Do Capital Income Tax Cuts Trickle Down?

Abstract - Reductions in the capital income tax rate generally stimulate investment and raise the marginal product of labor and the wage rate. Hence, it is often argued that cutting capital income taxes benefits capital owners and all workers. This result, however, depends on how government manages debt to maintain budget solvency. This paper analyzes the distributional effects of capital tax cuts, where endogenous adjustments in other tax rates are precluded. When productive public investment or transfers to liquidity-constrained workers are reduced, it finds that the trickle-down effect may not hold. This paper also demonstrates a well-known fallacy: tax liability changes are a poor proxy for welfare changes.

INTRODUCTION

Capital income tax reductions are often used to stimulate economic activity during business downturns or to promote economic growth. In general, lowering capital income tax rates improves the after-tax rate of return of investment and facilitates capital accumulation. A higher capital stock, in turn, raises the marginal product of labor and the real wage. Consequently, it is often argued that capital income tax reductions have trickle-down effects because labor also benefits from a higher income.

Can capital income tax cuts improve both capital owners’ and non-owners’ welfare? While the trickle-down effect seems plausible, the underlying analysis ignores fiscal adjustments due to the revenue loss resulting from a tax cut. I analyze the distributional effects of capital income taxes within a dynamic macroeconomic model. In particular, I focus on how capital and non-capital owners are affected by a capital income tax cut under various offsetting policies necessary to maintain government budget solvency. Such an analysis is especially relevant to policy makers facing a deteriorating budget.

The distributional effects of taxes have long been an important subject in public finance and tax policy. Since the first general equilibrium model to study corporate tax incidence by Harberger (1962), a voluminous literature has enhanced our understanding of the economic incidence of various types of taxes. However, conventional distributional studies do

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1 Several important studies followed Harberger. Pechman and Okner (1974) estimate the burden of corporate income and other taxes using effective tax rates. Auerbach and Kotlikof (1987) use an overlapping generation model
not concern government indebtedness. They focus on comparing tax reform options, which collect the same amount of revenues and are revenue neutral relative to the simulated current–law tax system (for example, Fullerton and Rogers (1993), Altig et al. (2001), Jorgenson and Yun (2001), and Nishiyama and Smetters (2005)). Even if debt is present in a model, the analysis does not address the distributional issue in a fiscal environment where the present value of government liability changes.2

I use a neoclassical growth model commonly adopted for studying fiscal policy in modern macroeconomics. Typical neoclassical growth models have a single representative agent who owns the entire capital stock. In this model, heterogeneity of capital ownership derives from two types of agents: savers and non–savers, as introduced in Campbell and Mankiw (1989). Savers are conventional forward–looking agents who work, save, consume, and own the entire capital stock; they are the capital owners in the model. Non–savers, being liquidity constrained, work and consume all of their disposable income; they are the non–capital owners in the model.3

Additional differences between savers and non–savers are introduced. In reality, people with higher income are more likely to save.4 I assume that a representative saver in the model earns more income than a representative non–saver because of higher labor productivity and capital income. Under a progressive income tax system, savers are subject to a higher average labor income tax rate than non–savers.

Three financing instruments are considered to satisfy an intertemporal budget constraint. Government can respond to rising debt resulting from a permanent capital tax cut by reducing: 1) government consumption, which provides public services; 2) government investment, which forms public capital; or 3) transfer payments.

The model is deterministic. The economy begins with a steady state under the initial fiscal policy. The government announces and implements a permanent ten percent reduction in the capital income tax rate, and the economy evolves to a new steady state. The government is fully credible and able to commit to its policy. The distributional analysis is based on the utility derived under a high and a low capital income tax rate over an infinite horizon.

I find that whether or not the trickle–down effect emerges depends on how the government manages its debt to maintain a sustainable budget. When transfers to non–capital owners are reduced, their welfare decreases through lower consumption and higher hours worked as a result of reduced disposable income. Moreover, when government decreases its productive investment, the marginal productivity of private inputs falls, which has a negative

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2 Another line of literature related to the incidence of capital income taxation is to study the redistributive effects on capitalists and workers (for example, Broadway (1979) and Judd (1985)). In this paper, all agents supply labor, whether they own capital or not. The key distinction between agents is capital ownership.

3 The original motivation for including non–savers in Campbell and Mankiw (1989) was to account for the well–documented excessive sensitivity of consumption movements in response to predictable fluctuation in disposable income.

4 The Federal Reserve Board’s Survey of Consumer Finance (Bucks, Kennickell, and Moore, 2006) reports that 80.6 (84.3) percent of the highest income quintile saved and 34.0 (30.0) percent of lowest income quintile saved in 2004 (2001).
impact on all agents’ income. As a result, the overall welfare of both types of agents decreases despite a permanent reduction in the capital income tax rate.

Finally, I illustrate the well–known fallacy that using tax liability as a proxy to measure tax burden can lead to false conclusions. Higher tax liability can result from higher tax rates and/or more economic activities. I show examples where people who pay more taxes can be better off relative to the situation without the tax cut, and vice versa.

THE MODEL

The economy has two types of infinitely lived agents: savers and non–savers, competitive firms, and a government. Both the population and the total amount of time an agent is endowed with are normalized to one.

The Setup

Savers

With predetermined capital and government debt, a representative saver chooses consumption \( (C_t^S) \), capital \( (K_t^S) \), labor \( (L_t^S) \), and government bonds \( (B_t^S) \) to maximize the expected utility over consumption and leisure \( (1 − L_t^S) \)

\[
E \sum_{t=0}^{\infty} \beta^t \left[ \frac{(\tilde{C}_t^S)^{1−\gamma}−1}{1−\gamma} + x^S (1−L_t^S)^{1−\theta^S}−1 \right],
\]

subject to the budget constraint

\[
(1+\tau^C_i)C_t^S + K_t^S − (1−\delta)K_{t−1}^S + B_t^S
\]

\[
=(1−\tau^K_i)\delta r_i K_{t−1}^S + (1−\tau^L_i)W_i v L_t^S
\]

\[
+ \delta^T \tau^K_i K_{t−1}^S + B_{t−1}^S R_{t−1}^S.
\]

The superscripts \( s \) and \( n \) indicate variables associated with savers and non–savers. \( \beta \) is the discount factor \((0 < \beta < 1)\). \( \tilde{C}_t^S \) is a composite of consumption goods, consisting of consumption financed by private spendings \( (C_t^S, \text{ referred as private consumption}) \) and public services financed by government consumption \( (G_i). \) \( \tau_i^C, \tau_i^K, \text{ and } \tau_i^L \) are tax rates on private consumption, savers’ labor income, and capital income. \( B_t^S \) is government debt issued at \( t \), which pays \( R, B_t^S \) at \( t+1 \). \( r_i \) is the rental rate of capital. \( \delta^T \) is the capital depreciation rate for tax purposes, and \( \delta \) is the economic depreciation rate of capital \((0 ≤ \delta^T, \delta ≤ 1)\). The elasticity of intertemporal substitution of consumption is \( 1/\gamma \) and the elasticity of intertemporal substitution of leisure for savers is \( 1/\theta^S \) \((\gamma > 0 \text{ and } \theta^S ≥ 0)\). \( x^S \) is savers’ preference weight on leisure.

To capture the income differential between average savers and non–savers in reality, the model assumes that savers have a higher productivity than non–savers. The weight of labor efficient units for savers is \( v \). \( W_i \) is the wage rate per labor efficiency unit. A saver who supplies \( L_t^S \) units of time earns \( W_i v L_t^S \).

Government consumption, \( G_i \), is used to provide an equal amount of public services per capita. Following Barro (1981), the contemporaneous level of public services and private consumption are substitutes in utility terms: each unit of public service delivers a fraction \( \sigma \) of the utility derived from consuming a unit of private consumption \((0 ≤ \sigma ≤ 1)\). Assume that the ratio of the number of savers to the total population is \( h \). Then, the composite consumption that enters the utility function is \( \tilde{C}_t^S ≡ C_t^S + \sigma h G_i \).

\( \delta^T \) As in Barro (1981), public services in the model are assumed to be rivalrous (vs. public goods, which are non-rivalry). Examples are school lunch programs, parks, health services, etc. Hence, the proportions of resources allocated to savers and non–savers are equal to their population shares in order to provide the same services per capita.
Non–savers

A representative non–saver solves a static optimization problem to maximize utility each period:

\[ \frac{\left(C_t^n\right)^{1-\gamma}}{1-\gamma} + x^n (1-L_t^n)^{1-\theta^n} - 1, \]

subject to the budget constraint

\[ (1+\tau^n_t)C_t^n = (1-\tau^n_t)W_t(1-v)L_t^n + T_t, \]

where non–savers’ composite of consumption goods is defined as \( C_t^S \equiv C_t^n + \sigma(1-h)G_t \), and \( T_t \) is government transfers. Transfers only target non–savers because they earn relatively low income. The model assumes different labor elasticities for savers and non–savers. See the appendix for the rationale.

Note that non–savers solve an intratemporal problem. As they have no vehicle to carry wealth to next period, the optimal choice is to consume all of their disposable income each period. Their labor decisions are affected by the marginal disutility from labor and the labor income tax rate.⁶

Firms

A representative firm rents capital from savers and rents labor from both types of agents to produce output \( Y_t \), according to the Cobb–Douglas production function:

\[ Y_t = K_{t-1}^{\alpha} I_t^L (K_t^G)^{\alpha G}, \]

where \( 0 < \alpha < 1 \), \( K_{t-1} \) and \( K_t^G \) are the private and public capital for production during period \( t \), and \( L_t = v I_t^S + (1-v) L_t^n \) is the weighted aggregate labor inputs in efficiency units. Private and public capital evolves according to \( K_t = I_t + (1-\delta) K_{t-1} \) and \( K_t^G = I_t^G + (1-\delta) K_{t-1}^G \), where \( I_t \) and \( I_t^G \) are private and public investment. The elasticity of output with respect to public capital is \( \alpha_G \). If public capital is unproductive, \( \alpha_G = 0 \). The firm solves the profit–maximization problem:

\[ \max_{\{I_t, G_t, \tau_t^L, \tau_t^G\}} L_t^{1-\alpha} (K_t^G)^{\alpha G} - r_t K_{t-1} - W_t L_t. \]

Government

Each period government chooses \( \{T_t, G_t, I_t^G, B_t, \tau_t^L, \tau_t^G\} \) to satisfy its budget constraint:

\[ T_t + G_t + I_t^G + R_{t-1} - B_{t-1} + \delta^T \tau_t^L K_{t-1} \]
\[ = \tau_t^L W_t v L_t^n + \tau_t^G W_t (1-v) L_t^n \]
\[ + \tau_t^L \tau_t^G K_{t-1} + \tau_t^L C_t + B_t, \]

where \( C_t = C_t^S + C_t^n \) is the total private consumption. In equilibrium, \( B_t = B_t^S \), \( K_t = K_t^S \), and an infinite sequence of policies must satisfy the intertemporal budget constraint,

\[ B_t \equiv S_t^G = \sum_{j=0}^{\infty} d_t s_{t+j}. \]

In the literature, non–savers (sometimes known as spenders or rule–of–thumb agents) do not face an optimization problem: their consumption expenditure is set at their total disposable income each period, and their labor inputs are set at savers’ (or optimizing agents’) decisions (see Mankiw (2000), Erceg, Guerrieri, and Gust (2005), and Gali, Lopez–Salido, and Valles (2007)). In the current model with different labor income tax rates, adopting the copycat labor rule for non–savers would produce an adverse result that distorting labor income taxation has no effect on non–savers’ labor decision. Hence, I do not adopt the commonly used modeling strategy for non–savers.

The model abstracts from growth. An exogenous labor–augmenting technology can be easily added to the model to have an economy with a deterministic trend of growth. Adding growth, however, does not alter the conclusion.
where $s_{t+j}^c$ is the government consumption–output ratio, $s_{t+j}^r$ is the government investment–output ratio, $s_{t+j}^T$ is the government transfer–output ratio, and $d_{t,t+j}$ is the growth–adjusted discount factor given by

$$d_{t,t+j} = \prod_{i=0}^{j-1} R_{t+i}^{-1} \frac{Y_{t+i+1}}{Y_{t+i}}.$$

Equation [8] implies the transversality condition for debt,

$$\lim_{T \to \infty} \prod_{i=0}^{T-1} R_{t+i}^{-1} \frac{B_{t+i+1}}{T_{t+i+1}} = 0,$$

is satisfied. When a debt–financed tax cut leads to an increased debt–output ratio at time $t$, [8] implies at least one of the fiscal variables on the right hand side has to adjust: one or more tax rates have to rise and/or government consumption, investment, or transfers shares have to fall. The policy rules, following Leeper and Yang (forthcoming), imply that some explicit offsetting policy must be taken to maintain fiscal solvency when the debt–output ratio deviates from the initial steady state level. Fiscal policies are determined according to

$$\ln \left( \frac{s^T}{s^r} \right) = q_T \ln \left( \frac{s^{s-1}}{s^g} \right), \quad q_T \leq 0,$$

$$\ln \left( \frac{s^C}{s^T} \right) = q_C \ln \left( \frac{s^{s-1}}{s^g} \right), \quad q_C \leq 0,$$

and

$$\ln \left( \frac{s^I}{s^r} \right) = q_I \ln \left( \frac{s^{s-1}}{s^g} \right), \quad q_I \leq 0.$$

A variable without a time subscript indicates its initial steady state value. All tax rates, except the capital income tax rate, are held at their initial steady state level throughout the horizon.

The aggregate resource constraint is

$$C_t + I_t + G_t + I_t^C = Y_t.$$

I solve the exact numerical solution by the dynamic iteration method, as described in section 16.4 of Judd (1999). The equilibrium is characterized by the first order conditions for all maximization problems, the aggregate resource constraint, the government budget constraint, and the fiscal rules. The unique competitive equilibrium consists of households’ decision, $\{C_t^s, C_t^r, L_t^s, L_t^r, K_t, B_t^q\}$, the firms’ decisions $\{L_t^s, L_t^r, K_t\}$, and prices, $\{r_t, W_t\}$, such that optimality conditions and transversality conditions for capital and debt hold, and labor, goods, and bond markets clear, the intertemporal government budget constraint, and policy rules are satisfied every period.

### Calibration

The model is calibrated at the annual frequency. The choice of common structural parameters is comparable to those in the real business cycle literature (Kydland and Prescott, 1982). The preference weights on leisure, $\chi^s$ and $\chi^r$, are chosen such that the model has the fraction of time spent on working equal 0.2 in the initial steady state, the consumption–output ratio is 0.623, and the investment–output ratio is 0.177. Table 1 summarizes the benchmark parameter values and some fiscal policy variables in the initial steady state.

When the government responds to rising debt, only one instrument is used so that the effects of different financing instruments can be isolated. For example,
in Table 1, \( q_G = -0.64 \) means that only government consumption adjusts to maintain budget solvency; hence \( q_I = q_T = 0 \). The benchmark parameter values of the fiscal adjustment parameters are set such that in response to a ten percent reduction in the capital income tax rate, the debt–output ratio rises from 0.43 to 0.46 in a new steady state for all fiscal instruments.10

The appendix describes the approaches to calibrating other parameters, including the population weight, the labor efficiency weight, economic and tax–based depreciation rates, fiscal policy variables, intertemporal labor elasticities, and the parameters governing the usefulness of government expenditures.

### DYNAMIC EFFECTS OF A PERMANENT CAPITAL INCOME TAX CUT

The thought experiment is a surprise ten–percent permanent reduction in the capital income tax rate (from 0.390 to 0.351). The transition dynamics under the benchmark calibration from the initial steady state to a new steady state is examined. Figure 1 compares the transition dynamics derived under the three financing instruments.

Variables are in percent deviations from the path without a tax cut (represented by the zero lines). Dotted lines are responses under government consumption adjustments, dotted–dashed lines are responses under government investment adjustments, and solid lines are responses under transfer adjustments.

When the capital income tax rate is permanently cut, it increases the expected after–tax rate of return to investment. Under any offsetting policy, capital owners (savers) sacrifice consumption in order to increase savings. As a result, consumption decreases below the path without a tax cut for the first four or five years. Lower consumption raises the marginal benefit of working; as a result, capital owners work more initially.

In later years, capital owners’ consumption and labor responses depend on a choice of financing instruments. Under government consumption adjustments, since government absorbs a smaller share of resources, it generates a positive wealth effect, amplifying the wealth effect from a higher income. Consequently, agents consume more and take more leisure. When government decreases transfers, the patterns of capital owners’ investment, labor, and consumption are similar to those under government consumption adjustments.

In contrast, if government investment is reduced to maintain budget solvency, while labor still falls, consumption and investment decrease substantially below the path without the tax cut. Under the benchmark calibration, public capital is productive. Reductions in government investment—hence, public capital—make the marginal product of private inputs

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10 Long–term government indebtedness is controlled for so that I can focus on how fiscal instruments affect the distributional effects of the tax cut. Sensitivity analysis explores less aggressive debt management policy, which leads to a higher debt–output ratio in a new steady state.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<th>Parameter</th>
<th>Value</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>0.360</td>
<td>( X^s )</td>
<td>2.721</td>
<td>( \tau^s )</td>
<td>0.253</td>
<td>( S^c )</td>
<td>0.160</td>
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<td>( \alpha_c )</td>
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<td>( X^s )</td>
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<td>( \tau^s )</td>
<td>0.096</td>
<td>( S^s )</td>
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<td>( \beta )</td>
<td>0.960</td>
<td>( h )</td>
<td>0.600</td>
<td>( \tau^c )</td>
<td>0.390</td>
<td>( S^t )</td>
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</tr>
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<td>( \gamma )</td>
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<td>( v )</td>
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<td>( \tau^c )</td>
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<td>( q^c )</td>
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</tr>
<tr>
<td>( \theta^t )</td>
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<td>( \delta^t )</td>
<td>0.070</td>
<td>( L )</td>
<td>0.200</td>
<td>( q^t )</td>
<td>-2.830</td>
</tr>
<tr>
<td>( \theta_t )</td>
<td>2.000</td>
<td>( \delta )</td>
<td>0.060</td>
<td>( \sigma )</td>
<td>0.200</td>
<td>( q^t )</td>
<td>-5.320</td>
</tr>
</tbody>
</table>
fall, resulting in a lower wage rate and return to private investment. Despite the permanent reduction in the capital income tax rate, capital owners reduce investment and cut consumption because of falling income.

The choice of financing instrument is important in capital owners' responses to a capital income tax cut. It also matters for non–capital owners' responses to the tax cut. When government consumption is reduced, non–capital owners enjoy higher consumption for most periods due to the positive wealth effect. However, instead of taking more leisure like capital owners, their labor increases slightly. When government cuts consumption, non–capital owners’ long–term labor decisions are mainly influenced by the substitution effect from a higher wage rate (due to a higher marginal product of labor from more capital) and the wealth effect from a higher income and a smaller government. Since non–capital owners’ wealth does not increase as much as that of capital owners, the substitution effect outweighs the wealth effect, leading to a small labor increase.

When government investment is reduced to maintain budget solvency, non–capital owners’ labor also rises slightly, but consumption falls substantially for most periods. Again, falling total capital stock reduces the wage rate.
and, hence, non–capital owners’ disposable income; the negative wealth effect dominates other effects, making them consume less and work harder. Similarly, when transfers decrease, their consumption falls. Note that non–capital owners’ labor inputs are the highest among the three financing instruments under transfer adjustments. Cutting transfers has a large negative wealth effect on non–capital owners. Combined with a rising wage rate, labor responses increase substantially.

In a typical neoclassical growth model with only conventional forward–looking agents, lump–sum transfers, which have no effects on agents’ economic decisions, are a convenient tool to balance the budget. As the above analysis shows, in an environment with liquidity–constrained agents (non–savers), adjustments in transfers are not inconsequential: a decrease in transfers has a direct impact on a non–capital owners’ consumption, labor, and, hence, the equilibrium wage rate and the entire labor market.

WELFARE ANALYSIS

To assess the welfare cost of the capital income tax cut, I compute the share of consumption to be reduced such that an agent’s utility level under the permanent lower capital income tax rate equals the utility derived without the tax cut. The calculation is based on allocations from the beginning of the tax cut to the infinite future. The tax cut occurs in time zero. The objective is to find $z^s$ or $z^n$ that solves the following equation:

$$[13] \sum_{t=0}^{\infty} \beta^{t-1} \left\{ \left[ \frac{[C_t^r (1-z^s)]^{1-\gamma} - 1}{1-\gamma} + x^t (1-L_t^r)^{1-\theta^t} - 1 \right] - U_t \right\} = 0,$$

where $j = s$ for capital owners and $j = n$ for non–capital owners, $C_t^r$ and $L_t^r$ are optimal allocations under the tax cut, and $U_t$ is the utility level derived from the path without the tax cut. As utility in a distant future is heavily discounted in calculation, the discounted sum of utility over an infinite horizon is approximated by 1,000 years.

In practice, changes in household tax liability of various income levels are often used to assess the distributional impact of a tax proposal. I also compute tax liability changes in present value over an infinite horizon. Table 2 contains the percent changes in welfare and tax liability relative to the economy without the tax cut under the benchmark calibration.

When government consumption is reduced to maintain a sustainable budget, both capital and non–capital owners’ welfare is elevated by the permanent capital income tax cut. Although capital owners sacrifice consumption to invest more in early years, their overall welfare is enhanced due to a higher level of consumption and leisure in later years. For non–capital owners, while their leisure reduces slightly, the rise of labor income (mainly from a higher wage rate) provides them with more consumption. Compared to utility without the tax cut, the welfare

\[\begin{array}{c|c|c|c|c}
\text{C} & \text{O} & \text{N} & \text{O} & \text{C} \\
\text{W} & \text{F} & \text{E} & \text{R} & \text{L} & \text{I} & \text{A} & \text{B} & \text{I} & \text{T} & \text{Y} & \text{I} & \text{A} & \text{B} & \text{I} & \text{TY} \\
\hline
\end{array}\]
gain of the ten–percent capital income tax cut is equivalent to a permanent increase in consumption of 1.017 percent for capital owners and 0.662 percent for non–capital owners. This result is consistent with the trickle–down effect: although non–capital owners do not own capital, the benefits of a lower capital income tax cut accrues to all workers through higher labor productivity and, hence, a higher income, allowing all workers to consume at a permanently higher level.

The trickle–down effect under government consumption adjustments, however, may not occur under the other two financing instruments. Because non–capital owners’ disposable income falls when either government investment or transfers are reduced, their consumption decreases substantially and, hence, their overall welfare is lower as a result of the tax cut. Compared to the utility level without the tax cut, the welfare cost for non–capital owners is equivalent to a permanent consumption decrease of 0.768 percent under government investment reductions and 3.024 percent under transfer reductions.

Surprisingly, capital owners’ welfare also decreases—a permanent reduction of 0.446 percent in consumption—when government reduces its productive investment to maintain budget solvency. This result is driven by the fact that public capital is a complement to private production inputs under the benchmark calibration. Aschauer (1989a) finds that empirical evidence supports this assumption.

Finally, when assessing if an agent is better off due to the tax cut, contradictory results are found between the two measures: welfare and tax liability. If tax liability changes can correctly indicate the direction of welfare changes, the sign of welfare changes should be opposite to the sign of tax liability changes. This is not the case in Table 2. Non–capital owners’ welfare increases despite paying more taxes when government consumption is reduced. When government investment decreases, although capital owners’ tax liability falls, their welfare also decreases. Higher tax liability can result from more economic activities such as more consumption, which enhances welfare, without a tax rate increase. Therefore, tax liability changes may not move in the same direction as welfare. Distributional analysis based only on tax liability changes may be misleading.

SENSITIVITY ANALYSIS

I now evaluate how sensitive the distributional outcome is to the following assumptions: 1) a less elastic labor supply, 2) a less aggressive debt management policy, and 3) wasteful government expenditures. Tables 3 and 4 contain the percent changes in welfare for capital and non–capital owners. Except under wasteful government expenditures, the results in the sensitivity analysis are all very close to those obtained under the benchmark calibration; only the transition dynamics

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**TABLE 3**

<table>
<thead>
<tr>
<th>Sensitivity Analysis</th>
<th>Percent Change in Capital Owners’ Welfare Relative to the Path Without the Tax Cut</th>
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<tbody>
<tr>
<td>$S^c$ adjusts</td>
<td>1.017</td>
</tr>
<tr>
<td>$S^l$ adjusts</td>
<td>–0.446</td>
</tr>
<tr>
<td>$S^u$ adjusts</td>
<td>1.267</td>
</tr>
</tbody>
</table>

11 He also finds that nonmilitary public capital is much more important in determining productivity than military capital (Aschauer, 1989b).
under wasteful government expenditures are presented (Figure 2).

**Less Elastic Labor Supply**

The intertemporal labor elasticity has been identified as an important factor in the macroeconomic effects of tax policy (Prescott, 2005; Mankiw and Weinzierl, 2006). Under the assumption of a less elastic labor supply, the intertemporal labor elasticities are reduced to 0.5 \((\theta^s = 2)\) for capital owners and 0.25 \((\theta^n = 4)\) for non–capital owners (vs. 1 and 0.5 in the benchmark calibration). Although a less elastic labor generates smaller labor responses, distributional outcomes are very similar to the results in earlier analysis.

To see why this is the case, take the example of government consumption adjustments. When government reduces consumption, capital owners’ long–term labor response to a smaller government is not as negative as under the benchmark calibration. This labor response yields lower utility from less leisure taken but higher utility from more consumption resulting from a higher labor income. The two offsetting forces generate a minimal welfare change.

Under a smaller labor elasticity, non–capital owners do not respond to a rise in the wage rate as much as under the benchmark calibration. As a result, their labor income and, hence, consumption do not rise as much. Again, the utility increase from more leisure is offset by the utility loss from less consumption; the net welfare change for non–capital owners under government consumption adjustments is also small.

One scenario in which the trickle–down effect does not occur is when non–capital owners’ labor surges in response to reductions in transfers. Empirical evidence shows different results on low–income transfer recipients’ labor responses to different transfer programs.12 The sensitivity analysis also examines the extreme case in which non–capital owners have an inelastic labor. Their labor supply is held at the initial steady state level throughout all experiments. Again, the transition dynamics are very similar to those in Figure 1, except a zero response of non–capital owners’ labor. The welfare result (not shown) is also very close to the benchmark case. Under an inelastic labor, although non–capital owners do not lose utility from working harder in response to a falling disposable income, their utility from consumption, however, falls more because they do not increase labor to mitigate their income loss due to a transfer cut.

The trickle–down effect does not occur under an inelastic labor supply for non–capital owners. What if transfer programs provide a working incentive like the Earned Income Tax Credit, opposite to the assumption imposed by this model? Under this scenario, although reductions in transfers allow non–capital owners to

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12 Moffit (1986), Hagstrom (1996), and Hoynes (1996) find the disincentive effects of the Aid to Family with Dependent Children program. Eissa and Liebman (1996) and Meyer and Rosenbaum (2001) find that the Earned Income Tax Credit has positive effects on labor force participation.
enjoy more leisure by working less, their utility loss from a falling consumption is also larger because their disposable income is further reduced by fewer labor inputs. In summary, non–capital owners’ labor response to changes in transfers only plays a minimal role in the welfare outcome of the capital tax cut.

**Less Aggressive Debt Policy**

When government pursues a less aggressive debt policy than under the benchmark calibration, the $q$ parameters in policy rules [9]–[11] are set such that in a new steady state the debt–output ratio is 20 percent above the initial steady state level ($q_G = -0.40; q_I = -1.79; q_T = -3.48$). A less aggressive debt control policy in the transition path leads to a higher degree of government indebtedness in the long run, which requires permanently stronger offsetting policy to stabilize the debt–output ratio. As a result, the effect from an offsetting policy is stronger than the benchmark case.

For example, under government investment adjustments, when government pursues a less aggressive debt policy, it cuts more investment than under the benchmark case. Because public capital is a complement to private capital, pri-
Private investment falls more under a less aggressive debt policy. As a result, labor productivity and, hence, the wage rate decrease more, which further reduces both capital owners’ and non–capital owners’ consumption. Not surprisingly, the welfare outcome is less favorable: capital and non–capital owners’ welfare falls by 0.470 and 0.807 percent under a less aggressive debt control policy, compared to 0.446 and 0.768 percent under the benchmark calibration.

Leeper and Yang (forthcoming) find that a debt–financed reduction in capital or labor income tax rates is more expansionary and less costly when the government pursues a more aggressive debt management policy. The result obtained here suggests that a more aggressive debt management policy seems to be generating a slightly more desirable distributional outcome than a less aggressive debt policy.

Wasteful Government Expenditures

Finally, when government services do not generate utility and public capital is not productive, there is no distinction between these two expenditure categories. The results are almost identical under government investment and consumption adjustments (see Figure 2).

While whether public services generate utility has little impact on the effects of the tax cut, whether public capital is productive plays a crucial role in the distributional outcome. Under the benchmark calibration with productive public capital, reductions in government investment have a negative impact on both output and welfare of all agents. When public capital is unproductive, the transition path and the distributional outcome are drastically different. Since reductions in public investment do not discourage private investment, the only effect left is a positive wealth effect of a smaller government, as in the case of reductions in government consumption. As a result, when public capital is unproductive, a capital income tax cut produces permanently higher output and both capital and non–capital owners are better off.

Consistent with the intuition, the more productive is public capital, the more negative is the distributional result when government cuts productive public investment to maintain a sustainable budget. Avoiding decreases in productive public investment is important to prevent negative welfare effects for a capital income tax cut on both capital and non–capital owners.

CONCLUSION

I analyze the distributional effects of a permanent reduction in capital income tax rates on capital and non–capital owners. In contrast with conventional distributional studies, I use a dynamic macroeconomic model, taking into account government indebtedness. The analysis does not provide a definite answer to the question raised by the title of this paper. Instead, it emphasizes the importance of accounting for the effects of offsetting policies when assessing the distributional effects of tax policy.

Supply–side economists often argue that the benefits of a capital income tax cut trickle down throughout the economy, and even workers without owning capital can benefit from it. I show that whether or not the trickle–down effect emerges depends on how government maintains budget solvency. When productive public investment or transfers have to be reduced, non–capital owners’ and even capital owners’ welfare can be hurt. Also, the analysis demonstrates that tax liability changes are a poor proxy for welfare changes.

As the first step in examining the trickle–down effects of capital income tax cuts, the model assumes the simplest distribution structure of capital owner-
ship. In reality, the capital ownership distribution is complex. As the literature has developed macroeconomic models with heterogeneous agents (for example, see Rios–Rull (1995) and Rubio–Ramirez (2002)), extending the current study to a model with more realistic income and wealth distributions will be a valuable line of research for policy makers.

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APPENDIX

The appendix describes the procedures to determine some parameters and policy variables under the benchmark calibration.

POPULATION AND LABOR EFFICIENCY UNIT WEIGHTS

The Survey of Consumer Finance reports that 56.1 (59.2) percent of families saved in 2004 (2001) (Bucks, Kennickell, and Moore, 2006). I assume that the population weight for savers (h) is 0.613

To determine the efficiency weight of labor inputs, v, I resort to estimates of the fraction of disposable income allocated to households that consume 100 percent of current income. Unfortunately, existing estimates of this parameter are quite divergent. Using postwar U.S. data, Campbell and Mankiw (1989) and Cushing (1992) find this fraction ranging from 0.3 to 0.6. However, when testing the robustness of this estimate in terms of intertemporal non–separability in the utility function, Weber (2002) finds that this fraction is small or negative and statistically insignificant.

To accommodate the wide difference in estimates, instead of using the commonly used fraction of 0.5, v is selected such that the fraction of disposable income allocated to non–savers (liquidity constrained agents) is 0.2 in the initial steady state; v = 0.72. As v is bigger than the assumed population weight of savers (h = 0.6), it reflects the assumption that a saver has higher labor productivity than a non–saver in the model.

CAPITAL DEPRECIATION RATES

The model distinguishes between the economic and tax–based capital depreciation rates. The economic depreciation rate is set at the average annual ratio of current–cost depreciation of private non–farm fixed assets to the value of private fixed assets between 1947 and 2004. Current–cost depreciation of private fixed assets is reported in Table 6.4 of Fixed Assets Tables by the Bureau of Economic Analysis. The value of private fixed assets is in Table 6.1. The calculation excludes assets owned by nonprofit institutions, households, and tax–exempt cooperatives.

The tax–based depreciation rate is set at the average ratio of depreciation allowances claimed to the value of private fixed assets, 1947–2004. The depreciation allowances claimed are obtained by summing capital consumption adjustments in lines 34, 38, and 50 of the NIPA Table 1.12. Current–cost depreciation of private fixed assets is the same as that used in computing δ.

13 The survey asks about the saving behavior in the past 12 months, not over a lifetime. Hence, it is foreseeable that the actual proportion of households that save should be higher than the reported number.
FISCAL POLICY

The tax rates are calibrated to income and consumption taxes levied by all levels of governments. The tax return data do not contain saving behaviors. The savers’ tax rate is, thus, assumed to be the average labor income tax rate for those in the top 60 percent of the labor income distribution among filers with positive labor income, based on the 2003 sample of Individual Statistics of Income (Internal Revenue Service, 2006), as computed by Joint Committee on Taxation (2006) using its microsimulation model (Joint Committee on Taxation, 2005). The non–savers’ labor income tax rate is the average rate for those in the bottom 40 percent. Labor income includes wages and salaries and half of the proprietors’ income, and labor income taxes include individual income taxes and Social Security contributions. This yields 0.232 for savers’ federal individual income tax rate and 0.088 for non–savers.

Next, the average state and local labor income tax rates are computed from the 1947–2005 NIPA data. Assume the ratio of federal labor income tax rate on savers to this tax rate on non–savers is the same for the ratio of state and local labor income tax rates. Combining the NIPA data with this assumption yields the state and local labor income tax rate of 0.021 for savers and 0.008 for non–savers. Summing up both rates, the labor income tax rate is set at 0.253 for savers and 0.096 for non–savers in the initial steady state and throughout the experiments.14

Jones’s (2002) definition is employed to construct the capital income tax rate, using 1947–2005 NIPA data. The initial capital income tax rate is set at 0.39.

The consumption tax receipts include excise taxes and customs duties collected by the federal government (lines 5 and 6 in NIPA Table 3.2) and sales taxes and other indirect business taxes collected by state and local governments (lines 7 and 9 in NIPA Table 3.3). Personal consumption expenditures net of consumption taxes are the tax base. The calculation of the average consumption rate yields 0.084, based on the 1947–2005 data.

The initial government consumption share of output (s^G) is set at the historical average ratio of government consumption (line 2 in NIPA Table 3.9.5, 1947–2005) to GDP, and the investment share of output (s^I) is set at the average ratio for the government investment (line 3 in NIPA Table 3.9.5, 1947–2005) to GDP. The government transfers share is determined such that the debt–output ratio in the initial steady state (0.43) roughly equals the historical average of postwar U.S. history, 0.44 (privately held federal debt to GDP, 1947–2005, Table 78, Economic Report of the President (2006)).

INTERTEMPORAL LABOR ELASTICITIES

The benchmark calibration assumes a smaller intertemporal labor elasticity for non–savers. To see the rationale underlying this assumption, consider a negative wage shock and the substitution effect, which makes people reduce their labor inputs. When saving is possible, people’s consumption may not fall as much because they can reduce current saving to increase current consumption. However, when saving is impossible, people’s labor inputs cannot fall as much because there is no means to keep the consumption from falling other than current labor income. As a result, the negative substitution effect of a negative wage shock on labor supply is not as strong when people cannot smooth consumption intertemporally than in the case in which they can. This implies liquidity constrained people,

14 Apparently, the income tax rates are biased–upwards for savers and downwards for non–savers, because not all households in the top 60 percent of the income distribution save, and vice versa. To the best of my knowledge, no estimates or data sets of income tax rates for savers and non–savers exist. Since labor income tax rates remain constant throughout the horizon across all experiments, and the study only concerns changes of the economy under the two capital income tax rate regimes, the biases in calibrated individual income tax rates are less a concern for the purpose of this study.
like non-savers in the model, have a smaller labor elasticity than savers. Domeij and Floden (2005) find that when excluding households that are likely to be liquidity constrained, the estimated intertemporal labor elasticity rises as the intuition suggests.

Chang and Kim (2006) estimate the intertemporal labor-supply elasticity based on a macroeconomic model, where agents differ in productivity. They find the aggregate labor-elasticity is around one, greater than a typical micro estimate, which is often below 0.5 (for example, see Altonji (1986)). The benchmark elasticity for savers is set at one, and for non-savers, at 0.5.

USEFULNESS OF GOVERNMENT EXPENDITURES

The elasticity of output with respect to public capital ($\alpha_G$) governs how productive public capital is for private production. Empirical estimates of this parameter can be as high as 0.4 (Aschauer, 1989b) and as low as zero (Kamps, 2004). I set $\alpha_G$ at 0.1 under the benchmark calibration.

The parameter $\sigma$ indicates how closely government services substitute for a unit of private consumption. Aschauer (1985) estimates this parameter and finds the confidence interval ranging from 0.0 to 0.4. The benchmark calibration sets $\sigma$ at 0.2.