To what extent are savings–cash flow sensitivities informative to test for capital market imperfections?

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Corporate Finance Topics

- Capital structure and corporate financing
- Equity and debt financing
- Credit risk management and corporate strategy
- Dividend payout policy
- Mergers and acquisitions
- Frictions in financial markets; firms' real financial decisions

Introduction/Motivation

- Investment–cash flow sensitivities have been a popular metric for gauging the importance of financial constraints.
- The upshot is that financial constraints matter for corporate investment (see Fazzari et al. 1988), although this finding is not immune to criticism (see Kaplan and Zingales, 1997).
- Almeida et al. (2004) propose to examine the *cash flow sensitivity of cash* as an indicator of financial constraints.
- Motivated partly due to critiques regarding the validity of these sensitivities as an informative indicator of financial constraints.

Introduction/Motivation

- Firms with investment opportunities but limited or no access to external capital markets will save cash out of cash flow when they anticipate to need resources for future investment expenditures.
- By contrast, firms for whom access to external finance is less costly will not engage in such liquidity management since they can easily acquire external finance when needed.
- Almeida et al. (2004) and subsequently, Khurana et al (2006) provide evidence, using data from the U.S. and other G-7 countries that confirm the prediction above.
- Clear evidence in favour of the above prediction: constrained firms exhibit a positive sensitivity while unconstrained firms exhibit no systematic sensitivity of cash to cash flow.

Introduction/Motivation

- These results provide more powerful and less ambiguous evidence of financial constraints, relative to results obtained within the investment–cash flow framework.
- A significant challenge to Almeida et al. (2004) came by Riddick and Whited (2009): once measurement error in Tobin's Q is accounted for, the sensitivity of savings to cash flow is negative for the majority of US firms in Compustat.
- While the savings–cash flow sensitivity contains information about financial constraints, other confounding factors, render this sensitivity no more informative than the investment–cash flow sensitivity.
- It therefore appears that the results from the savings–cash flow specification can be widely different, which may lead to concerns regarding its usefulness.

Aims

- We propose a simple investment model with lumpy investment and cash accumulation and test a key prediction, namely, that under costly external finance, savings-cash flow sensitivities will vary significantly by investment regime.
- We then propose a modification to the Almeida et al. (2004) equation that takes into account the predictions of the model, but also nests their original specification.
- We provide empirical evidence for the model, using a sample of small unlisted firms which are likely to face financing frictions, and exhibit lumpy investment behaviour.
- We carry–out a sharper empirical test of our model's key prediction, that focuses not on the sign of the sensitivity per se but on whether the sensitivity switches sign across investment regimes.

Related literature

- Optimal level of cash holdings: Opler et al. (1999) and Pinkowitz et al. (2013).
- The cash flow sensitivity of cash: Almeida et al. (2004); Sufi (2009); Hadlock and Pierce (2010) and Errel et al. (2013)
- Bank credit lines: Campello et al. (2011); Ippolito and Perez (2012) and Almeida et al. (2013).

The model

- A stylized version of the model generates two investment regimes: periods during which firms experience low or zero investment in physical capital (investment inaction) and periods during which firms invest substantially (investment spikes).
- Firms that face costly finance use cash to transfer resources from periods of investment inaction to periods of investment spikes, in order to avoid using more costly external funds when they invest during spikes.
- Firms maintain a constant level of cash during periods of inaction, so the policy rule is flat during those periods. When there is an investment spike, firms use some or all of this cash to finance investment.
- Thus, during and immediately after an investment spike, the cash policy is very non-linear: Cash changes from a positive level to either zero or a lower positive level. Hence, the change in cash, i.e. savings, is negative during these periods. The firm then builds up its cash level to what it was prior to the spike, so the change in cash or savings becomes positive. To summarize, the cash policy follows a step function, i.e, high-low-high-low.

The model

We construct model based on Cooper and Haltiwanger (2006) in which investment is lumpy and external financing is costly.

- The relationship between cash and cash flow is mediated by whether firms are going through a period of high investment activity, or not.
- During a period of activity firms use their existing cash holdings to help finance investment. Cash flow tends to rise during these investment spikes because productivity is high: so the sensitivity is negative during investment spikes.
- Immediately following the spike, the firm works to build up its cash reserves while cash flow continues to rise. Thus the cash-cash flow sensitivity becomes positive.
- After cash reaches its "target" level, it becomes insensitive to cash flow (the sensitivity goes to zero).

Simulation results

- We simulate two industries each consisting of 25,000 firm-year observations. One industry faces a premium for external funds, while the other does not.
- We use the two simulated panels to test whether the empirical equation we propose can reliably identify the firms that face costly external finance.

  We estimate the following equation

$$
\begin{aligned}
\frac{\Delta b_{it+1}}{b_{it}+k_{it}} = \beta_0 + \beta_1 \frac{Salesgrowth_{it}}{b_{it}+k_{it}} + \beta_2 \frac{CashFlow_{it}}{b_{it}+k_{it}} * SPIKE_{it} + \beta_3 \frac{CashFlow_{it}}{b_{it}+k_{it}} * (1 - SPIKE_{it}) \\
+ \beta_4 (b_{it}+k_{it}) + \epsilon_{it}
\end{aligned}
$$

- Δ is the first difference operator and $SPIKE_{it}$ is a dummy variable that controls for the investment regime.

Parameter values

- The risk-free rate is set equal to 2.65%.
- We set the discount factor, β, to 0.97, which implies $\beta(1+r) < 1$, a necessary assumption in order for cash to be dominated in the case without costly finance.
- We set the capital share in production, α, at 0.7.
- The depreciation rate is set at 0.15.
- The variable cost parameter, γ, at 0.049 and the fixed cost parameter, F, at 0.039.
- The parameter that determines the external finance cost, *fincost*, is set equal to 0.07.
- The persistence and standard deviation of the idiosyncratic productivity shock are $\rho = 0.75$ and $\sigma = 0.2$.

One more thing

. The firm accumulates capital according to the following rule:

$$k_{jt+1} = (1-\delta_k)k_{jt} + i_{jt}, \qquad 0 \leq \delta_k \leq 1, \tag{1}$$

where i_{jt} is fixed investment and δ_k denotes the depreciation rate of capital. Adjusting the capital stock is assumed to be costly. The adjustment costs consist of two components: a variable cost component, $c_v(i_t, k_t)$, given by a quadratic form:

$$c_v(i_{jt}, k_{jt}) = \frac{\gamma}{2}\left(\frac{i_{jt}}{k_{jt}}\right)^2 k_{jt}, \qquad \gamma \geq 0. \tag{2}$$

and a non-convex component which is given by:

$$c_f(k_{jt}) = \left\{ \begin{array}{cc} Fk_{jt} & \text{for } i_{jt} \neq 0 \\ 0 & \text{for } i_{jt} = 0 \\ & \end{array} \right\}, \qquad F \geq 0, \tag{3}$$

where F denotes a fixed cost incurred by the firm during investment episodes. This component is scaled by the capital stock, k_{jt}, to eliminate any size effects.

One more thing

. In each period each firm decides the amount of cash to hold, b_{jt}. Savings earn a positive post-tax risk-free interest rate of r. We assume that firms can obtain external funds to finance expenditure but only at a premium over the rate offered on savings. Specifically, whenever a firm's expenditure exceeds the available sources of income, the firm pays a premium over the risk-free rate. Formally, let

$$\text{div}_{jt} = \text{s}_{jt}\text{k}_{jt}^{\alpha} - \text{k}_{jt+1} + (1 - \delta_k)\text{k}_{jt} - \text{Fk}_{jt} - \frac{\gamma}{2}\frac{(k_{jt+1} - (1-\delta_k)k_{jt})^2}{k_{jt}} + (1+\text{r})\text{b}_{jt} - \text{b}_{jt+1}$$

denote the firm's net cash flow or dividend. We assume the firm pays a cost of obtaining external finance given by a function, $f_t^{ext}(\bullet)$, such that, $f_t^{ext}(\bullet) > 0$ if $div_{jt} < 0$, and $f_t^{ext}(\bullet) = 0$ otherwise.

One more thing

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To make this operational we assume it takes the following form:

$$f_t^{ext}(-div_{jt}) = fincost(-div_{jt}) = fincost(k_{jt+1} - (1-\delta_k)k_{jt} - s_{jt}k_{jt}^{\alpha} + Fk_{jt} + \frac{\gamma}{2}\frac{(k_{jt+1} - (1-\delta_k)k_{jt})^2}{k_{jt}} - (1+r)b_{jt} + b_{jt+1}) \quad (4)$$

In the expression above, *fincost* is a parameter capturing the premium the firm pays above the risk-free rate in order to use external funds. Notice that the expression in the external finance cost function is simply expenditures minus internal sources of funds. This cost is assumed to be linear. Also note that other things being equal, a higher level of cash, b_{jt}, helps to reduce the cost of external finance.

One more thing

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Let the value function describing each regime be given by $V^a(s_t, k_t, b_t)$ and $V^i(s_t, k_t, b_t)$ for the active and the inactive regime, respectively (dropping the subscript j for convenience). The firm then solves the following problem:

$$V(s_t, k_t, b_t) = \max\{V^a(s_t, k_t, b_t), V^i(s_t, k_t, b_t)\} \tag{5}$$

The value functions for the active and inactive regimes are given respectively by:

$$\begin{aligned} V^a(s_t, k_t, b_t) =& s_t k_t^{\alpha} - k_{t+1} + (1-\delta_k)k_t - \frac{\gamma}{2}\frac{(k_{t+1} - (1-\delta_k)k_t)^2}{k_t} \\ & - Fk_t + (1+r)b_t - b_{t+1} - f_t^{ext}(\bullet) + \beta E_{s_{t+1}|s_t} V(s_{t+1}, k_{t+1}, b_{t+1}) \end{aligned} \tag{6}$$

and

$$\mathrm{V}^i(\mathrm{s}_t,\mathrm{k}_t,\mathrm{b}_t)=\mathrm{s}_t\mathrm{k}_t^{\alpha}\text{-}\mathrm{f}_t^{ext}(\bullet)+(1+\mathrm{r})\mathrm{b}_t\text{-}\mathrm{b}_{t+1}+\beta\mathrm{E}_{s_{t+1}|s_t}\mathrm{V}(\mathrm{s}_{t+1},\mathrm{k}_t(1\text{-}\delta_k),\mathrm{b}_{t+1})).$$

In the value function formulation above, β denotes the discount factor and E, the expectation operator.

Simulation results

- Firms in the inactivity regime exhibit positive savings-cash flow sensitivities, while firms who experience spikes (activity regime) exhibit negative savings-cash flow sensitivities.
- In the industry with costly external finance, savings are accumulated during periods of investment inactivity, and run down during periods of activity to finance investment spending.
- In the industry without costly external finance, savings are equal to zero at all times and states, so the coefficients on the right hand side variables are identically equal to zero.
- The sign switch is robust to perturbation of model parameters, deprecation rate and the scale of fixed cost.

Table: Simulated savings regressions

Controlling for investment regime		
	Costly external finance	Costless external finance
	(1)	(2)
$\frac{CashFlow}{b+k} * (1 - SPIKE)$	0.085***	0
	(0.011)	
$\frac{CashFlow}{b+k} * (SPIKE)$	-0.985***	0
	(0.016)	
$k + b$	-0.014**	0
	(0.0003)	
$\frac{Salesgrowth}{b+k}$	0.129***	0
	(0.008)	
$Observations$	25,000	25,000
$\overline{R}^2$	0.45	
Test of equality: Cash Flow	0.00	
	Costly external finance	Costless external finance
$\frac{CashFlow}{b+k}$	0.106***	0
	(0.010)	
$k + b$	-0.005***	0
	(0.0002)	
$\frac{Salesgrowth}{b+k}$	-0.278***	0
	(0.009)	
$Observations$	25,000	25,000
$\overline{R}^2$	0.06	

Data description

- Annual accounting reports taken from the AMADEUS database, published by Bureau Van Dijk Electronic Publishing (BvDEP).
- Our sample covers the period 1998 to 2005.
- Our focus is on four transition economies, namely, Bulgaria, the Czech Republic, Poland and Romania (also studied by Konings et al., 2003) and four developed economies, namely, Belgium, France, Germany and the U.K (studied by Bond et al., 2003).
- The vast majority of the firms in the sample are not traded on the stock market.

Data description

- Standard cleaning techniques are applied in line with the literature.
- Our final panel, which is unbalanced, covers 459 firms for Bulgaria, 1515 firms for the Czech Republic, 1201 firms for Poland, 1006 firms for Romania, 1536 firms for Belgium, 4133 firms for France, 842 firms for Germany, and 2699 firms for the U.K.

Evidence for lumpiness

- There is significant investment inaction: firm-year observations with investment rates near zero
- Inaction ranges across countries ranging from 11.4% in Bulgaria to 6.3% in the U.K.
- These periods of inaction are complemented by periods of investment spikes or bursts.
- For an investment episode to be defined as a spike we require it to be occurring rather infrequently while at the same time to account for a significant portion of total investment spending.
- We define an investment spike when the investment rate exceeds 50%. This threshold ranges from approximately twice to three times the average investment rate in our sample.

Further evidence for lumpiness

- Investment rates exceeding 50% account for a considerable fraction of firm-year observations, ranging from approximately 23% for Bulgaria to 24% in Belgium.
- Importantly, these investment spikes account for a significant fraction of total investment spending: 25% in Bulgaria and 13% in Belgium.
- Very low serial correlations of investment rates in all countries.

Further evidence for lumpiness

- An alternative measure of investment lumpiness based on the percentage of firm-year observations characterized by investment rates at least 2.5 times above the firm-level median investment rate for each country.
- A considerable fraction of firm-year observations experience an investment spike. The fractions range, for example, from 8.4% in Poland to 36.6% in Romania in the set of transition economies; and from 12.6% in Belgium to 51.7% in Germany in the developed economies group.
- Taken together, these observations strongly suggest investment rates in our dataset are characterized by significant asymmetries and lumpiness.

Table: Investment lumpiness

	Bulgaria	Czech Republic	Poland	Romania	Belgium	France	Germany	UK
Investment rates within 2%	11.4%	6.8%	4.7%	5.5%	5.6%	3.7%	2.6%	6.3%
Investment rates $>$ 70%	17.1%	8.1%	12.0%	16.5%	14.9%	13.4%	11.2%	10.8%
Investment rates $>$ 50%	23.0%	13.8%	19.2%	21.4%	23.4%	22.2%	19.2%	17.2%
Investment rates: 2.5 times above firm median	18.2%	11.5%	8.4%	36.6%	12.6%	31.5%	51.7%	47.5%
$\frac{\frac{I50}{K}}{\frac{I}{K}}$	0.81	0.32	0.68	0.89	0.59	0.40	0.31	0.61
Correlation $(\frac{I}{K}, (\frac{I}{K})_{-1})$	0.13	0.09	0.14	0.01	0.25	0.26	0.36	0.25

Econometric model

- We estimate a model which relates the firm's accumulation of cash (saving) to total assets ratio ($\Delta Cash_{it}/TotalAssets_{it-1}$) to its cash flow to assets ratio, Tobin's Q, and size:

$$\frac{\Delta Cash_{it}}{TotalAssets_{it-1}} = \beta_0 + \beta_1 \frac{sales \quad growth_{it}}{TotalAssets_{it-1}} + \beta_2 \frac{CashFlow_{it}}{TotalAssets_{it-1}} * SPIKE_{it} + \beta_3 \frac{CashFlow_{it}}{TotalAssets_{it-1}} * (1 - SPIKE_{it}) + \beta_4 SIZE_{it-1} + \epsilon_{it}$$

- where $SPIKE_{it}$ takes the value of one for firm-year observations with investment rates above 50% and zero otherwise.
- The *SPIKE* dummy will then capture the incremental effect of cash flow on savings when the firm is operating in either one of the two investment regimes.

Estimation methodology

- We use three different approaches to take into account the possible endogeneity of our regressors, address measurement error and ensure the robustness of our findings.
- Fixed effects which controls for the time-invariant component of the measurement error.
- OLS-IV which deals with endogeneity using lagged values as instruments following Galvao et al, (2010).
- system Generalized Method of Moments (Arellano and Bover (1995) and Blundell and Bond (1998)), which combines in a system the relevant equation in first difference and in levels to control for endogeneity.
- We evaluate whether our instruments are legitimate and our model is correctly specified using diagnostic tests.

Main results

- The main prediction from the model is that the rate of cash accumulation will differ according to the investment regime.
- The sensitivity of savings to cash flow should be positive for those firms in the investment inactivity regime and negative for firms that exhibit investment spikes.
- The cash flow sensitivity of savings varies significantly with the investment regime. The coefficients on cash flow interacted with the inactivity dummy are positive and statistically significant.
- In contrast, the interaction terms between cash flow and the investment-spike have negative and statistically significant coefficients.
- Both the Sargan and $m3$ tests do not indicate significant problems with the choice of our instruments and the specification of our model.

Table: Savings specification controlling for investment regimes

	Bulgaria	Czech Republic	Poland	Romania	Belgium	France	Germany	UK
Sales growth	0.017	-0.002	0.014*	0.013	0.019	-0.006	0.026	-0.006
	(0.01)	(0.01)	(0.008)	(0.008)	(0.02)	(0.01)	(0.02)	(0.009)
Size	0.009	0.004	-0.001	0.002	0.005	0.010	0.005	0.002
	(0.008)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.01)	(0.01)
$CashFlow / A * (1 - SPIKE)$	0.107*	0.063*	-0.097	0.079**	0.588**	0.791**	0.120*	0.462*
	(0.06)	(0.04)	(0.16)	(0.03)	(0.27)	(0.28)	(0.44)	(0.27)
$CashFlow / A * SPIKE$	-0.173*	-0.197*	-0.122**	-0.130**	-0.135*	-0.284**	-0.349**	-0.262*
	(0.10)	(0.10)	(0.05)	(0.05)	(0.05)	(0.07)	(0.16)	(0.16)
Observations	2,250	7,449	5,428	4,513	8,475	21,574	3,204	10,214
Firms	459	1,515	1,201	1,006	1,536	4,133	842	2,699
m3	0.376	0.459	0.388	0.384	0.040	0.000	0.236	0.622
Sargan	0.516	0.645	0.081	0.082	0.567	0.086	0.464	0.467
Test of equality	0.00	0.01	0.88	0.00	0.00	0.00	0.00	0.04

First additional model prediction

- Cash should be going down during periods of investment spikes, and gradually increase after those periods.

$$\frac{\Delta Cash_{it}}{TotalAssets_{it-1}} = \beta_0 + \beta_1 \frac{sales \quad growth_{it}}{TotalAssets_{it-1}} + \beta_2 SPIKE_{it} + \beta_3 SPIKE_{it,14} + \beta_4 SIZE_{it-1} + \epsilon_{it}$$

- $SPIKE_{14}$ records four subsequent periods after investment spike periods. That is, if an investment spike occurs in period t, $SPIKE_{14}$ will be equal to one in period $t+1, t+2, t+3, t+4$ and zero otherwise.
- The coefficients on the *SPIKE* dummy are significantly negative in all eight countries, while the coefficients on the $SPIKE_{14}$ dummy are in general significantly positive.
- In line with the model's predictions, the results indicate that cash falls during spike periods and gradually builds up in the subsequent periods, suggesting firms are accumulating cash anticipating a future spike.

Table: Sensitivity of savings to investment spikes

	Bulgaria	Czech Republic	Poland	Romania	Belgium	France	Germany	UK
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales growth	0.004	0.019***	0.004	0.020***	0.024	0.010***	0.018***	-0.001
	(0.019)	(0.004)	(0.003)	(0.004)	(0.026)	(0.003)	(0.006)	(0.011)
Size	-0.008	-0.004	0.003	0.017**	0.065**	0.001	0.008	0.080**
	(0.014)	(0.005)	(0.003)	(0.007)	(0.030)	(0.005)	(0.007)	(0.034)
SPIKE	-0.046**	-0.032***	-0.019***	-0.012***	-0.017***	-0.009***	-0.009**	-0.014***
	(0.022)	(0.008)	(0.004)	(0.004)	(0.003)	(0.001)	(0.004)	(0.005)
$SPIKE_{14}$	0.011*	0.014***	0.007*	-0.003	0.008*	0.002**	0.002	0.012**
	(0.006)	(0.004)	(0.004)	(0.002)	(0.004)	(0.001)	(0.003)	(0.006)
CashFlow / A	0.070	0.092***	0.104***	0.092***	0.229***	0.180***	0.067*	0.334***
	(0.065)	(0.020)	(0.016)	(0.020)	(0.075)	(0.013)	(0.035)	(0.048)
Observations	2,250	7,479	5,428	4,513	8,475	21,574	3,204	10,214
Firms	459	1,515	1,201	1,006	1,536	4,133	842	2,699
Sargan	0.074	0.157	0.113	0.048	0.853	0.001	0.635	0.131
*m*3	0.659	0.574	0.317	0.164	0.204	0.752	0.420	0.178
*m*1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Second additional model prediction

- The cash flow sensitivity of savings should switch from positive to zero at some point after the firm has undergone an investment spike.

$$\frac{\Delta Cash_{it}}{TotalAssets_{it-1}} = \beta_0 + \beta_1 \frac{sales \quad growth_{it}}{TotalAssets_{it-1}} + \beta_2 \frac{CashFlow_{it}}{TotalAssets_{it-1}} * SPIKE_{it} +$$
$$\beta_3 \frac{CashFlow_{it}}{TotalAssets_{it-1}} * SPIKE_{it,14} + \beta_4 \frac{CashFlow_{it}}{TotalAssets_{it-1}} * OTHER_{it} + \beta_5 SIZE_{it-1} + \epsilon_{it}$$

- The dummy *OTHER* records periods that are neither spikes nor any of the four subsequent periods after the spike.
- The cash flow sensitivity of cash accumulation switches from positive during $SPIKE_{14}$, to negative when the *SPIKE* occurs, and then switches to zero during *OTHER*, broadly supporting the second additional prediction of the model.

Table: Investment spikes, cash build-up and other periods

	Bulgaria	Czech Republic	Poland	Romania	Belgium	France	Germany	UK
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales growth	0.071***	-0.015	0.028***	0.033***	0.011	0.030	0.016**	-0.016*
	(0.015)	(0.018)	(0.006)	(0.010)	(0.026)	(0.021)	(0.007)	(0.008)
Size	0.029	0.005	0.009*	0.021***	0.003	-0.003	0.023	-0.007
	(0.019)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.017)	(0.009)
$CashFlow/A * SPIKE$	-0.217**	-0.069**	-0.076***	-0.145***	-0.097***	-0.070***	-0.014	-0.059**
	(0.100)	(0.035)	(0.016)	(0.031)	(0.032)	(0.023)	(0.042)	(0.027)
$CashFlow/A * SPIKE_{14}$	0.246*	0.118*	0.075***	0.193***	0.122*	0.100*	0.093*	0.105***
	(0.137)	(0.061)	(0.021)	(0.050)	(0.068)	(0.053)	(0.052)	(0.034)
$CashFlow/A * OTHER$	0.133	0.053	0.047	0.181***	0.059	0.054	0.080	0.074
	(0.148)	(0.066)	(0.034)	(0.053)	(0.078)	(0.061)	(0.059)	(0.057)
Observations	2,250	7,479	5,428	4,513	8,475	21,574	3,204	10,214
Firms	459	1,515	1,201	1,006	1,536	4,133	842	2,699
Sargan	0.308	0.721	0.124	0.153	0.387	0.778	0.587	0.135
m3	0.657	0.680	0.749	0.203	0.191	0.677	0.459	0.319
m1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robustness tests

- We used alternative estimation methods: Fixed Effects and OLS-IV.
- We re-defined the investment spike threshold using the 2.5 higher than the median investment rate for each country and industry.
- We employed alternative model parameterizations.
- Our main findings are robust to the above modifications.

Table: Measuring spikes in a different way

	Bulgaria	Czech Republic	Poland	Romania	Belgium	France	Germany	UK
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales growth	0.023	0.017	-0.001	0.028*	0.050**	0.044**	0.010	-0.001
	(0.017)	(0.014)	(0.009)	(0.014)	(0.022)	(0.019)	(0.024)	(0.010)
Size	-0.009	0.004	0.019***	0.029***	0.007	-0.014	0.003	0.011
	(0.012)	(0.007)	(0.007)	(0.010)	(0.008)	(0.008)	(0.012)	(0.017)
$CashFlow/A * SPIKE_R$	-0.197**	-0.048	-0.073***	-0.168**	-0.264**	-0.268**	-0.249	-0.099
	(0.089)	(0.100)	(0.017)	(0.067)	(0.131)	(0.117)	(0.189)	(0.123)
$CashFlow/A * (1 - SPIKE_R)$	0.100*	0.109***	0.129***	0.193***	0.178***	0.182***	0.109**	0.212***
	(0.055)	(0.036)	(0.023)	(0.051)	(0.047)	(0.032)	(0.048)	(0.025)
Observations	2,250	7,479	5,428	4,513	8,475	21,574	3,204	10,214
Firms	459	1,515	1,201	1,006	1,536	4,133	842	2,699
Sargan	0.416	0.044	0.355	0.108	0.399	0.094	0.390	0.466
m3	0.446	0.673	0.319	0.242	0.288	0.709	0.309	0.221
m1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Test for equality	0.013	0.000	0.000	0.001	0.006	0.000	0.000	0.023

Table: Simulated savings regressions: robustness to alternative parameterizations

Controlling for investment regime with SPIKE dummy	Baseline calibration	Perturbation I	Perturbation II	Perturbation III	Perturbation IV
$\frac{CashFlow}{b+k} * (1 - SPIKE)$	0.085***	0.162***	0.243***	0.377***	0.117***
	(0.011)	(0.017)	(0.020)	(0.028)	(0.008)
$\frac{CashFlow}{b+k} * (SPIKE)$	-0.985***	-0.458***	-1.120***	-0.816***	-0.453***
	(0.016)	(0.011)	(0.023)	(0.031)	(0.008)
$k + b$	-0.014***	-0.028***	-0.009***	-0.012***	-0.0031***
	(0.0003)	(0.002)	(0.0001)	(0.0002)	(0.002)
$\frac{salesgrowth}{b+k}$	0.129***	0.116***	0.027**	-0.199***	-0.048***
	(0.008)	(0.009)	(0.011)	(0.018)	(0.008)
Observations	25,000	25,000	25,000	25,000	25,000
$\overline{R}^2$	0.43	0.57	0.56	0.52	0.34
Test of equality (p-value): Cash Flow	0.00	0.00	0.00	0.00	0.00

Conventional savings specification	Baseline calibration	Perturbation I	Perturbation II	Perturbation III	Perturbation IV
$\frac{CashFlow}{b+k}$	0.106***	-0.102***	0.487***	0.306***	-0.001
	(0.010)	(0.015)	(0.022)	(0.024)	(0.005)
$k + b$	-0.005***	0.061***	-0.005***	-0.007***	0.009***
	(0.0002)	(0.001)	(0.0001)	(0.0003)	(0.001)
$\frac{Salesgrowth}{b+k}$	-0.278***	0.366***	-0.519***	-0.427***	-0.348***
	(0.009)	(0.008)	(0.016)	(0.019)	(0.006)
Observations	25,000	25,000	25,000	25,000	25,000
$\overline{R}^2$	0.06	0.17	0.11	0.16	0.01

Conclusions

- We propose a simple investment model with lumpy investment and cash accumulation and test a key prediction, namely, that under costly external finance, savings-cash flow sensitivities will vary significantly by investment regime.
- Using a panel of European firms we find positive and significant savings-cash flow sensitivities for firms that operate in the investment inactivity regime, and negative and significant sensitivities for firms that operate in the investment activity regime.
- Our results offer a reconciliation between the findings of Almeida et al. (2004) and those of Riddick and Whited (2009): when one takes into account both investment regimes, both positive and negative savings cash flow coefficients can be observed with the sign determined by the investment regime.