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Investment-cash flow sensitivity and financial constraints: Evidence from unquoted European SMEs[☆]

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ABSTRACT

We contribute to the financial constraints literature and the investment-cash flow sensitivity debate by defining a new and simple index of firm level financial constraints for unquoted European SMEs. Firms that are constrained according to our index pay higher interest rates on their debt. An exogenous financial supply shock reveals that our index also captures financial constraints in terms of the volume of credit. Our index outperforms existing indices in capturing financial constraints of unquoted SMEs. Finally, employing our proposed index to identify financially constrained firms and using firm-level employment growth as a control for investment opportunities, we find that constrained firms display the highest investment-cash flow sensitivities.

1. Introduction

In recent years there has been an intense academic debate on investment dynamics and financial constraints. A firm is said to be financially constrained if its investment is limited by its generation of internal funds because it is unable to obtain sufficient external funds. The empirical literature has found financial constraints to be elusive, mainly because we lack a direct measure of financial constraints everyone can agree on. Financial constraints are therefore usually measured indirectly either through variables that are assumed to be related to financial constraints, or through the estimation of investment-cash flow sensitivities. The literature then interprets investment-cash flow sensitivities as an indication of the existence of firm level financial constraints. However, it remains unclear whether these high sensitivities reflect (i) an unsatisfied demand for external funds by the firm (supply effect), (ii) the preference for internal funds over external funds for a variety of underlying reasons (demand effect), or (iii) the fact that investment and cash flow are both correlated with an omitted variable such as investment opportunities. The empirical challenge is to disentangle these effects in the understanding that a perfect identification methodology may not exist. To this purpose we analyse a large sample of unquoted SMEs in Nordic, Western and Eastern European countries.

There is a very substantial literature on firm level financial constraints of quoted firms, often US firms. But the literature on unquoted SMEs, especially relevant in a European context, is more scant.[1] Our first contribution is our explicit focus on unquoted SMEs from a wide array of European countries, where financial constraints are bound to be more stringent than for large quoted US firms. As financial constraints may be specific to a country or a financial system, we investigate several countries characterized by different economic and financial systems.

Our second contribution is that we provide for these unquoted European SMEs (further firms) a new and simple index of financial constraints. Besides traditional variables proxying information asymmetries such as age and size, our index also incorporates firms' cash flows, proxying the debt/repayment capacity of the firm and the firms' leverage ratio, proxying solvency risk. We validate our index in a number of ways and simultaneously benchmark it to widely used indices in the literature, in particular the Kaplan–Zingales index (Kaplan and Zingales, 1997; Lamont et al., 2001),

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[1] A few notable exceptions are studies by Mizen and Vermeulen (2005), Guariglia (2008) and Becchetti et al. (2010).

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the Whited–Wu index (Whited and Wu, 2006) and the Hadlock–Pierce index (Hadlock and Pierce, 2010). We first employ information from implicit interest rates to disentangle supply and demand effects. A financially constrained firm is not necessarily fully excluded from external funding, but will be faced with a higher cost of external financing than unconstrained firms. We show that firms that are constrained according to our index indeed pay higher interest rates on their debt, while this is not so much the case for firms being constrained according to existing indices in the literature. In addition we also exploit the exogenous financial supply shock in Belgium and France that ensued in the aftermath of the 9/11 events. We show that firms that are constrained according to our index have a lower loan growth than unconstrained firms due to a more restricted supply of loans, but we again do not find such clear results using the existing indices. Thus, we find that our proposed index indeed captures firm financial constraints of unquoted European SMEs while existing indices often do not.

Our third contribution is that we use our new and simple index of financial constraints to assess whether investment-cash flow sensitivities are an appropriate measure of financial constraints for unquoted European SMEs. Cash flow may however be correlated to investment opportunities, generating spurious investment-cash flow sensitivities even in the absence of credit constraints. We therefore include employment growth as a proxy for investment opportunities, assuming that firms with more investment opportunities hire more people. We show that employment growth is indeed positively related to both investment and cash flow and thus constitutes an appropriate proxy for investment opportunities. Augmenting the empirical model with firm-level employment growth as a control for investment opportunities, we find that financially constrained firms also display the highest investment-cash flow sensitivities. This is in line with the conjecture that firm investment reacts positively to cash flow because cash flow relaxes external financial constraints for unquoted European SMEs.

Our findings are therefore consistent with the recent evidence of Campbell et al. (2012) that the cost of capital is the driving force behind investment and its relation with internal funds and with the recent evidence of Farre-Mensa and Ljunqvist (2013) that the existing indices of financial constraints are inadequate.

The paper is organized as follows: we start in Section 2 with an overview of the related literature. We describe the dataset in Section 3. We explain our identification strategy, namely the new index in Section 4, and test the performance and validity of our index in Section 5. Section 6 then applies the index to investigate what drives investment-cash flow sensitivity. Finally, Section 7 provides some concluding remarks.

2. Related literature

In their pioneering paper, Fazzari, Hubbard and Petersen (1988) (hereinafter FHP) find that the investment of firms with low dividend pay-out ratios (i.e. firms that are more likely to face financial constraints) is highly sensitive to the availability of cash flow. A number of subsequent contributions (Bond and Meghir, 1994; Carpenter et al., 1994; 1998; Hoshi et al., 1991; Kashyap et al., 1994; Mizen and Vermeulen, 2005; Whited, 1992) find results in line with FHP. The FHP results were challenged in 1997 by Kaplan and Zingales (hereinafter KZ). KZ show theoretically that a firm's profit maximizing investment choices do not yield a simple monotonic relation between financial constraints and investment-cash flow sensitivities, which invalidates the empirical strategy of the FHP strand of the literature. KZ's results were subsequently confirmed by several studies (Cleary, 1999; 2006; Cleary et al., 2007).

Several additional theoretical challenges to the FHP interpretation of investment-cash flow sensitivities were developed. Alti (2003) assumes that young firms are uncertain about the quality of their projects and derive information about their projects from cash realizations. In this environment investment-cash flow sensitivities arise in the absence of any financial market imperfections, challenging the classical FHP interpretations. Erickson and Whited (2000) and Cummins et al. (2006) similarly suggest that the significant role of cash flow for investment is related to investment opportunities, which are incorrectly measured by q. However, Gilchrist and Himmelberg (1995) and later Carpenter and Guariglia (2008) still find that cash flow sensitivities are a reflection from underlying credit frictions as cash flow remains significant for investment even when investment opportunities are controlled for.

The empirical literature has tried to realign or explain the contradictory theoretical predictions and empirical findings with respect to investment-cash flow sensitivities. Allayannis and Mozumdar (2004) argue that some firms might be in such severe financial distress that investment cannot respond to cash flow, implying a lower sensitivity for financially more constrained firms. Their argument boils down to the proposition that the sensitivity for firms in distress reflects a lower investment demand, rather than a credit supply constraint. Almeida et al. (2004) propose a model where constrained firms have a positive cash flow sensitivity of cash (i.e. a firm's propensity to save cash out of cash flows), while unconstrained firms' cash savings are not systematically related to cash flows. Their empirical tests validate their theoretical predictions for a large sample of US manufacturing firms over the period 1971 to 2000. Pawlina and Renneboog (2005) find, for a sample of quoted UK firms, that investment is strongly cash-flow sensitive and suggest that the agency costs of free cash flow are likely to be the main source of the observed investment-cash flow sensitivities. Hovakimian (2009) uses 20 years of US manufacturing data to estimate firm-specific investment-cash flow sensitivities and finds that cash flow-insensitive firms have the highest levels of internal liquidity and the lowest potential growth opportunities, and appear the least financially constrained, which seems to be in line with the interpretation of positive investment-cash flow sensitivities as financial constraints. She also finds, however, that firms with a negative investment-cash flow sensitivity have the lowest levels of internal liquidity, the highest potential growth opportunities, and appear most financially constrained.

Guariglia (2008) suggests that the opposite results found by FHP and KZ are due to different measures of financial constraints: while the FHP strand of the literature uses proxies for external financial constraints, such as firm size, age or dividend payout, the KZ strand of the literature uses proxies for firm liquidity that capture internal financial constraints. Guariglia (2008) also explains the U-shape form for the investment-cash flow relationship, as predicted by Cleary et al. (2007), with this difference in underlying measures. She shows that the U-shape is present when considering a sample-split on the basis of internal funding (the KZ case), while the investment-cash flow sensitivity increases monotonically when splitting the sample according to external financial constraints (the FHP case). For a sample of COMPUSTAT firms, Lyandres (2007) finds that the relation between the cost of external financing and the investment-cash flow sensitivity is also U-shaped. He shows that investment-cash flow sensitivity is decreasing in the cost of external financing when it is relatively low and is increasing in the cost of external financing when it is high.

Further, Duchin et al. (2010) show that investment dropped significantly in the financial crisis due to the negative supply shock to external finance that characterized the recent crisis. They show that this drop is greatest for firms that are financially constrained, but do not relate this to excess cash flow sensitivity. Campbell et al. (2012) provide evidence that the cost of capital explains the relation between decreasing internal funds and decreasing corporate investment. Contrary to what one would expect from the findings of Duchin et al. (2010) and Campbell et al. (2012), Chen and

Chen (2012) show that investment-cash flow sensitivities have disappeared during the financial crisis and conclude that they do not measure the credit frictions that were widely present during that period.

Becchetti et al. (2010) combine the traditional information on external financial constraints with qualitative information on self-declared credit rationing from a panel of Italian firms to assess the validity of the different points of view in the literature. They find that age and size are good predictors of the probability of being credit rationed. Also in support of the FHP results, Hadlock and Pierce (2010) show that an index based on firm size and age performs better in predicting financial constraints than the widely used KZ index, although they argue that investment-cash flow sensitivities are not a good setting to investigate financial constraints. However, Farre-Mensa and Ljunqvist (2013) find that none of the existing indices (including the index of Hadlock and Pierce (2010)) adequately measure financial constraints in a sample of quoted US firms.

3. Data

The data set used in this paper covers the period 1996–2008 and consists of the profit and loss account and balance sheet data for six European countries gathered by Bureau Van Dijk Electronic Publishing in the Amadeus database. One potential problem with this dataset is the survivorship bias. Bureau van Dijk releases updates of the Amadeus database on a monthly frequency and when a firm exits it is also no longer included in the database at some point. By compiling several releases (we use more than 10 versions with approximately one year interval) of the Amadeus database, our dataset comprises both entering and exiting firms over the sample period. Francis et al. (2013) have shown that country-level governance variables, such as investor protection, influence investment-cash flow sensitivities. To make sure that none of our results are driven by such country specific elements, we choose six countries with different backgrounds and sufficient data on the regression variables available and we will run our tests on each country individually. Belgium and France are two West European countries, Finland and Sweden represent the Scandinavian model and with the Czech Republic and Hungary, our sample also contains two transition countries. Following Cleary (1999), we exclude banks, insurance companies, other financial companies and utility firms from the dataset and retain firms from the following seven industries: agriculture and mining, manufacturing, construction, retail and wholesale trade, hotel and restaurants, services, and health and others (see Table 10 in the appendix for more details). Furthermore the sample consists of unquoted firms, which are more likely to face financial constraints than publicly quoted firms.

Table 1 shows descriptive statistics of the main variables of interest for our research.[2] Investment (I_{it}) is measured as the sum of depreciation in year t and the change in tangible fixed assets from year $t-1$ to year t. Using this measure of investment allows comparability with many other papers in the literature.[3] The replacement value of the capital stock is calculated with the perpetual inventory formula (Blundell et al., 1992). Using tangible fixed assets as the historic value of the capital stock and assuming that in the first period the historic value equals the replacement cost, we calculate the capital stock as $K_{it+1} = K_{it} * (1-\delta) * (p_{t+1}/p_t) + I_{it+1}$. With δ representing the depreciation rate, which we assume to be constant at 5.5%[4] and p_t is the price of investment goods, proxied by the gross total fixed capital formation deflator. Δs_{it} is the change in the log of real total sales, and measures sales growth. Δemp_{it} is the change in the log of real total costs of employees, and measures employment growth.[5] CF_{it}/K_{it-1} represents a firm's cash flow, scaled by its beginning of period capital.

Table 1
Descriptive statistics: sample means and standard deviations.

	BE	FR	FI	SE	CZ	HU
I_{it}/K_{it-1}	0.112	0.111	0.122	0.144	0.075	0.151
	(0.102)	(0.132)	(0.149)	(0.202)	(0.128)	(0.186)
$k_{it-2} - s_{it-2}$	−1.565	−1.860	−1.562	−1.848	−1.023	−1.360
	(0.912)	(0.690)	(0.894)	(1.316)	(1.063)	(0.975)
Δs_{it}	0.020	0.009	0.023	0.007	−0.020	0.007
	(0.122)	(0.106)	(0.179)	(0.338)	(0.210)	(0.271)
Δemp_{it}	0.011	0.018	0.032	0.007	−0.008	0.060
	(0.081)	(0.106)	(0.181)	(0.467)	(0.132)	(0.207)
CF_{it}/K_{it-1}	0.282	0.417	0.477	0.392	0.205	0.278
	(0.309)	(0.361)	(0.513)	(1.027)	(0.317)	(0.312)
#*firms*	2555	69,801	9876	31,396	2101	1405
#*obs*	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows sample means and in parentheses the corresponding standard deviations. The subscript i indicates firms, and the subscript t, time, where t = 1996–2008. I is the firm's investment, K the replacement value of the firm's capital stock and k its logarithm, s is the logarithm of total sales, *emp* is logarithm of total costs of employees, and finally *CF* represents a firm's cash flow.

Further, to control for outliers, large mergers or typing errors we drop observations in the 1% tails of the distribution of both the level and first difference of the regression variables. We also excluded firms with accounting periods that differ from the standard 12 months. Following Mizen and Vermeulen (2005) we also have a consecutive run of at least five observations for each firm. The descriptive statistics are relatively similar across the countries considered. The lower investment rate in the Czech Republic is partly due to the larger share of firms in the agricultural sector in the sample.

The descriptive statistics in Table 1 show that our data is similar to what is known from previous research. Investment levels are on average between 10 and 15 percent of the capital stock. Real sales growth is around 1 to 2 percent annually. Interestingly, this also appears to be the case for employment growth. Cash flow levels vary from 20 percent to 47 percent of the capital stock.

4. The age-size-cash flow-leverage (ASCL) index

In this section we define a new and simple index of firm level financial constraints for European unquoted SMEs.

As shown in Fig. 1 we think of firm size, age, the average cash flow level, and the average indebtedness as shifters of the supply curve of external finance. With respect to firm size and age, we believe that it is easier for financial institutions to gather sufficient information on larger firms (Bernanke et al., 1996) while older firms have better proven track records than young firms (Schiantarelli, 1995), which both decrease the degree of asymmetric information between lender and borrower. This, in turn, will increase the supply of external finance to larger and older firms (Hadlock and Pierce, 2010; Rauh, 2006). Further, since cash flows

[2] See Table 9 for a definition of the variables used.

[3] See for instance Mizen and Vermeulen (2005), Bloom et al. (2007), and Guariglia (2008).

[4] We repeated all our calculations and all later estimations with alternative depreciation rates, ranging from 2.5% to 8.5%. All results are qualitatively robust to changes in the assumed depreciation rate in the calculation of the capital stock. Results with alternative depreciation rates are available on request.

[5] Real sales and real costs of employees are obtained by deflating the nominal values with the gdp deflator.

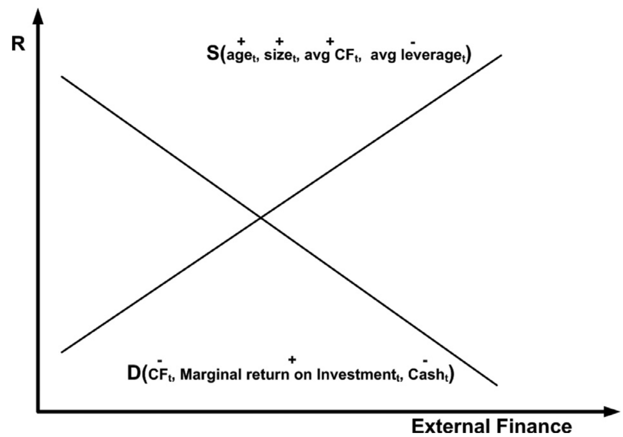

Fig. 1. The market for external finance.

determine the debt capacity of the firm,[6] external lenders (especially transaction lenders) will be less reluctant to fund firms with higher cash flows as these cash flows are crucial to repay the debt. Finally, firms that are financed with a smaller share of debt have a larger equity buffer against negative shocks and thus have a lower solvency risk. Larger and older firms with higher levels of cash flow and less leverage are therefore less likely to forgo positive net present value investments due to financial constraints. Unlike Campello and Chen (2010), we do not include variables like bond ratings, credit ratings or dividend payout ratios in our index, because these data are unavailable (or in fact nonexistent) for the large majority of unquoted SMEs in our sample. So we aim at constructing a simple index of financial constraints that outperforms the current indices in the literature for our sample of firms.

In order to approximate the (elasticity of the) supply of finance to firms we measure for each of the above stated determinants whether a firm is scoring below or above its industry median in a given year. A firm gets a score of 1 for age if the firm is younger than the median firm in the same industry in our sample in a given year, and 0 otherwise. We then proceed in the same way for the firm's size and the average cash flow to capital ratio of the previous two years. For the average leverage ratio, a firm gets a score of 1 if its average long term debt to total assets ratio of the previous two years is higher than its industry median, and 0 otherwise. We then sum the four scores and obtain for each firmyear observation a score between 0 (unconstrained supply of external finance) and 4 (constrained supply of external finance).

The main advantage of this approach is that it compiles multiple determinants of supply into a single measure, that it is easy to compute, and applicable to almost any dataset available in economics. A scoring system like this is also flexible in the weight that is given to a certain discriminating variable. As we have no a priori assumptions on the importance that the four variables play in the supply of external finance, nor on the different role they might play across countries, we use the unweighted sum of the components as our main financial constraints index. However, we will also construct a weighted version of our financial constraints index as an extension and robustness test. A disadvantage of our approach that compiles these multiple determinants into 1 measure is the interpretation of the index itself. While the interpretation of the scores 0 and 4 is still feasible (a score of 0 indicates that a firm is relatively old and large, with relatively high levels of cash flow and relatively low leverage ratio, and vice versa for a score of 4), the scores in between are less straightforward to interpret. Our approach is also relative to the industry median. The ASCL-index can therefore be used to distinguish financially constrained from financially unconstrained firms in a given period, but not to assess the evolution of financial constraints over time.

For the estimation purposes in the next section and to capture possible nonlinear effects of financial constraints, we generate a categorical variable $finconLOW_{it}$ which takes the value 1 if firm i gets a score on the ASCL-index below 2 in year t, and 0 otherwise, meaning unconstrained supply of external finance. Next, $finconHIGH_{it}$ takes the value 1 if firm i gets a score on the ASCL-index above or equal to 2 in year t, and 0 otherwise, and implies that firm i faces a constrained supply of finance in year t. Panel A of Table 11 in the Appendix shows the descriptive statistics for the index components across countries. Panel B of Table 11 in the Appendix shows that the probability that a firm stays within a certain category for several years is rather high, especially for unconstrained firms. On average, every year around 10 percent of the firms switch to a different constraint-group. This can be partly explained by the fact that size and age do not change quickly over time. Nonetheless, a reasonable amount of firms in the sample do switch between groups over time.

We also relate our new ASCL-index to three existing and widely used indices: the Whited–Wu (WW) index,[7] the Kaplan–Zingales (KZ) index[8] and the Hadlock–Pierce (HP) index (note that all four indices are supposed to be increasing with financial constraints). Table 2 shows that the correlation is only moderate (with WW and HP) or even negative (with KZ). This should not necessarily be seen as surprising since the existing indices were built using data on quoted US firms while our data consists only of unquoted small and medium sized European firms. Indeed, assuming that the existing indices are still valid, implies assuming that the estimated parameters are stable across time, samples and continent.[9] Further, this moderate correlation should not be seen as problematic since recent research suggests that the existing indices do not adequately measure financial constraints (Farre-Mensa and Ljunqvist, 2013).

Table 12 in the appendix provides additional information on the correlation between our index and the existing indices by showing the correlation between these indices and their components for all the countries jointly. The relatively low correlation between the ASCL-index and the WW-index can be ascribed to the fact that the WW-index correlates much less with the average cash flow and the average leverage, while the ASCL-index appears to be unrelated to the firms' sales growth and the industry sales growth. The negative correlation between the ASCL-index and the KZ-index can primarily be ascribed to the fact that the KZ-index correlates very highly and positively with q, while the ASCL-index appears to correlate negatively with q. The moderate correlation between the ASCL-index and the HP-index can be explained by the observation that the HP-index correlates only -but very highly- with age and size, while the ASCL-index also correlates highly with the average cash flow and the average leverage.

6 See for instance Altman (1968) or www.moodys.com for the importance of cash flows in a credit rating, which will determine the success of the access to external finance.

7 As we have no information on dividends, our measure of the KZ-index cannot take this dimension into account.

8 As there is no market data available for the unquoted firms in our sample, q cannot be computed. We construct an alternative measure of q following Honda and Suzuki (2000), who developed an accounting proxy for marginal q that can be applied to unquoted firms and which has been used in this context by for instance D'Espallier and Guariglia (2013). The accounting proxy for marginal q is basically defined as the ratio of profit per unit of capital over the cost of capital. As we have no information on dividends, equivalent to the WW-index, our measure of the KZ-index cannot take this dimension into account.

9 The indices were built using US quoted companies from 1975 to 2001 (WW), 1970 to 1984 (KZ), 1995 to 2004 (HP).

Table 2
Correlation between our ASCL-index and existing indices (WW, KZ, HP).

	BE	FR	FI	SE	CZ	HU
Corr(*ASCL*, *WW*)	0.38***	0.34***	0.32***	0.40***	0.05***	0.20***
Corr(*ASCL*, *KZ*)	−0.17***	−0.30***	−0.20***	−0.11***	−0.05***	−0.20***
Corr(*ASCL*, *HP*)	0.46***	0.50***	0.49***	0.47***	0.31***	0.44***

Notes. The table shows the correlation between our index (ASCL; based on age, size, average cash flow and average leverage) and other financial constraints indices such as the Whited–Wu (WW), the Kaplan–Zingales (KZ) and the Hadlock–Pierce (HP) index. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.
$WW = -0.091 * \frac{CF}{TA} - 0.044 * ln(TA) + 0.021 * \frac{Longtermdebt}{TA} - 0.035 * salesgrowth + 0.102 * industrysalesgrowth$
$KZ = -1.001909 * \frac{CF}{TA} + 3.139193 * \frac{Longtermdebt}{TA} - 1.314759 * \frac{Cash}{TA} + 0.2826389 * q$
$HP = -0.737 * log(TA) + 0.043 * (log(TA))^2 - 0.04 * age$

5. Validating the ASCL-index

In this section we demonstrate the performance and validity of our index of financial constraints in comparison to other indices found in the literature.

5.1. Interest rates

As can be seen in Fig. 2, constrained firms are expected to pay a higher interest rate on their external finance, and hence the interest rate that firms pay on their financial debt could be an important confirmation of our identification strategy. Therefore, in this section we measure this interest rate and relate it to our index to validate whether the ASCL-index is a good proxy for the supply of finance. Our measure of the interest rate is calculated as the ratio of the total interest paid (as reported in the profit and loss account) over the interest carrying liabilities, which are defined as the sum of the long term liabilities and the short term financial liabilities.

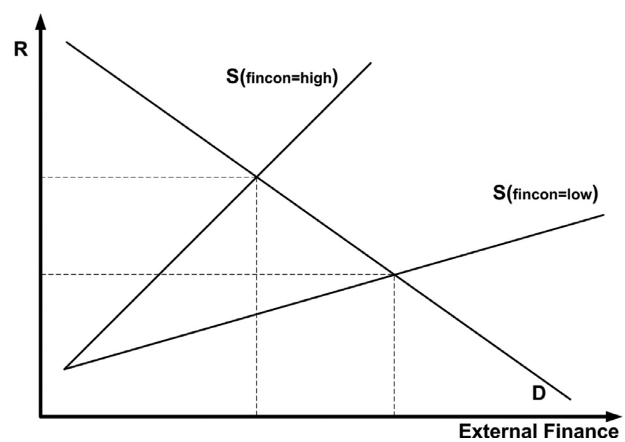

Fig. 2. The market for external finance: constrained vs unconstrained.

Petersen and Rajan (1997) argue that debt enforcement theories and the equity-stake theory of trade credit explain why suppliers are still willing to lend to financially constrained firms. Their evidence suggests that firms use more trade credit when credit from financial institutions or markets is limited or unavailable. In line with their suggestion that financially constrained firms use more trade credit, we find positive correlations between interest rates and net trade credit – defined as accounts payable minus accounts receivable – for all countries considered in our study (see Table 3, panel A). This is consistent with the interpretation that firms with more difficult access to external finance (higher interest rates) substitute external finance for net trade credit, while firms with easy access to external finance (low interest rates) also draw on external finance to invest in net trade credit. This indicates that it is mainly the supply of external finance and the associated cost of finance that is binding for firms.

Before analyzing panel B of Table 3 it is important to note that the results are designed to compare within countries. A comparison across countries is hard since there are important institutional differences that are hard to filter out (e.g. different monetary policy) or that we are unaware of. The composition of the samples is not exactly the same in all countries, in terms of firm characteristics, sectoral presence, or even in terms of the years (boom/recession) that they are present. These reservations do however allow within country analysis as we construct our ASCL-index

Table 3
Financial constraints and the interest rate.

	BE	FR	FI	SE	CZ	HU
Panel A						
$Corr(R, \frac{netTC}{K})$	0.13***	0.20***	0.21***	0.20***	0.08***	0.15***
Panel B						
$R(finconLOW)$	2.50%	2.12%	2.52%	2.94%	5.22%	4.22%
$R(finconHIGH)$	3.30%	2.62%	3.70%	5.00%	5.66%	5.44%
t-test $H_0 : low - high = 0$	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
$I/K(finconLOW)$	0.12	0.13	0.13	0.18	0.10	0.16
$I/K(finconHIGH)$	0.11	0.10	0.11	0.13	0.06	0.14
t-test $H_0 : low - high = 0$	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Panel C						
Corr(*ASCL*, *R*)	0.27***	0.18***	0.30***	0.32***	0.11***	0.20***
Corr(*WW*, *R*)	0.06***	0.12***	0.15***	0.15***	0.02*	0.01
Corr(*KZ*, *R*)	−0.16***	−0.18***	−0.16***	−0.14***	−0.18***	−0.26***
Corr(*HP*, *R*)	0.04***	0.09***	0.10***	0.12***	0.18***	0.11***

Notes. Panel A reports correlations of the implicit interest rate (R) with net trade credit (accounts payable minus accounts receivable). Where the net trade credit is scaled by the capital stock, and R is the ratio of the total interest paid over the interest carrying liabilities. The interest carrying liabilities are the sum of the long term liabilities and the short term financial liabilities. Panel B shows the average R that firms pay on their debt and the average investment level (I/K) for all the firms classified in a given constraint group. Panel C shows the correlation between the respective indices and R. * indicates that the either the correlation or the conducted *t*-test is significantly different from zero at the 10% level; ** and ***, respectively at the 5% or 1% level.

for firms within the same year, within the same sector (and obviously within the same country).

Panel B of Table 3 shows that firms that are more constrained according to our index pay – on average – a higher interest rate on their financial debt. A *t*-test on the equality of the means shows that the mean interest rates are in each country statistical significantly different from each other for each constraint-group. Secondly, panel B of Table 3 documents that firms that face a constrained supply of external finance invest significantly less than unconstrained firms in all countries. The evidence that firms for which external finance is more costly invest less should not be surprising as can be seen in Fig. 2: a low supply of external finance is associated with a higher cost of finance and a lower amount of borrowed funds, which indirectly implies that constrained firms cannot invest as much as unconstrained firms, all else equal. This can thus be seen as another indication that the index correctly measures the supply of finance. If the index would be positively correlated with the demand for finance, it could be possible to observe a demand driven higher interest rate for those firms that we consider financially constrained, but then they should also invest more instead of less. Table 3 thus shows that financial market frictions have real effects as firms that have a more costly access to finance invest significantly less. Also Minton and Schrand (1999) found this direct negative relation between capital costs and investment levels.

Finally, panel C of Table 3 displays the correlation of our index (and the other widely used indices) with the implicit interest rate. As argued above, if our identification of constrained supply of external finance is correct, we should observe that firms that are more constrained pay a higher interest rate on their debt. The Table reveals that our index has the strongest correlation with the implicit interest rate, while some of the existing indices even have a negative correlation with the interest rate. Moreover, this is indeed driven by the financial constraints captured by the indices and not driven by credit risk. Table 13 in the Appendix shows the correlation between the indices and the residual interest rate. The residual interest rate is taken from a regression where the implicit interest rate was regressed on the Altman Z-score, a measure often used to proxy for default/credit risk. The results show that the correlations are a little bit smaller once the interest rate is orthogonal to credit risk, but that the correlation with the residual interest rate is still by far the highest for the ASCL-index.

5.2. Exploiting an exogenous shock

Although the results in the previous section are in line with the conjecture that our proposed index indeed captures financial constraints, they fall short from constituting proof thereof. As a final test of our index, we investigate the loan growth of financially constrained firms versus the loan growth of financially unconstrained firms when total bank credit growth in the country of the firm is restrained because of an exogenous supply shock, in the spirit of Farre-Mensa and Ljunqvist (2013). Specifically, we use the exogenous shock in financial supply in Belgium and France generated by the events of 9/11. Time series data on domestic bank credit to non-financial corporations from the BIS (Bank for International Settlements) reveals a significant exogenous slowdown of the supply of external finance in 2002 and 2003 in response to 9/11. Such a slowdown did not occur in the other countries under study, which is why we only focus on Belgium and France in this subsection. Specifically we calculate the loan growth as the difference between the two-year average bank loan amount in the post credit-slowdown period and the two-year average bank loan amount in the pre credit-slowdown period and compare this loan growth of financially constrained firms to that of financially unconstrained firms. The results are shown in Table 4 and are consistent with our ASCL-index correctly identifying financially constrained firms, and confirm that the ASCL-index performs better in doing so than the traditional indices widely used in the literature.

Panel A of Table 4 shows that bank loan growth of ASCL-financially constrained firms is on average between 13 (Belgium) and 15 (France) percentage points lower than bank loan growth of ASCL-financially unconstrained firms in a period characterized by an exogenous negative credit supply shock. The question may arise to which extent this difference is driven by bank supply and not by loan demand by the firms that we classified as financially constrained. We try to shed some light on this by measuring the sales growth prior to the slowdown as a proxy for loan demand and then compare the sales growth of financially constrained firms versus the sales growth of financially unconstrained firms. It can be seen in Panel A that ASCL-financially constrained firms only have about 0.5 percentage points lower sales growth than ASCL-unconstrained firms. There is thus very little indication that this economically very significant lower bank loan growth for ASCL-financially constrained firms would be demand-driven, hence the results in Panel A reconfirm that the ASCL-index does a good job at identifying financially constrained firms.

Panel B of Table 4 shows differences in bank loan growth and sales growth for financially constrained firms versus unconstrained firms based on the WW-index, Panel C shows this based on the KZ-index and Panel D shows this based on the HP-index. To do this, we split the samples based on the median value of the respective indices (above = constrained, below = unconstrained). In general, the WW-index appears to produce unclear results in terms of the loan evolution of financially constrained firms (Belgium shows an insignificant increase, France a significant decrease), but the WW-constrained firms also have a much lower sales growth, indicating a lower demand for loans, which could be driving the observed difference in loan evolution in France. Panel C reveals that KZ-financially constrained firms even have a higher loan growth than KZ-financially unconstrained firms when bank credit is restrained. These firms also appear to have a higher sales growth than the KZ-financially unconstrained firms. Especially the observed difference in loan growth indicates that the KZ index is not a good index of financial constraints. Finally, Panel D shows that the results based on the HP-index are quite similar to the ASCL-index, with the qualification that the loan growth difference captured by the ASCL-index is a bit more pronounced.

Our results show that our new ASCL-index exhibits a moderately positive correlation with the WW-index and the HP-index and even a negative one with the KZ-index. Furthermore, of all considered indices, the ASCL-index correlates most strongly with firms' cost of debt (the KZ-index correlates negatively with the cost of debt). Finally, the ASCL-index identifies that constrained firms have significantly lower loan growth than unconstrained firms when total bank credit in a country is restrained by an exogenous shock. Having demonstrated the merits of the ASCL-index in our specific sample of unquoted European SMEs, we proceed by using the index to contribute to the investment-cash flow sensitivity debate in the next section.

6. Investment-cash flow sensitivity and the ASCL-index

If investment-cash flow sensitivities arise because cash flow relaxes constraints firms face in the financial market, then this should be particularly important for firms that pay the highest interest rate for a given level of demand; or stated differently, for those firms that face the most inelastic supply of external funds. For such firms, as shown in Fig. 3, a comparable windfall gain in cash flow results in a larger drop of the cost of external finance and hence a larger relaxation of the constraint, enabling new investment.

Table 4
Financial constraints and loan growth when bank credit is distressed.

	BE	FR
Panel A (ASCL-index)		
ΔΔ ln loans	−13.0%***	−14.5%***
ΔΔ ln sales	−0.42%	−0.56%***
Panel B (WW-index)		
ΔΔ ln loans	1.63%	−10.8%***
ΔΔ ln sales	−4.68%***	−4.68%***
Panel C (KZ-index)		
ΔΔ ln loans	7.72%	8.63%***
ΔΔ ln sales	5.20%***	4.57%***
Panel D (HP-index)		
ΔΔ ln loans	−13.9%***	−8.09%***
ΔΔ ln sales	0.69%	−0.33%**

Where

$$\Delta\Delta \ln\, loans = \left[ln\ avg\ loans^{finconHIGH}_{t=slowdown+0\&+1} - ln\ avg\ loans^{finconHIGH}_{t=slowdown-1\&-2}\right] - \left[ln\ avg\ loans^{finconLOW}_{t=slowdown+0\&+1} - ln\ avg\ loans^{finconLOW}_{t=slowdown-1\&-2}\right]$$

$$\Delta\Delta \ln\, sales = \left[ln\ sales^{finconHIGH}_{t=slowdown-1} - ln\ sales^{finconHIGH}_{t=slowdown-2}\right] - \left[ln\ sales^{finconLOW}_{t=slowdown-1} - ln\ sales^{finconLOW}_{t=slowdown-2}\right]$$

Notes. The Table reports the double differences in loan growth before and after the credit-slowdown for financially constrained firms versus financially unconstrained firms. The Table also reports double differences in sales growth prior to the credit slowdown period for financially constrained firms versus financially unconstrained firms. Panel A identifies financially constrained firms using the ASCL-index, Panel B using the WW-index, Panel C using the KZ-index, and Panel D using the HP-index. The reported differences are taken from a *t*-test. * indicates that the conducted *t*-test is significantly different from zero at the 10% level; ** and ***, respectively at the 5% or 1% level.

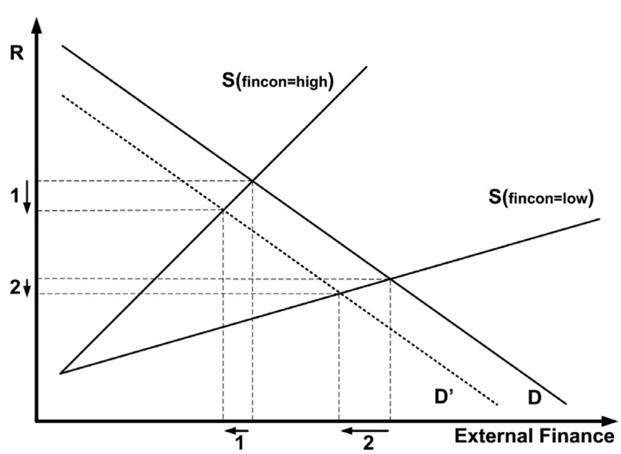

Fig. 3. The market for external finance: a windfall gain in cash flow.

6.1. The investment model

Our reduced form investment model is based on the error correction model (1) and follows the work of Bond et al. (2003), Mizen and Vermeulen (2005), Bloom et al. (2007) and Guariglia (2008). Changes in the capital stock are related to the optimal capital stock (k^*) and are dynamic, reflecting that capital adjustment is costly. As in the previous cited research, we use the approximation that $\Delta k_t \approx \frac{I_{it}}{K_{it-1}} - \delta_i$ and make the assumption that the optimal capital stock is related to output ($k^* \approx s$). This gives model (2) which can now be estimated with our data. See the online Appendix for a full derivation of the model. The widely used structural Q-model of investment is not applicable because the firms in our dataset are unquoted and hence it is not possible to construct a tobin's q with our data.

$$\Delta k_{it} = \alpha_0 + \alpha_1 \Delta k_{it-1} + \alpha_2 (k_{it-2} - k^*_{it-2}) + \alpha_3 \Delta k^*_{it} + \alpha_4 \Delta k^*_{it-1} + \upsilon_i + \upsilon_{jt} + \epsilon_{it} \tag{1}$$

$$\frac{I_{it}}{K_{it-1}} = \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{it-1} + \upsilon_i + \upsilon_{jt} + \epsilon_{it} \tag{2}$$

where I is the firm's investment, K the replacement value of the firm's capital stock and k its logarithm, s is the logarithm of real total sales. The subscript i indices firms, the subscript j industries and the subscript t, time, where $t = 1996$–2008. The error term consists of four components: an unobserved firm specific component υ_i, a time component to filter out business cycle effects υ_t, a time component which varies over industries accounting for industry specific effects υ_{jt} and finally an idiosyncratic component ϵ_{it}. The error-correction term $(k_{it-2} - s_{it-2})$ captures the long run equilibrium between capital and its target, proxied by sales.

The reduced form investment model (2) (as well as the majority of structural models in the literature) makes the assumption of perfect capital markets. This implies that a firm's investment decision is independent of its financial decision, and therefore, financial variables should not play a role for investment. Fazzari et al. (1988) were the first to test this assumption by including cash flow in the empirical specification. Since then, including cash flow has become a common way in the literature to test for capital market frictions, so we augment model (2) with cash flow ($\frac{CF_{it}}{K_{it-1}}$) to obtain the baseline model (3).

$$\frac{I_{it}}{K_{it-1}} = \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{it-1} + \alpha_6 \frac{CF_{it}}{K_{it-1}} + \upsilon_i + \upsilon_{jt} + \epsilon_{it} \tag{3}$$

All specifications are estimated with the first difference General Method of Moments (GMM) estimator developed by Arellano and Bond (1991). The first difference GMM estimator is appropriate since it controls for biases due to unobserved firm-specific effects and the endogeneity of explanatory variables. Note that we are estimating a reduced form model and therefore we need to be careful in interpreting the results. Moreover, as the instruments used in the estimations sometimes differ between countries, we shall focus on the economic importance of the findings rather than on the cross country comparison. The measure of the interest rate in-

Table 5
Baseline Estimation: model (3).

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.085	−0.182***	−0.204***	−0.008	0.016	−0.094**
	(0.054)	(0.028)	(0.021)	(0.103)	(0.027)	(0.044)
$k_{it-2} - s_{it-2}$	−0.218***	−0.191***	−0.247***	−0.165***	−0.127***	−0.195***
	(0.045)	(0.020)	(0.023)	(0.026)	(0.022)	(0.063)
Δs_{it}	0.214***	−0.075	0.152***	0.183***	0.123***	0.082
	(0.063)	(0.101)	(0.036)	(0.028)	(0.035)	(0.063)
Δs_{it-1}	0.209***	0.153***	0.258***	0.173***	0.141***	0.216***
	(0.042)	(0.031)	(0.021)	(0.026)	(0.021)	(0.044)
CF_{it}/K_{it-1}	0.080***	0.057***	0.029***	0.042***	0.078***	0.073
	(0.023)	(0.014)	(0.011)	(0.008)	(0.025)	(0.049)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	139	89	283	117	251	167
m2	0.94	0.07	0.51	0.44	0.25	0.31
J	0.53	0.13	0.09	0.13	0.37	0.87
# firms	2555	69,801	9876	31,396	2101	1405
#obs	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows the output for the GMM first difference estimation of specification (3). The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with industry dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at, the 10% level; ** and ***, respectively at the 5% or 1% level.

troduced in Section 5.1 will help us draw valid conclusions from the results. The instruments used for the endogenous variables are I_{it-2}/K_{it-3}, Δs_{it-2}, $k_{it-2} - s_{it-2}$, Δemp_{t-2}, CF_{it-2}/K_{it-3} and/or further lags. The exogenous time dummies and industry-time dummies are instrumented by themselves. Roodman (2009) warns for issues related to too many instruments used in the first difference GMM, but especially in the system GMM. Roodman (2009) points to efficiency problems that arise when the number of instruments is close to the number of cross-sections, which is likely not an issue in our case. Another issue relates to the weak power of the J-test when instruments are many, but note that few guidelines exist in the literature about how many instruments are too many to trust the J-statistic. In any case, we try to cap the number of instruments per period as much as possible.

Table 5 presents the estimates of specification (3). The lagged investment term is negative in some countries and zero in others. The error correction term always has a significant negative sign, indicating that when capital is lower than its desired level, investment increases, ensuring a return to the equilibrium level. Table 5 further indicates a significant positive relationship between sales growth and investment. The positive and significant value for cash flow implies that an increase in cash flow enables firms to invest more. Since all the firms in our sample are unquoted it is likely that this observed investment-cash flow sensitivity is an indication of financial constraints. A bit surprising, while the point estimate of cash flow in Hungary is very similar to that in other countries, it is not significant at the 10 percent level, but we will come back to this when we do some robustness checks. Quantitatively, our results are similar across countries and consistent with previous research. Finally, $m2$ provides no indication that the instruments would be correlated with the error term. The null hypothesis of no second order serial correlation cannot be rejected in all our regressions. Also the null hypothesis of instrument validity, known as the Sargan test of overidentifying restrictions (J), cannot be rejected in all our specifications.

6.2. The investment opportunities bias

As Bond and Van Reenen (2005) point out, this approach is valid in a structural model because all information about investment opportunities is captured by q and thus any information content of cash flow can be expected to reflect capital market imperfections.[10] While our reduced form model (3) bypasses the known problems with measurement error in q, it does not control for the possible information content of cash flow regarding investment opportunities and the expectation about future marginal revenue. To control for the latter, model (3) is augmented with firm level employment growth (Δemp_{it-1}) under the assumption that firms will increase their workforce if they expect good investment opportunities.[11] Labour chosen at the beginning of the period thus controls for the unobserved opportunity shock. As labour is assumed to be more flexible than capital in the production process, employment reacts in period t and investment in period $t+1$ to expected opportunities $E_t[opportunities_{t+1}]$. When the opportunities hence realise in period $t+1$, they will affect cash flow in $t+1$ which might coincide with the augmented planned investment in $t+1$ due to the opportunity shock. Firms with better investment opportunities are thus likely to increase their workforce while firms with bad investment opportunities are likely to lay off some employees. If investment reacts to cash flow because it reveals investment opportunities, cash flow should not be significant anymore after the inclusion of beginning of period employment growth as shown in model (4).

One might argue that labour is not so flexible in Belgium and France, which would invalidate our approach. This is true when one considers the hiring and especially firing of employees. However, when business booms, firms in these countries ask their employees to work overtime rather than hiring new employees, and vice versa when business slows down. Such behaviour would indeed not be visible when employment growth is measured by the number of employees, but will be visible when employment growth is measured by the cost of the employees. So we can assume that the total costs are a better reflection of the total hours worked by the employees, than the number of employees itself. Another advantage of using the costs of employees is that the data on the actual number of employees has a lot more missing values

[10] This approach is no longer valid if the structural model is not correctly specified or when marginal q does not fully capture the future marginal revenue of investing. See Erickson and Whited (2000) and Cummins et al. (2006) on the problems with measurement error in q.

[11] The literature on the identification of production functions uses a similar approach to control for shocks that are observed by the firm but not the econometrician. See for instance Olley and Pakes (1996), Levinsohn and Petrin (2003) and Ackerberg et al. (2006).

Table 6
Investment opportunities proxied by employment growth: correlations.

	BE	FR	FI	SE	CZ	HU
$Corr(\Delta emp_{t-1}, I_t/K_{t-1})$	0.12***	0.10***	0.09***	0.07***	0.17***	0.17***
$Corr(\Delta emp_{t-1}, CF_t/K_{t-1})$	0.08***	0.08***	0.06***	0.03***	0.17***	0.14***
#obs	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows correlations between employment growth and investment and between employment growth and cash flow. * indicates that the correlation is significantly different from zero at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 7
Baseline Estimation: model (4).

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.088**	−0.083	−0.218***	−0.121	0.007	−0.118**
	(0.044)	(0.085)	(0.020)	(0.079)	(0.039)	(0.048)
$k_{it-2} - s_{it-2}$	−0.220***	−0.157***	−0.260***	−0.198***	−0.130***	−0.208***
	(0.038)	(0.025)	(0.021)	(0.021)	(0.029)	(0.049)
Δs_{it}	0.204***	−0.027	0.180***	0.147***	0.120***	0.115**
	(0.059)	(0.079)	(0.034)	(0.023)	(0.039)	(0.052)
Δs_{it-1}	0.210***	0.148***	0.265***	0.201***	0.131***	0.224***
	(0.036)	(0.032)	(0.020)	(0.020)	(0.029)	(0.048)
CF_{it}/K_{it-1}	0.081***	0.123***	0.024**	0.033***	0.078**	0.074
	(0.023)	(0.017)	(0.011)	(0.007)	(0.032)	(0.047)
Δemp_{it-1}	0.005	0.197***	0.014***	0.003*	0.054***	0.052***
	(0.012)	(0.080)	(0.005)	(0.002)	(0.015)	(0.017)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	158	119	356	181	296	201
m2	0.96	0.67	0.39	0.76	0.35	0.85
J	0.81	0.17	0.17	0.13	0.17	0.50
#firms	2555	69,801	9876	31,396	2101	1405
#obs	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows the output for the GMM first difference estimation of specification (4). The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with sector dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at, the 10% level; ** and ***, respectively at the 5% or 1% level.

in Amadeus.[12] In the remainder of the paper, we refer to growth in the real total costs of employees as employment growth, unless explicitly stated differently.

$$\frac{I_{it}}{K_{it-1}} = \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{it-1} + \alpha_5 \Delta emp_{it-1} + \alpha_6 \frac{CF_{it}}{K_{it-1}} + \upsilon_i + \upsilon_{jt} + \epsilon_{it} \quad (4)$$

Table 6 shows the correlation between employment growth on the one hand, and the investment level and cash flow on the other hand. Investment is positively related to employment growth in all the countries under investigation, showing that higher opportunities are indeed associated with higher levels of investment. It can also be seen that cash flow has a positive relation with employment growth, again in every country. This could be an indication that also cash flow is associated with higher opportunities. If this is what drives the sensitivity of investment to cash flow, then the sensitivity should disappear after including employment growth in the regression.

However, it is clear from Table 7 that the investment opportunities bias does not drive the investment-cash flow sensitivity. In Belgium, France, Finland, Sweden and the Czech Republic investment still reacts significantly positive to a windfall in cash flow. In Hungary, the investment is not sensitive to the availability of cash flow, but that was already the case before the inclusion of employment growth. Given that our sample contains mostly small firms this finding is consistent with Carpenter and Guariglia (2008), who augmented a Q-model of investment with firm level opportunities and found that the cash flow sensitivity remains unchanged (or even increased) for small firms. In contrast to Carpenter and Guariglia (2008) our proxy for firm level opportunities is a measure of employment growth, which has the advantage of being available in many datasets. Further, the estimates for the lagged investment, the error correction term and sales growth parameters of model (4) are very comparable to those in model (3). The evidence on the impact of employment growth is not entirely robust. It is significantly positive in 5 countries and positive but insignificant in Belgium. This is however not so important, since we only want to make sure that the investment-cash flow sensitivities are a true reflection of underlying financial constraints by controlling for the effect of investment opportunities on investment.

6.3. Investment-cash flow sensitivities measure financial constraints

As a final test, we will interact cash flow with two categorical variables $finconLOW_{it}$ and $finconHIGH_{it}$ based on our financial constraints index and estimate model (5).

$$\begin{aligned} \frac{I_{it}}{K_{it-1}} = {} & \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} \\ & + \alpha_4 \Delta s_{it-1} + \alpha_5 \Delta emp_{it-1} + \alpha_6 finconLOW_{it} \\ & + \alpha_{7a} \left[\frac{CF_{it}}{K_{it-1}} * finconLOW_{it} \right] + \alpha_{7b} \left[\frac{CF_{it}}{K_{it-1}} * finconHIGH_{it} \right] \\ & + \upsilon_i + \upsilon_{jt} + \epsilon_{it} \end{aligned} \quad (5)$$

[12] We loose approximately 40 percent of the data when using the actual number of employees rather than the cost of employees. Nonetheless, later in the robustness section we will estimate the investment model (4) with the actual number of employees as a sensitivity check.

Table 8
Investment-cash flow sensitivities: constrained vs unconstrained firms (model (5)).

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.0597	−0.277**	−0.209***	−0.180**	0.0134	−0.137***
	(0.0707)	(0.116)	(0.0211)	(0.0772)	(0.0338)	(0.0325)
$k_{it-2} - s_{it-2}$	−0.185***	−0.267***	−0.250***	−0.210***	−0.110***	−0.222***
	(0.0586)	(0.0388)	(0.0232)	(0.0205)	(0.0297)	(0.0351)
Δs_{it}	0.140**	0.234**	0.206***	0.149***	0.146***	0.136***
	(0.0557)	(0.0914)	(0.0489)	(0.0219)	(0.0517)	(0.0344)
Δs_{it-1}	0.179***	0.333***	0.263***	0.213***	0.115***	0.238***
	(0.0538)	(0.0607)	(0.0229)	(0.0199)	(0.0303)	(0.0320)
Δemp_{it-1}	0.0145	0.273***	0.00824	0.00392**	0.0391**	0.0523***
	(0.0117)	(0.0825)	(0.00522)	(0.00178)	(0.0174)	(0.0150)
finconLOW	0.0233***	0.0579***	0.0277**	0.0228***	0.0415***	0.0464***
	(0.00883)	(0.00580)	(0.0108)	(0.00695)	(0.0128)	(0.0176)
CF_{it}/K_{it-1}*finconLOW	0.0165	0.0540**	0.0120	0.0207***	0.0786**	0.0134
	(0.0215)	(0.0255)	(0.0122)	(0.00745)	(0.0326)	(0.0462)
CF_{it}/K_{it-1}*finconHIGH	0.0783***	0.141***	0.0505**	0.0480***	0.187***	0.151**
	(0.0263)	(0.0294)	(0.0211)	(0.0114)	(0.0599)	(0.0607)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	342	114	198	210	162	278
m2	0.64	0.35	0.66	0.32	0.56	0.79
J	0.47	0.19	0.04	0.07	0.12	0.96
#firms	2555	69,801	9876	31,396	2101	1405
#obs	17,117	404,366	58,097	141,475	13,697	7443
Wald tests						
$H_0: low - high = 0$	0.03**	0.00***	0.05**	0.03**	0.09*	0.02**

Notes. The Table shows the output for the GMM first difference estimation of specification (5). The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with industry dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at, the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 8 presents the estimates of model (5) for all the countries under investigation. Again we find the negative sign for the lagged investment level and the error correction term. Sales growth is positively related to investment and so are opportunities, as proxied by beginning of period employment growth. Consistent with the results of the t-tests in Table 3, financially unconstrained firms invest more than financially constrained firms. As predicted, investment-cash flow sensitivities increase as the supply of external finance decreases. The impact of cash flow on investment is in every country larger for firms that are considered to be financially constrained than firms that are considered to be financially unconstrained; and significantly larger at the 5% level in five out of six countries. Also, note that in Hungary investment-cash flow sensitivities are present for the subsample of firms that face a restricted supply of external finance.

This evidence is in line with the interpretation that a windfall gain in cash flow implies a larger drop in the cost of finance for financially constrained firms, leading to significantly higher investment. Our findings are thus consistent with the hypothesis that investment-cash flow sensitivities reflect financial constraints in our sample of European unquoted SMEs.

6.4. Robustness

In this section we perform a number of robustness checks with respect to the construction of our ASCL-index, the measurement of investment opportunities and the mechanism driving investment-cash flow sensitivities.

Up till now, all the components in the ASCL-index received an equal weight of $\frac{1}{4}$. As a first robustness check, we compute a weighted version of the ASCL-index. We take the pairwise correlation between a component and the implicit interest rate as the weight of the component in the weighted ASCL-index. The underlying idea of this approach is that we expect to see a higher correlation between the component and the interest rate if the component is a stronger shifter of the supply curve. The component with the highest correlation will hence get the largest weight. By computing these weights by country, this approach allows us to take into account that certain components may be more (or less) important in one country than in another. Panel A of Table 14 in the Appendix shows the weights (i.e. the correlation between the components and the interest rate) we used to compute the weighted ASCL-index. Generally, age and size become less important in the weighted ASCL-index, and the average cash flow and average leverage ratio become more important in the weighted ASCL-index, relative to the unweighted ASCL-index. Still, there are cross-country differences in the relative weights components get according to this approach. Panels B and C of Table 14 in the Appendix show that either taking the correlation of each index component with the residual interest rate (orthogonal to credit risk) or taking the estimated coefficient from a regression of the interest rate on the index components (while controlling for credit risk), would yield very similar results in the relative importance of the components.

Unreported results[13] show that the weighted ASCL-index correlates even weaker with the existing indices (in particular due to a lower correlation with size and age); that the weighted ASCL-index correlates even higher with the interest rate than the unweighted ASCL-index (by construction) and thus also than the existing indices; and that this also leads to even stronger conclusions in the natural experiment of Section 5.2. Table 15 in the Appendix shows that the results concerning investment-cash flow sensitivities and financial constraints hold when we use the weighted ASCL-index to generate the financial constraint categories. Specifically, our categorical variable $finconLOW_{it}$ now takes the value 1 if firm i gets a weighted ASCL-index score below the median weighted ASCL-index in year t, and 0 otherwise (unconstrained supply of external finance), while $finconHIGH_{it}$ takes the value 1 if firm i gets

[13] See Tables 2, 2 and 3 in the online Appendix.

a weighted ASCL-index score above the median weighted ASCL-index in year *t*, and 0 otherwise (constrained supply of external finance). As can be seen in Table 15 in the Appendix, investment-cash flow sensitivities increase as the supply of external finance decreases. The impact of cash flow on investment is significantly larger for financially constrained firms than for financially unconstrained firms in every country, showing the robustness of our results.

As argued in the previous section, we believe that the growth in the cost of employees is better suited to measure investment opportunities than the growth in the actual number of employees. Nonetheless, we test how sensitive our results are to this. Table 16 in the Appendix shows that investment-cash flow sensitivities are quite similar when we use employment growth calculated from the actual number of employees instead of the cost of employees to control for opportunities. As an additional robustness check for the way we control for opportunities we use an alternative measure of marginal q, also used by D'Espallier and Guariglia (2013).[14] Table 18 in the Appendix shows that the main results hold when we use an alternative measure of marginal q instead of the growth in the cost of employees to control for opportunities. D'Espallier and Guariglia (2013) also test two other proxies for investment opportunities, namely, sales growth and industry sales growth. Sales growth is already an important determinant in our investment model and note that the industry-time fixed effects υ_{jt} imply that any kind of investment opportunities that are industry-time specific (e.g. industry sales growth) are controlled for and thus should not bias our results.

In this paper we have argued that investment-cash flow sensitivities arise in the presence of financial market imperfections. In this case, the mechanism should not play any role for firms that do not have external funds. We try to falsify our hypothesis by estimating our simple model (4) for firms that do not make use of bank loans, which is the most important source of external finance for the firms in our sample. The results are shown Table 19 in the Appendix and support our hypothesis. Investment-cash flow sensitivities have disappeared in all countries. On average, around 17 percent of the firms in our data set do not have short and long term bank loans on their balance sheet. Remarkably, in Hungary more than half of the firms in the data set do not seem to have bank loans on their balance sheet, which could explain why we did not find significant investment-cash flow sensitivities for Hungary in Tables 5 and 7, while we did for the other countries. This provides further evidence that investment-cash flow sensitivities are related to the relaxation of credit constraints (i.e. a drop in the cost of finance), induced by a windfall gain in cash flow.

Moreover, our findings do not seem to be driven by country specific elements as we find that investment-cash flow sensitivities are highest for constrained firms in all countries investigated. As argued above, the instruments used in the regressions are not exactly the same in every country, nor is the composition of the sample exactly the same across countries; therefore, a cross-country comparison of the size of the mechanism should be avoided. Nonetheless, it is clear that -unrelated to the economic structure of a country- a windfall gain in cash flow instigates most investment to those firms that face the most restricted credit supply.

[14] As there is no market data available for the unquoted firms in our sample, traditional variables such as Tobin's q or Fundamental q cannot be computed. Honda and Suzuki (2000) developed an accounting proxy for marginal q, which D'Espallier and Guariglia (2013) use to control for investment opportunities. The accounting proxy for marginal q is basically defined as the ratio of profit per unit of capital over the cost of capital.

7. Concluding remarks

Recent research of Farre-Mensa and Ljunqvist (2013) shows that existing, widely used indices of financial constraints do not adequately measure these constraints (in a sample of quoted US firms). This paper presents a new index (the ASCL-index) to identify financially constrained firms in a sample of unquoted SMEs in six European countries with different economic systems and institutions between 1996 and 2008. The components of the index capture information asymmetries (age and size), the debt/repayment capacity of the firm (proxied by cash flow), and the solvency risk of the firm (proxied by the leverage ratio).

We find that unquoted SMEs classified as financially constrained according to our ASCL-index pay on average the highest interest rate on their financial debt. Additionally, these constrained firms, which face a higher cost of debt, resort significantly more to other sources (net trade credit) to finance their operations and have lower investment levels. Further, we exploit the exogenous shock to the supply of finance in the aftermath of the 9/11 events in Belgium and France. We find that firms that are constrained according to our index have significantly lower loan growth than unconstrained firms after this exogenous supply shock. Finally our index outperforms existing indices in the literature in our sample of unquoted European SMEs.

We employ our proposed index to verify whether investment-cash flow sensitivities reflect financial constraints for unquoted European SMEs. Our empirical analysis detects the largest investment-cash flow sensitivities for firms that are most financially constrained according to our proposed index. Since we augment the empirical model with employment growth as a proxy for investment opportunities, we are confident our findings about financial constraints and investment-cash flow sensitivities are not driven by the possible correlation between cash flow and investment opportunities (Cummins et al., 2006; Erickson and Whited, 2000). Employment growth is shown to be positively related to both investment and cash flow, rendering it an appropriate proxy for investment opportunities. This suggests that investment-cash flow sensitivities indeed reflect financial constraints for European unquoted SMEs.

By providing new evidence consistent with the recent findings of Campbell et al. (2012) that the cost of capital is the driving force behind investment-cash flow sensitivities in a sample of unquoted European SMEs, this paper advocates the interpretation that investment-cash flow sensitivities reflect the role of cash flow in alleviating credit frictions, rather than differences in credit demand or investment opportunities, in this specific sample of firms. Our results also imply that credit market imperfections are still widely present and that policymakers may do well to ponder on the question how they could further alleviate these financial frictions and make investment and economic growth less dependent on internal cash flow generation for unquoted European SMEs.

We propose that future research on financial constraints complements the data on quantity outcomes with the information provided by implicit interest rates to ensure a better identification of financial constraints and more consistent tests of the underlying financial theories. Our results would be further reinforced if future studies affirm our findings with different measures of investment opportunities, possibly based on different data sources, such as firm surveys. This paper investigated the dynamics of investment in tangible fixed assets. Investigating investment-cash flow sensitivities in the context of other important types of investment such as for instance inventory investment is an interesting avenue for future research. Finally, since our index of financial constraints captures information asymmetries and since the impact of information asymmetries may be waning over time because of technological advances, improved access to information and more widely available analytical tools, we may see declining investment-cash flow sensitivities in the future. We defer a real test of this conjecture to explain the Chen and Chen (2012) paradox of declining investment-cash flow sensitivities to future research.

Appendix

Table 9
Definition of variables.

p_t^f	$gross\ fixed\ capital\ formation\ deflator_t$
p_t^g	$GDP\ deflator_t$
I_{it+1}	$(tangible\ fixed\ assets_{it+1}/p_{t+1}^f - tangible\ fixed\ assets_{it}/p_t^f) + depreciation_{it+1}/p_{t+1}^f$
$K_{it=0}$	$tangible\ fixed\ assets_{it=0}$
$K_{it \neq 0}$	$K_{it} * (1-\delta) * (p_{t+1}^f/p_t^f) + I_{it+1}$
k_{it}	$\log(K_{it})$
$sales_{it}$	$nominal\ sales_{it}/p_t^g$
s_{it}	$log(sales_{it})$
CF_{it}	$cash\,flow_{it}/p_t^g$
$cost\ of\ employees_{it}$	$nominal\ cost\ of\ employees_{it}/p_t^g$
Δemp_{it}	$log(cost\ of\ employees)_{it} - log(cost\ of\ employees)_{it-1}$
$net\ TC_{it}$	$(accounts\ payable_{it} - accounts\ receivable_{it})/p_t^g$
R_{it}	$interest\ paid_{it}/(noncurrent\ liabilities_{it} + current\ liabilities_{it} - accounts\ payable_{it})$
$bank\ loans_{it}$	$current\ liabilities\ loans_{it} + noncurrent\ liabilities\ long\ term\ debt_{it}$
q_{it}	$\frac{(\pi_{it}/K_{it-1})}{p_t^f * (R_{it} - corporate\ tax\ rate + \delta)}$
π_{it}	$operational\ profit_{it}$
δ_{it}	$depreciation\ rate$

Table 10
Descriptive statistics: industrial composition of the sample.

	BE	FR	FI	SE	CZ	HU
Agriculture and mining	1%	1%	4%	5%	12%	6%
Manufacturing	38%	20%	24%	21%	50%	41%
Construction	11%	18%	15%	15%	8%	12%
Retail and wholesale	39%	32%	26%	27%	20%	36%
Hotel and restaurant	1%	11%	4%	4%	1%	0%
Services	9%	11%	19%	21%	7%	5%
Health and other	1%	7%	8%	7%	2%	1%
#obs	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows the share of firms in a country that belong to the given sector in our sample. The nace 2-digit level is used to compose the sectors.

Table 11
Financial constraints: descriptive statistics and transition probabilities.

	BE	FR	FI	SE	CZ	HU
Panel A						
Age	29	18	18	24	12	10
Total assets	1.34	0.68	0.94	0.58	0.62	1.22
Average CF/K	0.30	0.47	0.54	0.52	0.23	0.35
Average leverage	0.12	0.09	0.15	0.21	0.11	0.08
#obs	17,117	404,366	58,097	141,475	13,697	7443
Panel B						
finconLOW	91%	87%	90%	86%	95%	87%
finconHIGH	88%	86%	87%	85%	78%	78%

Notes. Panel A of the Table shows the sample means for the given variables that are used to calculated the position of the supply curve of external finance. Age is in number of year. Total assets is in million euro. For non-euro countries the exchange rate used for conversion is that of January 1999. In concreto: EXR Swedish krona/euro = 9.0826, EXR Czech koruna/euro = 35.107, EXR Hungarian forint/euro = 250.79 . Average CF/K is the average cash flow to capital ratio of the previous two years for a given firm. Average leverage is the average long term debt to total assets ratio of the previous two years for a given firm. Panel B of the Table shows the transition probabilities of the financial constraints dummies. This is the likelihood of being in the same constraint group next period, expressed as a percentage.

Table 12
Financial constraints: correlation between the indices and their components.

	ASCL	*WW*	*KZ*	*HP*
Age	−0.30***	−0.20***	−0.06***	−0.83***
ln (total assets)	−0.34***	−0.74***	0.08***	−0.66***
Average CF/K	−0.41***	−0.05***	0.54***	0.02***
Average leverage	0.45***	0.05***	0.06***	0.04***
Sales growth	0.00	−0.22***	0.20***	−0.02***
Industry sales growth	0.04***	0.28***	0.07***	0.02***
Cash / total assets	−0.03***	−0.06***	−0.05***	0.00
q	−0.36***	−0.11***	0.87***	0.02***

Notes. The Table shows the correlation between the ASCL-index, the WW-index, the KZ-index, and the HP-index on the hand, and the components of the index itself and the components of the other indices on the other hand. To compute the correlation table, we have aggregated the data from all 6 countries into 1 panel, leading to a sample of 642,206 observations. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 13
Financial constraints and the residual interest rate.

	BE	FR	FI	SE	CZ	HU
$Corr(ASCL, \widetilde{R})$	0.26***	0.18***	0.29***	0.32***	0.15***	0.19***
$Corr(WW, \widetilde{R})$	0.09***	0.10***	0.13***	0.17***	0.03**	0.03
$Corr(KZ, \widetilde{R})$	−0.15***	−0.19***	−0.16***	−0.13***	−0.22***	−0.23***
$Corr(HP, \widetilde{R})$	0.04***	0.07***	0.11***	0.13***	0.05***	0.11***

Notes. The Table reports correlations of the respective indices with the residual implicit interest rate ($\widetilde{R}$). Where the firm's residual implicit interest rate is the firm's implicit interest rate orthogonal to the firms' credit risk (i.e. the residual from the following regression: $R_{it} = \beta *$ Altman Z-score$_{it} + \epsilon_{it}$. It follows thus that $\widetilde{R}_{it} \equiv R_{it}$ - $\widehat{\beta} *$ Altman Z-score$_{it}$). * indicates that the correlation is significantly different from zero at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 14
Weight of each index component.

	BE	FR	FI	SE	CZ	HU
Panel A						
Corr(age dummy, R)	0.03***	0.05***	0.06***	0.06***	0.06***	0.06***
Corr(size dummy, R)	0.05***	0.11***	0.14***	0.13***	0.10***	0.01***
Corr(average cash flow dummy, R)	0.20***	0.10***	0.19***	0.23***	0.09***	0.14***
Corr(average leverage dummy, R)	0.26***	0.14***	0.28***	0.29***	0.05***	0.20***
Panel B						
Corr(age dummy, $\widetilde{R}$)	0.04***	0.05***	0.06***	0.06***	0.06***	0.06***
Corr(size dummy, $\widetilde{R}$)	0.06***	0.10***	0.15***	0.13***	0.10***	0.01***
Corr(average cash flow dummy, $\widetilde{R}$)	0.20***	0.11***	0.17***	0.23***	0.09***	0.12***
Corr(average leverage dummy, $\widetilde{R}$)	0.26***	0.14***	0.26***	0.29***	0.05***	0.20***
Panel C						
$\widehat{\alpha}_1$ (age dummy)	0.13***	0.11***	0.18***	0.33***	0.45***	0.41**
$\widehat{\alpha}_2$ (size dummy)	0.16***	0.25***	0.57***	0.77***	1.11***	−0.05
$\widehat{\alpha}_3$ (average cash flow dummy)	0.55***	0.26***	0.52***	1.10***	1.23***	0.74***
$\widehat{\alpha}_4$ (average leverage dummy)	0.85***	0.39***	1.09***	1.73***	0.57*	1.29***

Notes. Panel A of the table shows the weight that each index component gets in the construction of the alternative, weighted ASCL-index. More specifically, these weights are the correlation between each component of the ASCL-index and the firms' implicit interest rate. Panel B and C show two alternative strategies to compute weights, but as can be seen, this would not change the relative importance of the components as found in Panel A and hence the information content of the index would be very similar. Panel B of the table also shows the correlation between each component of the ASCL-index and the firm's implicit interest rate orthogonal to the firms' credit risk (i.e. the residual from the following regression: $R_{it} = \beta *$ Altman Z-score$_{it} + \epsilon_{it}$. It follows thus that $\widetilde{R}_{it} \equiv R_{it}$ - $\widehat{\beta} *$ Altman Z-score$_{it}$). Panel C of the table shows the estimated coefficients obtained from the following regression $R_{it} = \alpha_1 *$ low age dummy$_{it}$ + $\alpha_2 *$ small size dummy$_{it}$ + $\alpha_3 *$ low average cash flow dummy$_{it}$ + $\alpha_4 *$ high average leverage dummy$_{it}$ + $\beta *$ Altman Z-score$_{it}$ + ϵ_{it}. The estimated $\widehat{\alpha}$'s are multiplied by 100 to reduce the amount of decimals. Note that this would not change anything to the relative importance of the components and hence also not the index if these weights would be used. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 15
Investment-cash flow sensitivities: constrained vs unconstrained firms based on the ASCL-index with weights.

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.0703**	−0.121	−0.215***	−0.101	0.0190	−0.137***
	(0.0333)	(0.126)	(0.0151)	(0.0799)	(0.0336)	(0.0517)
$k_{it-2} - s_{it-2}$	−0.191***	−0.165***	−0.252***	−0.186***	−0.108***	−0.226***
	(0.0289)	(0.0296)	(0.0165)	(0.0218)	(0.0314)	(0.0608)
Δs_{it}	0.143***	−0.0610	0.170***	0.137***	0.0910	0.0956*
	(0.0370)	(0.0806)	(0.0244)	(0.0221)	(0.0633)	(0.0554)
Δs_{it-1}	0.183***	0.135***	0.258***	0.190***	0.104***	0.235***
	(0.0275)	(0.0391)	(0.0158)	(0.0213)	(0.0317)	(0.0505)
Δemp_{it-1}	0.00987	0.114	0.0128***	0.00308*	0.0480***	0.0471***
	(0.0117)	(0.0778)	(0.00432)	(0.00177)	(0.0176)	(0.0155)
finconLOW	0.0403***	0.0841***	0.0263***	0.0241***	0.0419***	0.0796***
	(0.0105)	(0.0116)	(0.00938)	(0.00743)	(0.0127)	(0.0239)
CF_{it}/K_{it-1}*finconLOW	0.0367*	0.104***	0.0263***	0.0276***	0.0587*	0.00458
	(0.0193)	(0.0253)	(0.00833)	(0.00709)	(0.0349)	(0.0508)
CF_{it}/K_{it-1}*finconHIGH	0.144***	0.261***	0.0612***	0.0683***	0.177***	0.195**
	(0.0348)	(0.0430)	(0.0199)	(0.0166)	(0.0419)	(0.0801)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	336	113	478	203	107	193
m2	0.63	0.98	0.32	0.87	0.31	0.68
J	0.64	0.03	0.06	0.42	0.48	0.80
# firms	2555	69,801	9876	31,396	2101	1405
#obs	17,117	404,366	58,097	141,475	13,697	7443
Wald tests						
$H_0 : low - high = 0$	0.01***	0.00***	0.07*	0.02**	0.03**	0.03**

Notes. The Table shows the output for the GMM first difference estimation of specification (5). The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with industry dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 16
Baseline estimation: number of employees.

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.141**	−0.137	−0.259***	−0.177**	0.014	−0.264
	(0.063)	(0.142)	(0.034)	(0.082)	(0.034)	(0.528)
$k_{it-2} - s_{it-2}$	−0.265***	−0.177***	−0.293***	−0.247***	−0.116***	−0.300
	(0.052)	(0.049)	(0.039)	(0.028)	(0.031)	(0.332)
Δs_{it}	0.225***	0.196	0.223***	0.134***	0.076*	0.092
	(0.060)	(0.126)	(0.039)	(0.027)	(0.042)	(0.163)
Δs_{it-1}	0.251***	0.181***	0.303***	0.231***	0.123***	0.206
	(0.046)	(0.080)	(0.036)	(0.026)	(0.030)	(0.290)
Δemp_{it-1}	0.005	0.089**	0.014***	0.005	0.016***	−0.001
	(0.014)	(0.040)	(0.005)	(0.003)	(0.005)	(0.069)
CF_{it}/K_{it-1}	0.053*	0.120***	0.015	0.053***	0.070**	−0.045
	(0.027)	(0.038)	(0.017)	(0.014)	(0.035)	(0.256
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	145	104	334	164	187	117
m2	0.40	0.99	0.37	0.44	0.66	0.95
J	0.31	0.18	0.77	0.95	0.10	0.93
#obs	14,551	335,002	36,144	89,917	11,548	651

Notes. The Table shows the output for the GMM first difference estimation of specification (4), but uses the actual number of employees instead of the cost of employees to calculate Δemp_{it-1}. The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with sector dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 17
Descriptive statistics: sample means and standard deviations.

	BE	FR	FI	SE	CZ	HU
q_{it}	4.101	7.157	6.587	5.876	2.756	2.876
	(3.888)	(6.254)	(6.820)	(10.67)	(3.920)	(3.273)
# firms	2555	69,801	9876	31,396	2101	1405
#obs	17,117	404,366	58,097	141,475	13,697	7443

Notes. The Table shows sample means and in parentheses the corresponding standard deviations. The subscript i indicates firms, and the subscript t, time, where $t =$ 1996–2008.

Table 18
Investment-cash flow sensitivities controlling for q: constrained vs unconstrained firms.

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.0957**	−0.306**	−0.199***	−0.127***	0.00941	−0.422***
	(0.0455)	(0.126)	(0.0272)	(0.0172)	(0.0460)	(0.158)
$k_{it-2} - s_{it-2}$	−0.222***	−0.221***	−0.246***	−0.189***	−0.133***	−0.349***
	(0.0363)	(0.0319)	(0.0299)	(0.0192)	(0.0437)	(0.0975)
Δs_{it}	0.165***	0.0904	0.138**	0.157***	0.0715	0.208***
	(0.0403)	(0.0737)	(0.0593)	(0.0341)	(0.0549)	(0.0758)
Δs_{it-1}	0.217***	0.246***	0.252***	0.192***	0.132***	0.357***
	(0.0333)	(0.0417)	(0.0296)	(0.0184)	(0.0436)	(0.0984)
q_{it}	−0.00272	−0.00247	−0.00144	0.00422***	0.00947	1.41e−05
	(0.00350)	(0.00434)	(0.00362)	(0.00139)	(0.00745)	(0.0110)
finconLOW	0.0263***	0.0541***	0.0334***	0.0209***	0.0329**	−0.0173
	(0.00953)	(0.00733)	(0.0129)	(0.00753)	(0.0140)	(0.0595)
CF_{it}/K_{it-1}*finconLOW	0.0325	0.128*	0.0246	0.00804	0.0376	0.157
	(0.0263)	(0.0691)	(0.0320)	(0.0130)	(0.0499)	(0.166)
CF_{it}/K_{it-1}*finconHIGH	0.107***	0.196***	0.0818*	0.0198*	0.118*	3.377**
	(0.0342)	(0.0669)	(0.0427)	(0.0114)	(0.0658)	(1.720)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	336	113	195	158	161	100
m2	0.90	0.19	0.83	0.07	0.89	0.11
J	0.79	0.16	0.06	0.01	0.35	0.45
#firms	2430	50,844	8816	41,750	1962	583
#obs	15,297	239,961	43,391	119,009	10,840	1884
Wald tests						
$H_0: low - high = 0$	0.02**	0.00***	0.02**	0.47	0.06*	0.06*

Notes. The Table shows the output for the GMM first difference estimation of specification (5). The estimates are robust to heteroscedastic standard errors. All specifications are estimated with a constant and with time dummies interacted with industry dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

Table 19
Baseline estimation: no bank loans.

	BE	FR	FI	SE	CZ	HU
I_{it-1}/K_{it-2}	−0.303***	−0.166***	−0.241***	−0.178***	−0.116	−0.117**
	(0.079)	(0.044)	(0.055)	(0.034)	(0.079)	(0.056)
$k_{it-2} - s_{it-2}$	−0.365***	−0.180***	−0.252***	−0.235***	−0.214***	−0.187***
	(0.070)	(0.067)	(0.060)	(0.039)	(0.064)	(0.066)
Δs_{it}	0.140***	0.126	0.178***	0.208***	0.150***	0.055
	(0.055)	(0.143)	(0.042)	(0.034)	(0.043)	(0.070)
Δs_{it-1}	0.359***	0.180*	0.263***	0.236***	0.193***	0.202***
	(0.065)	(0.098)	(0.054)	(0.037)	(0.060)	(0.061)
Δemp_{it-1}	−0.041	0.038	0.002	0.003	0.040	0.054***
	(0.028)	(0.068)	(0.010)	(0.003)	(0.032)	(0.020)
CF_{it}/K_{it-1}	0.028	0.079	0.025	0.010	0.022	0.103
	(0.034)	(0.051)	(0.021)	(0.013)	(0.025)	(0.071)
sector: year dummies	YES	YES	YES	YES	YES	YES
#instruments	154	104	354	166	296	158
m2	0.18	0.52	0.58	0.50	0.52	0.41
J	0.50	0.36	0.53	0.29	0.39	0.83
#obs	2505	91,436	10,779	22,736	2381	4764

Notes. The Table shows the output for the GMM first difference estimation of specification (4), but only for the subsample that has no bank loans on their balance sheet. Bank loans include both short term and long term bank debt. The estimates are robust to heteroscedastic standard errors. All specifications were estimated with a constant and with time dummies interacted with sector dummies. m2 shows the p-value of the test of serial correlation in the error terms, under the null of no serial correlation. Values presented for the J-statistic are p-values of the test of overidentifying restrictions of the instruments, under the null of instrument validity. * indicates significance at the 10% level; ** and ***, respectively at the 5% or 1% level.

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