

Corporate Finance: Payout policies

Yossi Spiegel

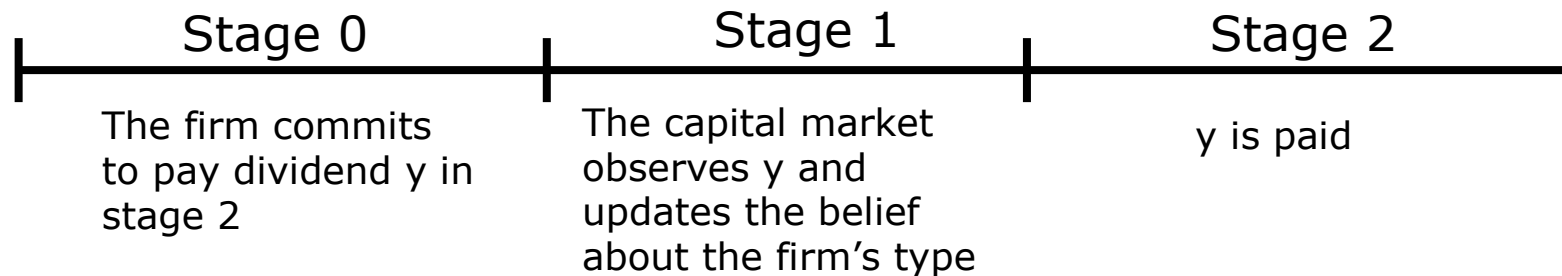
Recanati School of Business

Bhattacharya, BJE 1979

“Imperfect Information, Dividend Policy, and “The Bird in the Hand” Fallacy”

The model

- The timing:



- Cash flow is $x \sim U[0, T]$, where $T \in \{L, H\}$, $L < H$
- T is private info. to the firm; the market believes that $T = H$ with prob. γ
- If $y > x$, the firm bears a loss of $b(y-x)$
- Dividend tax t
- The manager's utility: $U = \alpha V + (1-\alpha)V_T$

The full information case

- The value of the firm when T is common knowledge:

$$V = V_T = \left[\int_0^T [(x - y) + y(1 - t)] dF(x) - b \int_0^y (y - x) dF(x) \right]$$

- With uniform dist.

$$V = V_T = \frac{T}{2} - ty - \frac{by^2}{2T}$$

- The manager's utility:

$$U = \alpha V_T + (1 - \alpha) V_T = \frac{T}{2} - ty - \frac{by^2}{2T}$$

- The manager will set $y = 0$

Asymmetric information

- y_T^* is the dividend of type T

- B^* is the prob. that the capital market assigns to the firm being of type T

- Perfect Bayesian Equilibrium (PBE), (y_H^*, y_L^*, B^*) :
 - y_H^* and y_L^* are optimal given B^*
 - B^* is consistent with the Bayes rule

Separating equilibria: $y_H^* \neq y_L^*$

- The belief function:

$$B^* = \begin{cases} 1 & y = y_H^* \\ 0 & y = y_L^* \\ ? & o/w \end{cases}$$

- In a separating equil., $y_L^* = 0$ because type L cannot boost V by paying dividend
- $y_L^* = 0 \Rightarrow B^*(0) = 0 \Rightarrow V(0) = L/2$

Separating equilibrium

- The IC constraint of H:

$$\underbrace{\alpha V + (1 - \alpha) \left(\frac{H}{2} - ty - \frac{by^2}{2H} \right)}_{\text{Payoff of H when paying dividend } y} \geq \underbrace{\alpha \frac{L}{2} + (1 - \alpha) \frac{H}{2}}_{\text{Payoff of H when } y = 0}$$

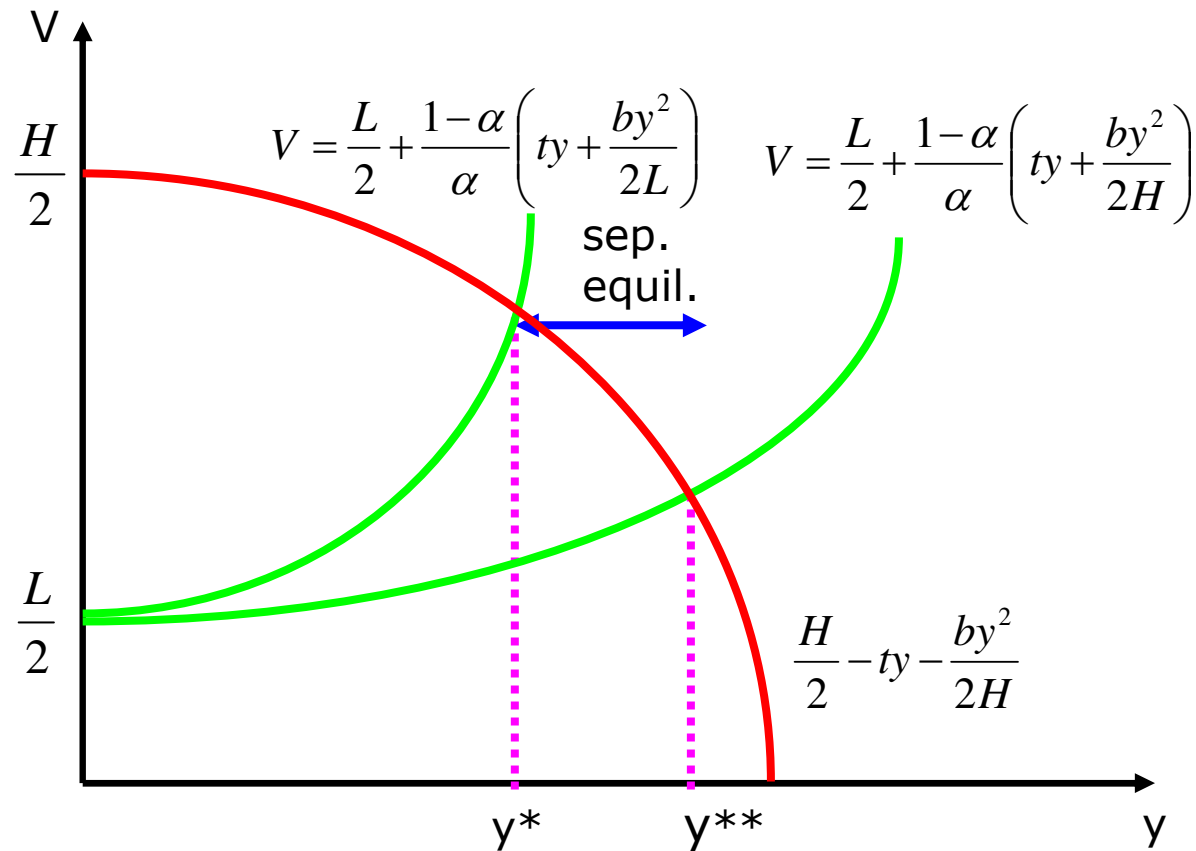
- The IC constraint of L:

$$\underbrace{\alpha V + (1 - \alpha) \left(\frac{L}{2} - ty - \frac{by^2}{2L} \right)}_{\text{Payoff of L when paying dividend } y} \leq \underbrace{\alpha \frac{L}{2} + (1 - \alpha) \frac{L}{2}}_{\text{Payoff of L when } y = 0}$$

- Indifference of type T between V and y:

$$\alpha V + (1 - \alpha) \left(\frac{T}{2} - ty - \frac{by^2}{2T} \right) = \alpha \frac{L}{2} + (1 - \alpha) \frac{T}{2} \Rightarrow V = \frac{L}{2} + \frac{1 - \alpha}{\alpha} \left(ty + \frac{by^2}{2T} \right)$$

The set of separating equilibria



The dividend of type H under the DOM criterion

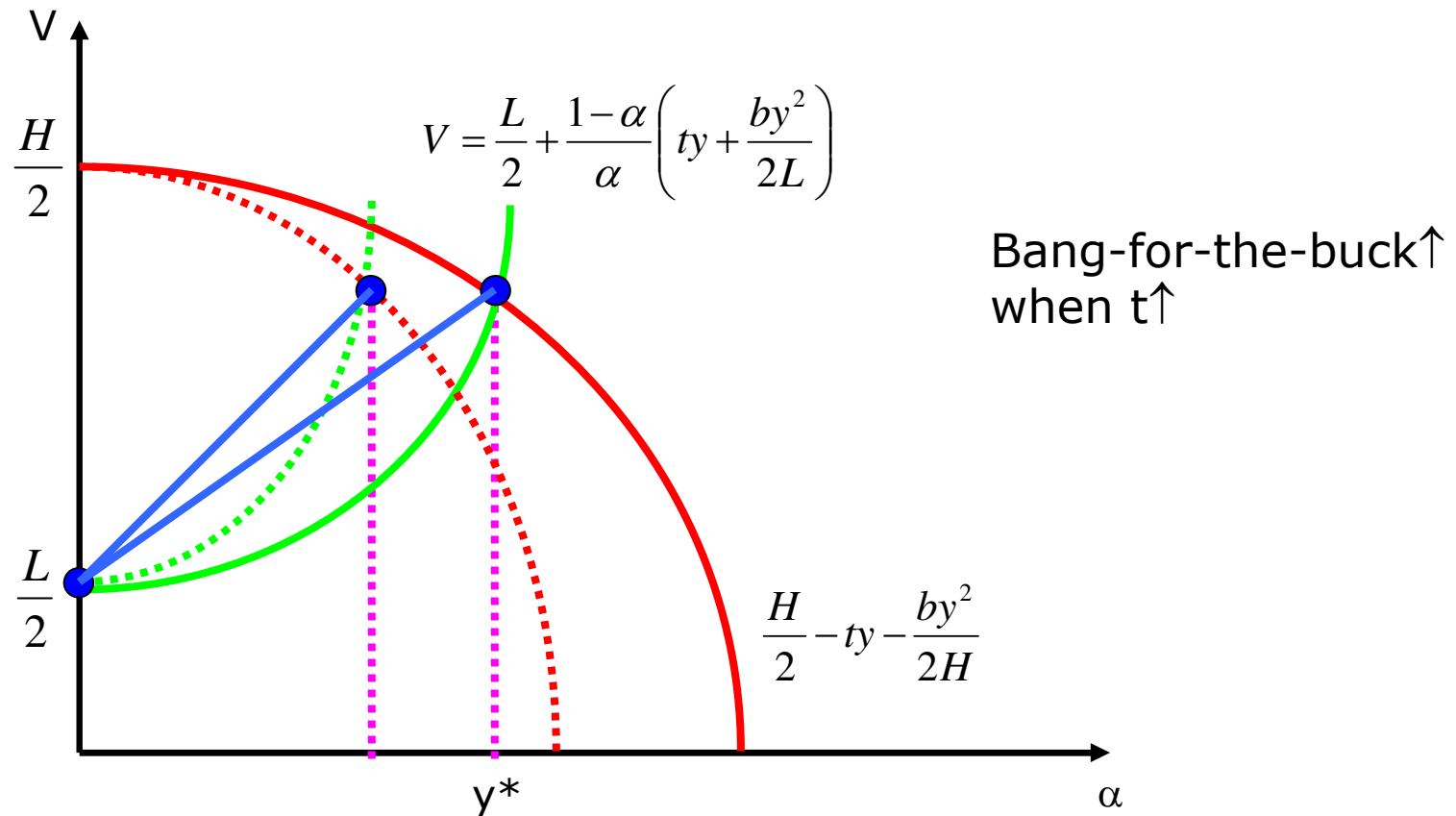
- The DOM criterion eliminates all separating equilibria except the Riley outcome:

$$\underbrace{\frac{H}{2} - ty - \frac{by^2}{2H}}_{\text{Value when the market believes that the firm's type is H}} = \underbrace{\frac{L}{2} + \frac{1-\alpha}{\alpha} \left(ty + \frac{by^2}{2L} \right)}_{\text{Indifference curve for firm L}}$$

- Solving:

$$y^* = \frac{-tHL + \sqrt{t^2 H^2 L^2 + 2\alpha b(H-L)HL(\alpha L + (1-\alpha)H)}}{b(\alpha L + (1-\alpha)H)}$$

Bang-for-the-buck (the effect of y on the firm's value)

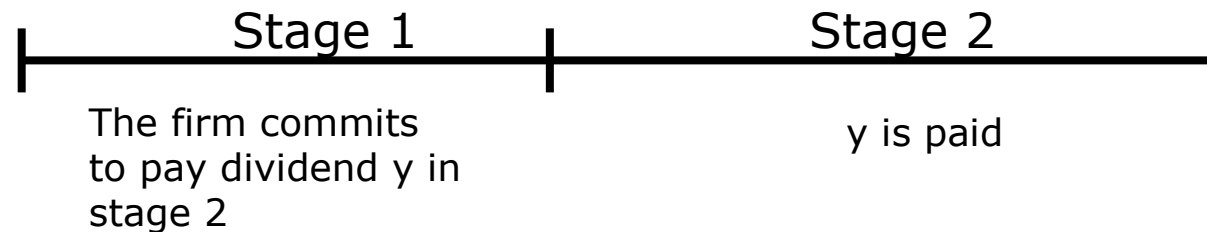


Bernheim and Wantz, AER 1995

“A tax-based test of the dividend signaling hypothesis”

An agency model of dividends - private info. about preferences

- The timing:



- Cash flow before dividends is Y
- The value of the firm is $v(Y-y)$
- Cum dividend value of the firm: $v(Y-y) + (1-t)y$, (t is dividend tax)
- The manager gets private benefits $w(Y-y)$
- The manager's utility: $U = v(Y-y) + (1-t)y + \theta w(Y-y)$, $\theta \sim [\theta_0, \theta_1]$

The manager's problem

- The manager chooses y to maximize:

$$U = \underbrace{v(Y - y) + (1 - t)y}_{\text{Cum dividend value}} + \underbrace{\theta w(Y - y)}_{\text{Private benefits}}$$

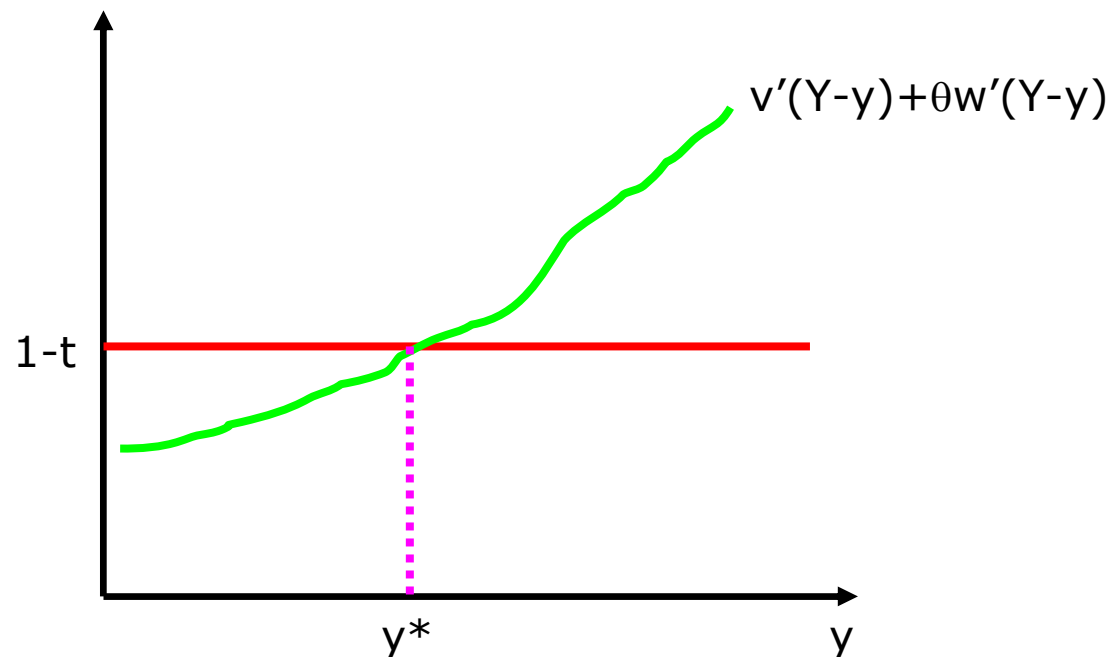
- F.O.C:

$$U' = \underbrace{1 - t}_{\text{Benefit of dividends}} - \left(\underbrace{v'(Y - y) + \theta w'(Y - y)}_{\text{Cost of dividends}} \right) = 0$$

- S.O.C:

$$U'' = \underbrace{v''(Y - y)}_{<0 \text{ by assumption}} + \underbrace{\theta w''(Y - y)}_{<0 \text{ by assumption}} < 0$$

Illustrating the manager's problem



- $t \uparrow \Rightarrow y^* \downarrow$ (the benefits of y is smaller)
- $\theta \uparrow \Rightarrow y^* \downarrow$ (the cost of y is bigger)

Bang-for-the-buck

- The cum dividend value of the firm in equil.:

$$V^* = v(Y - y^*) + (1-t)y^*$$

- Suppose that θ is private info. for the manager. The ex. value of the firm before y is paid:

$$E_\theta V^* = E_\theta v(Y - y^*) + (1-t)E_\theta y^*$$

- Effect of y on firm value:

$$A \equiv V^* - E_\theta V^*$$

- Bang-for-the-buck:

$$\frac{\partial A}{\partial y} = \frac{\partial V^*}{\partial y} = -v'(Y - y^*) + (1-t) \stackrel{\text{by F.O.C}}{=} \theta w'(Y - y^*)$$

Effect of t on bang-for-the-buck

- The effect of t on $\partial A/\partial y$:

$$\frac{\partial}{\partial t} \frac{\partial A}{\partial y} = -\underbrace{\theta w''(Y - y^*)}_{(-)} \underbrace{\frac{\partial y^*}{\partial t}}_{(-)} < 0$$

- $t \uparrow \Rightarrow \partial A/\partial y \downarrow$

- The effect of the opposite of what we had with signaling \Rightarrow we have a test to discriminate between the two explanations for dividend payments

An agency model of dividends – private info. about cash flows

- Consider the same model as before except that now $Y = \theta$ and the manager chooses y to maximize:

$$U = \underbrace{v(\theta - y) + (1 - t)y}_{\text{Cum dividend value}} + \underbrace{w(\theta - y)}_{\text{Private benefits}}$$

- F.O.C:

$$U' = \underbrace{1 - t}_{\text{Benefit of dividends}} - \left(\underbrace{v'(\theta - y) + w'(\theta - y)}_{\text{Cost of dividends}} \right) = 0$$

- F.O.C determines $\theta - y$. Hence, $\theta - y = \text{const.}$ and

$$\frac{\partial y^*}{\partial \theta} = 1$$

Effect of dividend on the firm's value

- The cum dividend value of the firm in equil.:

$$V^* = v(\theta - y^*) + (1-t)y^*$$

- Suppose that θ is private info. for the manager. The ex. value of the firm before y is paid:

$$E_{\theta}V^* = E_{\theta}v(\theta - y^*) + (1-t)E_{\theta}y^*$$

- Effect of y on firm value:

$$A \equiv V^* - E_{\theta}V^*$$

Bang-for-the-buck

- Suppose $\theta \uparrow$; then A and y change. We can define bang-for-the-buck as:

$$B \equiv \frac{\text{Change in value}}{\text{Change in } y} = \frac{\frac{\partial A}{\partial \theta}}{\frac{\partial y^*}{\partial \theta}}$$

- The effect of θ on A :

$$\frac{\partial A}{\partial \theta} = \frac{\partial V^*}{\partial \theta} + \frac{\partial V^*}{\partial y} \frac{\partial y^*}{\partial \theta} \quad \Rightarrow \quad \underbrace{\frac{\frac{\partial A}{\partial \theta}}{\frac{\partial y^*}{\partial \theta}}}_B = \frac{\frac{\partial V^*}{\partial \theta}}{\frac{\partial y^*}{\partial \theta}} + \frac{\partial V^*}{\partial y}$$

Effect of t on bang-for-the-buck

- Computing bang-for-the-buck:

$$B = \frac{\partial V^*}{\partial y} + \frac{\frac{\partial V^*}{\partial \theta}}{\frac{\partial y^*}{\partial \theta}} = \underbrace{-v'(\theta - y^*) + (1-t)}_{\frac{\partial V^*}{\partial y}} + \underbrace{\frac{v'(\theta - y^*)}{1}}_{\frac{\frac{\partial V^*}{\partial \theta}}{\frac{\partial y^*}{\partial \theta}}} = 1 - t$$

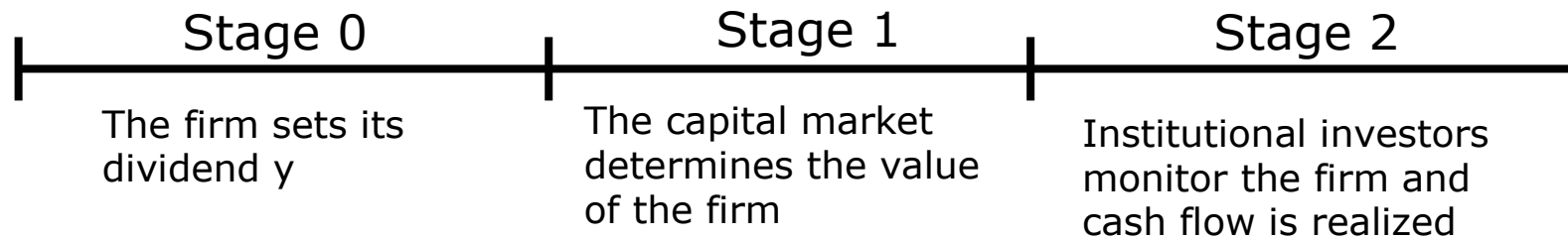
- B is decreasing with t

Allen, Bernardo, and Welch, JF
2000

“A Theory of Dividends Based on Tax
Clienteles”

The model

- The timing:



- Cash flow is $V \sim N(\mu, \sigma^2)$
- There are institutional investors and retail investors
- Monitoring by institutional investors adds $\ln(M)$ to the cash flow
- The cost of monitoring is cM
- Dividend taxes: $t_R > t_I$

Payoffs

- Wealth of institutional and retail investors:

$$W_I = \underbrace{\theta_I}_{\text{Stake}} \left(V + \ln(M) - \underbrace{t_I y}_{\text{Div. tax}} \right) + \underbrace{w_I}_{\text{Initial wealth}} - \underbrace{p\theta_I}_{\text{Payment for shares}} - \underbrace{cM}_{\text{Cost of monitoring}}$$

$$W_R = \underbrace{\theta_R}_{\text{Stake}} \left(V + \ln(M) - \underbrace{t_R y}_{\text{Div. tax}} \right) + \underbrace{w_R}_{\text{Initial wealth}} - \underbrace{p\theta_R}_{\text{Payment for shares}}$$

- The expected payoff of type $t = I, R$ investors:

$$EU(W_t) = EW_t - \frac{\gamma_t}{2} \times \text{Var}(W_t)$$

- EW_t is equal to W_t except that μ replaces V

- $\text{Var}(W_t)$: $\text{Var}(W_t) = E(W_t - EW_t)^2 = \theta_t^2 \sigma^2$

Institutional investors: monitoring and demand for equity

- Institutional investors choose M and θ_I to maximize:

$$EU(W_I) = \underbrace{\theta_I(\mu + \ln(M) - t_I y) + w_I - p\theta_I - cM}_{EW_I} - \frac{\gamma_I}{2} \times \underbrace{\theta_I^2 \sigma^2}_{\text{Var}(W_I)}$$

- F.O.C for M and θ_I :

$$\frac{\theta_I}{M} - c = 0 \Rightarrow M^* = \frac{\theta_I}{c}$$

$$\mu + \ln(M) - t_I y - p - \gamma_I \theta_I \sigma^2 = 0$$

- Using F.O.C: $\theta_I \gamma_I \sigma^2 - \ln\left(\frac{\theta_I}{c}\right) = \mu - t_I y - p$

- Ambiguous price effect: $\frac{\partial p}{\partial \theta_I} = \frac{1}{\theta_I} - \gamma_I \sigma^2$

Retail investors: demand for equity

- Retail investors choose θ_R to maximize:

$$EU(W_R) = \underbrace{\theta_R \left(\mu + \ln\left(\frac{\theta_I}{c}\right) - t_R y \right) + w_R - p \theta_R}_{EW_R} - \frac{\gamma_R}{2} \times \underbrace{\theta_R^2 \sigma^2}_{\text{Var}(W_R)}$$

- F.O.C for θ_R :

$$\mu + \ln\left(\frac{\theta_I}{c}\right) - t_R y - p = \gamma_R \theta_R \sigma^2$$

- Using F.O.C:

$$\theta_R \gamma_R \sigma^2 - \ln\left(\frac{\theta_I}{c}\right) = \mu - t_R y - p$$

- Downward sloping demand

Equilibrium

- Demands:

$$\theta_I \gamma_I \sigma^2 - \ln\left(\frac{\theta_I}{c}\right) = \mu - t_I y - p$$

$$\theta_R \gamma_R \sigma^2 - \ln\left(\frac{\theta_R}{c}\right) = \mu - t_R y - p$$

- Market clearing: $\underbrace{\theta_I + \theta_R}_{\text{demand}} = \underbrace{1}_{\text{supply}}$

- The equil. is given by the sol'n to the system of 3 equations (demands + market clearing) in 3 unknowns: θ_I , θ_R , p , given y

- The owners choose y to maximize p

Characterizing the equilibrium

- Rewriting the demand equations:

$$\theta_I \gamma_I \sigma^2 + t_I y = \ln\left(\frac{\theta_I}{c}\right) + \mu - p$$
$$\theta_R \gamma_R \sigma^2 + t_R y = \ln\left(\frac{\theta_I}{c}\right) + \mu - p$$

- From the 2 demand equations:

$$\theta_I \gamma_I \sigma^2 + t_I y = \underbrace{(1 - \theta_I)}_{\theta_R} \gamma_R \sigma^2 + t_R y \quad \Rightarrow \quad \theta_I^* = \frac{\gamma_R \sigma^2 + (t_R - t_I) y}{(\gamma_R + \gamma_I) \sigma^2}$$

- In equilibrium, $\theta_I = \theta_I^*$ and $\theta_R^* = 1 - \theta_I^*$ (using market clearing)
- We found θ_I^* and θ_R^* as functions of y . We now must determine y
- The owners of the firm will set y^* to maximize p

The effect of y on p :

- p is determined by the equil. system:

$$\ln\left(\frac{\theta_I}{c}\right) - \theta_I \gamma_I \sigma^2 + \mu - p = t_I y$$
$$\ln\left(\frac{\theta_R}{c}\right) - \theta_R \gamma_R \sigma^2 + \mu - p = t_R y$$
$$\theta_I + \theta_R = 1$$

- To find the effect of y on p we must differentiate the equil. system w.r.t. y

$$\left(\frac{1}{\theta_I} - \gamma_I \sigma^2\right) \times \partial \theta_I + 0 \times \partial \theta_R - 1 \times \partial p = t_I \times \partial y$$

$$\frac{1}{\theta_I} \times \partial \theta_I - \gamma_R \sigma^2 \times \partial \theta_R - 1 \times \partial p = t_R \times \partial y$$

$$1 \times \partial \theta_I + 1 \times \partial \theta_R + 0 \times \partial p = 0 \times \partial y$$

The comparative static matrix:

- Writing the system in matrix form:

$$\underbrace{\begin{pmatrix} \frac{1}{\theta_I} - \gamma_I \sigma^2 & 0 & -1 \\ \frac{1}{\theta_I} & -\gamma_R \sigma^2 & -1 \\ 1 & 1 & 0 \end{pmatrix}}_{\text{Comparative statics matrix}} \times \begin{pmatrix} \partial \theta_I \\ \partial \theta_R \\ \partial p \end{pmatrix} = \begin{pmatrix} t_I \\ t_R \\ 0 \end{pmatrix} \times \partial y$$

- Using Cramer's rule:

$$\frac{\partial p}{\partial y} = \frac{\frac{t_R - t_I}{\theta_I} - (\gamma_R t_I + \gamma_I t_R) \sigma^2}{(\gamma_R + \gamma_I) \sigma^2}$$

The optimal y

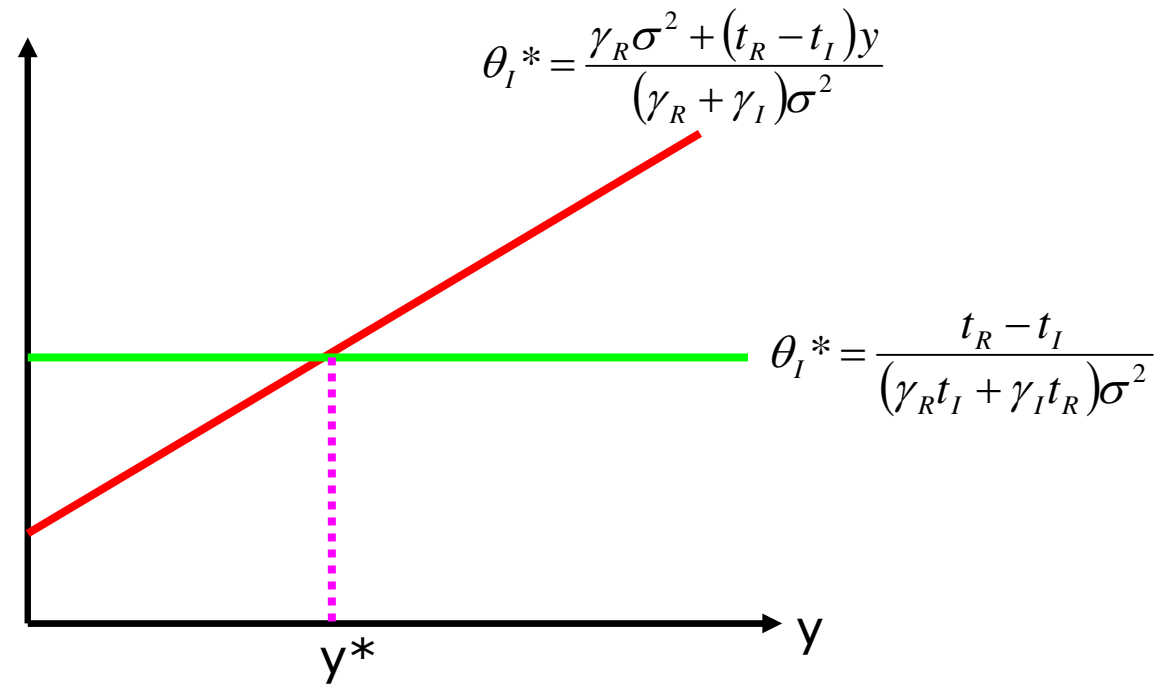
- The owners of the firm set y to maximize p :

$$\frac{\partial p}{\partial y} = \frac{\frac{t_R - t_I}{\theta_I} - (\gamma_R t_I + \gamma_I t_R) \sigma^2}{(\gamma_R + \gamma_I) \sigma^2} = 0 \Rightarrow \theta_I^* = \frac{t_R - t_I}{(\gamma_R t_I + \gamma_I t_R) \sigma^2}$$

- y^* is chosen so that $\theta_I = \theta_I^*$

- We found earlier that in equil. : $\theta_I^* = \frac{\gamma_R \sigma^2 + (t_R - t_I) y}{(\gamma_R + \gamma_I) \sigma^2}$

Solving for y^*



□ The optimal dividend:
$$y^* = \frac{\gamma_R + \gamma_I}{(\gamma_R t_R + \gamma_I t_I)} - \frac{\gamma_R \sigma^2}{t_R - t_I}$$

⇒ $y^* \uparrow$ when $\sigma^2 \downarrow$ and $t_R - t_I \uparrow$

Bang-for-the-buck

- The value of the firm is:

$$V^* = V + \ln\left(\frac{\theta_I^*}{c}\right) \Rightarrow \frac{\partial V^*}{\partial y} = \frac{c}{\theta_I^*} \times \frac{\partial \theta_I^*}{\partial y}$$

- From before we know that:

$$\theta_I^* = \frac{\gamma_R \sigma^2 + (t_R - t_I)y}{(\gamma_R + \gamma_I)\sigma^2} \Rightarrow \frac{\partial \theta_I^*}{\partial y} = \frac{t_R - t_I}{(\gamma_R + \gamma_I)\sigma^2} > 0$$

$$\begin{aligned} \Rightarrow \frac{\partial V^*}{\partial y} &= \frac{c}{\theta_I^*} \times \frac{t_R - t_I}{(\gamma_R + \gamma_I)\sigma^2} = \frac{c}{\frac{\gamma_R \sigma^2 + (t_R - t_I)y^*}{(\gamma_R + \gamma_I)\sigma^2}} \times \frac{t_R - t_I}{(\gamma_R + \gamma_I)\sigma^2} \\ &= \frac{c(t_R - t_I)}{\gamma_R \sigma^2 + (t_R - t_I)y^*} = \frac{c}{\frac{\gamma_R \sigma^2}{t_R - t_I} + y^*} \end{aligned}$$