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Neglected Effects on the Uses Side: Even a Uniform Tax Would Change Relative Goods Prices

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Recent efforts to calculate the incidence of fundamental tax reform have focused on the "sources side," that is, effects on sources of income such as labor and capital. The switch to a uniform consumption tax or wage tax would eliminate the taxation of capital income, raise the net rate of return, and thus redistribute toward the rich. Even the switch to a comprehensive income tax would integrate corporate and personal income-tax systems, lower the top marginal tax rate, and reduce the overall taxation of capital. These changes are thus perceived as regressive. In addition, the switch to a consumption tax would impose a one-time levy upon current older generations who will dissave and consume for the rest of their lives, while the switch from income tax to wage tax would confer a one-time windfall upon current older generations whose remaining income will not come from wages. Thus, fundamental tax reform would have *inter*generational as well as *intra*generational redistributions.

These general-equilibrium calculations often ignore important effects on the uses side, that is, effects of tax reform on the uses of income to buy commodities. If tax reform changes relative goods prices, then it will redistribute away from anyone (young or old, rich or poor) who spends a relatively large fraction of his or her budget on goods whose prices rise, and toward anyone who spends a relatively large fraction of income on goods whose prices fall. Perhaps these effects are ignored because fundamental tax reform is not thought to have any effects on relative goods prices. After all, the point is to tax all goods at a low uniform rate!

Neglected in this line of reasoning, however, is that the uniform tax would replace a current tax system that is anything but uniform. If reform eliminates the double taxation of capital in the corporate sector, then it would reduce the break-even price of any output produced by the corporate sector. The switch to a uniform tax would then redistribute toward anyone (young or old, rich or poor) who buys goods produced disproportionately by the corporate sector. And if reform cuts the overall taxation of capital income, then it would reduce the relative price of any good produced by an industry with a high capital/labor ratio.

The purpose of this paper is to investigate these neglected effects on the uses side. To do so, we calculate the impact of fundamental tax reform on relative product prices. Even with a value added tax (VAT) that raises all product prices relative to the wage rate, some prices rise more than others. We then use differential expenditure patterns by age and by income group to determine both intergenerational and intragenerational redistributions. In some cases these effects on the uses side serve to reinforce the standard effects on the sources side, and in other cases they offset. Either way, we conclude that the uses of income should not be ignored.

I. General-Equilibrium Effects on a Lifetime Basis

The calculations in this paper use the computational general equilibrium model of Fullerton and Rogers (1993), updated so that the benchmark equilibrium represents current tax law (as described in Fullerton and Rogers [1996]). Since the model is thoroughly described in those citations, it is reviewed only

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briefly here. We focus on its comparative advantages, relative to other models that might be used to evaluate fundamental tax reform.

Our model is not a macroeconometric forecasting model and thus should not be used to predict actual effects of tax reform along with changes in macroeconomic variables like inflation or unemployment. Instead, it is designed to answer conceptual questions about the effects of tax reform on real incomes, prices, and factor allocations, all else equal—with *no* changes in macroeconomic variables like involuntary unemployment or inflation. We assume away all market imperfections, transactions costs, factor immobility, and liquidity constraints. Like other general-equilibrium models (such as those of Alan J. Auerbach and Laurence J. Kotlikoff [1987], Eric M. Engen and William G. Gale [1996], and Dale W. Jorgenson and Peter J. Wilcoxen [1997]), our model can calculate the effects of a tax change on factor prices, voluntary labor supply decisions, savings, and capital formation.

The Fullerton-Rogers model uses a basic life-cycle framework, specifying a nested lifetime utility function and a present-value lifetime budget constraint. The consumer has a known and fixed profile of wage rates over the rest of a certain lifespan. This stream of potential earnings is discounted at the consumer's after-tax rate of return, and this present-value of lifetime income is allocated in the first stage of the utility function among composite goods in different time periods. In the second stage, the consumer allocates one period's composite good between "leisure" and "consumption." Then labor supply is calculated as the amount of time not retained as leisure. In addition, saving is calculated as the difference between one period's income and consumption. Since the wage profile is hump-shaped and declines later in life, while the desired consumption path is smooth, these individuals generally save during working years and dissave during retirement. They may also leave a bequest. At any point in time, aggregate accumulated saving is the capital stock, which is combined with labor in production.

All of the models mentioned above can be used to calculate effects of tax reform on the sources side. The switch to a wage tax or consumption tax eliminates capital taxation and raises the net return to those who own capital. It also affects the consumer's discount rate and thus the present value of future labor income. A higher net rate of return reduces the effective price of future consumption and thus may increase saving (depending on the intertemporal elasticity of substitution). Capital deepening may affect the marginal product of labor in production. As a consequence, tax reform may have long-run effects on the real net return to labor as well. These models also capture the one-time capital levy associated with the switch to a consumption tax. They thus capture intergenerational redistributions from old to young.

The models do have some differences, however, and thus have different comparative advantages. For example, since other models employ perfect foresight (with simultaneous calculations for all prices in all periods) they capture important effects during the transition from one tax regime to another. Auerbach and Kotlikoff (1987) also employ a "lump-sum redistribution authority" to calculate the amount that must be given to each older generation to keep them from loss, such that the gain to future generations represents a true efficiency gain (rather than partly redistribution from the old). Engen and Gale (1996) account for uncertainty and the precautionary savings motive. Our model lacks these features but has three other important advantages.

First, while the other models are particularly good for intergenerational effects, they only have one type of consumer at each age.[1] They cannot measure redistributions from rich to poor. In contrast, most models that *do* measure such redistributions use data on annual incomes. Each group therefore includes very different kinds of individuals. The group with the lowest annual income includes some very young (who will earn more later), some very old (who earned more earlier), some with volatile income (who earn more in other years), and some who are perennially poor. In order

[1] An exception is the model of Jorgenson and Wilcoxen (1997) who have many types of consumers and goods. They have not yet used their model to calculate incidence on the uses side, as we encourage here.

to capture the essential differences among these household types, our model classifies individuals by lifetime income. Instead of one type of consumer born each year, we have 12. Using data from the Panel Study on Income Dynamics, we first estimated wage profiles and allocated individuals into deciles based on the present value of lifetime income. Then the bottom decile was subdivided to identify the poorest 2 percent (group 1) separately from the next 8 percent (group 2), and the top decile was subdivided to identify the richest 2 percent (group 12) separately from the next 8 percent (group 11). After this allocation, we then estimated a different wage profile for each group. Thus some groups may have a profile that peaks earlier, which requires more savings to smooth consumption. These groups hold more capital during life, and are more burdened by capital taxation (on the sources side).[2]

Second, our model involves considerably more dissaggregation. Instead of one industry producing one good, we have 19 industries that each use a different capital/labor ratio:

Highest capital/labor ratios
real estate
agriculture
petroleum refining
crude petroleum, natural gas
transport, communication, utilities

Highest labor/capital ratios
services
construction
textiles, apparel, leather
lumber, furniture, stone, clay, glass
finance, insurance

These differences help determine the effects of capital tax changes on relative output prices. In addition, each industry has a particular mix of corporate and noncorporate production:

Highest percentage corporate
motor vehicles
petroleum refining
chemicals, rubber
metals, machinery
food, tobacco

Highest percentage noncorporate
agriculture
finance, insurance
services
construction
wholesale and retail trade

These differences help determine the effects of corporate tax reductions on relative output prices. Each industry has a unique mix of five capital types that face different tax treatments (equipment, structures, land, inventories, and intangible capital). The National Income and Product Accounts (NIPA) provide data on labor and capital use for this definition of industries or "producer goods," but the Consumer Expenditure Survey provides other data for households using completely different definitions for our 17 "consumer goods." Therefore we employ other NIPA data that relate the two sets of definitions.[3]

Changes in these relative prices would have no distributional effects, however, if all groups purchased all goods in the same proportions. Therefore the third comparative advantage of our model is that we estimate consumption demands that differ by age *and* income. After households allocate their present-value budget among time periods, and then between leisure and consumption, the third stage of utility maximization is to allocate consumption among the 17 goods in a Stone-Geary utility function. Each good has an intercept (or "minimum required purchase," b) and a slope coefficient (or "marginal expenditure share,"

[2] Kotlikoff (1996) has begun to add different lifetime income groups within the Auerbach-Kotlikoff model, although the model still has one consumption good, so the groups have no reason to differ on the uses side.

[3] For example, the consumer good called "appliances" and the one called "furniture" are each a fixed-coefficient combination of several producer goods (in different proportions) such as "metals, machinery," plus some "lumber, furniture, stone, clay, glass," plus some output of "retail and wholesale trade." In contrast, other consumer goods (such as utilities, shelter, transportation, financial services, health care, and education) are each made up almost entirely of one producer good.

β). These 34 parameters are estimated separately for each five-year age interval from age 20 to 75+. The estimation procedure and the $34 \times 12 = 408$ parameters are shown in Fullerton and Rogers (1993).[4]

All individuals in our model have the same lifetime utility function, so they know they have to spend initial dollars in proportions given by the b parameters for their age group, and that excess dollars can be spent in proportions given by the β parameters. Thus, even as everybody maximizes the same utility function, those with low income end up buying bundles of goods that differ from those with high income. The young also differ from the elderly:

Goods Purchased by Poor
- food
- shelter
- automobiles
- utilities
- gasoline

Goods Purchased by Elderly
- shelter
- financial services
- health care
- transportation (including airlines)
- utilities

Some of these goods have no particular effects on the uses side, such as those produced using a capital/labor mix and corporate/noncorporate mix that are near the national averages. Some other goods, however, appear on all of the lists above. Thus these lists can be used to explain the nature of results to follow.

II. Results, Emphasizing the Uses Side

Fundamental tax reform reduces capital taxation, especially by eliminating the double taxation of corporate income. It thus reduces the relative prices of outputs of capital-intensive industries like agriculture and petroleum refining, which are used to make food and gasoline, which are purchased in high proportions by low-income families.[5] The result is *less* regressive than it appears to be from looking only at the sources side and at changes in the personal rate structure.

Tax reform also reduces the relative prices of corporate-intensive outputs such as motor vehicles, petroleum refining, food, and tobacco. These producer goods are used to make consumer goods like automobiles, gasoline, and food, which again are purchased in high proportions by low-income families. The result again is less regressive than on the sources side.

With respect to intergenerational results, the usual story is that the elderly pay a one-time levy with a consumption-tax reform or receive a one-time windfall under the wage-tax reform. Both of these reforms would replace the current income-tax system's substantial tax advantages for housing, however, and so both would raise the relative price of shelter. Since shelter makes up a high fraction of *spending* by the elderly, as shown above, the important effect on the uses side is to increase the one-time levy on the elderly of the consumption-tax reform and to decrease the one-time windfall to the elderly of the wage-tax reform.

In addition, to continue tracing effects through the lists above, tax reform would reduce capital taxation and thus raise the relative prices of outputs of labor-intensive industries like "services" and "finance, insurance." These producer goods are used to make consumer goods such as "health care" and "financial services," which are shown above to constitute high fractions of spending by the elderly. Thus the higher prices of these goods also increase the one-time levy of the consumption-tax reform and decrease the one-time windfall of the wage-tax reform. It is more or less a coincidence that these various relationships all point in the same direction, but the combined effect is dramatic for the uses-side effects of changes in relative prices of commodities. As shown below, the wage tax can even hurt the elderly.

[4] We are grateful to Hilary Sigman who actually estimated these parameters for our book.

[5] The model is a closed-economy one, however. Acknowledging an open economy, we would expect the prices of traded goods to change less than the prices of nontraded goods.

TABLE 1—INTERGENERATIONAL WELFARE EFFECTS (EQUIVALENT VARIATION AS A PERCENTAGE OF LIFETIME INCOME)

Age at time of reform	VAT	Wage tax	Income tax
79	−0.088	−0 039	−0.046
69	−0.306	0 073	−0.059
59	0 077	0.577	0.333
49	0.904	1 236	0.973
39	2.115	1.844	1.700
29	3.285	2.132	2.181
9	4.018	1.800	1.910
−29	3.797	1.638	1.785

TABLE 2—INTRAGENERATIONAL WELFARE EFFECTS (EQUIVALENT VARIATION AS A PERCENTAGE OF LIFETIME INCOME)

Lifetime income group	VAT	Wage tax	Income tax
1 (poor)	8.13	11.23	6.72
2	6.19	6.37	4.22
3	4.12	3.23	2.10
4	4.19	2.72	2.06
5	5.37	3.36	3.16
6	2.64	0.33	0.41
7	3.60	1.38	1.29
8	3.41	0.43	1.06
9	3.51	0.32	1.10
10	3.01	0.04	0.92
11	3.14	1.39	1 77
12 (rich)	7.17	5 77	5.99

Now that we have explained the economics of these results using the unique features of our model, we are ready to describe the simulations. In this limited space, we discuss only three reforms. In all cases the current corporate and personal income-tax systems are eliminated, along with all of the associated nonuniform taxation of equipment versus structures, corporate sector versus noncorporate sector, and owner-occupied housing versus rental housing. In all cases, the reform is accompanied by a $10,000 annual exemption per person and a single rate of tax beyond that exemption on a comprehensive tax base. The three reforms are (i) a uniform consumption tax, or value-added tax at the same rate on all goods, (ii) a flat wage tax on all labor income, and (iii) a comprehensive income tax at the same rate on all capital types and all labor income. In all cases, we calculate the rate of tax necessary to collect the same real revenue as the taxes removed, so that government spending and transfers are unchanged from the benchmark. In all cases we use 0.5 for both the intertemporal and intratemporal elasticities of substitution.

Table 1 shows distributional effects by age at the time of the reform. The 79-year-old only lives one year under the new tax regime in our model, while the 69-year-old lives 11 more. At the other end, a person at economic age 9 has chronological age 29 (since individuals enter economic life at age 20). A person aged −29 reflects the steady-state effects on future generations. Our welfare measure is an equivalent variation, the present-value dollar equivalent of changes in lifetime utility. These amounts are expressed as percentages of total lifetime income.

The first column shows that the VAT imposes a loss on the two oldest groups, those whose consumption remains larger than income for the rest of their lives. It provides steady-state gains to future generations (though these gains should not be interpreted as efficiency gains). The second column shows that the wage tax provides smaller gains to future generations, basically because it does not impose the one-time levy on currently old individuals (revenue that can be used to reduce the rate of tax on future generations). Yet the wage tax does not provide the anticipated windfall to the elderly, because of the uses side: these reforms raise the relative prices of shelter, financial services, and health care, all goods consumed disproportionately by the elderly.

The comprehensive income tax is not generally thought to impose intergenerational redistributions. Once we account for the uses side, however, the third column of Table 1 shows that the comprehensive income tax also imposes loss on the elderly. It again raises the price of shelter and labor-intensive goods like financial services and health care.

Table 2 shows distributional effects by lifetime income category in the steady state. In the first column, the VAT provides welfare gains to all income groups. It most helps the

low-income groups, both because of the exemption and because of the uses side: although it raises the cost of shelter by eliminating current tax advantages to housing, this reform also *reduces* the relative prices of every other commodity in the above list of goods purchased by the poor. Because this reform eliminates double taxation in the corporate sector, it reduces the prices of automobiles, food, and gasoline (which are in the highly corporate list). Because it reduces capital taxation, it further cuts prices of agriculture (used to produce food), gasoline, and utilities (which are in the capital-intensive list). All of these goods constitute high fractions of low-income budgets. On the other hand, because the reform imposes only a single tax rate after the exemption, it cannot raise as much revenue from the rich as does the current progressive income tax. Therefore the highest-income group gains a relatively high percentage as well.

The second and third columns of Table 2 show that the wage-tax and comprehensive income-tax reforms have similar effects by lifetime income class. The lowest income groups gain the highest percentages, because all of these reforms reduce capital taxation, especially in the corporate sector, and these capital-intensive corporate goods are consumed disproportionately by the poor. The highest-income groups also gain, because of the flat rate structure.

III. Conclusion

This paper has pointed out important but neglected effects of tax reform on the uses side. Oddly enough, similar effects occur under any uniform and comprehensive tax reform, whether the current system is replaced by a consumption tax, a wage tax, or a pure income tax. Results on the uses side are driven by the nonuniform tax system being replaced. Any such reform that eliminates the current preferential treatment of housing would impose an additional one-time levy on the elderly, and any reform that eliminates the current double taxation of corporate capital would reduce the relative prices of corporate-capital-intensive goods bought by the poor.

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