A LINTNER MODEL OF DIVIDENDS AND MANAGERIAL RENTS

Bart Lambrecht
University of Lancaster
Department of Accounting and Finance

Stewart C. Myers
MIT Sloan School of Management

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Introduction

- Lintner's (1956) dividend model:

$$\Delta Div_t \;=\; \kappa + PAC\;(Target\,Dividend_t \;-\; Div_{t-1}) + e_t$$

- Model features:

- target dividend equals (contemporaneous) net income times the payout ratio
- dividend based on net income, but smoothed
- transitory shocks are smoothed out
- gradual adjustment to a permanent shock

- In absence of stock issues, payout smoothing means shocks in profitability are absorbed elsewhere:

$$\Delta D_t + Net\,Income_t \;=\; CAPEX_t + Payout_t \qquad (1)$$

- Net debt is shock absorber if CAPEX determined by firm's investment opportunities

- Consider market-value balance sheet:

$V_t(K)$	$(1+\rho)D_{t-1}$
	R_t
	S_t
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V_t	V_t

Interest on debt $= \rho\, D_{t-1}$

Annual rents $= r_t$

Dividends $= d_t$

$$S_t \;\geq\; \alpha\,[V_t \,-\, (1+\rho)D_{t-1}\,]$$

- Budget constraint for period t (for fixed K):

$$\rho\, D_{t-1} \,+\, d_t \,+\, r_t \,=\, K^{\phi}\pi_t \,+\, (D_t \,-\, D_{t-1})$$

Related Literature

- Literature on dividends and payout:

  - Asymmetric info and signalling: Bhattachary (1979), Miller & Rock (1985), John & Williams (1985)
  - Agency: Easterbrook (1984), Jensen (1986), Zwiebel (1996) Myers (2000), Lambrecht & Myers (2007,2008)

- Household consumption literature:

  - PIH: Friedman (1957), Hall (1978), Caballero (1990)
  - Habit formation: Muellbauer (1988), Sundaresan (1989), Constantinides (1990)

The Model

- Managers maximize NPV of their life-time utility:

$$U(r_t, r_{t-1}) \;=\; u\left(r_t - h\, r_{t-1}\right) = 1 - \frac{1}{\theta} e^{-\theta(r_t - h r_{t-1})} \equiv u(\hat{r}_t)$$

- risk aversion ($u`` < 0$)
- habit formation ($1 > h \geq 0$)
- subjective discount factor: ω ($\leq \beta \equiv \frac{1}{1+\rho}$)

- uncertainty: $\pi_t = \mu\pi_{t-1} + \eta_t$ (η_t i.i.d.: $N(0, \sigma_\eta)$)

$$\max E_t \left[\sum_{j=0}^{\infty} \omega^j U(r_{t+j}, r_{t+j-1}) \right]$$

subject to the constraints:

$$S_t \equiv d_t + \beta E_t [S_{t+1}] = \alpha [V_t - (1+\rho) D_{t-1}]$$

$$D_t = D_{t-1}(1+\rho) + d_t + r_t - K^{\phi} \pi_t$$

$$\lim_{j \to \infty} \left[\frac{D_{t+j}}{(1+\rho)^j} \right] = 0$$

Proposition 1 *Dividends are tied to managers' rents and given by:* $d_t = \left(\frac{\alpha}{1-\alpha}\right) r_t \equiv \gamma r_t$,

Proposition 2 *Managers' rents are given by:*

$$r_t = \beta h r_{t-1} + (1 - h\beta)(1-\alpha)Y_t + c \qquad (2)$$

$$c \equiv \left(\frac{\beta}{(1-\beta)\theta}\right) ln\left(\frac{\beta}{\omega}\right) - \frac{(1-\alpha)^2\beta(1-\beta)(1-h\beta)^2}{(1-\beta\mu)^2}\frac{\theta}{2}{\sigma_\eta}^2 K^{2\phi}$$

where Y_t *is the firm's "permanent income".*

$$Y_t = \rho\beta\sum_{j=0}^{\infty}\beta^j K^\phi E_t\left[\pi_{t+j}(\eta_{t+j})\right] - \rho D_{t-1} \qquad (3)$$

Optimal dividend policy

Corollary 3 *The firm's dividend policy is given by the following partial adjustment model:*

$$d_t - d_{t-1} = (1 - \beta h)(\alpha Y_t - d_{t-1}) + \kappa \quad (4)$$

$$\kappa \equiv \frac{\alpha c}{1-\alpha} = \text{dissavings} - \text{precautionary savings}$$

$$\text{dissavings} \equiv \left(\frac{\alpha\beta}{(1-\alpha)(1-\beta)\theta}\right) ln\left(\frac{\beta}{\omega}\right)$$

$$\text{precautionary savings} \equiv \alpha(1-\alpha)\left(\frac{\beta(1-\beta)(1-h\beta)^2}{(1-\beta\mu)^2}\right)\frac{\theta}{2}{\sigma_\eta}^2 K^{2\phi}$$

Dividend Smoothing

- PAC $\equiv [1 - \beta h]$ decreases with:

- habit persistence ($\frac{\partial PAC}{\partial h} < 0$)
- the market discount factor ($\frac{\partial PAC}{\partial \beta} < 0$)

- **Property:**

$$\Delta d_t = h \Delta d_{t-1} - \frac{\alpha \rho c}{1 - \alpha} + \alpha (1 - \beta h) \nu_t$$

$$var(\Delta d_t) = \Lambda^2 \alpha^2 \left[K^{2\phi} {\sigma_\eta}^2 \right]$$

where $\Lambda = \frac{(1-\beta h)(1-\beta)}{1-\beta \mu} < 1$ and ν_t is white noise

$$
\begin{aligned}
\frac{\partial Y_t}{\partial \tau_t} &= \rho\beta \;\; (\approx \; 0.05) \\
\frac{\partial Y_t}{\partial \eta_t} &= \frac{\rho\beta}{1-\mu\beta} \;\; (= 1 \; for \; \mu = 1) \\
\frac{\partial d_t}{\partial \tau_t} &= PAC\,\alpha\,\rho\beta \;\; (\approx \; 0.01) \\
\frac{\partial d_t}{\partial \eta_t} &= PAC\,\alpha \left(\frac{\rho\beta}{1-\beta\mu}\right) \;\; (\approx \; 0.3 \; for \; \mu = 1) \\
\frac{\partial \left[D_t \; - \; D_{t-1}\right]}{\partial \tau_t} &= (1-\beta h)\rho\beta - 1 \; < \; 0 \\
\frac{\partial \left[D_t \; - \; D_{t-1}\right]}{\partial \eta_t} &= \frac{(1-\beta h)\rho\beta}{1-\beta\mu} \; - \; 1 \; < \; 0 \qquad (5)
\end{aligned}
$$

Habit formation and risk aversion each induce smoothing.

Dividends and stock prices

$$S^e{}_t \;=\; \sum_{j=1}^{\infty} E_t[d_{t+j}]\beta^j \;=\; \frac{\alpha Y_t}{\rho\beta} - d_t \equiv S_t - d_t$$

- Announcing an unanticipated dividend change Δd_t causes:

$$\Delta S_t = \frac{\Delta d_t}{(1-\beta h)\rho\beta} \tag{6}$$

Optimal Investment Policy

- K financed by debt and equity issue: $K = \Delta D + \Delta S$
- But: $\Delta S = \alpha\,(\Delta V - \Delta D)$
- Hence: $\Delta D(K) \equiv \frac{K-\alpha\Delta V}{1-\alpha}$

- Managers choose K in order to maximize:

$$\max_{K} \sum_{j=0}^{\infty} \omega^{j}\, E_t[u(\hat{r}_{t+j})] \quad \text{where } \hat{r}_{t+j} \equiv r_{t+j} - hr_{t+j-1}$$

Proposition 4 *The managers' optimal investment policy K is the solution to:*

$$\phi K^{\phi-1}\sum_{j=1}^{\infty}\beta^{j}\,E_t[\pi_{t+j}]-1\;=\;\frac{\theta{\sigma_\eta}^2(1-\alpha)^2\beta(1-h\beta)\phi K^{2\phi-1}}{(1-\beta\mu)^2}$$

- Risk averse managers underinvest

- Habit formation mitigates underinvestment

Conclusions and Empirical Implications

- Investment, debt and payout policy modeled jointly
- Agency model of payout: managers' rents tied to dividends
- Managers' risk aversion and habit formation create desire to smooth rents
- Persistent and transitory earnings affect dividends differently

- We obtain Lintner model with following features:

  - PAC decreases with h and β
  - target dividend payout increases with investor protection
  - constant term increases with impatience and h, but decreases with risk aversion and earnings volatility
  - net debt absorbs shocks and CAPEX

- Risk averse managers under-invest (absent private benefits)
- Habit formation mitigates underinvestment