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Raising Taxes in Wisconsin: Measuring the Full Costs

REPORT FROM THE PRESIDENT:

For the last two years we have been developing a comprehensive model of Wisconsin's economy. It is designed to capture the principal effects of state tax changes on our economy. The final product is a Wisconsin State Tax Analysis Modeling Program (STAMP). This model was developed by a group of economists from The Beacon Hill Institute at Suffolk University in Boston. The primary author of this study is Dr. David Tuerck. He is Executive Director of The Beacon Hill Institute for Public Policy Research and Chairman and Professor of Economics at Suffolk University. He holds a Ph.D. in economics from the University of Virginia and has written extensively on issues of taxation and public economics. The coauthor is Dr. Jonathan Haughton, senior economist at The Beacon Hill Institute and Assistant Professor of Economics at Suffolk University. He holds a Ph.D. in economics from Harvard University and has published widely on economic development and taxation. John Barrett is a research economist at The Beacon Hill Institute with an M.S. in economics from New Mexico State University.

Their research has produced this first study, which deals with raising taxes in Wisconsin to cover our current deficit. What is unique about this model is that it is the first of its kind in Wisconsin and is a strict quantitative economic model designed to answer questions about the impact of tax policies. This study in particular asked: What if the state of Wisconsin chose to close a $1.6 billion budget deficit in the first year of its biennial budget by raising the revenue necessary through increasing the sales tax or, alternately, increasing the state income tax?

The results are straightforward and devastating. Not only would taxpayers contribute an additional $1.6 billion, tens of thousands of these taxpayers would also lose their jobs. If the sales tax were increased to cover the deficit, the reduction would be 55,514 jobs. If the state income tax were increased to balance the budget, the job loss would rise to 84,015.

Raising either tax at any level would be an economic disaster for the state. But that doesn't mean that it won't happen. Raising either the sales tax or the income tax would lead to job reduction in every major industry in the state of Wisconsin except one. The irony is that the one institution that would actually gain jobs is the government. That is why it still may happen. Historically, when push comes to shove politicians tax and do not cut spending. One can only hope that the best interests of taxpayers will supersede the special interest groups that dominate our state capital.

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PAGE

EXECUTIVE SUMMARY

Wisconsin is facing a fiscal crisis. According to budget estimates released in November 2002, the state is projected to face a deficit of $1.6 billion in fiscal year 2004[1] and $1 billion in FY2005.

There are no easy fixes for the looming deficit. Some have suggested that the state should borrow from the $52 billion state pension fund, or defer paying into the fund — a "contribution holiday" — as was done in 1999. Although this option will get serious attention, the pension fund is increasingly short of funds, and it is clear that other measures will be required to tackle the state budget deficit. A second approach is to cut spending. This will certainly be necessary, but specific details of possible cuts are unlikely before late January 2003, when the new 2003-2005 biennial budget will be proposed.

The third alternative is to raise taxes. For now, this is not under consideration, and the state's political leaders express strong opposition to any tax increases. Despite such statements, there is likely to be an increase in public sentiment for tax increases once the nature and extent of spending cuts become clear.

In considering possible tax increases, it is important to be clear about the costs that they impose on an economy. Tax increases that are used to pay for government services and transfer payments benefit one group (the recipients) at the expense of another (the taxpayers). But there are additional costs to the economy, which can be quite substantial, as the tax increases affect the behavior of households and firms: individuals may work less, and businesses may cut back on investment.

In this report we trace the effects of increasing state taxes in order to eliminate the projected $1.6 billion deficit in FY2004. We consider two cases:

a. An increase in the sales tax of 2.4 percentage points, from 5% to 7.4%;
b. An increase in the state personal income tax by about 2.0 percentage points, which would push the bottom rate from 4.6% to 6.6% and the main rate from 6.5% to 8.5%.

TABLE A EFFECTS OF INCREASES IN SALES AND PERSONAL INCOME TAXES THAT RAISE AT LEAST AN ADDITIONAL $1.6 BILLION IN NET STATE REVENUE, FY 2004.

	Baseline For FY 2004	Sales tax rises from 5% to 7.4%		Income tax rises by 2.0 percentage points*	
		Change	*% change*	*Change*	*% change*
Employment	3,082,805	-55,514	-1.80	-84,015	-2.73
Wage rate, $ per annum (p.a.)	40,163	131	0.33	723	1.80
Investment, $m	22,825	-465	-2.04	-509	-2.23
Real disposable income, $m	132,827	-1,986	-1.50	-2,655	-2.00
Real DI per capita	21,402	-109	-0.51	-121	-0.57
State tax revenue, $m	10,956	**1,617**	14.76	**1,602**	14.60
Of which:					
State sales tax	3,944	1,733	43.94	-90	-2.05
State personal income tax	5,553	-82	-1.48	1,733	31.21
Other	1,459	-34	-2.33	-41	-2.95
Memo: local property tax	8,098	-145	-1.79	-173	-2.14

Source: Based on simulations using Wisconsin STAMPfor FY 2004.
*Note: * The 6.15% effective rate would rise by 2.1 rather than 2.0 percentage points.*

Increases of this magnitude would be required to yield sufficient revenue to close the (conservatively) projected $1.6 billion gap.

For each case we use a specially-constructed computable general equilibrium model of the state, the Wisconsin STAMP (State Tax Analysis Modeling Program), to provide a rigorous framework for quantifying the effects of tax changes on a wide array of state economic indicators, including state tax revenue, employment, output, and real incomes.

An increase in the sales tax to 7.4% would raise state tax revenue by a net $1.617 billion; this represents an increase in sales tax revenue of $1.733 billion, offset by a reduction in other tax receipts of $0.116 billion. As Table A shows, the economic effects would be considerable. Most notably, there would be a reduction in employment of almost 56,000, or 1.8% of the work force. Real disposable income would fall by 1.5%. The combined effects of lower employment and lower incomes would prompt people to leave (or not enter) the state, so that for those who remain, real disposable income per person would fall by 0.5%. It is worth noting that while the wage rate would rise (by 0.33%), this would not be enough to offset the higher cost of living that would result from the increase in the sales tax rate by 2.4 percentage points. Gross investment is determined, sector-by-sector, based on the net of tax rate of return relative to the return in the base period. It is the increase or decrease of the capital stock (fixed non-residential assets) in that sector relative to the capital stock of the base period.

The projected deficit could also be made up by raising the state personal income tax. To yield enough revenue, the tax rate would have to rise by about 2.0 percentage points.[2]

The figures in Table A show that the effects of such an increase in the state personal income tax would be somewhat stronger than those associated with a comparable rise in the sales tax. Employment would fall by 84,000 (-2.7%), investment would drop by $509 million (2.2%), and real disposable income per capita would fall by 0.6%. The reduction in the number of working households would be particularly marked for those with annual incomes in the $50,000 to $69,999 range, where the work disincentives of a higher income tax would be particularly marked. Although the wage rate would rise, the change (+1.80%) would not be enough to offset the increase in the income tax, so that those who remain employed would generally not be better off. The main effect of the higher wage rate is that it would raise the cost of hiring labor, which mainly explains the large reduction in overall employment. The increase in personal income tax would also modestly reduce the sales tax and other tax revenues, since disposable income would be smaller.

The trade-offs for the state are difficult. If it chooses to increase the sales tax rather than cut spending, it will lose 55,000 jobs, discourage investment, and make citizens worse-off financially. If the state instead chooses to close the gap with a two-percentage point increase in personal income tax, the state loses even more jobs (84,000) and greater investment. Neither alternative is appealing. But at least one can now better know the costs of addressing the revenue shortfall through two alternative tax vehicles.

INTRODUCTION

Wisconsin is facing a fiscal crisis. According to budget estimates released in November 2002, the state is projected to face a deficit of $1.6 billion in fiscal year 2004 and $1 billion in FY2005. The deficit in the current fiscal year is projected to be $185 million, and would be much larger but for the one-time windfall that the state received by selling off most of the rights to the future revenue stream from the tobacco settlement; this "tobacco securitization" yielded $681 million in FY2002. In a recent survey, 87% of those polled were "somewhat" or "very" concerned that the budget crisis would affect them.[3]

Many believe that these deficit figures are too optimistic. Some of the assumptions that were made in making the projections are not entirely plausible: no increase in reimbursement rates for health care professionals under Medicaid; no pay increase for faculty and staff at the University of Wisconsin or other state workers; no additional payments on rising debt; no new buildings; and increases in tax revenue of 5.3% in FY2004 and a further 5.8% in FY2005. On the other hand the projections do allow for $2.7 billion in additional spending over the biennium, to permit additional aids to local government and public schools, and increased spending on Medicaid and on prisons. Governor Jim Doyle is on record as saying that the biennial budget deficit may be as large as $4.3 billion, equivalent to 19% of current tax revenues, and has expressed concern that "recovery may not come as quickly as expected."[4] The assumptions made about economic growth are important: every 1% increase in Gross State Product raises tax revenues by $110 million; and every one percentage point increase in the unemployment rate raises Medicaid caseloads by 4%.

There are no easy fixes for the looming deficit. Some have suggested that the state should borrow from the $52 billion state pension fund, or defer paying into the fund (a "contribution holiday"), as was done in 1999. The fund has 523,000 members, including 135,000 retirees, and gets $1.1 billion in contributions from state and local government annually. However, the fund's assets have dropped from $64 billion in late 1999, the rainy day portion has gone, a series of ill-considered increases in benefits have substantially increased the fund's obligations, and serious consideration is being given to cutting pension payments (per recipient) by 1%-2% in April 2003.

Although the pension fund is not completely off limits when considering ways to tackle the state's budget deficit, and a "contribution holiday" is likely to get serious attention, it is also clear that other measures will also be required.

A second approach is to cut spending. This will certainly be necessary. Governor Doyle says that he is determined to get the state's financial house in order "through a combination of [economic] growth and spending cuts."[5] Senate Majority Leader Mary Panzer, has said that Doyle must "propose real cuts in state spending to get us out of this hole." Specific details of possible cuts are unlikely before late January 2003, when the new 2003-2005 biennial budget will be proposed.

The third alternative is to raise taxes. For now, this is not under consideration. In the words of Governor Doyle, "tax increases are not an option." The sentiment is echoed by Senate Majority Leader Panzer, who said recently that "we are going to solve the state's fiscal problems, and we are not going to do it the easy way, by raising taxes. We're going to do it the harder way, by setting priorities."[6]

Despite such statements, there is likely to be an increase in public sentiment for tax increases once the nature and extent of spending cuts becomes clear.

In considering possible tax increases, it is important to be clear about the costs that they impose on an economy. Tax increases that are used to pay for government services and transfer payments benefit one group (the recipients) at the expense of another (the taxpayers). But there are additional costs, as the tax increases affect the behavior of households and firms: individuals may work less, and businesses may cut back on investment. The result can be a substantial additional cost to the economy.

In this report we trace the effects of increasing state taxes in order to eliminate the projected $1.6 billion deficit in FY2004. We consider two cases, a higher personal income tax, and a higher state sales tax. For each case we use a specially-constructed computable general equilibrium model of the state, the Wisconsin STAMP (State Tax Analysis Modeling Program), to provide a rigorous framework for quantifying the effects of tax changes on a wide array of state economic indicators, including state tax revenue, employment, output, and real incomes.

What is Wisconsin STAMP?

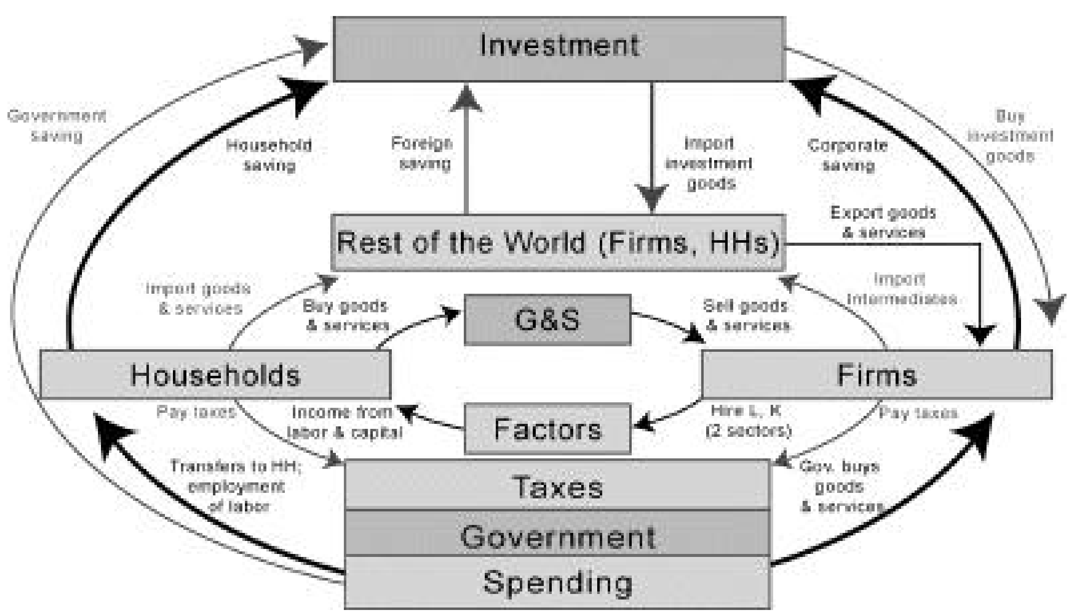
Wisconsin STAMP is a comprehensive model of the Wisconsin economy, designed to capture the principal effects of state tax changes on that economy. Wisconsin STAMPis computable general equilibrium (CGE) tax model. As such, it provides a mathematical description of the economic relationships among producers, 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 (goods and services, labor and capital); this is achieved by allowing prices to adjust within the model (i.e. they are endogenous). It is computable because it can be used to generate numeric 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.[7]

We begin by distinguishing between producers and consumers. Consumers/households earn income by supplying labor (wages and salaries) and capital (dividends and interest); they also receive transfer payments such as pensions. They are assumed to maximize their utility, which they do by using this income to buy goods and services, pay taxes and save. Their spending decisions are strongly influenced by the structure of prices they face; and the amount of labor that they are willing to provide depends to a substantial degree on the wage rates that they face.

Producers/firms buy inputs (labor, capital and intermediate goods that are produced by other firms) and transform them into outputs. They are assumed to maximize profits and are likely to change their decisions about how much to buy or produce depending on the prices they face for inputs and outputs.

In addition there is a government sector that collects taxes and fees and provides services and transfers. The rest-of-the world sector consists of the entire world outside Wisconsin. The relationships between these components are set out in the circular flow diagram shown in Figure 1. The arrows in the diagram represent flows of money (for instance, households purchase goods and services), and flows of goods and services (for instance, households supply 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 Diagram



Complex as it may seem, the diagram in Figure 1 is still too simple, because it lumps all households into one group, and all firms into another. To provide further detail it is necessary to create sectors; Wisconsin STAMPhas 75 sectors in total. Each sector is an aggregate that groups together 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 (12 of them at the state level) and 18 categories of government spending. To complete the model there are two factor sectors (labor, capital), an investment sector, and a sector that represents the rest of the world. The choice of sectors was dictated by the availability of suitably disaggregated data (for households and firms), and the purposes of the model, which is why we provide considerable detail about taxes.

Regional models, such as Wisconsin STAMP, are similar in many respects to national and international CGE models. However they differ in a number of important respects, which are worth listing:

a. In a national model, most saving goes toward domestic investment; however this need not be true at the regional level. If citizens of Wisconsin save more than they spend, then the excess saving will leak out of the state.

b. The smaller the unit under consideration, the greater the importance of trade with the rest of the world. This is an important consideration for state models.

c. Migration is likely to be larger and more responsive across states than across nations.

d. In regional models, taxes are interdependent. So, for instance, the amount of revenue collected by the Federal personal income tax depends significantly on whether there is a state income tax (which may be deducted from income before computing the Federal tax).

e. Data are less available at the regional than national level. This explains why scores of national CGE models have been built, but very few regional models.

Constructing a CGE Model

The construction of a CGE model involves several steps. First, one needs to organize the data needed by the model. Wisconsin STAMP is based on data for a single year, 2001, which the model then extrapolates to FY 2004. However the data from the base year, 2001, must be very detailed. Most of the data are organized into a *Social Accounting Matrix*, which in this case consists of a 75 by 75 matrix that accounts for the main economic and fiscal flows in the state. The model also requires some additional information — for instance data on employment and on the structure of the Federal income tax — which are put in separate files. And the model requires information on “elasticities” — these are the parameters, typically gleaned from the academic literature, that measure the responsiveness of households to changes in prices and wages, and of firms to changes in input costs and output prices. The economy is assumed to be competitive, and to run at full employment (by which we mean that there is no involuntary unemployment).

Second, the model needs to be specified in detail; the next section of this report sets out details of the model that we constructed for Wisconsin, along with some comments explaining the choices made at each step.

The third step is to program the model. For this we used the specialized GAMS (General Algebraic Modeling System) software. In order to make the model easier to use, we also developed an interface in Microsoft Excel. This allows the user to enter tax changes on an Excel spreadsheet, click on the “Estimate CGE” button, and read the key output on the same spreadsheet; the heavy-duty computing occurs in the background.

Before use, the model has to be calibrated. This consists of running the model — i.e., asking it to solve for all the variables in such a way as to maximize state personal income — and then checking that the results correspond with the actual values of the variables in the base year (taken to be 2001 in our case). Once the model reproduces the base year values, it is considered calibrated. Calibration is a non-trivial step, and is essentially a way of checking that the model is working properly.

Finally, the model is ready to be used to quantify tax change effects. The procedure is straightforward: specify a new tax rate (or change in the tax), run the model, and compare the new results with the baseline ones. At this point it is also possible to test the sensitivity of the results to different assumptions — such as the values of elasticities — that are incorporated into the model. We note in passing that Wisconsin STAMP is a policy model and not a forecasting model; in other words it is designed to answer “what if?” questions, not to estimate what is likely to occur in coming years.

Organizing the Data

The starting point in building a CGE model is to determine the degree of detail that is desired and to organize the collected data into the useful format of a Social Accounting Matrix (SAM). The SAM that we developed for Wisconsin is a 75 by 75 matrix. Each of the 5,625 cells represents the dollar value of a flow from one sector of the economy to another – for instance, purchases of business services by the agricultural sector, or labor earnings flowing to middle-income households. Reading along a row one finds the payments received by that sector; reading down

TABLE 1 INDUSTRIAL SECTORS USED IN WISCONSIN STAMP, WITH EMPLOYMENT LEVELS IN 2001

	2001
Agriculture, forestry and fishing	101,035
Mining	2,800
Construction	122,600
Food and food processing	67,000
Apparel and clothing	11,000
Building materials and furniture	62,100
Paper and Publishing	104,100
Chemicals, rubber, plastics	51,400
Electronic and electrical equipment	42,700
Motor vehicles	30,900
Primary and fabricated metal	87,600
Industrial machinery and equipment	102,100
Instruments	17,500
Other manufacturing	11,100
Transportation	94,600
Communications	20,800
Electricity, gas, sanitary	18,200
Wholesale trade	137,400
Retail trade	502,900
Banking	39,888
Insurance	50,274
Real estate	59,937
Repair services	54,500
Business services	187,795
Hotels, amusements, motion pictures, entertainment	87,488
Health services	233,200
Other services	244,112

Source: IMPLAN and Bureau of Economic Analysis.

a column one sees the payments made by that sector. The SAM is balanced, which means that the sum of the entries in any given row equals the sum of the entries in the corresponding column. Thus, for instance, the revenue received by agriculture must equal spending by that sector, so that all incoming and outgoing funds are completely accounted for.

For Wisconsin STAMP, we distinguish 27 industrial sectors, two factors (labor and capital), seven household categories, an investment sector, 37 government sectors (19 for taxes, 18 for spending) and a sector for the rest of the world. In sectoring the economy we sought to strike a balance between providing a high level of detail (especially on the tax side) and keeping the model to a manageable size. In addition there is a more pragmatic consideration, which is that the lack of finely disaggregated data limits the degree of detail that is possible. Data availability also determined some of the choices we made; for instance, it is possible to get a breakdown of households into seven income categories (see below for further details), and while we might have preferred a different set of categories, we were constrained by the nature of the data available.

Industrial Sectors

Afull list of the 27 industrial sectors that we used, along with employment in each industry, is shown in Table 1. Data from the Bureau of Economic Analysis would have allowed us to separate out 49 sectors. However some sectors were too small to merit separate attention, which is why, for instance, we combined textiles and apparel. In some other cases there were no matching employment figures, and so it was easier to work with aggregates. Further, only 37 sectors were distinguished for the input-output table.

Factor Sectors

We distinguish between two factors, labor and capital (which includes land). Businesses pay wages and salaries to labor, and they generate profits. These are then distributed to household owners as factor income.

Household Sectors

In Wisconsin STAMP, households receive wages, capital income and transfers; they use this income to buy goods and services; they pay taxes; and they save. We distinguish seven household sectors; these sectors group households by their levels of income, as shown in Table 2. Expenditure data are available for households in each of these categories, so it is relatively straightforward to work with this structure. One purpose of this disaggregation of households is to allow one to trace the distributive effect of tax changes; another is to allow different groups to have different levels of sensitivity to labor market conditions. Of a total estimated real disposable income of $132.5 billion in 2001, almost half (43%) accrues to the 19% of households that are in the top income category.

TABLE 2 NUMBER OF HOUSEHOLDS BY INCOME BRACKET, 2001

Category of household	Income per household level $ per annum (p.a.)	Total estimated real disposable income 2001, $bn	Number of households millions
LESS10	<$10,000	2.4	.28
LESS20	$10,000 – 19,999	8.7	.39
LESS30	$20,000 – 29,999	12.0	.32
LESS40	$30,000 – 39,999	13.3	.26
LESS50	$40,000 – 49,999	12.7	.20
LESS70	$50,000 – 69,999	26.5	.32
MORE70	$70,000 and up	56.7	.41
All Wisconsin		**132.5**	**2.19**

Investment Sector

There is one investment/savings sector. Households save, both directly out of their cash incomes, and indirectly because they own shares in businesses that save and reinvest profits. The government also saves and invests. Information is available from the Bureau of Economic Analysis on the pattern of gross investment by destination (i.e.

how much gross investment went into adding to the stock of capital in agriculture, in mining, and so on). We have constructed measures of the capital stock in each sector; by applying published depreciation rates and adding gross investment, one arrives at the capital stock in the subsequent period. This permits the model to track the expansion of the economy over time. The BEAhas also produced a matrix, built for the U.S. for 1992, that maps investment by destination with investment by source. In other words, it allows one to find out, for instance, how much of the investment destined for agriculture is spent on purchasing goods and services from the construction sector and the transport sector. Thus if investment rises, it is possible to identify which sectors would face an expansion in the demand for their output.

Government Sectors

Wisconsin STAMPwas designed primarily to analyze the effects of major changes in the structure of state taxes, and so we have paid particular attention to providing sufficient detail for government transactions. The sectoring is summarized below in Table 3.

The Wisconsin state government collects revenue from taxes on sales, motor fuel, the corporate income tax, excises on alcohol and tobacco, insurance and inheritance. It also collects a variety of fees. The relative importance of these sourses of revenue is clear from Table 4, which summarizes state receipts in FY2002 and presents the most recent estimates (as of November 2002) of revenue for FY2003 through FY2005.

All of the collections from these taxes and fees are deemed to go into one of the following funds: general fund, highway fund, special fund, trust fund or other fund. From these tax funds they flow to different categories of spending.

In the model, the government of Wisconsin pays directly for some education, mainly the University of Wisconsin system. It also spends on public safety, transportation, and general administration, mostly salaries for state workers. A major category of spending is health and welfare, mostly in the form of transfers to local authorities. All remaining state spending is gathered into a residual category.

Local governments in Wisconsin receive tax revenue from residential property and business and commercial property, as well as from a variety of other taxes and fees. These funds, augmented by transfers from the state level, flow to spending on education, health and welfare, and other areas such as public safety.

Rest of the World

To complete the model we have included a sector for the rest of the world (ROW). This refers to the rest of the United States as well as other countries. Information on flows between Wisconsin and the rest of the world is difficult to piece together, and is an area where considerable professional judgment was required.

Table 3 Government Sectors

Federal Government Receipts		
USSSTX	Social Security	Receives payments from employers and households; pays out transfers to households.
USPITX	Federal personal income tax	Receives payments from households, which are put into the Federal normal spending account.
USCITX	Federal corporation income tax	Receives payments from corporations and channels them into the Federal normal spending account.
USOTTH	Other federal taxes	Includes excises on motor fuel, alcohol, and tobacco; estate and gift taxes. Also funneled into the Federal normal spending account.
Federal Government Expenditure		
USNOND	Federal normal spending	Federal government purchases goods and services, hires labor, and transfers money to Wisconsin and to Federal defense fund.
USDEFF	Federal defense spending	Purchases goods and services, and pays labor for military purposes.
Wisconsin Government Receipts		
STSATX	Wisconsin sales tax	Sales tax, vehicle sales tax, utility taxes, hotel and motel tax. Revenues go into Wisconsin general fund.
STMOTX	Wisconsin tax on motor fuel	Revenues go into Wisconsin highway fund.
STCITX	Wisconsin corp. income tax	This is the tax on business; revenues go to into the Wisconsin general fund.
STALTX	Wisconsin tax on alcohol	Revenues go into Wisconsin general fund.
STCTTX	Wisconsin tax on tobacco	Revenues go into Wisconsin general fund.
STIHTX	Wisconsin tax on insurance occupation	Revenues go into Wisconsin general fund.
STPITX	Wisconsin personal income tax	Revenues go into Wisconsin general fund.
STINTX	Wisconsin inheritance tax	Revenues go into Wisconsin general fund.
STFEES	Wisconsin fees, licenses, permits	Revenues go into Wisconsin general fund, special fund, trust fund, highway fund, and “other funds”.
STWKTX	Wisconsin workers' compensation and disability	Sector combines workers compensation and unemployment funds. Receipts from Federal government go directly to households.
STGENF	Wisconsin general fund	An accounting device. Tax revenue is channeled into this fund before being distributed to other uses.
Wisconsin Government Expenditure		
STEDUC	Wisconsin spending on education	Mainly purchases of goods and services and labor in the higher education sector.
STHELT	Wisconsin spending on health & welfare	Buys some services; mainly transfers funds to local health spending fund.
STPBSF	Wisconsin spending on public safety	Spending on labor, goods and services.
STTRAN	Wisconsin spending on transport	Mainly buys engineering services and construction.
STOTHS	Wisconsin other spending	Miscellaneous other spending by the state on labor, goods and services.
Local Government Receipts		
LOPRTX	Local tax on residential property	Collected from households. Transferred to local government spending units.
LOPBTX	Local tax on business property	Collected from firms. Transferred to local government spending units.
LOTOT	Local taxes, other	Collected from firms. Transferred to local government spending units.
Local Government Expenditure		
LOEDUC	Local spending on education	Purchases goods and services and (mainly) pays teacher salaries.
LOHELT	Local spending on health & welfare	Purchases goods and services and pays labor; large transfers to the poorest category of households.
LOOTHS	Local other spending	Includes spending on police and firefighters, road repair, and miscellaneous local government services.

TABLE 4 WISCONSIN TAX REVENUES BY SOURCE, FY 2002 THROUGH FY 2005

	Actual	Estimates, as of November 2002		
	FY 2002	*FY 2003*	*FY 2004*	*FY 2005*
		(in millions of dollars)		
Individual income tax	4,980	5,248	5,553	5,970
General sales and use tax	3,696	3,793	3,944	4,126
Corporation franchise and income tax	503	509	547	566
Public utility	252	260	272	283
Excise taxes: cigarettes	289	292	292	291
Excise taxes: other	60	62	64	66
Estate taxes	83	74	119	126
Insurance companies	96	97	98	99
Miscellaneous tax revenue	63	65	67	69
Tobacco settlement	156	158	0	0
Tobacco securitization	681	0	0	0
Other departmental revenues	277	257	166	175
Total	**11,352**	**10,870**	**10,937**	**10,373**
***Of which:* Tax revenue**	**10,020**	**10,401**	**10,956**	**11,597**

Source: Division of Executive Budget and Finance, Department of Administration, State of Wisconsin: "Agency Budget Requests and Revenue Estimates FY2004 FY2005," November 20, 2002.

WISCONSIN STAMP IN DETAIL

In this section we set out the model in detail. First we introduce each equation, providing some context and a short description. Then we present each equation in mathematical form, followed by the form used in the GAMS (General Analytical Modeling System) program and finishing with information on the sources of data used.

Household Demand

Households are assumed to maximize their well being ("utility") by picking baskets of goods and services, subject to their budget constraints. The key set of equations in this section is labeled *Private Consumption*, and consists of a set of demand functions. These demand functions, based on a Cobb-Douglas utility function, take on the simple form,

$$X_i = \lambda_i * \frac{I}{P_i}, \quad i = 1,..., n$$

where X_i is the quantity demanded of good *i*, P_i is the price of good *i*, *I* is income, and the λ_i are parameters that measure the share of income that is devoted to good *i*. This is the simplest specification that is theoretically satisfactory: it is additive (so spending equals income less taxes less saving), has downward-sloping demand (i.e. it ensures that when the price of a good rises the quantity demanded falls), is zero degree homogeneous in prices and income (so that if prices and incomes were to double, the quantity demanded would not change), and meets the technical requirement of symmetry of the Slutsky matrix. More complex formulations are possible, but there is a lack of reliable data on the elasticity parameters that would be needed in such cases.

Household Gross Factor Income

Comments: The gross income of households in each of the seven groups (indexed by *h* in the set *H*) is found by first summing factor income (y_f) from labor and capital, subtracting the social security contributions paid by employees, and then allocating the total to each group on the basis of fixed shares. Factor payments are allocated to each household group using the same fixed shares as were found in the base year.

Eq.1.

$$y_h = \sum_{f \in F} \frac{\alpha_{hf} a_h^w}{\sum_{h \in H} \alpha_{hf} a_h^w} y_f \left(1 - \sum_{g \in GF} \tau_{gf}^h\right) \qquad h \in H$$

GAMS: Y(H) = E = SUM(F, A(H,F) * HW(H)/ SUM(H1, A(H1,F) * HW(H1))* Y(F) * (1 - SUM(G, TAUFH(G,F))));

Data: The information on earnings for each household group comes from household survey data for the Midwest of the U.S. for 2000-2001.

Source: *BLS Consumer Expenditure Report 2000-2001 (Midwest)*.

Available at <ftp://ftp.bls.gov/pub/special.requests/ce/crosstabs/y0001/regbyinc/xregnmw.txt.>

Household Disposable Incomes

Comments: Disposable household income is gross income, less taxes on household income and property (mainly personal income tax (USPIT, STPIT) and residential property tax (LOPRP)), plus transfer payments (such as social security and unemployment benefits).

Eq.2. $$y_h^d = y_h - \sum_{g \in GI} t_{gh} a_h^w - \sum_{g \in GH} \tau_{gh}^h a_h + \sum_{g \in G} w_{hg} a_h^n \tau_{hg}^{pc} - \sum_{g \in G} w_{hg} (a_h^n - \bar{a}_h^n) \pi_{hg}^{pc} SSIYES \qquad \forall h \in H$$

GAMS: YD(H) = E = Y(H) - SUM(GI, PIT(GI,H)) * HW(H) - SUM(G, TAUH(G,H) * HH(H)) + (SUM(G, TP(H,G) * HN(H) * TPC(H,G)));

Private Consumption Expenditure

Comments: This is the simplest demand system that is consistent with theoretical first principles, and it requires only a limited number of parameters.

Eq.3. $$c_{ih} = \bar{c}_{ih} \left(\frac{y_h^d}{\bar{y}_h^d} \div \frac{p_h}{\bar{p}_h} \right)^{\beta_{ih}} \prod_{i' \in I} \left[\frac{p_i \left(1 + \sum_{g \in GS} \tau_{gi}^c \right)}{\bar{p}_i \left(1 + \sum_{g \in GS} \tau_{gi}^q \right)} \right]^{\lambda_{i'i}} \qquad \forall i \in I, h \in H$$

GAMS: CH(I,H) = E = CH0(I,H) * ((YD(H) / YD0(H)) / (CPI(H) / CPI0(H))) ** BETA(I,H) * PROD(J, ((P(J) * (1 + SUM(GS, TAUC(GS,J)))) / (P0(J) * (1 + SUM(GS, TAUQ(GS,J)))))) ** LAMBDA(J,I));

Data: By construction, this equation has zero cross price elasticities. In the absence of adequate estimates of demand elasticities we follow the approach taken by Berck et al., setting all income and own-price elasticities equal to unity.

Direct Household Purchases of Imports

Some household spending goes directly to buy goods and services outside Wisconsin.

$$m_h = \bar{m}_h \left(\frac{y_h^d}{\bar{y}_h^d} \div \frac{p_h}{\bar{p}_h} \right)^{\eta_h^m} \qquad \forall h \in H$$

GAMS: M(H) =E= M0(H) * ((YD(H)/(YD0(H))/(CPI(H)/CPI0(H)))**ETAMH(H);

Household Savings

Comments: In Wisconsin STAMP, household savings is the residual after spending and taxes have been subtracted from income. Thus savings are seen as occurring passively.

Eq.4. $$s_h = y_h^d - \sum_{i \in I} c_{ih} p_i \left(1 + \sum_{g \in GS} \tau_{gi}^c \right) - m_h \qquad \forall h \in H$$

GAMS: S(H) =E= YD(H) - SUM(I, P(I) * CH(I,H)*(1+SUM(GS, TAUC(GS,I)))) – M(H);

Data: The savings rates for households at each income level were adjusted, based on professional judgement, to account for the imputed savings by corporations (which indirectly represents savings by the owners of the corporations).

Consumer Price Indexes

Comments: The price index in the reference period is set equal to 1. There is a separate price index for each household group. This allows one to compute the real (rather than nominal) income for each household group. A tax on, for instance, foodstuffs would tend to hit poor households relatively hard, and the CPI for poor households would pick up this effect.

Eq.5.

$$p_h = \frac{\sum_{i \in I} p_i \left(1 + \sum_{g \in GS} \tau^{c}_{gi}\right) c_{ih}}{\sum_{i \in I} \bar{p}_i \left(1 + \sum_{g \in GS} \tau^{q}_{gi}\right) c_{ih}} \qquad h \in H$$

GAMS: CPI(H) = E = SUM(I, P(I) * (1 + SUM(GS, TAUC(GS,I))) * CH(I,H)) / SUM(I, P0(I) * (1 + SUM(GS, TAUQ(GS,I))) * CH(I,H));

Data: The consumption of each good by each household group (c_{ih}) is derived from Consumer Expenditure Survey data (1999-2000). Expenditures on each product group by household groups were allocated based on the types of products that were reported. For example expenditures on pork went to the Food sector and expenditures on vehicles went to the Transportation sector (TPORT). The numbers refer to the Midwest region of the US, which we took to be an adequate representation of spending patterns in Wisconsin. The distribution of households by income group is also for the Midwest rather than Wisconsin, but we applied the same proportions to the population of Wisconsin.

Labor Supply

Comments: In Wisconsin STAMP, we model the participation rate, which is defined as the proportion of households in any given income category that work. The participation rate is assumed to rise if wage rates rise, if the taxes levied on earnings fall, or if the transfer payments paid out per non-working household fall. The participation rate for low-income households is assumed to be highly sensitive to the level of transfer payments, but relatively insensitive to changes in taxes or the wage rate. On the other hand high-income households are assumed to respond substantially to changes in the taxes and wage rates they face.

Eq.6.

$$\frac{a^{w}_{h}}{a_h} = \frac{\bar{a}^{w}_{h}}{a_h}\left(\frac{r^{a}_{L}}{\bar{r}^{a}_{L}} \div \frac{p_h}{\bar{p}_h}\right)^{\eta^{ls}_{h}} \left(\frac{\sum_{g \in GI} t_{gh}}{\sum_{g \in GI} \bar{t}_{gh}}\right)^{\eta^{PIT}_{h}} \left(\frac{\sum_{g \in G} \frac{w_{h'g}}{p_h}}{\sum_{g \in G} \frac{\bar{w}_{h'g}}{\bar{p}_h}}\right)^{\eta^{tp}_{h}} \qquad h \in H$$

GAMS: HW(H) / HH(H) = E = HW0(H) / HH(H) * ((RA('L') / RA0('L')) / (CPI(H) / CPI0(H))) ** ETARA(H) * (SUM(GI, PIT(GI,H)) / SUM(GI, PIT0(GI,H))) ** ETAPIT(H) * (SUM(G, TP(H,G) / CPI(H)) / SUM(G, TP0(H,G) / CPI0(H))) ** ETATP(H);

Data: The data on working households by income class came from the Consumer Expenditure Survey (1999-2000) for the Midwest, as did the total number of households in each category. These were then adjusted to fit the total number of households in Wisconsin.

Migration

Population

Comments: The number of households in each income group depends first and foremost on the initial number of households. To this we add the natural growth of the population and net in-migration. Migration in turn depends on the level of after-tax income, and the proportion of households that are not working (which reflects the employment prospects facing new migrants). This formulation is in the spirit of the migration model popularized by Harris and Todaro (*American Economic Review*, 1973).

Eq.7.

$$a_h = \bar{a}_h (1+\pi) + \bar{a}^i_h \left(\frac{y^d_h}{a_h} \div \frac{\bar{y}^d_h}{\bar{a}_h} \div \frac{p_h}{\bar{p}_h}\right)^{\eta^{yd}_h} \left(\frac{a^n_h}{a_h} \div \frac{\bar{a}^n_h}{\bar{a}_h}\right)^{\eta^u_h} - \bar{a}^o_h \left(\frac{\bar{y}^d_h}{\bar{a}_h} \div \frac{y^d_h}{a_h} \div \frac{\bar{p}_h}{p_h}\right)^{\eta^{yd}_h} \left(\frac{\bar{a}^n_h}{\bar{a}_h} \div \frac{a^n_h}{a_h}\right)^{\eta^u_h}, \quad h \in H$$

GAMS: HH(H) = E = HHOLD0(H) * (1+NRPG(H)) + MI0(H) * ((YD(H) / HH(H)) / (YD0(H) / HH0(H)) / (CPI(H) / CPI0(H))) ** ETAYD(H) * ((HN(H) / HH(H)) / (HN0(H) / HH0(H))) ** ETAU(H) - MO0(H) * ((YD0(H) / HH0(H)) / (YD(H) / HH(H)) / (CPI0(H) / CPI(H))) ** ETAYD(H) * ((HN0(H) / HH0(H)) / (HN(H) / HH(H))) ** ETAU(H);

Data: The natural rate of population growth is taken to be 0.72% p.a., based on recent Wisconsin experience. The elasticities used in this equation are the same as those used for California by Berck et al. (1996), and "reflect the middle ground found in the literature about migration" (p.117).

Number of Non-Working Households

Comments: This is a simple accounting equation; the number of non-working households is the total number of households, less the number that are working.

Eq.8. $$a^n_h = a_h - a^w_h \quad h \in H$$

GAMS: HN(H) = E = HH(H) - HW(H);

The Behavior of Producers/Firms

Producers are assumed to maximize profit. Combining intermediate inputs with labor and capital produces output. The amount of intermediate inputs required per unit of output is fixed, but firms have considerable leeway to vary the amounts of capital and labor that they use in production. The value of output less intermediate inputs is value added, and it is useful to compute a price for this value added; it is this price that determines factor demand – i.e. drives firms to hire more or less labor and capital. The amount of labor and capital inputs, in turn, drive the total value of output via the production function.

Intermediate Demand

Comments: Intermediate goods constitute a fixed share of the value of production.

Eq.9. $$v_i = \sum_{i' \in I} \alpha_{ii'} q_{i'} \quad i \in I$$

GAMS: V(I) = E = SUM(J, AD(I,J) * DS(J));

Data: From the Wisconsin input-output table, derived from data from IMPLAN, which in turn are based on data from by the Bureau of Economic Analysis.

Production Function

Comments: Output is determined by the quantities of labor and capital used in production; it is assumed that enough intermediate goods will be available. We use a Constant Elasticity of Substitution (CES) production function, which allows a degree of substitution between labor and capital; in other words, if the price of labor rises, firms will cut back on the number of workers they hire, and use more capital instead.

Eq.10. $$q_i = \gamma_i \left[\sum_{f \in F} \alpha_i \left(u_{fi}^d\right)^{-\rho_i} \right]^{-1/\rho_i} \quad \forall i \in I$$

GAMS: DS(I) = E = GAMMA(I)*SUM(F,ALPHA(F,I) * FD(F,I) ** (-RHO(I))) ** (-1/RHO(I));

Data: We use values for the elasticity of substitution that are close to, but slightly lower than, one. This is relatively standard in CGE models. Information on the shares of labor and capital in production come from the Bureau of Economic Analysis.

Price of Value Added

Comments: Define value-added as the value of output less the cost of intermediate inputs. One may then define a "price" of value added, which we then use below in the factor demand (i.e. labor demand, capital demand) equations.

Eq.11. $$p_i^{va} = p_i^d - \sum_{i' \in I} \alpha_{i'i} p_i \left(1 + \sum_{g \in GS} \tau_{gi'}^v \right) \quad \forall i \in I$$

GAMS: PVA(I) = E = PD(I) - SUM(J, AD(J,I) * P(J) * (1 + SUM(GS, TAUV(GS,J))));

Data: Prices are set equal to unit in the baseline case.

Factor Demand

Comments: It is possible to construct a profit function, which expresses profits as a function of factor inputs. From microeconomic theory it can be shown that the partial first derivative of the profit function, with respect to a given factor demand variable, gives the demand equation for that factor. The left hand side of the equation shows payments to labor (including the cost of factor taxes such as the employer share of social security contributions). The right hand side gives the amount of value added attributable to the factor. There is a separate equation for labor and for capital, for each of the 27 industrial sectors.

Eq.12. $$r_{fi} r_f^a \left(1 + \sum_{g \in GF} \tau_{fgi}^x \right) u_{fi}^d = p_i^{va} q_i \alpha_{fi} \quad \forall i \in I, f \in F$$

GAMS: R(F,I) * RA(F) * (1 + SUM(GF,TAUFX(GF,F,I))) * FD(F,I) = E = PVA(I) * DS(I) * ALPHA(F,I);

Data: Information on the wage bills comes from the Bureau of Economic Analysis. The total wage bill is divided by the numbers of workers (from the Bureau of Labor Statistics) to get measures of wage rates by industry. The intersectoral wage differentials are not allowed to vary within the model. The cost of capital was derived as property-type income divided by the capital stock. The capital stock was constructed by disaggregating the national aggregate level of capital using a series of proxy measures; further details of the methodology are provided in Appendix 2 of the *Texas State Tax Analysis Modeling Program: Texas-STAMP* (1999) and although this refers to Texas, the same approach was taken in computing the capital stock for Wisconsin.

Factor Income

Comments: The total income accruing to factors – i.e. to labor and capital – is computed here.

Eq.13.
$$y_f = \sum_{i\ \ I} r_{fi} r_f^a u_{fi}^d + \sum_{g\ \ G} r_{fg} r_f^a u_{gi}^d \qquad f \quad F$$

GAMS: Y(F) =E= SUM(I, R(F,I) * RA(F) * FD(F,I))+ SUM(G, R(F,G) * RA(F) * FD(F,G));

Trade with Other States and Countries

From a Wisconsin perspective, the “rest of the world” consists of the remainder of the United States as well as the world outside the U.S. Goods produced in Wisconsin are assumed to be close, but not perfect, substitutes for goods produced elsewhere. Thus if prices rise in Wisconsin, the state’s exports will fall and its imports will rise, but the adjustment need not be very large. There is no need for trade to be balanced; capital flows simply adjust to cover the gap between exports and imports. In this section we also develop a measure of the average price faced by domestic households and firms for goods and services produced by each industry: the price is a weighted average of the price of locally produced and imported goods.

Demand for Exports

Comments: Exports depend on the price of goods within the state relative to the price outside Wisconsin. If the domestic price rises relative to the foreign price, exports will fall. Note that the elasticity here is negative.

Eq.14.
$$e_i = \bar{e}_i \left[p_i^d \div \bar{p}_i^w \right]^{\eta_i^e} \qquad i \quad I$$

GAMS: CX(I) = E = CX0(I)*(PD(I) / PW0(I)) ** ETAE(I);

Data: The trade data for Wisconsin are not particularly reliable; we have used our judgement, combined with BEAdata, to arrive at sensible estimates. The elasticities we use are similar to those employed by Berck et al.

Domestic Share of Domestic Consumption

Comments: The demand for imports is handled indirectly, by modeling the share of domestic consumption that is supplied by domestic firms (*d*), following the approach pioneered by Armington (1969). This share depends on the domestic price relative to the price of the same goods in the rest of the world. We ignore import tariffs on the grounds that they are a tiny fraction (less than 1%) of the value of goods imported into Wisconsin.

Eq.15.
$$d_i = \bar{d}_i \left[p_i^d \div \bar{p}_i^w \right]^{\eta_i^d} \qquad i \quad I$$

GAMS: D(I) = E = D0(I) * (PD(I) / PW0(I)) ** ETAD(I);

Data: As with export demand we have used our judgement, combined with BEAdata, to arrive at sensible estimates.

Import Demand

Comments: Imports consist of the share of domestic consumption that is not supplied by domestic production.

Eq.16. $$m_i = \left(1 - d_i\right) x_i \qquad i \quad I$$

GAMS: M(I) = E = (1 - D(I)) * DD(I);

Average Prices by Industry

Comments: These aggregated prices are computed for each industry, and are weighted averages of the domestic price and the import price, with the weights consisting of the respective shares in consumption. The price is set to unity in the baseline situation.

Eq.17. $$p_i = d_i p_i^d + \left(1 - d_i\right) \bar{p}_i^w \qquad i \quad I$$

GAMS: P(I) = E = D(I) * PD(I) + (1 - D(I)) * PW0(I);

Net Capital Inflow

Comments: The net capital inflow is simply the value of imports less the value of exports. This is an unconstrained variable in Wisconsin STAMP.

Eq.18. $$z = \sum_{i \quad I} m_i \bar{p}_i + \sum_{h \quad H} m_h - \sum_{i \quad I} e_i p_i^d$$

GAMS: NKI = E = SUM(I, M(I) * PW0(I)) + SUM(H,M(H)) - SUM(I, CX(I) * PD(I));

Investment

We first constructed a measure of the capital stock for each industrial sector for 2000. This stock, less depreciation and plus gross investment gives the capital stock for 2001. Gross investment is determined, sector-by-sector, based on the net of tax rate of return (relative to the return in the base period). Once investment by, for instance, the agricultural sector has been determined, it is transformed with the help of the capital coefficient matrix into the demand for goods and services for each sector in the economy.[8]

Capital Stock

Comments: The capital stock in time *t* is the capital stock from the previous period adjusted for depreciation, and augmented by gross investment.

Eq.19. $$u_{Ki}^s = \bar{u}_{Ki}^s \left(1 - \delta_i\right) + n_i \qquad i \quad I$$

GAMS: KS(I) = E = KSOLD0(I)*(1-DEPR(I)) + N(I) ;

Data: A complete discussion of the construction of capital stock figures is given in *Texas State Tax Modeling Program: Texas-STAMP* (1999); the same approach and the same data sources are used for Wisconsin.

Gross Investment by Sector of Destination

Comments: The amount of gross investment in any given sector depends on the after-tax rate of return in that sector relative to the return in the base period. The terminology here can be confusing; investment destined for agriculture, for instance, consists of the purchases of goods that will add to the capital stock in the agricultural sector; the goods themselves will mainly come from other sectors (the sectors of source).

Eq.20. $$n_i = \bar{n}_i \left[\frac{r_{Ki}\left(1 - \sum_{g \in GK} \tau^{x}_{gKi}\right)\bar{u}_{Ki}}{\bar{r}_{Ki}\left(1 - \sum_{g \in GK} \tau_{gKi}\right)\bar{u}_{Ki}} \right]^{\eta_i} \quad \forall i \in I$$

GAMS: N(I) = E = N0(I) * ((R('K',I) * (1 - SUM(GK, TAUFX(GK,'K',I))) * KSOLD0(I)) / (R0('K',I) * (1 - SUM(GK, TAUF(GK,'K',I))) * KSOLD0(I))) ** ETAIX;

Data: The rate of return is computed as the property-type income for each sector (from BEA) divided by the capital stock (authors' computations). Based on the econometric results from STAMP models estimated for Texas and elsewhere, we estimated the investment demand elasticity to be about 0.6.

Gross Investment by Sector of Source

Comments: Given that investment has been determined for each sector of destination, this equation allows one to determine who will actually produce the investment goods. This is done with the help of a capital coefficient matrix.

Eq.21. $$p_i \left(1 + \sum_{g \in GS} \tau^{n}_{gi}\right) c_{in} = \sum_{j \in I} \beta_{ij} n_i \quad \forall i \in I$$

GAMS: P(I) * (1 + SUM(GS, TAUN(GS,I))) * CN(I) = E = SUM(J, B(I,J) * N(J));

Data: Based on the 1992 capital coefficient matrix for the United States from the BEA/Department of Commerce.

Taxation

Household Taxes

Comments: This equation computes the amount of direct taxes (on income and property) paid by households to local, state and Federal governments. It allows state and local income taxes to be deducted for Federal income tax purposes; and local property taxes to be deduced for state income tax purposes. The tax amounts are computed for each household group; households do not move from one tax bracket to the next in this model.

Eq.22. $$t_{gh} = \left\{ \tau^{b}_{gh} + \left[\frac{y_h}{a^{w}_h} - \tau^{d}_{gh} - \tau^{s}_{gh} - \left(\tau^{o}_{gh} + \sum_{g'} \alpha^{\tau}_{gg'} t_{gh} \right) \tau^{i}_{gh} \right] \tau^{m}_{gh} \right\} \tau^{c}_{gh} \quad \forall g \in GI, h \in H$$

GAMS: PIT(GI,H) = E = (TAXBASE(GI,H) + (Y(H) / HW(H) - TAXBM(GI,H) - TAXSD(GI,H) - (TAXOD(GI,H) + SUM(GI1, ATAX(GI1,GI) * PIT(GI1,H))) * TAXPI(GI,H)) * (MTR(GI,H))) * TAXCVC(GI,H);

Data: The Federal income tax rates came from tax forms, and the proportion of itemizers from *Statistics of Income* from the individual income and tax data for Wisconsin.

Government

Government derives income from a wide range of taxes. It purchases goods and services and makes transfers (such as pensions) to individuals. Some government spending is assumed to remain unchanged even if tax revenues vary; the rest of spending is endogenous, in that it responds to the availability of funds. Notionally, most revenues flow into the Wisconsin General Fund; they are then used in part to buy goods and services, but some are also transferred to local government units. The residual spending category, which ensures that all the government accounts balance, is local government spending on health and welfare payments directed to the poorest segment of society. A substantial proportion of incremental tax revenue flows to this group. It is debatable whether this is the most satisfactory way to endogenize government decision making, but it would be relatively straightforward to alter the model to accommodate other arrangements — for instance if a tax increase were specifically designed to boost spending on education.

Government Income

Comments: This equation adds up government income from multiple sources, including indirect taxes (sales, motor fuels) and direct taxes (income, franchise tax).

Eq.23.

$$y_g = \sum_{i \in I} \tau^v_{gi} v_i p_i + \sum_{i \in I} \tau^m_{gi} m_i pw^0_i + \sum_{h \in H} \sum_{i \in I} \tau^c_{gi} c_{ih} p_i + \sum_{i \in I} \tau^n_{gi} c_{in} p_i + \sum_{i \in I} \sum_{g' \in G} \tau^g_{gi} c_{ig'} p_i + \sum_{i \in I} \sum_{f \in F} \tau^x_{gfi} r_{fi} r^a_f u^d_{fi}$$
$$+ \sum_{g' \in G} \sum_{f \in F} \tau^x_{gfg'} r_{fg'} r^a_f u^d_{fg'} + \sum_{f \in F} \tau_{gf} y_f + \sum_{h \in H} \tau_{hg} a_h + \sum_{h \in H} t_{gh} a^w_h + \sigma_{gn} \qquad g \in G$$

GAMS: Y(G) = E = SUM(I, TAUV(G,I) * V(I) * P(I)) + SUM(I,TAUM(G,I) * M(I) * PW0(I)) + SUM((H,I), TAUC(G,I) * CH(I,H) * P(I)) + SUM(I, TAUN(G,I) * CN(I) * P(I)) + SUM((G1,I), TAUG(G,I) * CG(I,G1) * P(I)) + SUM((F,I), TAUFX(G,F,I) * RA(F) * R(F,I) * FD(F,I)) + SUM((F,G1), TAUFX(G,F,G1) * RA(F) * R(F,G1) * FD(F,G1)) + SUM(F, TAUFH(G,F) * Y(F)) + SUM(H, PIT(G,H) * HW(H)) + SUM(H, TAUH(G,H) * HH(H)) + SAM(G,'INV');

Government Endogenous Purchases of Goods and Services

Comments: Spending on these items is assumed to take a fixed fraction of total government receipts (from taxes and net intergovernmental transfers, less government savings). The endogenous sectors are state spending on education, health, safety, transport and "other," and local spending on education and health.

Eq.24.

$$p_i \left(1 + \sum_{g \in GS} \tau^g_{gi}\right) c_{ig} = \alpha_{ig} \left(y_g + \sum_{g' \in G} b_{gg'} - \sum_{g' \in G} b_{g'g} + b_{ussstx,g} - \sum_{h \in H} w_{hg} a^n_h \tau^{pc}_{hg} - \bar{s}_g \right)$$
$$i \in I, g \in GN$$

GAMS: P(I) * (1 + SUM(GS, TAUG(GS,I))) * CG(I,GN) = E = AG(I,GN) * (Y(GN) + SUM(G1, IGT(GN,G1))- SUM(G1, IGT(G1,GN)) +IGT('USSSTX',GN) - SUM(H, TP(H,GN) * HN(H) * TPC(H,GN))- S0(GN));

Data: The shares of spending going to these sectors are based on an analysis of the spending patterns of state and local government in Wisconsin in 2001, the latest year for which sufficiently detailed data were available.

Government Endogenous Rental of Factors

Comments: As in the case of goods and services, government is also assumed to devote a fixed share of its total spending to the purchase of labor and capital services for those sectors considered to be endogenous.

Eq.25. $$u^d_{fg} r^a_f r_{fg} = \alpha_{fg}\left(y_g + \sum_{g' \in G} b_{gg'} - \sum_{g' \in G} b_{g'g} - \sum_{h \in H} w_{hg} a^n_h \tau^{pc}_{hg} - \bar{s}_g\right) \quad f \in F, g \in GN$$

GAMS: FD(F,GN) * RA(F) * R(F,GN) = E = AG(F,GN) * (Y(GN) + SUM(G1, IGT(GN,G1)) - SUM(G1, IGT(G1,GN)) - SUM(H, TP(H,GN) * HN(H) * TPC(H,GN)) - S0(GN));

Government Savings

Comments: Government saving is a residual, consisting of revenue less spending.

Eq.26. $$s_g = y_g - \sum_{i \in I} c_{ig} p_i \left(1 + \sum_{g \in GS} \tau^g_{gi}\right) - \sum_{f \in F} u^d_{fg} r_{fg} r^a_f \left(1 + \sum_{g' \in GF} \tau^x_{fg'i}\right) -$$

GAMS: S(G) = E = Y(G) - SUM(I, CG(I,G) * P(I) * (1 + SUM(GS, TAUG(GS,I)))) - SUM(F, FD(F,G) * R(F,G) * RA(F) * (1 + SUM(GF, TAUFX(GF,F,G)))) - (SUM(H, TP(H,G) * HN(H) * TPC(H,G)) - SUM(G1, IGT(G1,G)) + SUM(G1, IGT(G,G1));

Distribution of Taxes to Spending and Transfers

Comments: Tax units, in this case those sectors collecting revenues, distribute some of their receipts to spending units, and others directly in the form of transfers to households. The matrix IGTD (in the miscellaneous input file) identifies which units pass on their revenues to other spending units, and the flows are recorded in this equation.

Eq.27. $$b_{g'g} = \mu_{g'g}\left(y_g - \left(\sum_{h \in H} w_{hg} a^n_h \tau^{pc}_{hg} - \sum_{h \in H} w_{hg}\left(a^n_h - \bar{a}^n_h\right)\tau^{pc}_{hg}\, SSIYES\right)\right) \quad g, g' \in G$$

GAMS: IGTD(G1,G) = E = TAXS(G1,G) * (Y(G) - (SUM(H, TP(H,G) * HN(H) * TPC(H,G)) - SUM(H,TP(H,G) * (HN(H) - HN0(H)) * TPC(H,G) * SSIYES(G))) - S0(G));

Data: This equation is based on institutional arrangements in place in Wisconsin.

Endogenous Balance Distribution of Wisconsin General Funds

Comments: This equation ensures that the Wisconsin General Fund is fully accounted for. The residual balance flows to the Wisconsin health fund.

Eq.28. $$b_{txhlt,txgf} = y_{txgf} + \sum_{g \in G} b_{txgf,g} - \sum_{g \in G} b_{g,txgf}$$

GAMS: IGT('STHLT','STGENF') = E = Y('STGENF') + SUM(G, IGT('STGENF',G)) - SUM(G$IGTD(G,'STGENF'), IGT(G,'STGENF'));

Data: Based on an analysis of the current pattern of state spending in Wisconsin.

Endogenous Local Health and Welfare Transfer

Comments: This equation tracks the transfer from the Wisconsin health and welfare sector to the local health and welfare sector. The change is proportional to changes in the Wisconsin General Fund transfer to Wisconsin health and welfare.

Eq.29.

$$b_{lohlt,txhlt} = \bar{b}_{lohlt,txhlt} + b_{txhlt,txgf} - \bar{b}_{txhlt,txgf}$$

GAMS: IGT('LOHLT','STHELT') =E= IGT0('LOHLT','STHELT') + IGT('STHELT','STGENF') - IGT0('STHELT','STGENF');

Data: Based on an analysis of the current flows of intergovernmental funds in Wisconsin.

Endogenous Transfer Payments

Comments: Endogenous transfers made by local health and welfare depend on the number of welfare families, and the transfers received from higher levels of government.

Eq.30.

$$w_{hg} a_h^n \tau_{hg}^{pc} = \bar{w}_{hg} \bar{a}_h^n \tau_{hg}^{pc} \left(\sum_{g' \in G} b_{gg'} \right) \div \left(\sum_{g' \in G} \bar{b}_{gg'} \right) \qquad g \in GWN$$

GAMS: TP(H,GWN) * HN(H) * TPC(H,GWN) = E = TP0(H,GWN) * HN0(H) * TPC(H,GWN) * SUM(G, IGT(GWN,G)) / SUM(G, IGT0(GWN,G));

Model Closure

State Personal Income

Comments: This equation defines state personal income as earnings (from labor and capital) plus transfer payments. The variable is of interest in its own right. However it also provides a convenient variable for GAMS to maximize (or minimize), because it is an unrestricted variable without a subscript. The equation holds social security transfers from the Federal government constant, which accounts for the presence of the SSIYES term.

Eq.31.

$$q = \sum_{h \in H} y_h + \sum_{h \in H} \sum_{g \in G} w_{hg} a_h^n \tau_{hg}^{pc}$$

GAMS: SPI = E = SUM(H, Y(H)) + SUM((H,G), TP(H,G) * HN(H) * TPC(H,G));

Labor Market Clearing

Comments: Labor supply equals labor demand. For this to occur, the wage rate must adjust to bring about this market clearing.

Eq.32.

$$\sum_{h \in H} a_h^w = \left(\sum_{i \in I} u_{Li}^d + \sum_{g \in G} u_{Lg}^d \right) \varepsilon$$

GAMS: SUM(H, HW(H)) = E = SUM(Z, FD('L',Z)) * JOBCOR;

Capital Market Clearing

Comments: Capital markets also clear, for each sector. In other words, demand for capital by industries equals supply of capital.

Eq.33. $$u_{Ki}^{s} = u_{Ki}^{d} \qquad i \quad I$$

GAMS: KS(I) =E= FD('K',I);

Goods Market Clearing

Comments: Domestic demand (intermediate, consumer, government and investment demand) plus exports less imports must equal domestic supply.

Eq.34. $$q_{\mathrm{i}} = \mathrm{x}_{\mathrm{i}} + \mathrm{e}_{\mathrm{i}} - \mathrm{m}_{\mathrm{i}} \qquad i \quad I$$

GAMS: DS(I) =E= DD(I) + CX(I) - M(I);

Domestic Demand Defined

Comments: These equations define domestic demand for each sector.

Eq.35. $$x_{i} = v_{i} + \sum_{h \quad H} c_{ih} + \sum_{g \quad G} c_{ig} + c_{in} \qquad i \quad I$$

GAMS: DD(I) = E = V(I) + SUM(H, CH(I,H)) + SUM(G, CG(I,G)) + CN(I);

PIT for Non Income Tax Units

Comments: This equation sets the personal income tax for non-income tax units to zero; this is a technicality, which ensures that the solution to the model does not create income tax revenue in an inappropriate place.

Eq.36. $$t_{gh} = 0 \qquad h \quad H, g \quad GI$$

GAMS: PIT.FX(G,H)$(NOT GI(G)) = 0;

Set Intergovernmental Transfers to Zero if Not in Original SAM

Comments: This is another housekeeping equation that ensures that the solution to the model does not create inter-governmental transfers where they should not occur.

Eq.37. $$b_{gg'} = 0 \qquad g, g' \quad G \quad \text{where } \bar{b}_{gg'} = 0$$

GAMS: IGT.FX(G,G1)$(NOT IGT0(G,G1)) = 0;

Federal Social Security Transfers to Wisconsin

Comments: Transfers paid to Wisconsin households from the Federal social security system are assumed to be mainly determined by the number of households in the state.

Eq.38. $$b_{\mathrm{h,USSSTX}} = \bar{b}_{\mathrm{h,USSSTX}} \times \left(\frac{a_{h}^{n}}{\bar{a}_{h}^{n}} \right)^{-0.9}$$

GAMS: TP(H,'USSSTX') =E= TP0(H,'USSSTX') * ((HN(H)/HN0(H)) ** (-.9)) ;

Fix Exogenous Federal Transfers to Households

Federal transfers to households are assumed to vary with the number of households in the state.

Eq.39. $$b_{\text{h,USNOND}} = \bar{b}_{\text{h,USNOND}} \times \left(\frac{a_h^n}{a_h^n} \right)$$

GAMS: TP(H,'USNOND') =E= TP0(H,'USNOND') * (HN(H)/HN0(H)) ;

Fix Exogenous Intergovernmental Transfers

Comments: Some of the intergovernmental transfers are exogenous; these cases are shown with a 2 in the IGTD matrix (see TXCGE.MSC file). This equation fixes these flows at the levels found in the baseline case.

Eq.40. $$b_{gg'} = \bar{b}_{gg'} \qquad g, g' \quad G$$,where defined.

GAMS: IGT.FX(G,G1)$(IGTD(G,G1) EQ 2) = IGT0(G,G1);

Fix Goods and Services Demand by Exogenous Government Units

Comments: The purchases of goods and services by some government sectors are considered to be exogenous to the model. This equation fixes these values.

Eq.41. $$c_{ig} = \bar{c}_{ig} \qquad i \quad I, g \quad GX$$

GAMS: CG.FX(I,GX) = CG0(I,GX);

Fix Factor Rentals Paid by Exogenous Government Units

Comments: The purchases of the services of labor and capital are considered to be exogenous to the model. This equation fixes these values.

Eq.42. $$u_{fg}^{d} = \bar{u}_{fg}^{d} \qquad f \quad F, g \quad GX$$

GAMS: FD.FX(F,GX) = FD0(F,GX);

Fix Intersectoral Wage Differentials

Comments: Although wage rates differ from sector to sector, these differentials are assumed to remain fixed, as set by this equation. Household labor supply responds to overall wage rates, and not to the wage rates in any particular sector.

Eq.43. $$r_{Li} = \bar{r}_{Li} \qquad i \quad I$$

GAMS: R.FX('L',Z) = R0('L',Z);

Fix Government Rental Rate for Capital to Initial Level

Comments: For Wisconsin STAMP, we have set these rental rates to zero, in the absence of viable information about the rental rates paid by government on the capital that it uses. However, the relevant equations are included, and so government rental rates could be incorporated in a future version of the model.

Eq.44. $$r_{Kg} = \bar{r}_{Kg} \qquad g \quad G$$

GAMS: R.FX('K',G) = R0('K',G);

Fix Economy Wide Scalar for Capital

Comments: The model allows both for an overall cost of capital, and sector-specific returns. This equation sets the overall scalar to its original level, so that only the sector-specific returns vary endogenously.

Eq.45. $$r_f^a = \bar{r}_f^a \qquad f \quad F$$

GAMS: RA.FX('K') = RA0('K');

Set Transfer Payments to Zero if Originally So

Comments: This equation ensures that if transfer payments to households were zero in the original social accounting matrix, they remain at zero.

Eq.46. $$w_{hg} = 0 \qquad h \quad H, g \quad GWX \ \text{where} \ \bar{w}_{hg} = 0$$

GAMS: TP.FX(H,G)$(NOT TP0(H,G)) = 0;

The Effects Of Raising Taxes In Fiscal Year 2004

In this section we report the results of using Wisconsin STAMP to simulate the effects of raising taxes enough to eliminate the $1.6 billion state budget deficit that is anticipated for FY2004.

In the first experiment, we increase the sales tax. The current sales tax is levied at a 5% rate and is projected to yield $3.944 billion in annual revenue in FY2004. If the tax rate were raised to 7.4%, net state tax revenue would rise by $1.617 billion; this represents an increase in sales tax revenue of $1.733 billion, offset by a reduction in other tax receipts of $0.116 billion.

The economic effects would be considerable, as Table 5 shows. Most notably, there would be a reduction in employment of almost 56,000, or 1.8% of the labor force. Real disposable income would fall by 1.5%. The combined effects of lower employment and lower incomes would prompt people to leave (or not enter) the state, so that for those who remain, real disposable income per person would fall by 0.5%. It is worth noting that while the wage rate

Table 5 Effects of increases in sales and personal income taxes that raise at least an additional $1.6 billion in net state revenue, FY 2004.

	Baseline	Sales tax rises from 5% to 7.4%		Income tax rises by 2.0 percentage points*	
		Change	***% change***	***Change***	***% change***
Employment	3,082,805	-55,514	-1.80	-84,015	-2.73
Wage rate, $ p.a.	40,163	131	0.33	723	1.80
Investment, $m	22,825	-465	-2.04	-509	-2.23
Real disposable income, $m	132,827	-1,986	-1.50	-2,655	-2.00
Real DI per capita	21,402	-109	-0.51	-121	-0.57
Working households:	1,779,772	-32,050	-1.80	-48,504	-2.73
< $10,000 income	151,479	-460	-0.30	-1,891	-1.25
$10,000-$19,999 income	274,656	-1,476	-0.54	-3,673	-1.34
$20,000-$29,999 income	242,812	-1,773	-0.73	-4,525	-1.86
$30,000-$39,999 income	223,160	-2,197	-0.98	-3,753	-1.68
$40,000-$49,999 income	182,883	-3,430	-1.88	-5,958	-3.26
$50,000-$69,999 income	307,578	-8,388	-2.73	-13,892	-4.52
$70,000 income and up	397,204	-14,324	-3.61	-14,811	-3.73
State tax revenue, $m	10,956	**1,617**	14.76	**1,602**	14.60
Of which:					
State sales tax	3,944	1,733	43.94	-90	-2.05
State personal income tax	5,553	-82	-1.48	1,733	31.21
Other	1,459	-34	-2.33	-41	-2.95
Memo: local property tax	8,098	-145	-1.79	-173	-2.14

Source: *Based on simulations using Wisconsin STAMP for FY 2004.*
Note: ** The 6.15% effective rate would rise by 2.1 rather than 2.0 percentage points.*

would rise (by 0.33%), this would not be enough to offset the higher cost of living that would result from the increase in the sales tax rate by 2.4 percentage points.

A breakdown of the effects by income category offers some additional insight. The effects of the tax increase (and associated higher spending, including transfer payments) would have little net effect on low-income households, who would get back almost as much as they would pay in the form of extra taxes. However, households in the top income brackets would pay the higher tax and receive few of the direct benefits of higher spending; these are the people who would, as a result, be most likely to withdraw from the labor force and even leave the state.

Table 6 Employment Effects of Increases in Sales and Personal Income Taxes That Raise at Least an Additional $1.6 Billion in Net State Revenue, FY 2004.

INDUSTRY	Sales tax rises from 5% to 7.4%	Income tax rises by 2.0 percentage points*
Agriculture, forestry, and fishing	-3,168	-4,097
Mining	-65	-144
Construction	-3,267	-4,237
Food and tobacco products	-1,689	-2,891
Textiles and apparel	-674	-1,317
Building materials	-1,427	-1,864
Paper and publishing	-2,031	-3,620
Chemicals, petroleum, rubber, plastics	-1,056	-1,397
Electronic and electronic equipment	-917	-1,113
Motor vehicles and other transportation vehicles	-1,006	-1,602
Primary and fabricated metal	-1,665	-2,984
Industrial machinery and equipment	-1,798	-3,054
Business machinery and instruments	-371	-340
Other manufacturing (includes metals machinery and other)	-624	-876
Transportation	-2,227	-3,060
Communications	-708	-912
Electricity, gas, sanitary	-608	-1,056
Wholesale trade	-3,430	-4,362
Retail trade	-12,257	-13,482
Banking	-1,161	-1,509
Insurance	-1,330	-1,603
Real estate	-1,703	-4,566
Personal and repair services	-1,536	-1,084
Business services	-3,515	-7,517
Hotels, amusements, motion pictures	-3,231	-3,360
Health services	-5,349	-6,392
Eating, drinking, miscellaneous services	-6,212	-6,741
Government	7,512	1,164

*Note: * The 6.15% effective rate would rise by 2.1 rather than 2.0 percentage points.*

The projected deficit could also be made up by raising the state personal income tax. To yield enough revenue, the tax rate would have to rise by 2.0 percentage points.[9] Thus the lowest tax rate would rise from 4.6% to 6.6%, the main rate would increase from 6.5% to 8.5%, and the top rate would go from 6.75% to 8.75%.

The figures in Table 5 show that the effects of such an increase in the state personal income tax would be somewhat stronger than those associated with a comparable rise in the sales tax. Employment would fall by 84,000 (-2.7%), investment would drop by $509 million (2.2%), and real disposable income per capita would fall by 0.6%. The reduction in the number of working households would be particularly marked for those with annual incomes in the $50,000 to $69,999 range, where the work disincentives of a higher income tax would be particularly marked. Although the wage rate would *rise*, the change (1.8%) would not be enough to offset the increase in the income tax, so that those who remain employed would generally not be better off. The main effect of the higher wage rate is that it would raise the cost of hiring labor, which mainly explains the large reduction in overall employment.

Table 6 demonstrates the impact of raising either the sales tax or the income tax by industrial segment across Wisconsin. As the data demonstrates, every business segment in Wisconsin would lose jobs if state sales or state income taxes were raised. The number of jobs lost in each sector have a definite relationship to the total amount of jobs in that sector. The irony is that there would be only one growth segment in Wisconsin if our taxpayers were asked to contribute approximately $1.6 billion additionally to the state. That segment, of course, is government. This table demonstrates that not only would state taxpayers have to make additional contributions to Wisconsin in the form of additional sales or income taxes; in addition many of these taxpayers would in fact lose their employment while at the same time subsidizing additional government jobs.

Appendix: Definitions And Glossary Of Terms

Summary of Set Names

Sets	Dimension	Math	GAMS
Factors	2	f F	F
Governments - All	37	g G	G
Governments - Wisconsin Special Fund Sources	3	g GC	GC
Governments - Factor Taxes	5	g GF	GF
Governments - Per Household Taxes	8	g GH	GH
Governments - Income Taxes	2	g GI	GI
Governments - Capital Income Taxes	3	g GK	GK
Governments - Endogenous Spending	16	g GN	GN
Governments - Sales or Excise Taxes	10	g GS	GS
Governments - Endogenous Transfer Payments	4	g GWN	GWN
Governments - Exogenous Transfer Payments	2	g GWX	GWX
Governments - Exogenous Spending	6	g GX	GX
Households	7	h H	H
Industries	27	i I or j I	I
All Social Accounting Matrix Accounts	75	z Z	Z

Summary of Parameter Names

Parameters	Dimension	Math	GAMS
Input Output Coefficients	75 x 75	-	A(Z,Z1)
Domestic Input Output Coefficients	27 x 27	α_{ij}	AD(Z,Z1)
Government Spending Shares of Net Income	37 x 37	α_{ig} ,α_{fg}	AG(Z,G)
Factor Share Exponents in Production Function	2 x 27	α_{fi}	ALPHA(F,I)
Initial Shares of Consumption	27 x 7	α_{ih}	ALPHA(I,H)
Deductibility of Taxes	3 x 3	$\alpha_{gg}{}^{t}$	ATAX(G,G1)
Income Elasticities of Demand	27 x 7	β_{ih}	BETA(I,H)
Capital Coefficient Matrix	27 x 27	β_{ij}	CCM(I,J)
Depreciation Rate	27	δ_i	DEPR(I)
Export Price Elasticities	27	$\eta_i{}^{e}$	ETAE(I)
Domestic Demand Elasticity	27	$\eta_i{}^{d}$	ETAD(I)
Investment Supply Elasticity	1	η_i	ETAI
L Supply Elasticity with respect to Average Wage	7	$\eta_h{}^{ls}$	ETARA(H)
Labor Supply Elasticity with respect to TP's[10]	7	$\eta_h{}^{tp}$	ETATP(H)
Labor Supply Elasticity with respect to Taxes	7	$\eta_h{}^{PIT}$	ETAPIT(H)
Responsiveness of In-Migration to Unemployment	7	$\eta_h{}^{u}$	ETAU(H)
Responsiveness of In-Migration to Disp. Income	7	$\eta_h{}^{yd}$	ETAYD(H)
Production Function Scale	27	γ_i	GAMMA(I)
Types of Inter-Government Transfers	37 x 37	-	IGTD(G,G1)
Correction Factor between Households and Jobs	1	ε	JOBCOR
Cross-Price Elasticities	27 x 27	$\lambda_{ii'}$	LAMBDA(I,J)
Miscellaneous Industry Parameters	27 x 10	-	MISC(Z,*)
Income Tax Table Data in Input File	7 x 8	-	MISCG(G,H,*)
Miscellaneous Household Parameters	7 x 8	-	MISCH(H,*)
Marginal Tax Rates	3 x 7	$\tau_{gh}{}^{m}$	MTR(G,H)
Natural Rate of Population Growth	7	π_h	NRPG(H)
Substitution Exponent in Production Function	27	ρ_i	RHO(I)
Social Accounting Matrix	75 x 75	$\sigma_{zz'}$	SAM(Z,Z1)
Consumption Sales and Excise Tax Rates	9 x 27	$\tau_{gi}{}^{c}$	TAUC(G,I)
Factor Tax Rates	5 x 2 x 75	τ_{gfz}	TAUF(G,F,Z)
Factor Taxes applied to Factors	5 x 2	-	TAUFF(GF,G)
Employee Portion of Factor Taxes	5 x 2	τ_{gf}	TAUFH(G,F)
Experimental Factor Tax Rates	5 x 2 x 75	$\tau_{gfz}{}^{x}$	TAUFX(G,F,Z)
Government Sales and Excise Tax Rates	9 x 27	$\tau_{gi}{}^{g}$	TAUG(G,I)
Household Taxes other than PIT	1 x 7	τ_{gh}	TAUH(G,H)
Investment Sales and Excise Tax Rates	9 x 27	$\tau_{gi}{}^{n}$	TAUN(G,I)
Sales and Excise Tax Rates	9 x 27	$\tau_{qi}{}^{q}$	TAUQ(G,I)
Intermediate Good Sales and Excise Tax Rates	9 x 27	$\tau_{gi}{}^{v}$	TAUV(G,I)
Tax Bracket Base Amount	3 x 7	$\tau_{gh}{}^{b}$	TAXBASE(G,H)
Tax Bracket Minimum Taxable Earnings	3 x 7	$\tau_{gh}{}^{d}$	TAXBM(G,H)
Tax Constant to Correct Calculated to Observed	3 x 7	$\tau_{gh}{}^{c}$	TAXCVC(G,H)
Tax Deduction other than Standard and other PIT	3 x 7	$\tau_{gh}{}^{o}$	TAXOD(G,H)
Percentage Itemizing	3 x 7	$\tau_{gh}{}^{i}$	TAXPI(G,H)
Tax Destination Shares	37 x 37	$\mu_{gg'}$	TAXS(G,G1)
Tax Deduction for Standard Deductions	3 x 7	$\tau_{gh}{}^{s}$	TAXSD(G,H)
Percent of Households Receiving TP's	7 x 6	$\tau_{hg}{}^{pc}$	TPC(H,G)

Summary of Variable Names

Variables	Dimension	Math	GAMS
Public Consumption	27 x 28	c_{ig}	CG(I,G)
Private Consumption	27 x 7	c_{ih}	CH(I,H)
Gross Investment by Sector of Source	27	c_{in}	CN(I)
Consumer Price Index	7	p_h	CPI(H)
Exports	27	e_i	CX(I)
Domestic Share of Domestic Consumption	27	d_i	D(I)
Domestic Demand	27	x_i	DD(I)
Domestic Supply	27	q_i	DS(I)
Sectoral Factor Demand	2 x 64	u_{fi}^d, u_{fg}^d	FD(F,Z)
Number of Households	7	a_h	HH(H)
Number of Non-Working Households	7	a_h^n	HN(H)
Number of Working Households	7	a_h^w	HW(H)
Household Out-Migration	7	a_h^o	MO(H)
Household In-Migration	7	a_h^i	MI(H)
Inter-Governmental Transfers	37 x 37	$B_{gg'}$	IGT(G,G1)
Capital Stock	27	u_{Ki}^s	KS(I)
Imports	27	m_i	M(I)
Gross Investment by Sector of Destination	27	n_i	N(I)
Net Capital Inflow	1	z	NKI
Aggregate Price	27	p_i	P(I)
Aggregate Price including Sales/Excise Taxes	27	p_i^c	PC(I)
Domestic Producer Price	27	p_i^d	PD(I)
Per Household Personal Income Taxes	3 x 7	t_{gh}	PIT(G,H)
Producer Price Index	1	p	PPI
Value Added Price	27	p_i^{va}	PVA(I)
World Price (Rest of US and Rest of World)	27	p_i^w	PW(I)
Sectoral Factor Rental Rates	2 x 27	r_{fi}, r_{fg}	R(F,I)
Economy Wide Scalar for Factor Rental Rates	2	r_f^a	RA(F)
Government Savings	37	s_g	S(G)
Private Savings	7	s_h	S(H)
State Personal Income	1	q	SPI
Transfer Payments	7 x 37	w_{hg}	TP(H,G)
Intermediate Goods	27	v_i	V(I)
Factor Income	2	y_f	Y(F)
Government Income	37	y_g	Y(G)
Household Income	7	y_h	Y(H)
Household after Tax Income including TP's	7	Y_h^d	YD(H)

NOTES

1. The fiscal year begins on July 1 and ends June 30. Thus fiscal year 2004 begins July 1, 2003 and ends June 30, 2004.

2. The 6.15% effective rate would rise by 2.1 percentage points to 8.25%.

3. As reported by Dennis Chaptman, *Milwaukee Journal Sentinel*, December 8, 2002. Based on a survey of 400 people conducted by WisPolitics.com/Wood Communications Group between November 21 and 25.

4. *Milwaukee Journal Sentinel,* Nov. 21, 2002.

5. The quotes in this and the subsequent paragraph are from the *Milwaukee Journal Sentinel*, November 21, 2002.

6. Quoted in *Milwaukee Journal Sentinel*, December 8, 2002.

7. For a clear introduction to CGE tax models, see John B. Shoven and John Whalley, “Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey,” *Journal of Economic Literature*, XXII (September, 1984), 1008. Shoven and Whalley have also written a useful book on the practice of CGE modeling entitled *Applying General Equilibrium* (Cambridge: Cambridge University Press, 1992).

8. The Capital Coefficient Matrix is a matrix of investments by using industries. It contains distribution ratios of new structures and equipment to using industries from the 1992 BEAcapital flow tables.

9. The 6.15% effective rate would rise by 2.1 to 8.25%.

10. TP is abbreviation for transfer payments.

About the Institute

The **Wisconsin Policy Research Institute** is a not-for-profit institute established to study public-policy issues affecting the state of Wisconsin.

Under the new federalism, government policy increasingly is made at the state and local levels. These public-policy decisions affect the life of every citizen in the state. Our goal is to provide nonpartisan research on key issues affecting Wisconsinites, so that their elected representatives can make informed decisions to improve the quality of life and future of the state.

Our major priority is to increase the accountability of Wisconsin's government. State and local governments must be responsive to the citizenry, both in terms of the programs they devise and the tax money they spend. Accountability should apply in every area to which the state devotes the public's funds.

The Institute's agenda encompasses the following issues: education, welfare and social services, criminal justice, taxes and spending, and economic development.

We believe that the views of the citizens of Wisconsin should guide the decisions of government officials. To help accomplish this, we also conduct regular public-opinion polls that are designed to inform public officials about how the citizenry views major statewide issues. These polls are disseminated through the media and are made available to the general public and the legislative and executive branches of state government. It is essential that elected officials remember that all of the programs they create and all of the money they spend comes from the citizens of Wisconsin and is made available through their taxes. Public policy should reflect the real needs and concerns of all of the citizens of the state and not those of specific special-interest groups.