

Auerbach and Hassett (2002): On the marginal source of investment funds

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Motivating questions

- What is the marginal source of funds for investment?
 - Traditional: new shares.
 - New view: retained earnings.
- Do dividend taxes affect cost of capital?
 - Traditional: additional wedge on corporate investment.
 - New view: No effect on investment. Tax advantage exactly offsets future taxation.
- How to answer these questions empirically?

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- Tax rates θ on dividends and c on accrued capital gains.
- V_t : firm value.
- V_t^N : value of new shares issued at the beginning of period t .
- D_t : firm's total dividend at the end of period t .
- Capital market equilibrium:

$$\tilde{\rho} = \frac{D_t}{V_t}(1 - \tilde{\theta}) + \frac{(V_{t+1} - V_{t+1}^N) - V_t}{V_t}(1 - c) \quad (1)$$

Rewrite (1) as a difference equation:

$$\left(1 + \frac{\tilde{\rho}}{1-c}\right) V_t = V_{t+1} + \left(\frac{1-\tilde{\theta}}{1-c}\right) D_t - V_{t+1}^N \quad (2)$$

Investment (no depreciation):

$$I_t = K_{t+1} - K_t$$

Resource constraint:

$$\pi(K_t) + V_{t+1}^N = D_t + I_t \quad (3)$$

and $D_t \geq 0$.

Bellman equation:

$$V(K_t) = \frac{1}{1 + \rho_t} [-\theta D_t + \pi(K_t) - I_t + V(K_{t+1})]$$
$$D_t \geq 0$$

with

$$\rho_t \equiv \frac{\tilde{\rho}_t}{1 - c}, \quad \theta \equiv \frac{\tilde{\theta} - c}{1 - c}$$

- Functional form for cost of capital

$$\rho_t = \rho(D_t, \pi_t, V_{t+1}^N)$$

- Traditional view:

$$\rho_t = \rho(D_t/\pi_t), \quad \rho'(\cdot) < 0$$

Cost of capital is reduced by paying out higher share of earnings as dividends.

- New view:

$$\rho_t = \rho(V_{t+1}^N), \quad \rho'(\cdot) < 0$$

Only the issuance or repurchase of shares matters for the cost of capital.

- Tobin's Q

$$V'_{t+1} = 1 - \theta \frac{\rho_3}{\rho_1 + \rho_3}$$

- Assume V' is constant:

$$\pi' = \frac{\rho_t}{1 + \theta \frac{\rho_2}{\rho_1 + \rho_3(1-\theta)}}$$

- $\theta = 0$: $V' = 1$, $\pi' = \rho_t$.

Traditional view: $\rho_t = \rho(D_t/\pi_t)$

- $\rho_3 = 0$, $\rho_1/\rho_2 = -D_t/\pi_t$.
- Tobin's Q & cost of capital

$$V'_{t+1} = 1$$
$$\pi' = \frac{\rho_t}{1 - \theta \frac{D_t}{\pi_t}}$$

- Lower ρ_t offsets tax cost on dividends.
- θ affects cost of capital, not marginal valuation.
- Marginal investment: financed by V'_{t+1} .

New view: $\rho_t = \rho(V_{t+1}^N)$

- $\rho_1 = \rho_2 = 0$

$$V'_{t+1} = 1 - \theta$$

- Assume V' is constant:

$$\pi' = \rho_t$$

- Dividend taxes do not affect cost of capital (assume constant θ)
- But they lower marginal valuation V'_{t+1} .

- Traditional view
 - ① Marginal source of funds: new shares
 - ② Dividend taxes: no impact on marginal valuation, but increases cost of capital.
- New view:
 - ① Marginal source of funds: retained earnings.
 - ② Dividend taxes: no impact on investment incentives (cost of capital), but lower marginal valuation.

- Suppose: $\pi_t = \pi(K_t) + \eta_t$, and $K_{t+1} = K_t + I_t - \eta_t$.
- Set $I_t^{new} = I_t^{old} + \eta_t$ restores old equilibrium, if ρ constant.
 - New view: $\rho(V_{t+1}^N)$ independent of profit, so dividend does not react.
 - Traditional view: $\rho(D_t/\pi_t)$ reacts to profit/cash flow \rightarrow desire to use part of η_t to pay dividends.

- Regression

$$\left(\frac{\textit{dividend}}{\textit{asset}}\right)_{it} = \alpha + \beta_1 \textit{cashflow}_{it-1} + \beta_2 \textit{investment}_{it-1} + \gamma \textit{firmvalue}_{it} \\ + \delta_t + \textit{contr}_{it} + \varepsilon_{it}$$

Null hypothesis: $\beta_1 + \beta_2 = 0$ for new view.

- Caveat: no investment adjustment cost, serially correlated errors.
- Data: Compustat 1982-1998.

Results: basic models

Table 2
Basic dividend models (dependent variable: dividend/assets ratio; sample period: 1982–98)

Sample	All	All	Mature	Mature	Mature	Mature	Mature
<i>Independent variable</i>							
Investment (-1)	-0.014 (0.001)	-0.063 (0.003)	-0.038 (0.003)	-0.042 (0.003)	-0.039 (0.004)	-0.044 (0.004)	-0.093 ^a (0.007)
Investment (-2)	-	-	-	-	-	-0.016 (0.003)	-
Cash (-1)	0.029 (0.001)	0.167 (0.004)	0.096 (0.005)	0.160 (0.008)	0.141 (0.007)	0.113 (0.008)	0.236 ^a (0.005)
Cash (-2)	-	-	-	-	-	0.059 (0.008)	-
Value (-1)	0.001 (0.0001)	-0.005 (0.0003)	0.007 (0.001)	0.005 (0.001)	0.007 (0.001)	0.005 (0.001)	0.006 (0.0004)
Value (-2)	-	-	-	-	-	0.001 (0.001)	-
Debt (-1)	-0.009 (0.0005)	-0.017 (0.001)	-0.009 (0.001)	-0.014 (0.002)	-0.035 (0.002)	-0.015 (0.004)	-0.038 (0.002)
Debt (-2)	-	-	-	-	-	-0.019 (0.003)	-
Dummies?	No	No	No	No	Yes	Yes	Yes
\bar{R}^2	0.070	-	0.190	-	-	-	-
Observations	68 578	68 578	30 881	30 881	27 627	27 627	27 627
Estimation technique	OLS	Tobit	OLS	Tobit	Tobit	Tobit	IV Tobit

Notes: All specifications include year dummies.
Investment, cash, value, and debt are divided by firm assets.
Robust standard errors are in parentheses.

^a = current value.

Mature firms sample

Table 3

Mature firm models (dependent variable: dividend/assets ratio; sample period: 1985–98)

Sample	All mature firms	Analysts, bond rating	Analysts, no bond rating	No analysts, no bond rating
<i>Independent variable</i>				
Investment	-0.092 (0.008)	0.005 (0.011)	-0.113 (0.012)	-0.080 (0.025)
Cash	0.238 (0.006)	0.195 (0.010)	0.185 (0.013)	0.318 (0.012)
Value (-1)	0.007 (0.0005)	0.005 (0.001)	0.007 (0.001)	0.013 (0.001)
Debt (-1)	-0.043 (0.002)	-0.031 (0.003)	-0.042 (0.004)	-0.053 (0.005)
Observations	22 369	6162	8384	6857

Notes: All specifications estimated as Instrumental Variables Tobits, with year, industry, and firm fixed effect dummies.

Investment, cash, value, and debt are divided by firm assets.

Robust standard errors are in parentheses.

External Equity Decision

Table 4
Determinants of new share issues and repurchases (mature firms, bivariate probit; sample period: 1985–98)

Dependent variable:	New shares	$\partial F / \partial x$	Repurchases	$\partial F / \partial x$
<i>Independent variable</i>				
Investment (-1)	1.236 (0.136)	0.257	-1.138 (0.216)	-0.165
Investment (-2)	0.187 (0.097)	0.039	-0.297 (0.150)	-0.043
Cash (-1)	-0.464 (0.164)	-0.096	1.258 (0.205)	0.182
Cash (-2)	-0.767 (0.167)	-0.160	0.587 (0.199)	0.085
Value (-1)	0.196 (0.025)	0.041	-0.107 (0.026)	-0.016
Value (-2)	-0.185 (0.032)	-0.038	-0.065 (0.026)	-0.009
Debt (-1)	0.740 (0.125)	0.154	-1.050 (0.150)	-0.152
Debt (-2)	0.612 (0.124)	0.127	-0.008 (0.149)	-0.001
Pseudo R^2		0.132		
Observations		22 352		
Correlation		0.998		

Notes: Both branches include year, industry, and size dummies, plus dummies for bond rating and number of analysts.

Investment, cash, value, and debt are divided by firm assets.

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No net impact of investment and cash on

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Effects of bond rating

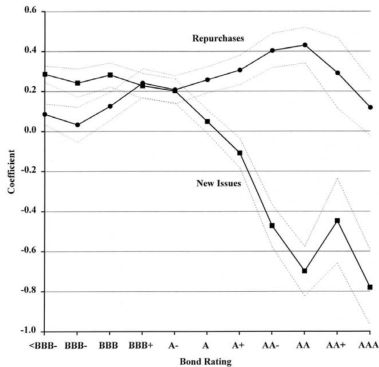
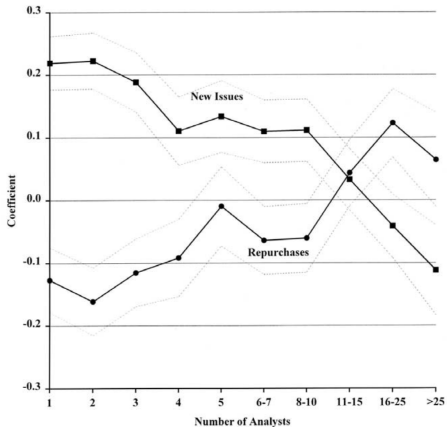


Fig. 3. Effects of bond rating on new issue and repurchase activity (relative to no bond rating).

Effects of analysts



Sample splits based on new issue and repurchase probabilities

Table 5

Sample splits based on new issue and repurchase probabilities (dependent variable: dividend/assets ratio; sample period: 1985–98)

Sample:	Repurchase High (pr>0.140)	Repurchase Low (pr<0.063)	New issue High (pr>0.202)	New issue Low (pr<0.095)
<i>Independent variable</i>				
Investment	-0.172 (0.015)	-0.024 (0.013)	0.010 (0.009)	-0.242 (0.015)
Cash	0.241 (0.016)	0.222 (0.011)	0.147 (0.008)	0.313 (0.013)
Value (-1)	0.011 (0.001)	0.006 (0.001)	0.005 (0.001)	0.009 (0.001)
Debt (-1)	-0.011 (0.005)	-0.045 (0.003)	-0.032 (0.004)	-0.024 (0.005)
Observations	7511	7507	7511	7507

Notes: All specifications estimated as Instrumental Variables Tobits, with year, industry, and size dummies.

Investment, cash, value, and debt are divided by firm assets.

Robust standard errors are in parentheses.

Further sample splits

Table 6

Further sample splits (dependent variable: dividend/assets ratio; sample period: 1985–98)

Sample:	New issue low ($pr < 0.095$)	New issue low ($pr < 0.095$)	New issue low ($pr < 0.141$)	New issue high ($pr > 0.141$)
<i>Independent variable:</i>	Analysts ≤ 15 , or Rating $< A+$	Analysts > 15 & Rating $\geq A+$	& Repurchase Low ($pr < 0.097$)	& Repurchase High ($pr > 0.097$)
Investment	-0.250 (0.016)	-0.109 (0.030)	-0.221 (0.028)	-0.075 (0.020)
Cash	0.327 (0.014)	0.216 (0.034)	0.264 (0.015)	0.234 (0.022)
Value (-1)	0.009 (0.001)	0.007 (0.001)	0.008 (0.001)	0.005 (0.002)
Debt (-1)	-0.024 (0.006)	-0.017 (0.007)	-0.061 (0.008)	-0.035 (0.008)
Observations	6696	811	3575	3579

Notes: All specifications estimated as Instrumental Variables Tobits, with year, industry, and size dummies.

Investment, cash, value, and debt are divided by firm assets.

Robust standard errors are in parentheses.

- Many firms do vary dividends in response to cash flow, investment, and debt.
 - small firms with weak market access.
 - very large firms with high bond rating and rely more on debt.
- The use of new share issues does not say anything about the impact of dividend taxes on the cost of capital.
 - Evidence for new view (constant ρ_t) “found” for firms with low probability of issuing shares.
 - But rejected by formal tests.
- The authors: “There is no reason to argue which “view” is “correct”. [...] We have failed to prove that dividend taxes have no effect at all on the cost of capital. [...] Our methodology is too simple...”