End of Double Taxation, Policy Announcement, and Business Cycles

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Abstract

This paper examines the effectiveness of the "end of double taxation" (on dividends) policy in stabilizing the economy. Both announced and unannounced policies are considered. A reduction in double taxation stimulates investment and improves welfare, but its impact on output is moderate and it has a negative effect on work hours. Temporary tax cuts serve as a double-edged sword that creates an investment boom but also generates an investment slump when the tax cut expires. Announcements of future tax cuts may have important effect on output dynamics. Agents respond to the tax policy even before it is implemented. If the tax cut is announced to be temporary, its impact on output can be greatly reduced.

Key words: double taxation, news and business cycles, capital-income tax.

JEL Classification: E6, E62.

1 Introduction

The benefits of reducing capital-income tax *in the long run* has been extensively studied in the literature. In Chamley (1986)'s seminal work, the optimal tax rate for capital income is shown to be zero in the steady state of a general equilibrium model. Following his work, extensive research has been conducted in this area (Lucas, 1990; Zhu, 1992; Chari et al., 1994; Devereux and Love, 1994; Correia, 1996; Atkeson et al., 1999). The general conclusion of the literature is that capital income taxation serves neither efficiency nor redistributive purposes in the long run, unless the tax system is incomplete. Therefore, reducing capital-income taxation is beneficial to the economy.

Few researchers, however, have paid much attention to the *short-run* dynamics associated with changes in capital-income taxes. If there is a temporary reduction in capital income taxes, how do output, investment, and employment respond? If the economy experiences a recession, can the reduction of capital-income taxes be used as a stabilization tool to restore the long-run equilibrium? Moreover, if the tax rate changes are announced beforehand, how does this *news* affect market expectations and how do these expectations in turn change the dynamics of the economy? We pose these questions within the context of recent fiscal policy changes in the United States. In the wake of the 2001 recession, policymakers have apparently adopted reductions in capital income taxes as a macroeconomic stabilization tool. The "Jobs and Growth Tax Relief Reconciliation Act" of 2003 included an immediate tax break for capital gains, new deductions for small businesses, and dividend tax reductions. Among these tax measures, the most advocated one was the elimination of "double taxation" on dividend income. Dividend income tax would be reduced beginning on January 1, 2003, and be further reduced in 2008. The reduction, however, will expire on January 1, 2011. The stated goal was to stimulate an economic expansion by encouraging consumer spending and promoting private sector investment.[1] These reductions were temporary in nature, and was clearly focused on achieving short-term economic goals.

In the U.S. tax system, corporate capital income is taxed at both the corporate level and individual level. In the first stage, a company is taxed on its profits, typically at a marginal rate of 35%. In the second stage, when the company passes along its profits to the investors in the form of dividends, the dividends are taxed at a marginal rate of 38.6% (Cassou and Lansing, 2004). This is sometimes referred to as "double taxation." The marginal federal tax rate on capital income sums up to as high as more than 60%. In other words, for every dollar of profit a company could pay out in dividends, fewer than 40 cents actually reach the investors. If the firms retain and reinvest the

[1] See, for example, the President's address of May 28, 2003, Office of the Press Secretary, the White House.

after-tax earnings, investors will be further taxed if the reinvestment causes any appreciation of the firms' stocks. This cumulative tax on retained earnings is up to 48%. Under the new law, dividends are taxed at a 15 percent rate for most individual taxpayers. Dividends received by low income individuals are taxed at a five percent rate until December 31, 2007 and become fully untaxed in 2008. And again, these provisions are set to expire on January 1, 2011.

In this paper, we evaluate the effectiveness of the "end of double tax" policy as a tool for economic stabilization in a competitive economy. We study a neoclassical business cycle model in which firms are subject to a capital income tax system similar to the one we just described. We then simulate the response of the economy to permanent and temporary reductions in "double taxation," and examine qualitatively and quantitatively whether or not the tax rate changes can "jump-start" the economy by stimulating investment, employment, and output. The conventional way to model temporary changes in tax rates is to model them as unexpected changes, or "shocks." We follow this approach in the first part of our analysis. The more interesting part of our research, however, is the second part, in which we allow the policymakers to announce to the market that the tax rate will be changed several quarters later. In this case, the announcement itself should have an impact on economic aggregates, since the private market would take the future changes in taxes into account when they form expectations about the future, which in turn affect the allocation of resources. By modelling the announcement effect, we hope to capture more closely agents' behavior in reality. As we described above, the removal of double taxation was announced to become effective in 2003 and end in 2011. One wonders how the market would respond to such announcement. In particular, since the tax changes are temporary and are known beforehand, one possibility is that there will not be any significant changes in agents' behavior at all, given that they realize that their permanent income may not be affected much by such short-term tax changes. Another possibility is that agents may decide to fully take advantage of the expected tax changes by increasing investment during the reform period, and reducing investment afterwards. In this case, one wonders if the planned reduction in investment would have any negative impact on the economy. In this paper, we use our theoretical model to evaluate the plausibility of each case.

Researchers have now realized that announcements or news can have significant impact on business cycles. Jaimovich and Rebelo (2006) introduce news into a real business cycle framework. Christiano et. al. (2006) studies boom-bust cycles driven by news in RBC and new Keynesian models. Beaudry and Portier (2003) study business cycles that arise when agents cannot properly forecast the future. All of these papers conclude that news can be an important impulse for business fluctuations. In this paper, we examine the effect of announcing a tax policy change to the public

before its implementation. Our approach closely follows that of Jaimovich and Rebelo (2006) and Christiano et. al. (2006).

Lucas (1990), Devereux and Love (1994) also study the quantitative effect of capital income taxes in general equilibrium models. Using endogenous growth models, they are able to identify the impact of a tax cut on the long-run growth rate of the economy. Their focus is on the "growth effect" of capital income taxes. The model environment we consider is a neoclassical economy, in which the growth rate of the economy is deterministic. Eliminating dividend taxes has no growth effect in this environment. Instead, there will only be a "level effect" reflected by changes in the steady state values of economic aggregates. The tax policy does speed up economic growth, but only up to the point where the long run growth path is reached. Our focus is therefore purely on the short run impact of the policy.

The results of our study are summarized as follows. In general, eliminating dividend tax is useful for fostering an economic recovery. A reduction in double taxation stimulates investment and improves welfare, but its impact on output is moderate and it has a negative effect on work hours. Temporary tax cuts serve as a double-edged sword that creates an investment boom but also generates an investment slump when the tax cut expires. News about future tax cuts may have important effects on output dynamics. With news, agents respond to the tax policy even before it is implemented. If a tax cut is announced to be temporary, the policy's intended impact on output can be greatly reduced.

The rest of the paper is organized as follows. The model is presented in section 2. Section 2 also describes the parameter values and the mechanism that generates the transitional dynamics of the economy. Quantitative results are provided in section 3 and 4. Section 5 concludes the paper.

2 The Model

We consider a decentralized neoclassical economy. The economy consists of three-sectors: households, firms and the government. The households own the firms and receive profits from the firms in the form of dividends. The firms produce a unique good, which can be either consumed in the current period or transformed to physical capital in the next period. The government taxes the private sector on their earnings from labor as well as capital services to finance its spending.

2.1 The Economy

There are a large number of infinitely lived identical individuals in the economy. The preferences of the representative individual are of the following form:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\gamma}}{1-\gamma} - B\frac{N_t^{1+\theta}}{1+\theta}\right),$$
$$0 < \gamma, B > 0, \theta > 0, 0 < \beta < 1.$$

where β is the discount factor, representing preferences for leisure, and C_t and N_t are consumption and hours worked. $\gamma, \theta > 0$ measure curvatures of the utility function. $B > 0$ is weight given to hours.

There are also a large number of competitive firms in the economy that produces a homogenous good. Each household owns a firm. The household also supplies labor and productive capital to the firms, and earns a wage rate w_t for each unit of labor and a rental rate r_t for each unit of physical capital K_t supplied. The household pays taxes on all forms of income at various tax rates. The budget constraint of the household is

$$C_t + I_t \leq w_t N_t + r_t K_t - T_t, \tag{1}$$

where I_t is gross physical investment defined as

$$I_t = K_{t+1} - (1-\delta)K_t. \tag{2}$$

$0 < \delta < 1$ is the depreciation rate of capital. The tax bill, T_t, paid by the household at each period of time is defined as:

$$T_t = \tau_t^p w_t N_t + \tau_t^b (r_t K_t - \phi I_t) + \tau_t^d (1-\tau_t^b)(r_t K_t - \phi I_t). \tag{3}$$

$\tau_t^p > 0$ is the tax rate on personal labor income $w_t N_t$. Note that the economic profits of competitive firms are zero, but their capital income, in the form of accounting profits, is $r_t K_t$. Capital income is taxed at the rate τ_t^b after deductions at the corporate level. The deductions are represented by the term ϕI_t, where the parameter ϕ is the fraction of gross investment that is deducted. This formulation, which is the same as in Cassou and Lansing (2004), captures an element of the U.S. tax code that provides incentives to private sector investment by allowing some new investment as well

as capital depreciation to be deducted from taxable income. We assume that firms do not retain any earnings. They return all their after-tax capital income to the individuals. This capital income, $(1-\tau_t^b)(r_tK_t - \phi I_t)$, is taxed for the second time at the rate τ_t^d at the individual level. This is "double taxation." The assumption of no retained earnings is unrealistic. But with a frictionless capital rental market and constant returns to scale, there is no need for firms to retain any earnings.

The firm combines physical capital and labor, to produce the final good, using the following production technology:

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha}, \tag{4}$$

where α represents the share of capital in total output. A_t represents the random productivity shock variable which follows an AR(1) process given by:

$$\log A_t = \rho \log A_{t-1} + e_t, \tag{5}$$

where $0 < \rho < 1$ is the persistence parameter and $e_t \sim N(0, \sigma^2)$.

In equilibrium, profit maximization by the firm implies that both factors are paid their marginal products. Thus we have the following:

$$w_t = (1-\alpha)\frac{Y_t}{N_t}, \tag{6}$$

$$r_t = \alpha\frac{Y_t}{K_t}. \tag{7}$$

Given the associated constraints the household chooses consumption, leisure, and capital to maximize her lifetime utility, which yields the following necessary conditions for equilibrium:

$$BN_t^{\theta} = (1-\tau_t^p)(1-\alpha)\frac{Y_t}{N_t}C_t^{-\gamma}, \tag{8}$$

$$C_t^{-\gamma} = \beta E_t C_{t+1}^{-\gamma}\left(\frac{1-\psi_{t+1}}{1-\psi_{t+1}\phi}\alpha\frac{Y_{t+1}}{K_{t+1}} + 1 - \delta\right), \tag{9}$$

$$C_t + (1-\psi_t\phi)[\gamma K_{t+1} - (1-\delta)K_t] = [(1-\psi_t)\alpha + (1-\tau_t^p)(1-\alpha)]Y_t, \tag{10}$$

where ψ_t is defined as

$$\psi_t = \tau_t^d(1-\tau_t^b) + \tau_t^b. \tag{11}$$

Equation (8) equates the marginal disutility of supplying labor to the after-tax real wage. Equation (9) equalizes the post-tax marginal costs and benefits of investing in future capital. Equation (10)

is the household's budget constraint. In equation (8), the term $(1-\tau_t^p)(1-\alpha)\frac{Y_t}{N_t}$ can be interpreted as the post-tax, *effective* level of the marginal product of labor. Likewise, in equation (9), the term $\frac{1-\psi_{t+1}}{1-\psi_{t+1}\phi}\alpha\frac{Y_{t+1}}{K_{t+1}}$, is the effective marginal product of capital at time $t+1$.

The government sets the tax code parameters to raise a specific level of government revenue each period. Government revenue, g_t, does not contribute to either production or individual utility. For simplicity, we assume that the government budget is balanced each period. The budget constraint of the government is defined as follows:

$$g_t = \tau_t^p w_t N_t + \tau_t^b(r_t K_t - \phi I_t) + \tau_t^d(1-\tau_t^b)(r_t K_t - \phi I_t). \tag{12}$$

The household's budget constraint and the government's budget constraint yield the following market clearing condition for the economy:

$$C_t + I_t + g_t = Y_t. \tag{13}$$

2.2 Calibration and system dynamics

Most parameters are calibrated to be consistent with existing findings in the literature. In section 3 we vary some parameters around our initial benchmark settings for robustness-check purposes.

King and Rebelo (2000) [henceforth KR] set the value of labor's share parameter as 2/3, which is a standard value for the long-run labor income share in the U.S. GNP. Following KR we set the value of capital's share in total output, α,equal to 0.33. The conventional annual depreciation rate used in neoclassical growth literature is 10% (KR, 1990). As we are interested in quarterly analysis, we use $\delta = 0.025$. KR derives the value of the discount factor by setting the steady state interest equal to 6.5%, which is the average annual return to capital in the U.S. For our quarterly model, we set β so that the quarterly interest rate is (0.065/4)%. Following the real business cycle literature we set the value of the persistence parameter, ρ, equal to 0.90. The long run growth rate of a neoclassical economy is determined by the exogenous rate of technological progress, χ. This long run rate remains unchanged in all the alternative tax regimes. χ is set to 1.004 in our model. The curvature of the utility function for consumption and labor hours, γ and θ, are set to be 1 and 0 in the benchmark calibration, to be consistent with most RBC models in the literature. When $\gamma = 1$, the utility function for consumption becomes a logarithmic function.

Personal income tax rate, τ_t^p, is set to be 0.253, on the basis of U.S. tax schedule for married taxpayers with no children who file IRS form 1040 jointly. Corporate income tax rate, τ_t^b, is set to

Parameter	Value	Empirical Facts to Match
τ_t^p Personal income tax rate	0.253	Fitted from U.S. Tax schedule
τ_t^b Business income tax rate	0.35	Statutory corporate tax rate
τ_t^d Dividend tax rate	0.173	Calculated dividend tax rate
β Discount rate	0.99	Return to capital is 6.5% per annum
α Capital share in production	0.33	Share of labor income in GNP is 2/3
γ Curvature for utility function	1	Intertemporal elasticity of consumption
θ Curvature for utility function	0	Labor supply elasticity
δ Capital depreciation rate	0.025	Annual depreciation is 10% in the U.S.
χ Long-run growth rate	1.004	Average per capita growth is 1.6% per annum
ρ Persistence of productivity shock	0.9	Errors in Solow residuals

Table 1: Calibration of Parameters

be 0.35, to match the statutory corporate tax rate. In the U.S. tax system, dividends received by a shareholder generally are taxed at the same rate that applies to the personal income tax; capital gains, however, are taxed at a lower rate. In our model, we do not specify the proportion of after-tax profit that is retained by the firm and that is distributed as dividends to the shareholders. As the dividend tax is generally higher than the tax on retained earnings, if all the after-tax profit of the firm of our benchmark model is taxed at the dividend tax rate, elimination of double taxation would generate an upward bias in our results. To avoid the bias, the after-tax profit of the firm is taxed at a rate equal to the weighted average of tax rates on retained earnings (capital gain) and dividends. The average dividend pay out for all COMPUSTAT active firms for 1993-2003 was 17.62% and for 1983-1993 was 28.55%. The average retained earnings respectively in these two periods were 82.38% and 71.45%. Therefore, on average, in those 20 years the proportion of dividend paid out was 23% and the firms retained 77% of their after-tax profit. The tax rate on dividend (after-tax profit) for our benchmark model is calculated as follows: [average dividend pay out (23%) $\times$ tax rate on dividend (25%) + average retained earning (77%) $\times$ capital gain tax rate (15%)] = 17.3%. ϕ is set to 0.844 to match the effective marginal capital tax rate, which is 0.16.

We summarize our calibrations in Table 1.

To analyze the short-run dynamics of the benchmark economy following tax policy reforms, we linearize the first order conditions around the steady state as in a standard RBC exercise. In our simulations, we fix the personal income tax rate τ_t^p and the corporate income tax rate τ_t^b at the steady-state levels. But to capture shocks to the capital income tax rates, we model the dividend tax rate τ_t^d as a variable, the percentage deviation of which, $\widehat{\tau}_t^d$, follows the process

$$\widehat{\tau}_t^d = \widehat{\tau}_{t-1}^d + \varepsilon_t. \tag{14}$$

The zero-mean, iid random variable ε_t is a shock to the tax rate. Hence a tax rate shock has permanent impact on the economy.[2]

In the case that a tax rate change are announced to the public before its implementation, we need to introduce a news variable, ξ_t, which is known p periods ahead and affects agents' expectations as follows:

$$E_t \widehat{\tau}^d_{t+p} = \widehat{\tau}^d_{t+p-1} + \xi_t. \tag{15}$$

In other words, at time t, the news announcement of a tax rate change p periods later would permanently change agents' expected tax rates for t+p. We follow Christiano et. al. (2006) by assuming that the tax rate follows the process

$$\widehat{\tau}^d_t = \widehat{\tau}^d_{t-1} + \xi_{t-p} + \varepsilon_t. \tag{16}$$

Given this, (15) must hold. If the news shock ξ_{t-p} is correct, $\varepsilon_t = 0$ at time t, so that the actual tax rate is changed by the amount contained in the news announcement. If the news is incorrect, ε_t can be given a value to offset completely or partially the effect of the news shock. In our model, all news are correct.

The model can be reduced to the conventional form:

$$E_t x_{t+1} = J x_t + Q S_t, \tag{17}$$

$$S_t = P S_{t-1} + D \eta_t, \tag{18}$$

where x_t is a vector of the model's endogenous and state variables. Suppose $p = 2$, variables and

[2] This captures the fact that a change in tax rates will shift the economy's steady state permanently.

matrices related to news shocks would be defined as follows:

$$S_t = (\widehat{\tau}_t^d, \xi_t, \xi_{t-1})', \tag{19}$$

$$\eta_t = (\varepsilon_t, \xi_t, 0)', \tag{20}$$

$$P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}. \tag{21}$$

$$D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}. \tag{22}$$

This way, the expectations of future shocks can be easily computed as

$$E_t S_{t+1} = P^j S_t, \tag{23}$$

and the model can be solved with the standard RBC approach.

3 Reduction of Double Taxation Without Announcement

3.1 Permanent reduction in double taxation

We begin by evaluating the effect of an unannounced, permanent reduction of dividend tax by 10%. Since our benchmark dividend tax rate is about 17%, the 10% reduction does not really "end" double taxation. It only reduces the degree of double taxation. Note that the 2003 Jobs and Growth Tax Relief Act did the same – it reduced double taxation but did not eliminate it.

This is easily implemented by imposing a -10% shock in equation (14). In this first experiment, we assume that the tax cut is never reversed. Impulse responses of the economy to the policy shock is plotted in Figure 1. The horizontal axis shows the number of quarters after the policy shock, and the vertical axis plots the percentage deviation of the variables from their long-run levels. The left panel shows the responses of consumption, labor hours and output, while the right panel shows the response of investment. We separate the plots because the response of investment is much stronger than other variables, and it may obscure the changes in them if plotted in the same diagram.

As Figure 1 shows, investment increases by more than 8% on impact of the shock, consumption also rises gradually by about 1.2%. As a result, total output rises, to about 0.5% above the original

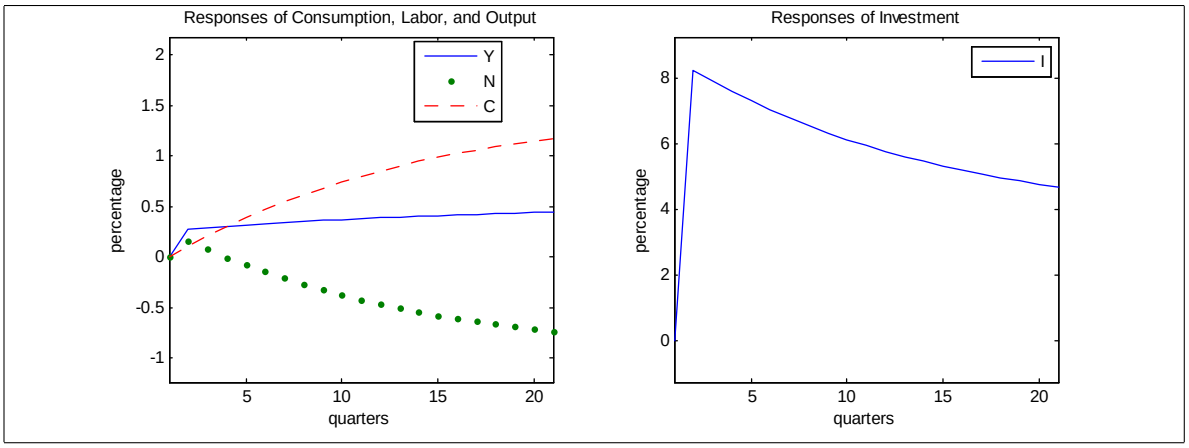

Figure 1: Dynamic Response to an Unannounced Tax Shock

level in 20 quarters. The response of output is relatively moderate compared with consumption and investment. Note that because the impact of the tax shock is permanent (see equation 14), the response of the endogenous variables are also permanent. They do not converge back to the benchmark steady states. Since the variables are measured as percentage deviations from the benchmark steady states, all variables will deviate from 0 permanently after the shock. Figure 1's general implication is that a reduction in double taxation does stimulate investment, consumption, and output.

What is interesting, however, is that the tax policy does not increase labor hours. Labor hours go down for almost 1% in about 20 quarters after the shock. The decrease in hours is no doubt responsible for the moderate response of output to the tax cut. What accounts for the reduction of work hours? As capital income tax is cut, the effective marginal product of capital will increase (see equation 9), which induces agents to substitute capital for labor in production. This is the substitution effect. The permanent tax cut also increases agents' life-time wealth, which encourages them to increase consumption and leisure. More leisure implies less work hours. This is the wealth effect. These two effects combine to cause work hours to decrease in response to a tax cut. What could have offset these two effects is the income effect: the prospect of more income with more work generally stimulates labor hours. Indeed, in a standard RBC model, a productivity shock usually produces a stronger income effect and a weaker wealth effect, and raises labor hours on impact. Our analysis shows that a reduction in capital income tax does not produce that type of dynamics.

The simulation therefore highlights a potential weakness of the dividend tax policy: while the policy will surely boost investment, its impact on output is quite moderate, and its impact on employment can even be negative. If this policy is used as a stabilization tool, its effectiveness is ambiguous. In Figure 2, we simulate a recession by generating a one standard deviation of negative

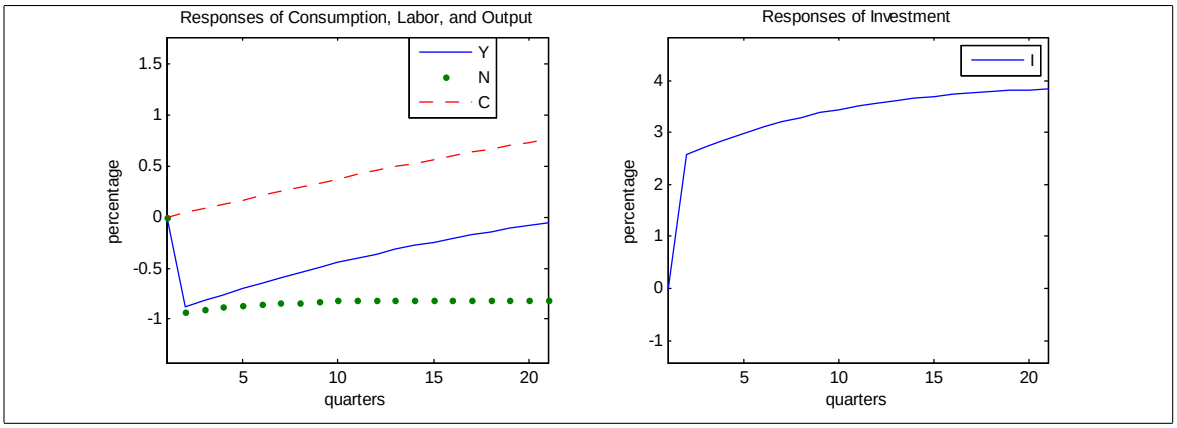

Figure 2: Reduction in double taxation as a stablization tool

productivity shock in period 1, but we also simultaneously impose a 10% reduction in dividend tax.

As Figure 2 shows, due to the tax policy, consumption and investment do not go below trend on impact of the negative productivity shock. But the responses of output are all negative in the first 20 quarters, and the responses of hours are even worse. One way to further stabilize output is to reduce dividend tax even more. But as Figure 1 indicates, the trade-off is that labor hours will decrease more too.

In Figure 2, both consumption and leisure are increasing, indicating that the policy is definitely welfare improving. The negative productivity shock would have caused welfare to decrease if there were no tax policy. In this sense, the decrease in hours is not a problem per se, and the policy is a good "stabilization tool." However, this result is model dependent: in our neoclassical framework, unemployment is voluntary, and its decrease improves welfare as long as consumption is going in the opposite direction. This is certainly not true in general. A more serious investigation requires a more sophisticated model with involuntary unemployment, which could be a direction for future research. For now, we consider the sluggish response in output and the reduction in hours as a potential weakness of the tax policy. After all, a stabilization policy that causes negative movements in labor input is rarely considered a good one in reality.

In principle, one could always change the model environment in certain dimensions and make the tax policy work better. For example, we may consider a utility function with small risk aversion. If we set γ at a low value of 0.5, the wealth effect should be reduced and the income effect might dominate. As Figure 3 shows, this is indeed the case. Labor hours increase on impact, and output rises for more than 1.5% within 20 quarters. Moreover, the responses of consumption and investment are all higher than those in Figure 1. In another experiment, we try to make labor less elastic. The parameter θ is the inverse of the elasticity of labor to real wages. We ran a number of experiments

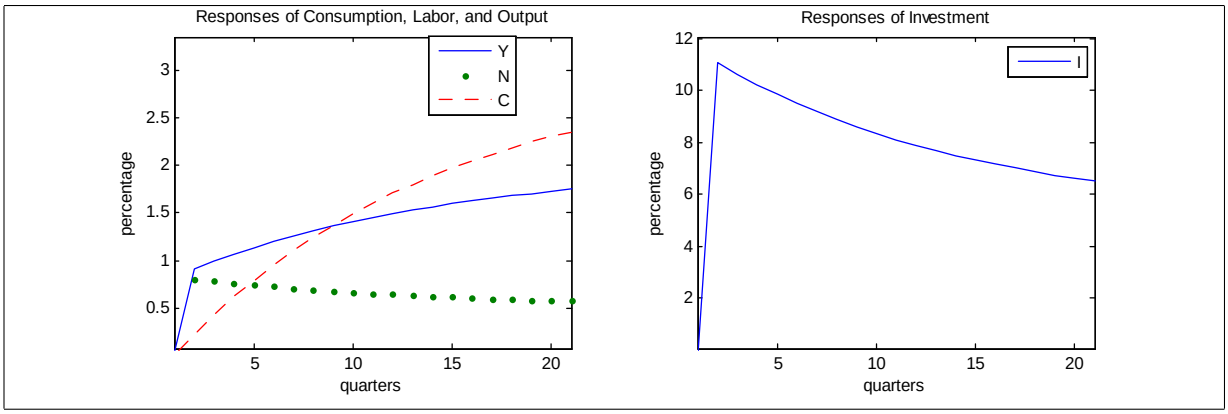

Figure 3: Reduction in double taxation with low risk aversion

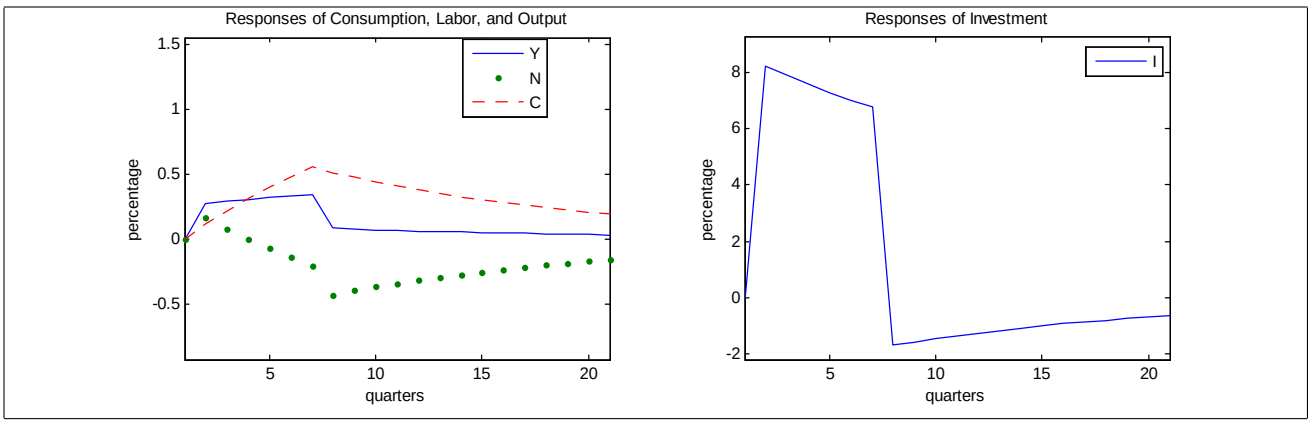

Figure 4: Temporary reductions in double taxation

with higher levels of θ, and found that the policy's negative effect (as shown in Figure 1) on labor can be reduced, but will not go away (not shown in figures).

These experiments are useful since they show that the policy works better in a low risk aversion and low labor elasticity world. But they do not provide satisfactory solutions to the weaknesses of the policy that we point out earlier. After all, our benchmark calibrations for γ and θ ($\gamma = 1$ and $\theta = 0$) are most frequently used in the literature to match empirical facts. For some researchers, γ should even be calibrated at higher values to match asset pricing facts.

3.2 Temporary reduction in double taxation

We next move one step closer to reality by assuming that the reduction in dividend tax is temporary. In period 1, there is an unannounced tax cut of 10%. In period 7, the tax cut is reversed, also without any announcement. We plot the responses of the economy in Figure 4.

Since the 10% tax cut is imposed and reversed in the same manner, it is not surprising to see

that consumption, output, and investment increase on impact of the first shock, and decrease on impact of the second, and eventually converge to their long run values. Given our setup, it is also not surprising to see that labor hours respond in an opposite pattern. What is not expected, is that investment does not simply converge back to its long run value on impact of the second policy shock, as consumption and output do. Instead, it first goes below trend for about 2% in period 8, and then gradually reverts to the steady state. In other words, investment has an "overshooting" feature. This has an important policy implication: while the reduction in double taxation is beneficial for investment in general, a *temporary* reduction can be a double-edged sword. When the tax cut is over, investment will drop strongly from its current position, and fall below trend for a considerable length of time. Sudden drops in investment can have serious repercussions in the economy.

4 Reduction of Double Taxation With Announcement

That news alone can drive business cycles has become a new area of research in the literature. In fact the idea dates back to the early 20th century. The most influential work was probably conducted by Pigou (1927). What's new in recent research is the incorporation of the idea with modern techniques of macroeconomics. Beaudry and Portier (2003), Jaimovich and Rebelo (2006), and Christiano et. al. (2006) have all made important progress in this direction.

In reality, reforms of double taxation rarely come as shocks to the market. The Jobs and Growth Tax Relief Reconciliation Act, for example, went through a series of congressional debates before it was passed in May 2003. Moreover, the proposed cut in dividend taxes was set to expire in January 2011. Therefore, investors understand that the tax cut is only temporary, and they know when it will be reversed.[3] An interesting question is, does the knowledge of future changes in dividend tax rates affect investor's behavior now?

One possibility is that investors may not respond to the tax cuts as much as in the unannounced case, because they may realize that their permanent income are not affected much by such short-term tax changes. Another possibility is that agents may decide to fully take advantage of the expected tax changes by increasing investment during the reform period, and reducing investment afterwards. In this case, one wonders if the planned reduction in investment is still as strong as in Figure 4. We next attempt to investigate which case is more likely in our model.

[3] It is of course possible that the tax cut will be renewed in 2011 (although a change of ruling party will perhaps make it less likely). Even so, investors cannot make such an assumption in their decision-making prior to the announcement of the renewal.

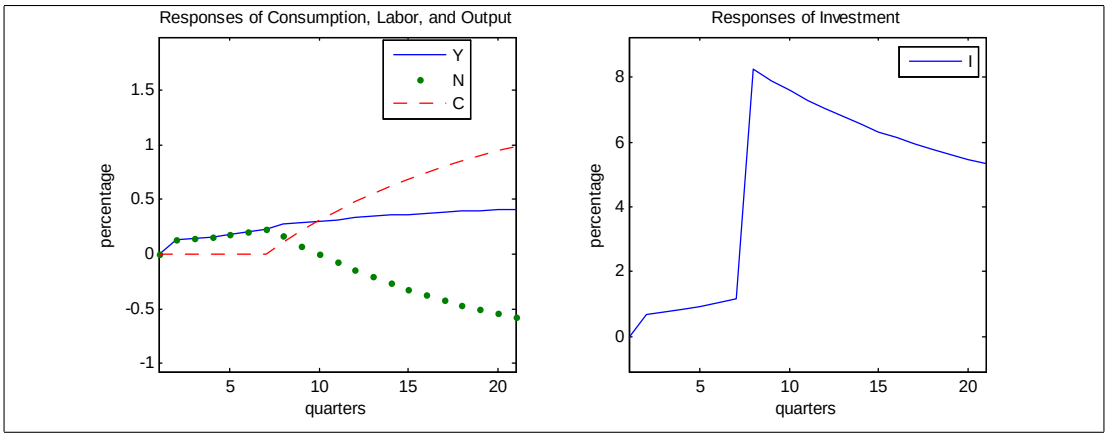

Figure 5: News about future reductions in double taxation

4.1 News about future reductions in double taxation

As a first step, we experiment a scenario in which agents know 6 quarters beforehand that there will be a 10% reduction in dividend tax, and the tax cut is permanent. To do this, let the economy stay at the steady state in period 1. Let $p = 6$ in equation (16), $\xi_2 = -10\%$, and let there be no other shocks to the economy from periods 2 to 7. In period 8, the announced tax reform is implemented, and the actual tax rate is cut by 10%. We plot the impulse responses in Figure 5.

From periods 2 to 7, the only shock to the economy is the news shock. In response to the news, agents increase their investment for about 1%, and their hours and output for about 0.3%. There is no change in consumption. In period 8, when the actual tax rate is cut, investment increases sharply to 8%, output increases further, consumption starts to increase, and hours starts to decrease. It is quite obvious that the responses after period 8 is similar to those in Figure 1. But what explains the responses in periods 2 to 7? The news about the tax cut changes agents' expectations in two ways. One, it raises agents' expectations about their life-time wealth. Two, it also raises their expectations about the future effective marginal product of capital. The wealth effect would prompt the agents to increase leisure and reduce work hours, but the expected rising marginal product of capital would cause them to substitute labor for capital now, and do the opposite in the future. Apparently the second mechanism dominates, and labor hours increase, as well as output. What is somewhat puzzling is that response of consumption – it does not increase with the expected increase in life-time wealth. A possible explanation is that the wealth effect is exactly offset by an intertemporal substitution effect. Agents prefer future consumption to current consumption, and they choose to accumulate more capital by increasing investment spending (right panel of Figure 5).

From Figure 5, we also learn that the economy's output dynamics can be strongly affected by the

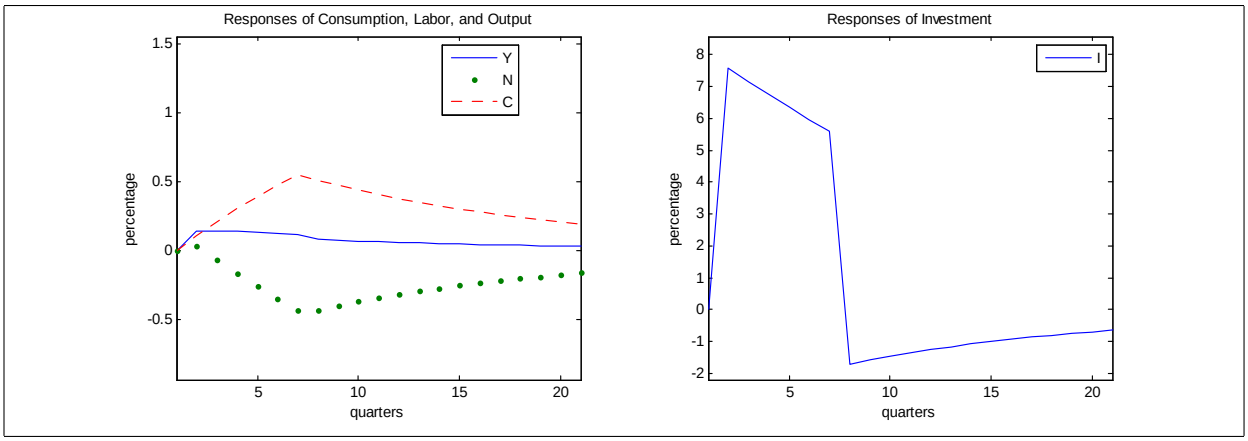

Figure 6: Reduction in double taxation with an announced expiration date

policy announcement. For example, on hearing the news, agents raise output by more than 0.3%. When the tax policy is actually implemented in period 8, the rise in output is very mild. Because the total effect of the policy on output is less than 5% (Figure 1), the announcement effect accounts for more than 60% of output changes, at least in the first 20 quarters. The implications of this finding will be further explored in the next section.

4.2 Announced expiration of dividend tax cuts

We are now ready to experiment with a more realistic scenario, in which a 10% tax shock occurs in period 2, but at the same time, there is an announcement that the tax cut is only temporary, and it will be reversed in period 8.[4] The results are plotted in Figure 6.

With the two shocks, consumption, output, and investment increase from period 1 to 7, and then decrease in period 8, when the tax reform is over. Labor hours respond in an opposite pattern. Overall, the dynamics of the economy seems to be very similar to those in Figure 4, in which there is no news announcement about the expiration of the tax cut. While knowing that the reform is temporary and their life-time wealth will increase only moderately, agents choose to make contingent plans based on future expected changes in the tax rates. They let their spending and leisure rise during the tax cut period, and restore to normal when the cut is over. The overshooting feature of investment still persists. And our earlier lesson still holds: a temporary reform will induce a temporary investment boom. But when the reform expires, an investment slump follows.

However, a closer look at Figure 6 still reveals some important quantitative differences between it and Figure 4: with the news announcement, the volatilities of output, investment, and hours

[4] We can also add an announcement to the tax cut in period 2, but we will not gain any more insights by doing so.

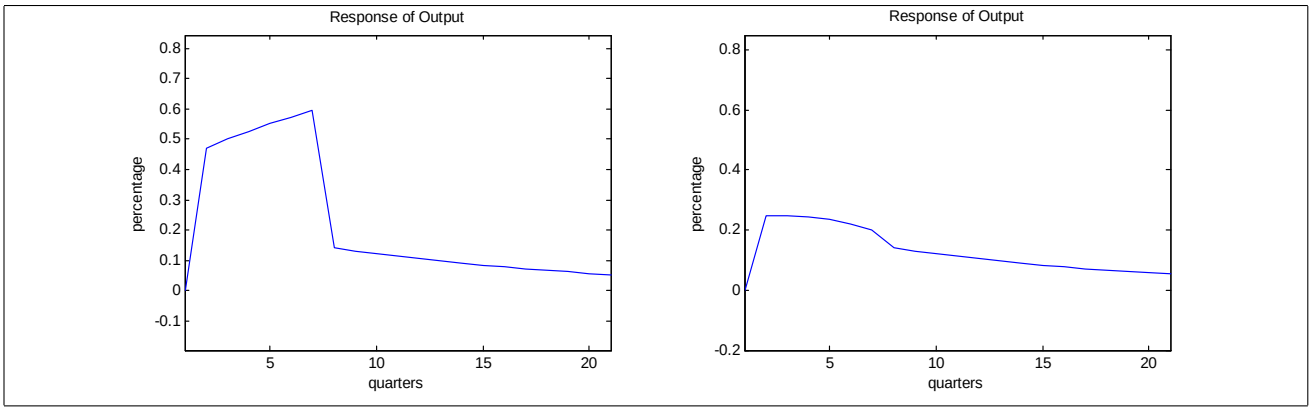

Figure 7: Output Response with Unannounced (left panel) and Announced (right panel) Tax Cuts

are all reduced. This effect is most obvious with output. To highlight this difference, we make a side-by-side comparison of the responses of output in the two cases in Figure 7. To emphasize the differences, we also set the size of the tax cut at 17.3% – higher than the 10% benchmark value and would completely eliminate all dividend taxes. In the left panel, we show the response of output to a -17.3% tax shock in period 2, and a positive 17.3% tax shock in period 8. Output rises for about 0.5% on impact and the peak of the output response is at 0.6%. In the right panel, we show the case with policy announcement. We let there be a -17.3% tax shock in period 1, but at the same time, let there be an announcement that the tax cut will expire in period 8. Output rises for only about 0.25% on impact, and it gradually decreases even before the tax cut is reversed. This happens because agents are not "fooled" to believe that the tax cut is permanent, as in the case of the left panel of Figure 7. They know that the effect of the temporary tax cut on their permanent income is limited, and hence the moderate response.

The bottom line is clear. Temporary tax cuts with announcements reduce the intended impact on output. If the tax cut is used as a stabilization policy to combat recessions, the announcement of an expiration date will make the policy less effective.

5 Conclusion

This paper examines the effectiveness of the "end of double taxation" on dividends policy in stabilizing the economy. Both announced and unannounced policies are considered. A reduction in double taxation stimulates investment and improves welfare, but its impact on output is moderate and it has a negative effect on work hours. Temporary tax cuts serve as a double-edged sword that creates an investment boom but also generates an investment slump when the tax cut expires. News about

future tax cuts may have important effect on output dynamics. With news, agents respond to the tax policy even before it is implemented. If a tax cut is announced to be temporary, its impact on output can be greatly reduced.

This study also shed some lights on the issue of the optimal rate of capital income taxation. The analysis shows that much of the welfare improvement associated with cuts in capital income taxes come from strong wealth effect which increases leisure but depresses work hours. This mechanism is derived from a neoclassical framework, which is the workhorse for the literature that advocates a zero rate of capital income tax. One naturally wonders if this result is robust to a change of assumption about the labor market. When unemployment is involuntary, reduction in work hours might be welfare-reducing, and it may significantly lower the benefits of capital income tax cuts.

Opportunities also exist to enrich our understanding of the issues in other aspects. One possible extension of the current model is to make retained earnings an endogenous variable for the firms, and distinguish between capital gains tax and dividend tax. Another extension is to study a model with unemployment, so that the implications of dividend tax cuts on employment can be made more transparent.

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