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The Impact of Progressive Dividend Taxation on Investment Decisions

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The Impact of Progressive Dividend Taxation on Investment Decisions[1]

Abstract

In this paper, we study the distortionary impact of progressive dividend taxation on dynamic investment decisions under the "new view" of dividend taxation. We use a stochastic general equilibrium model to examine the qualitative and quantitative importance of the distortion. We find that the theoretical irrelevance of dividend taxation advocated by the new view does not hold when dividends are taxed progressively in an economy with uncertainty. In such an economy, dividend taxation introduces a wedge between the marginal cost and benefit of investment. The distortion is caused by endogenous variations in the marginal tax rates over the business cycle, and is absent if dividend taxes are proportional. We find that the magnitude of distortion critically depends upon the progressivity of the tax system. We calibrate our model to quantify the importance of the distortion for an income tax system as progressive as the one in the United States. We find that the progressivity of such a tax system is too small for the distortion caused by dividend taxation to be quantitatively important for investment decisions.

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1 Introduction

In the United States, tax codes are generally progressive. Traditionally all the dividends received by an individual were included in the gross income and were taxed as ordinary income with a progressive schedule (Section 1(h) of the Code). The Jobs and Growth Tax Relief Reconciliation Act (JGTRRA), enacted in 2003, reduced dividend tax rates until 2011 and converted the taxation of dividends from a progressive to a proportional schedule for most filers.[2] There has been research on the importance of the dividend tax cut on the corporate behavior in a proportional dividend tax environment.[3] However, one question remains unanswered: Does the progressivity of dividend taxes *per se* matter for dynamic corporate investment decisions?

In this paper we examine both the theoretical and quantitative importance of progressive dividend taxation on corporate investment decisions. We introduce progressive dividend taxation into a general equilibrium model with aggregate uncertainty. We find that progressive dividend taxation matters for dynamic investment decisions at the theoretical level.

Two of our model's features are behind the theoretical relevance of dividend taxation. First, given the progressivity of the tax schedule, the firm takes into account how its investment decisions affect not only the total tax burden, but also the marginal tax rate on dividends that shareholders bear. Second, in the presence of uncertainty, the marginal dividend tax rate becomes a stochastic variable, so the firm in the model makes investment decisions under stochastic taxation. Progressivity introduces a wedge between the effect of dividend taxes on the marginal cost and marginal benefit of investment because of the time-varying nature of the taxable income, thus creating distortions in dynamic investment decisions. This wedge is absent in a proportional dividend tax environment.

We then proceed to evaluate the quantitative importance of progressive dividend taxation using the model. We parameterize our tax schedule to capture the progressivity of the U.S. income tax code, and find that the quantitative importance of dividend taxation crucially depends upon the progressivity of the tax code. In the model, progressivity is indexed by the derivative of the marginal tax rate with respect to the taxable income. We

[2]Under JGTRRA, dividends paid to most individuals by corporations are taxed at the same flat rate (15%, for most income brackets) until 2011. That rate also applies to capital gains until 2011 (Section 302 of JGTRRA).

[3]For example, Chettty and Saez (2005, 2007) and Gourio and Miao (2006).

find that the income tax code of the United States is not progressive enough for dividend taxation to be quantitatively important for marginal investment decisions.

These findings are important not only for policy makers, but also for academic economists.

There has been much research on the impact of dividend taxation on corporate investment decisions. However, virtually all of that literature has confined itself to the analysis of flat-rate taxes. There are two prevalent competing views of how flat dividend taxes affect decisions by firms. Under the "traditional" view, the marginal source of investment finance is new equity and the return to investment is used to pay dividends. Thus, dividend tax reductions lower the pre-tax return that firms are required to earn; hence dividend tax reductions raise investment. Under the "new" view, firms use internal funds and do not issue new equity. Because these future taxes are capitalized into share values, shareholders are indifferent between policies that retain earnings for investment or that use earnings to pay dividends. Thus, dividend taxes have no impact on a firm's marginal incentive to invest[4]. Our model is constructed under the premise of the new view. However, our results contrast with the new view in that the progressivity of dividend taxation is theoretically relevant for dynamic investment decisions.

Our work relates to an expanding literature on progressive taxation in heterogeneous agent models, including Erosa and Koreshkova (2007) and Consea and Krueger (2006). We choose to work in a representative-agent environment because of our focus on the dynamic impact of progressive taxation. A progressive tax system has both distributional and dynamic implications. By distributional implications, we mean that heterogeneous agents may be in different tax brackets at any given point in time and, as a result, may make different decisions. The distributional implications are present even when agents are locked in their respective tax brackets forever. The dynamic implications, however, capture how an agent's intertemporal investment decisions are altered because of the different marginal tax rates that individual might be facing over time. The focus of our paper is on the latter. We examine this issue in a representative-agent model to isolate the dynamic implications from distributional issues.

[4]The traditional view is examined by Poterba and Summers (1983, 1985). Auerbach (2002) and Hasset and Hubbard (2002) have a comprehensive survey of the literature on the new view.

Our paper also relates to the literature on the clientele effect, as postulated by Miller and Modigliani (1961). The clientele effect implies that shareholders in high-income tax brackets may choose to reduce holding of shares that pay high dividends. In our model, the representative household holds one unit of shares for all periods. As a result, it cannot reduce its tax burden by selling its shares. We share the main theme of this literature, namely, that dividend taxation affects investor behavior. However, this literature focuses on the change in shareholding, which might allow individuals to minimize their dividend tax burden. In our model, we do not analyze this type of shareholding behavior.

The organization of the paper is as follows. Section 2 describes a representative-agent dynamic stochastic general equilibrium model. Section 3 presents results and discusses intuition. Section 4 concludes.

2 The Model

There are a large number of identical and infinitely-lived firms and households. There is a single consumption-investment good. The households' personal income is subject to progressive taxation. The economy grows at a constant trend g on the balanced growth path.

2.1 Households

Each household maximizes a lifetime utility function:

$$\max_{a_{t+1}, f_{t+1}, c_t} E_0 \sum_{t=0}^{\infty} \beta^t \frac{(C_t - bC_{t-1})^{1-\gamma}}{1-\gamma} \tag{1}$$

subject to the following budget constraint:

$$C_t + a_{t+1}V_t + f_{t+1}V_t^f = a_t(V_t + D_t) + f_t(V_t^f + D_t^f) + W_tL_t - T(S_t) + \psi_t. \tag{2}$$

Here β is the subjective discount factor and C_t is real consumption at time t. The coefficient γ measures the curvature of the representative agent's utility function with respect to its argument $C_t - bC_{t-1}$. When $b > 0$, the utility function allows for habit persistence based on the household's own consumption in the previous period.

In the budget constraint, a_t represents shares of the representative firm held from period $t-1$ to t. V_t and D_t are the value per share and pre-income-tax dividends per share, respectively. The vector f_t represents the vector of other financial assets held at period t and chosen at $t-1$, including private bonds and other assets. The vectors V_t^f and D_t^f are corresponding vectors of asset prices and current-period real payouts; W_t represents the real wage, and L_t is the labor supply at time t. Each household faces a (normalized) time constraint 1. Given that leisure does not enter the utility function, agents allocate their entire time endowment to productive work. ψ_t is a lump sum transfer of all the tax revenues from the government.[5] The tax function $T(\bullet)$ represents the income tax based on taxable income, S_t, which is a combination of dividends and labor income. According to the tax function, labor income and dividends are taxed jointly and progressively:[6]

$$S_t = D_t a_t + W_t L_t. \tag{3}$$

The household's first-order condition with respect to the real equity holding is given by

$$V_t = \beta E_t \left\{ \frac{\Lambda_{t+1}}{\Lambda_t} \left[(1-\tau_{t+1}) D_{t+1} + V_{t+1} \right] \right\}, \tau_{t+1} = \frac{\partial T_{t+1}}{\partial S_{t+1}}. \tag{4}$$

Here Λ_t is the Lagrange multiplier of the budget constraint (2), and τ_t denotes the marginal tax rate at time t. The first order condition demonstrates that the value of the firm is the present discounted value of after-tax dividends.

2.2 Production

Output Y_t is produced using the Cobb-Douglas production technology:

$$Y_t = Z_t K_t^{\alpha} L_t^{(1-\alpha)}. \tag{5}$$

where K is the capital stock, and the logarithm of the stochastic productivity level, Z_t, follows a first-order autoregressive process given by:

$$z_t = \rho z_{t-1} + \sigma \xi_t. \tag{6}$$

[5]We assume that the government rebates all the tax revenues to the household as a lump sum. By doing this, we abstract from the income effect of the taxation system, and focus on the distortionary aspect of progressive taxation.

[6]In equilibrium, the representative household holds zero real bonds. As a result, in the model interest payment is not included in taxable income.

We assume convex capital adjustment costs in the capital accumulation process, similar to Jermann (1998) and Boldrin, Christiano, and Fisher (2001):

$$K_{t+1} = (1-\delta)K_t + \Phi\left(\frac{I_t}{K_t}\right)K_t, \tag{7}$$

where δ is the depreciation rate and $\Phi(\bullet)$ is a positive, concave function. Concavity of the function $\Phi(\bullet)$ captures the idea that changing the capital stock rapidly is more costly than changing it slowly, and the adjustment cost of investment is less when the capital stock is large.

We assume that the representative firm does not issue new shares and finances its capital stock solely through retained earnings. The dividends to shareholders are then equal to:

$$D_t = Y_t - W_t L_t - I_t, \tag{8}$$

where I_t represents investment.

The representative firm maximizes the present value of a stream of after-tax dividends:

$$\max_{I_t} E_0 \sum_{t=0}^{\infty} \left\{ \beta^t \frac{\Lambda_t}{\Lambda_0} [(1-\tau_t)D_t] \right\}, \tag{9}$$

subject to equation (7).

The first-order condition with respect to investment is:

$$\frac{1-\tau_t - D_t a_t \frac{\partial^2 T_t}{\partial S_t^2}}{\Phi'\left(\frac{I_t}{K_t}\right)} = \beta E_0 \left\{ \frac{\Lambda_{t+1}}{\Lambda_t} \left(1 - \tau_{t+1} - D_{t+1} a_{t+1} \frac{\partial^2 T_{t+1}}{\partial S_{t+1}^2}\right) \left[\alpha \frac{Y_{t+1}}{K_{t+1}} + \frac{(1-\delta) + \Phi\left(\frac{I_{t+1}}{K_{t+1}}\right) - \Phi'\left(\frac{I_{t+1}}{K_{t+1}}\right)\frac{I_{t+1}}{K_{t+1}}}{\Phi'\left(\frac{I_{t+1}}{K_{t+1}}\right)} \right] \right\}. \tag{10}$$

The left-hand side represents the shadow price of the installed capital in terms of the consumption good, or the marginal q. There are two factors that make investment cheaper in terms of the consumption good. First, a positive marginal tax rate means that, by investing the marginal unit of the good, the representative household avoids paying dividend taxes at τ_t. This effect is present even when dividend tax is proportional. Second, by investing the marginal unit of the good, the representative household avoids paying taxes at a higher marginal income tax rate, which would have been in effect with a larger dividend distribution. This effect, captured by $D_t a_t \frac{\partial^2 T_t}{\partial S_t^2}$, reflects the progressivity of the income tax system, and disappears in a proportional dividend tax environment. Investment provides an additional benefit in avoiding dividend taxes. As a result, the marginal q is lower.

The right-hand side of equation (10), which is the marginal benefit of investing an extra unit of the good, is affected by dividend taxes as well. The marginal gain from investment is subject to the marginal income tax rate τ_{t+1}. At the same time, the marginal increase in dividends may move the household to a higher marginal tax rate, which is captured by the term $D_{t+1} a_{t+1} \frac{\partial^2 T_{t+1}}{\partial S_{t+1}^2}$. In our model with aggregate uncertainty, the firm makes investment decisions under stochastic dividend taxation.

There is a wedge between the effect of progressive dividend taxes on the marginal cost and benefit of investment due to the time-varying nature of the combination term, $1 - \tau_t - D_t \frac{\partial^2 T_t}{\partial S_t^2} \frac{\partial S_t}{\partial D_t}$. This term is time-varying because dividend taxes are progressive and depend upon the time-varying taxable income.

The term $\zeta_{t,t+1}$, defined as

$$\zeta_{t,t+1} = \frac{1 - \tau_{t+1} - D_{t+1} \frac{\partial^2 T_{t+1}}{\partial S_{t+1}^2}}{1 - \tau_t - D_t \frac{\partial^2 T_t}{\partial S_t^2}}, \tag{11}$$

augments the stochastic discount factor and alters the marginal investment decision. The farther $\zeta_{t,t+1}$ is from 1, the larger the distortion of the progressive dividend tax. Under a proportional dividend tax regime, $\frac{\partial^2 T_t}{\partial S_t^2}$ is equal to zero and τ_t is constant; as a result, $\zeta_{t,t+1}$is equal to 1. Thus, under a proportional tax schedule, dividend taxation has no impact on the firm's investment decisions. This is the essence of the new view. Furthermore, in the steady state where marginal income tax rate is constant, dividend tax has no impact on investment decisions. Thus, the steady state equilibrium in our model is the same as in an economy with proportional dividend tax.[7]

[7] This result is particular to our model where labor is inelastic. When labor supply is elastic, the steady state equilibria will be different for economies with different proportional income tax rates.

2.3 Equilibrium

In equilibrium, all produced goods are either consumed or invested:

$$Y_t = C_t + I_t. \tag{12}$$

Labor is supplied inelastically at 1. Financial market equilibrium requires that a_t equals 1 for all t, and that all other assets are in zero net supply. In our model, the representative household cannot vary its labor supply or shareholding to avoid income taxes. This allows us to isolate the impact of progressive dividend taxation on dynamic investment decisions.

In equilibrium, what is not distributed as dividends and labor compensation is used for firm investment. Therefore, the taxable income S_t, which is a combination of dividends and labor compensation, is equal to consumption C_t.

3 Calibration and Model Results

The objective of the quantitative evaluation is to examine the implications of progressive dividend taxation on investment and other aggregate variables. We first present our benchmark calibration and then discuss the model results.

3.1 Calibration

3.1.1 Production

We set the quarterly trend growth rate, $1+g$, to 1.005, the capital depreciation rate δ is 0.025, the constant labor share in a Cobb-Douglas production function is 0.64. We assume that the capital adjustment cost function $\Phi(\bullet)$ takes the following form:[8]

$$\Phi\left(\frac{I_t}{K_t}\right) = \frac{(g+\delta)^{\eta}}{1-\eta}\left(\frac{I_t}{K_t}\right)^{1-\eta} + \frac{\eta(g+\delta)}{\eta-1}. \tag{13}$$

The capital supply becomes inelastic as η approaches infinity. We follow Jermann (1998) in setting η to 4.3.

[8] The functional form implies that $\Phi\left(\frac{I}{k}\right) = g+\delta$ and $\Phi'\left(\frac{I}{K}\right) = 1$ when evaluated at the steady state. As a result, incorporation of capital adjustment costs does not change the steady state of the model.

3.1.2 Preferences

We set the trend-adjusted subjective time preference, $\beta\,(1+g)^{1-\gamma}$, to 0.99. We will fix the risk-aversion parameter, γ, at 3 for our benchmark parameterization. We set b to 0.819, a value similar to that used in Constantinides (1990)[9].

3.1.3 Technology Shock Process

Estimates of the Solow residual, z_t, typically yield a highly persistent AR(1) process in levels. We calibrate the standard deviation of the shock innovation to replicate U.S. postwar quarterly output growth volatility of 1%. We set ρ to 0.97 in our benchmark case, as is standard in the real business cycle models.

3.1.4 Calibration of Tax Function

The progressive tax schedule in the model is based on a relationship between individual effective federal income tax rates and income for the U.S. tax return estimated by Gouveia and Strauss (1994). The tax function is given by:

$$T(S_t) = \phi_0\{S_t - [S_t^{-\phi_1} + \phi_2]^{-\frac{1}{\phi_1}}\}, \phi_0, \phi_1 > 0. \tag{14}$$

When ϕ_1 is equal to 0, the tax system is close to proportional with a tax rate of ϕ_0. Gouveia and Strauss (1994) use this parametric class of tax functions to approximate the U.S. tax system prior to the tax reform in 2003. They obtain values of $\phi_0 = 0.258$ and $\phi_1 = 0.768$. The parameter ϕ_2 is not unit free. We set ϕ_2 to 0.3045 so that the average tax rates in the U.S. economy and in the model are the same.[10]

The first-order derivative of the tax function with respect to taxable income is the marginal income tax rate τ_t, which is given by

$$\tau_t = \phi_0\{1 - [S_t^{-\phi_1} + \phi_2]^{-\frac{1}{\phi_1}-1} S_t^{-\phi_1-1}\}. \tag{15}$$

[9] We assume habit persistence in the household's preferences to obtain hump-shaped impulse responses of consumption to technology shocks, as is standard in the real business cycle models. Our results on the quantitative relevance of progressive income taxes remain robust when $b = 0$.

[10] This normalization amounts to choosing ϕ_2 in the model so that $\phi_2^{\text{model}} = \phi_2 \left(\frac{AHI\text{model}}{AHI_{\text{U.S. 1990}}}\right)^{-\phi_1}$, where AHI is the average household income (about \$50 thousand for the United States)

The second-order derivative of the tax function, which measures the progressivity of the tax system, is given by

$$\frac{\partial^2 T_t}{\partial S_t^2} = \phi_0 \left(1 + \phi_1\right) \phi_2 [S_t^{-\phi_1} + \phi_2]^{-\frac{1}{\phi_1} - 2} S_t^{-\phi_1 - 2}. \tag{16}$$

Given the estimates of ϕ_0, ϕ_1 and ϕ_2, the marginal tax rate and the second-order derivative of the tax function in the steady state are respectively 17 percent and 0.02. Figure 1 plots the marginal tax rate and the second-order derivative of the tax function as a function of taxable income.

3.2 The Theoretical and Quantitative Importance of Progressive Taxation

We use Dynare to compute the nonlinear solutions to the model to take into account possible second order effects of progressivity. The policy and transition functions are contained in Table 1.

The coefficients of the policy and transition functions, even those on the second-order terms, are very similar under both proportional and progressive dividend taxation. These results indicate that progressive taxation does not have quantitative impact on dynamic investment decisions. The distortion arising from progressive dividend taxation is very small.[11]

Figure 2 plots the impulse responses of consumption and investment in response to a one-unit standard deviation in the technology shock with and without progressive dividend taxes. The dynamic responses of consumption and investment with and without taxes are very similar. They show a hump-shaped impulse response of consumption observed in the data. Investment increases in response to the positive technology shock but returns to a level slightly higher than the steady state after about four quarters. Afterward, investment reverts slowly to the steady state level because of the presence of capital adjustment costs. Since taxable income S_t is equal to consumption in equilibrium, its dynamic response mimics that of consumption. As a result, there are no visible differences in the impulse responses of taxable income under progressive or proportional dividend taxation.

[11] We also augment the model with a flat capital gain tax and a flat corporate income tax. The distortion from progressive dividend taxation remains quantitatively very small. The results are available from the authors upon request.

As mentioned above, ζ determines the distortions in dynamic responses of consumption and investment caused by progressive taxes. The term ζ is a function of the first-and second-order derivatives of the tax function. We thus plot the dynamic responses of the two components τ_t and μ_t, where $\mu_t = \frac{\partial^2 T_t}{\partial S_t^2}$. As shown in Figure 3, following a one-unit standard-deviation in the technology shock, the largest absolute deviation of the marginal tax rate is merely 0.05 percent above the steady state rate of 17 percent. Similarly, the largest absolute deviation of μ_t from its steady state value of 0.02 is merely 0.0003. Therefore, the changes in these two components are too small for the distortionary term $\zeta_{t,t+1}$ to deviate from 1.

The model is able to capture other salient features of real business cycle models. The model replicates the relative volatility of consumption and investment with respect to output observed in the data.

	$\frac{\sigma_{\triangle C}}{\sigma_{\triangle Y}}$	$\frac{\sigma_{\triangle I}}{\sigma_{\triangle Y}}$
Model	0.50	2.55
Data	0.51	2.65

3.2.1 Intuition: Why is the Quantitative Effect So Small?

Additional insight into why the quantitative effect is so small can be obtained from a log-linear approximation of $\zeta_{t,t+1}$, which summarizes the distortionary effect of progressive dividend taxes on corporate investment decisions. The log-linear approximation of $E_t \log\left(\zeta_{t,t+1}\right)$ can be represented as:[12]

$$\begin{aligned} E_t \log\left(\zeta_{t,t+1}\right) &\approx -\frac{\mu}{1-\tau-\overline{D}\mu}\left(E_t \triangle S_{t+1} + E_t \triangle D_{t+1}\right), \\ \text{where } \mu &= \left.\frac{\partial^2 T}{\partial S^2}\right|_{s.s.} \end{aligned} \quad (17)$$

There are three factors that determine the size of the distortion. The first factor is the expected change in taxable income. For a given level of progressivity of the tax system indexed by μ, the larger the expected change of taxable income S_{t+1}, the larger the possible differences between the marginal

[12] There is a third term on the right hand side of equation (17), $-\frac{\varphi \overline{D}}{1-\tau-\overline{D}\mu}$, where $\varphi = \left.\frac{\partial^3 T}{\partial S^3}\right|_{s.s.}$ We ignore this term because φ is not only very small, but also has a negative sign, which compensates the distortionary effect of progressive taxation.

tax rates facing the agent in periods t and $t+1$. Similarly, given the same progressivity of the tax system, a larger expected change in dividends also implies a higher tax burden. The last element, $\frac{\mu}{1-\tau-\overline{D}\mu}$, measures the amount of distortion from expected changes in taxable income and dividends. The term μ represents the marginal change in the marginal tax rate due to the marginal change in the taxable income: the higher μ, the larger the distortion brought by the tax wedge on both sides of the investment equation. The distortion is higher for a higher marginal tax rate τ. According to our benchmark calibration using the tax function estimated to match the U.S. income code, $\frac{\mu}{1-\tau-\overline{D}\mu}$ takes the value of 0.0274 in the steady state. The distortionary effect of progressive dividend taxation turns out to be too small to have any impact on dynamic investment decisions.

We proceed to examine whether our results are robust under more progressive tax codes around the 1960s in the United States. Figure 4 compares the plots of the marginal tax rates and the second-order derivatives of the tax functions as a function of taxable income in 1957, 1967, and our benchmark case.[13] The tax system in 1957 is the most progressive of the three, with τ and μ being respectively 33.37% and 0.0599 when evaluated at our model's steady state. Consequently, the term $\frac{\mu}{1-\tau-\overline{D}\mu}$ takes the value of 0.0918 in the steady state, nearly four times higher than the corresponding value in our benchmark model. Figures 5 and 6 plot the dynamic evolutions of consumption, investment, τ_t and μ_t in response to a positive technology shock. Again, the plots of the first two variables are very similar to their flat-tax counterparts. The marginal tax rate τ_t and the second-order derivative μ_t vary more in response to a one-unit standard deviation in the technology shock, as compared with the benchmark case. However, even under such a highly progressive tax system, the distortionary effect of progressive dividend taxation is still too small to affect dynamic investment decisions.[14]

Even in heterogeneous-agent models where the expected growth rate of taxable income and dividends may be higher than in our representative-agent model,[15] our results still impose strong restrictions on the size of the

[13]The tax parameters ϕ_0, ϕ_1, and ϕ_2 for the effective tax functions in 1957 and 1967 are estimated by Young (1990).

[14]We have carried out a heuristic experiment by fixing τ but varying μ. We find that we need the value of μ to be as high as 2 for progressive income taxes to have distinguishable impact on investment decisions, an unrealistic value for the U.S. income tax code. The results are available from the authors upon request.

[15]In the representative-agent model, taxable income is much less volatile compared with

distortion in investment. In heterogeneous-agent models, the term $\frac{\mu_t}{1-\tau_t-D_t\mu_t}$ can be evaluated at different levels of taxable income. However, given the tax function in the model, the second-order derivative μ_t ranges from close to 0 to 0.4 (the latter value occurs in the lowest income bracket). Moreover, for the households that would most likely hold on to stocks (typically people in the middle to top income tax brackets), the second order derivative of the tax function is even smaller.

4 Conclusion

In this paper, we study the distortionary impact of progressive dividend taxation on dynamic investment decisions. We use a stochastic general equilibrium model to examine the qualitative and quantitative importance of the distortion. We find that, theoretically, progressive dividend taxation distorts dynamic investment decisions by creating a wedge between the marginal cost and benefit of investment. The wedge is introduced by the variations in the marginal tax rate caused by dynamic evolutions of taxable income over the business cycle. This type of distortion is not present if dividend taxes are proportional.

We calibrate our model to quantify the importance of this distortion for an income tax system that is as progressive as the system in the United States. We find that the magnitude of distortion critically depends upon both the marginal tax rate and the progressivity of the tax system, as measured by the derivative of the marginal tax rate with respect to the taxable income. We find the progressivity of the U.S. tax code too weak for the distortion caused by progressive dividend taxation to be quantitatively important for dynamic investment decisions.

Our model is constructed under the premise of the new view. We find that the theoretical irrelevance of dividend taxation advocated by the new view does not hold when dividends are taxed progressively. However, it is a reasonable approximation to reality because of the weak progressivity of the U.S. income tax system.

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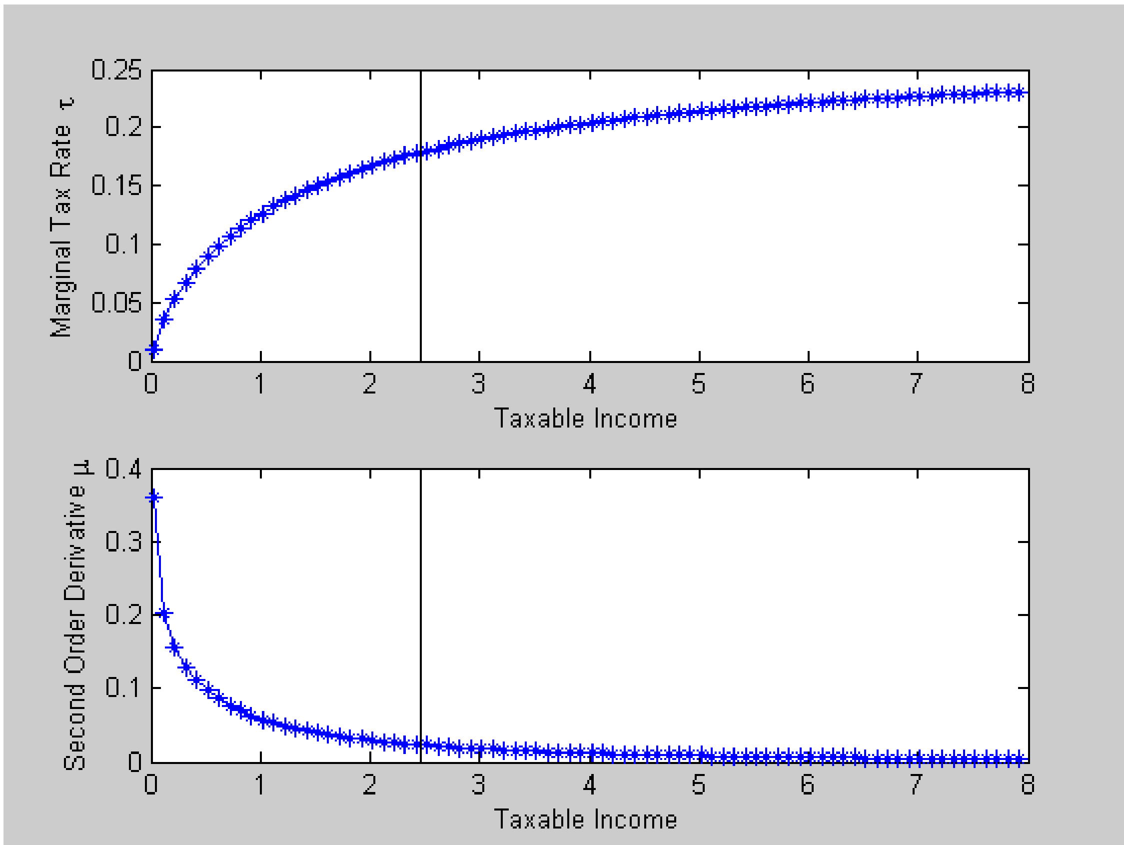
that of heterogeneous-agent models because of aggregation.

Table 1: Comparison of the Model Results

	C_t		I_t		λ_t		τ_t	μ_t
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(a)
constant	2.5519	2.5519	1.0793	1.0793	1.8059	1.8054	0.17	0.02
$\widehat{K}_t$	0.0052	0.0052	0.0311	0.0311	-0.1040	-0.1033	0.00	-0.00
$\widehat{z}_{t-1}$	0.9697	0.9694	2.5526	2.5528	-20.1120	-20.0462	0.02	-0.01
$\widehat{C}_{t-1}$	0.6405	0.6419	-0.6405	-0.6419	4.889	4.8398	0.01	-0.01
$\widehat{\xi}_t$	0.01	0.01	0.0263	0.0263	-0.2073	-0.2067	0.00	-0.00
$\widehat{K}_t^2$	-0.0001	-0.0001	-0.0002	-0.0002	0.0060	0.006	0.00	0.00
$\widehat{z}_{t-1}\widehat{K}_t$	-0.0026	-0.0025	0.0378	0.0378	1.4323	1.4226	-0.00	0.00
$\widehat{z}_{t-1}^2$	-0.0399	-0.0342	1.7483	1.7425	124.0330	123.3532	-0.01	0.00
$\widehat{C}_{t-1}\widehat{K}_t$	0.0033	0.0033	-0.0033	-0.0032	-0.3956	-0.3917	0.00	-0.00
$\widehat{C}_{t-1}\widehat{z}_{t-1}$	0.3530	0.3508	-0.3530	-0.3508	-64.3132	-63.6573	0.00	0.00
$\widehat{C}_{t-1}^2$	-0.0606	-0.0604	0.0606	0.0604	7.7041	7.5980	-0.00	0.00
$\widehat{\xi}_t^2$	-0.0000	-0.0000	0.0002	0.0002	0.0132	0.0131	0.00	0.00
$\widehat{K}_t\widehat{\xi}_t$	-0.0000	-0.0000	0.0004	0.0004	0.0148	0.0147	-0.00	0.00
$\widehat{z}_{t-1}\widehat{\xi}_t$	-0.0008	-0.0007	0.0360	0.0359	2.5574	2.5434	-0.00	0.00
$\widehat{C}_{t-1}\widehat{\xi}_t$	0.0036	0.0036	-0.0036	-0.0036	-0.6630	-0.6563	0.00	0.00

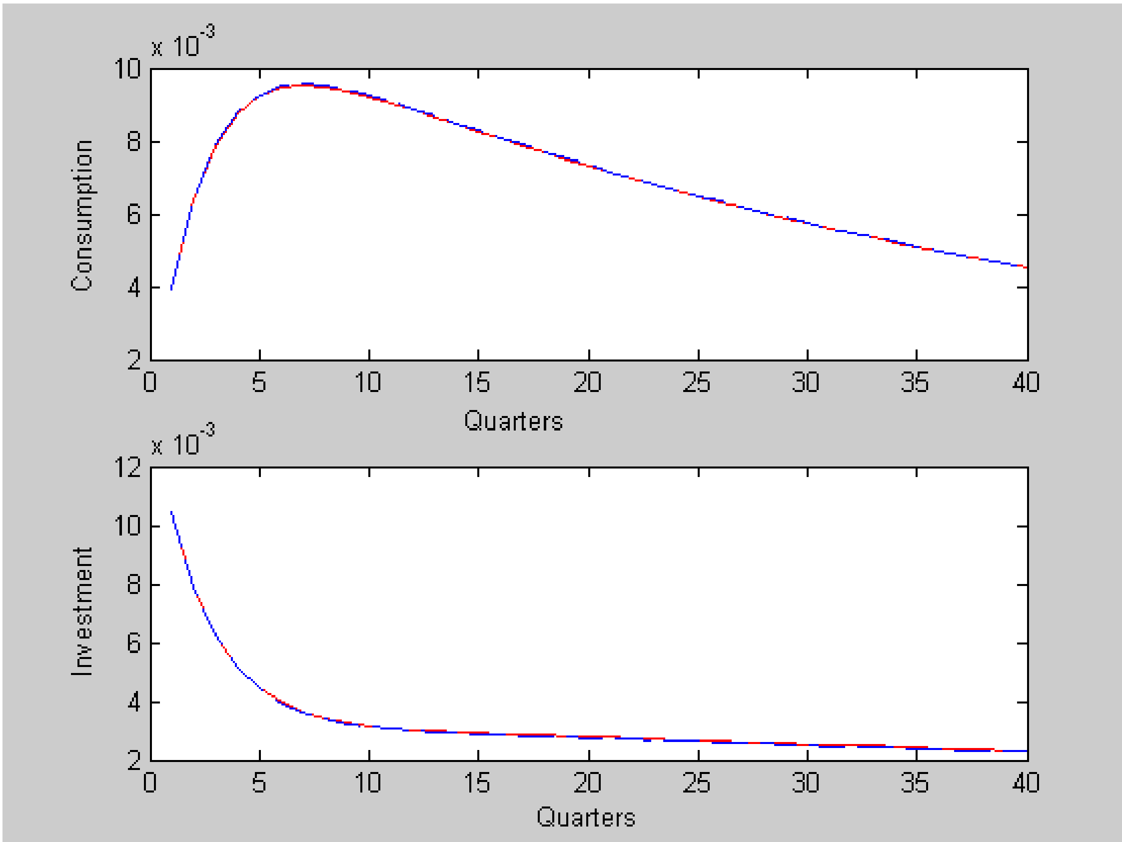
Column (a) contains the coefficients of policy and transition functions for the benchmark model with progressive taxation (the second-order approximation). Column (b) contains the coefficients for the case with proportional taxation. For τ_t and μ_t, the entries in column (b) (the flat-tax case) are all zero. The $\widehat{\cdot}$ variables in the rows represent deviations from their respective steady state values. The constant term is the sum of the steady state value and the shift effect of the variance of future shocks.

Figure 1: The First and Second Derivative of the Tax Function



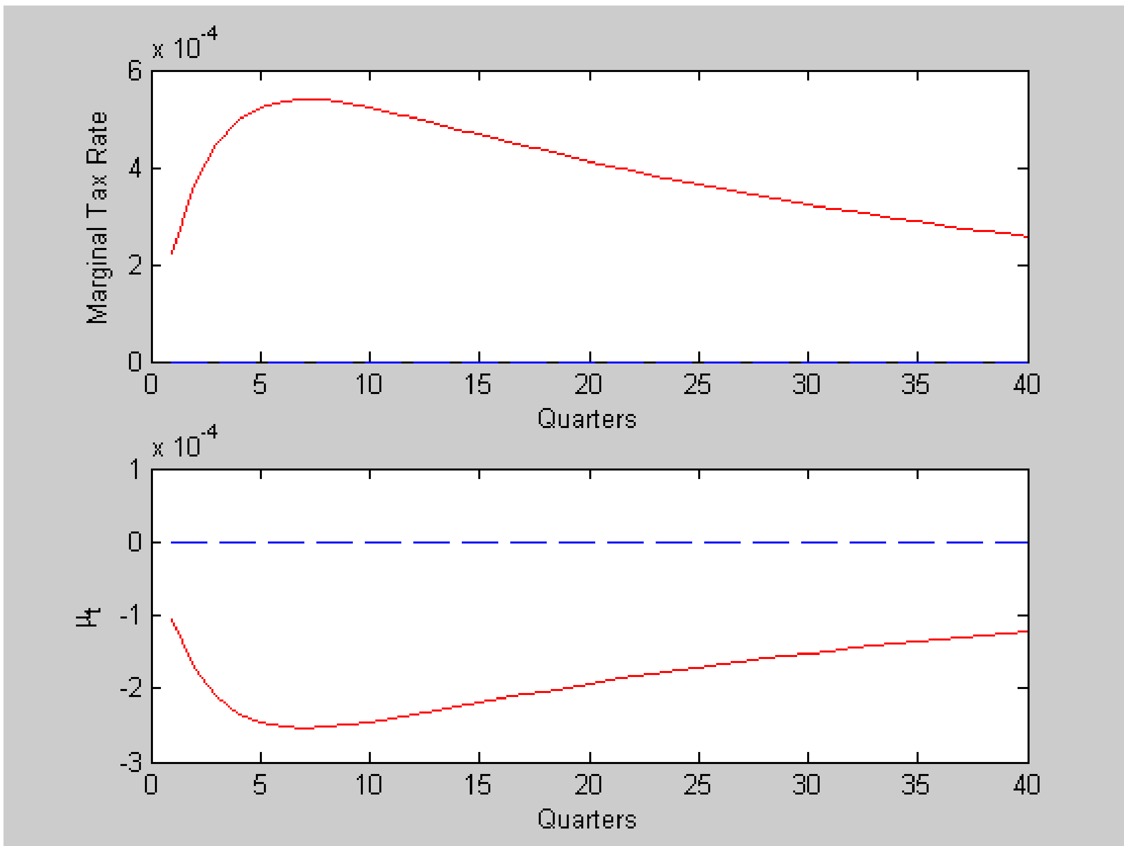
The vertical line represents the taxable income in the steady state.

Figure 2: Impulse Responses for Consumption and Investment



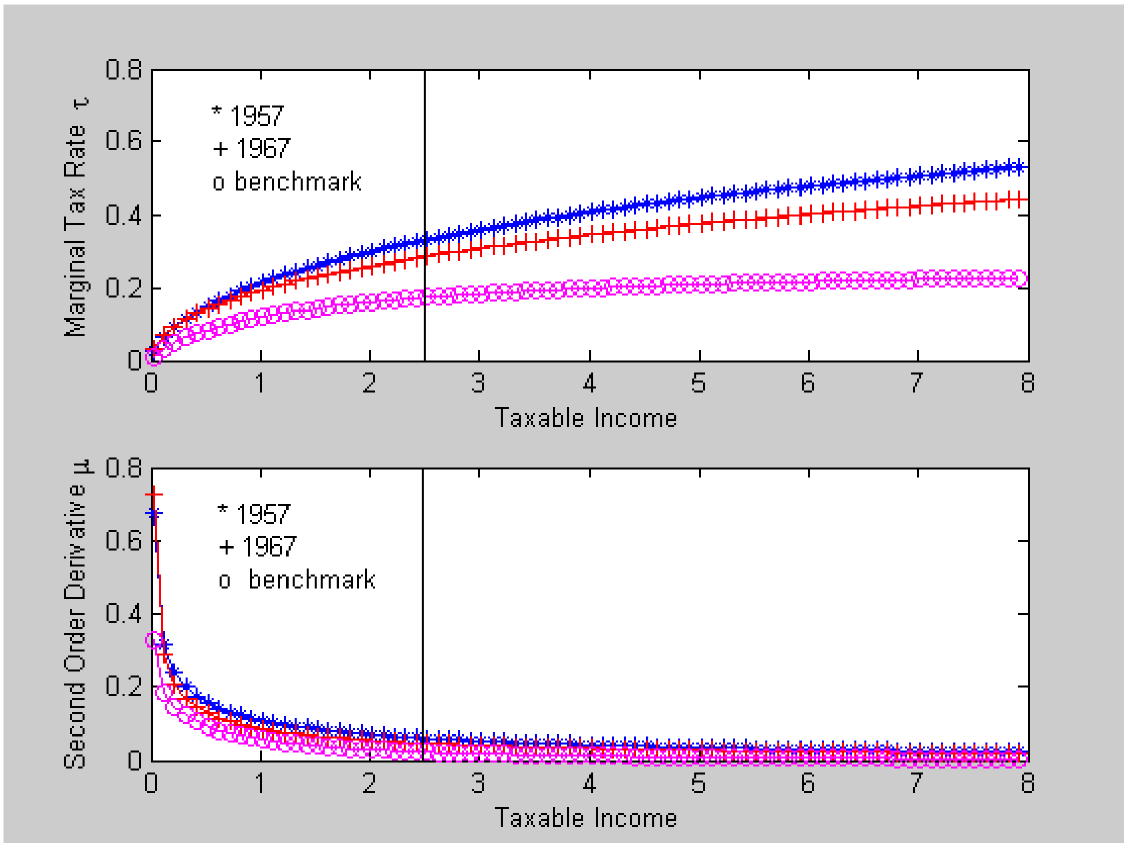
The impulse is a 1 percent positive productivity shock. The responses are in percentage deviations from steady state values. The solid lines are the impulse responses under our benchmark progressive income taxation, and the dashed lines are those under flat taxes.

Figure 3: Responses of τ and μ



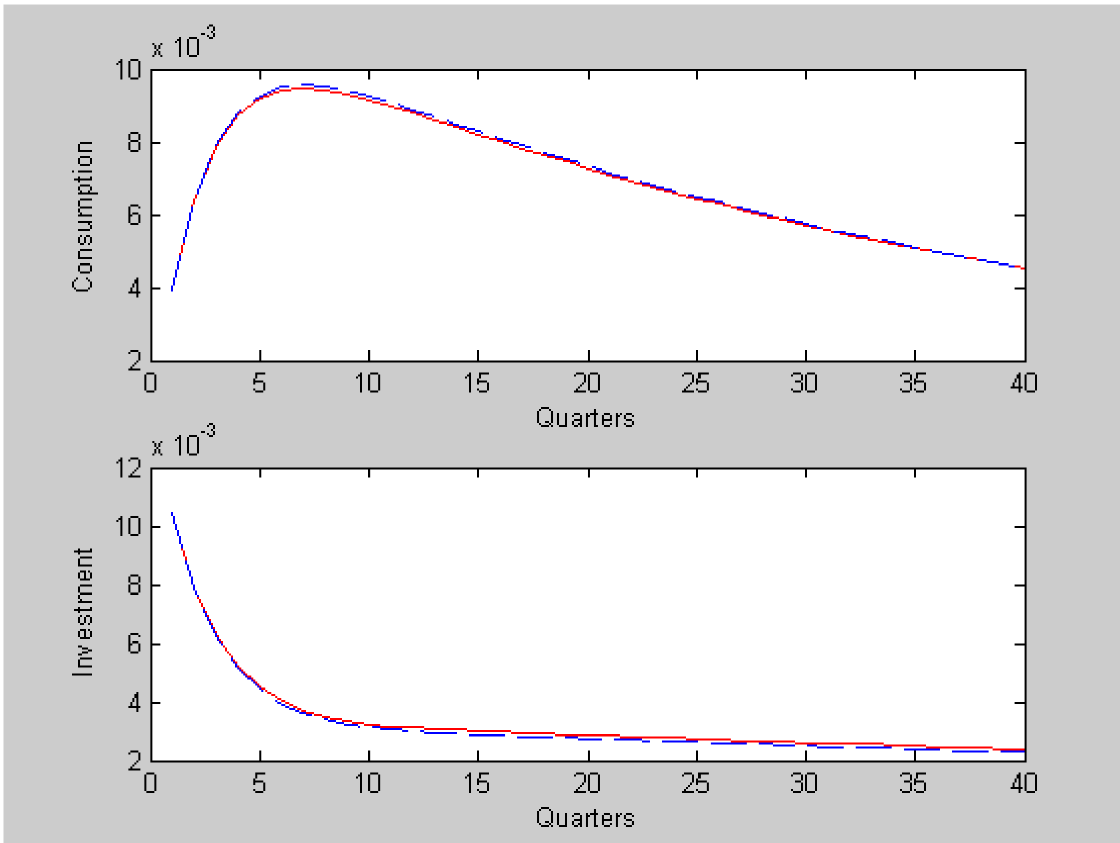
The responses are in absolute deviations from steady state values in response to a one-unit standard deviation in the productivity process z.

Figure 4: Comparison of the Tax Functions



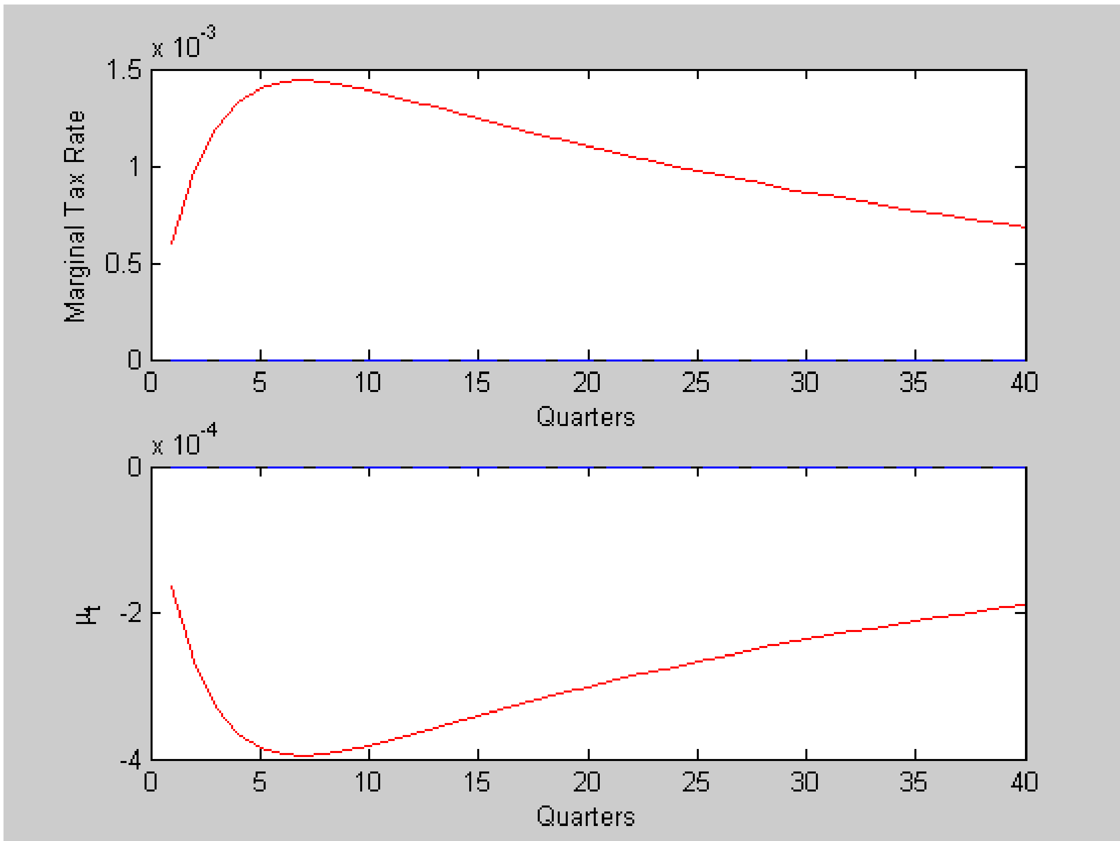
The vertical line represents the taxable income in the steady state.

Figure 5: Impulse Responses: The Case of 1957



The impulse is a 1 percent positive productivity shock, the responses are in percentage deviations from steady state values. The solid lines are the impulse responses under our benchmark progressive income taxation, and the dashed lines are those under flat taxes.

Figure 6: Responses of τ and μ: The Case of 1957



The responses are in absolute deviations from steady state values in response to a one-unit standard deviation in z.

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