The Corporate Propensity to Save

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The Cash Flow Sensitivity of Cash

In a recent paper Almeida, Campello and Weisbach run the following OLS cross-sectional regressions

$$\Delta CashHoldings_{i,t} = \alpha_0 + \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \varepsilon_{i,t}$$

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Formal explanation: three periods model of liquidity demand with full capital depreciation

Problems

- static cross-sectional regressions are affected by a relevant endogeneity problem
- $Q_{i,t}$ is measured with errors $\Rightarrow$ errors in variables problem
- the theoretical model proposed to rationalize the empirical findings cannot discriminate between the level of cash and the change in cash: one period savings decision

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Solution proposed by Riddick and Whited:

- Dynamic trade-off theory model with costly external equity financing and costly internal corporate savings
- Better econometrics: error-in-variables model

Production Technology

- Risk neutral firm in a discrete-time, infinite-horizon, partial-equilibrium framework
- Profit function: $\pi(k, z)$ continuous and concave
- z is a first-order markov process with support $[\underline{z}, \overline{z}]$ and law of motion given by $g(z', z)$
- Standard capital accumulation equation: $k' = I + (1 - d)k$
- Capital adjustment costs:

$$A(k, k') \;\; = \;\; ck\phi_i + \frac{a}{2}\Big(\frac{k' - (1-d)k}{k}\Big)^2$$

ϕ_i is an indicator function equal to 1 if investment is different from zero

Financing Technology

Firm's budget constraint:

$$e = \overbrace{(1-\tau_c)\pi(k,z) + p}^{\text{Beginning of period C. H.}} - \underbrace{\frac{p'}{(1+r(1-\tau))}}_{\text{Corporate Savings}} - \overbrace{(k' - (1-d)k) - A(k,k')}^{\text{Investment Cost}}$$

Equity issuance cost paid if $e < 0$

$$\phi(e) = \Phi_e\Big(-\lambda_0 + \lambda_1 e + \frac{1}{2}\lambda_2 e^2 \Big)$$

Φ_e is an indicator function equal to 1 if e is negative and $\lambda_i > 0$ $i = 0, 1, 2$

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$1 + (1-\tau_c)r$ is the internal accumulation rate $\Rightarrow$ trade-off between costly external financing and costly internal savings

Recursive Formulation

$$V(k,p,z) \;=\; \max_{k',p'} \left\{ e + \phi_e + \frac{1}{1+r} \int V(k,p,z) dg(z',z) \right\}$$

s.t.

$$e \;=\; (1-\tau_c)\pi(k,z) + p - \frac{p'}{(1+r(1-\tau_c))} - (k' - (1-d)k) - A(k,k')$$

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$$e \quad = \quad (1-\tau_c)\pi(k,z) + p - \frac{p'}{(1+r(1-\tau_c))} - (k' - (1-d)k) - A(k,k')$$

A unique optimal saving policy function exists. The FOC w.r.t. p' is:

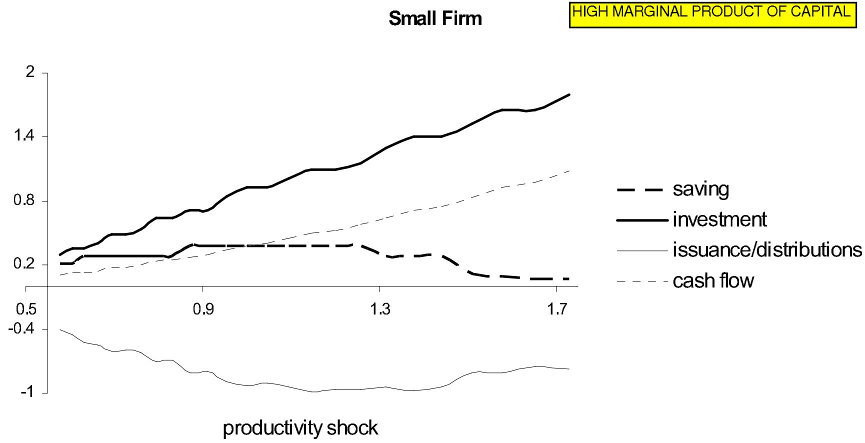
$$\underbrace{1 + (\lambda_1 - \lambda_2 e)\Phi_e}_{\text{Shadow value of Cash Balance}} \quad = \quad \underbrace{\frac{1+(1-\tau_c)r}{1+r} \int (1 + (\lambda_1 - \lambda_2 e')\Phi'_e) dg(z',z)}_{\text{Marginal Cost of Equity Financing}}$$

Calibration

Functional Form	Parameters
$\pi(k,z) = zk^{\theta}$	$\theta = 0.75$
$\ln(z') = \rho \ln(z) + v'$	$\rho = 0.66$
$v' \sim N(0, \sigma_v^2)$	$\sigma_v^2 = 0.121$
Financing Cost	$\lambda_0 = 0.389$ $\lambda_1 = 0.053$ $\lambda_2 = 0.002$
Adjustment Cost	$c = 0.039$ $a = 0.049$
Depreciation	$d = 0.15$
Risk-free interest rate	$r = 0.04$

Optimal Policies: Small Firm

Savings are defined as $\left(\frac{p'}{1+(1-\tau_c)r} - p\right)/k^*$



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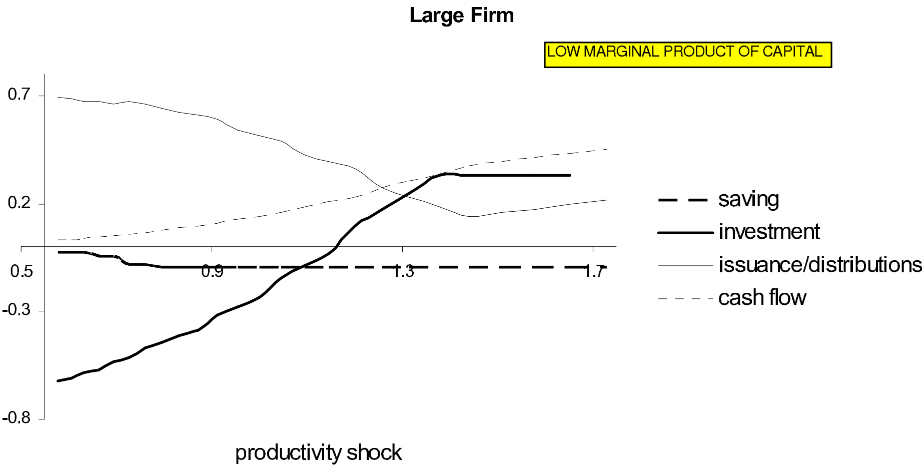


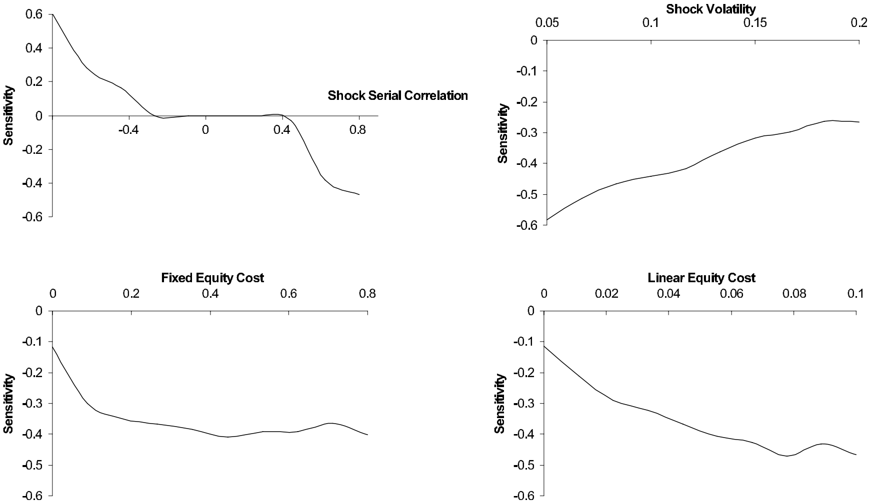
The Cash Flow Sensitivity of Cash

$$\frac{p' - p}{k} = \alpha_0 + \beta \frac{V(k,p,z)}{k} + \alpha_1 \frac{\pi(k,z)}{k} + \alpha_2 \ln(k) + u \quad (1)$$

Asses the change of some key model's parameters on the magnitude of the coefficient α_1, e.g. let ρ to vary in $[-0.8, 0.8]$ and leave all the other parameters at their calibrated values.
Testable implications:

- α_1 is negative
- α_1 increases in absolute value with the cost of external financing
- α_1 increases in absolute value as ρ increases
- α_1 decreases in absolute value with the volatility of cash flows

Testable Implications



Empirical Strategy

- Data relative to USA from Compustat and data relative to Canada, Japan, Germany, France and United Kingdom from Standard and Poor's Compustat Global Issue
- Estimation using a classical errors-in-variables model (Erickson and Whited 2000, 2002)

$$\begin{aligned} y_i &= \omega_i \alpha + \chi_i \beta + u_i \\ x_i &= \gamma + \chi_i + \varepsilon_i \end{aligned}$$

  χ_i: variable measured with errors
  γ_i: variable perfectly measured

- Third moments GMM estimation

Results

	OLS			GMM4			
Country	q	CF	R^2	q	CF	R^2	τ^2
United States	0.029*†	0.103*†	0.112*†	0.283*†	-0.397*†	0.440*†	0.255*†
	(0.003)	(0.009)	(0.010)	(0.016)	(0.060)	(0.031)	(0.014)
Canada	0.045*†	0.053*†	0.144*†	0.213*†	-0.076*†	0.495*†	0.323*†
	(0.006)	(0.025)	(0.026)	(0.018)	(0.022)	(0.051)	(0.041)
United Kingdom	0.009†	0.103*†	0.047*†	0.427	-0.485*†	0.356*†	0.137*†
	(0.002)	(0.016)	(0.013)	(0.076)	(0.168)	(0.042)	(0.026)
Japan	0.019*†	0.141*†	0.049*†	0.318*†	-0.162*†	0.255*†	0.113*†
	(0.002)	(0.019)	(0.005)	(0.040)	(0.037)	(0.020)	(0.015)
France	0.021*†	0.126*†	0.084*†	0.263*†	-0.304*†	0.303*†	0.226*†
	(0.003)	(0.033)	(0.013)	(0.084)	(0.097)	(0.060)	(0.060)
Germany	0.018†	0.078*†	0.082*†	0.310*†	-0.200*†	0.354*†	0.122*†
	(0.004)	(0.020)	(0.018)	(0.073)	(0.087)	(0.069)	(0.025)

Results

Subsample	OLS q	OLS CF	OLS R^2	GMM4 q	GMM4 CF	GMM4 R^2	GMM4 τ^2
Small	0.045*†	0.134*†	0.166*†	0.265*†	-0.147*†	0.522*†	0.300*†
	(0.004)	(0.011)	(0.015)	(0.019)	(0.071)	(0.034)	(0.020)
Large	0.006*†	0.083*†	0.046*†	0.281*†	-0.856*†	0.183*†	0.342*†
	(0.001)	(0.008)	(0.006)	(0.054)	(0.172)	(0.027)	(0.031)
No Bond Rating	0.032*†	0.110*†	0.122*†	0.244*†	-0.247*†	0.444*†	0.291*†
	(0.003)	(0.010)	(0.012)	(0.023)	(0.068)	(0.036)	(0.038)
Bond Rating	0.016*†	0.046†	0.070*†	0.219*†	-0.815*†	0.254*†	0.417
	(0.003)	(0.015)	(0.009)	(0.030)	(0.130)	(0.034)	(0.022)
High Standard Deviation	0.037*†	0.128*†	0.150*†	0.315*†	-0.274*†	0.517*†	0.264*†
	(0.004)	(0.008)	(0.013)	(0.062)	(0.090)	(0.037)	(0.018)
Low Standard Deviation	0.014*†	0.081*†	0.058*†	0.299*†	-0.836*†	0.322*†	0.366*†
	(0.002)	(0.009)	(0.008)	(0.098)	(0.280)	(0.033)	(0.025)
High Serial Correlation	0.023*†	0.088*†	0.102*†	0.248*†	-0.579*†	0.380*†	0.344*†
	(0.003)	(0.009)	(0.008)	(0.025)	(0.072)	(0.033)	(0.017)
Low Serial Correlation	0.033*†	0.122*†	0.122*†	0.213*†	-0.074	0.416*†	0.266*†
	(0.004)	(0.009)	(0.011)	(0.025)	(0.045)	(0.037)	(0.018)

To conclude

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- The dynamic model has uncovered an important <u>SUBSTITUTION</u> mechanism that the simple one–period model by ACW is not able to explain:
  positive productivity shock $\Rightarrow$ more productive capital $\Rightarrow$ firms dissave and invest $\Rightarrow$ negative cash flow sensitivity of cash
- Another example of dynamic trade-off model of the firm that provides theoretical guidance for a better econometric practice in corporate finance