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Firm size, corporate debt, R&D activity, and agency costs: Exploring dynamic and non-linear effects

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Agency Costs in Corporate Finance

Proxy for Agency Costs – Inverse of *Asset Turnover*

**U.S. Information and Communications
Technology (ICT) Firms**

**Annual Data from 1990 to 2013
for 81 ICT Firms**

Blundell and Bond (1998) Two-Step System GMM

Conclusions:

1. ***Asset Turnover Has Inverted U-shaped Relationship with Total Debt***
 - a. Also, consistent with the agency literature, *short-term debt* provides an additional effective monitoring mechanism to alleviate *agency costs*.
2. ***Asset Turnover Has U-shaped Relationship with Firm Size***
3. ***Asset Turnover Has U-shaped Relationship with R&D Activity***

Conclusions (continued):

4. Agency Costs Experience a Minimum Value in the Case of *Total Debt*

- a. The *total debt* of the average firm in the sample falls below the minimum *agency costs*

5. Agency Costs Experience a Maximum Value in the Case of *Firm Size*

- a. The *firm size* of the average firm in the sample falls below the minimum *agency costs*

6. Agency Costs Experience a Maximum Value in the Case of *R&D Activity*

- a. The *R&D activity* of the average firm in the sample falls below the minimum *agency costs*

Conclusions (continued):

7. ***Agency Costs Are Dynamic in Nature, Mean-Reverting, and Persistent Over Time***
8. ***Positive Association between Agency Costs and Firm Profitability***
9. ***Negative Association between Agency Costs and Firm Growth***

Table 1. Descriptive Statistics

Variable	Mean	St. Dev	Min	25%	Median	75%	Max
ATR	1.021	0.511	0.014	0.667	0.940	1.248	3.783
DEBT	0.368	0.193	0.000	0.218	0.342	0.502	0.914
SDEBT	0.698	0.225	0.070	0.540	0.729	0.885	1.000
SIZE	6.219	2.783	0.310	4.035	6.035	8.426	11.867
R&D	0.095	0.086	0.000	0.037	0.074	0.137	0.776
PROF	0.046	0.125	-1.541	0.014	0.057	0.104	0.531
GROWTH	0.100	0.234	-1.054	-0.016	0.074	0.104	1.729

Corporate Finance Agency Costs

- Overinvestment or asset substitution problem
(Jensen and Meckling, 1976)
- Underinvestment and debt overhang problem
(Myers, 1977)

Most Empirical Analysis Considers How Agency Costs Affect Capital Structure and Firm Characteristics

Examples:

Titman and Wessels (1988)

Rajan and Zingales (1995)

Ozkan (2001)

Firm Characteristics Affecting Agency Costs

U.S. Firms

Ang et al. (2000)
Singh and Davidson (2003)
Jelinek and Stuerke (2009)

U.K. Firms

McKnight and Weir (2009)
Florackis and Ozkan (2009)
Florackis (2008)
Zhang and Lee (2008)

Australian Firms

Fleming et al. (2005)
Truong and Heaney (2013)

Role of Governance on Agency Costs

Effect of Firm Characteristics on Agency Costs

1. R&D Activity

2. Firm Size

3. Corporate Debt

Dynamic Panel Data Model

Nonlinearities in Effects

Blundell and Bond (1998)

Model

$$AC = F(ATR)$$

$$\begin{aligned} ATR_{it} = & \lambda ATR_{it-1} + \beta_1 R\&D_{it-1} + \beta_2 DEBT_{it-1} + \beta_3 SIZE_{it-1} \\ & + \beta_4 SDEBT_{it-1} + \gamma_1 R\&D^2_{it-1} + \gamma_2 DEBT^2_{it-1} \\ & + \gamma_3 SIZE^2_{it-1} + \mu_i + \theta_t + \varepsilon_{it} \end{aligned}$$

$$\beta_1 + 2\gamma_1 R\&D_{it-1}$$

$$\beta_2 + 2\gamma_2 DEBT_{it-1}$$

$$\beta_3 + 2\gamma_3 SIZE_{it-1}$$

Table 2. Pearson Correlation Matrix

	ATR	DEBT	SDEBT	SIZE	R&D	PROF	GROWTH
ATR	1.000						
DEBT	0.177	1.000					
SDEBT	0.296	-0.418	1.000				
SIZE	-0.393	0.343	-0.285	1.000			
R&D	-0.420	-0.267	0.017	0.104	1.000		
PROF	0.055	-0.143	0.149	0.136	-0.265	1.000	
GROWTH	-0.017	-0.054	0.082	0.049	-0.082	0.506	1.000

Table 3a. Parameter estimates of the dynamic agency costs adjustment model: Full sample

Independent Variables	Model 1	Model 2	Model 3	Model 4
ATR(t-1)	0.526	0.423	0.556	0.543
	(6.45)	(5.36)	(6.21)	(7.61)
SIZE(t-1)	-0.048	-0.161	-0.038	-0.188
	(-4.77)	(-3.72)	(-3.60)	(-4.92)
SIZE SQ(t-1)		0.009		0.012
		(3.23)		(4.36)
DEBT(t-1)	0.847	3.431	0.614	3.154
	(4.12)	(4.04)	(2.95)	(3.29)
DEBT SQ(t-1)		-3.31		-3.205
		(-3.77)		(-3.14)
R&D(t-1)	-0.556	-2.412	-0.659	-2.050
	(-2.10)	(-3.54)	(-2.50)	(-3.15)
R&D SQ(t-1)		5.215		4.258
		(3.40)		(2.91)
SDEBT(t-1)	0.281	0.402	0.255	0.411
	(3.02)	(3.64)	(2.60)	(3.34)
GROWTH(t-1)			0.041	0.060
			(1.42)	(2.20)
PROF(t-1)			-0.370	-0.301
			(-3.12)	(-3.24)

**Table 3b. Parameter Estimates of the Dynamic Agency Costs Adjustment Model:
Full Sample, Non-Linearity Tests**

Independent Variables	Model 1	Model 2	Model 3	Model 4
Lind-Mehlum test on <i>R&D</i>				
Overall test		3.37		2.87
p-value		0.000		0.000
Turning point (min)		0.231		0.241
95% Fieller CI		0.19 0.29		0.18 0.34
Lind-Mehlum test on <i>SIZE</i>				
Overall test		2.23		2.68
p-value		0.013		0.003
Turning point (min)		8.564		8.683
95% Fieller CI		7.72 10.86		7.77 10.44
Lind-Mehlum test on <i>DEBT</i>				
Overall test		3.38		4.38
p-value		0.000		0.000
Turning point (max)		0.517		0.512
95% Fieller CI		0.48 0.58		0.46 0.56

Table 4a. Parameter Estimates of the Dynamic Agency Costs Adjustment Model Excluding SDEBT: Full Sample

Independent Variables	Model 5	Model 6	Model 7	Model 8
ATR(t-1)	0.581	0.508	0.676	0.626
	(8.62)	(7.95)	(11.31)	(10.91)
SIZE(t-1)	-0.042	-0.224	-0.035	-0.200
	(-4.17)	(-4.89)	(-3.98)	(-5.09)
SIZE SQ(t-1)		0.013		0.012
		(4.47)		(5.05)
DEBT(t-1)	0.501	4.561	0.488	2.600
	(3.32)	(3.69)	(3.04)	(2.62)
DEBT SQ(t-1)		-4.823		-2.902
		(-3.54)		(-2.57)
R&D(t-1)	-0.687	-1.986	-0.636	-1.998
	(-2.37)	(-2.60)	(-2.38)	(-3.35)
R&D SQ(t-1)		4.441		4.271
		(2.47)		(3.14)
GROWTH(t-1)			0.067	0.080
			(2.36)	(3.33)
PROF(t-1)			-0.445	-0.296
			(-3.25)	(-3.01)

**Table 4b. Parameter Estimates of the Dynamic Agency Costs Adjustment Model
Excluding SDEBT: Full Sample, Non-Linearity Tests**

Independent Variables	Model 1	Model 2	Model 3	Model 4
Lind-Mehlum test on <i>R&D</i>				
Overall test		2.46		3.10
p-value		0.007		0.000
Turning point (min)		0.223		0.234
95% Fieller CI		0.17 0.33		0.18 0.31
Lind-Mehlum test on <i>SIZE</i>				
Overall test		3.54		4.55
p-value		0.000		0.000
Turning point (min)		8.158		7.750
95% Fieller CI		7.62 9.06		7.15 8.41
Lind-Mehlum test on <i>DEBT</i>				
Overall test		3.36		2.50
p-value		0.000		0.006
Turning point (max)		0.472		0.447
95% Fieller CI		0.44 0.51		0.44 0.52

Conclusions:

- 1. *Asset Turnover* Has Inverted U-shaped Relationship with *Total Debt***
- 2. *Asset Turnover* Has U-shaped Relationship with *Firm Size***
- 3. *Asset Turnover* Has U-shaped Relationship with *R&D Activity***