A LINTNER MODEL OF DIVIDENDS AND MANAGERIAL RENTS

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Introduction

- Lintner’s (1956) dividend model:

\[ \Delta \text{Div}_t = \kappa + PAC (\text{Target Dividend}_t - \text{Div}_{t-1}) + e_t \]

- 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:

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

- Net debt is shock absorber if CAPEX determined by firm’s investment opportunities
- Consider market-value balance sheet:

\[
\begin{array}{c|c}
V_t(K) & (1 + \rho)D_{t-1} \\
R_t & \\
S_t & \\
V_t & V_t \\
\end{array}
\]

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)

- Household consumption literature:
  - PIH: Friedman (1957), Hall (1978), Caballero (1990)
The Model

- Managers maximize NPV of their life-time utility:

\[ U(r_t, r_{t-1}) = u(r_t - h r_{t-1}) = 1 - \frac{1}{\theta} e^{-\theta(r_t - h r_{t-1})} \equiv u(\hat{r}_t) \]

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

- uncertainty: \(\pi_t = \mu \pi_{t-1} + \eta_t \quad (\eta_t \text{i.i.d.: } N(0, \sigma_\eta))\)
\[
\max E_t \left[ \sum_{j=0}^{\infty} \omega^j U(r_{t+j}, r_{t+j-1}) \right]
\]

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:

\[
r_t = \beta h r_{t-1} + (1 - h \beta)(1 - \alpha) Y_t + c
\]

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

where \( Y_t \) is the firm’s “permanent income”.

\[
Y_t = \rho \beta \sum_{j=0}^{\infty} \beta^j K^\phi E_t [\pi_{t+j}(\eta_{t+j})] - \rho D_{t-1}
\]
Optimal dividend policy

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

\[ d_t - d_{t-1} = (1 - \beta h)(aY_t - d_{t-1}) + \kappa \]  

(4)

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

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

\[ \text{precautionary savings} \equiv \alpha(1-\alpha) \left( \frac{\beta(1-\beta)(1-h\beta)^2}{(1-\beta\mu)^2} \right) \frac{\theta}{2} \sigma^2 \eta^2 K^{2\phi} \]
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 \( \nu_t \) is white noise
\[ \frac{\partial Y_t}{\partial \tau_t} = \rho \beta \quad (\approx 0.05) \]
\[ \frac{\partial Y_t}{\partial \eta_t} = \frac{\rho \beta}{1 - \mu \beta} \quad (= 1 \text{ for } \mu = 1) \]
\[ \frac{\partial d_t}{\partial \tau_t} = PAC \alpha \rho \beta \quad (\approx 0.01) \]
\[ \frac{\partial d_t}{\partial \eta_t} = PAC \alpha \left( \frac{\rho \beta}{1 - \beta \mu} \right) \quad (\approx 0.3 \text{ for } \mu = 1) \]
\[ \frac{\partial [D_t - D_{t-1}]}{\partial \tau_t} = (1 - \beta h)\rho \beta - 1 < 0 \]
\[ \frac{\partial [D_t - D_{t-1}]}{\partial \eta_t} = \frac{(1 - \beta h)\rho \beta}{1 - \beta \mu} - 1 < 0 \quad (5) \]

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 \( \Delta d_t \) causes:

\[ \Delta S_t = \frac{\Delta d_t}{(1 - \beta h) \rho \beta} \]  

(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:

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