Cash Flow Taxes, Investment, and Corporate Financial Policy

Jason DeBacker*

October 2017

Abstract

A cash flow tax, such as that proposed by the House Republicans, eliminates the tax-induced bias between debt and equity financing and also places zero tax burden on marginal investments. I simulate the effects on such a cash flow tax on the investment activity and financial policy of U.S. corporations using a structural model of corporate finance. The findings point to significant increases in investment and movement towards equity financing by these firms. The effects of the cash flow tax in partial equilibrium are compared to those obtained in a general equilibrium model, and its found that while the qualitative results hold, price changes significantly dampen the responses of corporations to the reform.

keywords: Corporate finance, Firm dynamics

JEL classification: D21, E22, G11, H25

*Darla Moore School of Business, University of South Carolina, Department of Economics, DMSB 427B, Columbia, SC 29208, (803) 777-1649, jason.debacker@moore.sc.edu
1 Introduction

This paper considers the impact of two policy reforms, a reduction in the corporate income tax rate to 25% and a switch to a cash flow tax with a 25% rate, on corporate investment and financial policy. This analysis is done by considering the changes in the long run steady state of a general equilibrium model that endogenizes the firms choice of investment and financing as done in Hennessy and Whited (2005).

I find that the cash flow tax results in a stronger investment response and lower leverage than a reduction in the corporate rate alone.

2 Model

2.1 Firms

There are a continuum of ex-ante identical firms. Firms choose investment, demand labor, issue debt and new equity, and distribute dividends to maximize the after-tax value of the firm to the representative shareholder. Firms face idiosyncratic shocks to productivity and thus, at any point in time, firms are heterogeneous in productivity, their stock of capital, and their level of debt.

If \( V_t \) is the value of a firm at time \( t \), \( d_t \) the amount of dividends distributed, \( s_t \) the amount of new equity issued and \( \eta(s_t) \) are the flotation costs for that equity, then the expected, after tax return to a shareholder is given by:

\[
E_t(r_t) = \frac{(1 - \tau_d)d_t + (1 - \tau_g)(E_tV_{t+1} - V_t - (1 + \eta(s_t))s_t)}{V_t}
\]

Marginal tax rates on dividends and capital gains are given by \( \tau_d \) and \( \tau_g \), respectively. Because the only uncertainty derives from the idiosyncratic productivity shocks to the firms, there is no aggregate uncertainty. Without aggregate uncertainty, asset pricing equilibrium implies: \( E_t(r_t) = (1 - \tau_i)r \), where \( r \) is the risk free interest rate. The right hand side of this equation is the after-tax return on holding the risk free bond. That is, asset pricing equilibrium requires the expected after-tax return on bonds and
equity to be the same for the household to trade both assets in equilibrium.

Using Equation 1 together with the asset pricing equilibrium condition, iterating forward, and applying the transversality condition one can obtain the value of a firm at time $t$:

$$E_t(R_t) = \frac{(1 - \tau_d) d_t + (1 - \tau_g)(E_t V_{t+1} - V_t - (1 + \eta(s_t)) s_t)}{V_t}$$

$$\Rightarrow (1 - \tau_i)r = \frac{(1 - \tau_d) d_t + (1 - \tau_g)(E_t V_{t+1} - V_t - (1 + \eta(s_t)) s_t)}{V_t}$$

$$\Rightarrow V_t(1 - \tau_i)r = (1 - \tau_d) d_t + (1 - \tau_g)(E_t V_{t+1} - V_t - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow V_t(1 - \tau_i)r + (1 - \tau_g)V_t = (1 - \tau_d) d_t + (1 - \tau_g)(E_t V_{t+1} - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow V_t(1 - \tau_i)r + 1 - \tau_g = (1 - \tau_d) d_t + (1 - \tau_g)(E_t V_{t+1} - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow \frac{V_t((1 - \tau_i)r + 1 - \tau_g)}{1 - \tau_g} = \frac{1 - \tau_d}{1 - \tau_g} d_t + (E_t V_{t+1} - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow V_t \left( \frac{1 - \tau_i}{1 - \tau_g} r + 1 \right) = \frac{1 - \tau_d}{1 - \tau_g} d_t + (E_t V_{t+1} - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow V_t \left( 1 + \frac{1 - \tau_i}{1 - \tau_g} r \right) = \frac{1 - \tau_d}{1 - \tau_g} d_t + (E_t V_{t+1} - (1 + \eta(s_t)) s_t)$$

$$\Rightarrow V_t = \frac{1}{1 + \left( \frac{1 - \tau_i}{1 - \tau_g} r \right)} \left[ \left( \frac{1 - \tau_d}{1 - \tau_g} d_t - (1 + \eta(s_t)) s_t + E_t V_{t+1} \right) \right]$$

(2)

$$V_t = E_t \sum_{j=0}^{\infty} \left( \frac{1}{1 + r(1 - \tau_i)/(1 - \tau_g)} \right)^j \left( \frac{1 - \tau_d}{1 - \tau_g} d_{t+j} - (1 + \eta(s_{t+j})) s_{t+j} \right)$$

(3)

Equation 3 is a standard representation of the value of a firm in the presence of taxes (Auerbach (2002)). The equation says the value of the firm is the expected present value of the after-tax dividends less the present value of new shares issued, which the current share holders would have to purchase to maintain their claim on the same fraction of the firm’s total dividends and profits.

From Equation 3, one can see the firm’s problem of maximizing shareholder value can be represented by the following Bellman Equation:
In Equation 4, \( z \) denotes the firm’s productivity, \( x \) investment, \( k \) its capital stock, and \( b \) the stock of net debt. Primed variable denote one period ahead values. Let \( \upsilon(x, k) \) characterize the costs a firm faces when adjusting its capital stock and \( \delta \) represent the rate of physical depreciation. Additionally, let \( \pi(z, k; w) \) represent the firm’s profit function given capital and productivity, \( \tau_c \) be the taxes paid on corporate income, \( \delta^r \) the rate of depreciation for the tax basis of the capital stock, \( k^\tau \) the tax-written-down basis for the capital stock, \( f_b \) the fraction of interest paid that is deductible, and \( f_e \) be the fraction of an investment that can be immediately expensed. The firm faces the following constraints:

\[
(1 - \tau_c)\pi(k, z; w) + \tau_c\delta^r k^\tau + \tau_c f_e \mathbf{1}_{x > 0} x + \tau_c r b - (1 - f_b) \mathbf{1}_{b > 0} \tau_c r b + b' + s \\
= d + x + \upsilon(x, k) + (1 + r)b
\]

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

\[
k^\tau' = (1 - \delta^r)k^\tau + (1 - f_e \mathbf{1}_{x > 0}) x,
\]

\[
d \geq 0
\]

\[
s \geq s
\]

\[
(1 + r)b' - f_b r \tau_c b' \leq (1 - \tau_c)\pi(z, k') + \tau_c\delta^r k^\tau + \theta k'
\]
That is, the sources and uses of funds must be equation (5), physical capital evolves
according to the law of motion for capital (6), the tax basis for capital evolves accord-
ing to its law of motion (7), dividends must be non-negative (8), equity issues must
be above some lower bound (9), and debt cannot exceed the collateral constraint.
The reasons for the bound on equity issues are \textit{de facto} or \textit{de jour} restrictions on
shares repurchases. There may be large costs associated with share repurchases due
to asymmetric information (Brennan and Thakor (1990), Barclay and Smith (1988))
or there may be legal restrictions on share repurchases. For example, in the United
States, while share repurchases are allowed, regular repurchases may lead the IRS
to treat repurchases as dividends. Throughout, I assume $s = 0$.\footnote{Admittedly, when $s = 0$, as it does for the analysis this paper, one can not answer questions regarding the observed “dividend puzzle”.}
The constraint on debt says that firm must be able to pay off the interest and principle on its debt
obligations in the worst state (i.e., $z = \bar{z}$) with it’s cash flow and the sale of capital.
Sales of capital to repay debt are made at a fire-sale price, $\theta < 1$.

Firm’s combine capital and labor to produce output. The firm’s intratemporal
profit function is given by:

$$\pi(z, k; w) = \max_{l \geq 0} \{ F(z, k, l) - wl \}$$

(11)

$F(z, k, l)$ is the firm’s production function, which may be a decreasing returns to scale function. The solution to this intratemporal problem yields the firm’s policy functions for labor, $l(z, k; w)$, and output, $y(z, k; w)$. That is, the intratemporal labor
demand decision is determined by the capital stock and productivity of the firm and
the market wage. Thus I omit the choice of labor is from Equation 4.

The future value of the firm is discounted by a rate less than one if the household’s
rate of time preference parameter $\beta$ is less than one. One can show the function
$V(z, k, b; w)$ is concave, bounded, and continuous, so long as the firm’s production
function $F(z, k, l)$ does not exhibit increasing returns to scale. Given this, one can
apply the arguments of Stokey et al. (1989) to show the solution to Equation 4 exists
and consists of unique functions $V(z, k, b; w), k'(z, k, b; w), b'(z, k, b; w), d(z, k, b; w), \ldots$.
2.2 Households

There is a representative household who supplies labor, trades shares in all firms and a risk free bond, pays taxes, receives transfers, and consumes. Labor is supplied inelastically and risk free bonds are in zero net supply. The household chooses consumption, equity holdings, and bond holdings to solve:

$$\max_{\{C_t, L_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t U(C_t, L_t),$$

where $C_t$ is consumption in period $t$ and $L_t$ is labor supply. The rate of time preference is given by $\beta$. The per period flow utility is given by:

$$u(C, L) = \ln(c) - \frac{hL^2}{2}$$

Where $h$ is a scale parameter on the disutility of labor. Note that this function satisfied the properties that it is increasing and concave in $C$ and decreasing and convex in $L$. Further, given the log-utility, we are ensured an interior solution for consumption.

$$C_t + \int b_{t+1} \Gamma_t + \int V_t \theta_{t+1} d\Gamma_t = \int [(1 - \tau_d) d_t + V_t - (1 + \eta(s_t)) s_t - \tau_g (V_t - V_{t-1} - (1 + \eta(s_t)) s_t)] \theta_t d\Gamma_t$$

$$+ \int (1 + (1 - \tau_i) r_t) b_t \Gamma_t + (1 - \tau_i) w_t L_t + T_t + \int \eta_t d\Gamma_t,$$

where $b_{t+1}$ represents the holding of bonds expiring in period $t + 1$, $V_t$ is the value of the firm in period $t$ and $\theta_{t+1}$ are the shares of firms held in period $t + 1$. The function $\Gamma_t(z_t, k_t, b_t; w_t)$ characterizes the distribution of firms in period $t$ and $d_t$ are dividends issued in period $t$. $r_t$ is the return on risk free bonds and $w_t$ is the wage rate. The government transfers $T_t$ to the household, and $\tau_d$, $\tau_g$, and $\tau_i$ are the tax rates paid on dividend income, capital gains income, and labor income, respectively.
The total financing costs paid by firms when raising external funding are returned to the household and are represented by $\eta_t$.\footnote{Unlike the real costs of adjusting capital, financial frictions are transaction costs paid by firms to financial intermediaries. To close the model, it is assumed that households own these financial institutions and thus receive these costs. The affect of this assumption is to increase household income and thus consumption and investment by the household.}

Equilibrium requires $\theta_t = 1$ for all $t$ since the representative household must hold all the shares from each firm. Gomes (2001) shows that in a stationary equilibrium the pricing kernel is given by $\beta$. That is, in a stationary equilibrium, $r$ solves, $\beta(r(1 - \tau_i) + 1) = 1$.

### 2.3 Government

The government levies linear taxes on labor income, capital gains income, dividend income, and corporate profits. The government does not issue debt. The revenues from the taxes are assumed to be distributed in a lump sum manner to the household so the government budget balances each period. The assumption of a lump sum transfer is made for simplicity. Government spending on goods and services would introduce additional distortions to the model unrelated to the effects of taxation on investment decisions, which are the focus of the analysis. Additionally, government spending on goods and services would mean tax cuts would necessarily have to be accompanied by spending reductions in the stationary equilibrium, which would further complicate the analysis in a way that is unnecessary to understand the mechanisms of interest.

The government budget constraint in any period (where I drop the time subscripts for simplicity) is:
\[ T = \tau_c \int (\pi(z, k, w) - \delta k) \Gamma(dz, dk, db; w) - \tau_c \delta \int k^r \Gamma(dz, dk, db; w) \]

\[ - f_e \tau_c \int x(z, k, b; w) \Gamma(dz, dk, db; w) + (\tau_i - f_b \tau_c) r \int b \Gamma(dz, dk, db; w) \]

\[ + \tau_d \int d(z, k, b; w) \Gamma(dz, dk, db; w) + \tau_i w L - \tau_g \int (1 + \eta(s)) s(z, k, b; w) \Gamma(dz, dk, db; w) \]

(15)

2.4 Stationary Distribution and Aggregates

Idiosyncratic shocks to the productivity of firms represent the only source of uncertainty in the model. At each point in time the economy is characterized by a measure of firms, \( \Gamma_t(z, k, b; w) \) for each productivity \( z \in Z = [\bar{z}, \bar{z}] \), level of capital stock \( k \in K = [\bar{k}, \bar{k}] \), and debt \( b \in B = [\bar{b}, \bar{b}] \). For there to be a stationary measure of firms, it must be the case that firms never accumulate capital beyond some endogenously determined level \( \bar{k} \). If the optimal decision rule for capital accumulation is increasing in \( z \), it is clear the value of \( \bar{k} \) is determined by the point at which the decision rule \( k'(z, k, b; w) \) crosses the 45° line.

The law of motion of \( \Gamma_t(z, k, b; w) \) is given by:

\[ \Gamma_{t+1} = \mathcal{H}_t(\Gamma_t) \]  

(16)

Let \( A, B, \) and \( C \) be Borel sets of \( Z, K, \) and \( B \) respectively and let \( P(z, z') \) be the probability the firm transitions from a productivity of \( z \) to productivity \( z' \). The function \( \mathcal{H}_t \) can then be written as follows:

\[ \Gamma_{t+1}(A \times B \times C) = \int 1_{\{k'(z, k, b; w) \in B \}} P(z, A) \Gamma_t(dz, dk, db; w), \]

(17)

where \( 1 \) is the indicator function.

I study the long run effects of tax policy and therefore focus the analysis on the invariant distribution of firms denoted \( \Gamma^* \). The invariant distribution is found by
solving for the fixed point in the mapping given by $\mathcal{H}$. That is, $\Gamma^*$ solves $\Gamma^* = \mathcal{H}(\Gamma^*)$. Stokey et al. (1989) state the conditions necessary to prove the existence of an invariant distribution. The decision rules of the firms and the stochastic process give rise to the mapping from the current distribution of firms to the distribution of firms next period. Stokey et al. (1989) show $\Gamma^*$ exists, is unique and the sequence of measures generated by the transition function, $\{\mathcal{H}^n(\Gamma_0)\}_{n=0}^\infty$, converges weakly to $\Gamma^*$ from any $\Gamma^0$. The measure of firms is normalized to one.

With the definition of the stationary distribution in hand, it is straight forward to calculate the aggregate quantities in this economy:

- **Aggregate output**
  \[ Y(\Gamma^*; w) = \int y(z, k; w) \Gamma^*(dz, dk, db; w) \quad (18) \]

- **Aggregate labor demand**
  \[ L^d(\Gamma^*; w) = \int l(z, k; w) \Gamma^*(dz, dk, db; w) \quad (19) \]

- **Aggregate investment**
  \[ I(\Gamma^*; w) = \int (k'(z, k, b; w) - (1 - \delta)k) \Gamma^*(dz, dk, db; w) \quad (20) \]

- **Aggregate adjustment costs**
  \[ \Upsilon(\Gamma^*; w) = \int \upsilon(k'(z, k, b; w) - (1 - \delta)k) \Gamma^*(dz, dk, db; w) \quad (21) \]

- **Aggregate financing costs**
  \[ H(\Gamma^*; w) = \int \eta(s(z, k, b; w)) \Gamma^*(dz, dk, db; w) \quad (22) \]
2.5 Stationary Equilibrium

Definition 1. A Stationary Recursive Competitive Equilibrium (SRCE) consists of a wage rate $w^*$, a distribution of firms $\Gamma^*(z,k,b;w^*)$, and functions $V(z,k,b;w^*)$, $l(z,k,w^*)$, $k'(z,k,b;w^*)$, $d(z,k,b;w^*)$, and $s(z,k,b;w^*)$ such that:

- Given $w^*$, $V(z,k,b;w^*)$, $l(z,k;w^*)$, $k'(z,k,b;w^*)$, $b'(z,k,b;w^*)$, $d(z,k,b;w^*)$, and $s(z,k,b;w^*)$ solve the firm’s problem.

- The stationary distribution is such that $\Gamma^*(z,k,b;w^*) = \mathcal{H}^*(\Gamma^*(z,k,b;w^*))$

- Given $w^*$, the household maximizes utility subject to its budget constraint.

- The labor market clears: $L = \int l(z,k;w^*)\Gamma^*(dz,dk,db;w^*)$

- The goods market clears: $Y(\Gamma^*;w^*) = C(\Gamma^*;w^*) + I(\Gamma^*;w^*) + \Upsilon(\Gamma^*;w^*)$ \(^3\)

The above are standard conditions for a stationary equilibrium. The value function and policy functions are such that they solve the firm’s problem given prices. The evolution of the distribution reproduces itself each period and is consistent with the equilibrium decision rules of the firms and the distribution of idiosyncratic shocks to firms. Finally, the representative household maximizes utility and markets clear.

Using a general equilibrium framework is important because the feedback of wages dampens the effects of tax policy. For example, lowering the corporate income tax increases the capital stock and so increases the marginal product of labor and thus the wage. The higher wage lowers employment and thus the marginal product of capital. Allowing wages to adjust reduces the effect of tax policy on investment relative to a partial equilibrium model.

3 Firm Investment and Financial Policy

Let $q_t$ be the Lagrangian multiplier on the law of motion for the capital stock (Equation 6) in period $t$, $q^*_t$ the multiplier on the law of motion for the tax basis of the

\[^3\]Note the absence of financial frictions in this condition. Financial frictions are not real costs. These transactions costs are assumed to go to the households.
capital stock (Equation 7), $\lambda^d_t$ the multiplier on the dividend non-negativity constraint (Equation 8), $\lambda^s_t$ the multiplier on the constraint on equity issues (Equations 9), and $\lambda^b_t$ the multiplier on the collateral constraint.

Further, let $\beta_f$ represent the firm’s discount factor:

$$\beta_f = \frac{1}{1 + r(1 - \tau_i)(1 - \tau_g)} \quad (23)$$

The Lagrangian is:

$$\mathcal{L} = \sum_{j=0}^{\infty} \beta^j_f \left[ \left( \frac{1 - \tau_d}{1 - \tau_g} \right) d_{t+j} - (1 + \eta(s_{t+j}))s_{t+j} + \lambda^d_{t+j}d_{t+j} + \lambda^s_{t+j}s_{t+j} 
\right.
\left. + q_{t+j} (x_{t+j} + (1 - \delta)k_{t+j} - k_{t+j+1}) 
+ q^\tau_{t+j} ((1 - f e_1 x_{t+j}>0)x_{t+j} + (1 - \delta^\tau)k^\tau_{t+j} - k^\tau_{t+j+1}) 
+ \lambda^b_{t+j} ((1 - \tau_c)\pi(z, k_{t+j+1}) + \tau_c \delta^\tau k^\tau_{t+j+1} + \theta k_{t+j+1} - (1 + r)b_{t+j+1} + f_e \tau_c b_{t+j+1}) \right] \quad (24)$$

where

$$d_t = (1 - \tau_c)\pi(z_t, k_t) + \tau_c \delta^\tau k^\tau_t + \tau_c f e_1 x_{t>0} x_t + \tau_c r b_t - (1 - f_b) b_{t>0} \tau_c r b_t + b_t + s_t - v(x_t, k_t) - (1 + r) b_t \quad (25)$$

With this notation defined, we can write the first order conditions for the firm’s problem as follows (note that we can use the sources and uses of funds condition (Equation 5) to write dividends in terms of the other endogenous variables):

$$\frac{\partial V_t}{\partial x_t} : q_t + (1 - f e_1 x_{t>0}) q^\tau_t = \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda^d_t \right) \left( 1 + \frac{\partial v(x_t, k_t)}{\partial x_t} \right) \quad (26)$$
\[ \frac{\partial V_t}{\partial k_{t+1}} : q_t - \lambda_t^b \left( 1 - \tau_c \right) \frac{\partial \pi(z_t, k_{t+1})}{\partial k_{t+1}} + \theta = \beta_f E_{zt+1} \left[ \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) \left( 1 - \tau_c \right) \frac{\partial \pi(z_{t+1}, k_{t+1})}{\partial k_{t+1}} \right] - \frac{\partial v(x_{t+1}, k_{t+1})}{\partial k_{t+1}} + (1 - \delta) q_{t+1} \] \tag{27}

\[ \frac{\partial V_t}{\partial b_{t+1}} : \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) = \beta_f E_{zt+1} \left[ \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) \left( 1 + r - \tau_c r + (1 - f_b) \tau_c r^1 b_{t+1} > 0 \right) \right] \tag{28} \]

\[ \frac{\partial V_t}{\partial s_t} : \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) + \lambda_t^d = (1 + \eta(s_t)) + \frac{\partial \eta(s_t)}{\partial s_t} s_t \tag{29} \]

\[ \frac{\partial V_t}{\partial k_{t+1}} : q_t^\tau - \lambda_t^b \tau_c \delta^\tau = \beta_f E_{zt+1} \left[ \left( \frac{1 - \tau_d}{1 - \tau_g} + \lambda_t^d \right) \tau_c \delta^\tau + (1 - \delta^\tau) q_{t+1}^\tau \right] \tag{30} \]

Equation 29 provides us with the following set of results. If \( \tau_d = \tau_g \) and if \( \eta(s_t) = 0 \forall s_t \), then it must be that case that neither the constraint on dividends of equity is binding. With these assumptions, we have the environment of the Modigliani-Miller Theorem (Modigliani and Miller (1958)). As we can see here, the theorem holds given these assumptions and corporate finance is irrelevant since internal and external funds have the same cost. We can also see that if \( \tau_d < \tau_g \) and there are no costs to external finance \( (\eta(s_t) = 0 \forall s_t) \) the equation can’t hold. In this case, the firm would want to raise infinite equity and pay it out to shareholders purely as tax arbitrage. If \( \tau_d > \tau_g \) then it must be the case that one or both constraints bind. That is, either \( d_t > 0 \) and \( s = 0 \), or \( d_t = 0 \) and \( s_t > 0 \), or \( d_t = 0 \) and \( s_t = 0 \). That is, the corporation will never simultaneously distribute dividends and issue new equity.
3.1 Debt policy

Debt will be lower when the firm has a lower marginal product of capital, higher with high mpk. But debt policy also depends on current debt, resulting in persistence in the level of debt over time. Also important and to be seen from the FOC for debt, debt policy depends on the current and expected future financing regimes (i.e., whether internal funds or equity will be used as the marginal source of funds next period). This is because the source of financing reflects tells us the benefits of issuing more debt. In particular, there is a discrete jump in this benefit as the firm moves from retained earnings to equity as the marginal source of funds. In this case, the cost jumps from $1 - \tau_d$ to $1 + \eta(s_t)$.

The cost of debt is affected by the tax treatment of debt, but also by the collateral constraint. Having more debt pushes the firm closer the collateral constraint and thus reduces financial flexibility going forward. E.g., even if debt is tax favored, the firm will issue debt up to it’s constraint before using other sources of funds since higher debt in the current period leaves less ability to finance investments next period with debt. And given the stochastic process governing productivity shocks, a firm would like to retain that ability in case of high productivity shock.

4 Calibration

I set $\beta$ to generate an after-tax risk free interest rate of 4%. This implies that $\beta = 0.971$ if the representative household has a marginal income tax rate of 25%. The rate of depreciation is set to generate the aggregate investment-capital ratio of 0.095. I assume that the scaling factor for the disutility of labor, $h$, equals 6.16, which yields an equilibrium labor supply of 0.3. Note that the disutility of labor function implies a Frisch elasticity of labor supply of unity.

Following the macro literature, I set $\alpha_l = 0.65$ because labor’s share of output is approximately 65% in the U.S. I set $\alpha_k = 0.311$, which implies that firms have decreasing returns to scale. The shock to firm’s profits is assumed to follow an AR(1) process:
\[ \ln(z_{t+1}) = \rho \ln(z_t) + (1-\rho)\mu + \varepsilon_t \quad (31) \]

I assume that \( \rho = 0.767, \mu = 0 \) and that \( \varepsilon \sim N(0, \sigma_{\varepsilon}) \), with \( \sigma_{\varepsilon} = 0.211 \).

I set the parameters determining the sizes of these frictions to values found by others in the literature who use similar models. I set \( \psi = 1.08 \) as done in Gourio and Miao (2010). This value is similar to the parameter’s value in Cummins et al. (1994) and elsewhere.

External financing costs are assumed to be given by \( \eta(s_t) = \eta_1 \). \( \eta_1 \) is set 0.02. This value similar to that estimated by Altinkilic and Hansen (2000). The fire sale price parametr, \( \theta \) is set to a value of 0.3 to give a steady state leverage ratio similar to that found in the data.

4.1 Tax Rates

At the moment I’m setting tax rates based on statutory rates. I take the top corporate rate, \( \tau_{uc} = 0.35 \). For individual taxes, I assume that the household is in the 3rd bracket and faces a rate of 25% on interest income and labor income. However, I assume the household faces the top rate on dividend and capital gains income, a rate of 20%.

I set \( \delta^{\tau u} = \delta \). Although the tax system generally accelerates depreciation deductions relative to economic depreciation, if \( \delta^{\tau u} \neq \delta \), then an additional state variable must be added to the model to keep track of the tax basis of the capital stock. With two endogenous state variables already (\( k \) and \( b \)), I will not add the additional computational cost to be more precise with this variable. This will tend to overstate the effects of the corporate tax reform and of the difference between the cash flow tax and the The tax policy changes is assumed to be unexpected and permanent. Results are for changes in the steady state equilibrium.

Going forward, I’ll probably move these to be some weighted average of individual marginal rates found with Tax-Calculator. ** Although preliminary runs with this
result less well fitting moments and very small changes in macro variables when lowering the corp rate (but about the same results for a switch to a CFT).

4.2 Model fit

The model parameterization is summarized in Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.971</td>
</tr>
<tr>
<td>$h$</td>
<td>6.616</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.095</td>
</tr>
<tr>
<td>$\alpha_l$</td>
<td>0.650</td>
</tr>
<tr>
<td>$\alpha_k$</td>
<td>0.311</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.767</td>
</tr>
<tr>
<td>$\mu$</td>
<td>0.000</td>
</tr>
<tr>
<td>$\sigma_\varepsilon$</td>
<td>0.211</td>
</tr>
<tr>
<td>$\psi$</td>
<td>1.080</td>
</tr>
<tr>
<td>$\eta_1$</td>
<td>0.020</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.300</td>
</tr>
</tbody>
</table>

See the fit of the baseline model to the data in Table 2.

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment rate</td>
<td>0.095</td>
<td>0.095</td>
</tr>
<tr>
<td>Aggregate dividends/earnings</td>
<td>0.137</td>
<td>0.306</td>
</tr>
<tr>
<td>Aggregate new equity/investment</td>
<td>0.130</td>
<td>0.162</td>
</tr>
<tr>
<td>Volatility of investment rate</td>
<td>0.156</td>
<td>0.160</td>
</tr>
<tr>
<td>Autocorrelation of investment rate</td>
<td>0.596</td>
<td>0.630</td>
</tr>
<tr>
<td>Volatility of earnings/capital</td>
<td>0.623</td>
<td>0.152</td>
</tr>
<tr>
<td>Autocorrelation of earnings/capital</td>
<td>0.791</td>
<td>0.678</td>
</tr>
<tr>
<td>Aggregate leverage ratio</td>
<td>0.120</td>
<td>0.163</td>
</tr>
<tr>
<td>Corr(Earnings, Leverage)</td>
<td>-0.001</td>
<td>-0.098</td>
</tr>
</tbody>
</table>

Model moments by financing regime:
Table 3: Investment and Financial Policy by Type of Financing Regime

<table>
<thead>
<tr>
<th>Moment</th>
<th>Equity Issuance</th>
<th>Liquidity Constrained</th>
<th>Dividend Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of firms</td>
<td>0.046</td>
<td>0.849</td>
<td>0.106</td>
</tr>
<tr>
<td>Share of capital</td>
<td>0.013</td>
<td>0.752</td>
<td>0.235</td>
</tr>
<tr>
<td>Share of investment</td>
<td>0.062</td>
<td>0.995</td>
<td>-0.057</td>
</tr>
<tr>
<td>Earnings/capital ratio</td>
<td>0.386</td>
<td>0.220</td>
<td>0.170</td>
</tr>
<tr>
<td>Investment rate</td>
<td>0.444</td>
<td>0.126</td>
<td>-0.023</td>
</tr>
<tr>
<td>Average Q</td>
<td>2.809</td>
<td>1.419</td>
<td>1.026</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>0.106</td>
<td>0.160</td>
<td>0.185</td>
</tr>
<tr>
<td>Frequency of debt &gt; 0</td>
<td>0.403</td>
<td>0.000</td>
<td>0.597</td>
</tr>
</tbody>
</table>

5 Policy Simulations

I simulate two policies and compare these to the baseline (current law) policy and each other. These policies are a reduction in the corporate income tax rate from 35% to 25% and then a cash flow tax with a rate of 25%. The cash flow tax allows for immediate expensing, but no deduction for interest expenses.

Table 4: Changes in Economic Aggregates (percentage point change)

<table>
<thead>
<tr>
<th></th>
<th>25% Corporate Income Tax</th>
<th>25% Cash Flow Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>2.869</td>
<td>9.531</td>
</tr>
<tr>
<td>Investment</td>
<td>7.571</td>
<td>19.212</td>
</tr>
<tr>
<td>Consumption</td>
<td>1.486</td>
<td>4.224</td>
</tr>
<tr>
<td>Labor</td>
<td>0.345</td>
<td>2.403</td>
</tr>
<tr>
<td>Accounting Profits</td>
<td>2.869</td>
<td>9.531</td>
</tr>
<tr>
<td>Average Q</td>
<td>4.815</td>
<td>8.362</td>
</tr>
<tr>
<td>Total Taxes</td>
<td>-6.938</td>
<td>-1.787</td>
</tr>
<tr>
<td>Corporate Income Taxes</td>
<td>-29.637</td>
<td>-20.249</td>
</tr>
</tbody>
</table>

Table 5: Changes in Financial Policy (percentage point change)

<table>
<thead>
<tr>
<th></th>
<th>25% Corporate Income Tax</th>
<th>25% Cash Flow Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividends</td>
<td>13.917</td>
<td>34.826</td>
</tr>
<tr>
<td>New Equity</td>
<td>16.049</td>
<td>45.860</td>
</tr>
<tr>
<td>Corporate Debt</td>
<td>3.942</td>
<td>-72.112</td>
</tr>
<tr>
<td>Payout Ratio</td>
<td>10.740</td>
<td>23.094</td>
</tr>
<tr>
<td>New equity/investment</td>
<td>7.882</td>
<td>22.353</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>-6.623</td>
<td>-75.247</td>
</tr>
</tbody>
</table>
5.1 Partial vs. General Equilibrium

Partial equilibrium results are not believable. This is what the model says, but need to think about why so sensitive to wage changes (because they don’t change a ton between these policies).

Table 6: Macro results - PE vs GE

<table>
<thead>
<tr>
<th>Macro Aggregate/Price</th>
<th>25% Corporate Income Tax</th>
<th>25% Cash Flow Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PE</td>
<td>GE</td>
</tr>
<tr>
<td>GDP</td>
<td>44.088</td>
<td>2.869</td>
</tr>
<tr>
<td>Investment</td>
<td>50.016</td>
<td>7.571</td>
</tr>
<tr>
<td>Consumption</td>
<td>42.396</td>
<td>1.486</td>
</tr>
<tr>
<td>Labor</td>
<td>44.088</td>
<td>0.345</td>
</tr>
<tr>
<td>Accounting Profits</td>
<td>44.088</td>
<td>2.869</td>
</tr>
<tr>
<td>Average Q</td>
<td>7.158</td>
<td>4.815</td>
</tr>
<tr>
<td>Total Taxes</td>
<td>-16.755</td>
<td>-6.938</td>
</tr>
<tr>
<td>Corporate Income Taxes</td>
<td>-0.923</td>
<td>-29.637</td>
</tr>
</tbody>
</table>

Table 7: Financial Policy Results - PE vs GE

<table>
<thead>
<tr>
<th></th>
<th>20% Corporate Income Tax</th>
<th>20% Cash Flow Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PE</td>
<td>GE</td>
</tr>
<tr>
<td>Dividends</td>
<td>60.296</td>
<td>13.917</td>
</tr>
<tr>
<td>New Equity</td>
<td>58.416</td>
<td>16.049</td>
</tr>
<tr>
<td>Corporate Debt</td>
<td>44.393</td>
<td>3.942</td>
</tr>
<tr>
<td>Payout Ratio</td>
<td>11.249</td>
<td>10.740</td>
</tr>
<tr>
<td>New equity/investment</td>
<td>5.599</td>
<td>7.882</td>
</tr>
<tr>
<td>Leverage ratio</td>
<td>-8.664</td>
<td>-6.623</td>
</tr>
</tbody>
</table>

6 Conclusion/Discussion

References


Appendix

A-1 Details of Model Solution

I approximate the AR(1) process for productivity using the method of Rouwenhorst (1995). The model is solved using value function iteration (VFI). From the decision rules of the firms, I solve for the fixed point in the stationary distribution by iterating on Equation 17. Using the stationary distribution, I calculate the aggregate labor demand to see if the labor market (and by Walras’ Law the goods market) clears.

There are 9 points in the grid for productivity, which has support:

\[
\left[ \frac{-3\sigma}{\sqrt{1-\rho^2}}, \frac{3\sigma}{\sqrt{1-\rho^2}} \right],
\]

(A.1.1)

The capital grid has 135 points. This grid is finer for lower levels of capital stock. The grid of for capital has support:

\[
\left[ \bar{k}, (1-\delta)\bar{k}, (1-\delta)^{1/2}\bar{k}, (1-\delta)^{1/3}\bar{k}, (1-\delta)^{1/4}\bar{k}, \bar{k} \right],
\]

(A.1.2)

where \( \bar{k} = 0.001 \) and \( \bar{k} = 12 \).

The grid for debt has 33 points that include zero and positive and negative levels of debt. The grid points are spaces similarly to that used for the capital grid space and set so that the highest level of debt satisfies the collateral constraint with \( k = 0.7*\bar{k} \).