

# Articles

## 1 The real effects of credit constraints

Prepared by Miguel García-Posada

*This article reviews the existing literature on financial constraints and their effect on investment. It also provides new evidence on this issue using a large sample of firms from 12 European countries for the period 2014-17. The data come from the ECB and European Commission survey on the access to finance of enterprises (SAFE), which focuses specifically on small and medium-sized enterprises (SMEs). The available evidence suggests that credit constraints play a crucial role in the investment decisions of non-financial corporations.*

### 1 Introduction

**Under certain assumptions, a firm's financing structure does not influence its investment.** The Modigliani-Miller theorem<sup>40</sup>, which is the cornerstone of the corporate finance literature, states that, 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 that case, internal and external funds are perfect substitutes, and firms' investment decisions are not affected by financial factors such as internal liquidity, debt leverage or dividend payments.

**In practice, however, several factors mean that external funds are generally more costly than internally generated cash flows.** Factors such as transaction costs, tax advantages, costs of financial distress, agency costs and asymmetric information cause the Modigliani-Miller theorem to break down.<sup>41</sup> In this context, internal and external funds are imperfect substitutes, which leads to the emergence of an external finance premium. Financial constraints may thus have important (negative) effects on real variables and, as a consequence, the availability of external finance may affect investment decisions.

**This article reviews the existing literature and provides new evidence on this issue.** Section 2 reviews the empirical evidence on the impact of financial constraints on corporate investment. Section 3 provides new evidence using the ECB and European Commission survey on the access to finance of enterprises

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<sup>40</sup> Modigliani, F. and Miller, M.H., "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, Vol. 48, 1958, pp. 261-297.

<sup>41</sup> For a review of the theoretical research in this area see Schiantarelli, F., "Financial Constraints and Investment: Methodological Issues and International Evidence", *Oxford Review of Economic Policy*, Vol. 12, No 2, 1996, pp. 70-89.

(SAFE),<sup>42</sup> complemented by information from the euro area bank lending survey.<sup>43</sup> Section 4 concludes.

## 2 Literature review

**This section summarises micro-econometric evidence on the effects of credit constraints on the real economy.** It highlights the most noteworthy studies in the literature that follow a micro-econometric approach<sup>44</sup> to provide a context for the new evidence presented in Section 3.

### 2.1 Early research: investment-cash flow sensitivities and financial statement data

**Early research on financial constraints was based on firms' financial statement data and indirect measures of financial constraints.** In this literature, the standard approach was to use indirect measures of financial constraints such as dividend payout behaviour, association with business groups, size, age, ownership form and credit ratings to test whether the sensitivity of investment to cash flows was greater in types of firm that were more likely to be financially constrained.<sup>45</sup>

**The seminal work of Fazzari et al.<sup>46</sup> found that investment was more sensitive to cash flows in financially constrained firms.** According to the authors, low-dividend firms were more likely to be financially constrained because firms might pay low dividends, when they require investment finance that exceeds their internal cash flows, in order to retain all of the low-cost internal funds they can generate. The presence of financial constraints could be tested by analysing the sensitivity of investment to cash flows. The intuition is that, if the cost disadvantage of external finance is small (i.e. no financial constraints), firms can use external funds to smooth investment when internal finance fluctuates. By contrast, if the cost disadvantage is significant (i.e. financial constraints are relevant), firms may have no alternative low-cost source of finance, and their investment is likely to be driven by fluctuations in cash flows. In line with this hypothesis, the authors found that investment by low-dividend firms was more sensitive to fluctuations in cash flows than investment by high-dividend firms.

<sup>42</sup> The regular reports on the [SAFE](#) survey can be found on the ECB's website.

<sup>43</sup> For more information about the banking lending survey see Köhler-Ulbrich, P., Hempell, H. and Scopel, S., "The euro area bank lending survey. Role, development and use in monetary policy preparation", *Occasional Paper Series*, No 179, ECB, 2016.

<sup>44</sup> There is also a large body of macro literature that studies the effects of financial friction on long-run growth and business cycles. For instance, Aghion et al. (Aghion, P., Angeletos, G., Banerjee, A. and Manova, K., "Volatility and growth: Credit constraints and the composition of investment", *Journal of Monetary Economics*, Vol. 57, No 3, 2010, pp. 246-265) show that, through their effect on the cyclical composition of investment, credit constraints can lead to both higher output volatility and lower mean growth.

<sup>45</sup> For a review of this literature see Schiantarelli, F., op. cit.

<sup>46</sup> Fazzari, S.M., Hubbard, R.G. and Petersen, B.C., "Financing Constraints and Corporate Investment", *Brookings Papers on Economic Activity*, Vol. 1988, No 1, 1988, pp. 141-206.

**A standard criticism of this approach is that cash flows may proxy for other, unobservable determinants of investment, such as investment opportunities.**

Cash flows may capture the current and expected profitability of investment: high cash flows signal that the firm has done well and is likely to continue doing well.<sup>47</sup> Thus, more liquid firms have better investment opportunities, and accordingly they tend to invest more. One way around this problem is to control for the expected profitability of investment when estimating investment-cash flow sensitivities. This can be done by using Tobin's average  $q$ <sup>48</sup> (the ratio of the market value of the firm to the replacement cost of its assets), as it contains forward-looking information on profitability. Theory predicts that, if financial constraints are unimportant, Tobin's  $q$  should be the only determinant of investment. However, Tobin's  $q$  is difficult to measure in practice and may well differ from the marginal  $q$ <sup>49</sup>, which is the relevant measure for firms' investment decisions, unless very stringent conditions are satisfied. Hence, when Tobin's  $q$  is not a good measure of investment opportunities, the significance of cash flows may simply reflect the fact that they contain information about future profitability.

**In addition, this strand of the literature has been challenged by Kaplan and Zingales,<sup>50</sup> who provide empirical evidence that a greater sensitivity of investment to cash flows is not a reliable measure of financing constraints.**

The authors undertake an in-depth analysis of the low-dividend firms that Fazzari et al. identify as financially constrained according to the investment-cash flow criterion. In particular, they examine managers' views on their firms' access to credit gleaned from comments on the firms' annual reports or "10-K" reports<sup>51</sup>, complemented by additional quantitative information. On this basis, they rank the extent to which the firms are likely to be financially constrained. Strikingly, firms classified as less financially constrained exhibit significantly greater investment-cash flow sensitivity than those classified as more financially constrained, which implies that investment-cash flow sensitivities do not always increase with the degree of financing constraints.

**Another study that highlights the limitations of these methodologies is by Farre-Mensa and Ljungqvist.<sup>52</sup>** The authors, using a large sample of US publicly-listed firms for the period between 1989 and 2011, find that firms typically classified

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<sup>47</sup> For instance, in Fazzari et al., op. cit., cash flows equal income after interest and taxes plus depreciation and amortisation, and it is divided by the capital stock. This variable is likely to be highly correlated with a return on assets ratio (net income over total assets).

<sup>48</sup> See Tobin, J., "A General Equilibrium Approach to Monetary Policy", *Journal of Money, Credit and Banking*, Vol. 1, No 1, 1969, pp. 15-29.

<sup>49</sup> Tobin's marginal  $q$  is the ratio of the market value of an additional unit of capital to its replacement cost.

<sup>50</sup> Kaplan, S. N. and Zingales, L., "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?", *Quarterly Journal of Economics*, Vol. 112, No 1, 1997, pp. 169-215.

<sup>51</sup> 10-K is an annual report required by the US Securities and Exchange Commission that gives a comprehensive summary of a company's financial performance.

<sup>52</sup> Farre-Mensa, J. and Ljungqvist, A., "Do Measures of Financial Constraints Measure Financial Constraints?", *Review of Financial Studies*, Vol. 29, No 2, 2016, pp. 272-308.

as constrained<sup>53</sup> do not actually behave as such. In particular, these firms have no difficulty raising debt when tax rates increase (as an increase in tax rates raises the value of tax shields) and they use the proceeds from equity issues to increase payouts to shareholders, which indicates that they do not face an inelastic supply of equity curve. According to the authors, traditional measures of credit constraints identify young and fast-growing firms that obtain financing primarily from the equity and loan markets, rather than capturing actual financial constraints.

## 2.2 Survey-based indicators of financial constraints and firm performance

**Given the limitations of previous studies based on investment-cash flow sensitivities and financial statement data, a new strand of the literature 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 problems in their access to credit markets.

**Campello et al.**<sup>54</sup> **use a worldwide survey to assess the impact of the 2008 financial crisis on spending plans.** They do so with a sample of very large corporations from the United States, Europe and Asia surveyed in 2008. They find that constrained firms planned, on average, deeper cuts in technology expenditure, capital expenditure, marketing expenditure and employment. The inability to obtain external funds also caused many constrained firms to forgo attractive investment opportunities.

**Ferrando and Mulier**<sup>55</sup> **analyse the effect of being a discouraged borrower (i.e. a firm that needs external finance but does not apply for a bank loan because it fears that its application will be rejected) on firm investment and growth.** They do so by combining the answers to the SAFE survey with financial statement data for nine euro area countries for 2010-14. The discouraged borrowers in the survey tend to be riskier and lower quality firms than non-discouraged borrowers, as suggested by, among other things, their lower Altman Z-scores<sup>56</sup> and their low interest coverage ratios.<sup>57</sup> Using instrumental variables to take into account

<sup>53</sup> On the basis of not having a credit rating or paying low dividends, or on linear combinations of observable characteristics such as size, age or leverage as in the Kaplan-Zingales, Hadlock-Pierce and Whited-Wu indices. The actual Kaplan-Zingales index comes from Lamont, O., Polk, C., and Saa-Requejo, J., "Financial Constraints and Stock Returns", *Review of Financial Studies*, Vol. 14, No 2, 2001, pp. 529-554. The Hadlock-Pierce index comes from Hadlock, C. and Pierce, J., "New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index", *Review of Financial Studies*, Vol. 23, No 5, 2010, pp. 1909-1940. The Whited-Wu index comes from Whited, T. and Wu, G., "Financial Constraints Risk", *Review of Financial Studies*, Vol. 19, No 2, 2006, pp. 531-559.

<sup>54</sup> Campello, M., Graham, J.R and Harvey, C., "The real effects of financial constraints: Evidence from a financial crisis", *Journal of Financial Economics*, Vol. 97, No 3, 2010, pp. 470-487.

<sup>55</sup> Ferrando, A. and Mulier, K., "The real effects of credit constraints: evidence from discouraged borrowers in the euro area", *Working Paper Series*, No 1842, ECB, 2015.

<sup>56</sup> The Z-score is a linear combination of five common business ratios, weighted by coefficients. The formula is used to predict the probability that a firm will go into bankruptcy within two years. See Altman, E.I., "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", *Journal of Finance*, Vol. 23, No 4, 1968, pp. 589-609.

<sup>57</sup> The interest coverage ratio is defined as earnings over interest payments, with earnings measured before interest, taxes, depreciation and amortisation (EBITDA).

the endogeneity between discouragement and investment (as discouraged borrowers are likely to have worse investment opportunities) the authors show that discouragement has large negative effects on investment, employment and asset growth. They argue that this negative impact is due to the lack of access to bank finance implied by discouragement.

**A different approach is taken by Buca and Vermeulen,<sup>58</sup> who examine the negative impact of bank credit tightening on aggregate investment.** They use information on banks' credit standards (i.e. loan approval criteria) from the euro area bank lending survey to construct tightening indices for six European countries<sup>59</sup> for the period 2004-09. Tighter credit standards are likely to lead to a higher proportion of credit-constrained firms, and may thus have effects on the real economy. In particular, the authors find that, following a tightening of bank credit, bank-dependent borrowers (i.e. firms with a high percentage of bank debt over total assets) reduced investment to a much larger extent than non-bank dependent borrowers. As tightening of bank credit standards was substantial in the last financial crisis, they argue that this phenomenon may explain a significant proportion of the drop in aggregate investment by non-financial corporations during that period.

**Nevertheless, a caveat of all these studies is the potential endogeneity of financial constraints.** The fact that the unobserved component of investment opportunities may be correlated with the indicator of credit constraints, and one can only control imperfectly for investment opportunities and investment demand, undermines a causal interpretation of the estimates. For instance, firms with weak balance sheets may have both low investment opportunities and a high probability of being financially constrained, so the relationship between these two variables may be endogenous.

### 2.3 The real effects of the sovereign debt crisis

**Finally, another strand of the literature studies the real effects of the sovereign debt crisis.** In particular, the euro area sovereign debt crisis in 2010-12 may have caused a credit crunch and have negatively affected firms' investment and job creation through credit rationing by banks in difficulties because of the sovereign-debt crisis, the so-called sovereign-bank nexus.

**Ferrando et al.<sup>60</sup> find that the euro area sovereign debt crisis caused a large reduction in credit access.** The authors, who use data from the SAFE survey on 11 countries for the period 2009-12, find that the euro area sovereign debt crisis caused a large supply-driven reduction in credit access because of the sovereign-bank nexus. In particular, after the sovereign debt crisis started, and controlling for

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<sup>58</sup> Buca, A. and Vermeulen, P., "Corporate investment and bank-dependent borrowers during the recent financial crisis," *Journal of Banking & Finance*, Vol. 78, May 2017, pp. 164-180.

<sup>59</sup> Belgium, Germany, Spain, France, Italy and Portugal.

<sup>60</sup> Ferrando, A., Popov, A. and Udell, G.F., "Sovereign stress and SMEs' access to finance: Evidence from the ECB's SAFE survey," *Journal of Banking & Finance*, Vol. 81, Issue C, 2017, pp. 65-80.

borrower quality, firms in stressed countries<sup>61</sup> became more likely to be denied credit, to be credit-rationed and to face higher loan rates.

**In addition, Acharya et al.<sup>62</sup> find that the European debt crisis had strong negative effects on the real economy through the bank lending channel.**

According to this study of the European syndicated loan market for the period 2006--12, the credit crunch that followed the European debt crisis had strong negative effects on the real economy, as the contraction in lending by banks affected by the crisis depressed the investment, job creation and sales growth of firms associated with these banks. The authors' estimates suggest that the credit crunch explained between one-fifth and half of the overall negative real effects suffered by European borrowing firms during the crisis. This was primarily associated with banks from distressed countries facing losses on their domestic sovereign debt holdings and the resulting incentives for weakly-capitalised banks from those countries to engage in risk-shifting behaviour by buying even more domestic sovereign bonds, which crowded out corporate lending.

### 3 The impact of financial constraints on investment: new survey-based evidence

**This section provides new evidence on the relationship between a firm's financial constraints and investment.<sup>63</sup>** The findings suggest that financial constraints have a strong negative impact on corporate investment.

#### 3.1 Sample and descriptive statistics

**The analysis is based on data from the SAFE survey covering 12 European countries for 2014-17.** The sample contains only non-financial firms and excludes firms in agriculture and public administration. Most of the firms are interviewed only once, but there is a small rotating panel of enterprises that are surveyed in successive rounds.<sup>64</sup> The sample is limited to rounds 11 to 16 of the survey (from April-September 2014 to October 2016-March 2017) because of the availability of some key variables. The sample has 7,506 observations corresponding to 4,863 firms from 12 European countries.<sup>65</sup>

**The key variable is a measure of overall credit constraints.** Credit constraints are assessed in bank financing (bank loans and credit lines), trade credit and other

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<sup>61</sup> Ireland, Greece, Spain, Italy and Portugal.

<sup>62</sup> Acharya, V., Eisert, T., Eufinger, C. and Hirsch, C., "Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans", *CEPR Discussion Paper*, No DP10108, 2014.

<sup>63</sup> A complementary analysis of the effect of financial constraints on investment using SAFE data can be found in the box entitled "Recent business investment developments from the perspective of firm-level survey data", *Economic Bulletin*, Issue 7, ECB, 2016.

<sup>64</sup> See the report "[Survey on the access to finance of enterprises. Methodological information on the survey and user guide for the anonymised micro dataset](#)".

<sup>65</sup> Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, Slovakia and Finland.

financing (equity and debt securities, leasing, factoring, intercompany loans, etc.) A firm is considered to be financially constrained if it is constrained in any financing source. In particular, the credit constraint variable equals 1 if, for some type of financing, any of the following circumstances applies: a) a firm's application for external financing was rejected; b) a firm received only a limited part (i.e. less than 75%) of the financing it applied for (i.e. quantity rationing); c) a firm refused the lender's offer of 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 borrower).<sup>66</sup> The variable equals 0 (i.e. unconstrained) if the firm successfully applied for external financing. Firms that did not apply for external financing are excluded from the sample. According to this indicator, 24% of the sample firms are constrained in some source of financing.<sup>67</sup>

**The distribution of constrained firms differs across firm categories, highlighting the role of information asymmetries and credit risk.** Charts 1-3 show the percentage of constrained firms across several categories. In line with previous literature, there is a negative relationship between the probability of experiencing financial constraints and size (Chart 1a).<sup>68</sup> Also in line with previous studies,<sup>69</sup> the proportion of mature firms (ten or more years) that are constrained is much lower than that of relatively young firms (less than five years), although the proportion of very young firms that are constrained is also slightly lower (Chart 1b). Consistently with the literature that suggests that belonging to a business group relaxes financial constraints,<sup>70</sup> the proportion of constrained firms among subsidiaries or branches is significantly lower than that among autonomous enterprises (Chart 2a). Ownership structure also matters, as sole traders and family businesses are more likely to be constrained than publicly listed firms (Chart 2b). There is also a significant proportion of constrained firms among those owned by venture capital enterprises, as venture capital tends to fund new and risky projects for which conventional finance is often not available. Exporting firms are less likely to be financially constrained than non-exporting firms, because the former tend to be more competitive and productive (Chart 3a).<sup>71</sup> Finally, the proportion of credit-

<sup>66</sup> Similar indicators have been constructed in previous literature but focused on bank credit only. See, for instance, Ferrando, A., Popov, A. and Udell, G.F., "Do SMEs Benefit from Unconventional Monetary Policy and How? Micro-evidence from the Eurozone", *Journal of Money, Credit and Banking*, 2018, forthcoming; Ferrando, A. and Mulier, K., "Firms' Financing Constraints: Do Perceptions Match the Actual Situation?", *Economic and Social Review*, Vol. 46, No 1, 2015, pp. 87-117.

<sup>67</sup> This figure is much higher than the figures presented in ECB's reports on the SAFE survey. There are two reasons for the discrepancy. First, the indicator in the reports focuses on bank loans only. Second, it uses as a denominator all SMEs for which bank loans are relevant, while the indicator in this article uses as a denominator only the firms that applied for external financing.

<sup>68</sup> See Beck, T., Demirgüç-Kunt, A. and Maksimovic, V., "Financial and Legal Constraints to Growth: Does Firm Size Matter?", *Journal of Finance*, Vol. 60, No 1, pp. 137-177; Beck, T., Demirgüç-Kunt, A., Laeven, L. and Maksimovic, V., "The determinants of financing obstacles", *Journal of International Money and Finance*, Vol. 25, No 6, 2006, pp. 932-952; Artola, C. and Genre, V., "Euro Area SMEs under Financial Constraints: Belief or Reality?", *CESifo Working Paper*, No 3650, 2011.

<sup>69</sup> Ferrando, A. and Griesshaber, N., "Financing obstacles among euro area firms: Who suffers the most?", *Working Paper Series*, No 1293, ECB, 2011. Ferrando, A. and Mulier, K., "Firms' Financing Constraints: Do Perceptions Match the Actual Situation?", op. cit..

<sup>70</sup> See, for instance, Hoshi, T., Kashyap, A. and Scharfstein, D., "Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups", *Quarterly Journal of Economics*, Vol. 106, No 1, 1991, pp. 33-60.

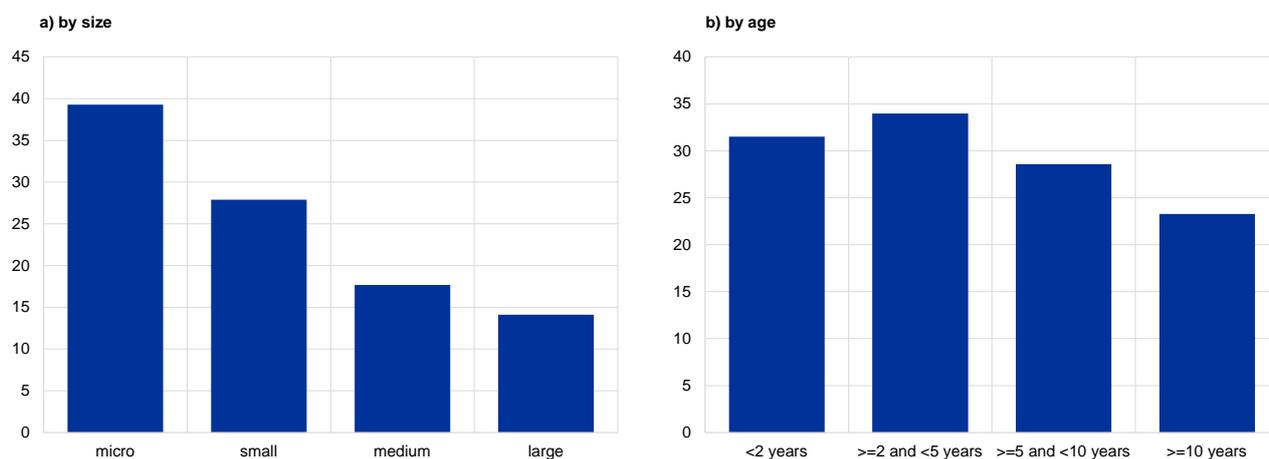
<sup>71</sup> Correa-López, M. and Doménech, R., "The Internationalisation of Spanish Firms", *BBVA Research Working Papers*, No 12/30, 2012.

constrained firms is higher in countries vulnerable to economic and financial shocks than in less vulnerable countries<sup>72</sup> (Chart 3b).

## Chart 1

### Percentage of constrained firms by size and by age

(weighted percentages)



Source: ECB and European Commission survey on the access to finance of enterprises.

Notes. A firm is constrained if any of the following circumstances apply: a) its application for external financing was rejected; b) it received only a limited part (i.e. less than 75%) of the financing it applied for; c) it refused the lender's offer of external financing because the borrowing costs were too high; d) it did not apply for external financing because it feared its application would be rejected. The following financing instruments are considered: bank loans, credit lines, trade credit, other financing (equity and debt securities, leasing, factoring, intercompany loans, etc.)

Observations are weighted using sampling weights. The weights restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity and country. The number of observations is 7,506.

Countries: Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, Slovakia and Finland.

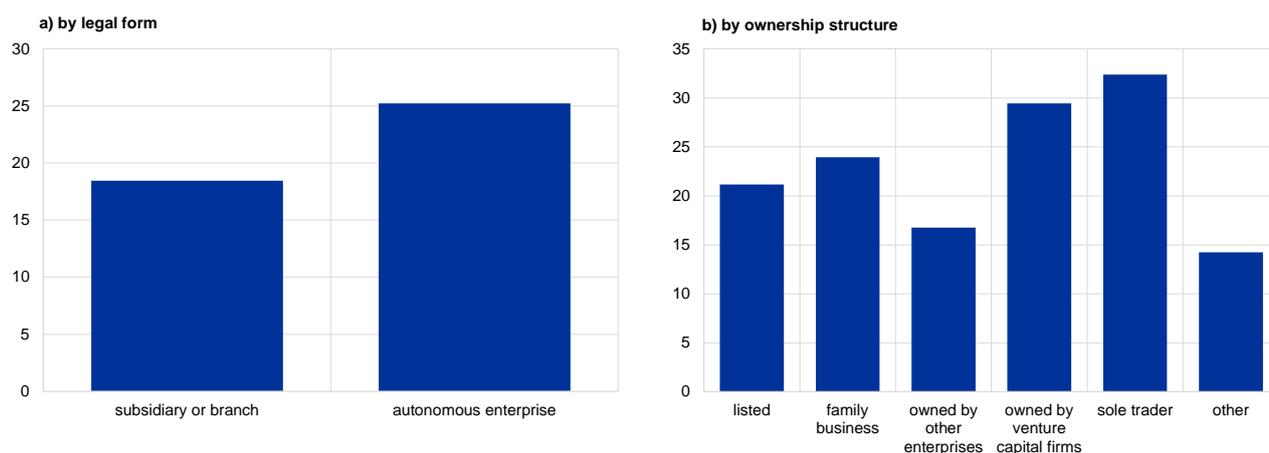
Period: rounds 11 to 16 of the SAFE survey (from April-September 2014 to October 2016-March 2017).

Size classes based on number of employees are as follows. micro: less than 10, small: between 10 and 49, medium: between 50 and 249, large: 250 or more.

## Chart 2

### Percentage of constrained firms by legal form and by ownership structure

(weighted percentages)



Source: ECB and European Commission survey on the access to finance of enterprises.

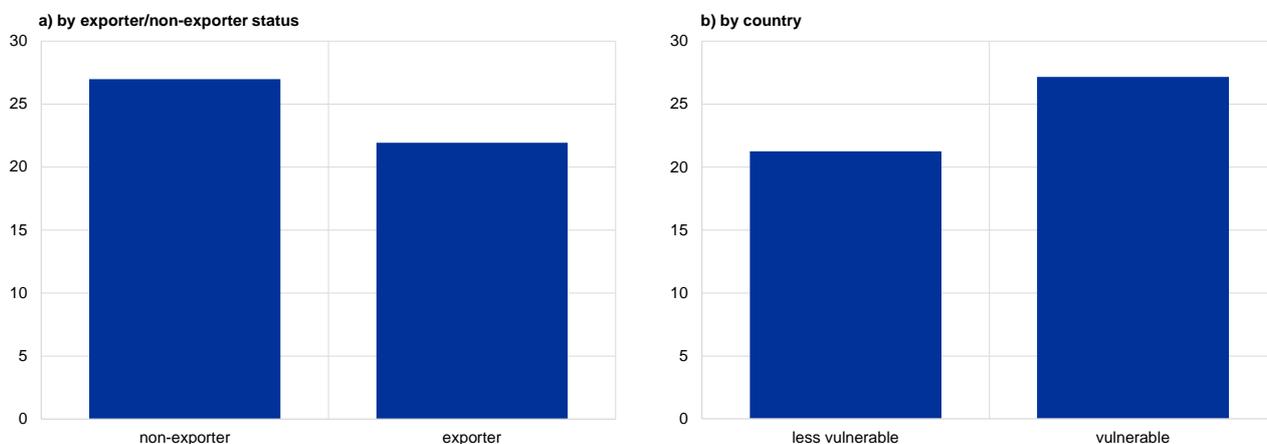
Notes: See Chart 1.

<sup>72</sup> "Vulnerable countries" refers to Ireland, Greece, Spain, Italy, Portugal and Slovakia, "less vulnerable countries" refers to the remaining countries in the sample.

### Chart 3

#### Percentage of constrained firms by exporter/non-exporter status and by country

(weighted percentages)



Source: ECB and European Commission survey on the access to finance of enterprises.

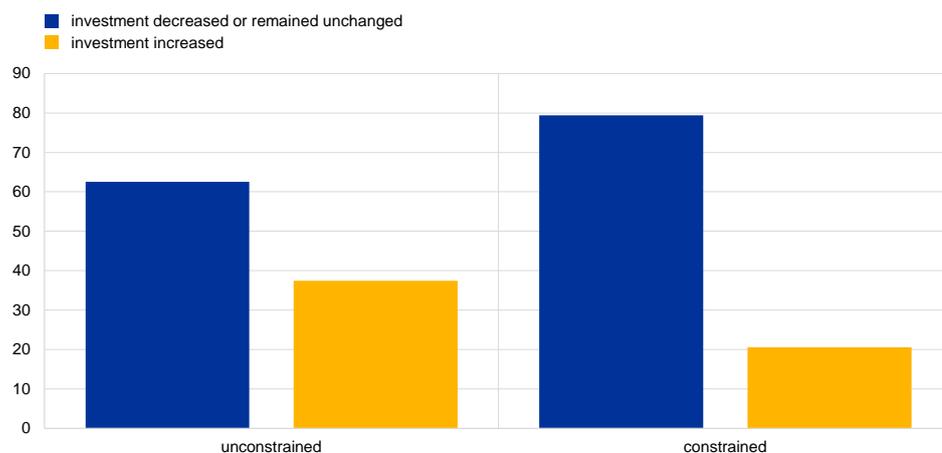
Notes: See Chart 1. "Vulnerable countries" refers to Ireland, Greece, Spain, Italy, Portugal and Slovakia, "less vulnerable countries" refers to the remaining countries in the sample.

**Descriptive evidence suggests a negative relationship between financial constraints and corporate investment.** In the survey firms are asked whether their investment has decreased, remained unchanged or increased over the past six months. To investigate a possible link between financial constraints and investment, Chart 4 shows the distribution of investment for constrained and unconstrained firms. The percentage of firms reporting that investment decreased or remained unchanged is substantially larger (about 15 percentage points) in the group of financially constrained firms.<sup>73</sup>

### Chart 4

#### Investment and credit constraints

(weighted percentages)



Source: ECB and European Commission survey on the access to finance of enterprises.

Notes: See Chart 1.

<sup>73</sup> The difference is statistically significant at 1%.

## 3.2 Econometric analysis

**A more formal test of the effects of credit constraints on investment can be carried out through regression analysis.** The analysis uses linear probability models. The dependent variable is *investment*, a dummy variable that equals 1 if investment has increased and 0 if it has decreased or remained unchanged. This variable is regressed on the credit constraint indicator, a large set of firm-level and country-level controls and country and time-fixed effects.

**The key identification challenge is omitted variable bias.** Firms with poor investment opportunities tend to invest less and are likely to have a higher probability of being credit-constrained. Hence, the coefficient on the credit constraint indicator may be affected by endogeneity.

**To tackle this problem, the analysis follows two approaches, one that uses proxies for investment opportunities and another that uses instrumental variable methods.** The first approach relies on the use of ordinary least squares (OLS) and a large set of covariates to control for firms' investment opportunities. The main measure of investment opportunities is an indicator for changes in the enterprise-specific outlook, as in Ferrando and Mulier.<sup>74</sup> In particular, the firm is asked to assess the evolution of its own outlook, with respect to sales and profitability or business plan, over the past six months. The analysis also includes an indicator for changes in a firm's turnover as a proxy for growth opportunities, as in Gomes.<sup>75</sup> Regarding the remaining firm-level controls, size and age, together with the firm's sector of activity, are traditional determinants of investment opportunities (see Petersen and Rajan<sup>76</sup>).<sup>77</sup>

**Nevertheless, as one cannot perfectly control for firms' investment opportunities, instrumental variables are also used.** The instrumental variables approach is aimed at removing any remaining correlation of the error term in the regression with the credit constraint indicator. The proposed instruments, *adjusted credit standards*, are two variables that measure the level of (adjusted) credit standards in each country, as applied to large firms and SMEs respectively. The variables, which come from the euro area bank lending survey, measure the supply-only component of banks' credit standards (i.e. banks' loan approval criteria), as influenced by factors such as their cost of funds, competitive pressures and risk tolerance.<sup>78</sup> Adjusted credit standards should be uncorrelated with demand factors such as the macroeconomic and industry-specific outlook, borrowers' creditworthiness and risks related to the collateral demanded. However, to rule out the possibility that

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<sup>74</sup> Ferrando, A. and Mulier, K., "The real effects of credit constraints: evidence from discouraged borrowers in the euro area", *op. cit.*

<sup>75</sup> Gomes, J.F., "Financing Investment", *American Economic Review*, Vol. 91, No 5, 2001, pp. 1263-1285.

<sup>76</sup> Petersen, M.A. and Rajan, R.G., "The Benefits of Lending Relationships: Evidence from Small Business Data", *Journal of Finance*, Vol. 49, No 1, 1994, pp. 3-37.

<sup>77</sup> Other firm-level controls are also included. See notes to Table 1.

<sup>78</sup> To construct these two variables, credit standards are regressed on the demand factors "general economic situation", "industry or firm-specific situation/borrower's creditworthiness" and "risk related to the collateral demanded". The residuals of those regressions are the adjusted credit standards variables. For further details on the construction of the variables, see García-Posada, M., "Credit constraints, firm investment and growth: evidence from survey data," *Working Paper Series*, ECB, forthcoming.

the instrument is just capturing the economic cycle and in turn the economy-wide investment opportunities, macroeconomic controls have been included: real GDP, the consumer confidence indicator and the ten-year government bond yield.

**The results suggest that financial constraints have a large effect on investment.**

Table 1 presents the results of linear probability models estimated by OLS and two-stage least squares (2SLS), in which the dependent variable is *investment*.<sup>79</sup> Column 1, estimated by OLS, shows a negative and strong correlation between the endogenous regressor, *constrained*, and the dependent variable *investment*. However, to establish a causal relationship one needs to make use of the instrumental variables. First, a single instrumental variable, the adjusted credit standards in loans to SMEs, is used (column 2). According to these estimates, the presence of credit constraints reduces the probability of increasing investment by 67 percentage points, but the effect is estimated imprecisely and is only statistically significant at 10%. To increase the precision of the estimates, a second instrumental variable is used, namely the adjusted credit standards in loans to large firms.<sup>80</sup> The result, displayed in column 3, is a very strong and precise effect: credit constraints reduce the probability of an increase in investment by 92 percentage points, and the coefficient is significant at 5%.<sup>81</sup>

**Table 1**  
Impact of credit constraints on investment

	1	2	3
<b>Constrained</b>	-0.096*** (0.019)	-0.668* (0.387)	-0.917** (0.360)
<b>Estimator</b>	OLS	2SLS	2SLS
<b>Instruments</b>		credit standards SME	credit standards SME credit standards large
<b>F-test (first stage)</b>		11.711	11.510

Sources: ECB and European Commission survey on the access to finance of enterprises and ECB calculations.  
Notes: The dependent variable is *investment*, a dummy that equals 1 if investment has increased and 0 if it has decreased or remained unchanged.  
*Constrained* is a dummy that equals 1 if the firm is credit-constrained and 0 otherwise.  
The instrumental variables are adjusted credit standards in loans to SMEs and adjusted credit standards in loans to large firms.  
All specifications include country dummies, time dummies, macro controls, firm controls and other firm controls.  
Macro controls are detrended real GDP, a consumer confidence indicator and the ten-year government bond yield.  
Firm controls are dummies for sector, size (in terms of employment and turnover), age, legal form, ownership structure and exporter/non-exporter status.  
Other firm controls are dummies for increase/decrease in turnover, profits, labour costs, other costs, the debt-to-assets ratio and interest expenses and dummies for improvement/deterioration in the 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.  
OLS is ordinary least squares. 2SLS is two-stage least squares. Estimations are weighted using sampling weights. The weights restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity and country.  
The number of observations is 7,506.  
Countries: Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, Slovakia and Finland.  
Period: rounds 11 to 16 of the SAFE survey (from April-September 2014 to October 2016-March 2017).

<sup>79</sup> All time-varying controls are lagged one period, while the endogenous regressor, *constrained*, and the adjusted credit standards instruments are included contemporaneously.

<sup>80</sup> Notice also that the instruments do not seem to be weak, as the first-stage F-statistic is above 10, the reference value suggested by the literature. The specification also passes the Sargan-Hansen J test (p-value = 0.291), i.e. we cannot reject the null of validity of the over-identifying restrictions.

<sup>81</sup> This average effect may hide important heterogeneity, as the impact of credit constraints may be very strong for some types of firm and weak or inexistent for other types. In particular, using the same sample, García-Posada, M., op. cit., finds that most of the causal impact of credit constraints on firm investment is driven by old SMEs.

**The analysis abstracts from other potentially relevant channels such as the extensive margin.** The results are conservative measures of the total impact of credit constraints in the real economy, as the analysis ignores the extensive margin, i.e. businesses that shut down because of a lack of credit and firms that do not enter the market because they do not obtain financing to undertake their investment projects.

## 4 Conclusions

**It is not clear a priori that credit constraints should affect corporate investment.** In frictionless perfect capital markets, the Modigliani-Miller theorem 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 mean that they are imperfect substitutes, so financial constraints may have important effects on corporate investment. This article has reviewed the existing literature and provided new evidence based on a large sample of European firms.

**The available evidence suggests that financial constraints have important effects on the investment decisions of non-financial corporations, highlighting the important role of monetary policy in alleviating them.** In the face of the recent financial crisis, central banks around the globe took unprecedented measures to repair the transmission mechanism of monetary policy and thereby reduced the financial constraints faced by households and firms.<sup>82</sup> These actions, in turn, may have spurred investment through the credit channel and their effect on the external finance premium paid by firms. Nevertheless, conclusions on the macroeconomic implications of the above studies, which are based on micro-econometric evidence, should be drawn with caution, as the studies rely on partial equilibrium analyses and often use qualitative survey-based data.

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<sup>82</sup> The proportion of financially constrained firms in the euro area has declined since 2012. See the box entitled "Recent business investment developments from the perspective of firm-level survey data", *Economic Bulletin*, Issue 7, ECB, 2016.