

Firm Heterogeneity and the Long-Run Effects of Dividend Taxation

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Motivation

- Jobs and Growth Tax Relief Act (2003) reduced capital gains and dividend tax:
 - Capital gain taxes reduced from 20% to 15% / from 10% to 5%.
 - Dividends now taxed at the same rate as capital gains.
- Tax cut effective through 2008 initially, now 2010.
- What are the long-run effects of dividend taxation on aggregate capital accumulation and productivity?

“New View” vs. “Traditional View”

- Firms can finance by internal funds or external funds.
- What is the marginal source of investment finance?
 - Traditional View: Firms rely on new equity issuance as the marginal source and tax reduction reduces user cost of capital.
 - New view: Firms use retained earnings as the marginal source and dividend taxation has no effect on investment.
- Empirical evidence is mixed (Poterba Summers 1985, Desai Goolsbee 2004, Auerbach Hassett 2003).

This paper

- We build a dynamic general equilibrium model with firm heterogeneity.
- Even without any other friction, dividend taxation creates a **wedge** between internal and external funds.
 - Firms with high productivity need to invest \rightarrow issue equity.
 - Firms with low productivity \rightarrow pay out dividends.
 - Firms with intermediate productivity, investment = internal funds (kink).
- Use the model to evaluate tax reform.

Outline

- Motivating Evidence
- Setup model.
- Calibrate the model using Compustat.
- Tax Experiments.
- Some extensions.

Distribution of Firms

	Equity issuance	Liquidity constrained	Dividend distribution
Share of firms	0.230	0.297	0.474
Earnings-capital	0.567	0.275	0.355
Investment rate	0.290	0.193	0.194
Tobin's q	3.768	1.784	2.837

Model Structure

- Fixed number of identical firms which draw idiosyncratic productivity shocks.
- Firms accumulate capital in response to shocks, subject to physical adjustment costs, and make financing decisions.
- Representative household.
- Government levies linear taxes to finance lump-sum transfers.
- No aggregate uncertainty \rightarrow steady-state stationary equilibrium.

- Operate Cobb-Douglas technology subject to Markov productivity shocks z :

$$\pi(k, z; w) = \max_{l \geq 0} \{zk^\alpha l^v - wl\}$$

$$0 < \alpha + v < 1$$

- z follows Markov process with transition
 $Q(z, A) = \Pr(z_{t+1} \in A | z_t = z)$
- Yields labor demand $l = l(k, z; w)$.
- No entry or exit.

Equity Value

- P_t = ex-dividend value of equity, R_{t+1} = return on equity:

$$R_{t+1} = \frac{(1 - \tau_d)d_{t+1} + (1 - \tau_g)(P_{t+1} - s_{t+1} - P_t)}{P_t}$$

- No aggregate shocks:

$$E_t(R_{t+1}) = (1 - \tau_i)r.$$

- Define cum-dividend equity value $V_t = P_t - s_t + \frac{1 - \tau_d}{1 - \tau_g}d_t$.

Then:

$$V_t = \frac{1 - \tau_d}{1 - \tau_g}d_t - s_t + \frac{E_t[V_{t+1}]}{1 + r(1 - \tau_i)/(1 - \tau_g)}.$$

Bellman Equation for the Firm

$$V(k, z; w) = \max_{k', x, s, d} \frac{1 - \tau_d}{1 - \tau_g} d - s + \frac{1}{1 + \frac{r(1 - \tau_i)}{1 - \tau_g}} \int V(k', z'; w) Q(z, dz')$$

$$\text{s.t.} \quad : \quad x + \frac{\psi x^2}{2k} + d = (1 - \tau_c) \pi(k, z; w) + \tau_c \delta k + s,$$

$$k' = (1 - \delta)k + x,$$

$$d \geq 0,$$

$$s \geq 0.$$

- Solution yields policy functions:

$$x = x(k, z; w), \quad k' = g(k, z; w), \quad s = s(k, z; w), \quad d = d(k, z; w).$$

- For a fixed wage, the shock process z and the policy functions generate a stationary distribution of firms over k and z : $\mu(k, z)$.

Household

- Exogenous labor \bar{L} .
- Standard preferences:

$$\sum_{t \geq 0} \beta^t u(C_t)$$

Budget constraint:

$$\begin{aligned} C = & (1 - \tau_d) \int d(k, z; w) \mu^*(dk, dz) \\ & - (1 - \tau_g) \int s(k, z; w) \mu^*(dk, dz) \\ & + (1 - \tau_i) w \bar{L} + T. \end{aligned}$$

- The government:
 - 1 levies linear personal and corporate income taxes,
 - 2 levies dividend and capital gain taxes,
 - 3 rebates lump-sum transfers.

Stationary Equilibrium: Definition

a wage w and a distribution $\mu^*(k, z)$ such that:

- (1) Firms maximize value, i.e. their policies solve the Bellman equation.
- (2) These policies generate the invariant distribution $\mu^*(k, z)$.
- (3) Consumers maximize utility subject to their resource constraint.
- (4) The government budget constraint holds.
- (5) Markets clear:

$$L^d(\mu^*; w) \stackrel{\text{def}}{=} \int l(k, z; w) \mu^*(dk, dz) = \bar{L},$$

$$C(\mu^*; w) + I(\mu^*; w) + \Psi(\mu^*; w) = Y(\mu^*; w).$$

$$\frac{1 - \tau_d}{1 - \tau_g} + \lambda^d + \lambda^s = 1.$$

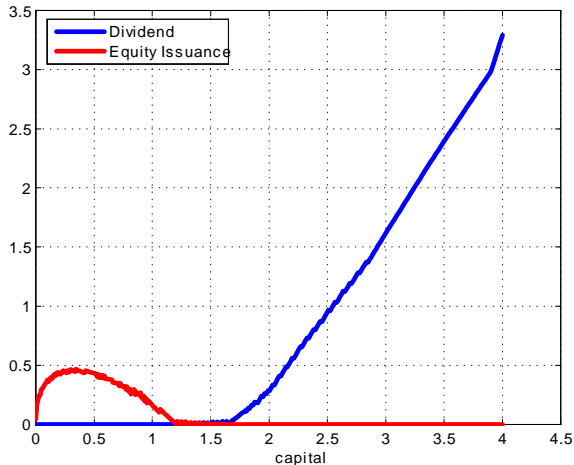
- If $\tau_d = \tau_g$, $\lambda^d = \lambda^s = 0$: d and s indeterminate, but $d - s$ determined (MM).
- If $\tau_d > \tau_g$, then either $\lambda^d = 0$ or $\lambda^s = 0$. Kink in marginal cost of funds.
- Three regimes:
 - ① $d = 0, s > 0$: equity issuance regime.
 - ② $d > 0, s = 0$: dividend distribution regime.
 - ③ $d = 0, s = 0$: liquidity constrained regime.

Regime will change over time according to shocks and capital accumulation.

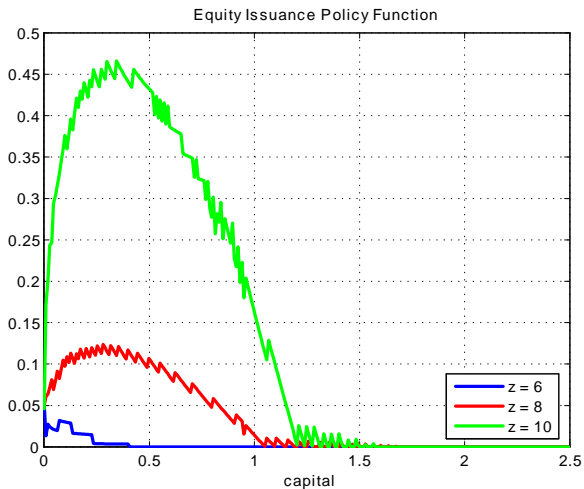
Importance of Firm Heterogeneity

- With a representative firm, in steady-state all investment can be financed without equity issuance.
- Finance regime is constant.
- The 'New View' applies: the steady-state stock of capital does not depend on the dividend tax.
- To examine the conflict between 'new view' and 'old view', we need to have 'growth firms' as well as 'mature firms' in this analysis.
- In our setup, finance regime shifts over time.

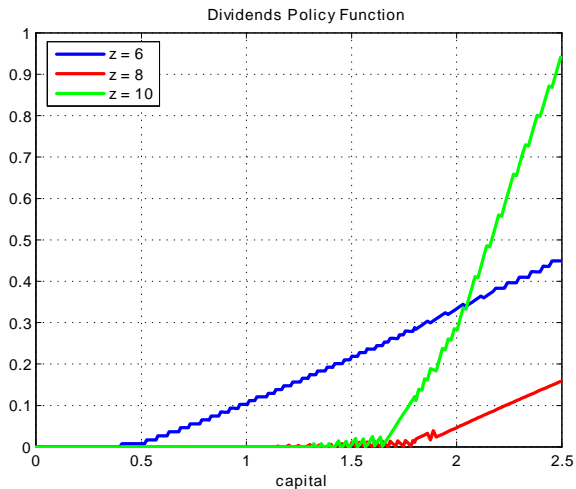
Policy Functions: Equity issuance and Dividends as a function of (k,z)



Equity Issuance Policy Function



Dividend Payout Policy Function



Calibration: parameters set a priori

	Parameter	Value
Corporate income tax	τ_c	0.34
Personal income tax	τ_i	0.25
Dividend tax	τ_d	0.25
Capital gain tax	τ_g	0.20
Depreciation rate	δ	0.095
Discount factor	β	0.971

Calibration: other parameters

- Compustat. 1988-2002. Estimate returns to scale and shock process by a regression:

$$\begin{aligned}\log \pi_{it} &= a_0 + a_1 \log k_{it} + \varepsilon_{it}, \\ \varepsilon_{it} &= \rho \varepsilon_{it-1} + \sigma \eta_{it}.\end{aligned}$$

- Then, choose adjustment cost parameter ψ to match data cross-sectional $\sigma(I/K)$.

	Parameter	Value
Exponent on capital	α_k	0.311
Exponent on labor	α_l	0.650
Shock persistence	ρ	0.767
Shock standard deviation	σ	0.211
Adjustment cost	ψ	1.08

Calibration: results

Variable	Data	Model
Investment rate I/K	0.095	0.095
Aggregate dividends/ aggregate earnings	0.137	0.353
Aggregate new equity/aggregate investment	0.130	0.148
Standard deviation of investment rate	0.157*	0.157*
Autocorrelation of investment rate	0.596	0.648
Standard deviation of earnings/capital	0.623	0.175
Autocorrelation of earnings/capital	0.791	0.658

Calibration: results

	Equity issuance	Liquidity constrained	Dividend distribution
Fraction of firms	0.201	0.343	0.456
Share of K	0.108	0.231	0.661
Share of I	0.401	0.442	0.156
E/K	0.430	0.266	0.170
I/K	0.354	0.182	0.022
Tobin's q	2.633	1.940	1.348

Tax Reform: Aggregates

	$\tau_d = 0.22$	$\tau_d = 0.20$	$\tau_d = 0.15$
	$\tau_g = 0.20$	$\tau_g = 0.20$	$\tau_g = 0.15$
Capital	0.17	0.35	3.85
Output	0.49	0.83	1.75
Consumption	0.28	0.45	0.89
Dividends	6.18	indeterminate	indeterminate
Equity Issuance	40.22	indeterminate	indeterminate
Wage	0.49	0.84	1.76

Change in Firm Distribution after Tax Reform

	Equity issuance	Liquidity constrained	Dividend distribution
Fraction of firms	0.249 (0.201)	0.259 (0.343)	0.492 (0.456)
Share of K	0.138	0.169	0.693
Share of I	0.518	0.325	0.157
E/K	0.415	0.264	0.171
I/K	0.357	0.183	0.022
Tobin's q	2.619	2.001	1.406

Number in Parenthesis = Before reform.

- Firms move from liquidity constrained regime to equity issuance and dividend distribution regimes as kink is reduced / eliminated.

Productivity Effect of Dividend Tax Cut

	$\tau_d = 0.25$	$\tau_d = 0.22$	$\tau_d = 0.20$
change in TFP	0.00	0.49	0.84
change in Y/L	0.00	0.43	0.72
Correl($\ln k$, $\ln z$)	0.438	0.450	0.456
Slope of $\ln k$ on $\ln z$	1.203	1.268	1.312

- More capital per worker \rightarrow higher Y/L .
- Also eliminate wedge \rightarrow reduce financing friction \rightarrow higher.

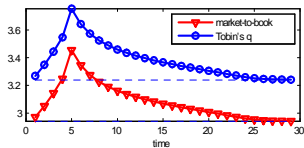
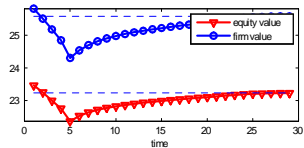
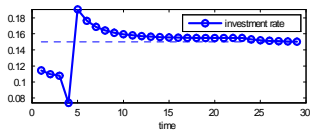
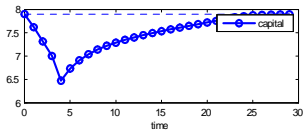
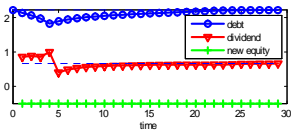
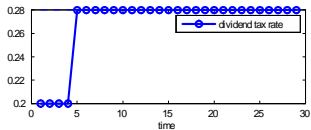
Extensions:

- Adding elastic labor supply
 - larger effect since increase in MPL leads to increase in labor.
- Share repurchases. Allow s to be negative. Constrain $s > \underline{s}$ however.
 - smaller effect because dividend tax matters less.
- Cost of external finance.
 - smaller effect because smaller % reduction in wedge
- Debt. Assuming a collateral constraint $b = \tilde{\zeta}k$.
 - smaller effect since reallocation effects smaller

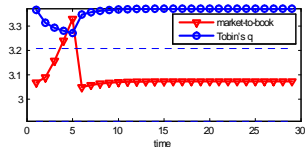
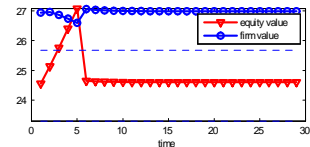
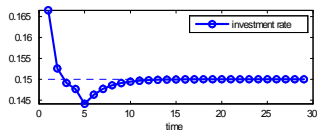
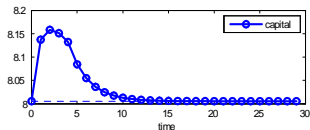
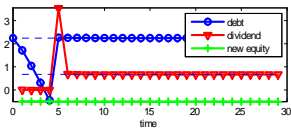
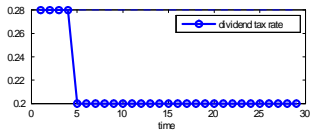
Transitional Dynamics

- Use PE model, without shocks, but with debt and transitional dynamics
- Anticipation of future policies is very important.
- Anticipated dividend tax increase depresses investment.
- Hence, a transitory unanticipated tax cut depresses investment.

Unanticipated Transitory Dividend Tax Cut



Anticipated Permanent Dividend Tax Cut



Conclusions

- Effect of a cut in the dividend tax itself is not large.
- Effect larger if cut both dividend and capital gains tax (as in JGTRA 2003).
- Result appears robust to changes in the model or parameter values.
- Importance of *firm heterogeneity* and *general equilibrium*.
- Reallocation effects.

Future research

- Debt with richer trade-off
- Transitional dynamics in GE.
- Introducing aggregate growth.
- Role of government spending (how to balance the budget).

Backup

Calibration: Sensitivity Analysis

	$\rho = 0.6$	$\rho = 0.8$	$\sigma = 0.1$	$\sigma = 0.3$	$\psi = 0.$
Investment share I/Y	0.181	0.147	0.184	0.139	0.160
Dividends / Earnings	0.252	0.349	0.254	0.359	0.426
New equity / Investment	0.007	0.203	0.007	0.226	0.338
Cross-Sectional $\sigma(I/K)$	0.110	0.235	0.090	0.248	0.324
$\rho(I/K)$	0.494	0.625	0.657	0.573	0.540
XS σ (Earnings/Capital)	0.251	0.274	0.114	0.381	0.237
ρ (Earnings/Capital)	0.492	0.660	0.699	0.569	0.610

Tax Reform: Sensitivity Analysis

% change when go from initial steady-state to $\tau_g = \tau_d = 15\%$.

% change	Capital	Output	Consumption	Wage
Baseline parametrization	3.12	1.37	0.64	1.37
$\rho = 0.6$	2.79	0.87	0.37	0.84
$\rho = 0.8$	3.43	1.44	0.66	1.44
$\sigma = 0.1$	2.47	0.86	0.36	0.85
$\sigma = 0.3$	3.72	1.47	0.68	1.45
$\psi = 0.5$	4.34	1.88	0.86	1.88
$\psi = 1.5$	2.81	1.18	0.55	1.16

Importance of Shifting Finance Regimes

- FOC wrt k' yields:

$$\left(\frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) \left(1 + \frac{\psi x_t}{k_t} \right) = \frac{1}{1 + r(1 - \tau_i) / (1 - \tau_g)} \times$$
$$E_t \left\{ \left(\frac{1 - \tau_d}{1 - \tau_g} + \lambda_{t+1}^d \right) \left[\frac{(1 - \tau_c) \pi_1(k_{t+1}, z) + \tau_c \delta}{2} + \frac{\psi}{2} \left(\frac{x_{t+1}}{k_{t+1}} \right)^2 + (1 - \delta) \left(1 + \frac{\psi x_{t+1}}{k_{t+1}} \right) \right] \right\}.$$

- If paying dividends at t and $t + 1 \rightarrow$ no effect of τ_d . 'New view'.
- But also: If issuing equity at t and $t + 1 \rightarrow$ no effect of τ_d either.
- Hence, dividend tax matters only if finance regimes shift over time.

User Cost of Capital

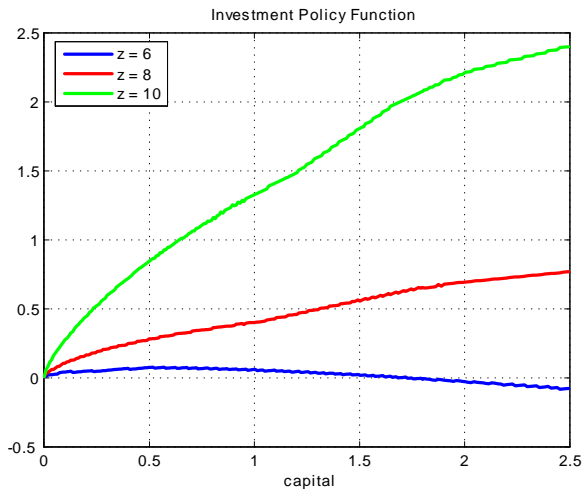
- Define user cost of capital: $u_t = (1 - \tau_c) \pi_1(k_{t+1}) + \frac{\psi}{2} \left(\frac{x_{t+1}}{k_{t+1}} \right)^2$
- FOC can be rewritten as:

$$u_t = \left(\frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) \left(\frac{1 - \tau_d}{1 - \tau_g} + \lambda_{t+1}^d \right)^{-1} \left(1 + \frac{\psi x_t}{k_t} \right) \left(1 + \frac{r(1 - \tau_c)}{1 - \tau_g} \right) - (1 - \delta) \left(1 + \frac{\psi x_{t+1}}{k_{t+1}} \right) - \tau_c \delta.$$

Welfare Effect and Budget Balance

- We assume the decrease in dividend and capital gains taxes is offset by a decrease in lump-sum transfers.
- With inelastic labor, we could also assume there is a reduction in government spending or an increase in the labor income tax.
- However, it could also be that the income tax is increased to balance the budget.
- This would affect our conclusions, esp. regarding welfare.

Investment Policy Function



The three regimes: partition of the state space

