Tax reform looks low risk for economy

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The Tax Overhaul Bill of 1986 is the most comprehensive restructuring of federal income tax law in the past 40 years. This bill changes many of the tax rates, deductions, exemptions, and credits that affect individuals and businesses. It was designed to be "revenue neutral;" that is, it was intended neither to increase nor to cut the tax receipts of the federal government. Rather, the purpose was to shift some of the tax burden from individuals to businesses, and to reduce inequities and imbalances created by various loopholes in the system. It has been estimated that the net effect, over the next five years, will be to raise business taxes by $120 billion and to reduce personal income taxes by a like amount.

The top tax rate for individuals will be lowered from 50 percent to 28 percent by 1988, although some portion of high incomes will be subjected to a marginal tax rate of 33 percent. Most individuals will fall in a lower tax bracket of 15 percent. There were a number of other adjustments and changes, particularly in the area of deductions from income.

Of the 100 million persons who file a federal income tax, about three out of four will pay lower taxes. For individuals the average reduction will be about 6 percent of their taxes.

For businesses the biggest change is the elimination of the investment tax credit. Depreciation allowances have been scaled back somewhat and a minimum tax will affect certain corporations. Partially offsetting these changes is a reduction in the top tax rate for corporations from 46 percent to 34 percent.

Given such major changes and the numerous other provisions of this tax reform, it is natural to wonder what will be the net effect on the economy in the coming years. With almost every household and business directly affected, what will be the eventual effect on investment, output, interest rates, employment, and other measures of economic performance? Attempts to answer this question, in the form of guesses, hunches, estimates, and predictions have flooded the popular and business press in recent months.

Much of this coverage has been somewhat negative and has emphasized the adverse effects the new law could have on business investment. This has been especially true in analysis of industries that have received investment tax credits.

While we consider it virtually impossible to predict what the eventual net effects will be, our model simulations suggest that any negative effects will likely be small and we are unable to reject the possibility of a significant positive response.

This paper looks at some possible effects of the new law on the economy by studying the effects of the tax changes on a small model of the economy. Numerous simulations of this model indicate that any negative effect on output will be quite small. A number of scenarios are run, and show that modest positive adjustments in the economy could more than offset the losses in our "worst case scenario," which itself turns out not to be that bad. These offsetting adjustments could include an increase in the supply of labor due to the lowering of individual tax rates, an increase in the efficiency in investments by businesses, and a reduction in corporate dividends.

Specification of the model

The trick in building an economic model is to make it complex enough that there is a reasonable approximation to the real economy, yet simple enough that the model's economic interactions can be understood. Although the model uses only about two dozen variables, it captures many of the relationships in an economy that are affected by changes in tax rates. As is the case with any model of this type, the variables are highly aggregated— each variable lumps together a great deal of economic information. For example, labor, capital, output, prices, and interest rates are each represented by a single variable, or measure.

The model is based on standard assumptions of macroeconomics and has been "tuned" to approximate the magnitudes of the U. S. economy. It consists of some basic economic

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definitions and accounting identities, an assumption about the financing and investment decisions of businesses, and a specification of some of the factors that critically affect interest rates and dividend yields. The equations and variables of the model are listed in the box.

The simulations start from an initial point of equilibrium; the tax rates are then changed to reflect the basic shifts of the new tax law. This leads to a new long-run equilibrium. The model is based on the 1979 paper by Martin Feldstein, Jerry Green, and Eytan Sheshinski.

Output is assumed to be produced by combining the inputs of capital and labor. The production process is such that a doubling of each input leads to a doubling of output. Workers receive a real wage rate that represents their marginal contribution to output.

The sources of income for households in this model include wages received by labor, interest earned on corporate bonds, and dividends paid by businesses. This income is used to pay personal income taxes, to buy output for consumption, and to add to savings. All savings are used to buy additional corporate bonds. Individual taxes are proportional to personal income plus capital gains. In equilibrium, personal savings equal the growth rate of the economy multiplied by the outstanding stock of bonds. Capital gains equal the growth rate multiplied by the equity value of businesses. Equity is defined as the difference between the value of the existing capital and the amount of bonds outstanding.

The Federal Reserve is assumed to conduct monetary policy so as to maintain a constant price level; that is, there is no inflation in this model. This is an assumption that monetary policy will not try to "take up the slack." For a discussion of issues associated with a more active monetary policy and the resulting inflation, see Feldstein, Green, and Sheshinski (1978).

Business' source of funds include revenue from the sale of output plus new bonds that have been issued. These funds are used to pay wages, interest payments, dividends, and corporate taxes. The remaining funds are used to purchase output for investment in additional or replacement capital.

Taxable profits equal receipts from output sold minus allowable deductions. These deductions include wages, interest payments, and a depreciation allowance. For simplicity,

the depreciation allowance is assumed to equal actual depreciation in balanced growth where there is no inflation. Corporate income ("profit") taxes are a fraction of taxable profits minus any investment tax credits.

Businesses are assumed to select a debt-capital ratio that will minimize their cost of capital. As is the custom in theories of corporate finance, this cost of capital is an after-tax rate of return net of depreciation. In balanced growth equilibrium, the ratio of gross investment to the existing stock of capital equals the rate of growth plus the rate of depreciation. Under these conditions, minimizing the cost of capital is equivalent to assuming that businesses invest so as to maximize their level of output.[1]

In the absence of an investment tax credit or accelerated rates of taxable depreciation, the cost of capital is a simple weighted average of the after-tax rates of return on bonds and on equity. The weights are the debt-capital ratio and the equity-capital ratio, respectively. The rate of return on debt is the interest rate, and the gross rate of return on equity is the dividend yield plus the growth rate of capital. The after-tax return on equity is the gross rate of return divided by one minus the corporate income tax rate.

There are two factors that are assumed to affect the rate of interest in the absence of inflation. First, as corporations acquire a higher debt ratio, they must pay a higher real rate of interest. This risk adjustment factor makes it possible for the optimal investment decision to include a combination of both debt and equity financing.

The second factor that can influence the real rate of interest is the personal income tax rate. Households are assumed to be the sector that is willing to lend money to businesses by buying corporate bonds. Individuals are interested in their after-tax rates of return on bonds and equity. When the individual income tax rate is reduced, a proportional reduction in the rate of interest can generate the same after-tax rate of return. The dividend yield on equity is also positively linked to the income tax rate.

The final specification of the model is a brief description of the government sector. The government receives taxes from individuals and businesses. All of this revenue is spent on purchasing output for public consumption. The government is assumed to have no existing debt

and never to run a deficit. These simplifying assumptions focus the analysis on the effects of revenue-neutral tax changes and eliminate the need to distinguish between interest rates on government and private debt.

Estimation of the model

Before using the model to simulate the effects of a change in tax rates, it is necessary to establish the equations of the model and to estimate or specify values for each of the variables. The box lists the equations and parameters of the model. The following section briefly describes how these variables were selected so as to approximate the U. S. economy for 1984-85.

Gross National Product in the United States was approximately $4 trillion (or $4,000 billion) in 1985. The value of output in the model was set equal to 4,000 and all dollar magnitudes can be interpreted as being in billions of current dollars. The price index is initially equal one and remains constant, given the assumptions about monetary policy and inflation.

Because one of the interesting questions about the tax reform bill is the effect it would have on investment decisions by businesses, the investment numbers have been selected to approximate nonresidential fixed investment as a fraction of the overall economy. Gross investment is set equal to 12 percent of total output, with the capital consumption allowance (amount of depreciation of nonresidential capital) equal to 9 percent of total output. The difference between gross investment and depreciation represents net investment. Three percent of total output is used to increase the nonresidential stock of capital.

If the balanced growth rate of the economy is also assumed to equal 3 percent per year, then the equilibrium capital-output ratio must be equal to one.

The debt-equity ratio is initally set equal to 0.6. This ratio for nonfinancial corporations in the United States rose from 0.4 in the mid 1960s to fluctuate between 0.6 and 0.8 in the 1980s. The corresponding debt-capital ratio is 0.375.

The dividend yield on equity is assumed to be 3 percent initially and the interest rate for bonds is set at 5 percent. The gross return on equity equals the dividend yield plus the rate of growth of equity. With 3 percent balanced growth, accrued capital gains will equal 3 percent of equity. The tax rates on interest, dividends, and accrued capital gains are assumed to be the same.

The government initially purchases 10 percent of total output. This number approximates the percent of GNP that is collected by the federal government from personal and corporate profit taxes if one excludes the net earnings of the Federal Reserve System. It is slightly higher than the 8-9 percent of GNP that is federal government purchases of goods and services. (The size of the federal government would be significantly higher if we included all transfer payments.) State and local government taxes and expenditures are netted out or subsumed into consumption.

Of the $400 in government expenditures, 15 percent or $60 initially is raised by corporate profit taxes. The remaining 85 percent or $340 is collected from personal income taxes. The primary effect of the tax changes is to increase corporate taxes by approximately $20 and to lower individual taxes by an equal amount.

The investment tax credit rate is assumed to equal 6 percent. In 1985, this rate was 10 percent for most producer durable equipment, 6 percent for autos, and zero for nonresidential structures. The 6 percent rate approximates the weighted average of these rates, where the weights are the proportions of total nonresidential fixed investment.

Given these initial conditions, the equations of the model can be used to determine the corresponding corporate and personal tax rates, the coefficients of the production function, and the coefficients that link the interest rate to the debt-capital ratio.[2]

Once the model has been completely specified, it is possible to simulate the effects of a change in tax structure. The investment tax credit is eliminated and the corporate profit tax rate is reduced so as to raise an additional $20 in corporate taxes. Given the new tax structure, business calculates the new optimal mix of debt and equity financing and adjusts the capital stock accordingly.

Equations of the Simulation Model

[1] $$Q = \gamma K^{\alpha} L^{\beta}$$

[2] $$1.0 = \alpha + \beta$$

[3] $$Q = C + I + G$$

[4] $$W = \frac{\partial Q}{\partial L}$$

[5] $$T_L = \tau_L(WL + RB + \psi E + \lambda K)$$

[6] $$E = K - B$$

[7] $$Y_K = Q - WL - RB - \delta K$$

[8] $$T_K = \tau_K Y_K - \xi I$$

[9] $$I = (\delta + \lambda)K$$

[10] $$\theta = B/K$$

[11] $$N = \theta R + (1 - \theta)(\psi + \lambda)/(1 - \tau_K) - \xi(\delta + \lambda)/(1 - \tau_K)$$

[12] $$\frac{\partial N}{\partial \theta} = 0$$

[13] $$\frac{\partial Q}{\partial K} - \delta = N$$

[14] $$R = (\rho_0 + \rho_1 \theta^2)/(1 - \tilde{\tau}_L)$$

[15] $$\psi = \psi_0/(1 - \tilde{\tau}_L)$$

[16] $$G = T_K + T_L$$

Initial Conditions

$L = 4000$	$Q = 4000$	$I = 480$	$G = 400$
$T_K = 60$	$\delta K = 360$	$\theta = 0.375$	$\tilde{\tau}_L = 0.32$
$R = 0.05$	$\psi = 0.03$	$\xi = 0.06$	$\lambda = 0.03$

Variables

B	Bonds	C	Consumption
E	Equity	G	Government
I	Gross investment	K	Capital stock
L	Labor employed	N	Cost of capital
Q	Real output	R	Interest rate
T_K	Corporate taxes	T_L	Personal taxes
W	Nominal wage rate	Y_K	Corporate taxable income
α, β, γ	Production function coefficients	δ	Rate of depreciation
θ	Debt-capital ratio	λ	Growth rate of labor
ξ	Investment tax credit rate	ρ_0, ρ_1	Interest rate equation coefficients
τ_K	Tax rate for corporate income	τ_L	Average tax rate for personal income
$\tilde{\tau}_L$	Marginal tax rate for personal income	ψ	Dividend yield on equity
ψ_0	Dividend equation coefficient		
$\partial Q/\partial K$	Marginal product of capital	$\partial Q/\partial L$	Marginal product of labor

The individual tax rate is lowered until personal income taxes have been reduced by $20. A reduction of personal income taxes from 340 to 320 would represent lowering personal tax rates by about 6 percent on average.

With a progressive income tax, the change in the average tax rates will generally not be the same as the change in "the" marginal tax rates. It is difficult to identify what the relevant marginal tax rates are for this model. Ideally it would be a dollar-weighted average of different taxpayers' marginal income tax rates, where the weights would be proportional to the relative size of the taxpayers' savings. It is this rate that is linked to interest rates and dividend yields.

As a ballpark estimate, the change in marginal tax rates is assumed to be about 12 percent, or twice the change in the average tax rates. The marginal income tax rate for individuals is assumed to decline from 32 percent to 28 percent.

Simulation results

To demonstrate the sensitivity of this model, a series of simulations were run using different assumptions about the response of labor supplied, the dividend policies of corporations, and the magnitudes of marginal tax rates. These factors are important because they can determine whether the tax changes eventually will increase or decrease the level of real output. To provide a range of possible effects, four cases were simulated.

In the first simulation, labor and real dividend yields are held constant, i.e. there is not a supply-side labor response to the lower personal tax rates and businesses take the full hit of new corporate taxes. This simulation can be considered a "worst case" scenario since it allows for no positive responses in output and maximizes business losses.

A second simulation is run to determine how much the quantity of labor supplied would need to increase to maintain a constant level of output, i.e., how much of a labor response would be necessary to offset the hit on business. The existence of a substantial labor supply-side effect has yet to be demonstrated. Lower tax rates on wages increase the return for working. This change should motivate some people to spend less time in leisure and more time in work. On the other hand, a lowering of personal taxes will increase incomes. With higher incomes some people might prefer to work less and spend more time in leisure. Empirical studies by Hausman (1985) have not been able to resolve this ambiguity.

The third scenario has businesses passing on some of the additional taxes to their stockholders by reducing dividend yields. This is essentially one way businesses could try to pass the increased taxes back to individuals. To provide a benchmark, dividend yields are lowered by an amount such that the level of real

output is unchanged in equilibrium. In the other simulations, after-tax dividend yields are assumed to be constant.

The final simulation adjusts the production function by increasing the scale parameter. Some people expect that businesses will be more efficient in their investment decisions and with the new tax structure and thus additions to the capital stock could be more productive. This could lead to a higher level of output for a given quantity of labor employed. As a reference point, the production function is shifted so as to maintain the initial level of output.

The results of these simulations are shown in Table 1 along with the initial conditions. Corporate and personal income tax rates have been changed by an amount that would shift exactly $20 billion in taxes from individuals to corporations *if* the quantity of labor remains unchanged. Whenever there is a change in labor supplied, the new tax rates might not be revenue neutral. This is the case in the last two simulations where the net effect is to raise slightly more or slightly less than the $400 billion in taxes. The model does not try to identify the short-run adjustment paths for the different variables.

The most striking feature of these simulations is their relative uniformity. The expected, long-run effects of the tax changes appear to be quite small under all of the simulations. Even in the case where labor and after-tax dividend yields are constant, the decline in real output is only slightly over one-fourth of one percent.

Except for the quantity of labor and the production function scale parameter, the results of the second and fourth simulations are identical. This result is due to the particular production function that is used in these simulations. This production function assumes that a constant fraction of output is always paid to workers. There would be small differences between these simulations if an alternative production function is used.[3]

Real output can increase if one uses a combination of supply-side effects, some shifting in the incidence of corporate taxes, and upward shifts in the production function. The potential increase is limited only by how large these effects might be. For example, an alternative simulation was run where the 12 percent

decrease in marginal income tax rates results in a 3.6 percent increase in labor. This response is consistent with the empirical studies (Killingsworth [1981]) that find a large and positive linkage between labor supply and personal tax rates. The corresponding increase in real output is approximately 3.3 percent.

For each simulation, the debt-equity and debt-capital ratios are lowered due to the reduction in corporate income tax rates. With a lower rate, the deductibility of interest payments is worth less. On the other hand, a lowering of the debt-capital ratio is assumed in this model to lead to a reduction in interest rates. Interest rates are reduced further by the lowering of marginal personal income tax rates. The reduction in interest rates varies between 55 and 70 basis points (100 basis points equals one percentage point).

Given the accuracy of economic data in general, and the ability of economists to identify causes and consequences in particular, these findings strongly suggest that the net effects of the tax changes may be very difficult to estimate in the coming years. The "noise" and irregular movements in most economic data could effectively mask any long-run changes. In his 1985 Richard T. Ely lecture, Herbert Stein described this general problem. "Macroeconomists can feel confident in wartime, because in wartime they deal with large numbers—large enough to override the noise in the data and the conditionality of the analysis. We may not predict very well the consequences of the difference between federal spending of 20 or 25 percent of GNP, or of a deficit of 2 or 3 percent of GNP. But we can give a useful, if rough, estimate of the consequences of raising federal spending from 10 to 50 percent of GNP, or of raising the deficit from 3 to 25 percent of GNP."

The overall size of the effects appears to be relatively insensitive to the estimation of the model. A large number of alternative simulations were run using different values of the parameters. For example, the initial debt-equity ratio was varied from 0.4 to 0.8. Likewise the other initial conditions were varied by plausible amounts. The results were quite similiar to the numbers reported in Table 1. The model, at least, predicts very modest net effects when there is a $20 billion shift in taxes within a $4,000 billion economy.

Table 1
Simulation results

Variables	Initial values	I Constant labor	II Increased labor	III Decreased yields	IV Production function
Capital	4000.0	3926.0	3937.8	4000.0	3937.8
Labor	4000.0	4000.0	4012.1	4000.0	4000.0
Output	4000.0	3988.0	4000.0	4000.0	4000.0
Consumption	3120.0	3116.9	3126.3	3120.2	3126.3
Investment	480.0	471.1	472.5	480.0	472.5
Government	400.0	400.0	401.2	399.8	401.2
Corporate Taxes	60.0	80.0	80.2	79.2	80.2
Income Taxes	340.0	320.0	321.0	320.6	321.0
Debt	1500.0	1390.0	1394.2	1374.9	1394.2
Equity	2500.0	2536.0	2543.7	2625.1	2543.7
Debt-Equity Ratio	60.00%	54.81%	54.81%	52.38%	54.81%
Debt-Capital Ratio	37.50%	35.40%	35.40%	34.37%	35.40%
Interest Rate	5.00%	4.45%	4.45%	4.30%	4.45%
Yields	3.00%	2.83%	2.83%	2.58%	2.83%
Interest	75.0	61.8	62.0	59.3	62.0
Dividends	75.0	71.9	72.1	67.7	72.1
Capital Gains	75.0	76.1	76.3	78.8	76.3
Investment Tax Credit	6.00%	0.00%	0.00%	0.00%	0.00%
Profits Tax Rate	42.29%	35.10%	35.10%	35.10%	35.10%
Income Tax Rate	9.50%	9.00%	9.00%	9.00%	9.00%
Marginal Income Tax Rate	32.00%	28.00%	28.00%	28.00%	28.00%
Gross Cost of Capital	16.12%	16.38%	16.38%	16.13%	16.38%
Before Tax Profits	210.0	227.9	228.6	225.7	228.6
Production Function Parameter	1.000	1.000	1.000	1.000	1.0025

Conclusion

In the coming years, the taxpayers of the United States will be adjusting to the many changes of the 1986 tax reform bill. At the individual level, these changes could be substantial. Businesses that had benefitted from investment tax credits will carefully reevaluate their investment decisions. Individuals will adjust their work efforts and savings strategies so as to maximize their expected welfare.

As these decisions are carried out in the marketplace, some new jobs will be created and others lost. Some types of goods and services will grow while others will decline. Collectively these decisions and adjustments will determine the overall level of economic activity.

At this time, it is difficult to determine what the net effect will be. Numerous simulations of the model presented in this paper predict that any negative impact on the level of output will be quite small and could easily be more than offset by a combination of stimulative factors. The three factors considered in this paper are an increase in the supply of labor due to the lowering of personal income tax rates, an increase in the efficiency of investment by business, and a possible reduction in dividends as businesses try to pass some of the increase in taxes onto stockholders. While we consider it virtually impossible to predict what the eventual net effects will be, our model simulations suggest that any negative effects will likely be small and we are unable to reject the possibility of a significant positive response.

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[1] The relationship between the cost of capital and the level of output in this model comes from the balanced growth equation for business receipts and expenditures. The sources of revenue for a business include receipts from the sale of output and the issuance of new bonds. In balanced growth, the quantity of new bonds issued in any period is equal to the growth rate of the economy multiplied by the outstanding supply of bonds.

These revenues are used to pay wages for workers, corporate income taxes, interest on outstanding bonds, and dividends on equity. The remaining money is used to purchase output for investment purposes. In equilibrium, the capital stock should be increasing at the balanced growth rate.

By rearranging some of the terms in the balanced growth equation for business and dividing by the capital stock, one obtains an equation that relates the marginal product of capital (and therefore the level of output for a given quantity of labor) to the rate of depreciation plus the cost of capital. This is equation 13 in the box.

[2] The initial conditions and equations of the model can be used to determine uniquely all of the variables in a balanced growth equilibrium. For example, since the level of government expenditures and corporate income taxes have been specified, the corresponding level of personal income taxes can be derived from the assumption that the government has a balanced budget. In a similiar manner, the other variables and coefficients can be calculated by simple substitutions.

[3] This model used a linearly homogeneous, Cobb-Douglas production function. The proportion of output that is paid to workers is constant and equal to labor's coefficient in this log-linear function.