The Transition to Consumption Taxation, Part 1: The Impact on Existing Capital

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This article discusses only the impact of tax reform on the real value of the capital stock. Part 2, which will appear in a future issue of Economic and Financial Review, *will examine the effects on the valuation of outstanding debt and the resulting distributional implications.*

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Many tax reform proposals call for replacing the individual and corporate income taxes with a consumption tax. Supporters contend that such a reform would increase national saving, boosting future income and consumption. They also argue that consumption taxation is fairer and simpler than income taxation. An extensive literature discusses the wide-ranging transitional effects of such a reform, particularly the potential devaluation of the capital stock in existence on the reform date. In this article, I review and synthesize this literature.

The effects on the capital stock's real value arise from the differences in how the income and consumption taxes treat investment. A stylized income tax applies to gross output minus depreciation, while a stylized consumption tax applies to gross output minus gross investment. In other words, the income tax allows a deduction only as the investment depreciates, while the consumption tax allows new investment to be deducted immediately. As explained below, the consumption tax eliminates the net tax burden on (marginal) investments because the savings from the initial deduction offset the taxes on the subsequent output. Since the switch to a consumption tax removes the tax penalty on new investment, it is likely to expand the capital stock.

However, the timing of the consumption tax—an initial deduction offset by subsequent taxes—has unfavorable implications for the existing capital stock on the date of the reform. This capital is subject to the future taxes but does not receive the tax deduction granted to new investment because the deduction was unavailable when the capital was produced. This capital also loses the depreciation deductions the income tax system provides. The introduction of the consumption tax therefore tends to reduce the real value of the existing capital stock.

Assuming the income and consumption taxes have stylized forms and capital is produced without adjustment costs, the real value of the initial capital stock is reduced uniformly by a proportion equal to the consumption tax rate. In this simplified analysis, a 25 percent consumption tax reduces the real value of all capital by 25 percent. However, the tax reform is likely to increase after-tax rates of return, which benefits the owners of existing wealth. The decline in value can be mitigated by transition relief (such as maintaining depreciation deductions), at the cost of a higher tax rate on current and future workers.

I show that under more realistic assumptions, the decline in the real value of the initial

capital stock is likely to be smaller in aggregate, but less uniform, than the simplified analysis suggests. Consumer-owned capital and government-owned capital escape the decline in value because they receive special treatment under consumption tax proposals. Also, tax reform forgives the deferred income tax liabilities that many types of capital currently face, which mitigates or potentially reverses the decline in their real value. Furthermore, tax reform is likely to increase investment in most types of capital, which in the presence of adjustment costs drives up the price of new capital and mitigates the decline in the value of existing capital. However, tax reform is likely to reduce investment in types of capital that are fully or partly exempt from federal income tax, driving down their value.

The combined effect of these factors is that some types of capital experience little or no decline in value or even rise in value, while other types experience significant declines. In many cases, the magnitudes are uncertain.

I begin by comparing income and consumption taxes, with particular attention to their treatment of investment. I explain how the timing of the consumption tax tends to cause a decline in the real value of the initial capital stock and present the simplified analysis, concluding that the proportional decline equals the tax rate. I then describe the implications of special treatment for consumer and government capital, deferred income tax liabilities, and adjustment costs and summarize the overall impact.

COMPARISON OF INCOME AND CONSUMPTION TAXES

I use a simple economic model to compare income and consumption taxes. I assume that there is no risk or uncertainty and that the economy is closed to international trade and investment. Gross output is produced from labor and capital in accordance with a production function that may vary over time, $F(K_t,L_t,t)$. Since output and income are identical in this closed economy, I use the terms interchangeably.

Output can be used as the economy's single consumption good or as capital. At each date t, gross output is divided between consumption and gross investment (production of new capital),

$$F(K_t,L_t,t) = Y_t = C_t + I_t. \quad (1)$$

Since saving is equal to investment in this closed economy, I use the terms interchangeably. Capital is the result of any current production that allows an increase in future output and includes intangible investments, such as research and development.

In my initial simplified analysis, I assume that capital can be produced at a constant marginal cost (in terms of consumption goods) and that there are no adjustment costs associated with investment. An unlimited number of units of new capital can be produced, with each costing one unit of consumption. Conversely, any unit of existing capital can be converted back into one unit of consumption. Because capital does not become more expensive as more is produced, the supply of capital goods is infinitely elastic. I also assume that new capital is economically identical to, and therefore a perfect substitute for, existing capital. I modify these assumptions below.

I assume that capital depreciates at an annual geometric rate δ. One unit of current investment increases the capital stock n years later by $\exp(-\delta n)$ units. The equation of motion for the capital stock is

$$\dot{K}_t = I_t - \delta K_t, \quad (2)$$

where the dot denotes rate of change.

The annual after-tax real rate of return demanded by the savers who supply funds to the firm is r. To simplify notation, I assume that r is constant over time. The wage rate demanded at date t by households supplying labor to the firm is w_t.

In this closed economy, aggregate wealth equals the value of the aggregate capital stock. The combined value of the debt and equity each firm issues must equal the value of its capital. Some households may issue debt to each other, but this does not change aggregate wealth since the lending household's asset is offset by the borrowing household's liability. Therefore, the impact of tax reform on the real value of the capital stock also determines its impact on real aggregate wealth.

However, the distribution of the wealth changes among households depends on how tax reform affects the real value of firms' and households' outstanding debt. If the real value of debt is unchanged, changes in the value of a firm's capital are borne solely by its equity holders as residual claimants and there are no wealth effects for households borrowing and lending to each other. But if the real value of outstanding debt changes, part of the change in the value of capital is shifted to firms' debt holders and wealth is also transferred between borrowing and lending households. This article

discusses only the impact of tax reform on the real value of the capital stock. Part 2, which will appear in a future issue of *Economic and Financial Review*, will examine the effects on the valuation of outstanding debt and the resulting distributional implications.

I now consider the treatment of labor supply and investment under the different tax structures. It is simplest to assume that tax revenues are rebated back to households.

Labor Supply and Investment Under Stylized Income Tax

In my initial simplified analysis, I consider a pure, or stylized, income tax that accurately measures and taxes net income. The base of this stylized income tax is $Y - \delta K$, gross output minus the depreciation of capital. The tax allows depreciation deductions that match true economic depreciation, δK, and provides no tax credits. Corporate dividends, corporate retained earnings, and the capital income of noncorporate firms are taxed uniformly. A single tax rate applies to all households, although there may be a refundable exemption to provide relief for poorer households. I later consider a somewhat more realistic description of the federal income tax that reflects the deferred liabilities it imposes on many types of capital.

A well-established principle of public finance states that in a stylized model of this type, it makes no difference whether taxes are collected from buyers or from sellers. It is simplest to assume that a single firm carries out all production and that the income tax is collected from this firm. If $\tau_{y,t}$ is the income tax rate at time t, the firm's tax liability is

$$T_t = \tau_{y,t}[F(K_t, L_t, t) - \delta K_t]. \tag{3}$$

The firm chooses the quantity of labor L and gross investment I to maximize the present discounted value of $Y - wL - I - T$, which is its payment to the savers who provide its funds,

$$Max \int_{t=0}^{\infty} \exp(-rt)\begin{bmatrix}(1-\tau_{y,t})F(K_t, L_t, t)\\ +\ \tau_{y,t}\delta K_t - w_t L_t - I_t\end{bmatrix} dt, \tag{4}$$

subject to the constraints of Equations 1 and 2.

The first-order condition for labor is

$$F_{L,t} = \frac{w_t}{1-\tau_{y,t}}. \tag{5}$$

With no taxes, the marginal product of labor equals the wage rate. With income taxation, the marginal product is higher than the wage rate, reflecting a distortion in the trade-off between work and leisure.

The first-order condition for investment can be derived from the following analysis. Consider a small deviation that increases the capital stock by one unit at date t, followed at time $t + dt$ by an increase in consumption that returns the capital stock to its original path. The investment at date t reduces consumption by one unit. Between t and $t + dt$, the additional unit of capital depreciates to $1 - (\delta dt)$ units but produces $F_{K,t}dt$ units of output, on which taxes of $\tau_{y,t}(F_{K,t} - \delta)dt$ are paid. Consumption at date $t + dt$ is $1 + (F_{K,t} - \delta)(1 - \tau_{y,t})dt$ units. Since the firm cannot have an incentive to deviate from the optimal path, the consumption gained at $t + dt$ must be $1 + (rdt)$ times greater than that sacrificed at date t, which requires

$$F_{K,t} = \delta + \frac{r}{1-\tau_{y,t}}. \tag{6}$$

It is easy to show that if savers demand a time-varying rate of return, a condition of this form holds at each instant using the contemporaneous rate of return. Also, with several types of capital, each decaying at a different (geometric) rate, a condition of this form holds separately for each type.

With no taxes, the firm invests until the pretax rate of return, $F_K - \delta$ (marginal product minus depreciation), equals savers' required after-tax rate of return. With income taxation, however, this pretax return exceeds savers' required after-tax rate of return. This wedge between pretax and after-tax returns reflects an economic distortion between consumption and saving, which is widely viewed as a major disadvantage of the income tax. As shown below, a constant-rate consumption tax avoids this distortion.

Real Value of Capital Under Stylized Income Tax

I next examine the real value of capital, which I define as the number of units of consumption its owner(s) can obtain by selling one unit of capital and consuming the after-tax proceeds. I show that under the maintained assumptions, this value is always unity in the no-tax economy and under the stylized income tax, regardless of the age of the capital and the income tax rate.[1]

This result follows from a simple arbitrage relationship. With no adjustment costs and constant costs of capital production, one unit of new capital can be obtained at an opportunity cost of one unit of consumption and is therefore worth one unit of consumption. One unit of existing capital—for example, the surviving remnant of $\exp(\delta n)$ units of investment made n

years ago—must have the same value as the unit of new capital because both units have the same marginal product and, under the stylized income tax, are subject to the same taxes. Their marginal products are the same because old and new capital are perfect substitutes in production. Each unit of capital, new or old, bears the same tax, $\tau_{y,t}(F_{K,t} - \delta)$, at each date t.

A different calculation confirms that each unit of capital is worth one unit of consumption. The value of each unit of capital must equal the present discounted value of its after-tax cash flows. From Equation 6, the after-tax cash flow (marginal product minus tax liability) is

$$F_{K,t} - \tau_{y,t}(F_{K,t} - \delta) = r + \delta. \tag{7}$$

For each unit of existing capital, this cash flow declines at rate δ as the unit depreciates. So the present value (discounted at rate r) of future cash flow is

$$V = \int_{t=0}^{\infty} \exp(-rt)(r + \delta)\exp(-\delta t)dt = \frac{r + \delta}{r + \delta} = 1. \tag{8}$$

The real value of capital is always unity under the stylized income tax, regardless of the tax rate or fluctuations in the production function. The after-tax cash flow remains equal to $r + \delta$, due to changes in the quantity of capital (which alter its marginal product) or changes in the after-tax rate of return. Due to the infinite supply elasticity, fluctuations in the production function or changes in the income tax rate alter the quantity of capital or after-tax returns but not the real value of each unit. Since this result also holds for a zero tax rate, adoption or repeal of the income tax does not change the real value of capital.

Labor Supply and Investment Under Stylized Consumption Tax

I now consider the effects of a stylized consumption tax. The tax base is consumption, which equals gross output minus gross investment, $Y - I$, in accordance with Equation 1. The stylized consumption tax differs from the stylized income tax solely in deducting gross investment rather than depreciation from gross output. In other words, the firm may deduct capital investment costs immediately rather than as the capital depreciates. Many economists have noted that an income tax can be transformed into a consumption tax simply by replacing depreciation allowances with expensing, which is an immediate deduction for investment costs.[2]

The difference between this base and the income tax base $Y - \delta K$ is net-of-depreciation investment $I - \delta K$, which, from Equation 2, equals the change in the capital stock. In the United States and other growing economies, the capital stock increases over time, so net investment is positive and consumption is lower than income. A stylized consumption tax requires a higher tax rate than a stylized income tax to meet a given revenue target.

In an economy with multiple firms, a consumption tax can be collected in different ways. A retail sales tax is collected solely from the firm that sells to the consumer, while a value-added tax is collected from firms at different stages of the production process. A flat tax is similar to the value-added tax but is collected partly from firms' workers. A personal consumption tax (sometimes called a personal expenditures tax or a consumed-income tax) is collected from consumers. Koenig and Huffman (1998, 25–26), Congressional Budget Office (1997, 7–22), Gillis, Mieszkowski, and Zodrow (1996), McLure and Zodrow (1996), Slemrod (1996), Auerbach (1996, 43–46), Gravelle (1996a, 1423–28), and Joint Committee on Taxation (1995, 51–52, 57–58) describe and compare these different methods of imposing a consumption tax. Part 2 of this series will examine the differing implications of these taxes for the real value of outstanding debt and for the distribution of wealth changes across households.

However, since these taxes have economically similar effects on the real value of capital and aggregate wealth, I do not distinguish them here. I again assume the tax is collected from the representative firm. Letting τ_c denote the consumption tax rate,[3] which is assumed to be constant over time, the firm's tax liability is

$$T_t = \tau_c[F(K_t, L_t, t) - I_t]. \tag{9}$$

The firm again chooses the quantity of labor L and gross investment I to maximize the present discounted value of $Y - wL - I - T$,

$$Max \int_{t=0}^{\infty} \exp(-rt)\begin{Bmatrix}(1-\tau_c)[F(K_t, L_t, t) \\ - I_t] - w_t L_t\end{Bmatrix} dt, \tag{10}$$

subject to Equations 1 and 2.

The first-order condition for labor is unchanged from Equation 5, except that the consumption tax rate replaces the income tax rate,

$$F_{L,t} = \frac{w_t}{1 - \tau_c}. \tag{11}$$

However, the first-order condition for investment takes a different form. Again, consider a small deviation that increases the capital stock by one unit at date t, followed at date $t + dt$ by an increase in consumption that returns the capital stock to its original path. The investment of one unit at date t provides tax savings of τ_c, so after-tax consumption falls by only $(1 - \tau_c)$. Between t and $t + dt$, the initial unit of capital depreciates to $1 - (\delta dt)$ units but produces $F_{K,t}dt$ units of output. Pretax consumption at date $t + dt$ is $1 + (F_{K,t} - \delta)dt$ units, and after-tax consumption is $(1 - \tau_c)[1 + (F_{K,t} - \delta)dt]$. Around the optimal path, the consumption gained at date $t + dt$ must be $1 + (rdt)$ times greater than that sacrificed at date t, which requires $(1 - \tau_c)[1 + (F_{K,t} - \delta)dt] = (1 - \tau_c)[1 + (rdt)]$ or

$$F_{K,t} = \delta + r. \tag{12}$$

Unlike the income tax, the constant-rate consumption tax does not impose a net tax burden on the marginal new investment. The tax savings from expensing exactly offset (in present discounted value) the taxes on the subsequent cash flows. The reason is that the marginal unit of investment generates cash flows with a present discounted value of exactly one unit. Because there is no net tax burden, the pretax rate of return equals savers' required after-tax rate of return, as in the no-tax economy. Unlike the income tax, the constant-rate consumption tax does not distort the investment decision.[4]

Because it removes the wedge between pretax and after-tax returns, the replacement of the income tax by a constant-rate consumption tax has major economic implications. It either reduces the marginal product of capital or increases the net return savers receive, or both. In the long run, both effects are likely to occur, as after-tax returns rise to prompt more saving and the resulting expansion of the capital stock drives down the marginal product. The breakdown depends on the elasticity of investment with respect to rates of return (the rate at which marginal product declines as the capital stock expands) and the corresponding elasticity of saving.

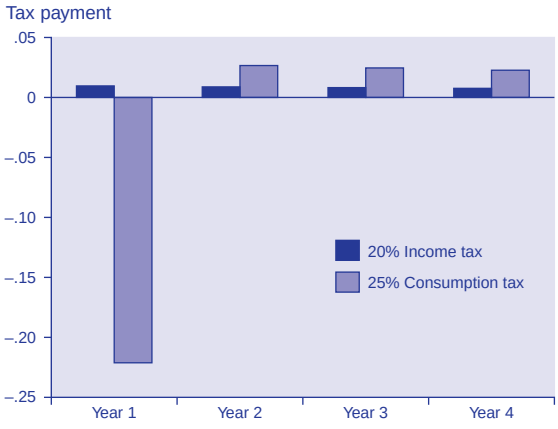
Consider an example in which the depreciation rate is 0.08. Assume that savers' required rate of return does not vary in response to tax changes and always equals 0.04. If the actual U.S. individual and corporate income taxes were of the stylized form assumed in this simplified analysis, a tax rate of about 20 percent or slightly higher would be sufficient to raise current revenues and provide a significant refundable exemption. I compare this income tax with a 25 percent consumption tax, which would raise approximately the same revenue, with a similar refundable exemption.[5] I use these values—$\delta = 0.08$, $r = 0.04$ (both before and after tax reform), $\tau_y = 0.2$, $\tau_c = 0.25$—as a standard example throughout this article. In the no-tax economy, the equilibrium marginal product is 0.12. With the 20 percent income tax, the marginal product is 0.13, in accordance with Equation 6; the pretax rate of return is 0.05; and the tax payment is 0.01. With the 25 percent consumption tax, the marginal product is 0.12, in accordance with Equation 12. Since the consumption tax payment is 0.03, the after-tax cash flow is 0.09.

Using these parameters, Figure 1 illustrates the source and timing of the consumption tax's favorable treatment of a marginal new investment. The figure compares the time paths of the income and consumption tax payments that result from one additional unit of gross investment, with no later change in gross investment. The difference in timing is dramatic. The income tax payment at each point in the life of the investment is positive, declining as the capital depreciates. The initial consumption tax payment is negative, but subsequent payments are positive and three times larger than under the income tax (because the tax rate is higher and depreciation is not deductible). As I explain below, this timing difference plays a crucial role in the transition between the two tax systems.

One other effect of the consumption tax should be mentioned. If the firm makes inframarginal investments that generate pure profits

Figure 1

Tax Payments Resulting from One Unit of Gross Investment

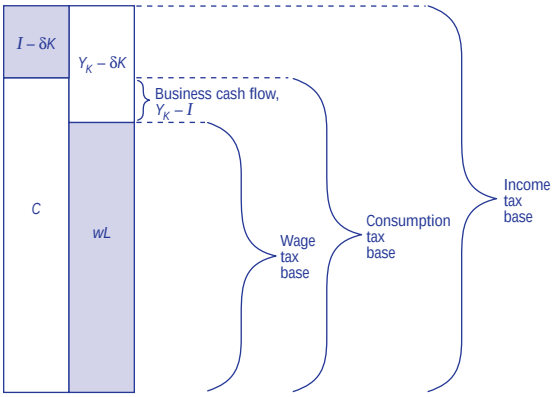


NOTE: $\delta = .08$; both before and after tax reform, $r = .04$.

(cash flows with present discounted value greater than initial investment costs), the consumption tax takes a fraction τ_c of the profits. However, since the firm still retains $(1 - \tau_c)$ of the pure profits and an investment with any pure profits is worth making, the tax does not deter any of these investments. (The income tax, in addition to taking τ_y of the pretax return to the marginal investment, also takes τ_y of any pure profits generated by inframarginal investments.)[6]

The consumption and income taxes have different effects on investment incentives. I now show that they also have different effects on the real value of capital.

Figure 2
Relationship of Tax Bases



Real Value of Capital Under Stylized Consumption Tax

The expensing provided by the consumption tax reduces the real value of each unit of capital to $(1 - \tau_c)$ units of consumption. The opportunity cost of an additional unit of new capital is now $(1 - \tau_c)$ units of consumption because the investment provides τ_c in tax savings. Conversely, since converting a unit of capital into one unit of consumption triggers a tax payment of τ_c, the net yield of such a conversion is now only $(1 - \tau_c)$.

The reduction in the real value of capital is confirmed by a reduction in the present discounted value of its cash flows. From Equation 12, the marginal product of each unit of capital is $r + \delta$, so the after-tax cash flow is $(1 - \tau_c)(r + \delta)$. With depreciation rate δ and discount rate r, the present discounted value of each unit's cash flow is

$$(13)\quad V = \int_{t=0}^{\infty} \exp(-rt)[(1-\tau_c)(r+\delta)]\exp(-\delta_t)\,dt = \frac{(1-\tau_c)(r+\delta)}{r+\delta} = 1-\tau_c.$$

The timing of the consumption tax causes the lower value of capital. Tax savings at the date of investment offset τ_c units of the investment costs. For the marginal investment, the subsequent after-tax cash flows (which must offset the remainder of the costs) have a value of only $1 - \tau_c$ units. Each unit of existing capital has already received the initial tax savings and has only $1 - \tau_c$ units of remaining value.

Decomposing the Income and Consumption Taxes

The above analysis indicates that income and consumption taxes are similar in one respect but different in two others. Both taxes distort the labor supply decision by driving a wedge between the marginal product of labor and the wage rates workers demand. However, the income tax creates an additional distortion by driving a wedge between the pretax and after-tax rates of return on investment, while the consumption tax does not. Also, the consumption tax depresses the value of capital below its pretax replacement cost, while the income tax does not.

A decomposition of the taxes helps clarify their similarities and differences. Define gross capital income as gross income minus wages,

$$(14)\quad Y_{K,t} = Y_t - w_t L_t.$$

The stylized income tax consists of a tax on wages, wL, plus a tax on net-of-depreciation capital income, $Y_K - \delta K$. The consumption tax can also be decomposed. Combining Equations 1 and 14 reveals that consumption equals wages plus capital income minus investment,

$$(15)\quad C_t = w_t L + (Y_{K,t} - I_t).$$

The excess of capital income over investment is called business cash flow because it is the portion of capital (or business) income that is not used to produce new capital and that is distributed (flows back) to savers. Business cash flow measures capital's net contribution to consumption (the output it produces minus the portion reinvested to produce it). Equation 15 states that consumption equals wages plus business cash flow. If business cash flow is positive, as in the United States, capital is productive, permitting consumption to exceed wages.[7] A consumption tax is a wage tax plus a business-cash-flow tax.[8]

Figure 2 shows the relationship of these quantities. Because cash flow is positive, wages are lower than consumption. Because net investment is positive, as noted above, consumption is lower than net income.

Since the income and consumption taxes both include a wage tax, it is useful to consider its properties. The wage tax drives a wedge between the pretax product of labor and the after-tax wage rate and distorts the labor supply decision. This explains why the income and consumption taxes both have this effect.

However, the wage tax has no effect on the investment decision or on the value of capital. An addition to Figure 1 charting the wage tax payments triggered by an additional unit of gross investment would show zero at every date. The initial investment does not change the wage tax, since output produced by labor is taxed whether it is used as consumption or as capital. The subsequent output the investment generates is untaxed, because the wage tax applies only to the marginal product of labor, not capital. Each unit of capital is still worth one unit of consumption.

The effects of the income and consumption taxes on investment and the value of capital therefore arise from their net-capital-income-tax and business-cash-flow-tax components rather than their common wage-tax component. A net-capital-income tax creates an investment distortion by imposing a tax burden on the marginal new investment. In contrast, a constant-rate business-cash-flow tax creates no distortion because it imposes zero present-discounted-value burden on the marginal new investment. With a constant rate, a cash-flow tax is a lump-sum tax that does not distort economic decisions.

Since business cash flow is positive and substantial, the cash-flow tax raises significant revenue. The tax is lump sum because this revenue is not raised from labor or (in present discounted value, on the margin) from new investment, the two economic activities that can be distorted in this model. Where then does the revenue come from? As noted above, the tax collects revenue from any pure profits generated by inframarginal new investments; a tax on pure profits has long been recognized as lump sum. But the bulk of the revenue is collected from the capital stock in existence when the tax is introduced. It is well known that a tax on existing capital is also lump sum. I now describe the effects on existing capital in more detail.

SIMPLIFIED ANALYSIS OF THE TRANSITION

The above analysis permits a simple description of the transitional effects of repealing a stylized income tax and introducing a consumption tax. The change is assumed to be unexpected. Under the stated assumptions, the real value of the existing capital stock declines by a proportion equal to the consumption tax rate. This result has been widely noted and can be regarded as canonical.[9]

Real Value of Capital Declines by Proportion Equal to Tax Rate

Each unit of capital is worth one unit of consumption under the stylized income tax and $(1 - \tau_c)$ units under the stylized consumption tax. The tax reform therefore causes the real value of capital to decline by proportion τ_c. For example, the introduction of a 25 percent consumption tax reduces the value of existing capital by 25 percent.

Many believe the switch to a consumption tax reduces the value of existing capital because it increases the taxes on that capital. As explained below, this belief is largely incorrect. However, it is useful to consider the change in the tax burden on existing capital. These taxes are likely to increase, largely because depreciation is no longer deductible. Also, if the tax reform is revenue-neutral, the stylized consumption tax rate is higher than the stylized income tax rate was. (The tax increase can be readily seen in Figure 1.) For any capital already in existence on the reform date, the tax payments increase due to the midstream change.

Nevertheless, the devaluation of existing capital does not occur because it is taxed more heavily under the consumption tax than it was under the income tax. The decline in value equals the consumption tax rate, regardless of whether any income tax previously existed or what was done with it. For example, repealing a 90 percent income tax and adopting a 25 percent consumption tax (with spending cuts financing the revenue shortfall) reduces the tax burden on existing capital. Yet in this simplified analysis, the real value of existing capital still declines by 25 percent.

Instead, the existing capital stock is devalued because it is taxed more heavily than new investment. Existing capital declines in value either when it is subjected to a tax increase from which new capital is spared or when it is excluded from a tax cut given to new capital. The relative treatment of existing and new capital is crucial because they are perfect substitutes for each other in production and have the same marginal product.

For new investment to remain viable under an income tax, the tax payments on it must be offset by a marginal product that exceeds savers' required returns, as stated in Equation 6. Since existing capital is a perfect

substitute for new capital, it also enjoys this higher marginal product (or lower required rate of return). Therefore, the introduction of an income tax or an increase in its rate does not affect the value of existing capital. The marginal product or the required return or both change so that cash flow remains equal to $r + \delta$, which ensures the value remains equal to unity.

Under the consumption tax, however, Equation 12 makes clear that the future tax payments from new investments are *not* offset by a marginal product that exceeds savers' required rate of return. Instead, they are offset by the tax deduction granted on the date of investment. Since this tax deduction is not given to the existing capital stock, it receives no offset for its future tax payments and its value declines.

This point can be clarified by returning to the standard example, in which $\delta = 0.08$, $r = 0.04$ (both before and after tax reform), $\tau_y = 0.2$, and $\tau_c = 0.25$. Column A of Table 1 shows that with the income tax, the marginal product is 0.13 and the tax payment is 0.01, so the after-tax cash flow is 0.12. As shown in column B, when the consumption tax replaces the income tax, the capital stock expands until the marginal product falls from 0.13 to 0.12. The consumption tax payment from each unit of capital is 0.03, so the after-tax cash flow is 0.09.

The 25 percent decline in the value of capital reflects the 25 percent decline in the after-tax cash flow, from 0.12 to 0.09. Of the 0.03 decline in after-tax cash flow, 0.02 is due to higher tax payments. Tax payments rise from 0.01 to 0.03, due to the higher consumption tax rate and the loss of depreciation allowances. The other 0.01 of the decline in after-tax cash flow is due to the decline in pretax marginal product, which is an equilibrium response to the tax cut for new investment. The annual tax burden on new investment under the income tax is 0.01, but the effective annual burden under the consumption tax is zero because expensing offsets the 0.03 annual tax payment. With an unchanged after-tax rate of return, the 0.01 effective tax reduction causes an expansion of the capital stock that reduces the pretax marginal product by 0.01. In this case, two-thirds of the reduction in value is due to a tax increase on existing capital; because new investment is spared this increase, there is no offsetting increase in the equilibrium pretax marginal product. The other one-third is due to the exclusion of existing capital from a tax cut given to new investment—a tax cut that drives down the equilibrium pretax marginal product and thereby reduces the value of existing capital.

Table 1
Effect of Tax Reform on Existing Capital

	(A) 20 percent income tax ($\tau_y = .2$)	(B) 25 percent consumption tax ($\tau_c = .25$)	(C) 90 percent income tax ($\tau_y = .9$)
Marginal product, F_K	.13	.12	.48
Pretax rate of return, $F_K - \delta$	.05	.04	.40
Tax payment T	.01	.03	.36
After-tax cash flow, $F_K - T$	.12	.09	.12
Present value, $(F_K - T)/(r + \delta)$	1.00	.75	1.00

Income tax: $F_K = \delta + [r/(1 - \tau_y)]$; $T = \tau_y(F_K - \delta)$
Consumption tax: $F_K = \delta + r$; $T = \tau_c F_K$

NOTE: $\delta = .08$; both before and after tax reform, $r = .04$.

Column C shows the outcome with a 90 percent income tax. Replacing this onerous income tax with a 25 percent consumption tax provides a large tax cut of 0.33 to existing capital, reducing annual payments from 0.36 to 0.03. However, it grants an even larger tax cut of 0.36 to new investment. (Its annual tax burden is 0.36 under the income tax but is effectively zero under the consumption tax, due to expensing.) In equilibrium, this 0.36 tax reduction causes the capital stock to expand until the marginal product falls from 0.48 to 0.12. Due to the 0.36 decline in marginal product, the after-tax cash flow from existing capital falls by 0.03 despite the 0.33 tax cut.

Regardless of the rate of the income tax being replaced, the tax disparity between existing capital and new investment is 0.03, which is 25 percent of pretax marginal product. The value of the existing capital therefore always declines by 25 percent.

For simplicity, this standard example makes the extreme assumption that tax reform does not change the after-tax rate of return, which remains equal to 0.04, while the capital stock expands to drive the pretax rate of return down to that value. Realistically, savers may demand a higher after-tax return to provide the additional funds required for this expansion. However, this does not alter the conclusion that the real value of existing capital falls by 25 percent. Consider the opposite assumption, in which the pretax return remains equal to 0.05, while the after-tax return rises to this value. (This extreme is also unrealistic since the higher after-tax return is likely to prompt additional saving, which expands the capital stock

and reduces the pretax rate of return.) The marginal product is 0.13, the consumption tax payment is 0.0325, and the after-tax cash flow is 0.0975. Although this cash flow is higher than in the standard example, it must be discounted at a higher after-tax rate of return. The value of each unit of capital is

$$\int_{t=0}^{\infty} \exp(-.05t)(.0975)\exp(-.08t)dt = \frac{.0975}{.13} = .75.$$

It can be seen that intermediate, more realistic assumptions about the rate of return also yield the same result.

Although these different assumptions about after-tax returns result in the same value of capital, they have different implications for the well-being of wealth holders.

Wealth Holders Benefit from Higher After-Tax Rates of Return

The real value of the capital stock (aggregate wealth) is not the only factor affecting the well-being of its owners. This value merely measures the consumption the owners can obtain by immediately liquidating their wealth. Since most wealth holders do not intend to consume their entire wealth immediately, their well-being also depends on the future rates of return they will earn.

As discussed above, tax reform is likely to cause after-tax returns to rise and pretax returns to fall. The former effect is likely to be larger in the short run because it takes time for additional new investment to expand the capital stock and drive down pretax returns. Therefore, wealth holders are likely to enjoy significantly higher after-tax returns for some time. Koenig and Huffman (1998), Congressional Budget Office (1997), Auerbach (1996), and Auerbach and Kotlikoff (1987, 66) provide quantitative estimates.

For most wealth holders, the increase in net returns mitigates the effects of switching to a consumption tax. Consider a household with initial wealth W that intends to consume at a level rate over the next H years. If the after-tax return is r, it consumes at an annual rate of

$$\frac{Wr}{1-\exp(-rH)}.$$

If the annual after-tax real return is initially 0.04, a household with initial wealth equal to 100 units of consumption and a forty-year horizon consumes 5.01 units per year. If tax reform reduces its real wealth from 100 to 75 units but raises the annual after-tax real return from 0.04 to 0.05, the household's annual consumption falls to 4.34 units. Consumption declines only 13 percent, not 25 percent. More dramatically, consider a household that consumes nothing for H years after the tax system changes and then splurges by consuming $W\exp(rH)$. With the above parameters, a household that plans to wait forty years can consume 554 units under the consumption tax, an increase of 12 percent from the 495 units available under the income tax. Some wealth holders, therefore, may support the adoption of a consumption tax, despite the reduction in the value of their wealth. Of course, the rare household that consumes its entire wealth immediately after tax reform is unaffected by future returns and suffers the full 25 percent reduction in consumption.[10]

The rise in after-tax returns is due to the repeal of the income tax rather than the introduction of the consumption tax. If the consumption tax is introduced as a supplement to the income tax (or as a replacement for a wage tax), rates of return do not increase and all wealth holders suffer a proportional decline in consumption equal to the tax rate.

Effects of Transition Relief

Some consumption tax proposals call for transition relief to mitigate or offset the decline in the real value of existing capital. A simple approach is to remove the business-cash-flow-tax component of the consumption tax and impose only a wage tax. Since the wage tax has an even narrower base than the consumption tax (*Figure 2*), a higher rate is necessary to raise the same revenue, which imposes a heavier burden on workers. Workers finance transition relief for the owners of existing capital (and any investors who receive pure profits). The higher tax rate also exacerbates the labor supply distortion; since the cash-flow tax is lump sum, its removal offers no offsetting efficiency gains.

As described above, a wage tax imposes zero tax payments on investment at every date. It does not distort the investment decision, and the real value of capital remains equal to unity. Replacing the income tax with a wage tax therefore leaves the value of existing capital unchanged. Existing capital escapes any decline in value because it receives the same tax reduction given to new investment. The effects of a wage tax (for any rate) are shown in column C of Table 2 for the standard example, in which $\delta = 0.08$ and $r = 0.04$, both before and after tax reform. Columns A and B are repeated from Table 1 to show the effects of the 20 percent income tax and 25 percent consumption tax.

Table 2
Effect of Transition Relief on Existing Capital

	(A) 20 percent income tax (τ_y = .2)	(B) 25 percent consumption tax (τ_c = .25)	(C) Wage tax (any rate)	(D) Depreciation relief (τ_c = .25)
Marginal product, F_K	.13	.12	.12	.12
Pretax rate of return, $F_K - \delta$	.05	.04	.04	.04
Tax payment T	.01	.03	.00	.01
After-tax cash flow, $F_K - T$	.12	.09	.12	.11
Present value, $(F_K - T)/(r + \delta)$	1.00	.75	1.00	.917

Income tax: $F_K = \delta + [r/(1 - \tau_y)]$; $T = \tau_y(F_K - \delta)$
Consumption tax: $F_K = \delta + r$; $T = \tau_c F_K$
Wage tax: $F_K = \delta + r$; $T = 0$
Depreciation relief: $F_K = \delta + r$; $T = \tau_c(F_K - \delta)$

NOTE: δ = .08; both before and after tax reform, r = .04.

Since replacing the income tax with a wage tax increases after-tax rates of return while leaving the real value of wealth unchanged, it improves the well-being of wealth holders.[11]

A more modest (and more common) proposal allows firms to deduct the depreciation allowances on existing capital that they would have deducted under the income tax. The revenue loss from this relief also raises the tax rate required to meet a given revenue target, which exacerbates the labor supply distortion and increases the burden on workers and any investors with pure profits. However, these effects are smaller than under the wage-tax option.

This transition relief is insufficient to avoid a decline in real value. As shown in column D of Table 2, the provision of depreciation allowances (with the consumption tax rate still equal to 25 percent, for simplicity) results, for these parameters, in a tax liability of 0.01 on existing capital, the same as under the 20 percent income tax. (With higher depreciation rates, it results in a tax reduction; with lower depreciation, tax reform still increases tax liability but by less than without relief.) However, the pretax marginal product of capital still declines by 0.01, the equilibrium response to the 0.01 tax cut for new investment, so the after-tax cash flow falls from 0.12 to 0.11. Existing capital still declines in value, though only by 8 percent rather than 25 percent.

As emphasized above, existing capital declines in value if its tax treatment deteriorates relative to new investment. Maintaining depreciation deductions for existing capital is insufficient to prevent its devaluation because this treatment is less generous than the expensing provided for new investment. In general, it can be shown that existing capital declines in value by $\tau_c r/(r + \delta)$ under this policy rather than by the τ_c that occurs without transition relief. This form of transition relief is therefore more favorable to short-lived types of capital (those with high δ).[12]

Limitations of Simplified Analysis

Several aspects of this simplified analysis are unrealistic. The analysis does not reflect the special treatment capital owned by consumers and state and local governments would receive under consumption tax proposals. Also, the stylized income tax system does not accurately represent the U.S. income tax and the assumed production technology is unrealistic. The remainder of this article extends the analysis to address these limitations.

EXTENSION 1: SPECIAL TREATMENT OF CONSUMER AND GOVERNMENT CAPITAL

The simplified analysis assumes that all production is done by a single firm and is treated uniformly within each tax system. However, consumers and state and local governments, rather than private business firms, own significant portions of the U.S. capital stock.[13] Consumer capital includes owner-occupied homes and consumer durable goods; government capital includes public buildings and roads. These

types of capital are currently taxed differently than they would be under a stylized income tax, and they would be taxed differently under major consumption tax proposals than they would be under a stylized consumption tax. Because of this different treatment, they escape the decline in value other capital experiences on the reform date.

Under the stylized income tax, the marginal product of this capital is taxed and its depreciation is deducted. Under the stylized consumption tax, the marginal product of this capital is taxed and new production of such capital is deducted. The marginal product of consumer capital is its imputed rental value; the marginal product of government capital is the imputed value of the public services it produces. However, valuation difficulties arise because these services are not sold in the marketplace; consumers do not pay rent to themselves, and governments generally provide public services without charge. Consumers and recipients of public services receive the capital income in-kind rather than as cash payments.

Whether due to these valuation difficulties or other reasons, neither the current income tax system nor leading consumption tax proposals follow the stylized treatments described above. The current system and the proposals take the same approach to consumer and government production, treating these sectors as they would be treated by a wage tax. The current system exempts them from the net-capital-income tax, and the proposals exempt them from the business-cash-flow tax.

At a private golf course, the income tax applies to both the wages of course employees and the net capital income the course generates. At a municipal golf course, however, the federal income tax applies only to the employees' wages. The gross capital income of the course is not taxed, and depreciation is not deducted. For a rental housing unit, the income tax applies both to the wages of the landlord's employees and the landlord's net-of-depreciation capital income. For an owner-occupied home, the income tax applies only to the wages of workers who perform services (such as plumbers and carpenters).[14] The home's imputed rental income is not taxed, and depreciation is not deducted.

Similarly, proposed consumption taxes apply to both the wages of the private course's employees and the course's business cash flow, its gross capital income minus new investment. At the municipal course, however, the proposed taxes apply only to the wages of course employees. The course's gross capital income is not taxed, and construction costs of new courses are not deductible. For rental housing, both wages and business cash flow are taxed. For owner-occupied housing, only wages are taxed. Imputed rental is not taxed, and new home construction costs are not deductible.

One way to describe this treatment is that the production of consumer and government capital is treated as if it were consumption and the actual consumption subsequently produced by this capital is ignored. Any "consumption" tax that taxes investment as if it were consumption and exempts the output produced by capital is simply a wage tax; only wages remain if business cash flow (capital income minus investment) is removed from the consumption tax base.

Because wages in these sectors are taxed in the same way as in the rest of the economy, the income and consumption taxes affect labor supply in these sectors in the manner indicated by the general first-order conditions, Equations 5 and 11. Under the income tax, these sectors' exemption from the tax on net capital income causes a misallocation of capital. Since capital income is untaxed in these sectors, the marginal product of capital is $\delta + r$.[15] However, the marginal product is $\delta + [r/(1 - \tau_y)]$ elsewhere, in accordance with Equation 6. Pretax rates of return are higher for rental housing and private golf courses than for owner-occupied housing and municipal golf courses, implying that total output increases if capital is shifted from the latter to the former.

The consequences of the disparate treatment are less problematic under the consumption tax. Since the business-cash-flow tax is lump sum, its uneven application across sectors does not distort investment decisions. The marginal product of capital is $r + \delta$ throughout the economy, in accordance with Equation 12. To be sure, the rental payments on a new rental home are taxed, while the imputed rental of a new owner-occupied home is not. However, the construction costs of the new rental home are deductible, while those of the new owner-occupied home are not. Since the present discounted value of the rentals equals the construction costs (for the marginal home), the present discounted value of the tax burden is zero in each case. Treating the original production as consumption misstates the timing of consumption but not its present discounted value.[16]

Nevertheless, the disparate treatment has important implications for the value of consumer and government capital existing on the

reform date. Since the value of capital is unity under a wage tax, tax reform causes no decline in value. On the reform date, owner-occupied homes and municipal golf courses escape the decline in value experienced by rental housing and private golf courses.[17] Any pure profits generated by inframarginal investments of consumers and state and local governments also escape taxation.

Of course, the exemption of consumer and state and local government capital from the cash-flow tax reduces consumption tax revenue. A higher tax rate is necessary to meet any given revenue requirement, which exacerbates the labor supply distortion and increases the tax burden on workers, owners of other types of existing capital, and any investors who receive pure profits from other types of capital.

EXTENSION 2: INCOME TAX DEFERRAL

The simplified analysis assumes that the income tax is a stylized tax that measures income accurately and treats old and new capital neutrally. Under such a tax, the value of capital equals its replacement cost. However, under more realistic assumptions about the timing of the income tax, many types of capital are already worth less than replacement cost. Replacing the income tax with a consumption tax therefore causes a smaller reduction in (or may even increase) the real value of existing capital.

Income Tax Deferral Reduces the Real Value of Capital

As explained above, the differing impact of the stylized income and consumption taxes on the real value of capital result from differences in their timing. The stylized income tax collects the same tax from each unit of capital regardless of age, while the consumption tax grants an initial tax deduction offset by subsequent taxes (recall Figure 1). Unlike the stylized income tax, the consumption tax is a deferred tax.

However, as detailed below, the federal income tax system frequently imposes heavier burdens on old capital than on new investment. I show that this tax deferral reduces the real value of capital below unity. A tax reform that combines the introduction of a consumption tax with repeal of the income tax reduces the value of existing capital by less than the simplified analysis concludes. In some cases, the value of existing capital may increase.

Consider the standard example of a 20 percent income tax on a type of capital with a 0.08 depreciation rate, when the required after-tax return is 0.04. Suppose instead that this type of capital is tax exempt for the first 5.776 years after it is produced and thereafter is subject to a 40 percent tax on its subsequent income. Since this system imposes the same tax burden (in present discounted value) as the 20 percent income tax, the effective tax rate is 20 percent.[18] The equilibrium pretax return is still 0.05, and the marginal product is still 0.13. Since all units of capital, regardless of age, are perfect substitutes in production, they all have this marginal product.

However, the after-tax cash flow varies with age. It is 0.13 for each unit of capital that is less than 5.776 years old. Each unit of older capital faces a tax of 0.4 (0.05), or 0.02, and has an after-tax cash flow of 0.11. Due to this age-varying treatment, the value of capital also varies with age. Consider a unit of capital that is more than 5.776 years old. Since its after-tax marginal product is permanently 0.11, its real value (with a depreciation rate of 0.08 and a discount rate of 0.04) is 0.11/0.12, or 0.917.

Newly produced capital has an opportunity cost of one unit of consumption and, by the familiar arbitrage argument, is worth one unit of consumption. But capital that is older than 5.776 years is worth only 0.917 units of consumption.[19] The new capital is worth more because it still has 5.776 tax-free years left, while the older capital does not. It can also be shown that the real value of capital gradually falls from 1 to 0.917 during its first 5.776 years as it uses up its tax-free period.

Since the stylized income tax (which imposes the same tax on capital of all ages) does not reduce value, the devaluation arises solely from the fact that the tax burden is greater in the later part of the investment's life. It is helpful to view the deferred taxes as a liability the owners of capital owe the government. The economic burden of the tax system is 0.01 at all ages, since marginal product always exceeds $r + \delta$ by this amount. During the tax-free period, the owners effectively borrow from the government. Later, when they are paying 0.02, they effectively service this loan. The outstanding liability reduces the value of the capital. Indeed, the same effect could be achieved by imposing the 20 percent uniform tax and making an explicit loan. The capital, encumbered by the debt, would be worth less than unity.

This devaluation has implications for the effects of tax reform. Replacing the income tax with a 25 percent consumption tax reduces the value of each unit of existing capital (that is more than 5.776 years old) by only 18 percent,

from 0.917 to 0.75. Income tax repeal effectively forgives the deferred tax liability and increases the value of the capital, partly offsetting the 25 percent decline caused by the introduction of the consumption tax.

Therefore, to the extent current income taxes are imposed on a deferred basis, capital is already valued at less than replacement cost and the replacement of the income tax by a consumption tax has a smaller impact than the previous analysis suggests. If the devaluation under the income tax is sufficiently large, the switch to consumption taxation may even raise the real value of existing capital.

Note that the offsetting rise in value is due to the repeal of the income tax (and its associated deferred liabilities) rather than the introduction of the consumption tax. If a consumption tax is introduced as a supplement to the income tax (or as a replacement for a wage tax), the value of existing capital still declines by a proportion equal to the consumption tax rate, as in the simplified analysis. Similarly, if the consumption tax rate is subsequently raised to meet an increase in revenue needs, the real value of existing capital still declines by a proportion equal to the rate increase.

As described below, numerous instances of deferred taxation exist in the current system. Front-loaded investment and saving incentives result in deferred taxation. Also, under one theory of corporate financial policy, the taxation of corporate dividends at a higher rate than retained corporate earnings results in tax deferral.

Front-Loaded Investment Incentives

Front-loaded investment incentives include expensing, investment tax credits, and accelerated depreciation.[20] Current income tax law allows the cost of some investments to be expensed (as all investment would be under a consumption tax) rather than depreciated. Most intangible investments—such as research and development, worker training, and business planning—can be expensed. Small businesses are allowed to expense $20,000 (scheduled to rise to $25,000 by 2003) of equipment investment per year. Each unit of expensed capital is worth $(1 - \tau_y)$ under the income tax, so the net change resulting from tax reform is $(\tau_y - \tau_c)$.

In some instances, the income tax allows a credit against tax liability equal to a fraction k of investment costs when the investment is made. Each unit of capital then has a value of about $(1 - k)$, depending on how depreciation allowances are adjusted to account for the credit. Although the general credit for equipment investment was abolished in 1986, U.S. tax law still provides a 20 percent credit for research and experimentation, a 10 percent credit for business equipment that uses solar or geothermal energy, and a 10 percent to 20 percent credit for rehabilitation of historic structures.

Under accelerated depreciation, the tax law computes depreciation deductions as if capital depreciates more rapidly than it does. For example, capital with a 0.08 depreciation rate may be depreciated for tax purposes at a 0.12 rate. One unit of investment results in a depreciation deduction t years later of $0.12 \exp(-0.12t)$, rather than the true depreciation of $0.08 \exp(-0.08t)$. The deductions are higher than true depreciation for capital that is less than 10.137 years old and lower for capital that is older. This deferral of tax liability results in capital having a value less than unity. The tax law provides accelerated depreciation for nearly all types of tangible capital.

Front-Loaded Personal Savings Incentives

Another form of deferred income taxation is the provision of front-loaded incentives for personal saving. The amount saved is deducted and the proceeds are fully taxed when withdrawn from a designated account. These incentives apply to pensions, conventional individual retirement accounts (IRAs), 401(k)s, 403(b)s, medical savings accounts, education IRAs, and Keogh accounts for self-employed taxpayers. In some cases, a 10 percent penalty may also apply to withdrawals. The taxation of the proceeds reduces the value of the assets to $(1 - \tau_y)$ or, if the penalty is applicable, to $(0.9 - \tau_y)$. Repeal of the individual income tax forgives the tax and penalty.[21]

The incentives provided to Roth IRAs do not have the same effects. The household receives no deduction for the original saving, but the return on the account is exempt. Although these incentives are often referred to as back-loaded, their timing is actually neutral. There is no deferral because the same zero tax rate applies at all times. Income tax repeal does not increase the net value of Roth IRAs.

Another instance of deferred taxation is the delay in taxing capital gains until the gains are realized. Repeal of the income tax forgives the tax on unrealized capital gains.[22]

Taxation of Corporate Dividends and Retained Earnings

Another potential source of deferred taxation has broad applicability. Shareholders in many corporations must pay individual income tax on dividends and on the capital gains that

result from corporate retained earnings (in addition to the corporate income tax imposed at the firm level).[23] The tax on dividends is generally higher than the effective tax on retained earnings. Under one theory of corporate financial policy, this differential taxation is a deferral of tax liability and reduces the value of existing capital.

Consider a corporation that uses equity to finance all its investment. Let *ISSUE* denote the funds raised by issuing and selling new shares, *DIV* denote the dividends paid to existing shareholders (gross of dividend tax), and *RETAIN* denote the earnings retained on behalf of existing shareholders. The business cash flow distributed to stockholders consists of dividend payments to existing stockholders minus equity issuance proceeds received from new stockholders. By definition, business cash flow equals gross capital income minus gross investment, so $DIV - ISSUE = Y_K - I$. Retained earnings equal the net increase in the capital stock existing stockholders own, consisting of the increase in the firm's capital stock (gross investment minus depreciation) minus the portion sold to new stockholders, so $RETAIN = (I - \delta K) - ISSUE$. Rewriting these equations yields

$$(16) \qquad \begin{aligned} DIV_t + RETAIN_t &= Y_{K,t} - \delta K_t; \\ RETAIN_t + ISSUE_t &= I_t - \delta K_t. \end{aligned}$$

For given values of real variables (capital income, investment, and depreciation), Equation 16 places two restrictions on the three financial variables (dividends, equity issuance, and retained earnings). The corporation has one degree of freedom in choosing its financial policy.

If a common tax rate τ applies to both dividends and retained earnings, the liability under any financial policy satisfying Equation 16 is

$$(17) \quad T_t = \tau (DIV_t + RETAIN_t) = \tau (Y_{K,t} - \delta K_t).$$

Regardless of the corporation's financial policy, this is simply a tax on net capital income with no tax deferral.

However, since the federal income tax system offers a preferential tax rate on long-term capital gains, the dividend tax rate, τ_d, exceeds the effective tax rate on retained earnings, τ_r. Because this system treats different financial flows differently, its effects depend on the corporation's financial policy.

Economists have considered two major theories of corporate financial policy. The earliest theory, generally called the "old" or "traditional" view, assumes that firms pay dividends equal to a fixed fraction x of their net capital income, which implies

$$(18) \qquad \begin{aligned} DIV_t &= x (Y_{K,t} - \delta K_t); \\ RETAIN_t &= (1 - x)(Y_{K,t} - \delta K_t); \\ ISSUE_t &= I_t - (1 - x) Y_{K,t} - x \delta K_t. \end{aligned}$$

Since increases in *I* result in one-for-one increases in *ISSUE* with no changes in *DIV* or *RETAIN*, new share issuance is the marginal source of finance for new investment.

Under this theory, the tax imposed on stockholders is

$$(19) \qquad \begin{aligned} T_t &= \tau_d DIV_t + \tau_r RETAIN_t \\ &= [x \tau_d + (1 - x)\tau_r](Y_{K,t} - \delta K_t). \end{aligned}$$

Under the old view, the system imposes a tax on net capital income, with the effective rate equal to a weighted average of the rates on dividends and retained earnings. The lower rate on retained earnings merely reduces the overall tax rate with no deferral. Since investment is financed from new share issuance, with no change in dividends or retained earnings, no tax saving or payment occurs at the time of investment. The subsequent output from the investment generates a stable mixture of dividends and retained earnings at each date, so its tax treatment is the same at each date.

However, King (1974) and later writers challenge the old view's assumption that the corporation simultaneously issues new equity and pays dividends. Even in the no-tax economy, raising funds from new stockholders and paying them to current stockholders generates unnecessary transaction costs. More important, this behavior raises shareholders' taxes. Lowering both dividends and share issuance by one dollar, which increases retained earnings by one dollar, reduces taxes by $(\tau_d - \tau_r)$. Also, the small amount of equity issuance by mature corporations casts doubt on the old view's assertion that such issuance is the marginal source of investment finance.

King and those who followed him advocate an alternative theory of corporate financial behavior, known as the "new view."[24] Under this theory, a mature corporation, defined as one with positive cash flow, pays dividends equal to its business cash flow and issues no new equity:

$$(20) \qquad \begin{aligned} DIV_t = Y_{K,t} - I_t; \quad RETAIN_t &= I_t - \delta K_t; \\ ISSUE_t &= 0. \end{aligned}$$

Since increases in *I* result in one-for-one increases in *RETAIN* and decreases in *DIV*, with no change in *ISSUE*, retained earnings (foregone dividends) are the marginal source of finance for new investment.

Under this theory, the tax imposed on equity holders equals

$$(21)\qquad T_t = \tau_d DIV_t + \tau_r RETAIN_t = \tau_r(Y_{K,t} - \delta K_t) + (\tau_d - \tau_r)(Y_{K,t} - I_t).$$

The tax combines a net-capital-income tax with effective rate τ_r and a cash-flow tax with effective rate equal to $(\tau_d - \tau_r)$, the "extra" tax on dividends. Under the new view, the extra dividend tax is a deferred tax. Since new investment is financed by retained earnings (a reduction in dividends), a tax savings of $(\tau_d - \tau_r)$ is received at the time of investment. The subsequent output is distributed as dividends, in accordance with Equation 20, on which taxes are imposed. This tax timing—an initial tax savings offset by subsequent tax payments—is similar to that of the consumption tax and front-loaded investment incentives.

Under the new view, only the tax on retained earnings (capital gains) is a net-income tax that distorts investment. The extra tax on dividends is a business-cash-flow tax that leaves investment undistorted but reduces the value of capital to $1 - \tau_d + \tau_r$. The combined effect of income tax repeal and introduction of a consumption tax at rate τ_c is to change the capital stock's value by $(\tau_d - \tau_r - \tau_c)$. The real value of existing capital may even increase, depending on the tax rates.

Although the new view is a theoretically appealing description of the behavior of mature corporations with positive business cash flow, its validity remains controversial. Zodrow (1991) reports that some empirical evidence favors the old view, while Auerbach and Hassett (2000) report evidence favoring the new view. Zodrow discusses the difficulty of conclusively testing the two theories, particularly in light of additional modifications (not considered here) that can be made to each, including models of the interaction of equity and debt finance.

EXTENSION 3: ADJUSTMENT COSTS

Incorporating more realistic assumptions about production generally (but not always) mitigates the decline in value implied by the simplified analysis.[25]

The simplified analysis assumes the supply of capital is infinitely elastic because unlimited amounts of each type of capital can be produced and installed at constant cost (in terms of consumption). It is more realistic to assume that capital's marginal production cost rises when economy-wide production increases. Also, some evidence suggests adjustment costs exist at the firm level, causing the marginal installation costs of capital at each firm to rise when the firm installs more capital. Since both forces have similar implications when investment increases throughout the economy, I discuss them together and refer to them as adjustment costs.[26]

As discussed previously, tax reform is likely to cause the aggregate capital stock to expand, so that the equilibrium pretax rate of return is reduced. With adjustment costs, this expansion is associated with a rise in the cost of capital goods, which mitigates the decline in value for existing capital. Adjustment costs also restrain the expansion of the capital stock.

With adjustment costs, the pretax rate of return equals $(F_K + \dot{q})/q - \delta$ rather than $F_K - \delta$, where q is pretax replacement cost and the dot denotes rate of change. Dividing by q is necessary because q units of consumption must be sacrificed to obtain one unit of capital. Adding the change in q is necessary to reflect the capital gain (or loss) earned by holding capital. The first-order conditions for investment under income and consumption taxation are (respectively)

$$(22)\qquad \frac{F_{K,t} + \dot{q}_t}{q_t} = \delta + \frac{r}{1 - \tau_{y,t}},$$

and

$$(23)\qquad \frac{F_{K,t} + \dot{q}}{q_t} = \delta + r,$$

rather than Equations 6 and 12. If the after-tax required return r remains constant, the pretax return still declines after tax reform, but a decline in F_K is now only part of the likely response (and is smaller because the capital stock does not expand as much). Another part is a rise in q (and still another is a negative value of $\dot{q}$ since the increase in q following tax reform is likely to decay over time). Ignoring the income tax deferral considered above, each unit of capital is still valued at q under the income tax and $(1 - \tau_c)q$ under the consumption tax. However, this no longer implies a proportional decline of τ_c, because q is higher under the consumption tax.

Note that the increase in investment and the resulting rise in q are due to the repeal of the income tax rather than the introduction of the consumption tax. If a consumption tax is introduced as a supplement to the income tax (or as a replacement for a wage tax), the value of existing capital is still likely to decline by a proportion equal to the consumption tax rate, as in the simplified analysis. Similarly, if the consumption tax rate is subsequently raised to meet

increased revenue needs, the real value of existing capital is still likely to decline by a proportion equal to the rate increase.

In the simplified analysis, the decline in value is always τ_c, regardless of the response of r to tax reform; if r rises, it simply dampens the decline in F_K. With adjustment costs, however, an increase in r dampens the rise in q as well as the decline in F_K. If after-tax rates of return rise, the decline in value of existing capital is greater than it would otherwise be.

The extreme form of adjustment costs occurs when adjustment is impossible and the quantity of capital is fixed; additional units cannot be produced at any cost and the existing units cannot be converted back into consumption. If all types of capital are in fixed supply and changes in labor supply are unimportant, the marginal product of capital is unchanged by tax reform. Consider the standard example, in which $\delta = 0.08$ and $r = 0.04$ both before and after tax reform. With no adjustment costs, the marginal product declines from 0.13 to 0.12 and the value falls from 1 to 0.75. But if capital is in fixed supply and the marginal product remains unchanged at 0.13, the value of each unit of capital is

$$\int_{t=0}^{\infty} \exp(-.04t)[(.75)(.13)]\exp(-.08t)dt$$
$$= \frac{.75(.13)}{.12} = .81$$

and the decline in value is 19 percent rather than 25 percent. If some adjustment costs are present, but capital is not in fixed supply, an intermediate outcome occurs. Also, if tax reform raises the required after-tax return, the decline in value is greater than 19 percent, even under the fixed-supply assumption.

Adjustment costs have opposite implications for lightly taxed types of capital. Consider a system in which some types of capital face effective tax rates of 30 percent and others face effective rates of zero. If the after-tax rate of return is initially 0.04, pretax rates of return are 0.057 for the former and 0.04 for the latter. If tax reform causes the after-tax rate of return to rise to .045, the stock of the heavily taxed capital expands until its pretax rate of return falls from 0.057 to 0.045, while the stock of the untaxed capital contracts until its pretax rate of return rises from 0.04 to 0.045. The untaxed capital does not benefit from tax reform, and it is crowded out by the rise in after-tax interest rates.

Therefore, untaxed (or lightly taxed) types of capital are likely to contract rather than expand after tax reform. All of the above analysis is then reversed. Adjustment costs reduce the replacement cost of these types of capital, reinforcing any decline in the value of existing capital. As noted above, consumer and government capital is not taxed, while many types of intangible capital face effective tax rates of zero because they are expensed. This analysis is likely to apply to these types of capital.[27]

POTENTIAL MAGNITUDES OF EFFECTS

This section combines the various extensions discussed above and incorporates them into the simplified analysis. The aggregate decline in value is smaller than the simplified analysis suggests, but its distribution is less uniform.

Table 3 summarizes the possible impacts for five categories of capital. (Even so, the analysis is somewhat aggregated; the actual impact may vary significantly across different types of capital within each category.) The consumption tax rate is assumed to be 25 percent. Column A lists the percentage declines that apply when there is no income tax deferral and no adjustment costs. Column B lists the modification attributable to front-loaded investment incentives. Column C lists the modification attributable to adjustment costs; due to uncertainty about the magnitude, only the sign of the effect is reported. Column D combines columns A through C. Column E states the appropriate modification if the new view is valid, and column F combines that modification with column D.

The first row refers to consumer and government capital. Column A shows zero because this capital is exempt from the cash flow tax. The entry in column B is also zero because this capital does not receive any front-loaded investment incentives. Its preferential treatment under the current income tax consists of facing a zero tax rate at every stage of its life.

Column C reports a negative effect because consumer capital and government capital are exempt from income tax and are likely to contract after tax reform, as discussed above. Congressional Budget Office (1997, 45–46) and Gravelle (1996b) survey the literature on possible reductions in value of the largest category of consumer capital, owner-occupied homes. Allowing for some increase in after-tax interest rates, Gravelle estimates that homes would decline in value by about 22 percent under the extreme assumption that they are in fixed supply. With more realistic assumptions about the magnitude of adjustment costs, however, she concludes that the decline may be as low as 9 percent.

Table 3
Summary of Transition Effects on Real Value of Capital

Percentage change in value from replacement of income tax with 25 percent consumption tax

	(A) Simplified analysis*	(B) Front-loaded investment incentives	(C) Adjustment costs	(D) Net effect (if old view is valid)	(E) Additional effect (if new view is valid)	(F) Net effect (if new view is valid)
Consumer and government capital	0	0	< 0	< 0	0	< 0
Tangible capital except equity-financed mature corporation	–25	8	> 0	> –17	0	> –17
Tangible capital, equity-financed mature corporation	–25	8	> 0	> –17	25	> 8
Intangible capital except equity-financed mature corporation	–25	35	< 0	< 10	0	< 10
Intangible capital, equity-financed mature corporation	–25	35	< 0	< 10	25	< 35

* Modified to reflect special treatment of consumer and government capital.

The entry in column E is zero because the new view is inapplicable to noncorporate capital, including consumer and government capital. The net impact shown in columns D and F is a value decline whose magnitude depends on adjustment costs.

The next two rows refer to tangible capital, such as plant and equipment. The first of these rows refers to investment for which the new view is inapplicable. This includes debt-financed corporate investment, equity-financed investment by immature corporations with negative cash flow, and investment by noncorporate firms (proprietorships, partnerships, and limited liability companies) and S corporations that are taxed in the same manner as noncorporate firms. The other row refers to investment for which the new view (if valid) is applicable, which is equity-financed investment by corporations (other than S corporations) with positive cash flow.

Under the simplified analysis, the value of tangible capital declines by 25 percent, as shown in column A. However, this type of capital has deferred tax liabilities due to accelerated depreciation and other front-loaded investment incentives. Following Auerbach (1996, 51), I assume these incentives reduce the value of this capital by an average of 8 percent and enter this number in column B.

I report a positive effect in column C, since this type of capital should expand after tax reform and adjustment costs should increase its value. The magnitude is highly uncertain. Auerbach (1996, 62) estimates an increase of about 10 percent under one assumption about adjustment costs but notes that a smaller or larger increase is possible.

The combined effect shown in column D is a decline in value of less than 17 percent. An increase is possible if adjustment costs are quite large.

For equity-financed investment by mature corporations, the net impact is more favorable, if the new view is valid. This is the category Koenig and Huffman (1998) consider. Following their assumption that dividends are taxed at 25 percent and capital gains at zero, I enter 25 percent in column E. The net impact is an increase in value of more than 8 percent. If the old view is valid, this adjustment does not apply.

The last two rows refer to intangible capital, again distinguishing between capital for which the new view (if valid) is applicable and that for which it is inapplicable. The initial impact is 25 percent. Because this capital is expensed, it is currently devalued by a proportion equal to the income tax rate. I enter 35 percent, the top corporate income tax rate, in column B. The adjustment-costs effect is negative since, as explained above, tax reform is likely to reduce investment in this capital. The net impact is an increase in value of less than 10 percent. The value may decline if adjustment costs are sufficiently large. For equity-financed investment by mature corporations, the net impact is an increase in value of less than 35 percent, if the new view is valid.

These estimates do not include front-loaded saving incentives. The removal of the income tax (and penalty) on withdrawals from employer pension plans and tax-deferred accounts constitutes an increase in value that should be added to the numbers in Table 3.

CONCLUSION

Replacing income taxation with consumption taxation would have wide-ranging effects on the value of the capital stock. A simple result can be obtained by assuming that the income and consumption taxes have stylized forms and that capital goods can be produced at constant cost (with no adjustment costs). In this simplified analysis, the real value of existing capital would decline by a proportion equal to the consumption tax rate. This decline would occur because existing capital would be treated less favorably than new investment. The harm to owners of existing capital would be mitigated because income tax repeal would increase after-tax rates of return.

However, under a more realistic specification of the consumption tax, consumer and government capital would receive preferential treatment that would allow them to escape this value decline. Also, under more realistic assumptions about income tax design and the production process, income tax repeal would offset part of the negative impact from the introduction of the consumption tax. Income tax repeal would enhance the value of business capital by forgiving deferred tax liabilities. Repeal would also increase investment in many types of business capital, which, in the presence of adjustment costs, would drive up the value of existing capital. However, repeal would reduce investment in consumer and government capital and some lightly taxed forms of business capital, which would drive down their real value.

The net result is that the decline in the real value of existing capital is smaller and less uniform than the simplified analysis suggests. Some types of capital might even rise in value. The reduced overall impact on the real value of capital weakens the argument for broad transition relief. However, the uneven nature of the effects might support an argument for targeted relief for types of capital that are more adversely affected. Uncertainty about the magnitude of adjustment costs and the appropriate theory of corporate financial behavior complicates decisions on transition policies.

The analysis in this article offers an incomplete description of the transition. The distribution of the wealth decline depends on how tax reform affects the real value of outstanding debt. What are the relative effects on stockholders and bondholders? When owner-occupied homes decline in value, is the loss borne fully by the owners, or do mortgage lenders bear part of the loss? In Part 2, I address these issues.

NOTES

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1 Many authors discuss this result, including Bradford (2000, 319–25), Lyon (1990), Sandmo (1979), Johansson (1969), and Samuelson (1964).

2 See Koenig and Huffman (1998, 31), Gentry and Hubbard (1997, 8), Gravelle (1996a, 1427), Joint Committee on Taxation (1995, 57), and Auerbach and Kotlikoff (1987, 133).

3 I express the tax rate in a tax-inclusive manner rather than the tax-exclusive manner in which retail sales tax rates are usually expressed. For example, the sales tax rate is usually said to be 33.33 percent if a $33.33 tax is imposed on a consumption good with a pretax price of $100 and an after-tax price of $133.33. I refer to this levy as a 25 percent tax (τ_c equals 25 percent) because the tax is 25 percent of the after-tax price. The tax-inclusive approach is consistent with the manner in which income tax rates are stated. Koenig (1999, 685), Gale (1999, 443–44), Gillis, Mieszkowski, and Zodrow (1996, 730, note 17), and Joint Committee on Taxation (1995, 54, note 83) discuss the relationship between tax-exclusive and tax-inclusive rates.

4 A time-varying consumption tax rate is distortionary because it penalizes investment in years when the tax rate is temporarily low. Time-varying rates generally pose greater difficulties for consumption taxes than for income taxes. See Bradford (2000, 311–31) and Auerbach and Kotlikoff (1987, 62, 83–87).

5 Estimates of the revenue-neutral consumption tax rate include 21.8 percent (Koenig 1999, 697); 27.7 percent (Gale 1999, 455, replacing excise as well as income taxes and allowing for tax avoidance and evasion and base erosion); 25.2 percent to 25.7 percent (Ventura 1999, 1445, imposing revenue neutrality only in steady state); and 21.4 percent (Feenberg, Mitrusi, and Poterba 1997, 75). The Treasury Department has also estimated a revenue-neutral rate of about 25 percent. Gilles, Mieszkowski, and Zodrow (1996, 763) make a similar estimate.

6 Bradford (2000, 71–72, 91–92), Gentry and Hubbard (1997, 6), Congressional Budget Office (1997, 29), and Joint Committee on Taxation (1995, 58, note 94) discuss the taxation of pure profits. Also, in an economy with uncertainty, the returns from various risky investments may be higher or lower than the return on a safe investment. Under the income and consumption taxes, the government shares in these surpluses and shortfalls in the proportions τ_y and τ_c, respectively. The market value of the surpluses and shortfalls is zero, as Bradford (2000, 93; 1996, 129) and Gentry and Hubbard (1997, 7–9) explain. Also, see Joint Committee on Taxation (1995, 94–99).

7 Abel et al. (1989) demonstrate that business cash flow has been consistently positive in the United States. If it

were consistently negative, more resources would be devoted to producing capital than were produced by it. Such an economy would be considered dynamically inefficient because it could increase both current and future consumption by reducing its capital stock.

[8] Bradford (2000, 68), Koenig and Huffman (1998, 26), Gentry and Hubbard (1997, 5), Congressional Budget Office (1997, 66), Auerbach (1996, 30–31), and Joint Committee on Taxation (1995, 55) note this equivalence.

[9] See Bradford (2000, 80, 99), Diamond and Zodrow (1999, 25), Lyon and Merrill (1999, 308), Hall (1997, 147), Congressional Budget Office (1997, 66), Auerbach (1996, 47) and Gravelle (1996a, 1443). These authors differ in the extent to which they acknowledge the qualifications to this conclusion that I address in the text when I modify the simplified analysis. Lewis and Seidman (2000, 100), Gentry and Hubbard (1997, 10–11), Feenberg, Mitrusi, and Poterba (1997, 85), Gillis, Meiszkowski, and Zodrow (1996, 747), Joint Committee on Taxation (1995, 84), and Auerbach and Kotlikoff (1987, 62, 79) also note in more general terms that the adoption of a consumption tax reduces the real value of existing wealth.

[10] Lewis and Seidman (2000), Diamond and Zodrow (1999, 26), Congressional Budget Office (1997, 67), Gentry and Hubbard (1997, 11), Feenberg, Mitrusi, and Poterba (1997, 85), Gillis, Mieszkowski, and Zodrow (1996, 748), Auerbach (1996, 60), Bradford (1996, 139–40), and Joint Committee on Taxation (1995, 87) note the effects of higher after-tax returns. In the text, I consider households that experience a wealth decline equal to the 25 percent reduction in the value of the capital stock (aggregate wealth). Recall that this article does not address how the wealth decline is divided between debt and equity holders or household lenders and borrowers. I will explain in Part 2 that wealth changes may vary greatly across households with different portfolios.

[11] A related approach maintains the cash-flow tax but gives each unit of existing capital offsetting rebates with a present value of τ_c. This may be done through an immediate rebate of τ_c or, as Bradford (2000, 327–28) discusses, a permanent stream of rebates equal to $\tau_c(\delta + r)\exp(-\delta t)$ in year t. The rebate approach differs from the wage-tax option only in taxing any future pure profits and maintaining the appearance of a tax on capital.

[12] Bradford (2000, 110; 1996, 143) discusses the relative treatment of long-lived and short-lived capital under this transition policy.

[13] The federal government also holds capital. It is economically irrelevant, however, whether the federal government taxes itself on this capital. Capital held by nonprofit organizations would also receive preferential treatment under the major consumption tax proposals, and the analysis in the text generally applies to this capital.

[14] If homeowners perform their own services, their imputed wages are also exempt from income tax and proposed consumption taxes. This exemption distorts the allocation of labor but has no implications for the valuation of capital.

[15] This statement assumes that state and local governments make their investment decisions using the same profit-maximization criteria as private firms. In reality, their decisions may be affected by a variety of political factors.

[16] Some argue that the difficulty of measuring these imputed service flows is a disadvantage of the consumption tax. The opposite is true, since the exemption of these flows causes capital misallocation under the income tax but not under the consumption tax. Capital income must be measured to be taxed at a positive rate but need not be if it is to be taxed at a zero effective rate, which is the objective of the consumption tax. See Bradford (2000, 10–12, 94–95).

[17] Bradford (2000, 107; 1996, 140), Lewis and Seidman (2000, 100), Diamond and Zodrow (1999, 25), Hall (1997, 149), Congressional Budget Office (1997, 66–67), and Sullivan (1996, 342) note that consumer capital escapes the decline in value that affects other capital. In the absence of special rules, the preferential treatment applies to capital consumers and governments own on the reform date, regardless of subsequent transactions. For example, housing that is owner-occupied on that date still benefits, even if it is converted to rental use the next day; although subsequent rental payments are taxed, an immediate deduction equal to the home's value is granted because the conversion is treated as new investment. Conversely, housing used for rental on the reform date does not benefit, even if it is converted to owner use the next day; although the owner's subsequent imputed rental income is exempt, an immediate tax is imposed on the home's value because the conversion is treated as disinvestment and consumption.

[18] This equivalence follows because

$$.4\int_{t=5.776}^{\infty} \exp(-.12t)dt = .2\int_{t=0}^{\infty} \exp(-.12t)dt.$$

Note that $\exp[-(5.776)(.12)]$ equals 0.5.

[19] If firms can convert a unit of older capital back into one unit of consumption without any tax liability, the value of this capital cannot fall below unity. Indeed, no older capital remains in existence since all firms make such conversions. To prevent this outcome, the tax system must require the firm to pay a tax of 0.083 units to recapture the benefits of the earlier tax-free period. Under the federal income tax, most front-loaded investment incentives are accompanied by recapture taxes. Since the tax law often allows firms that purchase existing capital from other firms to claim the same front-loaded benefits as if they had produced new capital, it also imposes recapture taxes on selling firms to prevent tax-motivated sales. Auerbach and

Kotlikoff (1983, 129–36) describe U.S. recapture taxes then in place.

[20] Under the tax law, each owner of a sole proprietorship, partnership, limited liability company, or small (S) corporation pays individual income tax on his or her share of the firm's income. The front-loaded investment incentives discussed in the text are used in computing each owner's tax liability. Each corporation (other than an S corporation) pays a firm-level corporate income tax on its taxable income, and (as discussed in the text below) each of its shareholders also pays individual income tax on his or her dividends and capital gains. The front-loaded investment incentives are used to compute the corporate income tax but not the shareholders' individual income taxes. Auerbach and Kotlikoff (1987, 131–35; 1983) discuss the effects of front-loaded investment incentives on the value of capital. Lyon and Merrill (1999, 307), Diamond and Zodrow (1999, 26), Gillis, Mieszkowski, and Zodrow (1996, 748), Bradford (1996, 137), Auerbach (1996, 36), and Joint Committee on Taxation (1995, 84–85) discuss the resulting implications for the transitional effects of tax reform.

[21] Nondeductible IRAs and tax-deferred annuities also receive front-loaded incentives. Lewis and Seidman (2000, 100), Gillis, Mieszkowski, and Zodrow (1996, 747), and Auerbach (1996, 38, 69) discuss the transitional effects of front-loaded savings incentives.

[22] Lewis and Seidman (2000, 100), Congressional Budget Office (1997, 67), and Gillis, Mieszkowski, and Zodrow (1996, 747) discuss the transitional implications of accrued capital gains.

[23] The analysis in this section does not apply to investment by S corporations, noncorporate firms, or consumers and governments.

[24] Sinn (1991a; 1991b) thoroughly discusses the new view. Congressional Budget Office (1997, 67), Gentry and Hubbard (1997, 39), Gillis, Meiszkowski, and Zodrow (1996, 748), and Auerbach (1996, 37, 69) note its implications for the transitional effects of tax reform. Koenig and Huffman (1998) assume the validity of the new view in their analysis.

[25] If new investments are imperfect substitutes for old capital because they incorporate different technologies, the decline in value of existing capital is also mitigated. In the standard example, when tax reform reduces the marginal product of new capital from 0.13 to 0.12, I assume the marginal product of existing capital falls by the same amount, which (along with the increase in its tax payments) causes its value to decline. However, if the two vintages of capital are not perfect substitutes, the expansion of new investment may not drive down the return on existing capital to the same extent.

[26] Bradford (2000, 104–5; 1996, 138), Huffman and Koenig (1998, 27–29), Lyon and Merrill (1999, 307–09), Diamond and Zodrow (1999, 26), Gentry and Hubbard (1997, 41), Congressional Budget Office (1997, 67), and Auerbach (1996, 48, 61–63) discuss the implications of adjustment costs for the transitional effects of tax reform.

[27] Bradford (2000, 105, 107; 1996, 138, 140), Hall (1997, 149–50), Gentry and Hubbard (1997, 12, 43), and Joint Committee on Taxation (1995, 85) discuss the effects of tax reform on lightly taxed capital.

REFERENCES

Abel, Andrew B., N. Gregory Mankiw, Lawrence H. Summers, and Richard J. Zeckhauser (1989), "Assessing Dynamic Efficiency: Theory and Evidence," *Review of Economic Studies* 56 (January): 1–19.

Auerbach, Alan J. (1996), "Tax Reform, Capital Allocation, Efficiency, and Growth," in *Economic Effects of Fundamental Tax Reform*, ed. Henry J. Aaron and William G. Gale (Washington, D.C.: Brookings Institution), 29–81.

Auerbach, Alan J., and Kevin A. Hassett (2000), "On the Marginal Source of Investment Funds," NBER Working Paper Series, no. 7821 (Cambridge, Mass.: National Bureau of Economic Research, August).

Auerbach, Alan J., and Laurence J. Kotlikoff (1983), "Investment Versus Savings Incentives: The Size of the Bang for the Buck and the Potential for Self-Financing Business Tax Cuts," in *The Economic Consequences of Government Deficits*, ed. Laurence H. Meyer (Boston: Kluwer-Nijhoff), 121–49.

——— (1987), *Dynamic Fiscal Policy* (Cambridge: Cambridge University Press).

Bradford, David F. (1996), "Consumption Taxes: Some Fundamental Transition Issues," in *Frontiers of Tax Reform*, ed. Michael J. Boskin (Stanford: Hoover Institution Press), 123–50.

——— (2000), *Taxation, Wealth, and Saving* (Cambridge: MIT Press).

Congressional Budget Office (1997), *The Economic Effects of Comprehensive Tax Reform* (Washington, D.C.: Government Printing Office).

Diamond, John, and George R. Zodrow (1999), "Housing and Intergenerational Redistributions Under a Consumption Tax Reform," *Proceedings, Ninety-First Annual Conference on Taxation* (Washington, D.C.: National Tax Association), 25–31.

Feenberg, Daniel R., Andrew W. Mitrusi, and James M. Poterba (1997), "Distributional Effects of Adopting a National Retail Sales Tax," *Tax Policy and the Economy*,

vol. 11, ed. James M. Poterba (Cambridge: MIT Press), 49–89.

Gale, William G. (1999), "The Required Tax Rate in a National Retail Sales Tax," *National Tax Journal* 52 (September): 443–57.

Gentry, William M., and R. Glenn Hubbard (1997), "Distributional Implications of Introducing a Broad-Based Consumption Tax," *Tax Policy and the Economy*, vol. 11, ed. James M. Poterba (Cambridge: MIT Press), 1–47.

Gillis, Malcolm, Peter Mieszkowski, and George R. Zodrow (1996), "Indirect Consumption Taxes: Common Issues and Differences Among the Alternative Approaches," *Tax Law Review* 51 (Summer): 725–74.

Gravelle, Jane G. (1996a), "The Distributional Effects of Fundamental Tax Revisions," *San Diego Law Review* 33 (Fall): 1419–57.

——— (1996b), "Effects of Flat Taxes and Other Proposals on Housing," Congressional Research Service Report for Congress (April).

Hall, Robert E. (1997), "Potential Disruption from the Move to a Consumption Tax," *American Economic Review Papers and Proceedings* 87 (May): 147–50.

Huffman, Gregory W., and Evan F. Koenig (1998), "The Dynamic Impact of Fundamental Tax Reform, Part 2: Extensions," Federal Reserve Bank of Dallas *Economic Review*, Second Quarter, 19–31.

Johansson, Sven-Erik (1969), "Income Taxes and Investment Decisions," *Swedish Journal of Economics* 71 (June): 104–10.

Joint Committee on Taxation (1995), *Description and Analysis of Proposals to Replace the Federal Income Tax*, JCS-18-95 (Washington, D.C., June).

King, Mervyn A. (1974), "Taxation and the Cost of Capital," *Review of Economic Studies* 41 (January): 21–35.

Koenig, Evan F. (1999), "Achieving 'Program Neutrality' Under a National Retail Sales Tax," *National Tax Journal* 52 (December): 683–97.

Koenig, Evan F., and Gregory W. Huffman (1998), "The Dynamic Impact of Fundamental Tax Reform, Part 1: The Basic Model," Federal Reserve Bank of Dallas *Economic Review*, First Quarter, 24–37.

Lewis, Kenneth A., and Laurence S. Seidman (2000), "Transitional Protection During Conversion to a Personal Consumption Tax," *Public Finance Review* 28 (March): 99–119.

Lyon, Andrew B. (1990), "Invariant Valuation When Tax Rates Change Over Time: Confirmations and Contradictions," *Journal of Political Economy* 98 (April): 433–37.

Lyon, Andrew B., and Peter R. Merrill (1999), "The Stock Market and Consumption Tax Reform," *Proceedings, Ninety-First Annual Conference on Taxation* (Washington, D.C.: National Tax Association), 307–13.

McLure, Charles E., Jr., and George R. Zodrow (1996), "A Hybrid Approach to the Direct Taxation of Consumption," in *Frontiers of Tax Reform*, ed. Michael J. Boskin (Stanford: Hoover Institution Press), 70–90.

Samuelson, Paul A. (1964), "Tax Deductibility of Economic Depreciation to Insure Invariant Valuations," *Journal of Political Economy* 72 (December): 604–06.

Sandmo, Agnar (1979), "A Note on the Neutrality of the Cash Flow Corporate Tax," *Economics Letters* 4 (2): 173–76.

Sinn, Hans-Werner (1991a), "Taxation and the Cost of Capital: The 'Old' View, the 'New' View, and Another View," in *Tax Policy and the Economy*, vol. 5, ed. David F. Bradford (Cambridge: MIT Press), 25–54.

——— (1991b), "The Vanishing Harberger Triangle," *Journal of Public Economics* 45 (August): 271–300.

Slemrod, Joel (1996), "Which Is the Simplest Tax System of Them All?" in *Economic Effects of Fundamental Tax Reform*, ed. Henry J. Aaron and William G. Gale (Washington, D.C.: Brookings Institution), 355–84.

Sullivan, Martin A. (1996), "Housing and the Flat Tax: Visible Pain, Sudden Benefits," *Tax Notes* 74 (January 22): 340–45.

Ventura, Gustavo (1999), "Flat Tax Reform: A Quantitative Exploration," *Journal of Economic Dynamics and Control* 23 (September): 1425–58.

Zodrow, George R. (1991), "On the 'Traditional' and 'New' Views of Dividend Taxation," *National Tax Journal* 44 (December): 497–509.