates)

	Structural equation	First-stage	Reduced form	Structural equation	Structural equation
	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	working capital growth	cc_all (t)	working capital growth	working capital growth	working capital growth
cc_all (t)	-0.041***			0.158	-0.026
	(0.015)			(0.279)	(0.304)
credit standards sme (t)		0.094***	0.015		
		(0.030)	(0.027)		
ESTIMATOR	OLS	OLS	OLS	2SLS	G2SLS
INSTRUMENTS				credit standards sme	credit standards sme
COUNTRY DUMMIES	YES	YES	YES	YES	YES
INDUSTRY DUMMIES	YES	YES	YES	YES	YES
TIME DUMMIES	YES	YES	YES	YES	YES
MACRO CONTROLS	YES	YES	YES	YES	YES
FIRM CONTROLS	YES	YES	YES	YES	YES
OTHER FIRM CONTROLS	YES	YES	YES	YES	YES
F-TEST (FIRST-STAGE)		10.115		10.115	
P-VALUE TEST OF OVERIDENTIFICATION RESTRICTIONS		Exactly identified			
P-VALUE ENDOGENEITY TEST (RESIDUALS)				0.499	
P-VALUE ENDOGENEITY TEST (DIFFERENCE IN SARGAN)				0.496	
Observations	7,561	7,561	7,561	7,561	7,561
Number of firms	4,893	4,893	4,893	4,893	4,893

The instrumental variables are adjusted credit standards in loans to SMEs and adjusted credit standards in loans to large firms.
Macro controls are detrended real GDP, consumer confidence indicator and the 10 year government bond yield.
Firm controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other firm controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
F-test (first-stage) is the Kleibergen-Paap Wald rk F statistic.
The test of overidentification restrictions is the Sargan-Hansen J-test.
The endogeneity test (residuals) is carried out by including the first-stage residuals in the structural equation and testing their significance via a t-test. If they are significant, we reject the null hypothesis of exogeneity.
The endogeneity test (difference in Sargan) is defined as the difference of two Sargan-Hansen statistics: one for the equation with the smaller set of instruments, where the suspect regressors are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous. Under the null hypothesis the specified endogenous regressors can actually be treated as exogenous.

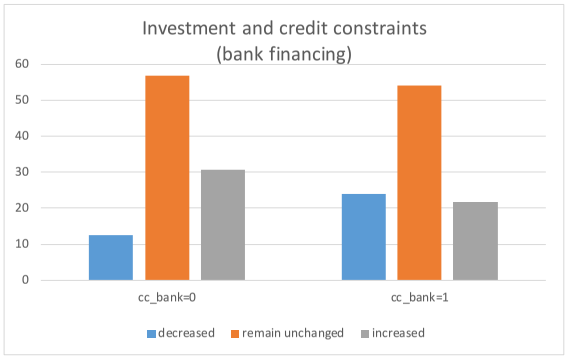
Table 23: impact of credit constraints on employment growth

(OLS and IV estimates)

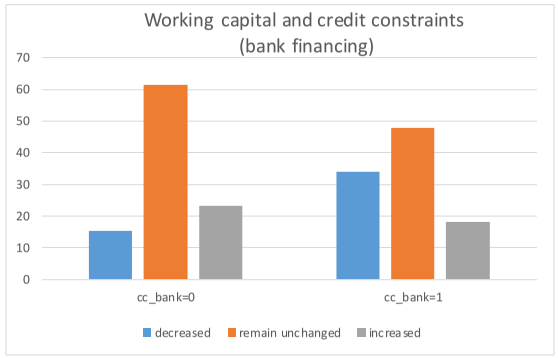
	Structural equation	First-stage	Reduced form	Structural equation	Structural equation
	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	employment growth	cc_all (t)	employment growth	employment growth	employment growth
cc_all (t)	-0.060***			0.298	-0.562*
	(0.015)			(0.439)	(0.328)
credit standards sme (t)		0.095***	0.028		
		(0.029)	(0.045)		
ESTIMATOR	OLS	OLS	OLS	2SLS	G2SLS
INSTRUMENTS				credit standards sme	credit standards sme
COUNTRY DUMMIES	YES	YES	YES	YES	YES
INDUSTRY DUMMIES	YES	YES	YES	YES	YES
TIME DUMMIES	YES	YES	YES	YES	YES
MACRO CONTROLS	YES	YES	YES	YES	YES
FIRM CONTROLS	YES	YES	YES	YES	YES
OTHER FIRM CONTROLS	YES	YES	YES	YES	YES
F-TEST (FIRST-STAGE)		10.687		10.687	
P-VALUE TEST OF OVERIDENTIFICATION RESTRICTIONS		Exactly identified			
P-VALUE ENDOGENEITY TEST (RESIDUALS)				0.429	
P-VALUE ENDOGENEITY TEST (DIFFERENCE IN SARGAN)				0.465	
Observations	7,644	7,644	7,644	7,644	7,644
Number of firms	4,935	4,935	4,935	4,935	4,935

The instrumental variables are adjusted credit standards in loans to SMEs and adjusted credit standards in loans to large firms.
Macro controls are detrended real GDP, consumer confidence indicator and the 10 year government bond yield.
Firm controls are dummies for size (in terms of employment and turnover), age, legal form, ownership structure and exporter.
Other firm controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, debt-to-assets and interest expenses and dummies for improvement/deterioration of enterprise-specific outlook, enterprise's own capital and enterprise's credit history.
All time-varying controls are lagged once (t-1).
Cluster-robust standard errors in parentheses. Cluster level: country-wave. *** p<0.01, ** p<0.05, * p<0.1
F-test (first-stage) is the Kleibergen-Paap Wald rk F statistic.
The test of overidentification restrictions is the Sargan-Hansen J-test.
The endogeneity test (residuals) is carried out by including the first-stage residuals in the structural equation and testing their significance via a t-test. If they are significant, we reject the null hypothesis of exogeneity.
The endogeneity test (difference in Sargan) is defined as the difference of two Sargan-Hansen statistics: one for the equation with the smaller set of instruments, where the suspect regressors are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous. Under the null hypothesis the specified endogenous regressors can actually be treated as exogenous.

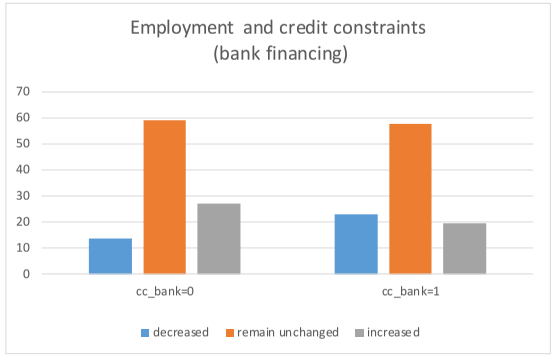
Figure 1: conditional distributions of investment growth, working capital growth and employment growth (credit constraints in bank financing)



Pearson chi2(2) = 397.4850 Pr = 0.000
Cramér's V = 0.1126

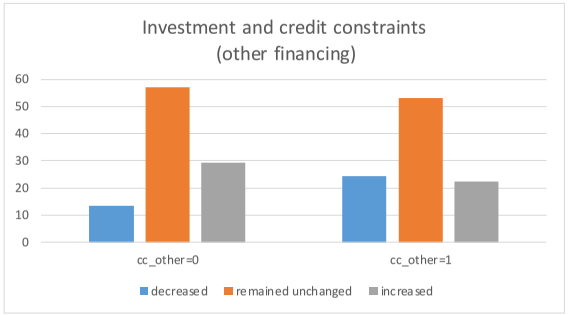


Pearson chi2(2) = 940.5114 Pr = 0.000
Cramér's V = 0.1722

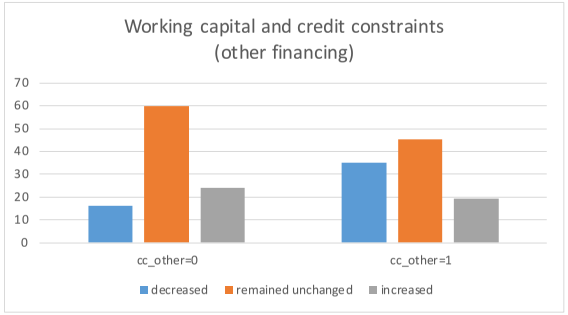


Pearson chi2(2) = 307.5548 Pr = 0.000
Cramér's V = 0.0976

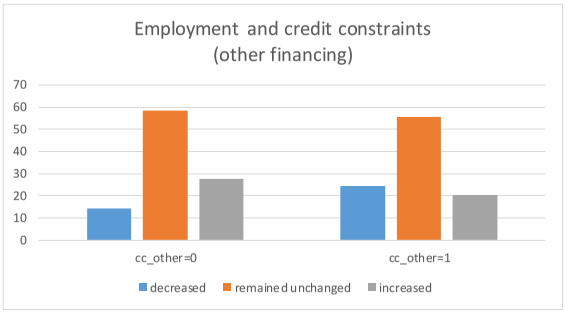
Figure 2: conditional distributions of investment growth, working capital growth and employment growth (credit constraints in other financing)



Pearson chi2(2) = 290.5076 Pr = 0.000
Cramér's V = 0.0970



Pearson chi2(2) = 704.4995 Pr = 0.000
Cramér's V = 0.1502



Pearson chi2(2) = 251.4925 Pr = 0.000
Cramér's V = 0.0889

Appendix A: additional summary statistics

Table A1: breakdown of observations by country

Country	Freq.	Percent	Cum.
AT	417	5.8	5.8
BE	343	4.8	10.6
DE	810	11.3	21.9
ES	1,101	15.4	37.3
FI	357	5.0	42.3
FR	1,014	14.2	56.4
GR	397	5.5	62.0
IE	355	5.0	66.9
IT	1192	16.6	83.6
NL	547	7.6	91.2
PT	437	6.1	97.3
SK	192	2.7	100.0
Total	7,162	100.0	

Table A2: breakdown of observations by firm characteristics

	Freq.	Percent	Cum.
sector			
Industry	2,312	32.3	32.3
Construction	780	10.9	43.2
Wholesale or retail trade	1,917	26.8	69.9
Other services	2,153	30.1	100.0
Total	7,162	100	
size_employment			
Micro	2,352	32.8	32.8
Small	2,446	34.2	67.0
Medium	2,364	33.0	100.0
Total	7,162	100	
size_turnover			
1	1,340	18.71	18.71
2	886	12.37	31.08
3	906	12.65	43.73
4	2,141	29.89	73.62
5	1,600	22.34	95.96
6	289	4.04	100.0
Total	7,162	100	
age			
>=10 years	6,094	85.1	85.1
>=5 and <10 years	775	10.8	95.9
>=2 and <5 years	242	3.4	99.3
<2 years	51	0.7	100.0
Total	7,162	100	
legal form			
Subsidiary or branch	807	11.3	11.3
Autonomous enterprise	6,355	88.7	100.0
Total	7,162	100	
ownership structure			
Public shareholders	70	1.0	1.0
Family or entrepreneurs	3,923	54.8	55.8
Other entreprises	790	11.0	66.8
Venture capital enterprises	43	0.6	67.4
Sole trader	2,168	30.3	97.7
Other	168	2.4	100.0
Total	7,162	100	
exporter			
0	3,314	46.3	46.3
1	3,848	53.7	100.0
Total	7,162	100	

Appendix B: ordered probit

For brevity of exposition, let us focus on the dependent variable investment growth ΔI. The order probit model is specified in terms of a continuous latent variable, latent investment growth ΔI^*:

$$\Delta I^*_{ijct} = X_i'\beta + \alpha_{jct} + \varepsilon_{ijct} \quad (1)$$

where i is firm, j is industry, c is country, t is wave, X_i' is a vector of variables that includes a set of credit constraints and firm-level controls, α_{jct} are country-industry-time fixed effects and ε_{ijct} is a disturbance that follows a N(0,1).

Observed investment growth ΔI, as reported to the SAFE, is then related to latent investment growth ΔI^* in the following way:

$\Delta I_{ijct} =$ "$decrease$" $(k = 0)$ if $I^*_{ijct} \leq \mu_1$

$\Delta I_{ijct} =$ "*remain unchanged*" $(k = 1)$ if $\mu_1 < I^*_{ijct} \leq \mu_2$

$\Delta I_{ijct} =$ "$increase$" $(k=2)$ if $I^*_{ijct} > \mu_3$

where the parameters μ_1, μ_2, μ_3 are thresholds to be jointly estimated with the slope parameters.

The probability that firm i answers option k is given by:

$$p_{ik} = P(\Delta I_{ijct} = k) = F(\mu_{k+1} - X_i'\beta - \alpha_{jct}) - F(\mu_k - X_i'\beta - \alpha_{jct}) \quad (2)$$

where F(.) is the CDF of the Normal distribution.

The log-likelihood of the data is given by:

$$\log L(\beta) = \sum_{i=1}^{N} \sum_{k=1}^{m} I_{ij} \log (p_{ik}) \quad (3)$$

where p_{ik} is given by (2) and $I_{ik} = 1$ if $I_i = k$ and $I_{ik} = 0$ if $I_i \neq k$ (i.e., if the alternative k is the observed outcome for observation i, then I_{ik} equals 1 and the remaining I_{ik} equal zero).

Then the model is estimated by maximum likelihood.

Appendix C: macroeconomic variables correlated with adjusted credit standards

Table C1

	(1)	(2)	(3)	(4)
DEPENDENT VARIABLES	adjusted credit standards (SME)	adjusted credit standards (SME)	adjusted credit standards (large)	adjusted credit standards (large)
gdp	-0.085***		-0.094***	
	(0.013)		(0.014)	
consumer confidence	0.006	-0.001	0.013**	0.007
	(0.007)	(0.009)	(0.005)	(0.008)
government bond yield	-0.012	0.009	-0.073**	-0.045
	(0.044)	(0.046)	(0.029)	(0.036)
investment growth	0.185	0.212	0.111	0.102
	(0.257)	(0.312)	(0.300)	(0.390)
unemployment rate		-0.202		0.041
		(0.339)		(0.324)
COUNTRY DUMMIES	YES	YES	YES	YES
TIME DUMMIES	YES	YES	YES	YES
Observations	72	72	72	72
R-squared	0.830	0.791	0.898	0.851

Estimator: OLS. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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