Taxes in South Carolina: No Relief in Sight

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Executive Summary

In June 2006, the South Carolina General Assembly passed, and the Governor signed, H. 4449 (R. 417) – legislation that will radically change the state's revenue system. The new law shifts the burden of funding public school operations from local to state government by replacing the local school district tax on owner-occupied residential property with a one-cent increase in the state retail sales tax. The law is intended to provide a clean, revenue-neutral swap of sales for property taxes, with the state government reimbursing the local governments for the revenue loss created by elimination of the property tax.

What home owners gain in the form of reduced property taxes, consumers will suffer in the form of increased sales taxes. Moreover, the hoped-for relief to property owners will prove illusory. Soon after the old taxes are removed, we predict, local taxpayers, particularly business taxpayers, can expect to find themselves burdened by new taxes, which will be imposed to replace the old taxes removed by H4449. The new taxes will be imposed to satisfy local governments' appetite for revenue and from state government's failure to impose a local spending cap.

We believe that local governments will, by 2010, have completely recouped the revenue loss attributable to the 2006 tax cut. They will thus be receiving a sizeable transfer from the state, while offering no relief to local taxpayers. This push could take a number of paths, with the renewed burden of local taxes falling in different ways on businesses and homeowners. In the report that follows we sketch one plausible outcome. In summary, we predict that, by FY 2010:

- The entire 2008 reduction in property taxes will have been extinguished by the introduction of new property taxes. And, because the 1¢ increase in the state sales tax will be in effect, the state will be collecting $594 million more in sales tax revenue.
- The 2008 reduction in property taxes will have been extinguished through the imposition of new taxes on commercial property and on residential property that remains taxed under H. 4449. We foresee a state of affairs in which:
    - Business, which saw no relief in taxes under the new law in 2008, will pay $409 million in additional taxes by 2010, a 12.51% increase in taxes over and above what they would have paid had H. 4449 not been adopted.
    - Home owners will find that their initial tax cut has been reduced by 45% (or $281 million) from $632 million to $351 million.

By 2010, the state will find that it has merely increased the sales tax while effecting a redistribution in property-tax burdens from home owners (who will pay somewhat less than they would have, absent the new law) to businesses (which pay much more).

These political developments will have adverse consequences for the state economy. In Table 1 we estimate the effects of the predicted local tax increases on state and local finances, as well as on key economic indicators, for FY 2008 to FY 2010. These effects are measured against a "baseline economy" with the new legislation in place but without the run-up in local taxes.

Table 1: Summary of Financial and Economic Effects

	FY 08	FY 09	FY 10
Finances ($ Millions)			
Net State Revenue Change	-16	-20	-28
Net Local Revenue Change	174	367	599
Residential Property Tax Rev. Change	77	170	281
Commercial Property Tax Rev. Change	114	249	409
Economic Indicators			
Private Jobs	-1,996	-4,178	-6,557
Investment ($ millions)	-258	-541	-852
State Personal Income ($ millions)	-88	-195	-321
Real Disposable Income per Capita ($)	-25	-51	-79

In this scenario, state tax revenues (consisting of the state's combined sales tax, income tax and other revenues) fall slightly – by $28 million in FY 2010 – as some people and jobs leave the state in response the higher local taxes.[1] Local tax revenues rise – by $599 million in 2010 – as local governments increase taxes on commercial property, as well as other taxes. The net effect is higher combined state-and-local taxes paid by fewer people.

A further effect is a loss in jobs, investment and personal income. By FY 10, the state will have 6,557 fewer jobs than it would have had if property taxes had not increased following the enactment of H. 4449. Investment will be $852 million lower. Personal income will fall by $321 million and real disposable income per capita by $79.

It is worth asking what would have happened if the state had cut the property tax, as provided for by H. 4449, without raising the sales tax and without the local governments hiking them back up.

[1] Note that, under this scenario and because of the rise in the sales tax, state tax collections go up. The loss in state tax revenues indicated here is the difference between what the state would collect under the new law without a run-up in local taxes and what it would collect with the run-up in local taxes that we are predicting.

We find that, by 2010, the state would have gained 8,965 jobs. In addition, it would have added $13 million in investment and $24 in real disposable income per capita. These findings are a reminder that tax policy can serve as an instrument of economic expansion, rather than contraction, provided that policy makers are willing to recognize that lower taxes entail economic gains just as higher taxes entail economic losses.

The law is currently expected to bring about a nearly perfect swap of new sales tax revenue for local property tax revenue. If we were to ignore the "dynamic" feedback effects on the economy and political fallout of the new law, using "static" estimates, we could expect local governments to have reduced their revenue collections by $632 million and to be receiving, in exchange, $599 million from the state in 2010. In the short run, the resulting gap ($33 million) could be covered by the current surplus.

However, static estimates assume that there is no change in underlying economic activity in response to a change in tax law. For example, a static estimate of a 17% rise in the sales tax, rate, say, from 6% to 7%, would cause revenue to rise by 17%. A dynamic estimate would show a smaller rise in revenue because it would capture the negative effect on the tax base of the rise in the sales tax rate When South Carolina increases its sales tax, South Carolina consumers buy fewer goods in South Carolina .

While the architects of the law might thus claim to have arranged for an almost clean swap of property taxes for sales taxes, we know that the result will be far less tidy. First, a massive restructuring of the state tax system of this kind will unleash dynamic effects on the economy that will substantially alter these numbers and exert possibly negative effects on the state economy. Second, the law makes property owners, particularly commercial property owners, vulnerable to future tax increases. On this matter, it is safe to say that, while the increase in state sales taxes will become a certainty under this legislation, the promised reduction in local property tax revenues is not at all guaranteed. What seems likely instead is a push to undo the H. 4449 tax cuts.

History bears out this forecast. In 1995 state government attempted to provide relief from local taxes. But the relief was short lived. Beginning in Fiscal Year (FY) 1997, local governments increased property taxes in such a manner that FY 2002 property tax revenues exceeded FY 1995 property tax revenues in inflation-adjusted dollars.

The architects of the new law apparently intended to avoid a similar outcome. The law limits the amount by which local government may increase property tax millage rates or assessments. It sets the growth of millage rates in any given year equal to the sum of the growth of the Consumer Price Index (CPI) and of population, and it limits the growth in assessment values to 15% in any given five-year period. Local governments may vote to override the millage-rate limit, but only under emergency circumstances such as a deficit or a newly-imposed state mandate.

However, the law does not take new local taxes off the table. It allows local governments to turn to local-options sales taxes in order to provide for future property tax reductions. More importantly, it leaves local governments free to raise taxes on commercial property and other taxes affecting business. We believe that local governments will, by 2010, have completely recouped the revenue loss attributable to the 2006 tax cut. They will thus be receiving a sizeable transfer from the state, while offering no relief to local taxpayers, leaving the net effect to be an increase in sales taxes, as outlined above.

One such solution would be to apply to local government the spending limitation embodied in bills currently before the legislature, which would limit the growth in spending to inflation or the sum of inflation plus the growth of population. This latter idea would have the effect of keeping real, inflation-adjusted spending per capita constant while limiting the growth of local taxes.

In the following report we describe in detail the process by which local governments can be expected to bring about the outcome predicted here and how it will do so by increasing taxes on business property and other taxes. We show that the revenue cap in the 2006 legislation will be no barrier to this outcome. We also show the economic consequences for the state.

Introduction

In June 2006, the South Carolina General Assembly passed, and the Governor signed, legislation that radically changes the state's revenue system. The legislation shifts the burden of funding public school operations from local taxes levied on owner-occupied residential property to the statewide retail sales tax.

Two pieces of legislation are involved. The first, H. 4450 (R. 418), amends the South Carolina Constitution and was approved by voters in November 2006 election. The constitutional amendment contains two significant changes to property taxes in South Carolina. First, it authorizes the General Assembly to define the "fair market value" of a parcel of real property for purposes of imposing the property tax when:

(1) improvements are made to the parcel;
(2) there is a decline in the value of the parcel; and
(3) ownership of the property changes.

Second, accounting for the changes described above, the amendment also limits increases in real property valuation to 15% over any five-year period.[2] This increase implies an average compound rate of 2.84%.[3]

The second piece of legislation, H. 4449 (R. 417), makes further changes in residential property taxes by eliminating the portion of the local tax levied on owner-occupied property used to fund local public schools, beginning in property tax year 2007. The state will provide reimbursements to school districts, based on the revenues lost from the elimination of this portion of the property tax. Beginning in FY 2008, school districts will be reimbursed for the estimated amount of revenue not collected as a result of the school operating exemption for owner-occupied property. H. 4449 guarantees that school districts will receive a minimum county-wide reimbursement of $2.5 million; any county scheduled to receive less that $2.5 million will be paid the difference by the state. After FY 2008, the total amount of these payments will grow as a function of the

[2] South Carolina State Election Commission, "2006 State Candidate and Election Information," Internet; available at http://www.state.sc.us/scsec/amendments.html; accessed 31 December 2006.

[3] This number is obtained thus: $2.84\% = \sqrt[5]{1+0.15} - 1$.

percentage change in the Consumer Price Index (CPI) and state's population growth rate, but never fall below the initial 2008 level.[4]

The transfer is financed through an increase in the state sales tax from five to six cents.[5] The revenue generated from the increased sales tax will be placed into a newly created Homestead Exemption Fund (HEF), from which payments to the school districts will be made. If at any point the HEF does not contain sufficient funds to pay the school districts, the shortfall will be covered by the state's general fund. On the other hand, if the fund runs in the black, the surplus must be distributed to the counties based on the ratio of the county population to the state population.[6]

The act also revises the caps on property tax millage-rate increases. Starting in 2007, millage-rate increases are limited to the percentage increase in the Consumer Price Index (CPI) plus the percentage increase in population over the previous year for the local government entity. The limitation applies to all counties, municipalities, school districts and special purpose districts. The combination of these rates is forecasted by the Bureau of Labor Statistics to be slightly above 3.10% a year, for all years up to 2011.

The law allows for local governments to override the caps by a two-thirds vote of the entire governing body under a number of broad "emergency" circumstances. These circumstances include a deficit during the previous year, the financial impact of a court order or settlement, a dramatic shift in the composition of taxpaying entities or "unfunded mandates" imposed by the state or federal government.

The law also allows for local governments to provide additional property tax relief by authorizing new local-option sales taxes. These taxes may be approved by a local referendum and would allow governments to enact a local sales tax in increments of one-tenth of 1%, up to a maximum of 1%, to allow for additional property tax credits to apply to all classes of property.[7] The tax would not apply to accommodations, unprepared food or any items subject to a sales tax cap.

[4] Neil Mellen, *Local Government Spending: South Carolina's Impending Fiscal Crisis*, South Carolina Policy Council, August 2006.
[5] The sales tax on food, defined as unprepared food which may be purchased with food stamps, dropped from 5% to 3% beginning in October 1, 2006. The sales tax on accommodations remains unchanged.
[6] South Carolina State Election Commission, 4.
[7] Ibid.,5.

The legislation provides tax relief by exempting owner-occupied property from the school operating portion of the property tax and by providing a mechanism for future property tax relief through the local-options sales tax. At the same time it increases taxes on consumption. Policymakers and voters in South Carolina have decided essentially to "swap" lower property taxes for higher sales taxes.

Policy Consequences

The enactment of these tax-law changes raises certain questions: What dangers are posed by the details of the legislation? What will be the likely trajectory of the local and state taxes and spending in the aftermath of the changes? Will the new law be successful in restricting tax increases or will it encourage officials to raise taxes?

In order to address these questions, we assess here the likely trend of taxation and spending after the implementation of the 2006 law. Using the experience with a 1995 "swap" of lower local property taxes in exchange for state funding of education as a template, we next estimate the likely trend in taxes and revenues after the FY 2008.

Economic Consequences

Here we address the economic, as well as the policy consequences of the new law. In approaching this task, we set two goals for ourselves: (1) to provide realistic and defensible estimates of the economic effects that are likely to stem from the law and from the policy changes it will set in motion and (2) to consider those economic effects that are likely to be most important to policy makers and to the voting public.

Concerning (1), it is important to understand that, in order to be defensible – or even believable – an analysis of tax policy changes must take into account the effects those changes would have on economic behavior. Taxes are imposed on economic activities such as work, saving and spending. And taxes affect the incentives of people to work, save and spend. Any defensible analysis of tax policy must take the effects of taxes on those incentives into account. To ignore the effects of taxes on those incentives is akin to trying to analyze proposed changes in the criminal law while ignoring the effects of prospective jail time on the incentives of would-be criminals to commit crimes.

Consider the factors that get a typical taxpayer to report taxable income on his 1040. One factor is the threat of going to jail. We can expect that a taxpayer will report his income more honestly the greater the risk of prosecution, should he underreport his income. But another factor is the amount of income the taxpayer chooses to earn (and to report honestly). We expect that the taxpayer will earn and report less income the less the reward, after taxes, for earning that income.

A self-employed worker, who might well have to pay 50 cents in taxes for each dollar earned, will not work as many hours – or earn and report as much income – as he would if he had to pay only 25 cents in taxes. Oddly, though, while no tax analyst would think to ignore the effect of IRS audit rates on the amount of income a taxpayer reports, there are many tax analysts who think they can ignore the effects of the taxes themselves on the amount of income he reports.

This failure to consider the effects of taxes on peoples' willingness to earn, spend or save their income characterizes what is called "static analysis" – an oxymoron, really, since it is not analysis at all, but rather a failure to perform the analysis needed to get an answer to two critically important questions: (1) How will a tax change affect work, saving and spending? And (2) how will the tax change affect tax revenue? Because the tax change will surely affect the taxpayer's willingness to work, save or spend and because a tax is always imposed on some work, saving or spending decision, the amount of revenue yielded by the tax will depend in part on how it affects this decision.

Here's how static analysis works. Suppose the government imposes a 25% tax on your income and suppose that your income is $40,000 a year. Then someone proposes increasing the tax rate to 50%. Static "analysis" predicts that you will then double the amount of taxes you pay, from $10,000 to $20,000. Because the tax rate doubled, so do your taxes. This assumes that you are willing to continue working as hard as you do and reporting your income as honestly as you do, even though your take-home pay has fallen by a third. It ignores all the many steps you might take to reduce the impact of the tax hike on your living standards by, say, giving up a part-time job and using the time saved to do your own remodeling, rather than paying a contractor. Likewise you may decide to stay home with the kids, rather than working to supplement household income, or to charge your customers under the table to reduce your reported income.[8]

[8] It is possible that you would increase, rather than decrease your work effort: Because the higher taxes have made you poorer, you might work all the harder to maintain your current standard of living. That this might occur does not change the importance of dynamic analysis, however; it only changes what a dynamic analysis might show. Also, there are reasons to expect that higher taxes will in fact lead, as illustrated above, to less, not more economic activity. First, there is a limit to how high taxes can go before people

Static analysis can be a useful step toward performing a more complete "dynamic" analysis, which captures the effects of tax changes on economic incentives. But static analysis, taken alone, has one overwhelming disadvantage: It is always wrong. There are no tax changes that, as static analysis assumes, have no effects on economic behavior. Hence, there are no static analyses of tax changes that correctly estimate the effects of those changes on tax revenues. And static analysis, by itself, tells us nothing about the effects of tax changes on economic behavior – on the number of jobs or the amount of investment that will be created or destroyed because of a tax change.

This leads to the question of which economic effects are important to policy makers and voters in making decisions about tax policy. Certainly the effect on tax revenues is one. Here we consider four additional economic indicators: jobs, investment, personal income and real disposable income per capita. Jobs are important because they measure the number of workers that the state economy can support. The fewer number of jobs, the weaker the economy is. Investment is important because it, along with innovation, measures the capacity of the economy to increase labor productivity and wages.

Personal income and real disposable income per capita are closely related, but not identical measures of economic well being. Personal income measures the number of dollars in income that state residents receive. (Basically, personal income equals total state income after taking out undistributed corporate profits, certain taxes on production and imports, social security taxes and after making other adjustments.) Real disposable income per capita measures the actual goods that the average person can buy out of his personal income, after taking out personal taxes. Ordinarily, a rise in personal income signifies an improvement in living standards, but not always. For example, as we see in a scenario below, even though personal income falls, prices and personal taxes might also fall increasing the individual's purchasing power, thus permitting him to buy more, rather than fewer goods. Both measures are useful, but both measure different things.

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will reduce their reported income. No one will work at all (or report any income) once the tax rate approaches 100%. Second, the incentive to work harder in the face of higher taxes will be diminished to the extent that government uses the tax revenue to provide services that people actually want. If the government uses the new tax revenue to provide something useful (say, trash collection), then you won't find it necessary to work harder in order to pay for trash collection out of your pocket. You will at the same time find that your take-home pay, and therefore your incentive to work, has been diminished by the higher tax. Finally, government might use the extra revenue to encourage you further to cut back on work, for example by expanding unemployment benefits. Thus the sometimes-asserted positive relation between taxes and economic activity is mostly a theoretical curiosity, not to be taken seriously in practice.

In order to estimate the economic effects of the tax changes examined here, we utilize a dynamic tax model that we have created for just this purpose. This model – the Beacon Hill Institute State Tax Analysis Modeling Program for South Carolina (SC-STAMP) – uses the "CGE" (computable general equilibrium) framework that BHI has used in building STAMP models for more than two dozen other states and localities.[9] SC-STAMP makes it possible to determine the effects of the expected tax and spending trends on key economic indicators, including wages, business investment, migration and tax revenues. (We provide details in the Appendix, below.)

The Baseline – The Economy under the Legislation.

The first step in building the SC-STAMP was to obtain a snapshot of the South Carolina economy absent the new law. The second step was to estimate in static terms, for the period of FY 2008 to 2010, (a) the amount by which local tax revenues would fall and (b) the transfer for which the state government would be accountable as a result of this fall.[10] Then, in step (3), using the estimations in step (2), as well as the sales tax increase of 1 cent, we estimated the values of the different economic and financial variables under the new baseline economy, i.e., the SC economy under the 2006 legislation. In this baseline economy, local governments have *not* reacted to the new law by raising tax rates. That we take up in the next section.

To obtain the school district owner-occupied property tax revenues in step (2), we used data from the 2004 "Local Government Financial Report" from the Office of Research and Statistics of the South Carolina State Budget and Control Office.[11] We used county level data and projected these revenues to FYs 2008, 2009 and 2010 using SC-STAMP to estimate the necessary growth rates.

To estimate state reimbursements, again in step (2), we used the cut in county revenue for FY 2008 estimated for (1) as the base. Because the law stipulates that the state reimbursement will be at least $2.5 million a year countywide, we took the larger of the county loss and $2.5 million as the size of the transfer in FY 2008. For FYs 2009 and 2010, we increased the estimate of the total transfer in FY 2008 by the predicted growth of the Consumer Price Index (CPI) and of population for the corresponding fiscal years, as specified in the law.

[9] More information on STAMP is available on the Institute's website at http://www.beaconhill.org/STAMP_Web_Brochure/StampOverview.html.
[10] The STAMP model covers fiscal years 2005 to 2010. Since the change in financing would have to start having an effect in FY 2008, the estimates we provide are from FY 2008 to 2010.
[11] Available from http://www.ors.state.sc.us/economics/economics.asp. Internet; accessed 23 January 2007.

Table 2: Static Estimates of the Local Revenue Cut and Mandatory State Transfer ($)

	FY 08	FY 09	FY 10
Local Revenue Cut (A)	542,873,089	586,441,482	631,577,367
Mandatory State Transfer (B)	563,126,941	580,816,292	598,941,074
Additional Transfer (A-B)	- 20,253,852	5,625,190	32,636,293

In Table 2 we present the static estimates of both the loss in local revenues (A) and the mandatory state transfer (B), as well as any difference between the two that would have to be made up by an

Table 3: Baseline Scenario (no increase in local property taxes)

Concept	FY 08	FY 09	FY 10
Finances ($ Millions)			
State Revenues			
Personal Income Tax	3,361	3,494	3,653
State Sales Tax	3,850	4,003	4,167
State Corporation Income Tax	255	258	261
Other State Taxes and Fees	8,941	9,520	10,148
Total State Revenues	16,407	17,275	18,229
Local Reimbursements	(573)	(619)	(666)
Net State Revenues	15,834	16,657	17,563
Local Revenues			
Local Tax on Residential Property	1,509	1,630	1,755
Local Tax on Business Property	2,807	3,032	3,265
Local Sales Tax	276	287	299
Other Local Taxes and Fees	4,594	4,864	5,150
Total Local Revenues	9,185	9,813	10,470
Reimbursements from State	573	619	666
Net Local Revenues	9,759	10,432	11,136
Economic			
Private Jobs	1,679,812	1,708,493	1,737,663
Investment ($ Millions)	26,674	27,024	27,379
State Personal Income ($ Millions)	138,746	145,284	152,130
Real Disposable Income per Capita ($)	23,507	23,377	23,248

transfer is larger that the local revenue cut. The reason is that the law stipulates that the minimum transfer for each county is set at $2.5 million. However, for FYs 2009 and 2010, the amount of the mandatory state transfer would not cover the estimated local revenue loss. The reason is that local spending is forecasted to grow by more than CPI growth plus population growth.

In Table 3 we present the step-3 baseline values of state and local revenues and of selected economic indicators. We make use of these numbers later in the report, when comparing to the scenario in which the local governments would increase the local property taxes by 5.08% a year.

The Reality – No Bounds on Local Governments

In a study released in August 2006, the South Carolina Policy Council (SCPC) identified some of the dangers that lie in the details of the legislation.[12] The SCPC argued that while the legislation contains many provisions that would, in theory, limit the growth of taxes and government spending, it may actually encourage both.

The legislation sets tax year 2007 as the starting point for limiting the millage-rate increases to the growth rate of CPI and population growth of the governing entity. In response, many local governments have already enacted millage-rate increases to provide themselves with a higher baseline from which they can make future increases. The changes have prompted local governments to raise property taxes today to make the limits less binding in the future. Thus the legislation has prompted property tax increases even before it becomes effective – just the opposite of what was intended.

Local governments can increase the millage rates for taxes on the school portion of owner-occupied property to ensure a high baseline for the initial transfer from the state. Taxpayers are likely to accept these increases with the full knowledge that the entire portion of the tax will be replaced by a transfer from the state. This millage-rate increase allows the school district to maximize their state transfer at little cost to local taxpayers.

Recent history provides further insight into the predictable reaction by local governments. In 1995, the South Carolina legislature enacted similar property tax relief measures. The legislation exempted the first $100,000 of assessed value of owner-occupied homes from school operating property taxes. The act created the State Trust Fund for Tax Relief to reimburse counties, municipalities, school districts, and special purpose districts for this increased exemption.

Property tax collections dropped substantially from FY 1995 to FY 1996. Total statewide property tax collections fell by 5.1% in 1996 and collections on owner-occupied property fell by 42%. Then, in FY 1997, total property tax revenues increased by 11.1% – more than enough to wipe out the entire reduction from the previous year. Moreover, statewide revenue on owner-occupied property rose by 17% in FY 1997. Overall, property tax revenues grew at an average annual rate of 6.2% from 1993 to 2004, while property taxes to fund school districts grew at a rate

[12] Mellen, *Local Government Spending*, 7.

of 6.0% over the same period. By FY 1999 total property tax revenues exceeded the FY 1995 levels in inflation-adjusted dollars. The 1995 legislation provided only fleeting tax relief to property owners in South Carolina.[13]

Property tax revenues increased because, while the first $100,000 of assessed value of owner-occupied homes was exempt from the school portion of property taxes, millage rates were free to grow. And grow they did. From 1994 to 2004, total average millage rates statewide grew by an average annual compound rate of 1.2% and school district and county millage rates grew by 1.7% each.[14] While these millage-rate increases appear at first glance to be modest, the same increases helped produce levels of property taxation that spurred subsequent tax relief efforts in 2000 and 2006. Moreover, the millage-rate increases in this time period were well below the limitations anticipated in the 2006 legislation (which effectively limits increases to 3.1% annually).

Based on this experience, we expect that the limitations on millage-rate increase contained in the 2006 laws will not constrain the growth of local tax revenues but will, instead, set the stage for a subsequent run-up in revenues collected on property not exempted from taxation by the new law. The provision that allows assessments to grow by 15% in any five-year period, provides further leeway for local governments to raise the taxes. Furthermore, local governments are authorized to overrule such restrictions in an emergency situation, such as a deficit in the previous year.

The result is that the new legislation will prove ineffective in limiting the growth of property taxes and of the overall tax burden borne by the citizens of South Carolina. With local taxpayers conditioned to accept the existing local tax burden, the likelihood is that the local government will simply replace the revenues lost with new revenues, obtained from other sources, principally business. And this would be true, no matter how generous the state was in providing transfer payments to plug a perceived or actual revenue gap. Of course, for the state to increase its transfers it would have to increase taxes even further or rely on revenue surpluses. The expectation that the restructuring will lighten the burden on local taxpayers by shifting a portion of local funding to the state ignores the fact that local taxpayers are also state taxpayers and that local governments will see the lightened burden on local taxpayers as an invitation to raise business taxes.

[13] South Carolina State Budget and Control Board, Office of Research and Statistics, "2004 Local Government Finance Report;" Internet; available at http://www.ors.state.sc.us/economics/economics.asp; accessed 31 January 2007.
[14] Ibid.

As noted, the 1995 legislative changes, which were intended to bring relief from property taxes to residents of South Carolina, left local governments with the incentive and the capacity to nullify the hoped-for relief. This point may not have been lost upon the authors of the new legislation, which includes caps on millage-rate increases, as well as assessment value increases. However, the rates at which the caps are set are not likely to bind revenue collections or spending. To show why, we estimated the annual rate at which property taxes (other than the ones being cut) could be expected to rise, with the new legislation in effect, as local governments strove to replace, by FY 2010, the revenue that the new law required them to forgo. Using SC-STAMP, we estimated the annual growth of these revenues to be 5.08%. This implies a total growth of 16.03% over the three-year period.

In the current legislation, the millage rates on property taxes are allowed to grow by the growth of the CPI growth rate plus the growth of the state population. We forecast the sum of these rates to be just over 3.10% for the three fiscal years considered in our analysis. The legislation also allows for assessed property values to increase by as much as 15% in any five-year period, which

Table 4: Tax-Hike Scenario (local governments raise property taxes)

Concept	FY 08	FY 09	FY 10
Finances ($ Millions)			
State Revenues			
Personal Income Tax	3,356	3,483	3,634
State Sales Tax	3,844	3,989	4,146
State Corporation Income Tax	253	255	256
Other State Taxes and Fees	8,928	9,491	10,099
Total State Revenues	16,381	17,218	18,134
Local Reimbursements	(563)	(581)	(599)
Net State Revenues	15,818	16,637	17,535
Local Revenues			
Local Tax on Residential Property	1,585	1,800	2,036
Local Tax on Business Property	2,920	3,281	3,674
Local Sales Tax	276	286	297
Other Local Taxes and Fees	4,588	4,851	5,128
Total Local Revenues	9,369	10,218	11,136
Reimbursements from State	563	581	599
Net Local Revenues	9,932	10,798	11,735
Economic			
Private Jobs	1,677,817	1,704,314	1,731,105
Investment ($ Millions)	26,416	26,483	26,527
State Personal Income ($ Millions)	138,658	145,089	151,809
Real Disposable Income per Capita ($)	23,482	23,326	23,169

translates into a 2.84% increase per year.[15]

The total permissible growth rate is therefore 6.02%.[16] Because this is larger than the annual growth rate necessary for local governments to recoup lost tax revenues by FY 2010 (while still getting the mandatory state reimbursements), we conclude that the limitations imposed will not stop local governments from recouping those revenues. On the basis of their track record in circumventing past efforts to reduce local taxes, we believe that local governments will take full advantage of this loophole.

In Table 4 we present estimates for the scenario in which local governments increase taxes (on property unaffected by the new legislation) by 5.08% annually from FY 2008 to 2010. The data presented in Table 4 indicate the predicted level of each variable in the baseline presented in Table 3. We present the nominal difference in each of the variables in Table 5 and the percentage difference in each of the variables in Table 6.

Table 5: Difference between the Tax-Hike and the Baseline Scenarios

Concept	FY 08	FY 09	FY 10
Finances ($ Millions)			
State Revenues			
Personal Income Tax	(5)	(11)	(18)
State Sales Tax	(6)	(14)	(22)
State Corporation Income Tax	(2)	(3)	(5)
Other State Taxes and Fees	(13)	(30)	(49)
Total State Revenues	(26)	(58)	(95)
Local Reimbursements	10	38	67
Net State Revenues	(16)	(20)	(28)
Local Revenues			
Local Tax on Residential Property	77	170	281
Local Tax on Business Property	114	249	409
Local Sales Tax	(0)	(1)	(2)
Other Local Taxes and Fees	(6)	(13)	(22)
Total Local Revenues	184	405	666
Reimbursements from State	(10)	(38)	(67)
Net Local Revenues	174	367	599
Economic			
Private Jobs	(1,996)	(4,178)	(6,557)
Investment ($ Millions)	(258)	(541)	(852)
State Personal Income ($ Millions)	(88)	(195)	(321)
Real Disposable Income per Capita ($)	(25)	(51)	(79)

[15] The law allows for assessed values to increase by the whole 15% in one year and then by 0% in the next four.

[16] This number is calculated thus: $(1+3.10\%)(1+2.84\%)-1=6.02\%$.

In this scenario, state government suffers a small loss in revenue because of the negative effect the increase of local taxes exerts on the economy. Our estimate is that the state government would lose $95 million in tax revenue by FY 2010 (Table 5, line 6) which represents a mere 0.52% loss of revenue when compared to the baseline (Table 6, line 6). The loss in state revenues is caused by the negative effect that the increase in the property tax has on private consumption. As individuals pay higher property taxes they buy fewer goods and the state collects less tax revenue from the sales tax and from other state taxes.

Since local governments are now raising more revenue, the states would no longer have to compensate them for the total revenue loss that they suffered under the baseline, but rather for the mandatory amount. This produces some "savings" in the form of reduced compensation to the states. Our estimate is that the states would not need to compensate $67 million in FY 2010 to local governments that they would otherwise do under the baseline (Table 5, line 7). Using these two estimates we compute that state government will lose $28 million in revenue by FY 2010 (Table 5, line 8), a change that represents 0.16% of the estimated baseline revenue (Table 6, line 8).

Local revenues will have increased by $599 Million by FY 2010 (Table 5, line 16), which is the same amount as the estimated mandatory state transfer for FY 2010 presented in Table 2. This is by construction since the scenario assumes that local governments will have recouped all tax revenues by FY 2010. Therefore, the amount of the state reimbursement would have to be the minimum stipulated in the law.

The increase in tax revenues comes from the increase in the local property taxes modeled into this scenario. We observe that residential property tax revenue increases by $281 million by FY 2010 (Table 5, line 10), which represents 16.03% of the revenue that would have been collected under the baseline by that tax (Table 6, line 10). This increase partially offsets the relief that residential homeowners would have enjoyed had local governments not raised taxes.

We estimate that by FY 2010 businesses would be paying $409 million more in property tax under this scenario than under the baseline (Table 5, line 11), which is an increase of 12.51% (Table 6, line 11). We must point out that this follows from our assumption that local authorities would increase their local revenues by 5.08% a year. In practice, local governments may increase businesses property taxes by more or less than we assume for the purpose of exploring this

scenario. However, because the underlying trend is toward providing home-owner relief from property taxes, it is likely that the bulk of the increase would fall on business.

Table 6: Percentage Difference between the Realistic and the Baseline Scenarios

Concept	FY 08	FY 09	FY 10
Finances			
State Revenues			
Personal Income Tax	-0.15%	-0.32%	-0.50%
State Sales Tax	-0.16%	-0.34%	-0.53%
State Corporation Income Tax	-0.66%	-1.35%	-2.07%
Other State Taxes and Fees	-0.15%	-0.31%	-0.49%
Total State Revenues	-0.16%	-0.33%	-0.52%
Local Reimbursements	-1.77%	-6.15%	-10.09%
Net State Revenues	-0.10%	-0.12%	-0.16%
Local Revenues			
Local Tax on Residential Property	5.08%	10.42%	16.03%
Local Tax on Business Property	4.05%	8.22%	12.51%
Local Sales Tax	-0.16%	-0.34%	-0.53%
Other Local Taxes and Fees	-0.13%	-0.27%	-0.43%
Total Local Revenues	2.00%	4.13%	6.36%
Reimbursements from State	-1.77%	-6.15%	-10.09%
Net Local Revenues	1.78%	3.52%	5.38%
Economic			
Private Jobs	-0.12%	-0.24%	-0.38%
Investment	-0.97%	-2.00%	-3.11%
State Personal Income	-0.06%	-0.13%	-0.21%
Real Disposable Income per Capita	-0.32%	-0.44%	-0.56%

The net effect on taxpayers is clear: The increase in local revenues is always higher than the decrease in state revenues, so taxpayers will suffer an increase in taxes from the beginning. By FY 2010 the combined state and local tax take will be 2% above baseline.[17]

We see how this train of events weakens the SC economy. By FY 2010, the economy will have 6,557 fewer jobs (Table 5, line 17), $852 million less investment (Table 5, line 18), $321 million less personal income (Table 5, line 19) and $79 less real disposable income per capita (Table 5, line 20) than under the baseline economy. These estimates are conservative, since in this scenario we are allowing for increases in the remaining residential property taxes, as well as in commercial property. However, as explained before, it is more than likely that state and local governments

[17] The estimate is obtained by dividing the net increase in revenues over the total revenue collection under the benchmark: $(599-28)/(17,563+11,136)=1.99\%$

would avoid new taxes on residential property. Their efforts would be directed at raising taxes on commercial property assessments and millage rates, as well as excise taxes and fees that fall on business activity. The consequences for the economy of these increases would be worse than those presented in Tables 4 to 6.

Simply Cutting the Property Tax: A "What-If" Scenario

What if the state had elected simply to cut property taxes, without raising the sales tax? Had it adopted this course of action, the results would have been mostly positive for economic activity. In Table 7, we detail the effects on financial and economic variables that would have followed the enactment of the same cut in property taxes provided for by H. 4449, without the increase in the sales tax provided for by the same legislation and without the local governments hiking the other property taxes back up.

Table 7: Effects of the Property Tax Cut

Concept	FY 08	FY 09	FY 10
Finances ($ Millions)			
State Revenue			
Change	28	29	30
% Change	0.18%	0.17%	0.17%
Local Revenue			
Change	(528)	(571)	(615)
% Change	-5.41%	-5.47%	-5.53%
Economic			
Private Jobs			
Change	8,687	8,826	8,965
% Change	0.51%	0.51%	0.51%
Investment ($ Millions)			
Change	13	13	13
% Change	0.05%	0.05%	0.05%
State Personal Income ($ Millions)			
Level	(133)	(140)	(148)
%	-0.10%	-0.10%	-0.10%
Real Disposable Income per Capita ($)			
Change	25	24	24
% Change	0.11%	0.10%	0.10%

Here the elimination of the school district tax on owner-occupied property causes local government tax revenues to fall by $615 million in FY 2010. State revenues rise by a small amount – $30 million – as a result of the positive effect of the cut in property taxes on the economy. By 2010, there are 8,965 more jobs, $13 million in new investment and $24 in increased real disposable income per capita. Personal income falls by $148 million, in nominal terms, but only as a result of wage and price adjustments that accompany the elimination of the property tax. [18]

[18] Personal income falls because wages fall. The cut in the residential property tax reduces the property owner's reservation wage (the minimum wage that he would accept in order to work). This is because the

It may seem odd that personal income falls by 0.10% even as real disposable income per capita rises by 0.10%. Even though both changes are very small, it is important to understand what they signify. Recall from the discussion above that personal income measures the number of dollars earned by all persons in the economy, whereas real disposable income measures the volume of goods that people can purchase with those dollars after they pay personal taxes. Real disposable income per capita then measures the goods the average person can buy. A fall in personal income will usually bring about a fall in real disposable per capita income (and vice versa), but not always. Here it does not.

We can look at it this way: Were prices and personal taxes to remain constant, then real disposable income per capita would fall by 0.10%, just as personal income does. But the 0.10% *fall* in real disposable income per capita caused by the fall in personal income is offset by approximately a 0.20% *rise* in real disposable income per capita, caused by the fall in prices (the cost of living) and personal taxes (the decrease in residential property tax). Thus individual South Carolinians end up 0.10% better off rather than 0.10% worse off.

Conclusions, Further Thoughts and Recommendations

In this report we set out to evaluate how recent legislation passed in South Carolina can be expected to affect state and local finances and state economic activity. The recent history of attempts at residential property tax relief in South Carolina leads us to predict that, absent a spending limitation, local governments will quickly re-impose the same burden on local taxpayers that the new law is intended to relieve, with predictable negative effects on the state economy.

Because the current legislation sets limits to millage-rate and assessment increases, we examined the question whether these limitations would stop local governments from repeating what they did after the 1995 change. We found that local governments can be expected to restore all the revenue that they would otherwise lose (while still receiving the stipulated state reimbursements) by increasing taxes by a yearly rate that is close to 100 basis points less than the "allowed" rate. We conclude that the limitations in place could not control local spending and will actually

property owner now has to pay fewer taxes (on property in this case) out of the wages he makes. At the same time the local government receives less revenue and, as a result, has to cut expenditures. Local government's demand for labor decreases, thus also pushing wages down. Because personal income consists mostly of wages, personal income, measured as we measure it here, in nominal dollars, falls. At the same time, the fall in wages causes prices to fall with the result that personal income, measured in real, inflation-adjusted dollars, remains about the same. This is why we observe a fall in personal income (in nominal terms) at the same time as we observe a rise in real disposable income per capita.

promote tax increases. These observations open the question of what kind of measures would be effective, or at least somewhat more effective, in controlling the size of local governments, or any government for that matter.

Limits on millage rates and assessments are intended to constrain the growth of local government. Our simulations, however, have shown that they prove to be an ineffective tool for that purpose. The question then becomes what measures would be more effective in controlling the natural tendency of governments to grow?

The answer is clear: It would be necessary to control spending growth. We have shown that the tax limitations provided for by the new law would not prevent local government from wiping out the entire tax cut for which that law provides. The result would be a surge in local government spending funded, in effect, by a windfall transfer from state government. A recent Beacon Hill Institute study showed that increases in the size of government reduce living standards.[19] Specifically, we found that a 10% increase in the share of Gross State Product represented by government spending brings about a 1.01% decrease in real GSP per capita. This argues for a cap on total spending. [20]

Spending caps often take the form of a Taxpayer Bill of Rights (TABOR) that limits government spending growth to CPI growth plus population growth. This keeps real government spending per capita constant. There are bills in the South Carolina House an Senate that would mandate spending caps. They tie spending to different economic indicators including income and population growth.

Government spending could be constrained to grow at the same rate as nominal GSP, a measure of income, and spending would be kept constant as a share of GSP. This would limit the growth of real government to the growth of real non-government economic activity. Table 8 shows the differences in the way the two constraints would work. Generally (though not always) limiting growth to inflation imposes the tighter constraint (compare lines 3 and 4). If one's intent is to keep the real value of government spending constant, irrespective of population changes, spending could be tied to CPI only. This would impose an even tighter constraint on government spending, as a comparison of lines 1, 3, and 4 in Table 8 indicates. States with a stagnant or

[19] David Tuerck, Paul Bachman, Alfonso Sanchez-Penalver and Emily Hausman, "A TABOR for Ten: Applying a Taxpayer Bill of Rights to Ten States," The Beacon Hill Institute at Suffolk University, June 2006, Available upon request.
[20] Ibid.

shrinking school age population might find this option most attractive, since public schools account for most state-and-local expenditures.

The choice of the actual constraint depends on what is seen as the proper size of government and of the role of budget constraints in squeezing the greatest possible efficiency out of government. Capping government spending at the growth in CPI would be a signal that real government spending must grow no larger and that government must find a way to do more with the resources it has if it wishes to expand services.

Table 8: Economic Growth Rates (calendar years)

	1998	1999	2000	2001	2002	2003	2004	2005
(1) CPI	1.27%	1.95%	3.21%	2.33%	1.29%	2.31%	2.54%	3.58%
(2) Population	1.54%	1.41%	1.23%	0.90%	1.06%	1.07%	1.24%	1.36%
(3) Nominal GSP	5.70%	5.55%	3.54%	4.25%	3.65%	4.83%	3.16%	6.48%
(4) CPI + Pop	2.82%	3.37%	4.44%	3.23%	2.34%	3.38%	3.77%	4.93%

Appendix

What is SC-STAMP?

SC-STAMP is a comprehensive model of the State, designed to capture the principal effects of city tax changes on that economy. SC-STAMP is a five-year dynamic 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., prices are endogenous). The model 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.[21]

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 income to buy goods and services, pay taxes and save. Their spending decisions are strongly influenced by the structure of prices they face. Their spending decisions are also influenced by the amount of labor that they are willing to provide given on the wage rates offered to them..

Producers/firms buy inputs (labor, capital and intermediate goods that are produced by other firms) and transform them into outputs. Producers 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 of South Carolina. The relationships between these components are set out in the circular flow diagram shown in Figure

[21] 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 titled *Applying General Equilibrium* (New York: Cambridge University Press, 1992).

1.[22] 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.

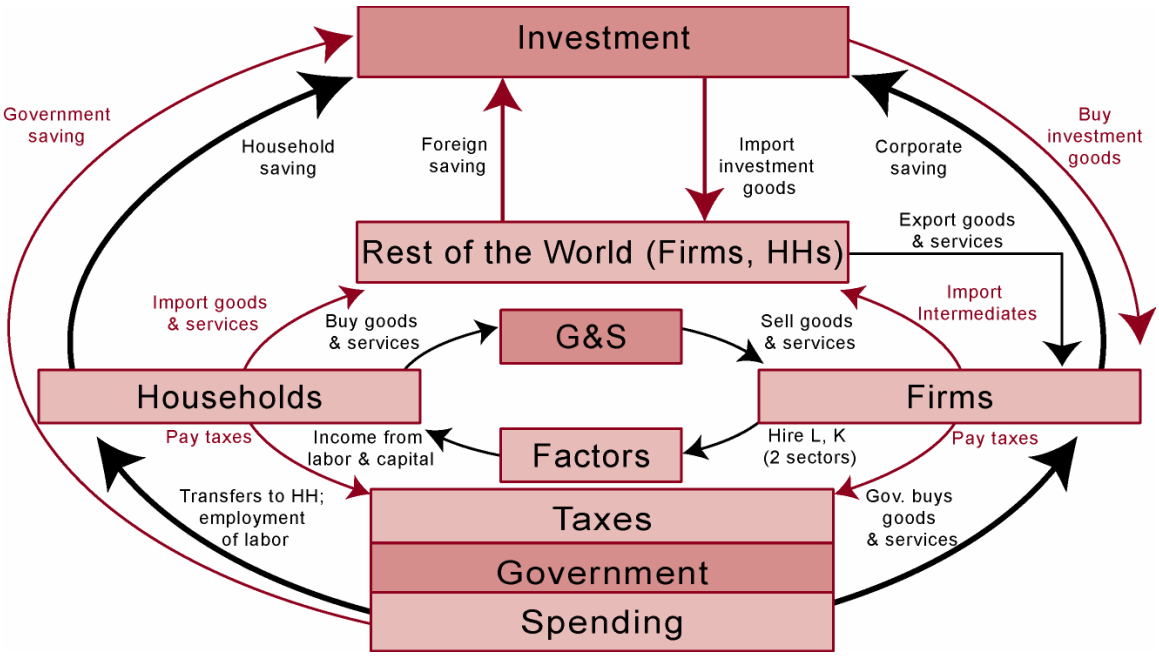

Figure 1. Circular Flow Diagram

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*. SC-STAMP includes 81 economic sectors. Each sector is an aggregate that groups together segments of the economy. We separate households into seven income classes and firms into 27 industrial sectors. In addition, we distinguish between 30 types of taxes and funds (four at the federal level, 14 at the state level, and 12 at the city level) and 13 categories of government spending (two at the federal level, six at the state level, and five at the city level). 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 is dictated by the availability of suitably disaggregated data (for households and firms), and the purposes of the model.

[22] Based on a similar diagram in Peter Berck, Elise Golan and B. Smith, with John Barnhart and Andrew Dabalen. "Dynamic Revenue Analysis for California," Summer 1996. University of California at Berkeley and California Department of Finance. Available at http://www.dof.ca.gov:8080/html/fs%5Fdata/dyna%2Drev/dynrev.htm; Internet: accessed 23 January 2007.

Sub-national models, such as SC-STAMP, are similar in many ways to national and international CGE models. However, they differ in a number of important respects, which are as follows:

a. In a national model, most saving goes toward domestic investment; however, this need not be true at the regional level. If citizens 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 cities and states than across nations.
d. In sub-national 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 or local income tax (which may be deducted from income before computing the Federal tax).
e. Data are less available at the sub-national than national level. This explains why scores of national CGE models have been built, but relatively few sub-national 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. SC-STAMP starts with data for a single FY, 2004, which we use as the basis to develop a steady state path through FY 2010 in the model. This steady state path is attained by applying growth rates for investment, population, employment and inflation throughout the time frame of the model. In SC-STAMP, the investment growth rate is assumed to be 1.31%.[23] The growth rate for population is assumed to be 1.7%.[24] The inflation growth rate is assumed to be 3.00%[25]. To attain a reasonable steady state path, the data for the base year, FY 2004, must be very detailed. Most of the data are organized into a *Social Accounting Matrix (SAM)*, which in this case consists of an 81 by 81 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 taken from the academic

[23] This figure is derived from taking the average nominal US gross domestic investment for the period 1929-2004, as published by the Bureau of Economic Analysis.
[24] This figure is the Census projection for SC for the period 2005-2010.
[25] This figure is based on data obtained from the U.S. Bureau of Labor Statistics.

literature, that measure the responsiveness of households to changes in prices and wages, and of firms to changes in input costs and output prices. These are set out in detail in Section 4 of this report. 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 South Carolina, along with some comments explaining the choices made at each step.

The third step is to program the model. For this we use 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 the "Estimate CGE" button, and read the key output on the same spreadsheet; the heavy-duty computing occurs in the background.

Before we can use it, the model must be calibrated. Calibration consists of running the model – i.e., asking it to solve for all the variables in such a way as to maximize (and minimize!) total personal income.[26] The results for the base year are checked to see that they correspond with the actual values of the variables in the SAM. Once the model reproduces the base year values, it is considered calibrated. Calibration is an important step, as it is essentially a way of checking that the model is working properly.

After it has been calibrated, 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 steady state 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. *It is worth stressing that SC-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 actually expected to occur in coming years.*

Organizing the Data

[26] The choice of variable to maximize has no substantive importance and serves as a device for getting the model to solve.

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) for the base year. The SAM that we developed for STAMP is an 81 by 81 matrix. Each of the 5,929 cells in the matrix represents the dollar value of a flow from one sector of the economy to another – for instance, purchases of business services by the utilities sector, or labor earnings flowing to middle-income households. Reading along a row, one finds the payments received by that sector; reading down 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 utilities must equal spending by that sector, so that all incoming and outgoing funds are completely accounted for.

For SC-STAMP, we distinguish 27 industrial sectors, two factors (labor and capital), seven household categories, an investment sector, 43 government sectors (26 for taxes, 13 for spending, four government funds) 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. An additional limitation 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

Although data for 49 sectors were available from the Bureau of Economic Analysis, SC-STAMP contains only 27 industrial sectors. This is because some sectors were too small to merit separate attention. In these cases, we combined some industries, such as textiles and apparel. In other cases, there were no matching employment figures, and so it was easier to work with aggregates.

Factor Sectors

We distinguish between two factors, labor and capital (which include 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 SC-STAMP, households receive wages, capital income and transfers and they use this income to buy goods and services to pay taxes; and to save. We distinguish seven household sectors, which group households by their levels of income. Expenditure data are available for households in each of these categories, which make it 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 and another one is to allow different groups to have different levels of sensitivity to labor market conditions.

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 (BEA) on the pattern of gross investment by destination (i.e., how much gross investment went into adding to the stock of capital in utilities, in industry, and so on). We have constructed measures of the capital stock in each sector, and by applying published depreciation rates and adding gross investment, arrived at the capital stock in the subsequent period. This permits the model to track the expansion of the economy over time. The BEA has also produced a matrix, built for the U.S. for 1997, which maps investment by destination with investment by source. This mapping allows one to determine, for example, how much of the investment destined for utilities 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

SC-STAMP was 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 A-1.

Table A-1. Government Sectors

Federal Government Receipts		
USSSTX	Social Security (OASDI and MEDICARE)	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.
USOTTX	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 SC and to Federal defense fund.
USDEFF	Federal Defense Spending	Purchases goods and services, and pays labor for military purposes.
SC State Government Receipts		
STPITX	State Personal Income Tax	Revenues go into State general fund.
STCBTX	State Corporate Income Tax	Revenues go into State general fund.
STSATX	State Sales Tax	Revenues go into State general fund.
STESTX	State Estate Tax	Revenues go into State general fund.
STINTX	State Insurance Tax	Revenues go into State general fund.
STHCPT	State Healthcare Provider Tax	Revenues go into State general fund.
STTPPT	State Telecommunication Personal Property	Revenues go into State general fund.
STFUTX	State Taxes on Motor Fuels	Revenues go into State special fund and highway fund.
STPUTX	State Public Utility Tax	Revenues go into State general fund.
STRETT	State Real Estate Transfer Tax	Revenues go into State general fund.
STALTX	State Alcohol Beverage Taxes	Revenues go into State general fund.
STTCTX	State Tax on Cigarettes and Tobacco	Revenues go into State general fund.
STPTTX	State Property Transfer Tax	Revenues go into State general fund.
STOTTX	State Other Taxes	Revenues go into State general fund and Other funds.
STMOTX	State Motor Vehicle Tax	Revenues go into State general fund.
STWKTX	State Worker Compensation Tax	Sector combines workers compensation and unemployment funds. Receipts go into proprietary fund.

STFEES	State Fees, License Permits and Other Revenue	Revenues go into all funds.
STGENF	State General Fund	An accounting device. Tax revenue is channeled into this fund before being distributed to other uses.
STFSCF	State Special Fund	An accounting device. Tax revenue is channeled into this fund before being distributed to other uses.
STHIWF	Highway Fund	
STSPCF	State Other Special Fund (Healthy Fund)	
State Government Expenditure		
STGGSP	State General Spending	General government spending.
STEDUC	State Spending on Education	Mainly purchases of goods and services and labor in the higher education sector.
STHELT	State Spending on Health & Welfare	Buys some services; mainly transfers funds to local health spending fund.
STPBSF	Public Safety	Public safety and fire departments spending.
STTRAN	State Spending on Transport	Mainly buys engineering services and construction.
STOTHS	State Other Spending	Miscellaneous other spending by the state on labor, goods and services.
Local Government Receipts		
LOPRTX	Local Tax on Residential Property	Revenues go into the local general fund.
LOPBTX	Local Tax on Business Property	Revenues go into the local general fund.
LOTCTX	Local Tax on Cigarettes and Tobacco	Revenues go to the local general fund.
LOOTRE	Local Taxes Other	Revenues go to the local general fund.
LOCHAR	Local Public Service Charge and Fees	Revenues go to all three funds (general, capital projects and other)
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.
LOPBSF	Local Public Safety	Public safety and fire departments local spending.
LOTRAN	Local Spending on Local Transportation	Mainly buys engineering services and construction.
LOOTHS	Local Other Spending	Includes spending on police and firefighters, road repair, and miscellaneous local government services.

South Carolina's state government collects revenue from taxes and fees. Specific tax categories at the state level included in the model are: sales and use, cigarettes and tobacco, mortgage recording, corporate and personal incomes, and taxes both on residential and commercial properties. The rest of the state taxes are grouped into a residual category (other local taxes).

The revenues from the taxes go to either the South Carolina general fund, the South Carolina capital projects fund or to other funds, or a combination of them. Funds then allocate the money into the five spending categories: education, health and welfare, transportation, public safety or others.

Rest of the World

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

SC-STAMP: The Model in Detail

This section of the report explains the SC-STAMP model in detail. First, we introduce each equation, providing some context and a short description. Then we present each equation in mathematical form, provide information on the sources of data used, and summarize the elasticity assumptions used in the model.

Detailed Equations for South Carolina STAMP

South Carolina STAMP is a dynamic CGE model which assumes a steady state growth path. Absent from any "shocks", the economy is assumed to remain on this path. If the economy experiences a shock, such as a tax change, the economy will diverge from this steady state path and eventually turn onto a new path. The size and length of the divergence will depend on the size of the shock to the economy. Below we set out the equations used in SC-STAMP and the assumptions inherent in them.

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,

$$X_{t,i} = \lambda_i * \frac{I_t}{P_{t,i}}, \quad i = 1,...,n; t = 1,...n,$$

where $X_{t,i}$ is the quantity demanded of good i at time t, $P_{t,i}$ is the price of good i at time t, I_t is income at time t, and 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 (ensuring 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. $$y_{t,h} = \sum_{f \in F} \frac{\alpha_{h,f} a^w_{t,h}}{\sum_{h \in H} \alpha_{h,f} a^w_{t,h}} y_{t,f} \left(1 - FFP_f\right)\left(1 - \sum_{g \in GF} \tau^{fh}_{t,g,f}\right) \qquad \forall t \in T, h \in H, f \in F$$

Description: Household income is the sum of income from each factor (labor and capital) less factor taxes, distributed by household groups according to their share of total.

Data: The information on earnings for each household group comes from SC (South Carolina) IMPLAN (an economic impact modeling system which allows users to perform in-depth regional analysis).[27]

Household Disposable Income

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

Eq. 2. $$y^d_{t,h} = y_{t,h} - \sum_{g \in GI} t_{t,g,h} a^{hh}_{t,h} - \sum_{g \in GH} \tau^h_{t,g,h} a^{hh}_{t,h} + \sum_{g \in G} w_{hg} a^n_{t,h} \tau^{pc}_{t,h,g} \quad \forall h \in H, t \in T$$

Description: Disposable household income is the household income less income taxes and other household taxes (property taxes etc), plus the government transfer payments.

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. $$c_{t,i,h} = \bar{c}_{t,i,h} \left(\frac{y^d_{t,h}}{\bar{y}^d_{t,h}} \div \frac{p_{t,h}}{\bar{p}_{t,h}} \right)^{\beta_{ih}} \prod_{i' \in I} \left[\frac{p_{t,i'}}{p_{t,i'}} \frac{\left(1 + \sum_{g \in GS} \tau^c_{t,g,i'} \right)}{\left(1 + \sum_{g \in GS} \tau^q_{t,g,i'} \right)} \right]^{\lambda_{i'i}} \quad \forall i \in I, h \in H, t \in T$$

Description: Consumption is a function of baseline consumption, adjusted to reflect the change in household disposable income (in constant prices), and the change in after-tax prices.

[27] For more details see Minnesota IMPLAN Group at http://www.implan.com..

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

Comments: Some household spending goes directly to buy goods and services outside South Carolina.

Eq. 4. $$m_{t,h} = \overline{m_{t,h}} \left(\frac{y^d_{t,h}}{\overline{y^d_{t,h}}} \div \frac{p_{t,h}}{\overline{p_{t,h}}} \right)^{\eta^m_h} \quad \forall h \in H, t \in T$$

Description: Household imports will increase with the increase in disposable income, in constant prices.

Household Savings

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

Eq. 5. $$s_{t,h} = y^d_{t,h} - \sum_{i \in I} c_{t,i,h} p_{t,i} \left(1 + \sum_{g \in GS} \tau^c_{t,g,i} \right) - m_{t,h} \quad \forall h \in H, t \in T$$

Description: See comments above.

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 Index

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. For instance, a tax on foodstuffs would tend to hit poor households relatively hard, and the CPI for poor households would pick up this effect.

Eq. 6.
$$p_{t,h} = \frac{\sum_{i \in I} p_{t,i} \left(1 + \sum_{g \in GS} \tau^{c}_{t,g,i}\right) c_{t,i,h}}{\sum_{i \in I} \overline{p}_{t,i} \left(1 + \sum_{g \in GS} \tau^{q}_{t,g,i}\right) c_{t,i,h}} \qquad \forall\, h \in H, t \in T$$

Description: Price index by household group is a function of the baseline price index, adjusted by the change in after-tax prices by industry, according to their corresponding share of consumption.

Data: The consumption of each good by each household group (c_{ih}) is derived from reports published by State and Federal agencies. The model also generates some of its own values.

Labor Supply

Comments: In the SC-STAMP we model the labor participation rate, 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. 7.

$$a_{t,h}^{w} = \overline{a}_{t,h}^{w} \frac{a_{t,h}^{hh}}{\overline{a}_{t,h}^{hh}} \left(\frac{r_{t,L}^{a}}{\overline{r}_{t,L}^{a}} \div \frac{p_{t,h}}{\overline{p}_{t,h}} \right)^{\eta_h^{ls}} \left[\prod_{g \in GI} \left(\frac{t_{t,g,h}^{pi}}{\overline{t}_{t,g,h}^{pi}} \div \frac{p_{t,h}}{\overline{p}_{t,h}} \right)^{\eta_{h,g}^{PIT}} \right]^{1/GINUM} \left(\frac{\sum_{g \in G} \frac{w_{t,h,g}}{p_{t,h}}}{\sum_{g \in G} \frac{\overline{w}_{t,h,g}}{\overline{p}_{t,h}}} \right)^{\eta_h^{tp}} \qquad \forall t \in T, h \in H$$

Description: The supply of labor is a function of the baseline supply of labor adjusted by population growth, the net change in wages, income taxes, and government transfer payments. We used professional judgment in determining the proper elasticities for each household group.

Data: The data on working households by income class came from SC-IMPLAN.

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.[28]

Eq. 8.

$$a_{t,h}^{hh} = \overline{a}_{t,h}^{hh} + \overline{a}_{t,h}^{i} \left(\frac{y_{t,h}^{d}}{a_{t,h}^{hh}} \div \frac{\overline{y}_{t,h}^{d}}{\overline{a}_{t,h}^{hh}} \div \frac{p_{t,h}}{\overline{p}_{t,h}} \right)^{\eta_h^{yd}} \left(\frac{a_{t,h}^{n}}{a_{t,h}^{hh}} \div \frac{\overline{a}_{t,h}^{n}}{\overline{a}_{t,h}^{hh}} \right)^{\eta_h^{u}} - \overline{a}_{h}^{o} \left(\frac{\overline{y}_{t,h}^{d}}{\overline{a}_{t,h}^{hh}} \div \frac{y_{t,h}^{d}}{a_{t,h}^{hh}} \div \frac{\overline{p}_{t,h}}{p_{t,h}} \right)^{\eta_h^{yd}} \left(\frac{\overline{a}_{t,h}^{n}}{\overline{a}_{t,h}^{hh}} \div \frac{a_{t,h}^{n}}{a_{t,h}^{hh}} \right)^{\eta_h^{u}}, \ \forall h \in H, t \in T$$

Description: See comments above.

[28] John R. Harris and Michael P. Todaro, "Migration, Unemployment and Development: A Two-Sector Analysis," *American Economic Review* 60, no. 1 (1970): 126-142.

Data: The elasticities used in this equation are the same as those used for California by Berck et al., and "reflect the middle ground found in the literature about migration."[29]

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. 9. $$a^{n}_{t,h} = a^{hh}_{t,h} - a^{w}_{t,h} \qquad \forall h \in H, t \in T$$

Description: See comments above.

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 amounts 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. 10. $$v_{t,i} = \sum_{i' \in I} \alpha_{t,i,i'} q_{t,i'} \qquad \forall i \in I, t \in T$$

Description: See comments above.

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

[29] Berck, et. al.,,117.

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. 11. $$q_{t,i} = \gamma_{t,i}\left[\sum_{f\in F}\alpha_{t,f,i}\left(u^{d}_{t,f,i}\right)^{-\rho_i} + g\alpha_{t,i}\left(gk_t\right)^{-\rho_i}\right]^{-1/\rho_i} \quad \forall\, i\in I, t\in T$$

Description: In addition to labor and capital used in production, we account for infrastructure.

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. 12. $$p^{va}_{t,i} = p^{d}_{t,i} - \sum_{i'\in I}\alpha_{t,i',i}\,p_{t,i'}\left(1+\sum_{g\in GS}\tau^{v}_{t,g,i'}\right) \quad \forall\, i\in I, t\in T$$

Description: Price of value-added by industry is the domestic price by industry minus the production prices by industry according to their share in domestic supply, including taxes on intermediates, if any.

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

Factor Demand

Comments: It is possible to construct a profit function that expresses profits as a function of factor inputs. Microeconomic theory shows 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 are separate equations for labor and for capital, for each of the 27 industrial sectors.

Eq. 13. $$r_{t,f,i} r^{a}_{t,f} \left(1 + \sum_{g \in GF} \tau^{x}_{t,f,g,i} \right) u^{d}_{t,f,i} = p^{va}_{t,i} q_{t,i} \alpha_{t,f,i} \quad \forall\, i \in I,\, f \in F, t \in T$$

Description: The factor demand at the current intra-industry rental rate (for labor and capital) times the overall rental rate, including factor taxes is a function of the price of value-added times the industry domestic supply.

Data: Information on the wage bills comes from the Bureau of Economic Analysis. The total wage bill is divided by the number 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 South Carolina.[30]

Factor Income

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

[30] David G. Tuerck, Jonathan Haughton, In-Mee Baek, James Connolly and Scott Fontaine, "Texas State Tax Analysis Modeling Program Methodology and Applications," The Beacon Hill Institute at Suffolk University, (February 1999, Revised); Internet; available from http://www.beaconhill.org/BHIStudies/TexasSTAMPFinal19Feb99.pdf.

Eq. 14. $$y_{t,f} = \sum_{i \in I} r_{t,f,i} r^a_{t,f} u^d_{t,f,i} + \sum_{g \in G} r_{t,f,g} r^a_{t,f} u^d_{t,f,g} \qquad \forall f \in F, t \in T$$

Description: The factor income is the sum of factor demand multiplied by rental rates, for all industries and government sectors.

Trade with other States and Countries

From a state perspective, the "rest of the world" consists of other states and U.S. territories as well as the world outside the United States. Goods produced in the state are assumed to be close, but not perfect, substitutes for goods produced elsewhere. Thus if prices rise in South Carolina, 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 the state. If the domestic price rises relative to the foreign price, exports will fall. Note that the elasticity here is negative.

Eq. 15. $$e_{t,i} = \overline{e}_{t,i} \left[\frac{p^d_{t,i} \div \overline{p}^w_{t,i}}{1 + \sum_{g \in G} \tau^m_{t,g,i}} \right]^{\eta^e_i} \qquad \forall i \in I, t \in T$$

Description: Current exports are a function of baseline exports adjusted by the change in domestic prices versus fixed world prices.

Data: The trade data for the state are not particularly reliable; we have used our judgement, combined with BEA data, 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.[31] 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 South Carolina.

Eq. 16. $$d_{t,i} = \overline{d}_{t,i}\left[\frac{p^{d}_{t,i} \div \overline{p}^{w}_{t,i}}{1+\sum_{g\in G}\tau^{m}_{t,g,i}}\right]^{\eta^{d}_{i}} \quad \forall i \in I, t \in T$$

Description: See comments above.

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

Intermediate Demand for Imports

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

Eq. 17. $$m_{t,i} = \left(1-d_{t,i}\right)x_{t,i} \quad \forall i \in I, t \in T$$

Description: See comments above.

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.

[31] Paul S. Armington, "A Theory of Demand for Products Distinguished by Place of Production," *IMF Staff Papers* 16, (1969): 159-176.

Eq. 18. $$p_{t,i} = d_{t,i} p^{d}_{t,i} + \left(1 - d_{t,i}\right) \overline{p}^{w}_{t,i} \qquad \forall\, i \in I, t \in T$$

Investment

We first constructed a measure of the capital stock for each industrial sector for 2003. This stock, less depreciation and plus gross investment gives the capital stock for 2004. Gross investment is determined, sector-by-sector, based on the net of tax rate of return (relative to the return in the base period). For instance, once investment by 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.[32]

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. $$u_{t,K,i} = u_{t-1,K,i}\left(1 - \delta_i\right) + n_{t,i} \qquad \forall i \in I, t \in T$$

Description: See comments above.

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 South Carolina.[33]

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).

[32] The Capital Coefficient Matrix is a matrix of investments by use by industries. It contains distribution ratios of new structures and equipment to using industries from the 1992 BEA capital flow tables.
[33] Tuerck, Haughton, et. al, Texas-STAMP.

Eq. 20. $$n_{t,i} = \overline{n}_{t,i}\left[\frac{r_{t,K,i}\left(1-\sum_{g\in GK}\tau^{x}_{t,g,K,i}\right)u_{t,K,i}}{\overline{r}_{t,K,i}\left(1-\sum_{g\in GK}\tau_{t,g,K,i}\right)\overline{u}_{t,K,i}}\right]^{\eta^i} \qquad \forall i\in I, t\in T$$

Description: Gross investment is the baseline gross investment by industry adjusted to the change in after-tax capital rental rates.

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 The state and elsewhere, we estimated the investment demand elasticity to be about 0.3.

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. $$p_{t,i}\left(1+\sum_{g\in GS}\tau^{n}_{t,g,i}\right)cn_{t,i} = \sum_{i'\in I}\beta_{i,i'}n_{t,i'} \qquad \forall i\in I, t\in T$$

Description: The gross investment by source in after-tax prices is a function of investment by destination according to the capital coefficient matrix.

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

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 State General Fund; they are then used in part to buy goods and services, but some are also transferred to local government units.

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. 22.

$$y_{t,g} = \sum_{i \in I} \tau^{v}_{t,g,i} v_{t,i} p_{t,i} + \sum_{i \in I} \tau^{m}_{t,g,i} m_{t,i} p w^{0}_{t,i} + \sum_{h \in H} \sum_{i \in I} \tau^{c}_{t,g,i} c_{t,i,h} p_{t,i} + \sum_{i \in I} \tau^{n}_{t,g,i} cn_{t,i,n} p_{t,i} + \sum_{i \in I} \sum_{g' \in G} \tau^{g}_{t,g,i} c_{t,i,g'} p_{t,i}$$
$$+ \sum_{i \in I} \sum_{f \in F} \tau^{x}_{t,g,f,i} r_{t,f,i} r^{a}_{t,f} u^{d}_{t,f,i} + \sum_{g' \in G} \sum_{f \in F} \tau^{x}_{t,g,f,g'} r_{t,f,g'} r^{a}_{t,f} u^{d}_{t,f,g'} + \sum_{f \in F} \tau^{fh}_{t,g,f} y_{t,f} + \sum_{h \in H} \tau^{pi}_{t,h,g} a^{hh}_{t,h} + \sum_{h \in H} \tau^{h}_{t,h,g} a^{hh}_{h}$$
$$\forall g \in G, t \in T$$

Description: Income by government sector is the sum of taxes on intermediates, imports, consumption, investment, government consumption, factors, income taxes and other household taxes.

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. 23.

$$p_{t,i} \left(1 + \sum_{g \in GS} \tau^{g}_{t,g,i} \right) cg_{t,i,g} = \alpha_{i,g} \left(y_{t,g} + \sum_{g' \in G} b_{t,g,g'} - \sum_{g' \in G} b_{t,g',g} + b_{t,ussstx,g} - \sum_{h \in H} w_{t,h,g} a^{n}_{t,h} \tau^{pc}_{t,h,g} - \overline{s}_{t,g} \right)$$
$$\forall i \in I, g \in GN, t \in T$$

Description: The government spending in after-tax prices computed according to their share of government income plus net inter-government transfers less government savings and transfer payments. Note that only state and local governments are endogenous in the model.

Data: The shares of spending going to these sectors are based on a careful analysis of State government budget and financial reports.

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. 24**.**

$$u^{d}_{t,f,g} r^{a}_{t,f} r_{t,f,g} = \alpha_{f,g} \left(y_{t,g} + \sum_{g' \in G} b_{t,g,g'} - \sum_{g' \in G} b_{t,g',g} + b_{t,ussstx,g} - \sum_{h \in H} w_{t,h,g} a^{n}_{t,h} \tau^{pc}_{t,h,g} - \overline{s}_{t,g} \right) \quad \forall f \in F, g \in GN, t \in T$$

Description: The government factor demand is computed according to the share of each government in total government spending, including net inter-government transfers, less savings and transfer payments.

Government Infrastructure Capital Stock

Comments: The government adds to its infrastructure capital stock through its spending on the government transportation sector, STTRAN.

Eq. 25.
$$gk_{t+1} = gk_t (1-\delta) + \sum_{g \in G} b_{t+1,STTRAN,g} - \sum_{g \in G} b_{t+1,g,STTRAN} + \sum_{g \in G} b_{t+1,LOTRAN,g} \quad \forall t \in T$$

Description: The infrastructure capital stock for the current year is the infrastructure for the previous year, less depreciation plus the net spending on transportation by state and local governments.

Data: The data for government infrastructure capital stock is based on national data from the BEA.

Government Savings

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

Eq. 26.
$$s_{t,g} = y_{t,g} - \sum_{i \in I} cg_{t,i,g} p_{t,i} \left(1 + \sum_{g \in GS} \tau^{g}_{t,g,i}\right) - \sum_{f \in F} u^{d}_{t,f,g} r_{t,f,g} r^{a}_{t,f} \left(1 + \sum_{g' \in GF} \tau^{x}_{t,f,g',g}\right) - \left(\sum_{h \in H} w_{t,h,g} a^{n}_{t,h} \tau^{pc}_{hg}\right) - \sum_{g' \in G} b_{t,g',g} + b_{t,ussstx,g} + \sum_{g' \in G} b_{t,g,g'} \qquad \forall g \in G, t \in T$$

Description: Government savings is the residual from government income, after spending and factor rental, transfer payments, plus net inter-governmental transfers.

Distribution of Taxes to Spending and Transfers

Comments: Tax units, in this case those sectors collecting revenue, 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.
$$b_{t,g',g} = \mu_{t,g',g} \left(y_{t,g} - \left(\sum_{h \in H} w_{t,h,g} a^{n}_{t,h} \tau^{pc}_{t,h,g} - \overline{s}_{t,g} \right) \right) \qquad \forall g, g' \in G$$

Description: The intra-fund accounting to distribute the government income, less transfer payments and savings.

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

Endogenous Distribution of SC Funds

Comments: This equation details the flows from state funds to state spending sectors and from state spending sectors to local spending sectors.

Eq. 28. $$b_{t,g,g'} = \mu_{t,g,g'}\left(\sum_{g''} b_{t,g',g''} + w_{g',INVEST} + w_{g',ROWSCT}\right) \quad \forall g, g' \in G$$

Description: Some funds are fixed to the original share.

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

State Personal Income

Comments: This equation defines state personal income as earnings (from labor and capital) plus transfer payments.

Eq.29. $$y_t^s = \sum_{h \in H} y_{t,h} + \sum_{h \in H} \sum_{g \in G} w_{t,h,g} a_{t,h}^n \tau_{h,g}^{pc} \quad \forall t \in T$$

Description: State personal income is the sum of household income and government transfer payments.

Model Closure

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. 30. $$\sum_{h \in H} a^{w}_{t,h} = \left(\sum_{z \in Z} u^{d}_{t,L,z} \right) \varepsilon_{t} \quad \forall t \in T$$

Description: Total working households equals the sum of private employment and government employment.

Capital Market Clearing

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

Eq. 31. $$u^{s}_{t,K,i} = u^{d}_{t,K,i} \qquad \forall i \in I, t \in T$$

Description: See comments above.

Goods Market Clearing

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

Eq. 32. $$q_{t,i} = x_{t,i} + e_{t,i} - m_{t,i} \qquad \forall i \in I, t \in T$$

Description: See comments above.

*Domestic Demand Define***d**

Comments: These equations define domestic demand for each sector.

Eq.33. $$x_{t,i} = v_{t,i} + \sum_{h \in H} c_{t,i,h} + \sum_{g \in G} cg_{t,i,g} + cn_{t,i} \quad \forall i \in I, t \in T$$

Description: Domestic demand is the sum of intermediate demand, household consumption, government consumption and investments.

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 that ensures the solution to the model does not create income tax revenue in an inappropriate place.

Eq.34. $$t_{t,g,h} = 0 \quad \forall h \in H, g \notin GI, t \in T$$

Set Intergovernmental Transfers to Zero if Not in Original SAM

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

Eq.35. $$b_{t,g,g'} = 0 \quad \forall g, g' \in G, t \in T \quad \text{where } \bar{b}_{gg'} = 0$$

Federal Social Security Transfers to SC

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

Eq.36. $$b_{\text{t,h,USSSTX}} = \bar{b}_{\text{t,h,USSSTX}} \times \left(\frac{\overline{a^n_{t,h}}}{a_{t,h}} \right)$$

Description: Transfer payments are adjusted by the change in nonworking households.

Fix Exogenous Federal Transfers to Households

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

Eq.37. $$b_{\text{t,h,USNOND}} = \overline{b}_{\text{t,h,USNOND}} \times \left(\frac{a^n_{t,h}}{\overline{a}^n_{t,h}} \right)$$

Description: Transfer payments are adjusted by the change in nonworking households.

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. 38. $$cg_{t,i,g} = \overline{cg}_{t,i,g} \qquad \forall i \in I, g \in GX, t \in T$$

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. 39. $$u^d_{t,f,g} = \overline{u}^d_{t,f,g} \qquad \forall f \in F, g \in GX, t \in T$$

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. 40. $$r_{t,L,i} = \overline{r}_{t,L,i} \qquad \forall i \in I, t \in T$$

Fix Government Rental Rate for Capital to Initial Level

Comments: For SC-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. 41. $r_{t,K,g} = \overline{r}_{t,K,g} \quad \forall g \in G, t \in T$

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. 42. $r^{a}_{t,K} = \overline{r}^{a}_{t,K} \quad \forall f \in F, t \in T$

Set Transfer Payments to Zero

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

Eq. 43. $w_{t,h,g} = 0 \quad \forall\ h \in H, g \in GWX, t \in T$ where $\overline{w}_{t,h,g} = 0$

Objective Function

Comments: This equation measures utility over the entire period of the dynamic model as measured by the sum of state personal income discounted. 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.

Eq. 44. $U = \sum_{t \in T} \beta_t statey_t \quad t \in T$

Description: Utility is defined as the net present value of future state personal income levels.

Elasticity Assumptions for SC-STAMP

For the model to work, one must introduce values for the relevant elasticities. These are drawn from the existing literature, as follows:

ETAM: Import elasticity with respect to domestic price for producers' purchase of intermediates. Most of the data on elasticities are taken from Reinert, Roland-Holst, and Shiells. The two most recent are Reinert and Roland-Holst[34] and Roland-Holst, Reinert and Shiells[35].

In the first study, the authors estimate an Armington model for 163 mining and manufacturing sectors. Two-thirds of the elasticities were positive and statistically significant, ranging from a low of 0.13 for chocolate to 3.49 for wine, brandy and brandy spirits. The second study looked at the impact of NAFTA. In this study many of the aggregate industries had an elasticity of 1.50. Since import data for goods between states is almost impossible to obtain, we made some assumptions and used 1.50 for most industries and a slightly lower elasticity of 0.50 for a handful of less traded industries such as service industries.

While these elasticities are slightly higher than the literature on national trade, we believe that goods in a state are more price-sensitive to goods in the Rest of the World (including other states) than national goods. Therefore, we converted the elasticities to a domestic share elasticity for each industry using the following equation. ETAD = ETAM * IMPORT / (DOM. DEMAND * DOM. SUPPLY SHARE OF DOM. DEMAND). The estimates for this elasticity were taken from the literature.

ETAE: Export elasticity with respect to domestic price for the sale producers' goods. Used in the export demand equation. The NAFTA study was also helpful with exports. We used an elasticity of 1.65 for industries which had an import elasticity of 1.50 and an export elasticity of 0.65 for those which had an import elasticity of 0.50.

SIGMA: Elasticity of substitution between capital and labor. Values in the literature range between 0.15 and 1.809 for industries with the majority close to 1, and we have used values of 0.90 for industries with substantial substitution and 0.8 in other cases (as shown in Table A-2).

[34] Kenneth.A. Reinert and Donald.W. Roland-Holst. "Armington Elasticities for United States Manufacturing Sectors," *Journal of Policy Modeling* 14, no.5 (1992): 631-639.
[35] Donald.W. Roland-Holst, Kenneth A. Reinert and Clinton.R. Shiells. "A General Equilibrium Analysis of North American Economic Integration," *Modeling Trade Policy: Applied General Equilibrium Assessments of North American Free Trade* (New York: Cambridge University Press, 1994): 47-82.

This measurement is used to calculate RHO, which is the exponent in the production function. The equation is: RHO = (1- SIGMA)/SIGMA.

Table A-2. Industry Elasticities					
	ETAM	**ETAE**	**ETAY**	**ETAOP**	**SIGMA**
AGRICF	1.50	-1.65	1.00	-1.00	0.90
MINING	1.50	-1.65	1.00	-1.00	0.80
CONSTR	1.50	-1.65	1.00	-1.00	0.90
FOODPR	1.50	-1.65	1.00	-1.00	0.90
APPARL	1.50	-1.65	1.00	-1.00	0.90
MFRCON	1.50	-1.65	1.00	-1.00	0.80
PPAPER	1.50	-1.65	1.00	-1.00	0.80
CHEMIC	1.50	-1.65	1.00	-1.00	0.80
ELECTR	1.50	-1.65	1.00	-1.00	0.90
MVOTRA	1.50	-1.65	1.00	-1.00	0.90
METALS	1.50	-1.65	1.00	-1.00	0.80
MACHIN	1.50	-1.65	1.00	-1.00	0.80
INSTRU	1.50	-1.65	1.00	-1.00	0.90
MFROTH	1.50	-1.65	1.00	-1.00	0.90
TRANSP	1.50	-1.65	1.00	-1.00	0.90
COMMUN	1.50	-1.65	1.00	-1.00	0.90
UTILIT	1.50	-1.65	1.00	-1.00	0.80
WHOLSA	0.50	-0.65	1.00	-1.00	0.90
RETAIL	0.50	-0.65	1.00	-1.00	0.90
BANKNG	1.50	-1.65	1.00	-1.00	0.90
INSURS	1.50	-1.65	1.00	-1.00	0.90
REALST	1.50	-1.65	1.00	-1.00	0.90
REPSVC	1.50	-1.65	1.00	-1.00	0.80
BSVCES	1.50	-1.65	1.00	-1.00	0.80
ENTRHO	0.50	-0.65	1.00	-1.00	0.80
HEALTH	0.50	-0.65	1.00	-1.00	0.80
OTHSVC	0.50	-0.65	1.00	-1.00	0.80
USNOND	0	0	0	0	0
USDEFF	0	0	0	0	0
STGGSP	0	0	0	0	0
STEDUC	0	0	0	0	0
STHELT	0	0	0	0	0
STPBSF	0	0	0	0	0
STTRAN	0	0	0	0	0
STOTHS	0	0	0	0	0
LOEDUC	0	0	0	0	0
LOHELT	0	0	0	0	0
LOPBSF	0	0	0	0	0
LOTRAN	0	0	0	0	0
LOOTHS	0	0	0	0	0

The following elasticities are used in household-specific equations:

ETAPIT: Labor supply elasticity with respect to income taxes. This elasticity appears as an exponent in the labor supply equation. Measurements were based on estimates taken from the literature. The labor supply elasticities (ETARA) are widely divergent in the literature and suffer from a lack of disaggregation. They range from close to zero to 2.3 for net wages, with rather high positive values for women, particularly married woman. This means that the *tax* elasticities are negative. There is some evidence of greater (absolute) tax elasticities at higher income levels, which is why we assume a graduated scale from -0.15 for the lowest income category to -0.35 in the top category (see Table A-3).[36]

ETATP: Household response to transfer payments. The transfer payment elasticities reflect a study by Robins (1985) on the effects of a negative income tax (NIT).[37] It is also a reflection of the observation that income received by upper income groups is on average largely unaffected by transfer payments.

ETAYD: Responsiveness of immigration to after tax income. Not much literature exists that ties migration to disposable income or unemployment. Studies by Bartik and Treyz et al. put the range of responses to a change in wage rates at between 0.835 and 2.39.[38] We used these as a basis for our after tax earnings elasticities. This elasticity appears in the population equation.

ETAU: Responsiveness of immigration to unemployment. We made some assumptions based on the responsiveness to employment elasticities in the literature.

ETAMH: Income elasticity of demand for imports by household. This elasticity appears in the household import equation.

[36] Note that ETAPIT = -ETARA (t/(1-t)), where t is the income tax rate.

[37] Philip K. Robins, "A Comparison of the Labor Supply Findings from the Four Negative Income Tax Experiments, *Journal of Human Resources*. 20, No. 4. (Autumn, 1985): 567-582.

[38] Timothy Bartik, *Who Benefits from State and Local Economic Development Policies?* (Kalamazoo, MI: W.E. Upjohn Institute, 1991). See also George I. Treyz; Dan S. Rickman; Gary L. Hunt; Michael J. Greenwood ,"The Dynamics of U.S. Internal Migration," *Review of Economics and Statistics* 75, no. 2. (May, 1993): 209-214.

Table A-3. Household-Related Elasticities						
	ETAPIT	**ETATP**	**ETARA**	**ETAYD**	**ETAU**	**ETAMH**
LESS10	-0.15	-0.05	0.17	1.30	-0.80	0.70
LESS25	-0.18	-0.05	0.17	1.50	-0.80	0.70
LESS50	-0.20	-0.04	0.20	1.60	-0.80	0.70
LESS75	-0.25	-0.04	0.30	1.80	-0.80	0.70
LES100	-0.25	-0.03	0.40	2.00	-0.80	0.70
LES150	-0.30	-0.03	0.50	2.10	-0.80	0.70
MOR150	-0.35	-0.02	0.50	2.30	-0.80	0.70

Definitions and Glossary

Summary of Set Names			
Sets	**Dimension**	**Math**	**GAMS**
Factors	2	$f \in F$	F
Governments - All	39	$g \in G$	G
Governments - Factor Taxes	6	$g \in GF$	GF
Governments - Per Household Taxes	8	$g \in GH$	GH
Governments - Income Taxes	2	$g \in GI$	GI
Governments - Capital Income Taxes	6	$g \in GK$	GK
Governments - Endogenous Spending	16	$g \in GN$	GN
Governments - Sales or Excise Taxes	11	$g \in GS$	GS
Governments - Endogenous Transfer Payments	1	$g \in GWN$	GWN
Governments - Exogenous Transfer Payments	4	$g \in GWX$	GWX
Governments - Exogenous Spending	6	$g \in GX$	GX
Households	7	$h \in H$	H
Industries	27	$i \in I$ or $j \in I$	I
All Social Accounting Matrix Accounts	77	$z \in Z$	Z

Summary of Parameter Names			
Parameters	**Dimension**	**Math**	**GAMS**
Input Output Coefficients	77 x 77	-	A(Z,Z1)
Domestic Input Output Coefficients	27 x 27	α_{ij}	AD(Z,Z1)
Government Spending Shares of Net Income	39 x 39	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	α_{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	η_i^e	ETAE(I)
Domestic Demand Elasticity	27	η_i^d	ETAD(I)
Investment Supply Elasticity	1	η_i	ETAI
L Supply Elasticity with respect to Average	7	η_h^{ls}	ETARA(H)
Labor Supply Elasticity with respect to TP's[39]	7	η_h^{tp}	ETATP(H)
Labor Supply Elasticity with respect to Taxes	7	η_h^{PIT}	ETAPIT(H)
Responsiveness of In-Migration to	7	η_h^u	ETAU(H)
Responsiveness of In-Migration to Disp.	7	η_h^{yd}	ETAYD(H)
Production Function Scale	27	γ_i	GAMMA(I)
Types of Inter-Government Transfers	39 x 39	-	IGTD(G,G1)
Correction Factor between Households and	1	ε	JOBCOR
Price Elasticities of Demand	27 x 27	λ_{ij},	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,*)
Natural Rate of Population Growth	7	π_h	NRPG(H)
Substitution Exponent in Production Function	27	ρ_i	RHO(I)
Social Accounting Matrix	77 x 77	$\sigma_{zz'}$	SAM(Z,Z1)
Consumption Sales and Excise Tax Rates	9 x 27	τ_{si}^c	TAUC(G,I)
Factor Tax Rates	5 x 2 x 77	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 77	τ_{gfz}^x	TAUFX(G,F,Z)
Government Sales and Excise Tax Rates	9 x 27	τ_{si}^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	τ_{si}^n	TAUN(G,I)
Sales and Excise Tax Rates	9 x 27	τ_{si}^q	TAUQ(G,I)
Intermediate Good Sales and Excise Tax Rates	9 x 27	τ_{si}^v	TAUV(G,I)
Tax Bracket Base Amount	2 x 7	τ_{gh}^b	TAXBASE(G,H)
Tax Bracket Minimum Taxable Earnings	2 x 7	τ_{gh}^d	TAXBM(G,H)
Tax Constant to Correct Calculated to	2 x 7	τ_{gh}^c	TAXCVC(G,H)
Tax Deduction other than Standard and other	2 x 7	τ_{gh}^o	TAXOD(G,H)
Percentage Itemizing	2 x 7	τ_{gh}^i	TAXPI(G,H)
Tax Destination Shares	39 x 39	$\mu_{gg'}$	TAXS(G,G1)
Tax Deduction for Standard Deductions	2 x 7	τ_{gh}^s	TAXSD(G,H)
Percent of Households Receiving TP's	7 x 6	τ_{hg}^{pc}	TPC(H,G)

[39] TP is abbreviation for transfer payments.

Summary of Parameter Names			
Variables	**Dimension**	**Math**	**GAMS**
Public Consumption	27 x 39	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 77	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	2 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	39	s_g	S(G)
Private Savings	7	s_h	S(H)
State Personal Income	1	q	SPI
Transfer Payments	7 x 39	w_{hg}	TP(H,G)
Intermediate Goods	27	v_i	V(I)
Factor Income	2	y_f	Y(F)
Government Income	39	y_g	Y(G)
Household Income	7	y_h	Y(H)
Household after Tax Income including TP's	7	Y_h^d	YD(H)

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The Beacon Hill Institute at Suffolk University in Boston focuses on federal, state and local economic policies as they affect citizens and businesses. The institute conducts research and educational programs to provide timely, concise and readable analyses that help voters, policymakers and opinion leaders understand today's leading public policy issues.

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