The Economic Effects of the FairTax:

Results from the Beacon Hill Institute CGE Model

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Executive Summary

In 2007, Representative John Linder filed legislation in the form of H.R. 25, the Fair Tax Act of 2007.[1] Senator Saxby Chambliss is expected to introduce companion legislation in the Senate, as he did in the previous Congress. This legislation calls for abolishing most existing federal taxes, including the personal and corporate income taxes, payroll taxes, and the estate and gift taxes and replacing them with a national retail sales tax. Under the FairTax, the federal government would raise almost all of its revenue by taxing sales at a "tax-inclusive" rate of 23 percent.[2] To offset otherwise "regressive" effects of the sales tax, the government would provide each qualified household with a transfer payment (called a "prebate") set just high enough to cover the sales tax paid by households living at the poverty line.

The Fair Tax Act has several objectives, including tax simplification and economic growth. The purpose of this report is to identify the economic effects of the FairTax. To this end, the report provides the findings of the Beacon Hill Institute's Computable General Equilibrium (CGE) model, developed for the purpose of determining the effects of the FairTax proposal on major economic indicators. The model was constructed in 2006 and we used the implementation date of January 1, 2007 contained in the Fair Tax Act of 2005, the relevant bill at that time.

The findings for 2007 through 2031 are summarized in Table 1 below. The table shows the percentage difference in each indicator resulting from implementation of the FairTax for selected years 2007 to 2031. For example, real GDP would be 7.9 percent higher in 2007 under the FairTax than under the "benchmark" current law and 10.3 percent higher by 2031.

Table 1. Summary of Effects of the FairTax Relative to Current Law (% change), 2007-2031

	2007	2008	2009	2010	2011	2016	2021	2026	2031
Year	**1**	**2**	**3**	**4**	**5**	**10**	**15**	**20**	**25**
Real GDP	7.9	9.3	9.9	10.3	10.7	10.9	10.7	10.5	10.3
Domestic investment	74.5	88.4	88.0	87.1	86.3	75.9	69.0	65.7	65.2
Capital stock	0.0	2.8	5.3	7.5	9.3	14.1	16.0	16.9	17.3
Employment	11.9	12.0	11.2	10.5	9.9	7.6	6.1	5.3	4.7
Real wages	10.3	10.6	10.4	10.3	10.2	9.5	9.1	9.0	9.2
Consumption	-0.6	-0.8	0.2	1.1	1.8	4.3	5.5	5.9	6.0

The BHI CGE model is a dynamic model in which households make decisions regarding work and saving, taking into account the effects of tax law changes on their lifetime "utility" or well-being. For this report, we modeled the representative household as adjusting its economic behavior in year 2006 onward assuming that the FairTax would have taken effect on January 1, 2007. The household enters 2007 with a view toward maximizing the present value of its future utility, given that introduction of the FairTax will increase the relative attractiveness of work and of saving in that year and in future years.

In particular, the household would find that, with the replacement of the existing income tax by a national sales tax, the reward for increased work and saving would rise, motivating economic

[1] In the 109th Congress the bills were H.R. 25 and S. 25. In the 110th Congress the Fair Tax Act is H.R. 25 in the House but as of February 1 was not yet reintroduced in the Senate.

[2] This means that the tax on a good priced at $77.00 would be $23.00, so that the total price is $100. The "tax-exclusive" rate would be about 30 percent (= 23/77).

"agents" (i.e., households and firms), beginning in 2007, to expand both. The capital stock would remain unchanged in the first year of the FairTax because incremental investment in that year would add only to the usable capital stock in the following year. But the capital stock would begin to increase in 2008 and eventually rise to 17.3 percent above the benchmark in 2031. Consumption would fall slightly in 2007, as agents would find it in their interest to take full advantage of the FairTax and substantially increase their investment. Consequently, investment would rise quickly to 88.4 percent above the benchmark in 2008. Consumption would rise steadily to 6.0 percent above the benchmark in 2031, as households take advantage of the increased income made possible by the increased capital formation.

These effects are largely driven by the fact that the FairTax would eliminate the existing "double taxation" feature of current law. To understand this feature, consider a wage earner who wants to save part of his income. That wage earner pays a tax once when he receives his wage and pays a tax a second time when he receives a return (interest, dividends, capital gains) on his saving. Because the FairTax would fall on consumption, not "income" conventionally defined, wage earners would pay a tax only when they consume. Eliminating the double tax on saving would encourage saving, investment, and capital formation, leading to an increase in production, as our results show.

All economic variables (real GDP, investment, labor compensation, consumption, and employment) show persistent growth under the FairTax simulation. The increase in the value of these variables is moderate in the first four years of the FairTax. However, a stronger incentive to invest and save would cut into consumption and the greater incentive to work would cut into leisure. These effects occur because of the efficiency gains from the FairTax. These are reflected in the higher growth rates over the next 20 years.

I. Introduction

The U.S. federal tax code has undergone major changes since the last important attempt at tax simplification in 1986. In the intervening years, Congress enacted legislation to raise and then lower income tax rates, reduce the tax rates on capital gains and dividends, increase deductions for IRA contributions, create medical savings accounts, increase the earned income tax credit for the poor, and make other changes. The result is over 60,000 pages of tax code, rules, and rulings. Additionally, despite recent changes aimed at reducing the burden on saving, the existing tax code continues to discriminate against saving, thus imposing a drag on capital formation, production, and economic growth.

This state of affairs has revived interest in tax reform. Several groups and legislators have proposed alternative plans. The FairTax plan is one such proposal. It essentially aims to replace most current federal taxes with a national sales tax. In 2007, Representative John Linder filed legislation in the form of H.R. 25: The Fair Tax Act of 2007.[3] Senator Saxby Chambliss is expected to introduce companion legislation in the Senate, as he did in the previous Congress. A number of other plans have emerged. These include publisher Steve Forbes's "flat tax" proposal and proposals from the President's Advisory Panel on Federal Tax Reform, issued on November 1, 2005.[4]

H.R. 25 would replace most of the existing federal taxes with a comprehensive consumption tax, effective January 1, 2009. The Fair Tax Act would repeal the federal income tax (including the capital gains and the alternative minimum tax), the corporate income tax, federal payroll taxes, the self-employment tax, and the estate and gift tax. It is intended to be revenue neutral and would replace the lost federal revenue with a national retail consumption tax (the "FairTax"), levied at a tax-inclusive rate of 23 percent.

Neal Boortz and Congressman John Linder, prominent FairTax advocates, claim that in the first year after implementation of the FairTax the economy would grow by 10.5 percent, exports by 26 percent, and capital spending by more than 70 percent.[5] Laurence J. Kotlikoff and Sabine Jokisch, using an overlapping-generations open-economy simulation model, estimate that in 25 years the introduction of a FairTax would raise the capital stock by 43.8 percent, the real pre-tax wage by 11.5 percent, and national income by 9.4 percent.[6] Arduin, Laffer & Moore Econometrics find that the FairTax would increase total economic output by 11.3 percent ten years after implementation. Investment would be 41 percent higher and employment 9 percent higher.[7]

II. Overview of the BHI Model

Sweeping tax changes such as the FairTax proposal exert effects throughout the economy – "general equilibrium effects" – on variables such as prices, incomes, employment, savings, interest rates, and exchange rates. The most appropriate tool for quantifying these effects is a

[3] In the 109th Congress the bills were H.R. 25 and S. 25. In the 110th Congress the Fair Tax Act is H.R. 25 in the House but as of February 1 was not yet reintroduced in the Senate.
[4] See Forbes (2005) and President's Advisory Panel on Federal Tax Reform (2005).
[5] Boortz and Linder (2005) p. 106.
[6] Kotlikoff and Jokisch (2005). See Table 4.
[7] Arduin, Laffer & Moore Econometrics (2006).

Computable General Equilibrium (CGE) model. Since their beginnings in the 1970s, CGE models have been used to address tax issues and are routinely used by government agencies such as the U.S. Treasury, the Congressional Budget Office, and the International Trade Commission for policy analysis.[8]

The Beacon Hill Institute has constructed a large, disaggregated dynamic national CGE model of the United States economy. In this paper, we report the results of applying this model to trace the effects of the introduction of the FairTax.

A CGE tax model is a formal description of the economic relationships among producers, households, government, and the rest of the world. It is general in the sense that it takes all the important markets and flows into account. It is an equilibrium model because it assumes that demand equals supply in every market (for goods and services and labor and capital); this is achieved by allowing prices to adjust within the model (which is to say that prices are endogenous). It is computable because it can be used to generate numerical solutions to concrete policy and tax changes with the help of a computer. And it is a tax model because it pays particular attention to identifying the role played by different taxes.

CGE models are typically large and complex; the BHI CGE model has about 15,000 variables and nearly 2,000 lines of computer code. Every run of the model produces 1,330 pages of output. The intellectual antecedents of the BHI model include a static CGE tax model for California developed by Berck, et al. and the dynamic models developed by Thomas Rutherford and others, as well as BHI's own "STAMP" (State Tax Analysis Modeling Program) line of models.[9] CGE models are particularly well-suited to analyzing tax policy questions: California developed its CGE model with state funding after passing a law (SB 1837 in 1994) requiring the Department of Finance to perform "dynamic revenue analysis" of any proposed legislation with a revenue impact of $10 million or more. In this context, a dynamic revenue analysis differs from a static revenue analysis in that it takes into account the secondary effects of tax changes; for instance, a lower property tax might leave more money in people's pockets and so, as they spend more, revenue from the sales tax might rise, offsetting in part the initial cut in the property tax.

The household is at the core of the model. Households own the factors of production – land and capital. They are assumed to maximize their lifetime "utility," which they derive from consumption and leisure, both now and in the future. Households have two key sets of decisions to make: How much to work and how much to save. If they work more, they earn more and so can afford to consume more. The savings decision is based on a tradeoff between consumption now and consumption in the future. Households are forward-looking, so that if they see a tax change in the future, they may react by changing their decisions even now. One reason for building a dynamic CGE model is to ensure that decisions about savings and investment are made within the model itself rather than imposed arbitrarily by the modeler.

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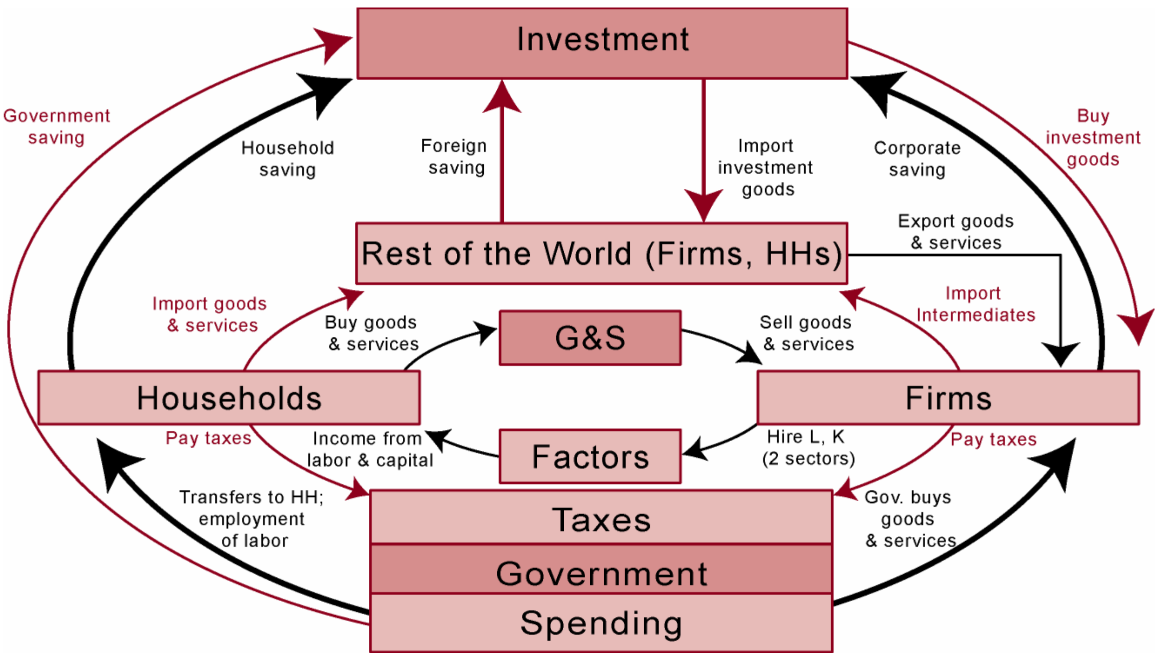
[8] For a clear introduction to CGE tax models, see Shoven and Whalley (1984) p. 1008. Shoven and Whalley have also written a useful book on the practice of CGE modeling titled *Applying General Equilibrium* (Cambridge: Cambridge University Press, 1992).

[9] Berck, et al. (1996). See also Bhattarai (2001). For more information on STAMP see http://www.beaconhill.org/STAMP_Web_Brochure/StampOverview.html.

The other major actor is the government, which imposes taxes and uses the revenue to spend on goods and services as well as to make transfer payments to households. There is also a production sector where producers buy inputs (labor, capital, and intermediate goods that are produced by other producers) and transform them into outputs. Producers are assumed to maximize profits and to base their decisions about how much to buy or produce on the prices they face for inputs and outputs. And there is a rest-of-the-world sector that provides goods (U.S. imports) to the United States and that purchases goods (U.S. exports) from the United States. Any deficit in the current account is just matched by a surplus in the capital account. If there is a trade deficit, the rest of the world is, in effect, lending to the United States.

The relationships between these components are set out in the circular flow diagram shown in Figure 1.[10] The arrows in the diagram represent flows of money (for instance, households buying goods and services) and flows of goods and services (for instance, households supplying their labor to firms). The separate box for government shows the flows of funds to government in the form of taxes, as well as government purchases of goods and services and government hiring of labor and capital.

Figure 1. Circular Flow in a CGE Model.



Complex as it may seem, Figure 1 is still very simple because it lumps all households into one group and all firms into another. To provide further detail it is necessary to create *sectors*. The BHI CGE model has 69 economic sectors. Each sector is an aggregation of individual segments of the economy. We separate households into 7 income classes and firms into 27 industrial sectors. In addition, we distinguish between 19 types of taxes and funds (9 at the federal level and 10 at the state and local level) and 11 categories of government spending. To complete the model, there are 3 factor sectors (labor, domestic capital, and foreign capital), an investment sector, and a sector that represents the rest of the world. The choice of sectors was dictated by

[10] Based on a similar diagram in Berck, et al. (1996).

the availability of suitably disaggregated data (for households and firms) and the purposes of the model.

The underlying data are gathered into a 69 by 69 social accounting matrix (SAM), which includes an input-output table as one of its components.

We can summarize the model as follows:

1. Rational households make economic choices to maximize their lifetime utility from the consumption of goods and services and leisure. Their utility functions are nested at three different levels. In each period, one composite commodity is made out of 27 domestic and imported goods. Households consume this composite commodity along with leisure to generate instantaneous utility. Finally, households choose the profile of consumption and leisure that maximizes their lifetime utility. Eliminating the personal income tax, corporate income tax, payroll taxes, and estate taxes at the federal level and applying the FairTax affects the choices of the households, leading to a reallocation of consumption, saving, and leisure that causes aggregate savings, employment, output, and other macroeconomic variables of the economy to change.

2. In each period, an investor collects investment goods that he allocates to various production sectors, depending on the rate of return specific to each. Each production sector has an initial endowment of capital that depreciates at a given rate and that, along with the net investment that takes place in a given period, constitutes the capital stock in the next period. The capital stock in each sector complements the labor input and domestic and imported intermediate inputs in production. The implementation of the FairTax raises the levels of investment and capital stock by removing the sector-specific distortions caused by the existing tax system in the benchmark economy.

3. Total investment in the national economy consists of the investment activities of domestic and foreign investors. Though foreign direct investment (FDI) comprises a relatively small proportion of total investment – about 10 percent – it can be important from the point of technological diffusion and the penetration of U.S. markets by foreign firms. Opening capital markets in this manner can have a significant impact on the level of welfare of households in the economy in two ways: The repatriation of capital income by foreigners will not only reduce the amount available to domestic households but will also make them more vulnerable to external shocks.

4. The benchmark reference path of the economy is represented by the steady-state growth rate for quantities of all goods and services and a common discount rate for prices of each commodity. Implementation of the FairTax in 2007 gives a positive shock to this steady state, leading to a more favorable outcome in terms of employment, output, well-being, and living standards. The economy moves toward a steady state as it moves toward the terminal period.

5. Trade in the model is represented by the standard Armington assumption, which aggregates domestic products with imported commodities into the aggregate supply of goods and services. A constant elasticity of transformation (CET) function denotes the allocation between domestic sales and exports. The elasticity of substitution between

domestic and imported commodities explains how domestic or imported commodities are to be combined in aggregate supply.

6. The model includes federal, state, and local governments. The FairTax is revenue neutral for the federal government in the first year of implementation.

7. Analysis shows that model results are sensitive to alternative elasticities of substitution between labor and capital, between consumption goods, between consumption and leisure, and between levels of utilities in each period.

III. The Formal Specification of the BHI Model

Infinitely-lived households maximize the present value of utility, as shown in equation (1), which derives from the consumption of goods and services (C_t^h) and leisure (L_t^h), shown in equation (2). Time that is not spent in leisure is devoted to work (LS_t^h). Welfare and utility of households in this model is nested in three different levels. A composite consumption good for each household is produced from 27 domestic ($C_1, C_2, \ldots, C_{27}$) and imported commodities ($C_{1m}, C_{2m}, \ldots, C_{27m}$) at the bottom of the nest (see Figure 2).

The second nest shows how households receive utility U_t^h from consuming goods and services, C_t^h, and leisure, L_t^h, where one can evaluate the trade-off between labor and leisure on one hand and establish a link between labor and the level of consumption on the other. A hard-working household will have more labor income to spend on consumption but will be left with less leisure. The ultimate aim of a household is to optimize its lifetime utility (LU^h) from choices made over the periods in the model. All U.S. households are categorized in one of the seven categories and indexed by *h* = 1, 2,…, 7.

The model follows major features outlined in Bhattarai.[11] In the model, infinitely-lived households allocate lifetime income to maximize lifetime utility, which is defined as:

$$(1) \qquad LU^h = \sum_{t=0}^{\infty} \beta^t \frac{U_t^{h,1-\sigma_{lu}^h} - 1}{1-\sigma_{lu}^h} ,$$

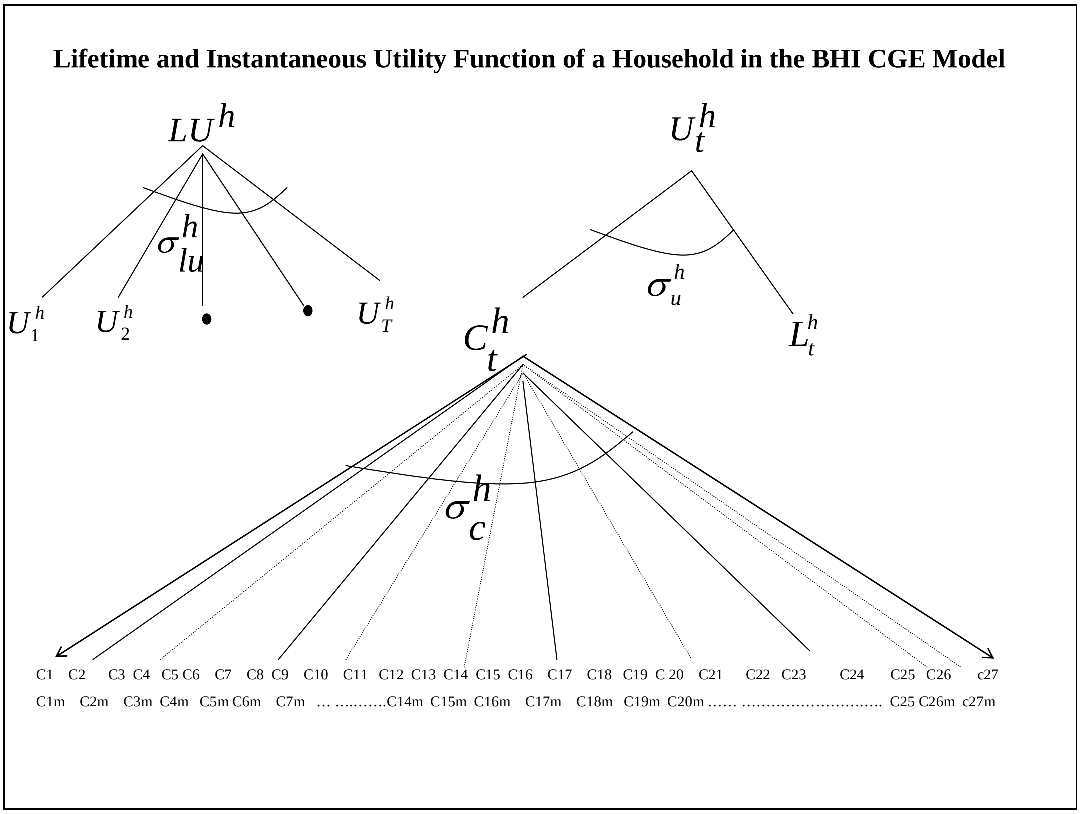
where β is the discount factor and depends on the rate of time preference, LU^h is the lifetime utility of the household *h*, σ_{lu}^h denotes inter-temporal substitution of household h, and U_t^h is its instantaneous utility function:

$$(2) \qquad U(C_t^h, L_t^h) = \left(\alpha_c^h C_t^{h\,\frac{\sigma_u^h - 1}{\sigma_u^h}} + (1-\alpha_c^h) L_t^{h\,\frac{\sigma_u^h - 1}{\sigma_u^h}} \right)^{\frac{\sigma_u^h}{\sigma_u^h - 1}} .$$

[11] Bhattarai (2001). See also Bhattarai (2005).

Here C_t^h is composite consumption in period *t*, L_t^h is leisure in period *t*, α_c^h is the consumption share of household *h*, and σ_c^h and σ_u^h respectively represent elasticities of substitution between goods and services and between consumption and leisure. The larger the value of σ_u^h, the more responsive are consumption and labor supply to changes in commodity prices and wage rates.

Figure 2. Nesting of Utilities



The representative household faces an inter-temporal budget constraint whereby the present value of its consumption and leisure in all periods cannot exceed the present value of infinite lifetime full income (wealth constraint). Lifetime income in this model includes the value of the household's labor endowment and other income under the benchmark economy:

$$(3) \qquad \sum_{t=0}^{\infty} \mu(t)(P_t(1+t^{vc})C_t^h + w_t^h(1-t_l)L_t^h) = W^h .$$

Under the FairTax there is no tax on income, only a sales tax, which modifies this budget constraint to give:

$$(4) \qquad \sum_{t=0}^{\infty} \mu(t)(P_t(1+t^F)C_t^h + w_t^h L_t^h) = W^h ,$$

where $\mu(t) = \prod_{s=0}^{t-1} \frac{1}{1+r_s}$ is a discount factor, r_s represents the real interest rate on assets at time *s*, P_t is the price of composite consumption (which is based on the price of goods), w_t^h is the wage rate for household *h*, t^{vc} is value-added tax on consumption, t_l is labor income taxes, t^F represents the FairTax rate, C_t^h is composite consumption which is composed of sectoral consumption goods, and W^h is the lifetime wealth of the household. Sectoral aggregations are of the Cobb-Douglas type $P_t = \vartheta \prod_{i=1}^{n} p_{i,t}^{\alpha_i}$, and $C_t = \prod_{i=1}^{n} C_{i,t}^{\alpha_i^h}$ where α_i^h gives the share of spending on good *i* by the representative household, $C_{i,t}^h$ is a composite of domestic and foreign sector *j* products that enter in the consumption basket of the household *h* and $p_{i,t}$ the gross-of-tax price, and ϑ is a constant price index in the base year. Lifetime wealth W^h is defined as:

$$(5) \qquad W^h = \frac{J_0^h}{1+r_0} + \frac{J_1^h}{(1+r_0)(1+r_1)} + ... + \frac{J_2^h}{\Pi_s^t (1+r_s)} + ... = \sum_{t=0}^{\infty} \mu(t) J_t^h ,$$

where J_t^h is the household's full disposable income in period *t*, which includes the value of labor endowments and capital income plus transfers in the benchmark economy. It can be stated as:

$$(6) \qquad J_t^h = (1-t_l^h) w_t^h \overline{L}_t^h + (1-t_{i,k}) r_{i,t} K_{i,t}^h + TR_t^h .$$

Both capital and labor income taxes are eliminated under the FairTax economy:

$$(7) \qquad J_t^h = w_t^h \overline{L}_t^h + r_{i,t} K_{i,t}^h + TR_t^h ,$$

where w_t^h is the wage rate for household *h*, $\overline{L}_{i,t}^h$ is its labor endowment, $r_{i,t}$ is the rental rate of capital, $K_{i,t}^h$ is the capital stock of type *i* owned by household *h*, TR_t^h is the transfer from the federal or the local government to the household *h*, t_l^h is the tax rate in labor supplied by household *h*, and $t_{i,k}$ is the corporate tax rate in the use of capital inputs.

We combine equations (1) through (7) to form the Lagrangian for the consumer's inter-temporal allocation problem in (8):

$$(8) \qquad \Im^h = \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^t \frac{\left(\left(\alpha_c^h C_t^{h\,\frac{\sigma_u^h - 1}{\sigma_u^h}} + (1-\alpha_c^h) L_t^{h,\,\frac{\sigma_u^h - 1}{\sigma_u^h}} \right)^{\frac{\sigma_u^h}{\sigma_u^h - 1}} \right)^{1-\sigma_u^h} - 1}{1-\sigma_u^h} + \lambda^h \left[\sum_{t=0}^{\infty} \mu(t) (P_t (1+t^{vc}) C,_t^h + w_t^h (1-t_l) L_t^h) - W^h \right] .$$

Under the FairTax, this optimization problem is represented by:

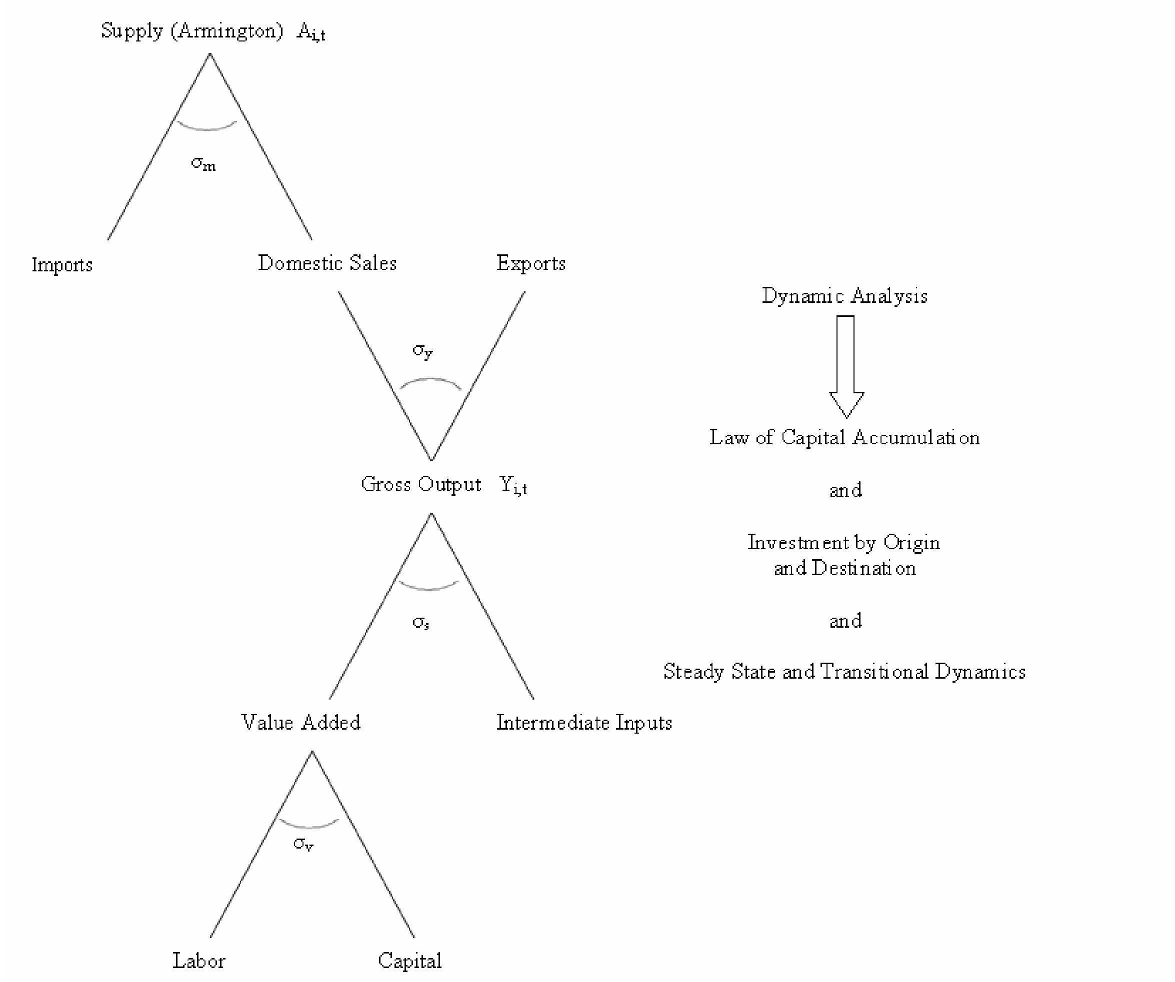
(9) $$\Im = \sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^{t} \frac{\left(\left(\alpha_c^h C_t^{h\,\frac{\sigma_u^h-1}{\sigma_u^h}} + (1-\alpha_c^h) L_t^{\frac{\sigma_u^h-1}{\sigma_u^h}}\right)^{\frac{\sigma_u^h}{\sigma_u^h-1}}\right)^{1-\sigma_u^h} - 1}{1-\sigma_u^h} + \lambda^h\left[\sum_{t=0}^{\infty}\mu(t)(P_t(1+t^F)C_t^h + w_t^h L_t^h) - W^h\right].$$

Here, σ_u^h is the intra-temporal elasticity of substitution between consumption and leisure, α_c^h is the consumption share of household *h*, λ^h is the shadow price of income in terms of the present value of utility, and β is replaced by $\frac{1}{1+\rho}$, where $\rho > 0$ is the rate of time preference which indicates the degree to which the household prefers leisure and consumption in earlier rather than in later years.

A. Production Function

In each period, the supply process in this economy can be explained by nested production functions for each of the 27 "production" sectors. Producers use intermediate inputs in fixed proportions (a "Leontief" technology), but there is flexibility in the use of capital and labor. The nested production structure in Figure 3 includes composite labor supply function from seven categories of households, sector-specific capital accumulation and capital allocation function, value-added function, a Leontief function between value-added and intermediate inputs, constant elasticity of transformation export function between the U.S. markets and the other economies, constant elasticity of substitution (CES) function between domestically supplied goods and imports, and total absorption in the economy.

Figure 3. Nested Structure of Production and Trade in the FairTax Model for Sector *i*.



The objective of a firm in the *j*th sector of the economy is to maximize the present value of profits subject to production technology constraints. Sectoral profits are given by the differences between the revenue from sales and the cost of supply. The unit revenue function is a constant elasticity of transformation composite of the unit price of domestic sales and the unit price of exports. The unit costs are divided between value added, i.e., payments to labor and capital, and domestic and imported intermediate inputs:

$$\Pi^{y}_{j,t} = [((1-\delta^{e}_{j})PD_{j,t}^{\frac{\sigma_y-1}{\sigma_y}} + \delta^{e}_{j}PE_{j,t}^{\frac{\sigma_y-1}{\sigma_y}})]^{\frac{1}{\sigma_y-1}} - \theta^{v}_{j}PY^{v}_{j,t} - \theta^{d}_{j}\sum_{i} a^{d}_{i,j}P_{i,t} - \theta^{m}_{j}\sum_{i} a^{m}_{i,j}PM_{j,t}, \quad (10)$$

where $\Pi^{y}_{j,t}$ is the unit profit of activity in sector j, $PE_{j,t}$ is the export price of good j, $PD_{j,t}$ is the domestic price of good j, $PY^{v}_{j,t}$ is the price of value added per unit of output in activity j, σ_y is a transformation elasticity parameter, $PM_{j,t}$ is the import price of intermediate input, $P_{i,t}$ is the price of final goods used as intermediate goods, δ^{e}_{j} is the share parameter for exports in total production, θ^{v}_{j} is the share of costs paid to labor and capital, θ^{d}_{j} is the cost share of domestic intermediate inputs, θ^{m}_{j} is the cost share of imported intermediate inputs, the $a^{d}_{i,j}$ are input-output coefficients for domestic supply of intermediate goods, and the $a_{i,j}^{m}$ are input-output coefficients for imported supply of intermediate goods. This coefficient is aggregated over industries in the BHI model.

At the bottom of the nest of the production side of the economy, producers use labor and capital in each of *N* sectors to produce added value. The amount of each type of these inputs employed by a producer in a particular sector is based upon the sector-specific production technology and input prices. We use a CES function to express this relationship:

$$(11) \qquad Y_{i,t} = \Omega_i \left((1-\delta_i)(K_{i,t})^{\sigma_v} + \delta_i (LS_{i,t})^{\sigma_v} \right)^{\frac{1}{\sigma_v}},$$

where $Y_{i,t}$ is the gross value added of sector i, Ω_i is a shift or scale parameter in the production function, $K_{i,t}$ and $LS_{i,t}$ are the amounts of capital and labor used in sector *i*, δ_i is the share of labor used in production, and σ_v is the elasticity of substitution. This is a constant-returns-to-scale production function. Euler's product exhaustion theorem implies that total output (value added) equals payments to labor and capital and each factor receives remuneration at the rate of its marginal productivity:

$$(12) \qquad PY_{i,t} Y_{i,t} = w_t LS_{i,t} + rk_{i,t} K_{i,t},$$

where w_t is the gross-of-tax composite wage rate that employer pays to use labor input and $rk_{i,t}$ is the gross rental rate of capital. Note that the w_t is a composite of wage rates for each category of household w_t^h, as $LS_{i,t}$ is the composite of $LS_{i,t}^h$, the labor supplied by households *h* = 1, 2,…, 7.

More explicit treatment of foreign capital requires one modification to the above equation:

$$Y_{i,t} = \Omega_i \left(\delta_{1,i} (K_{i,t}^d)^{\sigma_v} + \delta_{2,i} (K_{i,t}^F)^{\sigma_v} + \delta_{3,i} (LS_{i,t})^{\sigma_v} \right)^{\frac{1}{\sigma_v}},$$

where $K_{i,t}^d$ is the capital stocks owned by domestic entrepreneurs, $K_{i,t}^F$ is that owned by traders or foreign investors, $\delta_{1,i}$ is the share of domestic capital, $\delta_{2,i}$ that of foreign capital and $\delta_{3,i}$ that of labor. Euler condition implies that for each section the sum of these shares must be one:

$$\delta_{1,i} + \delta_{2,i} + \delta_{3,i} = 1.$$

Then the second nest in production is given by the relationship between the intermediate inputs and gross output expressed by input-output coefficients which form a fixed physical non-price-based constraint in the production system. The general form of production function is

$$(13) \qquad GY_{i,t} = \min\left(Y_{i,t}, \left(\frac{DI_{i,j,t}}{a_{i,j}^{d}} \right)_{i=j}, \left(\frac{MI_{i,j,t}}{a_{i,j}^{m}} \right)_{i=j} \right),$$

where $a_{i,j}^{d}$ are input-output coefficients for domestic supply of intermediate goods, $a_{i,j}^{m}$ are input-output coefficients for imported supply of intermediate goods, $DI_{i,j,t}$ is the supply of domestic intermediate input, and $MI_{i,j,t}$ is the supply of imported intermediate inputs. The presence of input-output linkages in the model enables us to assess various kinds of backward and forward impacts of policy changes. For instance, a tax on agricultural output has a direct effect on demands for agricultural goods and a backward impact that spreads to other sectors that provide inputs to that sector. Similarly, through forward linkages, the tax affects the cost of agricultural inputs to other sectors. For the BHI model, these domestic input-output coefficients are obtained from the 27 sector input-output table contained in the Social Accounting Matrix.

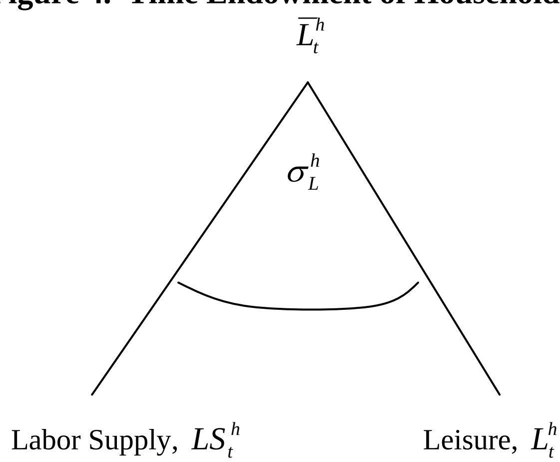
B. Labor Supply and Capital Accumulation

The underlying growth rate in the BHI CGE model is determined by the growth rate of labor and capital. The labor supply LS_t^h for each household h is given by the difference between the household labor endowment $\overline{L}_t^h$ and the demand for leisure L_t^h:

(14) $$LS_t^h = \overline{L}_t^h - L_t^h .$$

In equilibrium, the wage rate must be such that the labor supplied by the household equals the total demand for labor derived from the profit-maximizing behavior of firms (as set out above).

Figure 4. Time Endowment of Household



Capital accumulation in sector *i* in period *t+1*, then, is given by the capital stock of period *t*, net of depreciation and investment:

(15) $$K_{i,t+1} = K_{i,t}(1-\delta_i) + I_{i,t} ,$$

where $K_{i,t+1}$ is the capital stock in sector *i* for period *t+1*, δ_i is the sector-specific rate of depreciation, and $I_{i,t}$ is the net investment for sector *i* in period *t*.

Growth in sectoral output depends both upon the growth of employment and the growth of the capital stock in that sector. On a balanced-growth path, where all prices are constant and all real economic variables grow at a constant rate, capital stocks must grow at a rate fast enough to sustain growth. This condition can be expressed as:

$$(16) \qquad I_{i,T} = K_{i,T}(g_i + \delta_i),$$

where the subscript T denotes the terminal period of the model and g_i is the growth rate for sector i (assumed to be uniform across sectors for the benchmark economy).

Although the time horizon of households and firms is infinite, in practice the model must be computed for a finite number of years. Our model is calibrated using data for 2004 and extends to 27 years (i.e., through 2031). To ensure that households do not eat into the capital stock prior to the (necessarily arbitrary) end point, a "transversality" condition is needed, characterizing the "steady state" that is assumed to reign after the end of the time period under consideration. We assume, following Ramsey, that the economy returns to the steady-state growth rate of 3 percent at the end of the period.[12]

The model also requires a number of identities. After-tax income is either consumed or spent on savings (which equals investment here). Net consumption is defined as gross consumption spending less any consumption tax. The flow of savings is defined as the difference between after-tax income and gross spending on consumption, and gross investment equals national saving plus foreign direct investment.

C. Government Revenue and Spending

The model incorporates an important distinction between the economic activities of the federal and local governments. Federal government revenue is collected from various taxes in the benchmark model, all of which are replaced by a single consumption tax in the FairTax economy. Tuerck, et al.[13] have analyzed how federal/state distinction exists in tax rates and Kotlikoff and Jokisch assessed the impacts of the FairTax proposal on welfare levels of various categories of households using the overlapping generation framework.[14] State and local tax law is left unchanged.

The BHI model is more complex in terms of sectoral and household disaggregation and includes a mechanism to trace the response of capital inflows to the increased efficiency and competitiveness attributable to the FairTax.

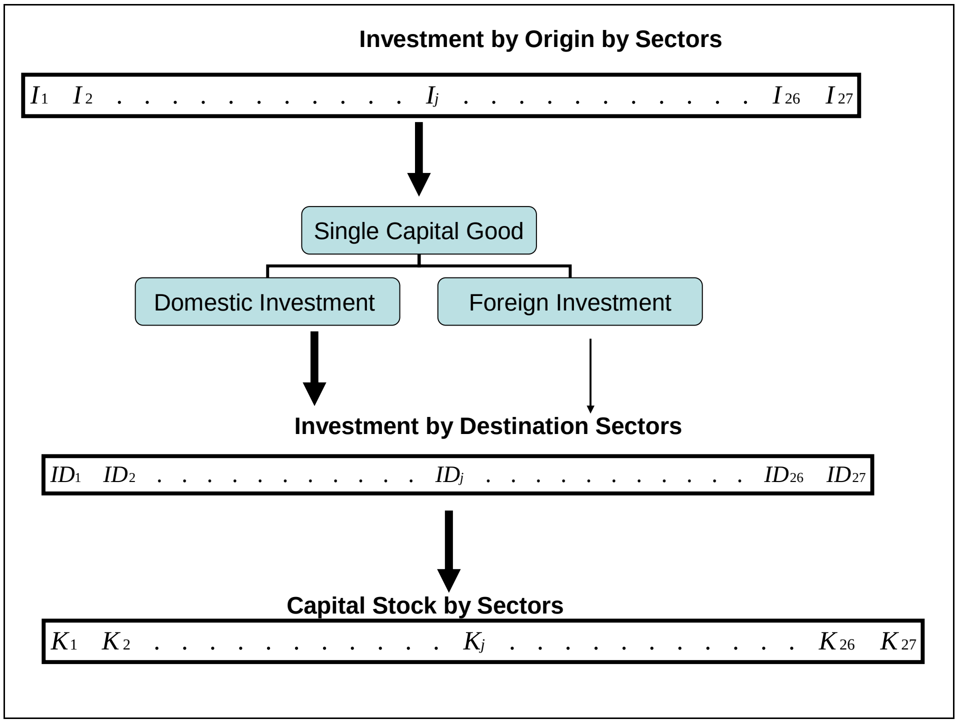
Both the federal and state/local governments derive revenues from taxes on personal and corporate income, on property, and on sales in the benchmark economy. The FairTax economy replaces almost all other federal taxes with a single sales tax that is imposed on household and government consumption. The model assesses how the implementation of the FairTax makes the economy more competitive and causes a significant inflow of capital to complement the domestic saving and investment. The magnitudes of impacts on capital accumulation, growth,

[12] Ramsey (1928) p. 556.
[13] Tuerck, et al. (*forthcoming*).
[14] Kotlikoff and Jokisch (2005).

and households' welfare under the BHI FairTax model are comparable to the findings reported by Kotlikoff and Jokisch.[15]

D. Foreign Direct Investment and Capital Inflows

Figure 5. Domestic and Foreign Investment and Capital Accumulation in the BHI Model



The model incorporates foreign direct investment (FDI), which is relatively unusual in CGE models. The basic idea is that policy changes, such as the abolition of the corporate income tax, which increase the attractiveness of investment for domestic investors also produce an equivalent increase in the attractiveness of investment to foreign investors. Operationally, we assume that the share of the capital stock owned by foreigners does not change in the wake of a policy change.

Suppose that, in response to a policy change, domestic investors boost their spending on investment by 20 percent. Then under our assumption, international investors will do the same. This has important implications.

- First, there will be an inflow of additional resources from abroad equivalent to the rise in FDI; it will be followed in subsequent years by an outflow of resources as the return on the FDI is repatriated. During this latter period, gross domestic product (i.e., production in the geographic U.S.) will rise more strongly than gross national product (i.e., income accruing to nationals). The inflow, and subsequent outflow, of resources will potentially affect the trajectory of the exchange rate.
- Second, the inflow of FDI will push down the rate of return on investment, relative to the situation with no FDI. With a lower return, some domestic investors will scale back their

[15] Ibid.

investment expansion. It follows that FDI substitutes, to some extent at least, for domestic investment.

- Third, the higher level of investment will raise the demand for labor, so wages will rise; and by putting downward pressure on the return to capital it will reduce the income that owners of capital derive from their existing assets.

The role of FDI in the U.S. has been studied since at least the 1950s. Blough and Musgrave examined the arguments for favorable tax treatment of foreign investment, Markusen summarizes the main empirical facts of FDI in the global context, and Anderson provides information on recent inward and outward flows of FDI in the *Survey of Current Business*.[16]

FDI outflows from the United States far exceeded inflows until the mid 1980s, and FDI inflows became prominent only after the U.S. federal budget deficit started rising significantly. Total FDI inflows stood at $58 billion in 1985 and had risen to $300 billion by 2000 before falling drastically after September 11, 2001. Advanced western economies such as Canada, the U.K., Western Europe, and Japan are the major sources of FDI inflows in the United States. The FDI relations are reciprocal: A country which generates inflows of FDI to the United States is usually the recipient of a correspondingly large amount of FDI from the United States. Given their impressive rates of growth, sizes of markets, and volume of trade with the United States, China and India are likely to emerge as other sources of FDI to the United States in the near future.

At the micro level, FDI takes the form of intra-firm trade and is not particularly related to factor endowments. Markusen claims that almost 98 percent of output generated by FDI in the U.S. is sold domestically.[17] Foreign investors both bring and use high levels of R&D, a high proportion of skilled labor, technically complex products, and a large degree of product differentiation.

The degree to which the rising inflows of FDI in the United States complement or substitute for domestic investment remains an unsettled question. Feldstein and Horioka found a capital-augmenting effect of FDI for the OECD economies.[18] But Desai, Foley, and Hines could not validate that for the U.S. economy.[19] The complexity of such contradicting effects of FDI had been noted by Van Loo as early as 1977 for Canada; she argued that the FDI flows may release extra resources for domestic consumption as foreigners buy equities and portfolios of domestic enterprises.[20]

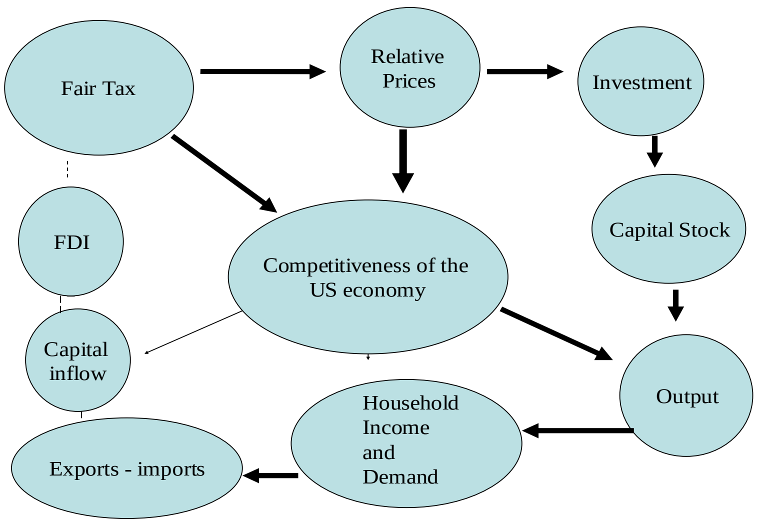
The zero trade balance is a property of a Walrasian general equilibrium model; export or import prices adjust until the demand equals supply in international markets. However, as Figure 5 shows, FDI plays a crucial role in the U.S. economy as exports and imports are not automatically balanced by automatic price adjustments. Therefore, the Walrasian model is modified here to incorporate capital inflows so that the FDI can pay for part of the trade imbalance:

$$(17) \qquad FDI_{i,t} = \theta . I_{i,t},$$

[16] See the following works: Blough (1956), Musgrave (1977), and Anderson (2004).
[17] Markusen (1995) pp. 169-189.
[18] Feldstein and Horioka (1980) pp. 314-29.
[19] Desai, et al. (2005) pp. 33-38.
[20] Van Loo (1977) pp. 474-481.

where for period t, $FDI_{i,t}$ is the value of net capital inflows into sector i of the U.S. economy. For our purposes we took θ to be 0.1.

Figure 6. Impact of FairTax on Competitiveness and Capital Inflows



The BHI model assumes that the FDI is used only to import investment goods, so there is no initial impact on the exchange rate. In practice, the model finds that by allowing for FDI, investment, the capital stock, output, and the utility of domestic households, all are what they would have been in the absence of FDI.

E. Calibration

The model is truly "dynamic" in that it optimizes over time and is calibrated using data for 2004. The model is programmed in GAMS (General Algebraic Modeling System).[21] The core of the model is programmed in MPSGE (Mathematical Programming System for General Equilibrium), which was written to facilitate the development of market-clearing CGE models.[22]

The dynamics of this model arise from an endogenous process of capital accumulation and endogenous labor supply, based on the exogenous growth rate of the labor force. We rule out uncertainty and rely on the perfect foresight of households and firms, which means that actual and expected values of variables are the same.

There are essentially five steps involved in the calibration of this dynamic model. The first relates to forming a relation between the price of commodities at period t, $P_{i,t}$, and the price of investment good $PINV_{i,t}$. Then the composite investment generates capital stock in period t+1 with price $P^k_{i,t+1}$. It also needs a link between prices of capital stock at periods t and t+1, $P^k_{i,t}$,

[21] See www.gams.com for an introduction to GAMS and useful links. The essential reference is Brooke, et al. (1998).

[22] MPSGE was written by Thomas Rutherford. For further explanation see Rutherford (1997). Also noteworthy are Paltsev (2000) and Lau, et al. (2000).

$PINV_{i,t}$, and $P^k_{i,t+1}$, with due account of the rental on capital and the depreciation rate. For instance, one unit of investment made using one unit of output in period *t* generates one unit of investment good. This then generates one unit of capital stock in period *t*+1. This implies that:

$$(18) \qquad P_{i,t} \Rightarrow PINV_{i,t} \Rightarrow P^k_{i,t+1},$$

where $P_{i,t}$ is the price of one unit of output in period *t*, and $PINV_{i,t}$ and $P^k_{i,t+1}$ are the *t* period price of one unit of investment and capital goods in period *t*+1 in sector *i*.

Capital depreciates at the industry-specific rate δ_i. One unit of capital at the beginning of period *t* in sector *i* earns a rental rate $rk_{i,t}$ at time *t*, and $(1-\delta_i)$ unit of it remains for the next period (or at the start of period *t*+1). Therefore:

$$(19) \qquad P^k_{i,t} = rk_{i,t} + (1-\delta)P^k_{i,t+1}.$$

The second step involves setting up a link between the rental rate with the benchmark interest rate and the depreciation rate; the rental covers depreciation and interest payment for each unit of investment. If the rental is paid at the end of the period, then:

$$(20) \qquad rk_{i,t} = (r+\delta_i)P^k_{i,t+1}.$$

The third step involves forming the relation between the future and the current price of capital, which is just the benchmark reference price as given by:

$$(21) \qquad \frac{P^k_{i,t+1}}{P^k_{i,t}} = \frac{1}{1+r}.$$

This means that the ratio of prices of the capital at period *t* and *t*+1 equals the market discount factor $\frac{1}{1+r}$.

The fourth step involves setting up the equilibrium relationship between capital earnings (value added from capital) and the cost of capital. We compute values for sectoral capital stocks from sectoral capital earnings in the base year. If capital income in sector *i* in the base year is $\overline{V_i}$, we can write $\overline{V_i} = rk_i K_i$. Since the return to capital must be sufficient to cover interest and depreciation, we can also write:

$$(22) \qquad \overline{V_i} = (r+\delta_i)P^k_{i,t+1}K_i \text{ or}$$

$$(23) \qquad K_i = \frac{\overline{V_i}}{(r+\delta_i)}, \text{ with normalization } P_t = P^k_{t+1} = 1.$$

The fifth step involves setting up the relation between the investment and capital earning on the balanced growth path. Investment should be enough to provide for growth and depreciation, $I_i = (g_i + \delta_i)K_i$, implying that:

$$(24) \qquad I_i = \frac{(g_i + \delta_i)}{(r + \delta_i)}\overline{V_i}.$$

Thus, investment per sector is tied to earnings per sector. In the benchmark equilibrium, all reference quantities grow at the rate of labor force growth, and reference prices are discounted on the basis of the benchmark rate of return. The balance between investment and earnings from capital is restored here by adjustment in the growth rate g_i, which responds to changes in the marginal productivity of capital associated with change in investment. Readjustment of capital stock and investment continues until this growth rate and the benchmark interest rates become equal.

If the growth rate in sector *i* is larger than the benchmark interest rate, then more investment will be drawn to that sector. The capital stock in that sector rises as more investment takes place, setting the diminishing return on capital. Eventually, the declining marginal productivity of capital retards growth in that sector. In addition, the BHI model builds scenarios for open capital markets and capital inflows to evaluate the impacts of FairTax reforms in 2007. Alternatively, it would be possible to build a scenario in which the economy is permitted to lend and borrow in response to trade imbalances in the open capital market case for certain years under the constraint that these imbalances disappear over the model horizon.

To solve the model, we allow for a time horizon sufficient enough to approximate the balanced-growth path for the economy. Currently, the model uses a 26-year horizon, which can be increased if the model economy does not converge to the steady state.

F. Behavioral Elasticities of Substitution in Consumption and Production

An elasticity of substitution measures the percentage change in quantity demanded, supplied, or traded in response to a one-percent change in price. High values denote high flexibility of markets and hence large impacts of policy changes in the economy. This elasticity also reflects the properties of underlying production and consumption functions. If the value of the substitution elasticity is close to zero, it reflects a Leontief technology and a more inflexible market. Higher elasticities generate greater responses on quantities and prices of any change in model tax rates as markets become more flexible. The substitution parameters for the BHI FairTax model given in the following table are comparable to the existing literature.[23]

[23] To derive the basic substitution parameters we reviewed the existing literature including: Bhattarai and Whalley (1999), Killingsworth (1983), Kotlikoff (1998) pp. 1-34, and Kydland and Prescott (1982). Also noteworthy are two works by Ogaki and Reinhart (1998a) and (1998b), Piggott and Whalley (1985), and Reinert and Roland-Holst (1992) pp. 631-639.

Table 2. Basic Parameters of the FairTax Model	
Steady-state growth rate for sectors (g)	0.03
Net interest rate in non-distorted economy (r or ρ)	0.03
Sector-specific depreciation rates δ_i (ranges between 0.02 - 0.12)	0.08
Elasticity of substitution for composite investment σ_I	1.0
Elasticity of transformation between U.S. domestic supplies and exports to the rest of the world (ROW) σ_e (can be sector specific)	2.0
Elasticity of substitution between U.S. domestic products and imports from the rest of the world (ROW) σ_m	1.5
Inter-temporal elasticity of substitution σ_{Lu}	1.3
Intra-temporal elasticity of substitution between leisure and composite goods σ_u	0.25
Elasticity of substitution in consumption goods across sectors σ_C	1.0
Elasticity of substitution between capital and labor σ_v	1.0
Reference quantity index of output, capital, and labor for each sector Q_{rf}	$(1+g)^{t-1}$
Reference index of price of output, capital, and labor for each sector P_{rf}	$1/(1+r)^{t-1}$

The application of the general equilibrium model generally uses values of these elasticities that are consistent with theoretical predictions and numerically close to those of prior models.

G. Inter-temporal Elasticity of Substitution

The inter-temporal elasticity of substitution σ_{Lu} measures the responsiveness of the composition of a household's current and future demand for the composite consumption good (composite of consumption and leisure) to relative changes in the rate of interest. This parameter is a crucial determinant of household savings. According to the current literature, no consensus exists regarding a reasonable value of this elasticity. Ogaki and Reinhart estimate it to be between zero and 0.1 in the case of durable goods.[24] In addition, Hall[25] finds it to be very small, even negative, while Hansen and Singleton[26] note considerably less precision in the measure of the elasticity of inter-temporal substitution. Auerbach and Kotlikoff assume it to be about 0.25;[27] on the other hand, Kydland and Prescott assume it to be 1.0.[28] Vissing-Jorgensen finds an elasticity of inter-temporal substitution as high as 1.2.[29] Hansen and Singleton and Attanasio and Weber estimate values above 1.5.[30] Bansal and Yaron use an elasticity of 1.5 and argue that estimation methods used by Hall are "misspecified and creates a downward bias."[31] We use a value of 1.3 in the BHI model.

[24] Ogaki and Reinhart (1998a). See also Ogaki and Reinhart (1998b) p. 106.
[25] Hall (1988) p. 339-357.
[26] Hansen and Singleton (1996) p. 65.
[27] Auerbach and Kotlikoff,(1987).
[28] Kydland and Prescott (1982). See footnote 20 in this report.
[29] Vissing-Jorgensen (1998).
[30] Hansen and Singleton (1983) pp. 249-265 and Attanasio and Weber (1989).
[31] Bansal and Yaron (2004) p. 1501.

H. Intra-temporal Elasticity of Substitution between Consumption and Leisure

The intra-temporal elasticity of substitution between consumption and leisure determines how consumers' labor supply responds to changes in real wages. Indirect evidence on this elasticity is derived from various estimates of labor supply elasticities that are available in the literature.[32] Here, we adopt a value of 0.25 for this substitution elasticity. Further discussion on how to derive numerical values of substitution elasticities from labor supply elasticities is provided in earlier studies on tax incidence analysis.[33]

I. Intra-temporal Elasticity of Substitution between Consumption Goods

This elasticity captures the degree of substitutability among goods and services in private final consumption. A higher value implies more variation in consumption choices when the relative prices of goods and services change. Consistent with Piggott and Whalley, we specify a value of 1.0 for this parameter.[34]

J. Armington Elasticities

The Armington transformation elasticity determines the supply of domestically produced goods between the home and foreign markets in response to the relative prices between these two markets. The Armington substitution elasticity determines how the domestic and import prices affect the composition of demand for home and foreign goods. Higher values of substitution and transformation elasticities mean a greater impact of the foreign exchange rate in domestic markets. Various estimates exist in the literature about the value of these elasticities: Reinert and Roland-Holst report estimates of substitution elasticities for 163 U.S. manufacturing industries and find these elasticities remain between 0.14 and 3.49.[35] Piggott and Whalley suggest central tendency values of these elasticities to be around 1.25.[36] We use 2.0 for elasticity of substitution in imports and domestic goods, and 1.5 for elasticity of transformation to represent the interaction of the U.S. with the global economy.

K. Elasticity of Substitution between Capital and Labor in Production

Early estimates of the elasticity of substitution between capital and labor are found in Arrow, et al.[37] They estimated constant elasticities of substitution for U.S. manufacturing industries using a pooled cross-country data set of observations on output per man hour and wage rates for a number of countries. We use 1.0.

IV. Solution Algorithm and Software

We formulate and solve the model using the GAMS/MPSGE software and the PATH solver.[38] Dirkse and Ferris have implemented a pathsearch-dampened Newton method (the PATH solver)

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[32] Killingsworth (1983).
[33] Bhattarai and Whalley (1999).
[34] Piggott and Whalley (1985).
[35] Reinert and Roland-Holst (1992).
[36] Piggott and Whalley (1985).
[37] Arrow, et al. (1961) pp. 225-250.
[38] Rutherford (1997).

that is fast and robust.[39] GAMS syntax (Brooke, et al.) permits us to generate a nonlinear mixed complementary model by declaring and assigning sets, data, parameters, variables, and equations in the model.[40] PATH is invoked by the "OPTION MCP = PATH" statement in the GAMS code. The command line "solve <model name> using MCP" instructs GAMS to solve the model using the PATH solver.[41]

V. Results

The model is first calibrated using the micro-consistent data derived from the SAM of the U.S. economy for 2004. The parameters of the model equations are consistent with benchmark replication, guaranteeing the existence, uniqueness, and stability of the general equilibrium for the reference path of the dynamic U.S. economy. These equations are then solved using the GAMS/MPSGE along with MCP/PATH algorithm. If the solutions generate the same numbers as the SAM, then the model is considered to have been calibrated successfully. The benchmark model is first solved on the assumption that the current federal tax system persists into the foreseeable future. We then assume that in 2007, the major federal direct taxes (personal and corporate income taxes, payroll taxes, and gift and estate taxes) are replaced by the FairTax, at a rate that is revenue neutral in 2007. The same FairTax rate is applied every year thereafter.[42]

Table 3. Effects of the FairTax Relative to Current Law (% change)

	2007	2008	2009	2010	2011	2016	2021	2026	2031
	1	2	3	4	5	10	15	20	25
Real GDP	7.9	9.3	9.9	10.3	10.7	10.9	10.7	10.5	10.3
Domestic investment	74.5	88.4	88.0	87.1	86.3	75.9	69.0	65.7	65.2
Capital stock	0.0	2.8	5.3	7.5	9.3	14.1	16.0	16.9	17.3
Employment	11.9	12.0	11.2	10.5	9.9	7.6	6.1	5.3	4.7
Real wages	10.3	10.6	10.4	10.3	10.2	9.5	9.1	9.0	9.2
Consumption	-0.6	-0.8	0.2	1.1	1.8	4.3	5.5	5.9	6.0

The key results from the solutions of the benchmark and FairTax economies are summarized in Table 3 above.

Figure 7 illustrates the effects on real output (i.e., real GDP). The graph is designed to begin in the first year of implementation of the FairTax. The real output would be 7.9 percent higher within a year, 10.7 percent in year 5 and 10.3 percent by the end of year 25. Figure 7 shows the evolution of an index of real output under the FairTax relative to real output under the benchmark scenario.

[39] Dirkse and Ferris (1994).
[40] Brooke et al. (1998).
[41] Many technical papers on the topic are available at http://www.cs.wisc.edu/~ferris/.
[42] In a multi-year model such as this one, there are a number of possible ways to incorporate revenue neutrality. One could impose revenue neutrality in a single base year (as we have done here). Alternatively, one could impose revenue neutrality in every year by adjusting the tax rate annually. Or one could define revenue neutrality as equalizing the present value of revenue between benchmark and simulation cases.

Figure 7. Real GDP

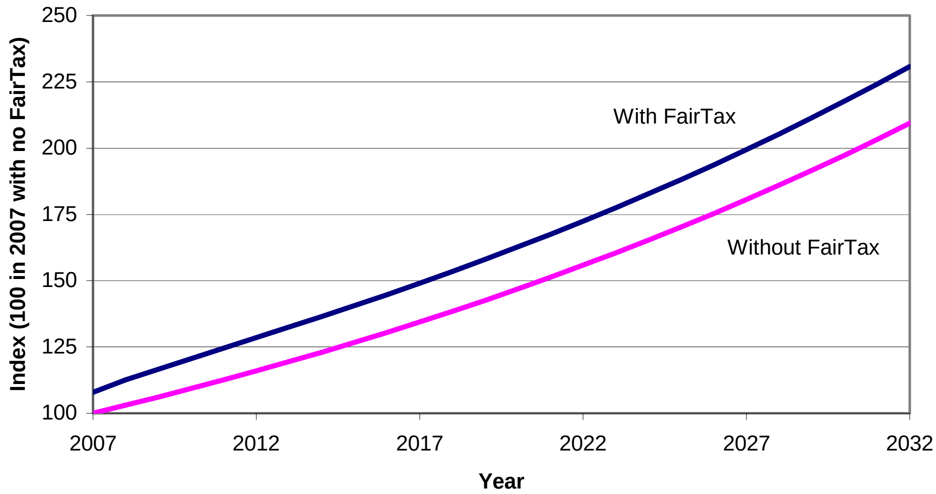


Table 4. Index of Change in Real Output Relative to Benchmark of 100, by Sector

Year	**2007**	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**1**	**5**	**10**	**15**	**20**	**25**
Industry						
Agriculture, forestry, and fishing	2.4	4.9	7.1	8.2	8.9	9.4
Mining	9.9	13.8	15.6	16.6	17.6	18.9
Construction	11.1	13.1	13.7	14.0	14.7	15.9
Food and tobacco products	1.6	3.8	5.8	6.8	7.4	7.6
Textiles and apparel	1.9	3.9	5.5	6.3	6.8	7.1
Building materials	8.8	10.5	11.3	11.7	12.3	13.3
Paper and publishing	1.6	3.6	5.0	5.8	6.3	6.9
Chemicals, petroleum, rubber, and plastics	1.4	3.8	5.3	6.2	6.8	7.4
Electronics and electronic equipment	24.1	27.2	28.4	29.0	30.4	32.7
Motor vehicles and other transportation	5.6	8.1	9.2	9.8	10.7	12.2
Primary and fabricated metal	6.6	9.4	10.5	11.0	11.9	13.3
Industrial machinery and equipment	32.8	36.6	37.9	38.7	40.2	42.8
Business machinery and instruments	13.4	17.0	18.3	19.0	20.0	21.4
Other manufacturing	14.4	17.9	19.3	20.0	21.0	22.3
Transportation	0.3	2.3	3.7	4.4	5.0	5.6
Communications	3.9	6.6	8.2	9.1	9.8	10.6
Electricity, gas, and sanitary	0.2	2.7	4.5	5.4	6.0	6.3
Wholesale trade	8.4	10.9	12.3	13.0	13.8	14.8
Retail trade	2.4	4.3	5.8	6.6	7.1	7.3
Banking	2.7	5.2	7.2	8.2	8.8	9.2
Insurance	2.8	3.9	5.9	7.0	7.5	7.8
Real estate	0.6	5.0	7.5	8.8	9.5	10.0
Personal and repair services	-16.0	-15.1	-14.2	-13.7	-13.3	-12.8
Business services	4.7	7.2	8.5	9.2	10.0	10.9
Entertainment and hotel services	0.4	2.2	3.6	4.3	4.7	4.9
Health services	0.0	0.9	2.0	3.0	3.6	3.8
Other services	-1.7	-0.2	1.1	1.8	2.1	2.3

The disaggregated model also allows one to break down the increase in output by sector when the FairTax is put in place, as shown in Table 4. The higher growth rates in some sectors like agriculture will be more favorable to poor households, whereas that of the service sectors will be more advantageous to households in the top income category. Economic growth is increased by FDI's spillover effects on technology and by complementarities between foreign and domestic investment.

Levels of investment would increase under the FairTax relative to the benchmark economy. Greater investment would boost the country's capital stock (Figure 8, Figure 9) ultimately by about 17.3 percent, raising the level of output across sectors and income of households.

Figure 8. Investment

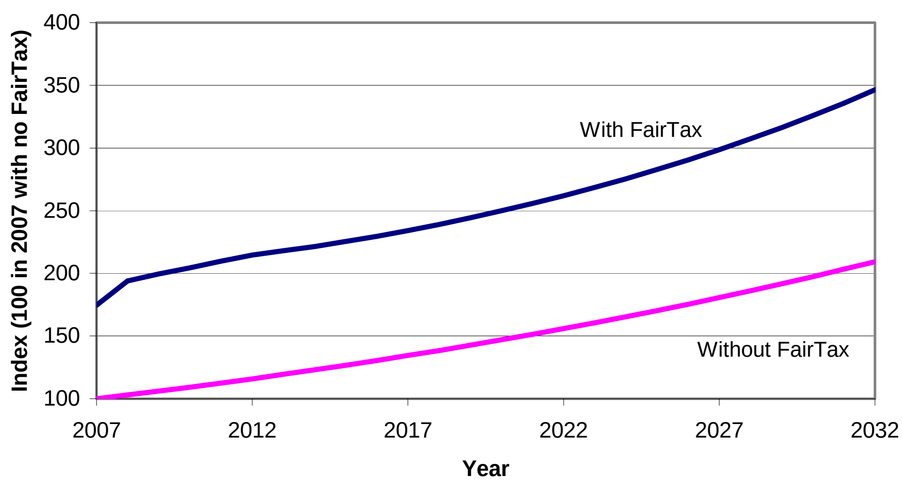
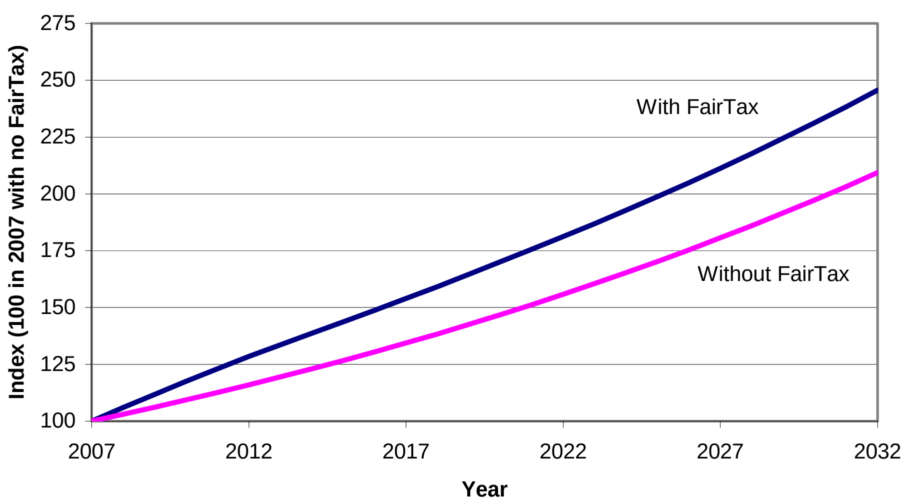
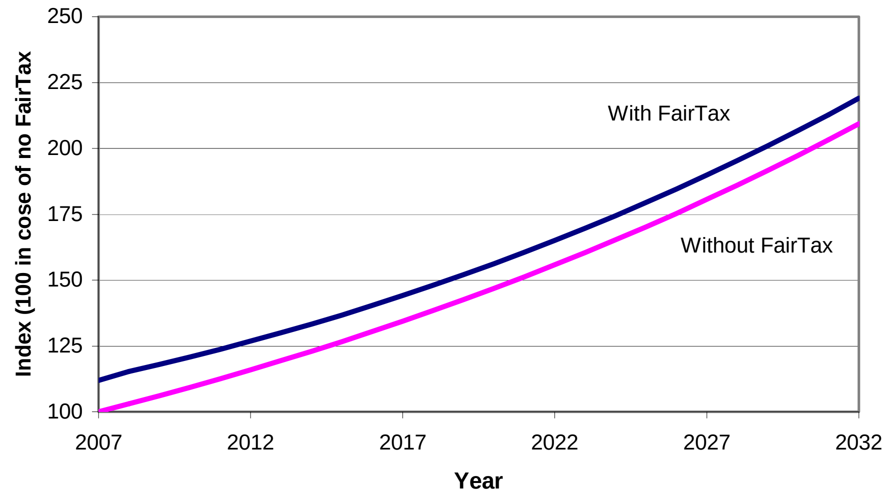


Figure 9. Capital Stock



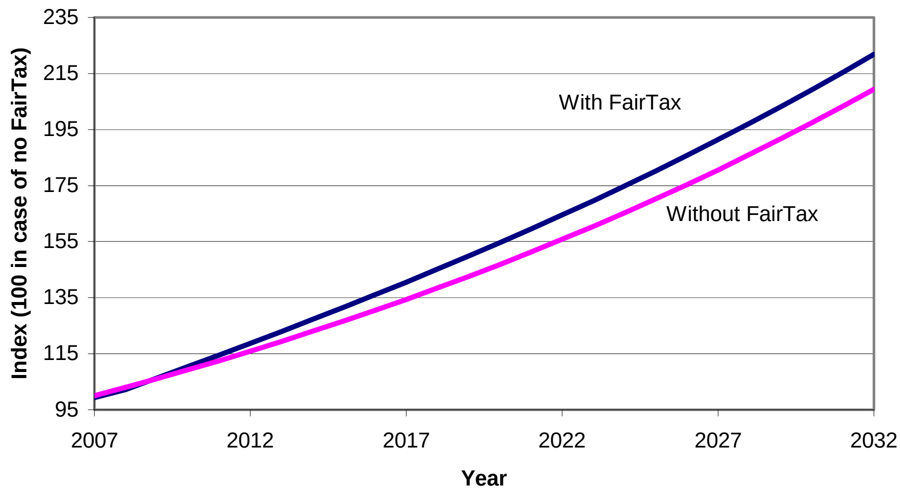
Similarly, levels of employment in the FairTax economy would be higher than in the benchmark. The aggregate employment would rise by 11.9 percent in the first year of the FairTax, settling at approximately 4.7 percent after 25 years (Figure 10).

Figure 10. Employment



In the early years of the FairTax, consumption would be lower since households increase the amount that they save, attracted by the higher net return on capital (since capital income is no longer taxed). In due course, this increased investment bears fruit, raising household incomes and permitting them to consume more. Consumption ultimately would be 6.0 percent higher than the benchmark after year 25 (Figure 11).

Figure 11. Real Consumption



Tables 5 through 8 provide summary effects of the FairTax on specific economic indicators for selected years 2007 – 2031.

Table 5. Summary Effects of the FairTax on Income Groups Relative to Current Law, 2007-2031 (% change)

Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**1**	**2**	**3**	**4**	**5**	**10**	**15**	**20**	**25**
Indicator									
Real Wages									
Less than $10,000	12.8	13.5	13.6	13.7	13.8	13.6	13.6	13.7	13.9
$10,000 - $24,999	0.3	1.0	1.1	1.2	1.2	1.1	1.1	1.1	1.3
$25,000 - $49,999	1.2	1.9	2.0	2.1	2.2	2.0	2.0	2.1	2.2
$50,000 - $74,999	1.5	2.1	2.2	2.3	2.4	2.2	2.2	2.3	2.5
$75,000 - $99,999	2.9	3.6	3.7	3.8	3.8	3.7	3.6	3.7	3.9
$100,000 - $149,999	2.6	3.3	3.4	3.4	3.5	3.3	3.3	3.4	3.6
More than $150,000	48.0	49.0	49.2	49.2	49.3	49.1	49.1	49.2	49.5
Labor Supply									
Less than $10,000	58.2	56.7	54.5	52.4	50.4	42.1	35.6	30.3	26.0
$10,000 - $24,999	19.6	19.4	18.4	17.4	16.6	13.3	10.9	9.3	8.0
$25,000 - $49,999	13.2	13.2	12.4	11.7	11.1	8.8	7.4	6.4	5.8
$50,000 - $74,999	10.3	10.4	9.8	9.3	8.8	7.1	6.0	5.4	5.1
$75,000 - $99,999	8.8	8.9	8.4	7.8	7.4	5.7	4.7	4.2	3.9
$100,000 - $149,999	8.2	8.3	7.8	7.3	6.9	5.4	4.5	4.1	3.8
More than $150,000	0.8	1.0	0.5	0.0	-0.4	-2.0	-2.9	-3.4	-3.7
Net Consumption									
Less than $10,000	1.6	1.6	2.9	4.1	5.0	8.2	9.7	10.3	10.5
$10,000 - $24,999	-1.6	-1.7	-0.7	0.3	1.0	3.7	5.0	5.5	5.6
$25,000 - $49,999	-2.8	-2.9	-1.9	-1.0	-0.3	2.2	3.4	3.9	4.0
$50,000 - $74,999	-3.4	-3.6	-2.7	-1.9	-1.2	1.1	2.2	2.6	2.7
$75,000 - $99,999	-1.8	-2.0	-1.1	-0.3	0.3	2.7	3.8	4.2	4.2
$100,000 - $149,999	-2.9	-3.0	-2.0	-1.2	-0.5	1.9	3.0	3.4	3.5
More than $150,000	19.7	19.4	20.5	21.4	22.2	25.0	26.3	26.8	26.8

Table 6. Summary Effects of the FairTax on Industry Investment Relative to Current Law, 2007-2031 (% change)

Year	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**5**	**10**	**15**	**20**	**25**
Industry					
Agriculture, forestry, and fishing	95.8	60.4	50.7	45.9	44.1
Mining	47.1	34.0	32.5	32.3	33.5
Construction	185.3	149.2	148.0	149.9	156.3
Food and tobacco products	176.1	131.6	119.8	113.1	109.5
Textiles and apparel	143.2	104.8	96.4	92.2	91.1
Building materials	136.9	92.5	87.4	86.8	90.6
Paper and publishing	76.8	57.0	53.5	52.0	52.3
Chemicals, petroleum, rubber, and plastics	110.3	83.5	78.8	76.8	77.2
Electronics and electronic equipment	32.3	24.2	23.8	24.1	25.4
Motor vehicles and other transportation	64.4	46.9	45.4	45.5	47.6
Primary and fabricated metal	138.5	91.3	86.7	86.8	91.7
Industrial machinery and equipment	81.1	62.7	61.9	62.9	66.3
Business machinery and instruments	178.4	139.5	136.6	137.2	142.3
Other manufacturing	260.5	193.8	186.9	186.4	193.1
Transportation	50.4	34.0	30.7	29.4	29.6
Communications	56.2	43.3	41.3	40.5	40.9
Electricity, gas, and sanitary	32.7	27.2	26.1	25.3	24.9
Wholesale trade	118.8	84.2	79.5	78.4	80.7
Retail trade	123.3	86.0	76.8	72.1	70.4
Banking	101.9	75.7	69.5	66.3	65.1
Insurance	257.8	157.5	127.5	112.4	106.1
Real estate	180.7	165.9	162.2	158.1	154.0
Personal and repair services	76.1	38.7	31.6	28.9	29.8
Business services	98.3	83.2	82.2	82.1	83.9
Entertainment and hotel services	59.1	49.4	47.7	46.6	46.0
Health services	-5.7	122.9	81.2	59.4	51.1
Other services	41.3	31.8	29.7	28.6	28.1

Table 7. Summary Effects of the FairTax on Industry Capital Stock Relative to Current Law, 2007-2031 (% change)						
Year	**2007**	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**1**	**5**	**10**	**15**	**20**	**25**
Industry						
Agriculture, forestry, and fishing	0.0	5.5	10.9	13.2	14.1	14.5
Mining	0.0	17.3	20.2	20.9	21.1	21.4
Construction	0.0	21.6	24.4	25.2	25.5	26.1
Food and tobacco products	0.0	5.8	12.2	15.0	16.2	16.6
Textiles and apparel	0.0	7.1	13.8	16.6	17.9	18.4
Building materials	0.0	14.1	19.0	20.9	21.8	22.5
Paper and publishing	0.0	9.1	14.9	17.3	18.3	18.9
Chemicals, petroleum, rubber, and plastics	0.0	9.5	13.9	15.6	16.4	16.7
Electronics and electronic equipment	0.0	37.5	40.6	40.9	41.0	41.6
Motor vehicles and other transportation	0.0	21.9	26.4	27.7	28.2	28.8
Primary and fabricated metal	0.0	18.2	22.7	24.2	24.8	25.5
Industrial machinery and equipment	0.0	45.9	47.6	47.0	46.7	47.2
Business machinery and instruments	0.0	24.0	27.0	27.6	27.9	28.2
Other manufacturing	0.0	22.2	26.3	27.6	28.2	28.6
Transportation	0.0	7.0	13.1	15.6	16.7	17.3
Communications	0.0	11.8	16.0	17.6	18.3	18.6
Electricity, gas, and sanitary	0.0	6.3	10.1	11.5	12.1	12.2
Wholesale trade	0.0	16.4	21.8	23.7	24.6	25.2
Retail trade	0.0	5.7	12.9	16.0	17.4	18.0
Banking	0.0	7.7	13.6	16.1	17.2	17.6
Insurance	0.0	2.6	11.6	15.8	17.8	18.7
Real estate	0.0	7.3	10.6	11.9	12.3	12.3
Personal and repair services	0.0	-3.4	2.6	5.1	6.3	7.0
Business services	0.0	15.5	19.6	21.0	21.6	21.9
Entertainment and hotel services	0.0	6.5	12.2	14.6	15.6	16.0
Health services	0.0	-5.9	4.0	10.9	14.5	16.4
Other services	0.0	5.4	12.0	14.9	16.2	16.7

Table 8. Summary Effects of the FairTax on Industry Employment Relative to Current Law, 2007-2031 (% change)						
Year	**2007**	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**1**	**5**	**10**	**15**	**20**	**25**
Industry						
Agriculture, forestry, and fishing	12.7	9.0	4.4	2.1	0.8	-0.2
Mining	34.7	16.9	11.2	8.3	6.7	5.8
Construction	23.7	18.0	13.8	11.5	10.4	10.0
Food and tobacco products	6.7	5.2	3.8	3.0	2.3	1.7
Textiles and apparel	6.8	6.4	5.2	4.4	3.8	3.3
Building materials	17.6	14.5	10.5	8.4	7.3	6.8
Paper and publishing	8.9	7.9	6.1	4.9	4.2	3.6
Chemicals, petroleum, rubber, and plastics	11.1	8.0	5.0	3.4	2.4	1.7
Electronics and electronic equipment	36.4	35.1	29.4	25.8	24.0	23.5
Motor vehicles and other transportation	20.5	20.1	16.4	14.1	12.8	12.3
Primary and fabricated metal	20.9	18.6	14.0	11.4	10.0	9.4
Industrial machinery and equipment	49.3	42.5	35.4	31.2	29.0	28.4
Business machinery and instruments	28.5	21.2	16.5	13.9	12.4	11.8
Other manufacturing	27.1	21.1	16.7	14.2	12.8	12.2
Transportation	8.1	7.4	5.0	3.7	2.8	2.2
Communications	14.7	10.0	6.8	5.1	4.0	3.4
Electricity, gas, and sanitary	6.4	3.4	0.8	-0.6	-1.5	-2.1
Wholesale trade	18.6	16.1	12.8	10.8	9.7	9.1
Retail trade	6.7	6.1	4.9	4.1	3.4	2.9
Banking	9.7	7.2	5.2	4.0	3.2	2.5
Insurance	8.3	7.0	5.6	4.7	4.0	3.4
Real estate	10.7	3.4	0.8	-0.5	-1.4	-2.1
Personal and repair services	-4.8	-2.8	-4.6	-5.6	-6.3	-6.7
Business services	13.7	11.4	9.1	7.7	6.8	6.4
Entertainment and hotel services	4.9	3.7	2.8	2.2	1.6	1.1
Health services	3.7	4.1	3.3	2.6	1.9	1.3
Other services	4.1	3.8	3.2	2.7	2.2	1.7

Appendix: Households' Well-Being under the FairTax

But how well-off would taxpayers be under the FairTax? This is a difficult question stemming from the problem of deciding what we mean by a representative "taxpayer" or "household" over a 25-year period and of defining what we mean by "well-off."

We know that in any given year, "income" is a poor indicator of well-being. In contrast, spending is generally a better measure because people typically (and for very good reasons) spend more than they earn in their youth and old age while they tend to spend less than they earn in their middle years. Finally, well-being does not depend just on income or spending but also on leisure. In our model, rational households make economic choices to maximize their "lifetime utility" from the consumption of goods, services, and leisure. Their utility functions are nested in three different levels. First, households get utility from consuming goods and services; our model distinguishes 27 such categories. Second, households get utility from leisure, defined as any use of time other than work for pay. And third, households organize their leisure and consumption over their lifetimes in a way that maximizes their lifetime utility. This means that we get a very inaccurate picture of how a tax change affects a household over the future if we do not allow for the fact that most households experience changes in their income over the years. Households that are young now will typically experience a rise in income. Households that are old will experience a fall.

Let's assume, nevertheless, that a household that belongs to a given income category in 2007 will remain in the same category over the next 24 years. Table 9 shows that, were we to make that unrealistic assumption, five out of seven household groups would gain under the FairTax; their lifetime utilities show a positive percentage change. To get a more complete picture of the impact of the FairTax on well-being, we can inspect the year-to-year effects on utility, as reported in Table 10,.making the same assumption that households remain fixed at their initial income level After about 20 years of FairTax implementation, all households benefit as their utilities by then would be higher relative to those under the current law.

Table 9. Lifetime Utility under the FairTax Relative to Current Law (static household mobility)

Household categories (by income per household, 2001)	Utility change (%)
Less than $10,000	6.7
$10,000 - $24,999	2.2
$25,000 - $49,999	0.3
$50,000 - $74,999	-1.2
$75,000 - $99,999	0.2
$100,000 - $149,999	-0.6
More than $150,000	18.6

Table 10 gives a breakdown of households by income group and shows, for instance, that 19.1 percent of households had incomes between $10,000 and $24,999 in our base year.

Table 10. Distribution of Household Units by Income Group		
Income group		Percentage of household units
1	Less than $10,000	9.5
2	$10,000 - $24,999	19.1
3	$25,000 - $49,999	29.3
4	$50,000 - $74,999	19.5
5	$75,000 - $99,999	10.2
6	$100,000 - $149,999	7.7
7	More than $150,000	4.7

The change to the FairTax appears (slightly) to reduce the lifetime utility of households in the $50,000 - $74,999 and $100,000 - $149,999 income brackets – using the CGE model (see Table 9 above). Together these represent 27.2 percent of households, leaving one with the impression that more than a quarter of all households would lose from a switch to the FairTax.

Table 11 shows that, mainly because of the prebate, households earning less than $10,000 per year would enjoy a 0.6 percent increase in utility (well-being) in the first year of implementation and a 9.0 percent increase in 2031. At the opposite end of the income spectrum, households making more than $150,000 per year would see their utility increase by 14.4 percent in year 1 and by 20.1 percent in year 25. Households in the other five categories would generally see their utility fall at first and then ultimately rise above the benchmark.

Table 11. FairTax Impacts on Instantaneous and Lifetime Utility of Households (relative to current law, % change)

Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2016**	**2021**	**2026**	**2031**
Period	**1**	**2**	**3**	**4**	**5**	**10**	**15**	**20**	**25**
Utility of households									
Less than $10,000	0.6	0.7	2.0	3.0	3.9	6.9	8.3	8.9	9.0
$10,000 - $24,999	-2.6	-2.7	-1.7	-0.8	-0.1	2.3	3.4	3.9	4.0
$25,000 - $49,999	-4.1	-4.2	-3.3	-2.5	-1.8	0.4	1.4	1.8	1.8
$50,000 - $74,999	-5.0	-5.1	-4.4	-3.7	-3.1	-1.1	-0.2	0.1	0.1
$75,000 - $99,999	-3.5	-3.7	-2.9	-2.3	-1.7	0.3	1.2	1.5	1.6
$100,000 - $149,999	-4.6	-4.7	-3.9	-3.1	-2.6	-0.5	0.4	0.8	0.8
More than $150,000	14.4	14.2	15.0	15.8	16.4	18.7	19.8	20.1	20.1
Aggregate	-2.5	-2.6	-1.7	-1.0	-0.4	1.8	2.8	3.1	3.2

In the aggregate, some households would not be as well off for the first couple of years. However, a stronger incentive to invest and save would cut into consumption, and the greater incentive to work would cut into leisure. These effects occur because of the efficiency gains from the FairTax. These are reflected in higher growth rates of capital, output and investment, and labor supply. The additional work and investment would raise consumption and generate a higher level of utility to households. Net positive benefits of the FairTax appear by year 6 and ultimately rise by 3.2 percent by the end of year 25.

Not every household would benefit equally, however. Households in the lowest income band, with an adjusted gross income (AGI) of less than $10,000 annually, would benefit because they would receive the prebate that would more than offset any higher cost of purchasing goods. Households in the top income category, with more than $150,000 in annual income, would also gain as they do not have to pay their highest marginal tax rates. Mid-income category households would lose because the FairTax would impose a relatively higher tax rate on them.

Now let us consider a more realistic scenario, in which households experience different income levels over their lifetimes. We know, in fact, that individual economic agents typically experience an increase in income as they advance from youth to middle age, which many taxpayers will do over a 25-year period. For this scenario, we take into consideration the income mobility of households in each group over the 25-year time period.

The conclusions reported in Tables 9 and 11 are correct only if every household remains in the same income bracket throughout its life, which is of course not the case. In practice, there is considerable income mobility. For example, Gottschalk and Danziger[43] show that just 57.9 percent of those in the middle fifth of the income distribution were still there in 1992, while 21.0 percent of these people had moved up at least one quintile and 21.0 percent had moved down at least a quintile.

In tracing the effect of the FairTax on the well-being of taxpaying units, it is necessary to take this income mobility into account. In what follows, we explain how we simulate the effects of mobility by taking 10,000 hypothetical taxpaying units, tracking their incomes over 25 years, and summarizing the effects of these profiles. Here, more specifically, are the steps we take.

The first step is to create a *transition matrix* for the seven income categories that we used in the macro model and that are therefore used in the underlying social accounting matrix. This shows the proportions of households in any income category in year 0 who find themselves in each income category in year 1. Based on the distribution of households by income as shown above in Table 10, and the quintile transition matrix reported by Gottschalk and Danziger, we compute a new stationary transition matrix, which is shown in Table 12.

Table 12. Transition Matrix for Income Categories

			New							
			< 10k	10k -	25k -	50k -	75k -	100k -	> 150k	All classes
			1	2	3	4	5	6	7	
Old	< 10k	1	0.593	0.333	0.062	0.007	0.003	0.001	0.001	1.000
	10k -	2	0.115	0.577	0.270	0.026	0.007	0.003	0.002	1.000
	25k -	3	0.047	0.137	0.654	0.142	0.012	0.005	0.003	1.000
	50k -	4	0.010	0.035	0.177	0.593	0.130	0.035	0.020	1.000
	75k -	5	0.006	0.016	0.062	0.220	0.474	0.160	0.062	1.000
	100k -	6	0.005	0.008	0.025	0.100	0.210	0.487	0.165	1.000
	>150k	7	0.004	0.005	0.015	0.050	0.150	0.300	0.476	1.000
	All classes		1.000	1.000	1.000	1.000	1.000	1.000	1.000	

[43] Gottschalk and Danziger (1997) p. 34.

The next step is to simulate, for any household of the population, the sequence of income categories into which it falls over time. First we pick an initial income category in proportion to the probability that a household fits into the category (for instance, there is a 19.1 percent probability that the initial bracket is 2). Suppose, for example, that this first pick actually gives a household in category 2 (i.e., in the $10,000 - $24,999 income bracket). This is their income bracket in year 1. Now we use this initial value, along with the transition matrix, to determine their income bracket in year 2. There is a 57.7 percent chance that they will still be in income bracket 2, an 11.5 percent chance that they will fall into income bracket 1, and so on. We repeat this process until we have a sequence of income brackets for each of the 25 years, which is the time horizon that we use. Table 13 sets out an example from one such "run."

Table 13. Sample of Sequence of Income Bracket Mobility for a Household

	Income category	Utility change relative to baseline	Category in year 1, grossed up by utility change
Year 1	2	-0.026	0.974
Year 2	4	-0.051	0.949
Year 3	4	-0.044	0.956
Year 4	3	-0.025	0.975
Year 5	2	-0.001	0.999
Year 6	2	0.005	1.005
Year 7	3	-0.008	0.992
Year 8	1	0.060	1.060
Year 9	1	0.065	1.065
Year 10	2	0.023	1.023
Year 11	2	0.026	1.026
Year 12	2	0.029	1.029
Year 13	2	0.031	1.031
Year 14	2	0.033	1.033
Year 15	3	0.014	1.014
Year 16	1	0.085	1.085
Year 17	1	0.086	1.086
Year 18	3	0.017	1.017
Year 19	4	0.001	1.001
Year 20	4	0.001	1.001
Year 21	3	0.018	1.018
Year 22	3	0.018	1.018
Year 23	4	0.002	1.002
Year 24	4	0.002	1.002
Year 25	5	0.016	1.016
Mean	**2.68**	**0.015**	**1.015**

In step three, we use the information from the CGE model on the growth of utility for each income class for each year to create a sequence of utility increases (relative to the baseline) and then take the average of these. In the example in the above table, this household would, on average, see an annual 1.5 percent increase in utility.

Finally, we repeat the above process 10,000 times, which is enough to ensure that the resulting summary statistics are robust. This is akin to randomly sampling 10,000 households and then computing 10,000 sequences of income brackets, 10,000 sequences of utility increases (relative to the baseline), and 10,000 average annual utility increases.

The results are reported on the last line of Table 14 and show that 91 percent of households will be better off over their lifetimes as a result of the FairTax. Even the losers would not lose by much; of the 10,000 cases, the biggest loser would see his or her utility fall by just 1.1 percent. Moreover, households in all income classes, on average, experience an increase in lifetime utility under the FairTax when compared to the benchmark. The percentage increase in utility, shown in the column labeled "Mean," ranges from 1.4 percent for the $50,000 to $74,999 income class to 3.0 percent for the more than $150,000 income class. The distribution of the increases in well-being ("lifetime utility") is shown in Figure 12.

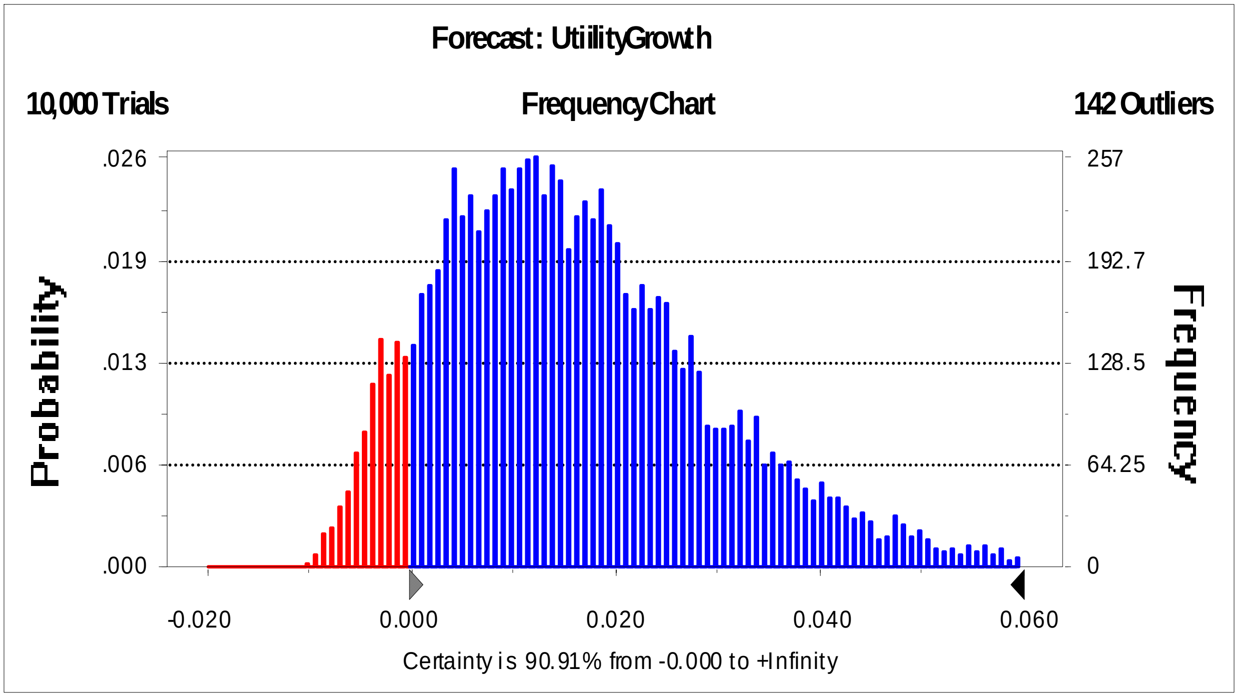
Table 14. Income Mobility and Utility Change Compared to Benchmark Models

Income class	Sample	Mean	Median	Min.	Max.	Probability of being better off*
Less than $10,000	10,000	2.0%	1.9%	-0.6%	11.1%	98%
$10,000 - $24,999	10,000	1.7%	1.5%	-0.9%	13.4%	94%
$25,000 - $49,999	10,000	1.5%	1.3%	-1.0%	10.2%	90%
$50,000 - $74,999	10,000	1.4%	1.2%	-1.2%	11.1%	87%
$75,000 - $99,999	10,000	1.7%	1.4%	-1.0%	11.0%	89%
$100,000 - $149,999	10,000	1.9%	1.6%	-1.2%	12.4%	90%
More than $150,000	10,000	3.0%	2.7%	-0.3%	13.9%	100%
Population (all classes)	10,000	1.7%	1.5%	-1.1%	11.8%	91%

** Note: Rounded to nearest whole percentage.*

We also undertook a second exercise, in which we started with a household in income category 1 (or 2, or 3, etc.) instead of picking the income category of the household randomly. We then used the transition matrix, as before, to trace out sequences of income over time, again for samples of 10,000. The result is a measure of the expected change in well-being, due to the FairTax, for someone who begins in income category 1 (or 2, or 3, etc.).

The results are shown in Table 14, and differ for each initial income bracket. For instance, if a household is initially in income group 2, there is a 94 percent probability that the household will be better off (in a lifetime utility sense) with the FairTax than without. Households who begin in the top bracket are almost certain to see an improvement in their condition (with a probability of 99.7 percent), as are those at the bottom of the income distribution (probability of 98 percent).



In sum, while not everyone would gain from the introduction of the FairTax, gainers would outnumber losers by a factor of more than ten to one, and none of the losses would be large. There are few, if any, policy opportunities in the U.S. that offer such large gains to so many people. Moreover, households in all income groups would, on average, experience increased welfare under the FairTax.

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