The Macroeconomic Effects of Business Tax Cuts

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Abstract

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1 Introduction

In 2017, Congress passed the Tax Cuts and Jobs Act, a tax reform that included a permanent cut in the income tax rate for corporations from 35 percent to 21 percent, and a smaller temporary cut in the income tax rate for pass-through businesses. More recently, in the President's Budget for fiscal year 2023, President Biden proposed that Congress partially reverse the corporate tax cut, raising the corporate tax rate to 28 percent. These are examples of changes in business income tax rates. What are the macroeconomic effects of such changes?

In this paper, I study the macroeconomic effects business tax cuts using a dynamic general equilibrium model that incorporates key features of business financing and tax legislation: debt and equity financing, interest deductibility, and accelerated depreciation of capital. These features play a key role for the effects of tax changes on investment: While in standard models a cut in the business income tax rate always raises investment, in models with debt financing, interest deductibility, and accelerated depreciation, it raises equity-financed investment but may lower debt-financed investment (Fullerton 1999).

The reason why debt financing and capital depreciation are so important for the effects of tax cuts has to do with the tax treatment of investment and interest expenses. A business tax cut has two partial-equilibrium effects on business investment, working in opposite directions. On the one hand, to the extent that businesses cannot immediately deduct their investment expenses, a business income tax discourages investment, so a cut in the tax rate stimulates investment. On the other hand, to the extent that businesses finance their investment through debt and deduct the associated interest expenses, a cut in the tax rate reduces the tax shield provided by interest deductibility and discourages investment. The balance of these two partial-equilibrium effects depends on how fast businesses can depreciate their capital for tax purposes, and whether they finance their investment through equity or debt. Besides these partial-equilibrium effects, the overall macroeconomic effect of the tax cut on investment depends on the additional effect on the capital structure and financing of businesses and on the general equilibrium effects on interest rates, the wage rate, and labor.

In this paper, I study the overall effect of a business tax cut on investment using a dynamic general equilibrium model that captures the just-described partial-equilibrium and general-equilibrium channels. The model builds upon Occhino (2022), adding the choice by businesses to finance their investment with a mix of debt and eq-

This paper contributes to two strands of literature. First, it belongs to the literature that uses dynamic general equilibrium models to study the macroeconomic effects of tax changes (for instance, House and Shapiro 2006, Fernández-Villaverde 2010, Sims and Wolff 2018, and Occhino 2022). Relative to Occhino (2002), in this paper businesses finance investment with a mix of debt and equity, which is important to estimate the effects of business tax cuts on investment. Relative to the other papers in the literature, this paper models debt financing, interest deductibility and accelerated depreciation of capital, which is also crucial for the estimates.

Second, this paper contributes to the empirical literature that estimates the tax multiplier and, more generally, the macroeconomic effects of tax changes (for instance, Blanchard and Perotti 2002, Mountford and Uhlig 2009, Romer and Romer 2010, Barro and Redlick 2011, Favero and Giavazzi 2012, Mertens and Ravn 2013 and 2014, and Caldara and Kamps 2017.) This literature estimates the effect of changes in the tax liability, not necessarily changes in the tax rate. In particular, to focus on business income taxes, Mertens and Ravn (2013) estimate the effect of exogenous changes in the corporate income tax liability. However, the exogenous tax changes that they consider in their study are mostly driven by increases in depreciation allowances and investment tax credits—Changes in the corporate income tax rate play some role for only 3 of the 16 exogenous tax changes. Hence, their estimates mainly refer to the effect of changes in depreciation allowances and investment tax credits, not changes in the corporate income tax rate. My paper shows that the macroeconomic effects of changes in the corporate tax rate can be very different (even the opposite when investment is financed only through debt) from the effect of changes in depreciation allowances and investment tax credits, so it can be very different from the effect of changes in the tax liability estimated by this empirical literature.

In the rest of the paper, Section 2 details the model and explains why the effect of tax cuts depends on business financing and capital depreciation; Section 3 describes the calibration, results, and sensitivity analysis; and Section 4 concludes.

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In the model, there is a continuum of representative households of measure one, a continuum of representative firms of measure one, and a government. Firms are owned by agents that are distinct from households and maximize their own utility function. Households supply labor and financial capital to firms. Firms invest, produce, and pay income taxes. The government uses household lump-sum taxes to balance its intertemporal budget constraint.

Business financing, interest deductibility, and capital depreciation play a crucial role for the effects of business tax cuts on investment. I model these features assuming that firms pay taxes on their income after deducting accounting depreciation and interest expenses. Accounting depreciation, which refers to the way capital is depreciated for tax purposes, is assumed to be faster than economic depreciation, which refers to the way economic capital depreciates over time. Firms finance their investment with a mix of debt and equity, but only debt provides a tax shield: while the debt interest expense can be deducted from business taxable income, the equity return cannot be deducted.

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The representative firm begins period t with economic capital, [illegible] capital, [illegible] short). The firme ittb[illegible]755(r)-1.42458 T

Accounting depreciation is modeled as in Occhino (2022). For tax purposes, capital is depreciated at the accounting depreciation rate $\tilde{\delta}$ □

Taxable income, I_t, is obtained deducting labor costs, accounting depreciation, and interest expenses from revenue:

$$I_t = y_t - w_t l_t - D_t - r_t b_t. \tag{11}$$

The last two terms generate the tax shields associated with, respectively, capital depreciation and interest deductibility.

The firm pays income taxes at the tax rate $\tau_t > 0$, but receives an investment tax credit equal to a fraction $\chi_t \in [0,1)$ of its investment expenses, so the tax liability is equal to

$$X_t = \tau_t I_t - \chi_t x_t. \tag{12}$$

The dividend distributed by the firm is obtained summing revenue and cash flow from financing and subtracting labor costs, investment, the tax liability, and the bankruptcy costs:

$$d_t = y_t - w_t l_t - x_t - X_t + [b_{t+} + e_{t+} - (1 + r_t)b_t - (1 + r_t^e)e_t] - w(\theta_t)a_t \tag{13}$$

Substituting the expressions for D_t, I_t and X_t from (3), (11), and (12) into (13), we obtain:

$$\begin{aligned} d_t = & y_t - w_t l_t - x_t - \tau_t(y_t - w_t l_t - \tilde{\delta}\tilde{k}_t - \kappa_t x_t - r_t b_t) + \chi_t x_t + b_{t+} + \\ & e_{t+} - (1 + r_t)b_t - (1 + r_t^e)e_t - w(\theta_t)a_t \\ d_t = & (1 - \tau_t)(y_t - w_t l_t) - (1 - \tau_t\kappa_t - \chi_t)x_t + \tau_t\tilde{\delta}\tilde{k}_t + b_{t+} + \\ & e_{t+} - [1 + r_t(1 - \tau_t)]b_t - (1 + r_t^e)e_t - w(\theta_t)a_t. \end{aligned}$$

Then, substituting the expressions for y_t, b_t, and e_t

The optimization problem solved by the owner of the representative firm is:

$$\max_{\{d_t, l_t, x_t, k_{t+1}, \tilde{k}_{t+1}, a_{t+1}, \theta_{t+1}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t u(d_t) \qquad (15)$$

subject to (2), (4), and (14),

given initial values for the state variables $k_0, \tilde{k}_0, a_0$

which imply that, in a linear approximation of the equilibrium, the rates of return on debt, equity, and government debt are equal:

$$r_{t+} = r^{e}_{t+} = r^{B}_{t+} . \tag{23}$$

3 o rm n

The government receives a constant endowment of goods, y^{G}, issues debt, B_{t+}, and collects tax revenue from firms, X_t, and from households, T_t. It uses the proceeds to finance government spending, G, and repay gross-of-interest debt to households:

$$G + (1 + r^{B}_{t})B_t = y^{G} + X_t + T_t + B_{t+} . \tag{24}$$

I assume that the household lump-sum taxes, T_t, respond to changes in government debt and adjust so that government debt is stationary and an equilibrium exists. Provided that an equilibrium exists, the timing of the adjustment in T_t affects only the evolution of government debt and does not matter for the dynamics of the otheru

The equilibrium condition for the goods market equates the sum of private and public consumption, investment and bankruptcy costs to GDP, while the equilibrium condition for the labor market equates labor demand and labor supply:

$$C_t + G + x_t + w(\theta_t)a_t = Y_t \tag{27}$$

$$l_t = n_t. \tag{28}$$

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The model captures why debt financing and the accelerated depreciation of capital are crucial for the effects of tax changes on investment.

A tax cut has two main partial-equilibrium effects, working in opposite directions. First, to the extent that investment expenses cannot be deduct ment expenses, and whether investment is financed through debt or equity. A tax cut tends to stimulate investment if accounting depreciation is slow and the debt share is low, while it tends to discourage investment if accounting depreciation is fast and the debt share is high.[2]

Appendix A illustrates how the effect of a tax cut on investment depends on debt financing and accelerated depreciation studying the steady s

$\chi = 0.17 \times 0.06 = 0.01$.

The steady-state total financial capital is set equal to the present discounted value of the firm $a = 1.28$. To determine the steady-state equity and debt, I turn to the percent of GDP (4.2 percent of business owners, and 60.5 percent of households).

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Figure 1 plots the macroeconomic effects of a permanent cut in the business income tax rate, τ_t. The size of the shock is 1. All variables, except for the interest rate and the debt share, are expressed in logarithms, so their responses can be interpreted as percent responses of the underlying variables to a 1 percentage point tax cut.

The solid line shows that a 1 percentage point cut in the tax rate raises business investment by 0.25 percent in the initial year, with the effect persisting over time. The increase in capital raises the marginal product of labor and stimulates the labor demand. As the real wage rate increases, labor and output increase. The effect on output is small in the initial year, only 0.05 percent, although it increases over time. The interest rate increases to encourage saving and finance the increase in investment. As a result of thehve.a□ianhThercent o97513947(v)34.1874(e6(r)-1.464515(o)-2.2439(.)e43 not debt financing. Comparing the solid and dotted lines shows that the predictions of the model with and without debt are relatively close. This is simply due to the fact that the calibrated debt share is rather small, $\theta = 0.21$. In contrast, comparing the solid and dashed-dotted lines shows that the effect on investment is much larger in the model without accelerated depreciation than in the model with accelerated depreciation.

Because the stimulative effect of the tax cut is rather small, a tax cut is a relatively inefficient policy tool to stimulate the economy. Figure 2 compares the macroeconomic effects of a permanent cut in the business income tax rate, τ_t, to two alternative of the temporary provisions. In contrast, a temporary tax cut depresses current investment and boosts future investment. The reason is that, when the tax cut is temporary, the tax rate is higher in the future than today, so the tax shields provided by interest deductibility and accelerated depreciation are higher in the future as well and businesses have an incentive to delay their investment and take advantage of the higher future tax shields.

One could also view these results as highlighting the importance of expectations for the immediate effects of tax cuts. A tax cut may have expansionary effects if businesses and the public expect it to be permanent, but contractionary effects if they expect it to be reversed soon. This view may help explain why investment did not respond much to the 2017 tax reform. Although the tax reform included some provisions (individual tax cuts stimulating the labor supply, increased bonus depreciation for equipment investment) that likely stimulated business investment, the overall response of business investment was muted. Several factors may have contributed to restrain investment, for instance, the increase in tariffs and related economic policy uncertainty in 2018. One additional factor may have been the expectation that the corporate tax cuts were going to be, at least partially, reversed. This expectation may have encouraged corporations to delay their investment and may have caused the corporate tax cuts to have contractionary, rather than expansionary, effects on investment and output (Occhino 2022).

shows that, after a permanent tax cut, investment and output increase if investment is financed mainly through equity but decrease if investment is finance

cut lowers the tax shield and works to discourage investment. This mechanism can be so strong that, when businesses finance their investment partly through debt and delay investment, depressing current investment and boosting future investment, as evident in the case of zero autocorrelation (dashed line). The reason is that interest deductibility and accelerated depreciation provide tax shields that increase with the

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expensing fraction is constant ($\kappa_t = \kappa$), and the tax credit is equal to zero ($\chi_t = 0$). Finally, to abstract from any effect of tax changes on the capital structure, the debt share is exogenous and constant ($\theta_t = \theta$), and there are no bankruptcy costs ($\Psi = 0$). We are interested in the steady-state response of business capital k_{t+} to a permanent change in the tax rate τ_{t+} .

In this simplified partial-equilibrium model, the optimization of the business owner is the same as problem (15), except that l_{t+} and θ_{t+} are constant and are not choice variables. The first-order conditions for the other choice variables are the same as the ones of problem (15). In particular, the ones with respect to x_t, k_{t+} , $\tilde{k}_{t+}$, and a_{t+} are, respectively:

$$\lambda_t(1 - \tau_t\kappa_t - \chi_t) = \mu_t + (1 - \kappa_t)\nu_t$$

$$\mu_t = E_t \left\{ \lambda_{t+} (1 - \tau_{t+})A^{\partial f (k_{t+} , l_{t+})} \right.$$

where the last step used the first equation again, evaluated at $t + 1$ rather than t.

The derivative is positive for $\theta = 0$, it decreases with θ, and is negative for $\theta = 1$:

$$LHS_\tau|_{\theta=0} = r\frac{(1-\kappa)}{(1-\tau)^2} > 0$$

$$\frac{\partial LHS_\tau}{\partial \theta} = r\frac{-(1-\tau)(1-\tau\kappa) - \tau(1-\kappa)}{(1-\tau)^2} < 0$$

$$LHS_\tau|_{\theta=} = r\frac{-(1-\tau)(1-\tau\kappa) + (1-\tau)(1-\kappa)}{(1-\tau)^2} = r\frac{-1+\tau\kappa+1-\kappa}{1-\tau} = -r\kappa < 0$$

Hence, for small values of θ (when investment is mainly financed through equity), the left-hand side of (29) is increasing in τ, capital k is decreasing in τ, and a h

	Description	Value	Target / source / note
β	o o pr r n o n or		$\mathbf{r} = \mathbf{r}^e = \mathbf{r}^B =$. [illegible]
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γ	r r r on		
φ	Fr o or pp		
	or p r r	7	**l = n = /**
α	pro on n on pon n		
δ	ono pr on r		
Y	D		nor
$\mathbf{y}^H$	o o n o n		D r o pr non o p
$\mathbf{y}^G$	o n o n		D r o o o p
A	pro on n on		**y =** .7 D r o o p
τ	r		pr 7 orpor r
κ	n n p n n r on	[illegible]	
δ	o n n pr on r		**δ = δ** r pr on
χ	n n r r on		[illegible] r
X		.	
θ	r o n n p		orpor n q
a	n n p		q o r
b		7	
E	o q		
v	n q		
e	o q		
ψ	n r p o pon n	[illegible]	o **θ** o **τ**
	n r p o		
G	o p n n		D r o o p n n
T	o o p	.	**B =** .7 o o D
C	r on p on	[illegible]	
x	n n	7	
k	p	7	
k	o n n p	[illegible]	

Table 1: Parameters and steady-state values. **Note: The length of a period is 1 year.**

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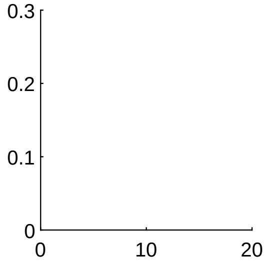

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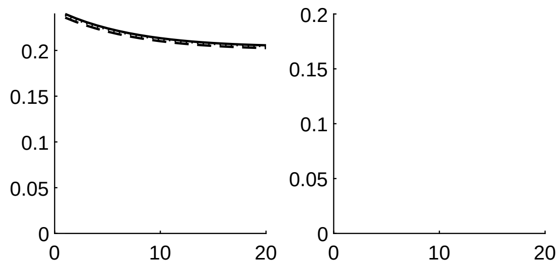

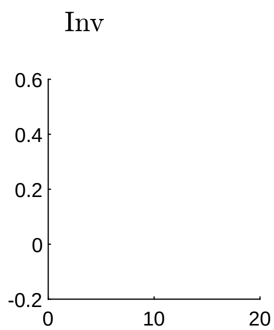
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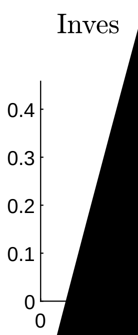
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