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Investments, financial constraints in non-quoted Swedish Firms

- How dependent are Swedish firms on internally generated funds to finance their investments?

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Abstract: Using panel data from 10 573 non-quoted Swedish SMEs over the period 2006-2014, we examine how dependent investments made by Swedish SMEs are of internally generated cash-flows. To control for investment opportunities, we use an accelerator model. Applying a static accelerator model our result shows that, investment levels are in fact affected by the availability of internal funding. It takes between 2-2.5 years for the capital stock to adjust to shocks in demand. As the speed of the adjustment rate increases firms' investment levels become more dependent on internal funding, indicating high adjustment costs. Finally, as firms become larger their investment level becomes less dependent on internal funding, indicating that it may be easier for larger firms to attract external funding.

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1 Introduction

There is a large literature showing that capital markets suffer from market imperfections due to information asymmetries and agency problem (e.g. Stiglitz and Weiss, 1981). These e.g. corporate managers (insiders) may have more or better information regarding strategic decisions which outside investors don't have access to.

Greenwald, et al. (1984) argued that in the presence of asymmetric information credit rationing may occur hence investment levels will be determined by the accessibility of capital rather than its cost. In the same manner Myers and Majluf (1984) proposed that when suppliers of capital have less information about the quality of an asset or a security they are forced to charge a risk premium reflecting the average risk of an investment project. This creates a gap between the cost of internal and external funding. Thus, a firm with larger internal cash flow has to rely less on costlier external financing. Managerial agency costs arise in the same manner as asymmetric information, firm managers may act in their own benefit rather than in the in favour of shareholders whereby external suppliers of capital will require a risk premium increasing the cost of external financing and consequently increasing the demand for internal funding (Jensen and Meckling, 1976). Furthermore, debt and equity financing is associated with transaction costs, while internal funding may minimize such cost firms are challenged with a hierarchy of financial funding sources were funds with lower cost will be used first[1]. Thus, firms demand for internal funding may be largely affected by the combination of asymmetric information, managerial agency problems and transaction costs (Kadapakkam, et al. 1998).

[1] According to the pecking order hypothesis in capital structure research, there is an increased demand for internal funding. See Kadapakkam et. al (1998).

There is a long-standing empirical literature that demonstrates a positive and significant relationship between cash flow and investment levels[2] Schiantarelli, (1995). In a ground-breaking empirical study Fazzari, et al. (1988) show that investment expenditures are more sensitive to internal cash flow among firms who are more likely to face financial constraints which in turn was interpreted as an indication of capital market frictions driven by information asymmetries (Carpenter and Guariglia, 2008). However, there is yet no consensus whether a positive correlation between cash flow and firm investment may be interpreted as an indicator of financial constraints. In a challenging paper Kaplan and Zingales (1997) demonstrate that investment cash flow sensitivity may occur in a complete market setting and for firms who are not likely to face financial constraints. The majority of empirical research on investment cash flow sensitivity/on financial constraint has been based on data from quoted firms. Quoted firms are generally well-establish large firms with strong finances and good credit rating hence, such firms are not likely to face financial constraints in the same manner as unquoted small and medium firms, see (Carpenter and Petersen 2002; Beck and Demirguc-Kunt 2006; Guariglia 2008; Becchetti, et al. 2010). In comparison to quoted firms unquoted SMEs tend to have shorter track records, lower assets and poorer solvency. Thus, unquoted SMEs are more likely to face financial constraints and are therefore more suitable for testing cash flow sensitivity (Holod and Peek, 2007). Furthermore, the link between cash flow and investment sensitivity has traditionally/generally been measured within the Q model framework were the firms market-to-book value has been used as a proxy for investment opportunities. Thus, the same data is not available for unquoted firms.

One of the key determinants of a well-functioning economy is the ability of efficient capital allocation. This requires a swift of capital from sectors with poor profitability to sectors with

[2] See, Bond and Van Reenen, 2005 for a survey.

high-expected prospects. The financial system serves to primary facilitate the allocation of resources in an uncertain environment thus, the mechanism through which firms access and manage capital becomes crucial for firm performance, as investors seek to maximize return on investment (Levine ,1997; King, et al. 1993)

The purpose of this study is to investigate to what extent investment levels are affected by cash flow among unquoted small and medium firms in Sweden. We preform our analysis based on accounting data over the period 2006-2014. Moreover, we are interested in how cash flow[3] effects investment levels depending on the rate of change in (re)allocation of a firm's capital stock and depending on the degree of financial constraint that a firm may face. A capital stock adjustment model derived from the accelerator approach is applied were the elasticity of capital with respect to sales measures the functional efficiency of capital (re)allocation. We include interaction effects between the elasticity of capital and cash flow to determine if cash flow has a different impact on investment deepening on the rate of change in (re)allocation of the capital stock. The degree of financial constraint is measured as firm size. Since size is positively correlated with age there should be less information asymmetry concerning future prospects for larger mature firms which in turn decreases firms specific risk. Moreover, larger firms may have higher value of collateral in relation to their liabilities and lower bankruptcy costs (Schiantarelli, 1995). For this purpose, we include interaction effects between size and cash flow in the model. Furthermore, as a robustness check we compare our full sample to the manufacturing sector as the manufacturing sector is in comparison to other sectors more constrained by the availability of liquidity to finance their fixed assets.

[3] Cash flow is defined as the sum of after tax profit and depreciation. Retained earnings is obtained by adding depreciation, given that depreciation is a noncash expense retained earnings understates the cash flow available for investment. See chapter 3 and Brealey, et al. 2012 for a detailed discussion.

We contribute to the literature of investment cash flow sensitivity with an emphasis on small and medium sized firms operating in Sweden. The data available for Swedish firms is rich and comprehensive. Given that, Sweden is a well-established market economy with few companies listed on the exchange market motivates our choice of country.

The rest of the paper is organized as fallows. Section II contains a literature review on investment behaviour in the presence of financial constraints. Section III presents model specification and data description. Section IV presents the main results and section V provides dissection and conclusion.

2 Literature review

In Jorgenson (1967) neoclassical investment model firms maximize profit in each period leading to an optimal capital stock. The optimal capital stock is determined by the level of output and on the user cost of capital. It is the capital-labor ratio that is referred to as the user cost and firms are assumed to adjust to flexible prices. Jorgenson assumed instantaneous capital stock adjustment were the adjustment cost is zero converting investment decisions to completely reversible. Essentially expectations are assumed to be static as investors do not need to look forward since they can adapt their production quickly and efficiently. Furthermore, optimal capital stock is derived under the assumption of constant returns to scale and exogenously given output. Jorgenson's model was criticized not only because of the assumptions mentioned above but also since the model relies on an ad hoc lag function.

As an amendment of Jorgenson's (1967) neoclassical model an adjustment cost function was introduced in the firm's optimization problem, (see Gould, 1968; Lucas, 1967; Treadway, 1969). If the net benefit of an additional unit of capital is lager (or less) then the replacement cost firms will adjust their existing capital stock accordingly. The change in marginal value of capital goods, the opportunity cost of lost earnings and the deprecation of capital goods are the main sources of maintaining the net benefit of the existing capital stock in adjustment cost models and Jorgenson's user cost model. However, both models neglect expectations. Brainard and Tobin (1968) proposed a solution to this problem using the market value of a firm as a reflection of expectations. If the market value of an additional unit of capital is lager or equal to the replacement cost investment will take place. As described by Hayashi (1982) this yields under the assumption that prices fully reflect all available information and that markets react instantaneously and completely to new information. Essentially, the optimization rule in q-theories is the dynamic equivalent to the optimization/investment rule proposed by Jorgenson (1967) were the marginal benefit is equal to the marginal cost of investment. Generally, empirical research has been based on the Q model framework were the firms market-to-book value has been used as a proxy for investment opportunities. However, since our study is applied on unquoted SMEs market to book value is not available. Thus, the use of an accelerator model.

Empirical research has divided the literature on financial constraints into two stands[4]. Fallowing the work of Fazzari, et al. (1988) a large body of empirical literature such as Chirinko and Schaller (1995); Hubbard et al. (1995); Calomiris and Hubbard (1995); Hubbard (1998) confirm that that firms that are more likely to face financial constraints may exhibit high cash flow sensitive to investment. On the other stand Kaplan and Zingales (1997) demonstrate the opposite result of Fazzari, et. al. 1988). Their result shows the lowest sensitivity to cash flow investments is found among firms that are highly financially constrained. Their critique is primary based on how Fazzari, et al. 1988 classify financially constrained firms. Cleary (1999) applies the same methodology on a lager data set and confirms Kaplan and Zingales (1997) result. The essential result of Kaplan and Zingales (1997;2000) and Cleary (1999) is that firms under distress experience a reduction in cash flow sensitivity thus, the positive relationship between constraints and cash flow sensitivity is not found for severely constrained firms.

Firm size has been considered as a key decisive factor of financial constraints when studying credit channel within countries (Mizen and Vermeulen, 2005). Gertler and Gilchrist (1994) show that small firms are generally younger thus, they are subject to higher levels of firm specific risk. Moreover, there is a lack of collateral making it harder to raise external finance.

[4] See, appendix for table of empirical result.

Gilchrist and Himmelberg (1995) show that small firms and firms whom lack a bond rating are subject to excess cash flow sensitivity. Schaller (1993) finds similar results for Canadian firms. On the other hand, based on U.S manufacturing data Hu and Schiantarelli (1998) demonstrate that lager firms are more financially constrained then smaller firms. Kadapakkam et al (1998) finds the highest cash flow sensitivity among large firms and lowest among small firms. They perform their analysis based on data from six OECD. Von Kalckeruth, (2001) does not find a significant distinction between the investment behaviour of small and large firms in Germany. Chatelain et al. (2003) preform a cross country analysis based on data from, Germany, France, Italy and Spain. Their findings suggest a significantly larger cash flow sensitivity among smaller firms only for Italy.

The above-mentioned literature is based on data from quoted firms. Thus, the empirical research on non-quoted firms is scare. Based on U.K non-quoted data Guariglia (2008) finds that cash flow sensitivity tends to increase monotonically with the degree of financial constraint. Moreover, firms with rather high level of internal funding tend to be more constraint by external funding. Becchetti et al. (2009) finds that self-declared credit rationing is associated to firm size and age thus, such firms exhibit high cash flow sensitivity. However, higher cash flow sensitivity is not found for financially constrained firms in the wider subsample group. Their analysis is based on non-quoted Italian firms. Mizen and Vermeulen, (2005) preform a cross country comparison of investment behaviour between Germany and UK where they note that firm size is not a determinant factor for cash flow sensitivity. In recent empirical cross-country study based on data from Belgium, France, Finland, Sweden, Czech Rep and Hungury, Mulier et al. (2016) shows that financially constrained firms exhibit higher investment cash flow sensitivity. Moreover, such firms tend to pay higher interest rate on their debt.

3 The accelerator model and cost adjustment

An investment is defined as a flow of expenditure intended to increase or maintain current capital stock. An expectation of change in returns of capital indicates an equal change in the desired capital stock. In an efficient capital market, in the absence of market frictions, there is an instantaneous reallocation of capital from sectors with poor profitability to sectors with high-expected prospects. Thus, firms will invest until marginal return is equal to real interest rate. The process of reallocation of capital is referred to as the functional efficiency of capital which may be measured as the elasticity of capital with respect to output (Eklund and Desai, 2013). We use sales as measure of output were sales is assumed to reflect future investment opportunities that is, future demand for capital. We follow the Keynesian school where we make the critical assumption that prices are constant thus, a change in sales and output are proportional. The higher elasticity the quicker is the response to future expected returns hence, indicating a more efficient capital reallocation. An accelerator model of investment is applied in order to capture the time structure of investment and responses to fluctuations in expectations and cash flow. There have been several propositions suggested as measurements of accelerators in the literature, see (Jorgenson, 1971). Tinbergen (1938, 1939) argues that since investment is function of profits current profits may be used as a measure of future profits. While Kuh (1963) uses both retained earnings and sales Jorgenson and Siebert (1968) use gross value added. Given that data and definition of value added may differ across industries/sectors causing inconsistency of measurement, we use sales as our measurement to insure consistency.

At each point in time output can be assumed to be proportional to the capital stock:

$$K_t^* = kY_t \quad (1)$$

where K_t^* denotes desired capital stock and k is the capital coefficient (capital – output ratio). For simplicity, we assume that desired level of capital is equal to the actual level of capital. Thus, net investments NI_t and $K_t - K_{t-1}$ are proportional to the changes in the desired capital stock, $K_t^* - K_{t-1}^*$.

Net investment, □I_t, can then be expressed as:

$$NI_t = \lambda(Y_t - Y_{t-1}) \tag{2}$$

Where λ denotes an accelerator which in turn is proportional to net investments in this particular formulation. If $K_t^* = K_t$ then k = λ, this equilibrium assumption is typically not fulfilled but that is not relevant for our purpose (see Jorgenson, 1971; Tinbergen, 1938, 1939). δ denotes replacement investments and is added for gross investments. This is assumed to be proportional to the old capital, δK_{t-1}. This yields:

$$I_t = \delta K_{t-1} + \lambda \Delta Y_t \tag{3}$$

Dividing both sides with K_{t-1} normalizes[5] eq. 3 and yields:

$$\frac{I_t}{K_{t-1}} = \delta + \lambda \frac{\Delta Y_t}{K_{t-1}} \tag{4}$$

Since, $K_t^* = kY_t$ yields:

[5] Normalization reduces heteroscedasticity and makes it possible to empirically estimate our baseline equation.

$$\frac{I_t}{K_{t-1}} = \delta + \lambda^* \frac{\Delta Y_t}{Y_{t-1}} \quad (5)$$

where $\lambda^* = \lambda/k$, which is the elasticity of the capital stock with respect to output. Note that the assumption of $K_t^* = K_t$ implies that $k = \lambda$ thus, the elasticity of the capital stock, $\lambda^* = 1$ at each point in time.

In order to capture to what extent investment levels are affected by cash flow we include cash flow as a control variable. We include an interaction effect between cash flow and the elasticity of capital with respect to output (reflected by sales) to determine whether cash flow has a different impact on investment deepening on the rate of change in (re)allocation of the capital stock. Furthermore, interaction effects between cash flow and size are included to measure the impact of cash flow on investment levels depending on the degree of financial constraint that firms may face. This yields the following equation:

$$\frac{NI_{it}}{K_{it-1}} = \delta + \lambda^* \frac{\Delta S_{it}}{S_{it-1}} + \beta_1 \frac{CF_{it}}{K_{it-1}} + \beta_2 \frac{CF_{it}}{K_{it-1}} * \frac{\Delta S_{it}}{S_{it-1}} + \beta_3 \frac{CF_{it}}{K_{it-1}} * Size_i + \varepsilon_{it} \quad (6)$$

where λ^* denotes the elasticity of investments with respect to sales thus, measure the speed of (re)allocation of the capital stock. Investment made by firm *i* at time *t* is captured by I_{it}. *K* is the capital stock in period *t-1* and *S* denotes sales in period *t-1*. CF_{it} is the cash flow of a firm in period *t* defined as the sum of after tax profit and deprecation. For net investments, it is expected that the intercept is equal to zero.

3.2 Data description

We construct our dataset of Swedish non-quoted firms using accounting data collected from Retriever Business data-base over the period 2006-2014. In-order to capture economic active firms we define small and medium firms as firms with 5-250 employees and a total annual turnover of minimum five million SEK[6]. The data set includes all business sectors with the exception of the financial and real estate sector[7]. This is of great advantage since the majority of research on internal financial constraints has been performed on manufacturing data. Each firm is identified with a unique organization number and sectors code. The classification of the branch industries is according to Statistics Sweden the so called SNI-code[8]. In order to diminish potential selection and survivor bias we allow both for entry and exit, which yields an unbalanced dataset. Our final data set consists of 10 573 unique firms.

Table 1 presents the definitions of the variables used. Investment is measured as the ratio of change in total asset. Fluctuations in total assets originates from changes in the current and basic elements of a firm's assets such as inventory or account receivable which in turn may be affected by the economic environment such as business cycles etc. Thus, fluctuations in a firm's assets may be interpreted as well-known decisions made by firm managers (Kaplan 1998). $\frac{\Delta s_{it}}{s_{it-1}}$ is the ratio of change in sales, which is used to measure the speed of (re)allocation in the capital stock. CF_t is cash flow defined as the sum of after-tax profit and depreciation. Retained earnings is acquired by adding depreciation, given that depreciation is a noncash expenditure it understates the cash flow available for investment. Free cash flow is the amount of cash that is available for dividend payout to investors after paying for all

[6] The Swedish tax system has a tendency to create shell companies for tax planning and income shifting reasons. Many of the low employees are there for believed to be non-active firms. See Brown, 2015 for a detailed discussion

[7] Fallowing Cleary et al. (2007) & Guariglia, (2007) we exclude firms operating on regulated markets.
[8] We use the 2007 SNI-code definition.

investments essential for growth. That is, earnings minus net investment. For rapidly growing firms free cash flow can be negative since required additional investments may exceed earnings (Brealey, et al. 2012). Thus, for our purpose cash flow is a more appropriate definition. $\frac{CF_t}{K_{it-1}}$ is the level of cash flow normalized by the level of total asset. Normalized cash flow serves as a measure of investment sensitivity to cash flow.

Table 1

Variable description

Variable name	**Definition**
$\boldsymbol{NI_{it}}$	Net investments of firm *i* in period *t*, defined as the change in the capital stock, which is measured as total assets, i.e. the ratio of the level of change in total assets
S	Output of firm *i* in period *t*. Output is measured with sales.
$\Delta\boldsymbol{S_{it}}/\boldsymbol{S_{it-1}}$	Growth in output. Output is measured as sales, i.e. the ratio of the level of change in sales.
$\boldsymbol{CF_{it}}$	Cash-flow measured as after-tax profit +depreciation
$\boldsymbol{CF_{it}/K_{it-1}}$	Ratio of investment sensitivity to cash flow in proportion to total assets, where K_{it-1}= capital stock measured as total asset
Size	Measured as the number of employees. Including firms with employees more 5 less than 250.

Note: The variables have been obtained using firm-level end of the year accounting data. The subscript *t* indexes time and *i* a specific firm.

Table 2 presents summery statistics of the main variables used in our analysis for the full sample and table 3 for the manufacturing sector. In the full sample, the mean firm has an investment rate of 12.8% annually and a sales growth of 12.6%. The corresponding values for the manufacturing sector are 10% respectively. It may be noted that there is less deviation in the data set for the manufacturing sector. Furthermore, there is a deviation between the mean and median values for all variables in the full sample and for the manufacturing sample. This indicates a bias/skewed distribution in the data set. Thus, a quintile median regression is used as a robustness check.

Table 2

Descriptive data for full sample

Variable name	Mean	Median	St.dev	Min	Max
NI_{it}	0.103	0.0499	0.309	-0.492	1.719
$\Delta S_{it}/S_{it-1}$	0.100	0.0457	0.337	-0.471	1.966
CF_{it}/K_{it-1}	0.006	0.00022	0.140	-0.594	0.612
Size	22.17	14	26.10	5	234
Number of firms	1265				

Table 3

Descriptive data for manufacturing sector

Variable name	Mean	Median	St.dev	Min	Max
NI_{it}	0.128	0.059	0.346	-0.492	1.718
$\Delta S_{it}/S_{it-1}$	0.126	0.053	0.349	-0.471	1.966
CF_{it}/K_{it-1}	0.033	0.020	0.175	-0.594	0.612
Size	21.71	12	26.95	5	250
Number of firms	10 573				

3.4 Estimation methodology

In order to check for non-normality, we perform a Jarque-Bera and Shapiro-Wilk test for all the variables in equation 6. Non, of the variables are normally distributed as both skewness and kurtosis provide high values. From histograms, it is determined that the cause of non-normality is due to outliers. The data set is winzorized at 1^{st} and 99^{th} percentiles for each of the regression variables. The purpose of outlier exclusion is to manage the issue of non-normality as well as mitigate the impact of potential specific firm shocks, large mergers and/or coding errors. Such elimination is common in the literature, which facilitates comparability with previous studies (Bond et al.2003; Cummines et al. 2006).

Normalization and the exclusion of outliers allows us to estimate equation eq. (6) using an Ordinary Least Squares (OLS) estimator. However, the OLS estimates may suffer from unobserved biases due heterogeneity. A fixed effect model is included to control for this bias. As observed in table 2 and table 3 there is a deviation between the mean and median values for all variables, indicating a bias distribution of the data set. Thus, adding a quintile median regression controls for this bias. The standard technique of quintile median regression accounts for outliers and describes the relationships between the variables at each point in the conditional distribution of the dependent variable. The latter allows for a more comprehensive analysis. As robustness check we also estimate equation (6) using Iteratively Reweighted Least Squares regression which minimizes the least absolute error term using a maximum likelihood model. This makes Iteratively Reweighted Least Squares less sensitive to outliers compare to quintile median regression and theoretically a more suitable way to cope with the issue of non-normality. Finally,[9], all regressions are estimated with time dummies controlling for exogenous shocks.

[9] We control for other statistical problems such as multicollinearity see appendix for matrix. The Variance Inflation Factor is below 2.

4 Empirical Results and discussion

Motivated by the accelerator principal the elasticity of capital with respect to sales is a way to estimate the functional efficiency of capital (re)allocation. It should be noted that capital elasticity does not measure (re)allocation efficiency between economic channels and firms it is rather a measure of efficiency between industries. However, if capital is allocated efficiently among industries this will reflect access to external capital among entrepreneurs and new ventures. Furthermore, using the accelerator principal indicates that a firms desired capital stock is proportional to its output level at each point in time. Hence, a change in desired capital stock is associated with a proportional change in output level. Thus, a low elasticity of capital with respect to sales indicates high adjustment cost (Wurgler, 2000; Eklund et al. 2014).

Table 4 presents the estimation results of equation (6) for the full sample. The higher elasticity the quicker is the response to future expected returns hence, indicating a more efficient capital (re)allocation between industries. An elasticity larger than one may have several potential explanations. The production function may be discontinuous due to indivisibilities causing disproportionate output to capital ratio. Excessive expectations may be another reason for an elasticity lager than one. Manne (1945) argued that depending on the different stages of the business cycle the accelerator principal has a different impact, as during periods of expansion firms may respond quicker to changes in output. Thus, there is a positive relationship between growth rate and capital elasticity. However, we control for cyclical investment behavior through the inclusion of time effects and fixed effect estimation. Our result shows that the coefficient for lagged sales that is, the elasticity of capital is positive and significant for all four estimators. The result is significantly less than one indicating inefficiency of capital (re)allocation between the industries. Moreover, our result implies that it takes between 2 to 2.5 years for the capital stock to adjust to changes in demand. The literature on non-quoted SMEs is scarce. Guariglia (2008) presents a lagged sales coefficient of 0.425 and a cash flow coefficient of 0.038 for UK firms. Based on Italian data Becchetti et al. (2009) presents a lagged sales coefficient of -0.004. Furthermore, Mulier et al. (2016) reports a lagged sales coefficient of 0.201 and a cash flow coefficient of 0.033 for Sweden. Similar results are found for Belgium, France Finland Czech Republic and Hungary[10]. Our result is somewhat higher due to the fact that Mulier et al. (2016) uses a dynamic model while our model is static.

We find a positive and highly significant relationship between cash flow and investment for all estimators which indicates that investments made by Swedish small and medium firms are affected by the accessibility of internal funding. The cash flow coefficient evaluated at sample means indicates that the elasticity of investment with respect to cash flow is in the range of 0.011-0.019. That is a 10% increase in cash flow is associated with an 0.11% - 0.19% increase in investment levels. Moreover, we use size as a measure of the degree of financial constraint that a firm my face. Smaller firms are in particular subject to greater information asymmetry as there is less public information available concerning future prospects in comparison to larger firms. In addition, size is generally positively correlated with age thus, younger firms tend to have shorter track records with higher levels of firm specific risk and less collateral available making it more difficult to access external funding (Gertler et al. 1994; Carpenter, 2002). The interaction effect between size and cash flow is slightly negative and significant for all estimators. A negative interaction coefficient implies that investment

[10] See appendix for literature table of previous results.

levels made by larger firms are less dependent on internally generated funds. Thus, our result confirms the hypothesis that it may be more difficult for smaller firms to attract external financing. Furthermore, this result is in line with previous empirical research. Wagenvoort (2003) evaluates financial constraints across EU countries and concludes that financial constraints appear to be existent and is particularly sever for firms with less than 50 employees. In addition, the author compares quoted firms with unquoted firms confirming that unquoted firms are more subject to financial constraints then quoted firms. Mulier et al. (2016) reaches the same conclusion for unquoted SMEs in Europe.

The size coefficient is marginally negative for the OLS estimator and for the fixed model and zero for reweighted least squares and the quintile median regression. However, the result is only significant for the fixed effect estimator.

The interaction effect between the capital elasticity with respect to sales and cash flow is positive and significant for all estimators, indicating that as the rate of capital (re)allocation increases firms' investment levels become more dependent on internal funding. As emphasized above, low elasticity of capital with respect to sales indicates high adjustment cost. Thus, the *change* in input demand is slower than the *shock* to input demand (Hamermesh et al.1996). The quicker a firm can adjust its desired capital stock to desired output level the higher is the demand for cash flow. This result is in line with the internal finance theory of growth as well as previous empirical research. Some of the earliest research provided by Butters and Lintner (1945) argue that small firms find it difficult to raise external funding on reasonable terms despite of promising growth opportunities reflected by sales thus, the majority of small firms finance their investment growth almost exclusively through retained earnings. Economic historians such as Mercer and Morgan, 1972; Seltzer, 1929 support this theory based on research conducted on firm growth in the early automobile industry. Brealey and Meyers, (2000) show that internal funding is close to 90% of total investment for small U.S firms. Carpenter and Peterson, (2002) study the sensitivity of firm's growth rate (measured as total asset growth) to its cash flow. They find that small quoted firms who use external equity have a lower growth rate to cash flow sensitivity compared to firms who use less external equity. Hence, they conclude that higher growth cash flow sensitivity is a sign of financial constraints. Wagenvoort (2003) shows that cash flow growth sensitivity is more severe for quoted firms than unquoted firms.

Table 4

Regression analysis small and medium firms

Variable name	OLS	Fixed	RLS	qreg
$\frac{\Delta S_{it}}{S_{it-1}}$	0.493	0.412	0.441	0.461
	(94.64)**	(67.93)**	(120.40)**	(113.39)**
$\frac{\Delta S_{it-1}}{S_{it-2}}$	0.052	0.012	0.026	0.034
	(13.41)**	(2.60)**	(9.55)**	(11.16)**
$\frac{CF_{it}}{K_{it-1}}$	0.330	0.562	0.389	0.401
	(30.23)**	(32.92)**	(50.61)**	(46.87)**
Size*$\frac{CF_{it}}{K_{it-1}}$	-0.001	-0.001	-0.002	-0.002
	(4.82)**	(2.99)**	(8.91)**	(8.18)**
$\frac{CF_{it}}{K_{it-1}} * \frac{\Delta S_{it}}{S_{it-1}}$	0.309	0.291	0.556	0.447
	(14.21)**	(11.36)**	(36.33)**	(26.30)**
$Size$	-0.000	-0.001	0.000	0.000
	(0.36)	(3.20)**	(0.81)	(0.58)
δ	0.052	0.087	0.010	0.003
	(11.40)**	(14.82)**	(3.01)**	(1.02)
R^2	0.26	0.23	0.41	0.16
Obs	41,565			

Note: * p<0.05; ** p<0.01. Standard errors reported in the parenthesis.

Time dummies are included in all specifications.

Table 5 presents the estimation results for small and medium firms operating in the manufacturing sector. Comparing the full sample to the manufacturing sector the elasticity of capital with respect to sales is somewhat lower in the manufacturing sector indicating a slower pace of capital (re)allocation between the industries. It takes approximately 2.5 to 2.9 years for the capital stock to adjust to changes in demand. As highlighted above low elasticity of capital is an indication of relatively high adjustment costs. Thus, our results suggest that that adjustments cost may be higher for manufacturing firms compared to the full sample. This result is reasonable as production in the manufacturing sector may be subject to indivisibilities.

The cash flow coefficient is somewhat larger for the manufacturing sector (with the exception of the fixed effect estimator), indicating that the manufacturing sector is more dependent on internal funding than the full sample. Furthermore, the interaction effect between capital elasticity and cash flow is positive and significant for all estimators, indicating that as the rate of capital (re)allocation increases firms' investment levels become more dependent on internal funding. These results imply that the manufacturing sector is more prosperous compare to the full sample. The fundamental argument is based on the pecking order theory proposed by Myers (1984) and Myers and Majluf (1984). According to the pecking order theory firms prefer internal funding to external funding due to adverse selection and asymmetry information issues. When external funding is required firms prefer debt financing to equity financing. Equity financing is strictly riskier than debt funding. An outside investor will therefor demand a higher rate of return on debt. Thus, firms will prefer using retained earnings if possible. In addition, internal finance theory suggests that the majority of small firms have a tendency to finance their investment growth through retained earnings due to difficulties of raising external finance. Thus, the quicker response to changes in input demand the greater demand for cash flow. This result is in line with previous results such as Guariglia, (2008) who shows a greater cash flow sensitivity within the manufacturing sector compare to the full sample among unquoted SMEs in the UK.

The interaction effect between size and the cash flow coefficient is slightly negative and significant for all the estimators, indicating that as manufacturing firms become larger their investment level becomes less dependent by internally generated funds. As emphasized above, as firms become larger it may be easier to attract external capital. Moreover, manufacturing firms have more collateral (in general they have more total assets on their balance sheet) which facilitate external funding compare to the full sample.

Table 5

Regression analysis for the manufacturing sector

Variable name	OLS	Fixed	RLS	qreg
$\frac{\Delta S_{it}}{S_{it-1}}$	0.397	0.342	0.384	0.383
	(31.08)**	(23.15)**	(45.09)**	(40.67)**
$\frac{\Delta S_{it-1}}{S_{it-2}}$	0.091	0.052	0.049	0.058
	(8.84)**	(4.19)**	(7.03)**	(7.62)**
$\frac{CF_{it}}{K_{it-1}}$	0.347	0.512	0.417	0.408
	(9.94)**	(9.66)**	(17.94)**	(15.87)**
Size* $\frac{CF_{it}}{K_{it-1}}$	-0.003	-0.006	-0.002	-0.002
	(2.56)*	(3.48)**	(2.27)*	(0.15)
$\frac{CF_{it}}{K_{it-1}} * \frac{\Delta S_{it}}{S_{it-1}}$	0.412	0.440	0.760	-0.002
	(6.49)**	(5.97)**	(17.95)**	(2.41)*
$Size$	-0.000	-0.001	-0.000	-0.000
	(1.05)	(1.90)	(0.12)	(0.15)
δ	0.052	0.094	0.007	0.004
	(4.63)**	(5.55)**	(0.93)	(0.59)
R^2	0.22	0.19	0.42	0.15
Obs	5,617			

Note: * p<0.05; ** p<0.01. Standard errors reported in the parenthesis.

Time dummies are included in all specifications.

5 Conclusion

This paper examines to what extent investment levels are affected by cash flow and whether this may be affected by the rate of change in (re)allocation of a firms' capital stock and the degree of financial constraint that a firm may face. We apply our analysis based on unquoted Swedish small and medium firms using accounting data from 10 573 unique firms. Deriving a static accelerator model the functional efficiency of capital (re)allocation is measured as capital elasticity with respect to sales.

Our result suggest that investments made by small medium firms are affected by the accessibility of internal funding. Moreover, it takes approximately between 2 to 2.5 years for the capital stock to adjust to shocks in demand. For the manufacturing sector, it takes approximately 6 months longer for the capital stock to adjust, implying that the manufacturing sector may be subject to greater adjustment costs. When the speed of the adjustment rate increases firms' investment levels become more dependent on internal funding. Finally, as firms become larger their dependence on internal funding decreases, indicating that it may be easier for larger firms to attract external funding. Although our result is in line with previous results[11] this paper does not cope with the hypothesis suggested in the literature namely, that a significant cash flow coefficient in an investment reduced form regression is an indication of financial constraint.

Our finding may have important policy implications given that efficient taxation treatment is a necessary condition for efficient capital allocation. Divergence in taxation of income from different types of assets could cause significant barriers to efficient capital allocation

[11] See ex. Mulier, 2016;

(Jorgenson and Yun, 1986). Furthermore, cash flow is a function of after-tax profits which in turn is a determining factor in investment spending thus, the average rate of corporate tax rate will influence the level of investment. The impact of taxes on the cost of capital and a potential increase in corporation tax rate may have a direct adverse effect on investment levels. Thus, it is a question for policy makers to manage the issue of how to make firms investment levels less dependent on internal funding (Bond and Meghir,1994).

6 References

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7 Appendices

Table 7
Literature review

Author	Country	Estimated function	Model	Selected variable
Fazzari et al. (1988)	USA Sample period: 1970-1984	OLS estimator using fixed firm & year effects	Q-model of investment	CF/K_{it} = 0.464 Q_{it}=0.0008
Carpenter et al. (2008)	U.K Sample period: 1980-2000	Within groups estimator using year effects	Q-model of investment	CF/K_{it-1} = 0.008 Q_{it-1}= 0.102
Cleary (1999)	USA Sample period: 1987-1994	Within groups estimator using fixed firm & year effects	?	CF/K_{it-1} = 0.096
Mizen et al. (2005)	Germany/UK Sample period: 1993-1999	GMM	Flexible error correction model	CF/K_{it-1} = -0.15/-0.02 ΔS_{it}= 0.60/0.67
Gilchrist et al.(1995)	USA Sample period: 1979-1989	GMM	Q-model of investment	CF/K_{it-1} = 0.033 Q_{it-1}= 0.242
Schaller, (1993)	Canada Sample period:	OLS/within estimator	Tax-adjusted Q-model	CF/K_{it-1} = 0.225/0.242 Q_{it-1}= 0.187/0.711

Hu, (1998)	USA Sample period: 1960-1987	Switching Q-model of investment	CF/K_{it} = 0.053 Q_{it}= 0.035
Kadapakkam et al. (1998)	USA	Q-model of investment	CF/K_{it} = 0.181 Q_{it}= 0.057
	Canada		CF/K_{it}=0.463 Q_{it}=0.047
	France		CF/K_{it}=0.308 Q_{it}=0.038
	Germany		CF/K_{it}=0.482 Q_{it}=0.035
	UK		CF/K_{it}=0.706 Q_{it}=0.035
	Japan		CF/K_{it}=0.217 Q_{it}=0.029
	Sample period: 1982-1991		

Table 8
Literature review

Author	Country	Estimated function	Model	Selected variable
Von Kalckeruth (2001)	Germany Sample period: 1985-1999	Within estimation	User Cost model	CF/K_{it}=
Chatelain et al. (2003)	France Germany Italy Spain Sample period: 1985-1999	GMM	User cost model	CF/K_{it}=0.20 ΔS_{it}=0.12 CF/K_{it}=0.08 ΔS_{it}=0.39 CF/K_{it}=030 ΔS_{it}=0.14 CF/K_{it}=0.15 ΔS_{it}=0.02
Guariglia (2008)	U.K Sampel period: 1993-2003	GMM	Error correction model	CF/K_{it}=0.038 ΔS_{it}=0.425
Becchetti et al.(2009)	Italy	GMM	Euler equation	CF/K_{it}=-0.096 ΔS_{it}=-0.004
Mulier et al. (2016)	Belgium France Finland Sweden Czech Rep	GMM	Index Error correction model	

Table 9
OLS, Regression analysis small and medium firms

Varible name	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta S_{it}}{S_{it-1}}$	0.445***	0.544***	0.506***	0.507***	0.507***	0.493***
	(0.00394)	(0.00513)	(0.00510)	(0.00512)	(0.00512)	(0.00520)
$\frac{\Delta S_{it-1}}{S_{it-2}}$		0.0574***	0.0512***	0.0517***	0.0516***	0.0517***
		(0.00392)	(0.00384)	(0.00386)	(0.00386)	(0.00385)
$\frac{CF_{it}}{K_{it-1}}$			0.344***	0.343***	0.366***	0.330***
			(0.00805)	(0.00805)	(0.0107)	(0.0109)
Size				-0.0000528	-0.0000354	-0.0000175
				(0.0000479)	(0.0000482)	(0.0000481)
Size$*\frac{CF_{it}}{K_{it-1}}$					-0.000862**	-0.00131***
					(0.000271)	(0.000272)
$\frac{CF_{it}}{K_{it-1}}*\frac{\Delta S_{it}}{S_{it-1}}$						0.309***
						(0.0217)
δ	0.0780***	0.0482***	0.0421***	0.0431***	0.0396***	0.0384***
	(0.00457)	(0.00416)	(0.00408)	(0.00419)	(0.00326)	(0.00326)
N	50862	41595	41595	41595	41595	41595
R^2	0.213	0.222	0.254	0.254	0.255	0.258

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10
Fixed effect, Regression analysis small and medium firms

Variable name	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta S_{it}}{S_{it-1}}$	0.408***	0.483***	0.421***	0.423***	0.423***	0.412***
	(0.00464)	(0.00600)	(0.00598)	(0.00601)	(0.00601)	(0.00607)
$\frac{\Delta S_{it-1}}{S_{it-2}}$		0.0262***	0.00982*	0.0109*	0.0109*	0.0123**
		(0.00488)	(0.00475)	(0.00476)	(0.00476)	(0.00475)
$\frac{CF_{it}}{K_{it-1}}$			0.587***	0.584***	0.604***	0.562***
			(0.0129)	(0.0130)	(0.0167)	(0.0171)
Size				-0.000578***	-0.000570***	-0.000546**
				(0.000171)	(0.000171)	(0.000170)
Size*$\frac{CF_{it}}{K_{it-1}}$					-0.000797	-0.00129**
					(0.000429)	(0.000430)
$\frac{CF_{it}}{K_{it-1}} * \frac{\Delta S_{it}}{S_{it-1}}$						0.291***
						(0.0256)
δ	0.0560***	0.0501***	0.0314***	0.0461***	0.0459***	0.0451***
	(0.00342)	(0.00338)	(0.00330)	(0.00544)	(0.00544)	(0.00543)
N	50862	41595	41595	41595	41595	41595
R^2	0.183	0.174	0.222	0.222	0.222	0.225

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11
Quantile median regression analysis small and medium firms

Variable name	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta S_{it}}{S_{it-1}}$	0.463***	0.539***	0.478***	0.478***	0.478***	0.461***
	(0.00339)	(0.00435)	(0.00405)	(0.00406)	(0.00406)	(0.00407)
$\frac{\Delta S_{it-1}}{S_{it-2}}$		0.0426***	0.0325***	0.0326***	0.0328***	0.0336***
		(0.00332)	(0.00305)	(0.00307)	(0.00307)	(0.00301)
$\frac{CF_{it}}{K_{it-1}}$			0.397***	0.397***	0.435***	0.401***
			(0.00639)	(0.00639)	(0.00847)	(0.00855)
Size				-0.00000199	0.0000200	0.0000220
				(0.0000380)	(0.0000382)	(0.0000376)
Size*$\frac{CF_{it}}{K_{t-1}}$					-0.00160***	-0.00174***
					(0.000215)	(0.000213)
$\frac{CF_{it}}{K_{it-1}}*\frac{\Delta S_{it}}{S_{it-1}}$						0.447***
						(0.0170)
δ	0.0205***	0.0148***	0.00437	0.00450	0.00425	0.00259
	(0.00281)	(0.00265)	(0.00244)	(0.00259)	(0.00259)	(0.00255)
N	50862	41595	41595	41595	41595	41595
R^2						

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12
Reweighted least squares, regression analysis small and medium firms

Variable name	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta S_{it}}{S_{it-1}}$	0.444***	0.526***	0.459***	0.459***	0.459***	0.441***
	(0.00285)	(0.00375)	(0.00359)	(0.00361)	(0.00361)	(0.00366)
$\frac{\Delta S_{it-1}}{S_{it-2}}$		0.0350***	0.0278***	0.0279***	0.0278***	0.0259***
		(0.00286)	(0.00270)	(0.00272)	(0.00272)	(0.00271)
$\frac{CF_{it}}{K_{it-1}}$			0.386***	0.386***	0.419***	0.389***
			(0.00567)	(0.00567)	(0.00751)	(0.00769)
Size				-0.00000536	0.0000155	0.0000275
				(0.0000337)	(0.0000339)	(0.0000338)
Size*$\frac{CF_{it}}{K_{it-1}}$					-0.00126***	-0.00171***
					(0.000191)	(0.000191)
$\frac{CF_{it}}{K_{it-1}}*\frac{\Delta S_{it}}{S_{it-1}}$						0.556***
						(0.0153)
δ	0.0322***	0.0236***	0.0149***	0.0150***	0.00443	0.00195
	(0.00330)	(0.00304)	(0.00287)	(0.00295)	(0.00230)	(0.00229)
N	50862	41595	41595	41595	41595	41595
R^2	0.336	0.329	0.379	0.379	0.380	0.411