The Effects Fundamental Tax Reform and the Feasibility of Dynamic Revenue Estimation

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by

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In this paper we analyze the impact of fundamental tax reform on U.S. economic growth over the next quarter century. We consider two alternative approaches to tax reform. The first is a flat rate consumption tax, similar to the one proposed by Hall and Rabushka (1985) and introduced in the 104th Congress by Majority Leader Dick Armey and Senator Richard Shelby. The second is an income-based value added tax, also with a flat rate. These taxes would be substituted for existing individual and corporate income taxes at federal and state and local levels. A full description of the two proposals is given by the Joint Committee on Taxation (1996). The goals of the study were twofold: to determine the effects of tax reform and to assess the feasibility of dynamic revenue estimation. In the remainder of the paper we present a short description of our model, an explanation of how we used it to assess the effects of tax reform, a summary of our results and some conclusions about both tax reform and revenue estimation.

I. An Overview of the Model

Our results are based on simulations of U.S. economic growth under alternative tax policies constructed using an intertemporal equilibrium model of the U.S. economy. The model is an extension of our earlier work on environmental regulation and has been continuously revised and updated since it was first published in 1990.[1] The version used for these simulations incorporates the detailed representation of the U.S. tax structure presented by Jorgenson and Yun

[1] Jorgenson and Wilcoxen (1990).

(1991). We present a detailed description of the model and summarize a variety of applications in Jorgenson and Wilcoxen (1993); in this section we summarize the key features of the model influencing our analysis of tax reform.

The model disaggregates the production side of the economy into the thirty-five industries listed in Table 1. Each of the 35 industries is represented by an econometrically estimated nested transcendental logarithmic unit cost function. At the function's top level, output is produced using capital, labor, energy and materials (KLEM). Capital and labor are both primary factors purchased directly from households. Energy and materials are translog aggregates of intermediate goods. The parameters in the cost functions are estimated using a set of consistent input-output tables we constructed for this purpose which span the period from 1947 through 1985.

The model also includes final demand submodels for consumption, investment, government spending, exports and imports. The consumption submodel distinguishes among 1344 types of households based on family size, age and gender of household head, region of residence, race, type of residence, and sex of household head, as shown in Table 2. We represent household behavior using the three-stage intertemporal optimization problem shown schematically in Figure 1. At the first stage, each household allocates full wealth (the sum of financial wealth, discounted future labor earnings and an imputed value of leisure time) across different time periods according to its rate of time preference and its intertemporal elasticity of substitution. We formalize this decision using a representative agent who maximizes an intertemporal utility function subject to an intertemporal budget constraint. In this version of the model we use a utility function which imposes the restriction that the intertemporal elasticity of subsitution be unity. The time preference rate is econometrically estimated using the Euler equation approach and is equal to about 0.0288, or 2.9%. The allocation of full wealth across time determines

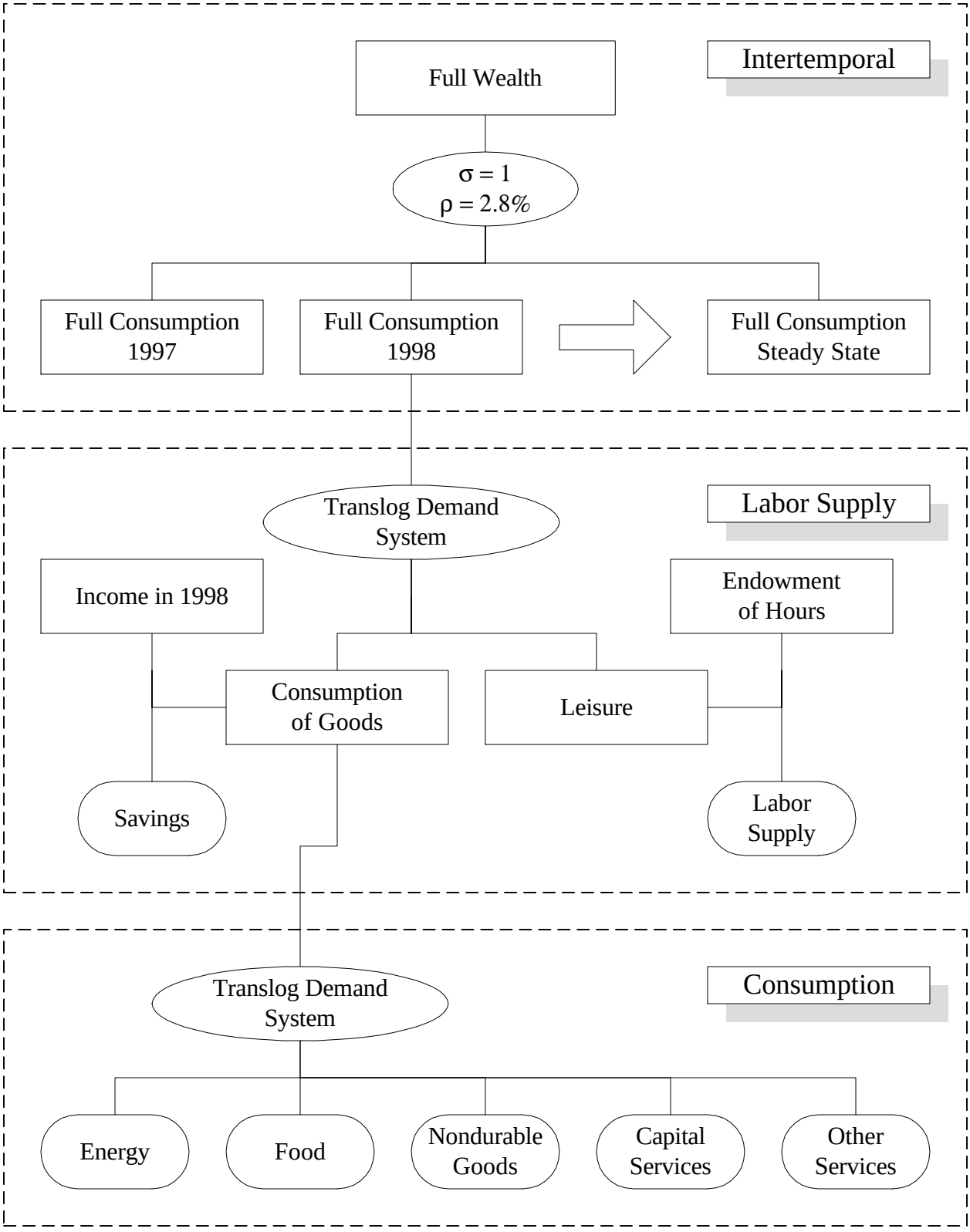
Table 1: List of Industries

Number	Description
1	Agriculture, Forestry and Fisheries
2	Metal Mining
3	Coal Mining
4	Crude Petroleum and Natural Gas
5	Nonmetallic Mineral Mining
6	Construction
7	Food and Kindred Products
8	Tobacco
9	Textile Milling
10	Apparel and Fabricated Textile Products
11	Lumber and Wood
12	Furniture
13	Paper and Allied Products
14	Printing and Publishing
15	Chemicals
16	Petroleum Refining
17	Rubber and Plastic
18	Leather
19	Stone, Clay and Glass
20	Primary Metals
21	Fabricated Metals
22	Non-electrical Machinery
23	Electrical Machinery
24	Transportation Equipment and Ordinance
25	Instruments
26	Miscellaneous Manufacturing
27	Motor Vehicles
28	Transportation
29	Communications
30	Electric Utilities
31	Gas Utilities
32	Trade
33	Finance, Insurance and Real Estate
34	Services
35	Government Enterprises

Table 2: Demographic Attributes of Households

Attribute	Categories
Family Size	1, 2, 3, 4, 5, 6, 7+
Age of Head	16-24, 25-34, 35-44, 45-54, 55-64, 65+
Region of Residence	Northeast, Midwest, South, West
Race	White, Nonwhite
Residence	Farm, Non-farm
Sex of Head	Female, Male

Figure 1: The Structure of the Household Model



consumption and saving in each period.

Once households have allocated full wealth they begin the second stage of their optimization: deciding on the mix of leisure and goods to consume in each period. As in the intertemporal allocation, we simplify the representation of household preferences between goods and leisure by the use of a representative consumer. The representative consumer has a translog intraperiod indirect utility function which depends on the prices of leisure and an aggregate consumption good. The estimated parameters in the model are such that the Allen elasticity of substitution between goods and leisure is about 0.8. We then derive the consumer's demands for leisure and goods in each period as a function of prices and the amount of full wealth allocated to the period. This produces an allocation of the household's time endowment, which is given exogenously, between leisure time and the labor market. Thus, the second stage of the consumer model determines labor supply.

In the simulations presented below the structure of existing taxes on labor income plays an important role. We approximate the tax code by a simple progressive tax that consists of a large zero bracket amount, which is exempt from tax, followed by a flat marginal rate that applies on all income above the zero bracket. The marginal tax is about 27 percent, which is the average marginal tax rate in our dataset. Average taxes on labor income are much lower, about 13%, because of the substantial large zero bracket.

The third stage of the household optimization problem is the allocation of consumption expenditures among capital, labor and the 35 commodities. At this stage, we depart from the representative consumer assumption and instead follow the methodology of Jorgenson, Lau and Stoker (1982) by formulating a system of individual household demand systems which can be aggregated. We then distinguish between 1344 household types noted above. For each of these

we follow the approach of Jorgenson and Slesnick (1987) by using a nested translog tier structure to represent demands for individual commodities.

Our investment model is based on the Q theory of Tobin (1969). We require that the present value of the returns expected on an extra unit of capital be equal to the purchase price of a new capital good.[2] We also assume there is a single capital stock in the economy which is perfectly malleable and can be reallocated between industries and final demand categories, including housing and consumer durables, at zero cost. This implies that capital will shift between uses until the after-tax rate of return is equated across the economy. New capital goods are produced out of individual commodities according to a production function estimated from historical data, so the price of new capital will be determined by commodity prices. The price of capital goods and the discounted value of future rental prices are brought into equilibrium by adjustments in the term structure of interest rates. Finally, the quantity of investment done in each period is determined by the amount of savings made available by households.

The two remaining final demand categories are the government and the foreign sector. Government consumption is determined from the income-expenditure identity for the government sector. We compute total tax revenue by applying exogenous tax rates to appropriate transactions in the economy. We then add the capital income of government enterprises (determined endogenously) and nontax receipts (exogenous) to tax revenue to obtain total government revenue. We take the value of the fiscal deficit to be exogenous and add it to total revenue to obtain total government spending. To arrive at government purchases of goods and services, we subtract interest paid to domestic and foreign holders of government bonds together

[2] We assume that there are no internal costs of adjusting the capital stock.

with government transfer payments to domestic and foreign recipients. We allocate the remainder among commodity groups according to fixed shares constructed from historical data.

Our treatment of the foreign sector includes a set of import and export demand equations for each commodity. For the purposes of domestic tax reform, however, the most important aspect of our foreign sector model is that we take the current account deficit, and hence the capital account surplus, to be exogenous. Since the fiscal deficit and the capital account surplus are both exogenous, any changes in investment must be financed by changes in domestic saving.

II. Modeling Fundamental Tax Reform

In order to analyze the economic impact of changes in tax policy, we simulate the growth of the U.S. economy with and without changes in these policies. The first and most difficult step is to generate the base case -- a simulation based on the assumption that current tax policy continues unchanged. We then produce alternative simulations based on substitution of the consumption or flat income taxes for the existing income tax. Finally, we compare the base case with the alternative cases in order to assess the economic impact of fundamental tax reform.

The first step in constructing the alternative cases is to specify as precisely as possible how the proposed changes would affect the tax system. A useful starting point for the definition of the consumption tax base is Personal Consumption Expenditures (PCE), as defined in the U.S. national income and product accounts. The taxation of services poses important administrative problems reviewed in the U.S. Treasury (1984) monograph on the value added tax. The rental equivalent value of the services of owner-occupied housing is included in PCE, but the services of consumers' durables are excluded. Both could be taxed by the "prepayment method" described by David Bradford (1986).

Housing and consumers' durables must be included in the tax base in order to reap the substantial economic benefits of putting household and business capital onto the same footing. Under the prepayment method purchases of consumers' durables by households for their own use would be subject to tax. This would include automobiles, appliances, home furnishings, and so on. In addition, new construction of owner-occupied housing would be subject to tax, as would sales of existing renter-occupied housing to owner-occupiers.

The prepayment of taxes on services of owner-occupied housing would remove an important political obstacle to substitution of a consumption tax for existing income taxes. At the time the substitution takes place all owner-occupiers would be treated as having prepaid all future taxes on the services of their dwellings. This is equivalent to excluding mortgage interest from the tax base, as well as returns to equity, which might be taxed upon the sale of residence with no corresponding purchase of residential property of equal or greater value.

Implementation of a flat rate income tax is very similar to that of a flat rate consumption tax. In defining the tax base economic depreciation rather than investment would be excluded from the tax base. Slemrod (1996) has pointed out that a income-base value added tax could be administered in the same way as a consumption-base tax by excluding the present value of economic depreciation, as proposed by Auerbach and Jorgenson (1980), rather than investment from the tax base. For example, purchases on capital account could be converted to Auerbach-Jorgenson depreciation allowances and deducted from value added.

In this paper we focus attention on long-run dynamics of fundamental tax reform. Concerns about progressivity could be addressed by adopting the methodology proposed by Feenberg, Mitrusi and Poterba (1997) for measuring the change in tax burdens in terms of levels of consumption of different households. This would make it possible to assess progressivity of the

proposals in terms of consumption rather than income, as in the distributional tables produced by the Joint Committee on Taxation.

Since state and local income taxes usually employ the same tax bases as the corresponding federal taxes, it is reasonable to assume that the replacement of income taxes at the federal level would be followed by replacement at the state and local level. For simplicity we have considered the economic impact of replacement at all levels simultaneously. Since an important advantage of a fundamental tax reform is the possibility, at least at the outset, of radically simplifying tax rules, it does not make much sense to assume that these rules would continue to govern state and local taxes, even if federal taxes were replaced.

Nearly two decades of economic dispute over the economic impact of the federal deficit have failed to produce consensus. This dispute could continue well into the next century and occupy the next generation of fiscal economists, as it has the current generation. An effective device for insulating the discussion of fundamental tax reform from the budget debate is to limit consideration to deficit neutral proposals. This device was critical to the eventual enactment of the Tax Reform Act of 1986 and is, we believe, essential to progress in understanding the economic impact of fundamental tax reform.

Finally, we hold net foreign investment constant, while allowing exchange rates to adjust. It might appear that elimination of taxes on capital income under a flat consumption tax would reduce net foreign investment by providing foreigners with incentives to acquire assets in the U.S. and domestic residents residents to sell foreign assets. However, the rise in exports that would result could require a substantial increase in net foreign investment. Within our modeling framework there is no way to assess the relative importance of these two economic forces, so that we assume that they will balance out.

III. The Effects of Tax Reform

We summarize our conclusions in a series of charts. We begin by examining a revenue neutral substitution of a flat consumption tax for existing taxes. Figure 2 shows that the required consumption tax rate would need to be initially about 23 percent. Of this, the federal rate would be approximately eighty percent of the total, or 18 percent. The remaining 5 percent would be the rate needed to replace state and local income taxes. Over time the rate gradually declines slightly and converges to around 22 percent.

The primary effect of the reform is to change the supplies of the economy's two primary factors, labor and capital. Figure 3 shows the time paths of labor and capital under the consumption tax expressed as percentage deviations from the base case. Labor supply increases sharply because the consumption tax raises real after-tax wages substantially at the margin. The reason is that the average marginal tax rate on labor income under the current tax system is fairly high (including all federal, state and local income taxes it comes to about 27%) and it is replaced by lower tax with a larger base. The consumption tax rate is comparable to the average tax paid on labor income but is much lower than the marginal rate. The immediate increase in labor supply probably overstates the true short run effect because our model does not include any labor market frictions. Workers are able to move from one industry to another, or into and out of the labor force altogether, without transactions costs.

Figure 3 shows that the reform would have only a small positive effect on the capital stock but this masks a very substantial shift of capital out of housing and consumer durables and into business capital. The shift comes about because the consumption tax would eliminate the mortgage interest deduction while providing more favorable tax treatment of business investment than exists under current law. This would cause a large reallocation of capital as shown in Figure

Figure 2: Expenditure-Neutral Tax Rate Under the Consumption Tax

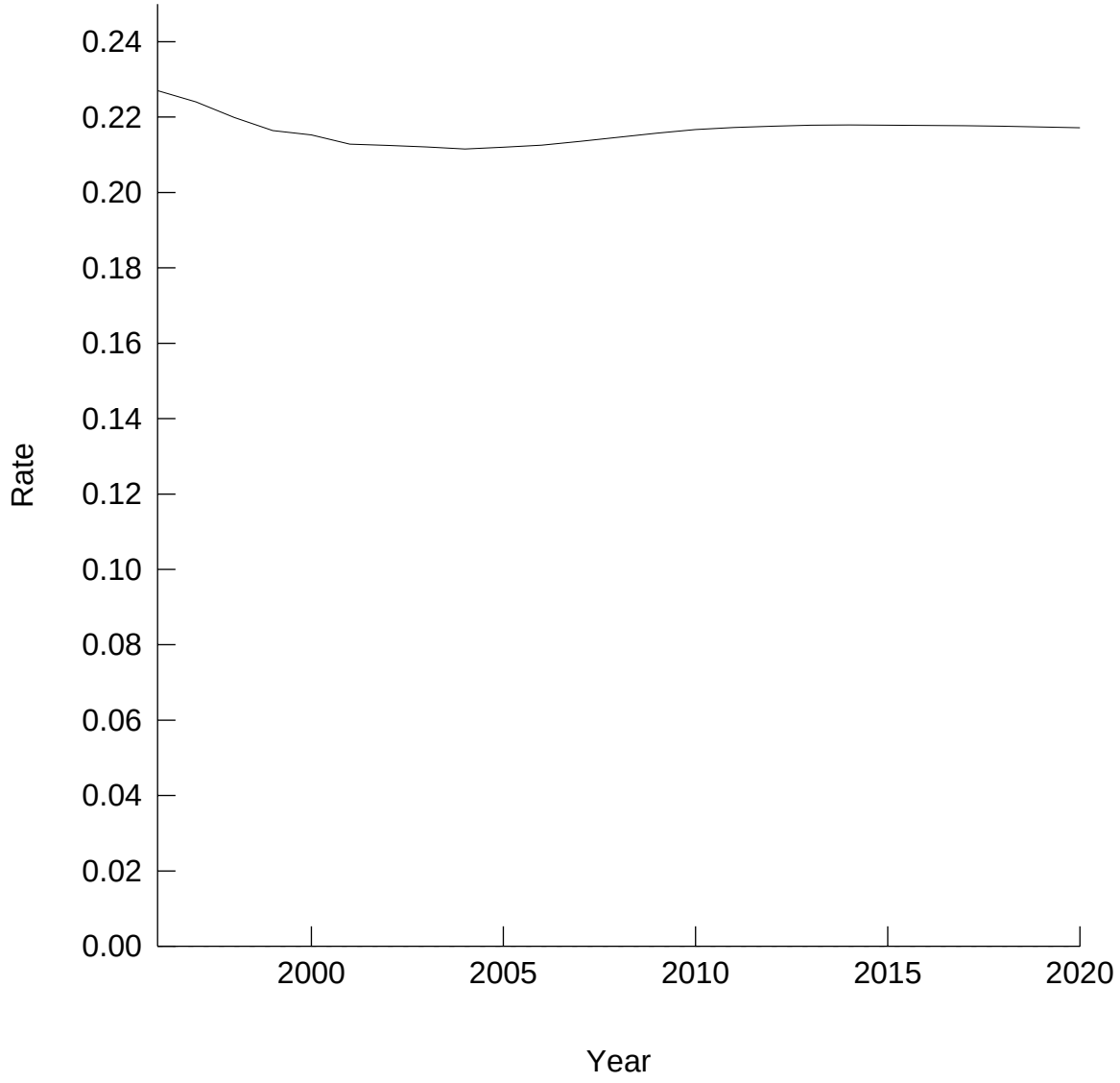
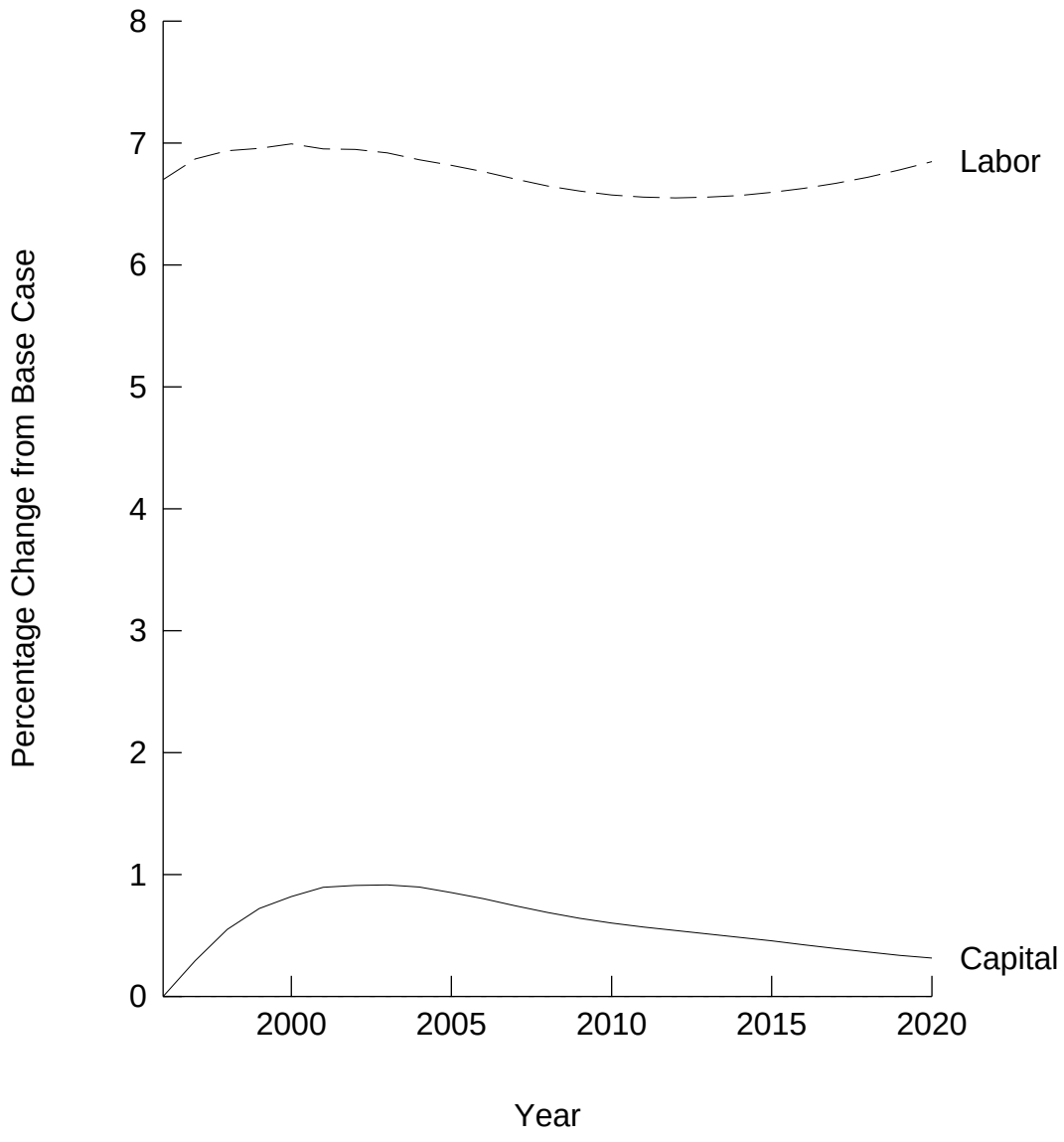


Figure 3: Effect of Tax Reform on Factor Supplies



4. Household capital would decline by about 10 percent and business capital would increase by about 12 percent. The reallocation happens immediately (that is, beginning in the first period after the change in tax systems) because we allow free mobility of capital between uses. This probably overstates the short run movement of capital out of housing.

Figure 5 shows the effect of the consumption tax on real GDP. GDP would increase by almost 3.3 percent in the first year relative to the base case due to the increase in labor supply,. This would rise gradually to a peak of 3.7 percent in 1999 and then decline to a long run level almost identical to the initial value of 3.3 percent over the next quarter century. Figure 6 shows that the composition of GDP would initially shift from consumption toward investment. Real investment would initially rise by 4.9 percent, relative to the base case, and then gradually fall to zero within the next decade. Consumption would initially rise by 2.9 percent and would eventually rise to a slightly higher proportion of the GDP than under the existing tax system.

Although GDP increases, the consumption tax does not increase overall welfare: the equivalent variation corresponding to it is essentially zero. The increase in GDP is brought about by higher labor supply and increased investment. This requires lower consumption of goods and leisure, particularly in the early years of the simulation, and tends to lower welfare and offset the effect on GDP.

Since producers would no longer pay taxes on profits or other forms of income from capital under a consumption tax, and workers would no longer pay taxes on wages, prices received by producers, shown in Figure 7, would fall by an average of around eight percent. Figure 8 shows that industry outputs would rise by an average of more than five percent. Although production would rise in all industries, economic activity would be substantially redistributed.

Figure 4: Effect of Tax Reform on Capital Stocks

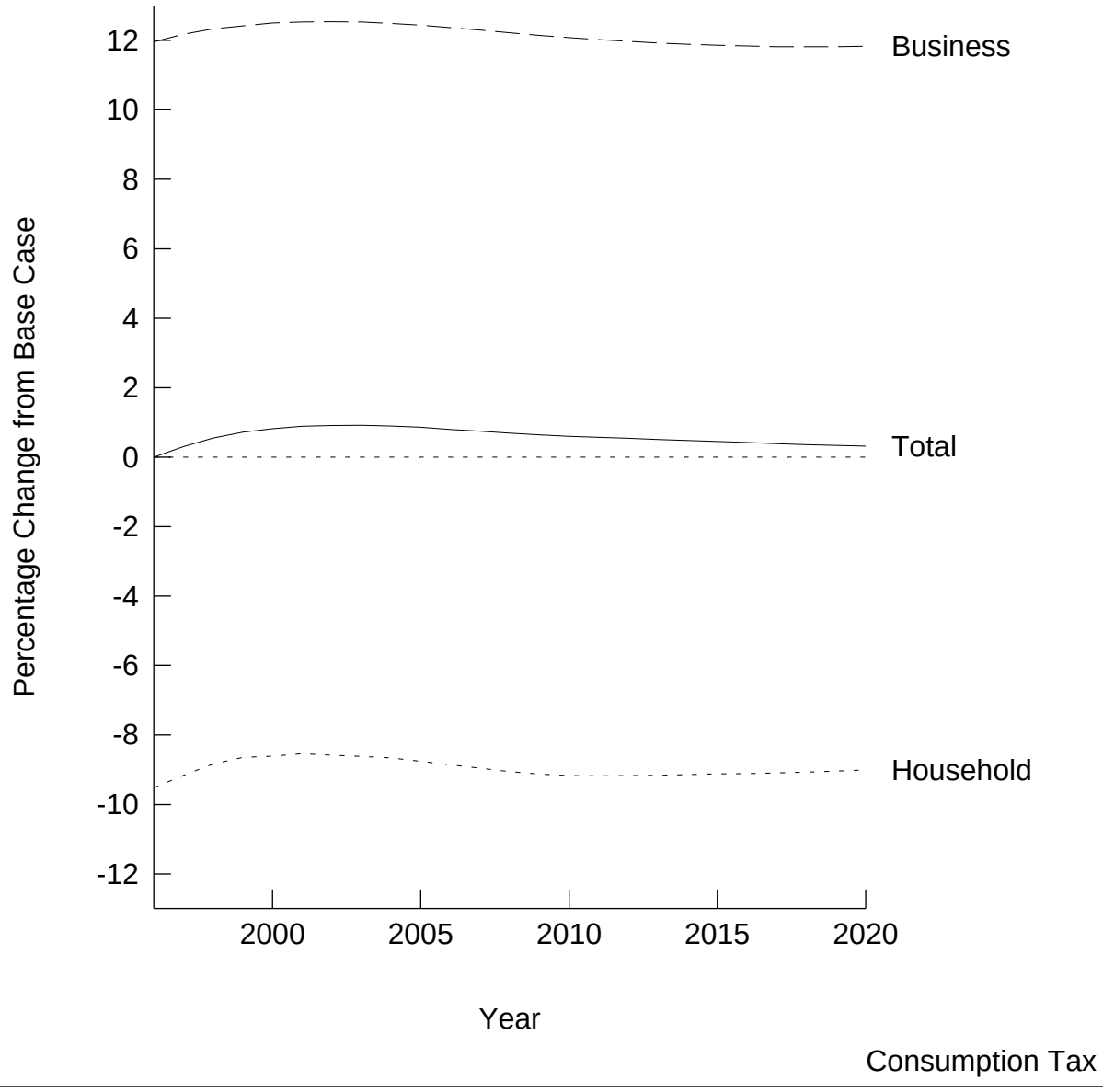


Figure 5: Effect of Tax Reform on Real GDP

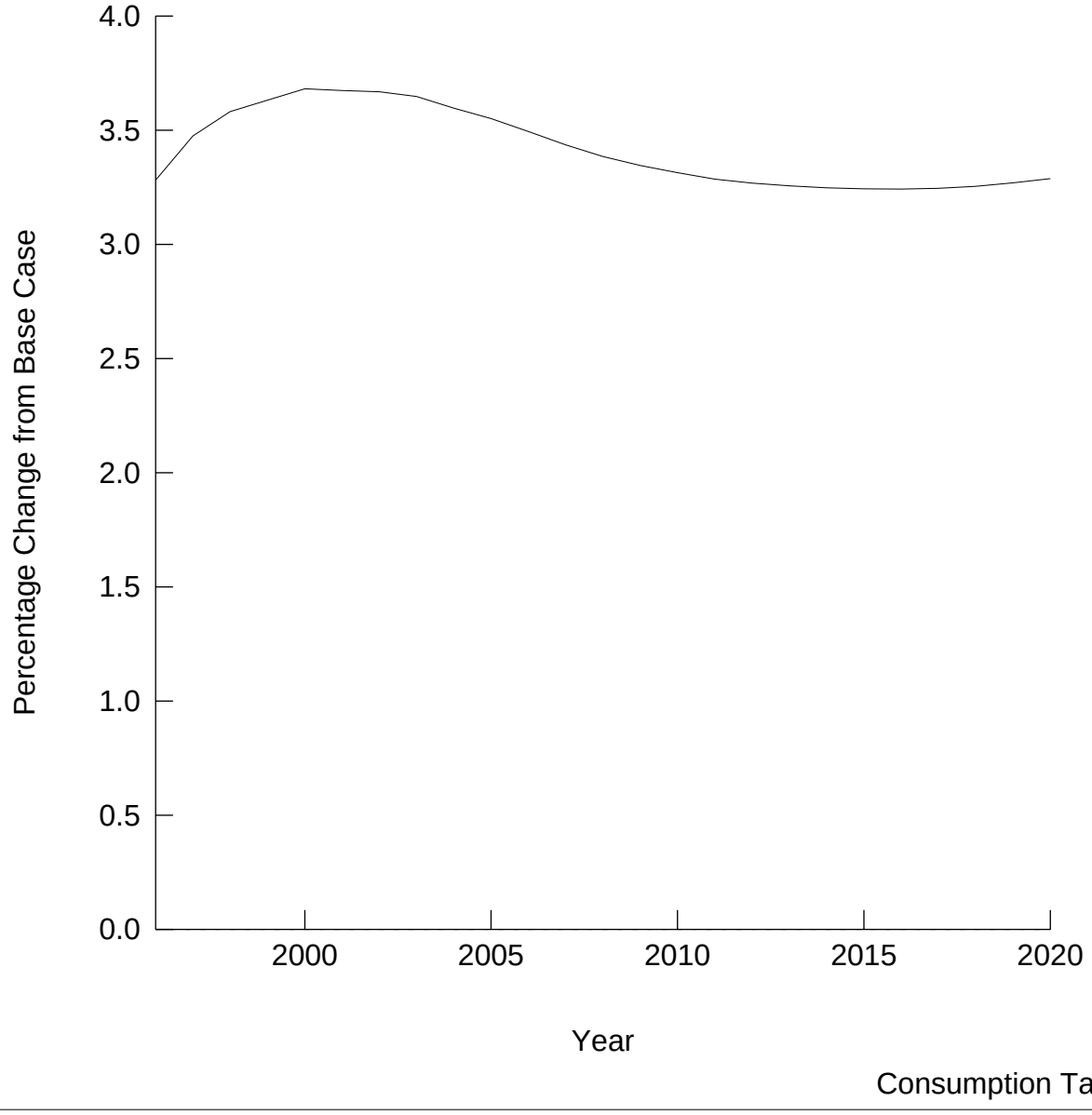
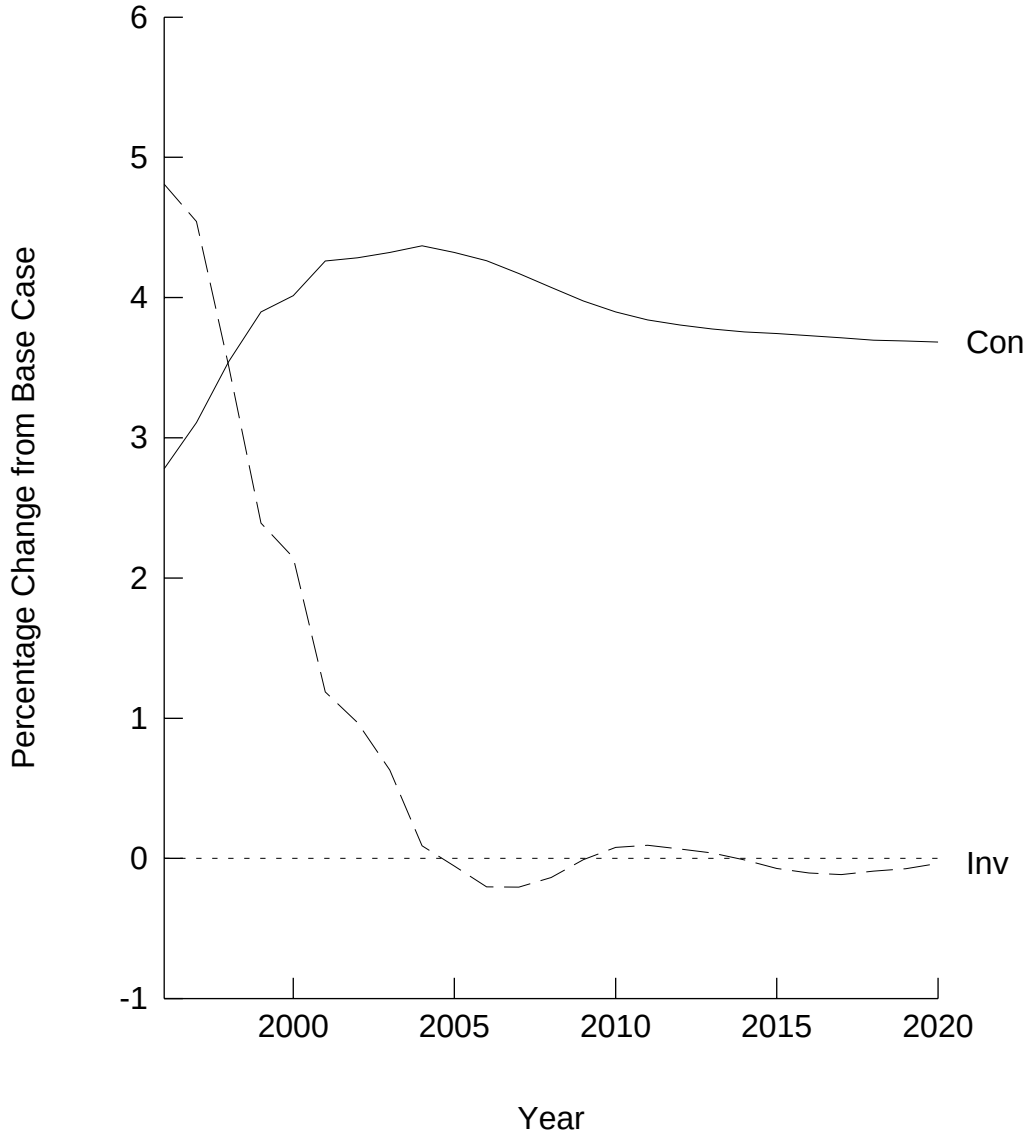


Figure 6: Effect of Tax Reform on Consumption and Investment



Consumption Tax

Figure 7: Effect of Tax Reform on Prices in 1996

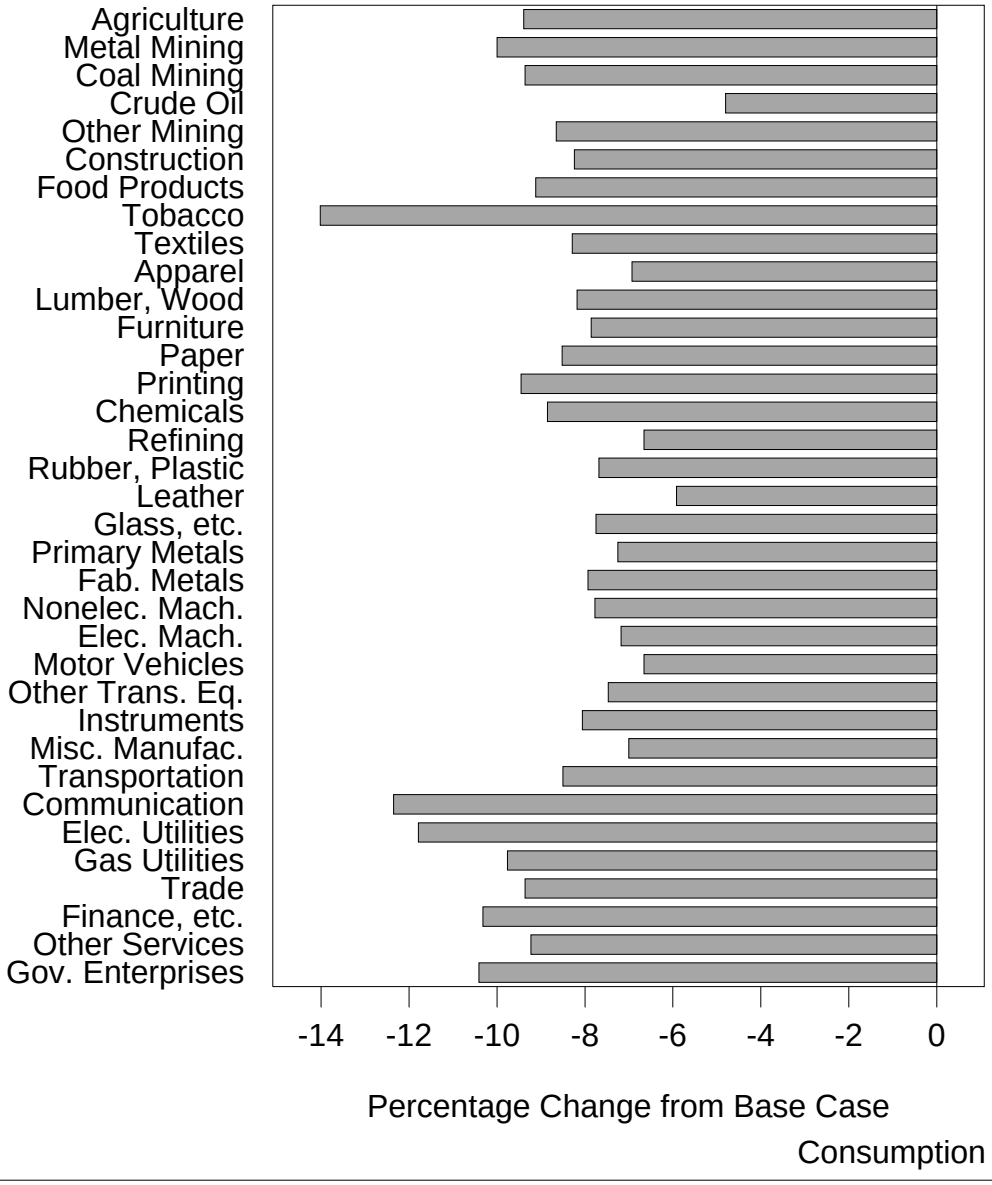
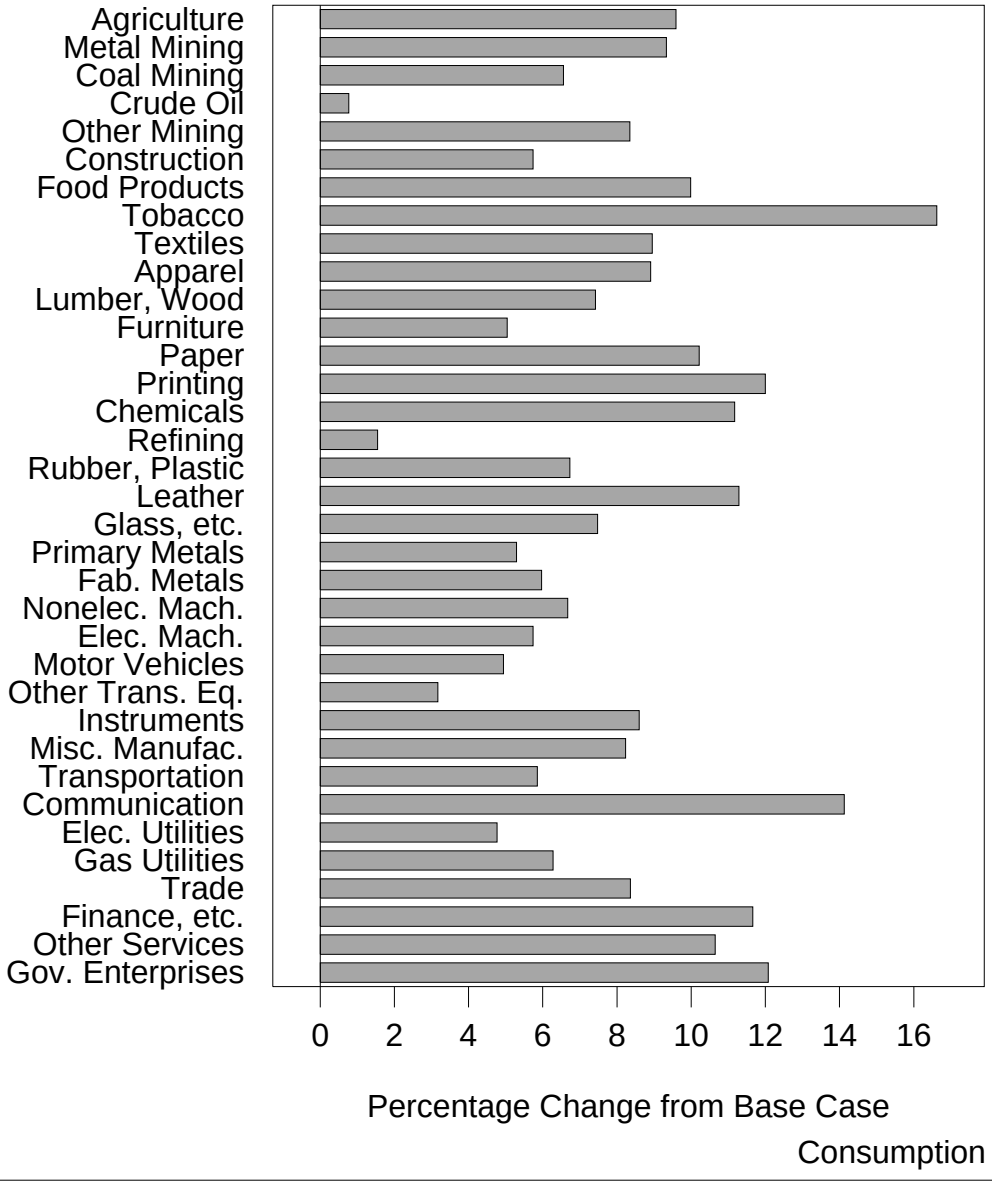


Figure 8: Effect of Tax Reform on Industry Output in 1996



A revenue-neutral substitution of a flat rate unified income tax for existing taxes would produce slightly different results. As show in Figure 9, the tax rate would be about 0.5 percent lower in each year. The reason is simply that the tax base would be larger because depreciation deductions would take less out of the tax base than the consumption tax approach of expensing all new investment. Put another way, these rates reflect the inclusion of net investment, as well as consumption, in the tax base under the unified income tax.

. The impact of a unified income tax on the level of economic activity is even more modest than that of a consumption tax. Figure 10 shows that GDP initially rises by slightly under 0.7 percent, but the impact gradually increases to more than 1.6 percent in 2002 and then subsides toward a long-run level of 1.4 percent. Figure 11 shows the effect of the tax on the composition of GDP. The income tax initially depresses investment by almost ten percent, but this decline falls to around four percent in the long run. The decline in the overall capital stock is due to the elimination of the mortgage interest deduction and the resulting decline the housing capital. Consumption initially jumps by more than four percent, but this declines toward a long-run level of around two percent.

Under the flat income tax, differences in taxes on capital and labor incomes are eliminated and marginal tax rates are lowered substantially. Figure 12 shows that the initial impact is to reduce prices at the producer level by an average of eight percent, while Figure 13 shows that, unlike the results for the consumption tax, this is associated with increases in outputs of some industries and decreases in others.

Figure 9: Expenditure-Neutral Tax Rate Under the Unified Income Tax

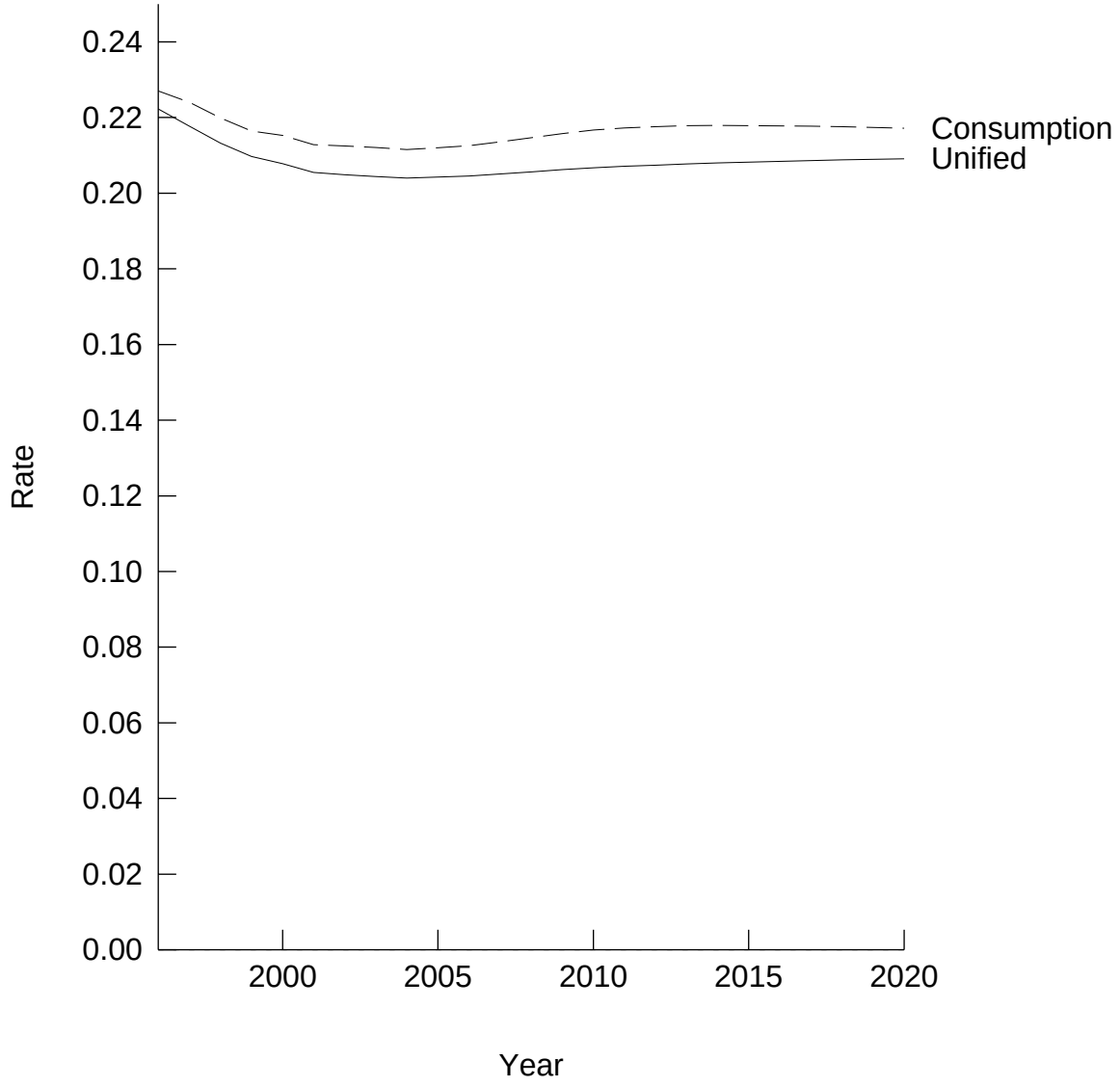


Figure 10: Effect of Tax Reform on Real GDP

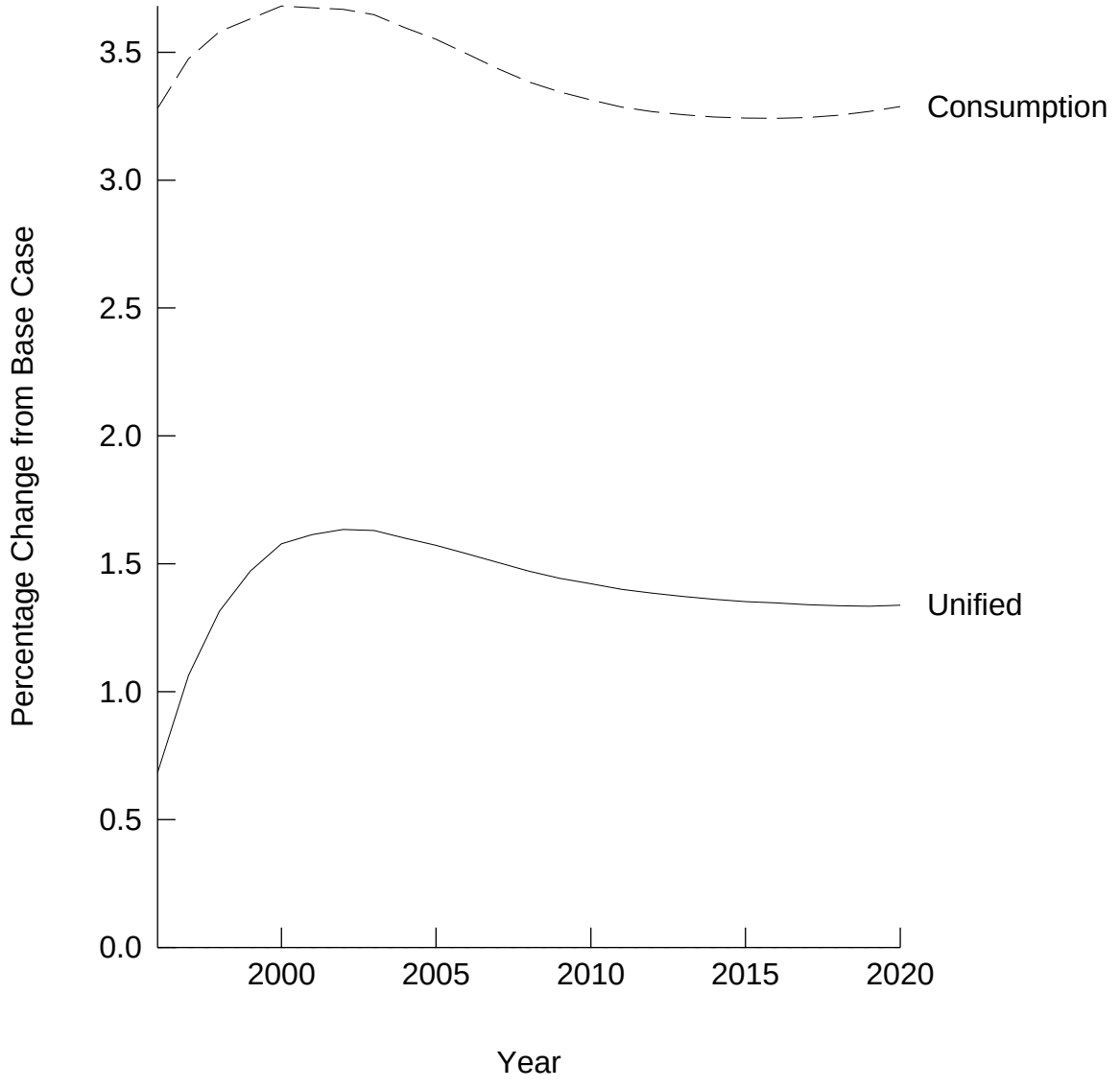


Figure 11: Effect of Tax Reform on Consumption and Investment

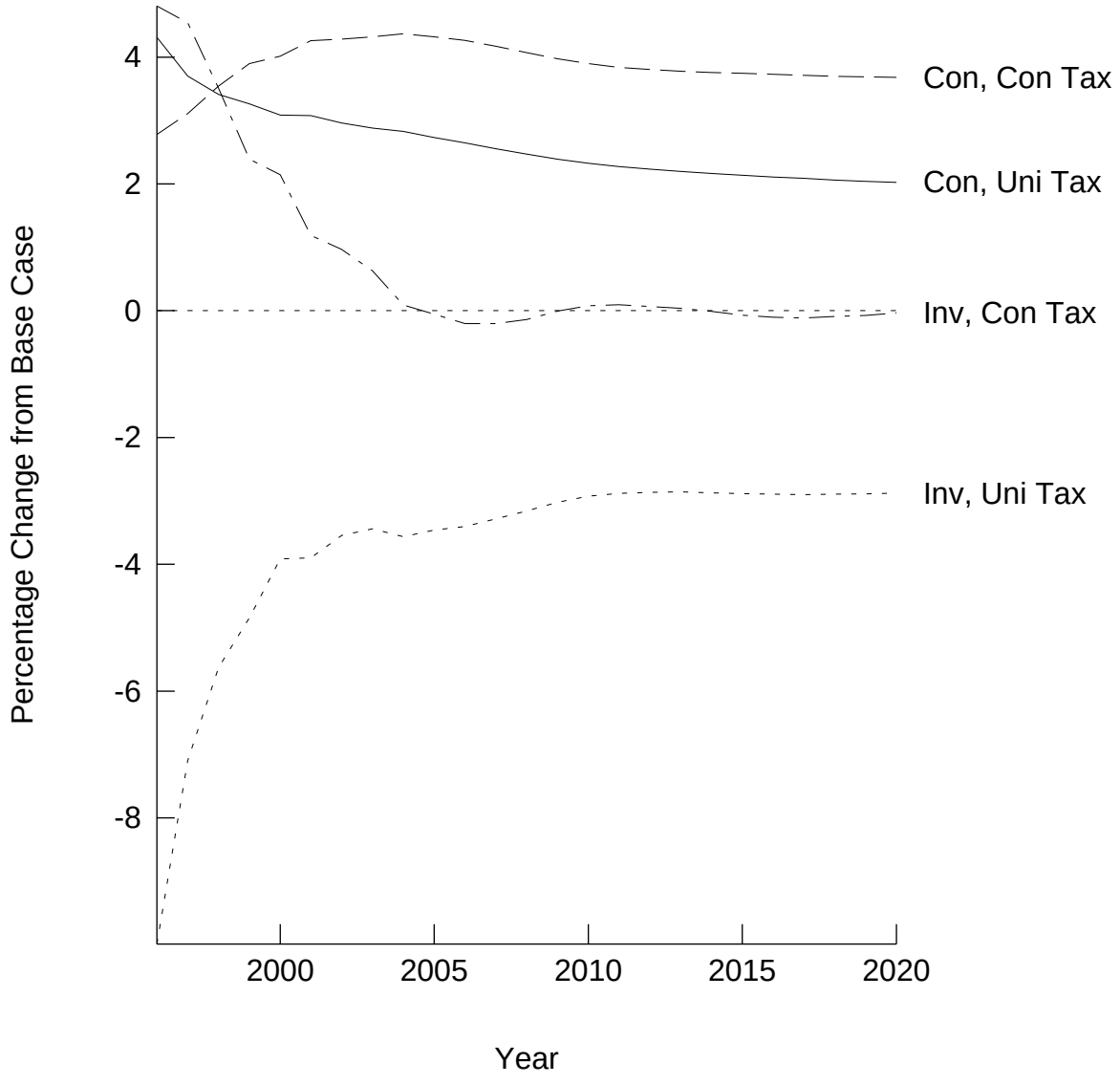


Figure 12: Effect of Tax Reform on Prices in 1996

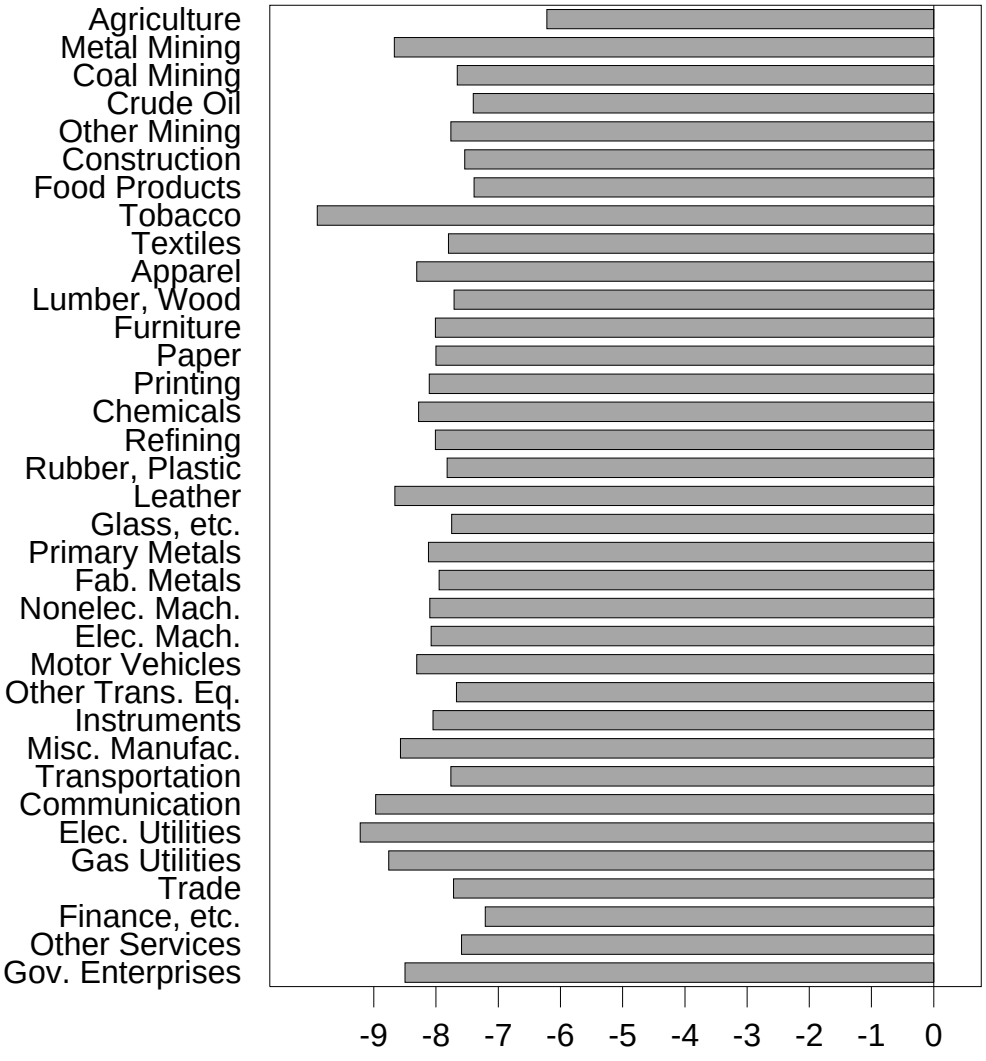
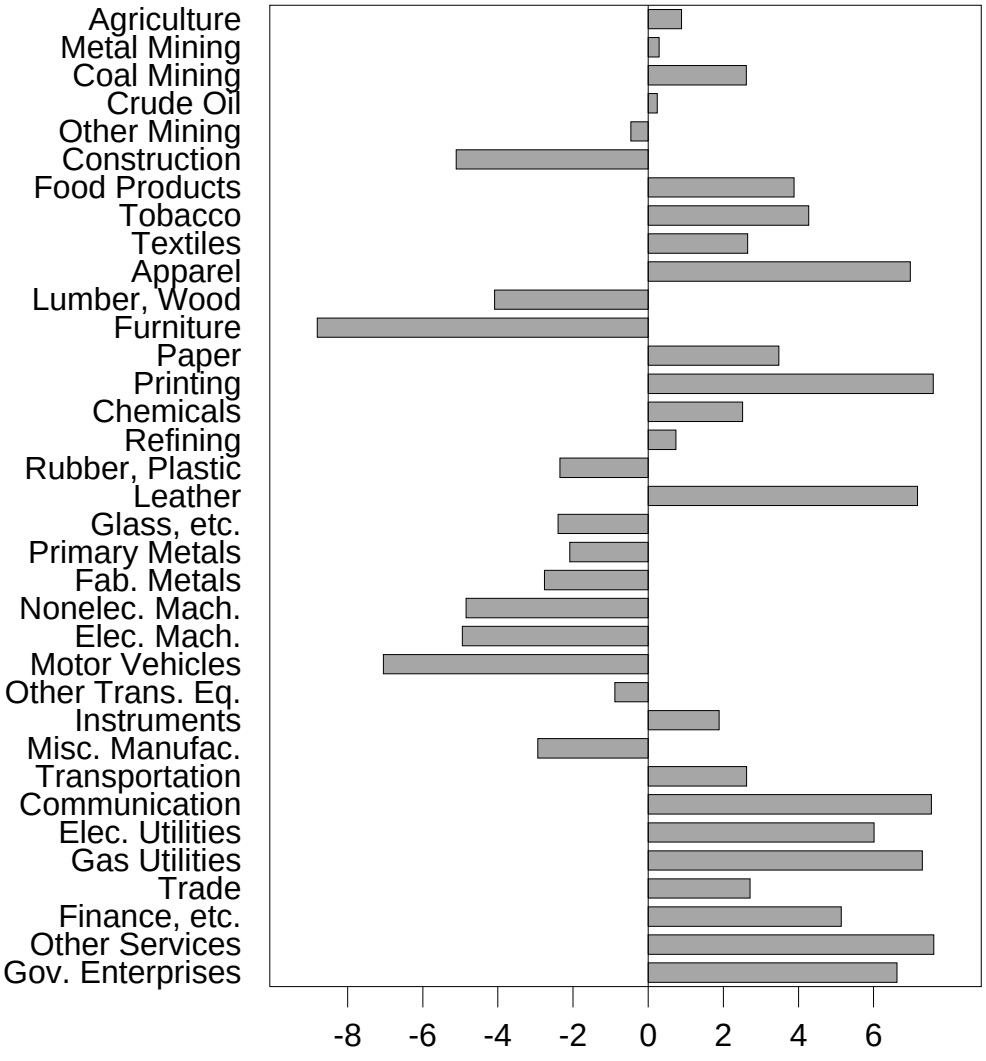


Figure 13: Effect of Tax Reform on Industry Output in 1996



IV. Conclusion

Substitution of flat rate consumption or income taxes for existing taxes would be the most drastic change in federal tax policy since the introduction of the income tax in 1913. Therefore, it is somewhat surprising that the economic impacts we have summarized would be so modest. In fact, in the case of the consumption tax it appears that the major gain from tax reform would be a reduction in the substantial compliance costs associated with the existing tax system, estimated to range from $100 to $500 billion per year. These benefits are large and are not captured by our model.

Our study reaches mixed conclusions on the question of dynamic revenue estimation. On one hand, our model and most others based on general equilibrium analysis are probably not suitable for very short term analysis. The model assumes too much mobility of labor and capital to be able to represent the economy well over very short periods of time. In addition, general equilibrium models will generally be far less detailed than one might like for revenue estimation. Although our model contains over 1000 consumer groups, which is large for a general equilibrium model, that is far less than could be attained with microsimulation. However, it is quite clear from our results that fundamental tax reform will produce very substantial effects on factor supplies and on relative prices, and these effects can only be captured by general equilibrium analysis. Thus, general equilibrium models have an important role to play in the analysis of fundamental tax reform, particularly when examining effects over the medium to long term, but they should not be the only tool used for dynamic revenue estimation.

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