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The Long (and Short) on Taxation and Expenditure Policies

One of the central issues in the 1992 presidential campaign was how best to promote economic growth. Because much of the growth debate concerned fiscal policy, taxation and expenditure plans came under intense public scrutiny. At issue were both the level of taxation and the proper mix of taxes. Similarly, voters were concerned with the composition as well as the level of government expenditures. While voter interest was high, the various programs put forth grew so detailed that their long- and short-run effects became difficult to evaluate and compare.

What distinguished the 1992 campaign was a fiscally sober post–Cold War reassessment of the government's economic priorities. All major candidates argued for cuts in defense spending and agreed that the resources saved—the peace dividend—should be spent on enhancing the nation's productivity. This productivity enhancement was to come from some combination of public investment and a more investment-friendly business tax structure. While the candidates' broad visions were similar, they disagreed on how much public investment to allocate to human capital (such as education and training) versus physical capital (such as roads, bridges, mass transit, and so on). Proposals also differed on how to change business taxation to promote investment, although all called for lower costs of private capital. Most candidates did not openly acknowledge that promoting growth usually entails a current sacrifice for future public and private consumption.

This article presents an analytical and graphical framework for evaluating the long- and short-run effects of a broad range of fiscal policies. Except for two simplifying assumptions on the structure of preferences and the production process, the model is fairly general. The model is well-suited for insights into the dynamic effects of some of the 1992 fiscal policy proposals, and it can easily be expanded to analyze distributional, educational, and industrial policy questions.[1] To set the stage, I focus first on the effects of changes in factor income taxation. Factor income taxes are the main components of an income tax. Factor income taxes also have a simple connection to most tax proposals, and this article shows how they relate to consumption and corporate taxes. Lastly, to frame the debate on what to do with the peace dividend, I analyze the effects of changes in government defense and investment expenditures.

Description of the model

This section presents a simple growth model that can be used to analyze the macroeconomic effects of alternative fiscal policies. The model consists of three sectors. The household sector determines current and planned future levels of

I wish to thank my reviewer, Evan Koenig, for helpful suggestions and my readers, Steve Brown, Ping Wang, and Mark Wynne, for their comments. Of course, any remaining errors are my own.

[1] *The analytical model used is a variant on Aschauer (1988, 1989) and Barro (1989). The graphical exposition is based on and complements that of Wynne (1991). This framework is extended by Becsi (1991) to deal with heterogeneity and distributional concerns. For extensions to an endogenous growth framework with education and industrial policies, see, for example, Barro and Sala-I-Martin (1992).*

consumption, labor, and savings. These plans are optimal in the sense that households' choices maximize lifetime utility subject to after-tax budget constraints. In the production sector, firms maximize after-tax profits. This is accomplished by choosing optimal paths for output and for capital and labor inputs. In the government sector, tax receipts from various sources are used to finance government consumption and investment. Equilibrium occurs when factor and goods markets clear in every period.[2]

The household sector is represented by an average household that values the amount of consumption, c, and leisure it obtains in each period of its life.[3] Individuals have a certain number of hours, H, per year to allocate to leisure and labor. Let h, where $0 \quad h \quad H$, be the number of hours devoted to market labor. Thus, $H - h$ is the amount of time devoted to leisure. For simplicity, preferences between any two time periods are described by $U(c, H - h) + (1 + \rho)^{-1}U(c_{+1}, H - h_{+1})$.[4,5] The pure rate of time preference that discounts future utility is given by $\rho > 0$. An increase in this parameter reflects an increase in the individual's desire for early gratification.

The representative individual chooses those feasible time streams of consumption and labor that maximize lifetime utility. Feasibility is determined by the individual's period-by-period budget constraint. The budget constraint requires that purchases of consumption goods and purchases of assets (which are held until the next period) not exceed current period after-tax income. After-tax income is defined as the sum of after-tax labor income, after-tax income from assets, and lump-sum transfers. Savings are put into interest-earning productive capital. The budget constraint for each period is summarized by

$$(1) \qquad c + (k_{+1} - k) = (1 - t_w)wh + (1 - t_r)rk + \bar{l},$$

where $\bar{l}$ is the lump-sum transfer (or tax), k is the physical capital accumulated up to the current period, and $k_{+1} - k$ is the net purchase of capital. The pretax real wage and real interest rate are given by w and r, while the t_i $(i = w, r)$ are the tax rates on wage and interest income. For example, the wage tax encompasses payroll taxes for social security and the salary component of personal income taxes. The interest income tax is a tax on the real returns to capital including dividends, capital gains, and so on.

Households choose feasible streams of consumption, labor, and savings that maximize utility. This leads to well-known optimality conditions for constrained utility maximization: the marginal rate of substitution (*MRS*)—which equals the rate at which the household is just willing to trade one good for another—is equated to the price ratio of the two goods. The price ratio is the rate at which the two goods can be substituted and still satisfy the budget constraint.

Within a time period, households adjust private consumption and labor until the *MRS* between consumption and leisure is equal to the ratio of the after-tax wage to the price of consumption goods, that is, is equal to the after-tax real wage:

$$(2) \qquad MRS(c, H - h) = (1 - t_w)w.$$

The *MRS* between consumption and leisure tells

[2] *For simplicity, the model abstracts from money and uncertainty. It also does not consider market imperfections and intergenerational issues.*

[3] *The representative household is assumed to live infinitely long. An infinite lifetime can be viewed as dynastic families that care about the welfare of future generations. Or, it can be viewed as a useful abstraction of long lives. Time begins in period one, at which point the individual is endowed with* k_1 *units of capital.*

[4] *From time to time, it will be convenient to assume, additionally, that utility is separable between consumption and labor, so that* $U(c, H - h) = u(c) + v(H - h)$.

[5] *Alternatively, one could easily expand utility to include composite consumption, where composite consumption is defined as private consumption plus the consumption services derived from public spending. The services of such spending as health care, education, food stamps, and transportation enter individual utility as substitutes for private consumption. Similarly, services from some government expenditures may substitute or complement private inputs into production. Thus, the only difference between public consumption and public capital is that the latter takes time to be productive and depreciates over time. I abstract from these considerations by assuming that the consumption services from public spending enter utility separably, and that only public investment has productive services. However, in several footnotes below, extensions are considered.*

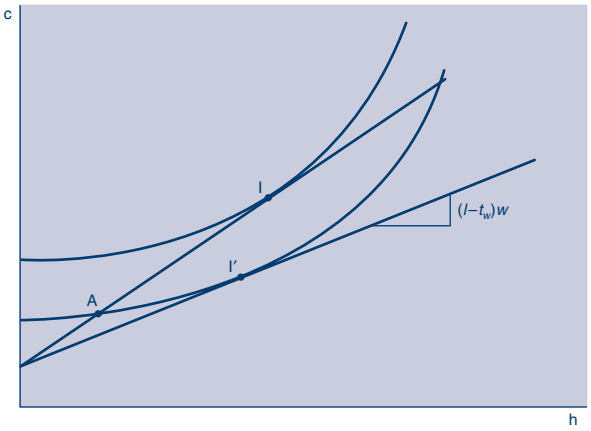
how much additional consumption is required to compensate for a reduction in leisure (an increase in labor). Since a reduction in leisure lowers utility, consumption must rise to increase utility to its original level. However, as leisure falls, a unit of leisure becomes more valuable to individuals, so that progressively more consumption is required to compensate for a unit loss of leisure. In other words, the additional consumption required as compensation for lost leisure rises as leisure falls. Thus, the *MRS* is negatively related to leisure (positively related to labor) and, by the same logic, positively related to consumption.

From the budget constraint, increasing labor by one hour of work increases the household's take-home pay by $(1 - t_w)w$ units. This allows consumption purchases to rise by $(1 - t_w)w$, which is the ratio of the price of leisure to the price of consumption. If the *MRS* is smaller than this price ratio, consumers require less consumption to make up for the disutility of working than they actually can get. Thus, households find it desirable to work more, because utility rises when work effort (and consumption) are increased. Since the *MRS* is positively related to consumption and labor, as households increase their labor and consumption the *MRS* rises until condition 2 is satisfied.

When hours of labor are plotted on the horizontal axis and private consumption on the vertical axis, one can trace the trade-offs between consumption and labor for a given level of utility (*Figure 1*). These indifference curves are convex to the origin and curve upward because an increase in labor requires an increase in consumption to keep utility constant. The slope of the indifference curve is the *MRS* and increases with labor and consumption. Higher indifference curves represent higher levels of utility. The budget constraint also slopes upward and has as its slope the after-tax real wage rate. The vertical intercept of the budget line is nonlabor household income such as capital income and transfers.

Household plans for consumption and labor are determined by the tangency of household indifference curves and budget constraints at point I in Figure 1. At point A the *MRS* is below the after-tax real wage rate. Since the slope of the indifference curve is less than the slope of the budget line, the household can increase its utility while staying on its budget line. The household

Figure 1
Optimal Consumption–Labor Combination



moves to a higher indifference curve by substituting leisure for consumption or increasing labor and consumption. Consumption and leisure are assumed to be normal goods: a good is said to be "normal" when consumption of the good increases for a parallel upward shift of the budget line. Reducing the after-tax wage rate is equivalent to a flattening of the budget line. When consumption and leisure are normal goods, this will move the individual to point I′ where consumption and labor are lower.

Households adjust consumption and savings across time until the *MRS* between consumption in adjacent periods equals the price of current consumption in terms of future consumption:

$$(3) \qquad MRS(c_{+1}, c) = 1 + r_{+1}(1 - t_r).$$

The *MRS* tells how much next period's consumption must rise to compensate for the fall in lifetime utility that occurs when current consumption is reduced. When current consumption is low relative to future consumption, its value is relatively high for the individual. Thus, the compensation required for a fall in current consumption rises as current consumption is reduced. In turn, progressively more future consumption is required to compensate for a unit loss of current consumption. Thus, the *MRS* is negatively related to current consumption. Similarly, it is positively related to future

consumption.[6] An impatient household has a high rate of time preference, ρ. This means that an impatient household requires a higher return of future consumption for a sacrifice of current consumption than a patient household. Thus, the *MRS* will tend to be higher the more impatient the individual is.

From the budget constraint, decreasing current consumption by one unit allows the household to increase savings by one unit. In turn, this increased saving allows future consumption to rise by $[1 + r_{+1} (1 - t_r)]$. Thus, the after-tax interest rate affects how much additional future consumption one can have for a unit reduction of current consumption. As long as the *MRS* exceeds this relative price, the individual requires more future consumption to keep utility constant for a sacrifice of current consumption than the budget constraints allow. Thus, households will have an incentive to raise current consumption relative to future consumption. As current consumption rises relative to future consumption, the *MRS* falls until equality in equation 3 is reestablished.

Given the stock of public capital, $\bar{k}$, the representative firm chooses two inputs, labor and private capital, to maximize its after-tax profit from selling its final output, y. The firm's profits are given by

$$(4) \qquad y - wh - (r + \delta)k - (k_{+1} - k),$$

where δ is the physical rate of depreciation of capital, and $(r + \delta)$ is the cost of capital. I assume that the output production function is constant returns to scale in all inputs and given by $y = f(k,h) + g(\bar{k})$.[7] In other words, total final output is the sum of output produced by private inputs and output produced by public inputs.[8]

Profit maximization by the firm implies that the firm adjusts private inputs until their marginal products equal their factor costs:[9]

$$(5) \qquad f_h(k,h) = w, \text{ and}$$

$$(6) \qquad f_k(k,h) = r + \delta.$$

If the marginal product of labor is greater than the cost of labor, an additional hour of labor will add more to revenues than to costs. Thus, firms can increase profits by hiring more labor. As labor is increased, each additional unit of labor becomes less productive. The marginal product of labor falls until equality in equation 5 is reestablished. Similarly, if the cost of capital is greater than the marginal product, firms will cut back on capital to raise the marginal product of capital.

For a given stock of private capital, the production sector's plans for output and labor are determined by the point on the firm's production function where the slope—the marginal product of labor—equals the ratio of the after-tax wage cost to the after-tax output price. Increasing labor increases output at a decreasing rate so that the production function is concave to the origin. In other words, the slope decreases as labor is increased. Point F in Figure 2 gives the profit maximizing labor–output combination for a given stock of capital.

Increasing public capital causes a parallel upward shift in the production function, and the firm's optimal combination of labor and output moves from F to F′. An increase in private capital causes the production function to twist upward.

[6] *When utility is separable in consumption and leisure, the intertemporal* MRS *has the following form:*

$$MRS(c_{+1},c) = \frac{u'(c)}{\frac{1}{1+\rho}u'(c_{+1})}.$$

In steady state, consumption is constant across time, so that the MRS *equals* $1 + \rho$.

[7] *Constant returns to scale means that if all inputs are scaled up by the same proportion, output will rise by the same scaling factor.*

[8] *To simplify the analysis, public capital is assumed to enter production separably. Thus, public capital does not raise (or lower) the marginal product of a private input. Empirical evidence suggests that this is an oversimplification. For instance, Lynde and Richmond (1992) estimate that a constant-returns-to-scale production function with a positive marginal product of capital is plausible. However, they find that public capital raises the marginal product of private capital and lowers the marginal product of labor. Their evidence on the complementarity in production of private and public capital is consistent with previous findings.*

[9] *Equation 6 is inoperative in the short run when the capital stock is fixed.*

This causes the firm's labor and output to move from F to F″. Also, an increase in wage costs increases the slope of the tangency line and causes point F to move down the production function.

The public sector purchases consumption and investment goods. It finances its expenditures and lump-sum transfers with tax revenues. For simplicity, in the model the government's budget is balanced in each period. In this case, the revenue constraint of the government is described by

$$(7) \qquad \bar{d} + [(\bar{k}_{+1} - \bar{k}) + \delta\bar{k}] + \bar{l} = t_w wh + t_r rk,$$

where $\bar{d}$ denotes defense expenditures. This is a comprehensive revenue constraint that aggregates federal, state, and local levels of the government.[10]

Finally, the goods, factor, and asset markets are assumed to clear in all periods. In particular, equilibrium in the goods markets is

$$(8) \qquad c + (k_{+1} - k) + \delta k + \bar{d} + (\bar{k}_{+1} - \bar{k}) + \delta\bar{k} = f(k,h) + g(\bar{k}).$$

A dynamic equilibrium occurs when all markets clear. Also, households and firms must be behaving optimally subject to their feasibility constraints and the government's actions.[11]

Graphing the model

In this model, the short run is defined as the amount of time it takes to adjust the capital stock. The short-run equilibrium can be described by equations 2, 5, and 8 and by the fact that the capital stock is constant. To study the long-run effects of fiscal policies, one needs the steady-state version of equations 2, 3, 5, 6, and 8. In a steady state, all variables are constant through time. Thus, time subscripts may be dropped. In particular, this means that the net increments to capital are zero. The only investment is replacement investment to offset physical depreciation.

The optimality conditions can be jointly analyzed by combining Figures 1 and 2. Subtracting private investment and public spending from output gives the amount of output available for private consumption. This is equivalent to a parallel downward shift of the production function and causes points F and I to coincide. Where the two points coincide is depicted as point O in

Figure 2
Optimal Output–Labor Combination

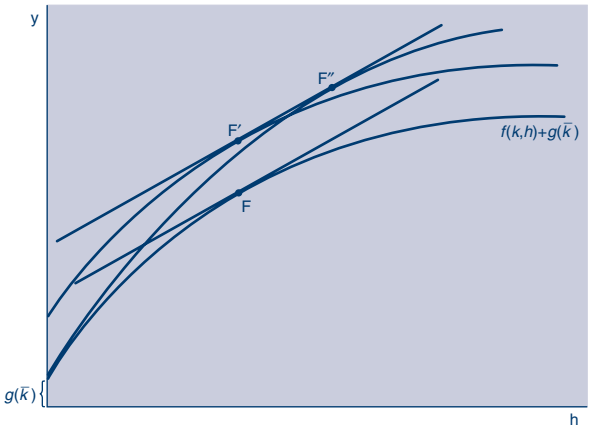


Figure 3. At point O, the (downward-shifted) production function and the indifference curve intersect at their points of tangency with their respective budget lines. Thus, point O determines the profit and utility maximizing aggregate consumption and labor levels.

Point O is optimal for individual households and firms. However, it is suboptimal for the economy as a whole as long as the slope of the indifference curve does not equal the slope of the production function. If firms increased labor by one unit, the additional output produced would increase utility for the household sector. However, the tax structure makes this move unprofitable for

[10] *As a point of reference, defense expenditures averaged 18.4 percent of total government expenditures, transfers to the private sector were 35.8 percent, and gross public investment averaged around 6.8 percent for the period 1986–90. (See Akhtar and Harris [1992] and Council of Economic Advisers [1992]. Also, see footnote 15.)*

[11] *A perfect foresight equilibrium is defined as sequences of optimal household consumption, labor, and savings plans and sequences of optimal firm plans of output and inputs that perfectly forecast the time path of all prices and government variables. These optimal plans also clear product and factor markets.*

the firms. In fact, the difference between the intercepts of the two tangency lines is a measure of the aggregate distortion from the tax system. This distortion is termed the aggregate tax wedge.

Figure 3 can be augmented to show the long and short-run equilibrium levels of consumption and labor. First, market equilibrium is given by equation 8. In steady state, this equation reduces to

$$(9) \qquad c + \bar{d} + \delta\bar{k} = h\left[f\left(\frac{k}{h},1\right) - \delta\frac{k}{h}\right] + g(\bar{k}).$$

Also, combining household and firm optimality conditions and imposing steady state yields

$$(10) \qquad MRS(c, H-h) = (1-t_w) f_h\left(\frac{k}{h},1\right).$$

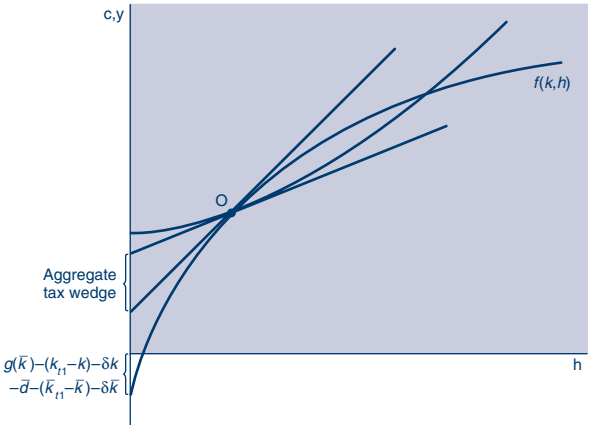
Since consumption in steady state is constant across time, the *MRS* between two adjacent consumptions only depends on the individual's impatience for early consumption:

$$(11) \qquad \rho = (1-t_r)\left[f_k\left(\frac{k}{h},1\right) - \delta\right].$$

Since the rate of time preference is the required rate of return to compensate for the individual's impatience, the *MRS* in steady state equals the constant ρ. Equation 11 determines the marginal product of private capital, and it also pegs the private capital–labor ratio to the rate of time preference.[12] Raising the tax rate on interest income reduces the after-tax marginal product of private capital below its long-run equilibrium level. To restore it to its long-run level, the steady-state marginal product of capital must rise, and the capital–labor ratio must, in turn, fall.

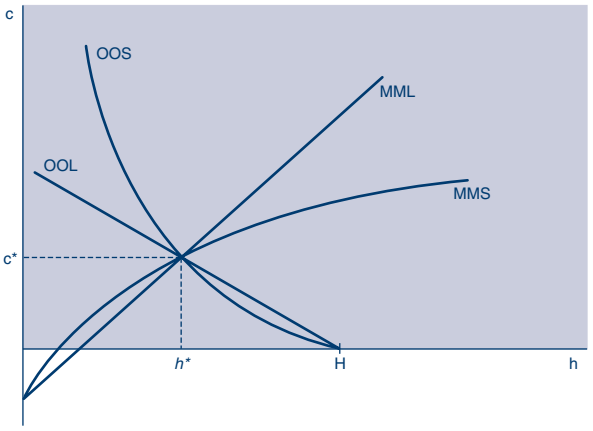
The market equilibrium condition, equation 9, determines the long-run market equilibrium

Figure 3
Combining Intratemporal Optima



relationship of consumption and labor for a given capital–labor ratio and for a given level of government expenditures. In the long run, equilibrium consumption is positively related to equilibrium employment. This is graphed as the line MML in Figure 4. Consumption and labor are linearly related because the capital–labor ratio is fixed. When the capital–labor ratio increases, labor is more productive at all levels of employment. This causes line MML to twist upward from its intercept. As will be discussed below, changing government expenditures causes a parallel shift of line MML.

Figure 4
Short- and Long-Run Equilibria



[12] *This is because of the homogeneity properties of the production function and because public capital enters separably. Thus, the capital–labor ratio is not affected by wage taxation and government consumption and investment. See footnote 20 on how the analysis changes when public capital is not separable in production.*

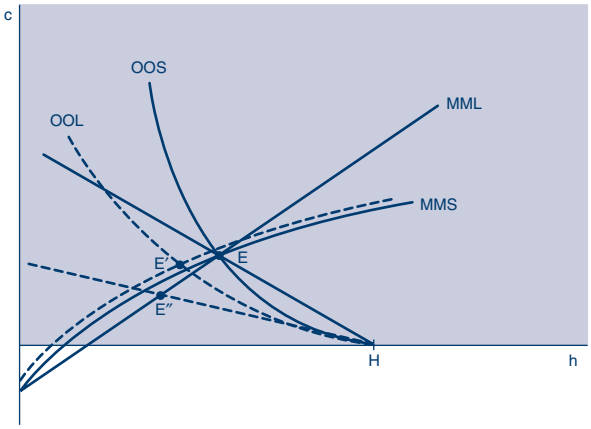
In the short run, the capital stock is fixed and the market equilibrium condition is given by equation 8. The short-run equilibrium relationship between consumption and labor is represented by line MMS. This line is just the parallel-shifted production function from Figure 3. Note that as labor increases beyond h^*, output will increase more in the long run than in the short run. This is because an increase in labor lowers the capital–labor ratio in the short run, which has a partially offsetting effect on output. In the long run, this partial offset does not occur because capital and labor move together.

Equation 10 determines the aggregate trade-off between private consumption and labor. One can use this equation to trace all intersections of the indifference and production functions in Figure 3 that are compatible with utility and profit maximization. In other words, one can trace all possible points O in Figure 3 for parallel shifts in the tangency lines for the production function and the indifference curves. Given the private capital–labor ratio, these points constitute the line OOL in Figure 4. Line OOL gives all the desired steady-state combinations of consumption and labor for a given wage rate. In essence, line OOL traces how consumption and labor respond to changes in wealth, holding relative after-tax prices constant.[13] For a given tax system, there are an infinite number of similar lines associated with different capital–labor ratios (or wage rates). The paths lying above and to the right of OOL are associated with higher after-tax wages or a higher capital–labor ratio. For a constant capital–labor ratio, a lower output tax or a lower consumption tax also causes OOL to shift up and to the right. Thus, shifts of line OOL represent substitution effects on labor and consumption.

When capital rather than the capital–labor ratio is held fixed, equation 10 gives the desired short-run combinations of labor and consumption. This is graphed as OOS in Figure 4. OOS is steeper than OOL, because as labor is reduced from h^* the capital–labor ratio and, hence, the wage rate, rises in the short-run. Households, therefore, require a larger compensation in terms of current consumption than in the long run when the wage rate is fixed.

In sum, the OO lines give desired combinations of labor and consumption, while the MM lines represents technologically feasible combinations. The intersection of the curves yields the overall equilibrium for the economy (in the short and long run).

Figure 5
Effects of a Higher Wage Tax



The effects of tax policies[14]

What happens when the government raises wage taxes? A permanent increase in wage taxes is the analytical counterpart to increasing payroll taxes. Wage taxes do not affect the long-run market equilibrium relationship. Thus, line MML is unchanged in Figure 5. Since the after-tax interest rate is pegged to the constant rate of time preference in the long-run, a wage tax does not alter the steady-state capital–labor ratio.

[13] *When preferences are homothetic, scaling consumption and leisure by the same scaling factor will leave the* MRS *unchanged. This implies that the* MRS *is constant along OOL and that OOL is a straight line.*

[14] *To isolate the effect of each fiscal policy instrument, I assume that the government uses lump-sum transfers to balance its budget when tax rates are increased. For the same reason, lump-sum taxes are used to finance increases in government expenditures.*

Since the capital–labor ratio does not change, the wage rate before taxes is unaffected. But since the after-tax wage rate received by households falls, households substitute away from work and consumption towards leisure. This is equivalent to a downward shift of OOL in Figure 5. Since OOL shifts down and the intersection of OOL and MML determines the long-run effect of the wage tax on consumption and labor, the long-run equilibrium moves from E to E″. Thus, consumption and labor fall in the long run. Because the capital–labor ratio is unchanged in the long run, raising the wage tax causes the capital stock to decline proportionately to the fall in labor. In turn, output will fall in the long run.

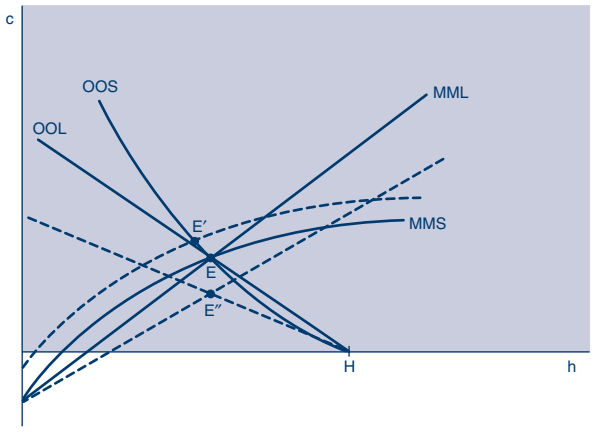
In the short run, capital is fixed, and line OOS shifts to the left. As households substitute away from labor, the short-run capital–labor ratio rises. This causes the wage rate before taxes to rise. Thus, the short-run fall in the after-tax wage rate is less than the long-run fall. The increase in the short-run capital–labor ratio also affects the market equilibrium line MMS given by equation 8. Since the capital–labor ratio is unchanged in the long run, investment must fall over time to return the capital–labor ratio to its original level. A reduction in investment tends to offset the necessary reduction in consumption, given that labor and output fall. For any level of labor (and output), a reduction of investment means that there is more output available for consumption. Thus, consumption increases according to equation 8, and MMS shifts upward in the short run. Assuming the effect on OOS dominates, the economy jumps from E to E′, and labor and consumption fall in the short run.

What happens when the government raises taxes on interest income? This tends to reduce the after-tax interest rate received by households for any given pretax interest rate. But since the after-tax interest rate is pegged in the long run, the pretax interest rate must rise. To accomplish, this the long-run capital–labor ratio falls in order to increase the marginal product of capital. In turn, a fall in the steady-state capital–labor ratio will affect lines MML and OOL. For any given level of labor, reducing the capital–labor ratio means that labor is less productive. This reduces long-run output and consumption. Thus, MML rotates down and to the right. At the same time, the after-tax wage rate falls with a reduction in the capital–labor ratio. Thus, households substitute away from work and consumption. This is equivalent to a leftward shift of OOL. Figure 6 shows how increasing the interest rate tax twists MML and OOL downward. This causes the equilibrium to move from E to E″. Consumption falls in the long run. Whether labor falls or rises is unclear and depends on how much OOL falls relative to MML. Nonetheless, for all reasonable parametrizations, capital and output will fall in the long run. Since the capital–labor ratio falls in the long run, investment will fall in the short run. Thus, MMS shifts up and the economy moves from E to E′ in the short run.

To summarize, increasing either factor tax will lower labor and output in the short run and increase the capital–labor ratio. But a wage tax will lower consumption in the short run, while an interest rate tax will raise consumption. In the long run, both taxes depress consumption and output. However, they affect labor and the capital–labor ratio differently. A wage tax leaves the capital–labor ratio unchanged and depresses labor. On the other hand, an interest rate tax lowers the capital–labor ratio and has an uncertain effect on labor.

A brief glance at the box titled "Equivalence of Permanent Tax Policies," shows how taxes on consumption and corporations are equivalent to the factor income taxes introduced in this article. In short, most taxes correspond to taxes on capital or labor. Ostensibly, having a personal and cor-

Figure 6
Effects of a Higher Interest Rate Tax



Equivalence of Permanent Tax Policies

One can easily expand the model by including household consumption taxes, t_c, that comprise excise and sales taxes. In this case, equation 1 expands to

$$\text{(A)} \qquad (1+t_c)c+(k_{+1}-k)=(1-t_w)wh + (1-t_r)rk+\bar{l}.$$

Additionally, various taxes can be levied on the firm so that after-tax profits are given by

$$\text{(B)} \qquad (1+t_o)y-(1+t_h)wh-(1+t_k)(r+\delta)k - (k_{+1}-k),$$

where t_o is a tax rate on the output of the firm. Also, t_h is a tax surcharge on firms' labor costs, such as contributions for social insurance. The term t_k is the tax surcharge on the rental payments of capital and adds to (or subtracts from) the cost of capital through alternative tax depreciation schedules, capital consumption allowances, and taxation and deductibility of dividends, debt, and capital gains.

In this case, the combined household and firm steady-state optimality conditions generalize to

$$\text{(C)} \quad MRS(c,H-h)=\left[\frac{(1-t_w)(1-t_o)}{(1+t_c)(1+t_h)}\right]f_h\left(\frac{k}{h},1\right),$$

$$\text{(D)} \qquad \rho=(1-t_r)\left[\frac{1+t_o}{1-t_k}f_k\left(\frac{k}{h},1\right)-\delta\right].$$

From the optimality conditions, one can show that the following taxes are equivalent, in the sense that their qualitative effects on aggregate consumption, investment, labor, and output (in the short run and long run) are the same. The equivalence relationships show that taxes on corporations imitate taxes on households by ultimately taxing labor and capital. It also can be shown that a consumption tax is equivalent to a tax on labor:

1. A tax on the wage income of households, t_w, is equivalent to a surcharge on the labor costs of firms, t_h.
2. A tax on the interest income of households, t_r, is equivalent to a surcharge on the capital costs of firms, t_k.
3. A (simple) income tax, t_y, is equivalent to taxing households' wage and interest incomes at the same rate—that is, $t_w = t_r$.
4. An output tax, t_o, is equivalent to taxing firms' wage and interest costs at the same rate—that is, $t_h = t_k$.
5. An output tax, t_o, is equivalent to a (simple) income tax, t_y.
6. An output tax, t_o, is equivalent to a consumption tax plus a tax on interest income—that is, $t_c = t_r$. Or, a consumption tax is equivalent to a sales tax with capital costs exempt.
7. A consumption tax, t_c, is equivalent to a tax on wage income, t_w.

porate income tax implies that tax rates on labor and capital are equal or that a "simple income tax" exists. This is misleading because of special tax considerations for capital, such as depreciation schedules, capital gains taxes and so on. In fact, there is evidence that tax rates on capital far exceed tax rates on labor.[15] Thus, it is natural to ask what are the effects of a reduction in interest rate taxes

[15] *Marginal tax rates have been estimated by a number of authors. For instance, Hansson's (1985) survey concludes that the labor tax rate lies between 0.2 and 0.3, while the capital tax rate is bounded above by 0.5. McGrattan (1991) estimates that the labor tax rate fell in the interval between 0.1 and 0.35, and the capital tax rate ranged between 0.3 and 0.6.*

and an increase in wage taxes. Such a scheme may be considered a variant of the investment-friendly restructuring of business taxes proposed by the presidential candidates.[16] From the analysis above, one sees that the short-run effect is to shift OOS leftward. However, the individual taxes affect short-run investment in opposite directions. Since the capital–labor ratio rises in the long run, it is likely that investment will increase in the short run and that the MMS will shift down. However, even if the effects on investment approximately cancel, consumption and labor will fall in the short run.

Line MML will shift up in the long run, because the long-run capital–labor ratio rises. Assuming that the different effects on line OOL approximately cancel, consumption will increase and labor will fall. Also, output will rise in the long run along with the capital–labor ratio. This exercise is intriguing, because it is possible to get a long-run expansionary effect simply by changing the tax mix from capital to labor taxation. However, the short-run economic costs of such policies may outweigh the long-run benefits.

The effects of spending policies

Suppose that defense spending falls permanently.[17] Since capital tax rates do not change, the capital-labor ratio is unaffected in the long run. Thus, the long-run market equilibrium relationship MML depends solely on the demand and supply effects of the change. Since defense spending does not enter the production function, there is only a demand effect. This means that more output is left for consumption than before the shock. For all levels of equilibrium labor, consumption rises. Thus, line MML shifts up in Figure 7, while line OOL is unaffected. Consequently, the long-run equilibrium moves from E to E″, with private consumption rising and labor falling. Also, since the long-run capital–labor ratio does not change, capital must fall proportionately to labor.

The short-run effects are qualitatively similar; only MMS shifts up. Private consumption will be crowded in and labor will fall because households feel wealthier. Since the capital–labor ratio remains unchanged in the long run, investment will fall. This reinforces the positive effect on private consumption. Since labor falls, output will fall, too.[18]

The effects of increased public investment differ from those of increased defense spending. Because of the separability of the production function, public investment does not affect the private capital–labor ratio. While higher public investment does not affect OOL, it has two effects on MML. Not only does public investment have a demand effect, it also has a supply effect on the market equilibrium condition. If the marginal product of public capital is greater than the depreciation rate, then the supply effect will dominate. Since this is likely, output increases relatively more than demand does, and consumption rises for all levels of labor. Thus, line MML shifts up in Figure 8. Therefore, labor, capital, and private output fall in the long run, while consumption and total output increase.

The short-run effect of public investment does not include a supply effect. This is because investment takes time to be productive. Thus, the demand effect governs the short-run market equilibrium relationship. For all levels of labor, higher investment means lower consumption. Thus, line MMS shifts down in the short run in Figure 8. This means that at the short-run equilibrium point E′,

[16] *Reducing the cost of capital can be accomplished by an investment tax credit or by reducing the capital gains tax. The cost of labor would rise if a tax for worker training were instituted, or employer health care costs were raised. Since consumption taxes and labor taxes are equivalent, one would get the same result by increasing sales taxes.*

[17] *This policy exercise was analyzed by Wynne (1991). He also considers the aggregate effects of military employment policies.*

[18] *What if government consumption enters private utility, as in footnote 5? In this case, the MRS is a function of composite, not private, consumption. Also, public consumption enters the market equilibrium condition just like defense expenditures. These two facts can be attached to the graphical analysis for defense spending.*

If government consumption falls, lines MMS and MML shift up just as they do with a reduction in defense spending. However, lines OOS and OOL will also shift down, because private consumption must rise to offset the fall of the MRS induced by public consumption. If public and private consumption are less than perfect substitutes, households will work more to raise output and to mitigate the negative effect on private consumption. In the short and long run, private consumption will rise, while the effect on labor is uncertain.

Figure 7
Effects of Lower Defense Spending

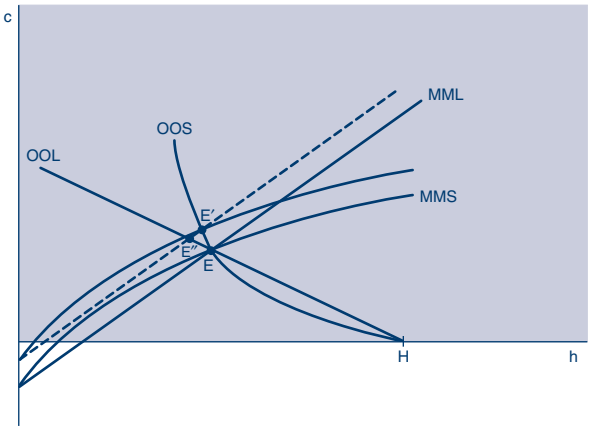
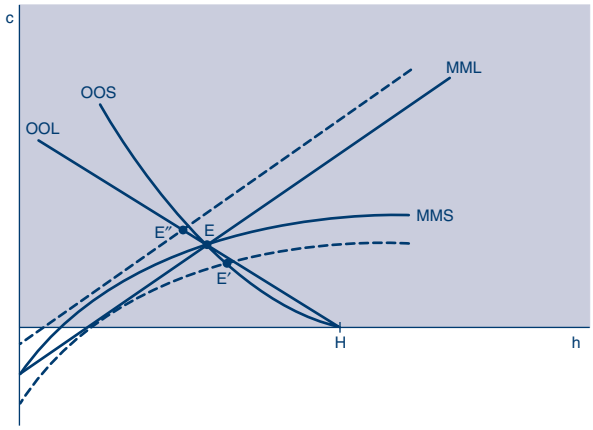


Figure 8
Effects of Higher Public Investment



labor is higher and consumption lower than at the point of departure, E. Over time, as the economy moves from E′ to E″, consumption will rise and labor fall.[19]

In sum, in the short run, more public investment tends to lower consumption and increase labor and output. In the long run, public investment raises consumption and output and lowers labor. A reduction of defense expenditures will, on the other hand, raise consumption and reduce labor and output in the long run and in the short run. Spending the peace dividend from reduced defense outlays on public investment is equivalent to increasing public investment and reducing defense spending by an equal amount. In this case, demand effects will cancel in the market equilibrium condition MMS. While there are no supply effects in the short run, in the long run there will be positive demand and supply effects on MML. Since the supply effect dominates, MML shifts leftward by more than if public investment were increased by itself. Thus, in the short run there is no effect on the aggregate variables. However, in the long run private consumption will rise and labor will fall. Since public output rises in the long run and private output falls, the effect on total output is indeterminate.[20]

Finally, what if the government reduces defense spending and legislates an investment-enhancing reduction in capital taxes? Briefly, in the short run there are no effects on OOS. There are offsetting

[19] *If public capital is not separable in production and production is constant-returns-to-scale in all inputs, then the public capital to private labor ratio enters equations 9 through 11. Thus, the private capital–labor ratio is not pegged by the constant rate of time preference in equation 11 and will adjust with changes of the public capital–labor ratio. The government can peg the private capital–labor ratio to the discount rate by varying the public capital–labor ratio (using lump-sum taxes to balance its budget). It then is free to pursue the policies discussed above with the same aggregate effects.*

If the government targets a higher public capital–labor ratio, the marginal product of private capital rises in the long run, raising the private capital–labor ratio. In the short run, public and private investment increase, causing MMS to shift down. Assuming that supply effects dominate demand effects, line MML will shift up. Line OOL shifts rightward because wages rise, while OOS remains unaffected. Thus, the graphical analysis resembles the case of increasing public investment and simultaneously reducing capital taxes.

[20] *What if (separable) public capital is raised and public consumption is reduced dollar for dollar? In this case, line OOS shifts up. Since labor rises in the short run and the capital–labor ratio falls, private investment will increase. Thus, MMS shifts down. Therefore, labor, investment, and output rise in the short run, while private consumption may rise or fall. Also, line MML will shift upwards because of the supply effect of public investment. At the same time, line OOL will shift down when public consumption is not separable. Thus, it follows that labor and output fall in the long run, but the effect on consumption is uncertain.*

Table 1
Summary of Policy Effects

Policy	Short-Run Effects					Long-Run Effects				
	Con-sumption	Labor	Capital–labor ratio	Invest-ment	Output	Con-sumption	Labor	Capital–labor ratio	Capital	Output
Higher labor tax	–	–	+	–	–	–	–	0	–	–
Higher capital tax	+	–	+	–	–	–	?	–	–	–
Higher labor tax and lower capital tax	–	–	+	–	–	+	–	+	+	+
Lower defense spending	+	–	+	–	–	+	–	0	–	–
Higher public investment	–	+	–	+	+	+	–	0	–	+
Lower defense spending and higher public investment	0	0	0	0	0	+	–	0	–	?
Lower defense spending and lower capital tax	?	?	?	?	?	+	–	+	+	?

effects on investment, so that the effects on MMS are unclear. In the long run, both MML and OOL will shift upward, except that the shift of MML will be magnified. Since the short-run effects depend on how MMS shifts, consumption will move in the opposite direction of labor (and output). In the long run, consumption rises, labor falls, and the effect on output is ambiguous.

Conclusion

In this article, I have developed a simple framework to analyze the effects of various fiscal policies. Abstracting from distributional considerations, this model is useful for looking at the short-run and long-run effects of various taxation and expenditure schemes. In particular, I contrast wage income taxation (or taxes on labor) with interest income taxation (or taxes on capital), and I contrast defense spending with government investment. The effects of the policy experiments are summarized in Table 1. These particular instruments are chosen because they figured prominently in the fiscal policy debate of 1992. Also, many fiscal policies can be described as a combination of these four instruments. For instance, it is shown that most corporate taxes are equivalent to personal income taxes in their effects on macroeconomic aggregates. This is because corporate and personal income taxes ultimately tax the inputs to production. This equivalence lies at the heart of economists' observation that the current tax system heavily taxes capital.

The model suggests that increases in taxes on inputs will depress output and consumption in the long run. While labor taxes tend to lower labor and capital in the long run, capital taxes lower capital but may raise or lower labor in the long run. The model also shows that a consumption tax is equivalent to a tax on labor. Thus, a differential change in factor taxes may have been implicit in some of the 1992 campaign proposals for a pro-investment restructuring of business taxes. Suppose that capital taxes are lowered and labor (or consumption) taxes raised such that the effect is neutral on government revenues. In this case, it

is likely that consumption, labor, and output will fall in the short run. In the long run, labor still may fall, but consumption and output will rise. Thus, it is possible that changing the tax mix will have expansionary long-run effects on the economy and still be revenue neutral. However, these long-run benefits must be weighed against their short-run costs.[21]

On the other hand, the model proposes that spending the peace dividend from reduced defense spending on public investment will yield long-run benefits and no short-run costs. A reduction in defense expenditures tends to increase consumption and reduce capital, labor, and output in the short and long run. By contrast, public investment will raise labor and output and lower consumption in the short run; it will reduce labor and raise consumption and output in the long run. Thus, if government investment increases and defense spending falls dollar for dollar, consumption, labor, and output are not affected in the short run, but in the long run, consumption rises and labor and private capital fall. Whether output rises depends on the output effects of shifting from private capital to public capital. The model also has implications for when the peace dividend is used to create a more investment-friendly business tax structure by reducing tax distortions on capital. In the short run, output may rise or fall; however, consumption and output (and labor) will move in opposite directions in the short run. In the long run, consumption and capital will rise while labor falls. Whether output rises depends on the output effects of shifting from labor to private capital.

Whether this last option is preferable to increasing public investment was a principle difference between the major contending fiscal policy platforms. However, it turns out that both options would be likely to have very similar qualitative outcomes in the long run. And they also appear to be similar to a shift from capital to labor (or consumption) taxes in their long-run effects. While these three policies have qualitatively similar long-run effects, their short-run effects are dissimilar. Increasing public investment by reducing defense spending dollar-for-dollar clearly dominates a differential tax change (from a labor tax to a capital tax) in the short run. Whether this policy also dominates a reduction of defense spending and capital taxes depends on whether output rises or falls. And since consumption will move opposite to output, the ranking of the short-run effects of the last two policies depends on whether the public puts a higher value on movements in consumption or output. Currently, the empirical testing of these models is an active area of research. This research will provide estimates of the short-run and long-run policy effects and help in deciding which policies are implemented.

[21] *Note that increasing the progressivity of the personal income tax by increasing taxes on the rich (and maybe lowering taxes on the middle class) is a capital tax in disguise. Because the share of capital income increases with income, taxing the rich taxes capital income (and reducing middle class taxes lowers labor taxes). Thus, increasing the progressivity of the income tax might offset the pro-investment business tax restructuring discussed above.*

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