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A Multiregional Model of Growth Oriented State Tax Reforms: An Application to Georgia and Five Comparison States

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ORIENTED STATE TAX REFORMS:
AN APPLICATION TO GEORGIA AND
FIVE COMPARISON STATES**

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Summary

A number of states, including Georgia, are considering revenue neutral tax reforms in which the state significantly reduces its income tax rates or eliminates both the corporate and personal income taxes altogether and recovers the lost tax revenue by expanding its sales tax base and increasing its sales tax rate. To gauge the economic effects of such reforms, we construct a multi-regional, dynamic, open economy, general equilibrium model. We examine the case of Georgia pursuing alternative tax reforms and simulate the impact of each reform on Georgia's economy and that of five comparison states and the rest of the U.S. We find that Georgia's annual growth rate of aggregate personal income increases relative to the baseline by 0.6 percentage points if both the personal and corporate income taxes are eliminated. Georgia's benefits from tax reform, however, come at the expense of the comparison states and the rest of the United States.

Background

Fundamental national tax reform, by which is meant substituting a broad-based consumption tax for the existing federal income tax, has been an important topic of ongoing policy discussion and of research for the past several decades. A growing number of states are now discussing the merits of legislative proposals to change their state's tax structure by significantly decreasing the proportion of tax revenue raised through the income tax and replacing the lost revenue with an expanded sales tax base and/or increased sales tax rate. The principal economic argument for doing so is to reduce the distortionary tax on capital income, thereby promoting increased capital accumulation which, in turn, increases the state's long-run economic growth rate. While there are several studies that explore the effects of fundamental national tax reform, there is virtually no research addressing this issue at the subnational level, despite the political interest in such state-level reforms. The purpose of this study has been to address this gap in the literature.

To that end, we have constructed a multiregional, dynamic, open economy, general equilibrium model to gauge the effect of a variety of tax reform options on economic growth and welfare in the reform state. This model builds on the work of Plassmann (2005) and Feltenstein and Plassmann (2008). Previous studies using simulation models to gauge the effect of state tax reforms generally employ static models with two regions, the state and the

rest of the world. Our model is a substantial advance over such models. First, ours is a dynamic model. State tax reforms that reduce distortionary taxes on capital income will affect savings and investment behavior. Second, a multiregional model has several advantages over a two region model. A multiregional model provides for differential responses by each of the comparison states and the Rest of the U.S. (ROUS). These responses depend on the particular circumstances of each region in the model, particularly their tax and economic structures, relative to that of Georgia. The aggregate of these differential responses in a multiregional model, such as ours, may differ from the aggregate response of the rest of the world in a two region model. In the latter, the distinguishing features of individual regions are averaged out through aggregation. In addition, a multiregional model provides detailed information on the impact of Georgia's tax reform on each of the comparison states and the ROUS, which may be of independent interest, particularly to policy-makers.

The feature that most distinguishes our model from others is the way in which we model inter-state trade. We use a non-Armington approach in which goods traded between states are viewed as being identical and thus perfect substitutes in production and consumption. This approach has a number of advantages in a multiregional model of a highly integrated common market, such as the U.S. Briefly, the typical Armington version of a multiregional economy, as used in many other studies, would have a single type of labor in each region. Hence there would be a single wage rate for all sectors in a region, which would force us to neglect the relative wage effects of alternative fiscal policies. Since the reform options analyzed here involve partial and complete repeal of Georgia's personal income tax (PIT), which includes a tax on labor income, we believe that it is particularly important to account for the relative wage effects of such reforms.

In light of the diversity of reform proposals being considered by various states, we have simulated three tax reform options that might be adopted by Georgia. We simulate the effects of these reforms on Georgia's economy as well as their effects on five comparison states, namely Alabama, Florida, North Carolina, South Carolina, and Tennessee, and the ROUS. In Tax Reform Option A, we simulate the effect of expanding the sales tax base to include services and a revenue neutral reduction in the PIT rate. This is the reform option proposed in Georgia and several other states. Next, we simulate Tax Reform Option B which

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involves eliminating the PIT altogether and a revenue neutral increase in the sales tax rate on the expanded sales tax base. Finally, in Tax Reform Option C, or fundamental tax reform, we simulate the effect of eliminating both the PIT and corporate income tax (CIT) and a revenue neutral increase in the sales tax rate on the expanded sales tax base. In this manner, we are able to address the benefits of incremental tax reforms leading up to fundamental tax reform.

These reforms are shown to have positive effects on Georgia's economy relative to the baseline. However, these benefits come at the expense of reduced economic growth in the comparison states as well as the ROUS. By increasing the after-tax rate of return to capital in Georgia relative to that in the other states, these reform options allow Georgia to attract capital from the comparison states and the ROUS. This increase in capital per worker, in turn, increases the returns to labor which results in an increase Georgia's labor supply. The combined effect of the increase in capital accumulation and in labor supply increases Georgia's long-run economic growth rate. The resulting increases are economically significant. For example, fundamental tax reform increases Georgia's compound growth rate in personal income by 0.6 percentage points relative to the baseline.

Intuition

We use a multiregional, dynamic, open economy, non-Armington, general equilibrium model. The model includes Georgia, five comparison states, and the ROUS. It accounts for the federal tax system and international trade and financial capital flows. The non-Armington approach is described in greater detail in the paper upon which this report is based, but we note here that this approach permits physically similar intermediate and final goods to be treated as perfect substitutes when traded across states. Thus, we do not have to estimate elasticities of substitution between, say Georgia peanuts and Alabama peanuts to take just one example. Avoiding the use of interregional elasticities of substitution for each industry relieves us of two serious problems. First, the elasticities are unknown, and second, their inclusion would make the computational requirements of the model very large.

The model provides for international trade in goods and financial capital, but the U.S. is treated as a closed economy in terms of labor and capital mobility. Georgia, the state that is adopting the tax policy reform, and all other states are treated as open economies in terms

of trade in goods and services and factor mobility. Since distance (transportation costs) is not modeled, the location of the states does not matter in this model. As we simulate the reforms, we maintain revenue neutrality rather than budget neutrality to focus the analysis on the effect of tax reform on economic growth and to be consistent with the actual tax reform proposals. The reforms we simulate in this study involve expanding Georgia's sales tax base by adding services to the base and increasing the sales tax rate. These revenues are used to reduce or eliminate Georgia's CIT and PIT. Prior to the tax reform, as reported in Table 1, the percentage of state tax revenue collected with capital taxes (including property taxes), personal income tax, and sales tax are 37.7 percent, 26.5 percent, and 35.8 percent, respectively.

Tax Background

We chose Georgia for our simulated reform, in part, because Georgia is considering reducing the PIT rate and recovering the lost revenue by broadening the sales tax base to include services. The choice of the five comparison states is based in part on convenience; however, we also want to have a diverse set of states. The comparison states are the five states bordering Georgia. There is considerable heterogeneity in the size distribution of these five comparison states, with some larger and some smaller than Georgia, and interesting differences in their economic and tax structures. For example, Florida and Tennessee do not have state income taxes. Finally, the six states represent a regional economy. As reported in Table 1, Florida has the largest economy in terms of gross state product (GSP) of the six states at $737.1 billion, which is nearly twice that of Georgia. These six states account for 15 percent of the gross domestic product (GDP) of the United States. In column 2 of Table 1, we report state and local government expenditures as a share of GSP by state. These range from 14.0 percent in North Carolina to 18.2 percent in North Carolina. Except for Alabama and South Carolina, the share of state and local expenditures in GSP is less than the average share for the ROUS. This is consistent with the reputation of this region for being fiscally conservative.

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TABLE 1. SIZE OF STATE ECONOMIES AND TAX STRUCTURE PRIOR TO REFORM

Region	Gross State Product (GSP) (Billions $'s) (1)	-----------Share in GSP of:----------		---Share in Total Tax Revenue of:---		
		State and Local Expenditures (Percent) (2)	State and Local Tax Revenue (Percent) (3)	Capital Taxes (Percent) (4)	Sales Taxes (Percent) (5)	Personal Income Tax (Percent) (6)
Alabama	169.1	16.5	7.7	31.3	46.2	22.5
Florida	737.1	14.1	9.0	53.5	46.5	--
Georgia	*398.6*	*14.2*	*7.8*	*37.7*	*35.8*	*26.5*
North Carolina	411.4	14.0	7.6	33.2	34.7	32.1
South Carolina	160.6	18.2	8.0	42.8	34.2	23.0
Tennessee	246.4	14.4	7.0	40.4	58.3	1.4
Rest of the USA	11,995.8	16.2	9.0	43.7	32.2	24.1
USA	14,119.0	16.0	8.9	43.6	33.7	22.7

Source: Authors' calculations.

In short, there is considerable diversity in the size of these six state economies as well as in their tax structures. These differences make it essential to specify the individual structures of Georgia and the surrounding states, rather than simply treating all states as being economic replicas of one another.

The Model: A Brief Outline[1]

A feature of our model that most differentiates it from other general equilibrium models is our treatment of the substitutability of a good produced in multiple states. Thus, we will give a general description of this non-Armington approach to interstate trade.

Differences in factor prices—and, more generally, differences in the costs of production across states that arise from different production functions—pose difficulties for multi-region general equilibrium models if these cost differences translate into different output prices. If goods from different states are perfect substitutes for each other, then consumers will acquire these goods only from the state with the lowest production cost and hence the lowest price. To avoid such corner solutions which imply, unrealistically, that each good is produced only in one state, models that allow for trade generally incorporate the so-called Armington assumption that goods produced in different regions or countries are imperfect substitutes for one another (see Armington, 1969). This assumption yields an

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[1] A detailed description of the underlying theoretical model is given in Condon, et al. (2014).

intuitively plausible explanation for trade in seemingly identical final goods—for example, if consumers view German cars and Japanese cars as being distinct goods, then it is plausible that Germany and Japan would trade cars with each other. Hence the Armington approach distinguishes final goods by physical characteristics as well as by place of origin.

While the Armington assumption is appropriate as a motivation for international trade in final goods, we contend that the assumption is less appropriate as an explanation of interregional commodity flows in final goods and intermediate inputs between the states of the U.S. Many companies produce identical goods in different plants that are located in different states, but because the units produced in different states are indistinguishable from each other, consumers generally do not care (or know) in which state the particular unit that they acquire has been produced. For example, it is difficult to argue that Netflix customers who obtain DVDs by mail care whether their DVD requests were fulfilled by a facility located within their own state or some other state.

Our solution algorithm proceeds as follows: consider a single sector—say manufacturing—that operates in all states. If manufacturing output in any state is a perfect substitute for the manufacturing output of other states, then the equilibrium price of manufacturing output must be identical across states. To establish such a single equilibrium price for manufacturing output, we begin with the manufacturing industry in a reference state.[2] We follow the standard practice and assume that the manufacturing sector in each state has its own two-part production function. The first part uses a neoclassical production function that transforms substitutable factor inputs of capital and labor into value added. There is a single, perfectly mobile, type of capital, while labor is both sector and state specific. Since capital is assumed to be perfectly mobile, we assume that it will have the same after-tax rate of return in every state and sector.

Households make decisions each period regarding the utility maximizing level of saving and labor supply. These decisions depend positively on the rates of return to savings and to labor. Domestic savings and net financial capital inflows from abroad are assumed to be equal to gross physical investment. We assume a given depreciation rate for existing capital. Thus, net capital accumulation for the entire economy is equal to savings plus net financial capital inflows from abroad less the depreciation of the existing capital stock. Since

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[2] In the models that we describe below, we use the "rest of the United States" as the reference "state."

all capital earns the same net of tax return, the location of where capital is used is not material, only the location of the owner matters for income determination.

The second part of the algorithm uses an input-output (IO) matrix to describe intermediate inputs that are used in fixed proportions. We use this two-part production function for, say the manufacturing industry in the reference state, together with the price of capital and the manufacturing wage in the reference state, to determine the output price of the manufacturing sector. We view this price as the equilibrium price of manufacturing output. Thus, we must ensure that the prices of manufacturing output in all states equal this equilibrium price. As noted above there is a single type of perfectly mobile capital with an identical price across states. However, we assume that labor is, at least in the short run, immobile. We can then solve backwards, in every other state, for the wage rate in manufacturing that implies zero economic profits and the same price of manufacturing output as in the reference state. This backwards solution follows from the assumed constant returns to scale structure of production functions across states. Thus, given a price of capital (that is identical across states) and a set of wages for the industries in the reference state, our model yields an equilibrium solution with industry-specific output prices that are identical across states, a single price of capital, and state and sector specific wages.[3]

All governments make transfers to consumers, invest in government assets (bonds), and demand intermediate inputs to produce public goods. They finance these expenditures by levying corporate income taxes, as well as property taxes, personal income taxes, sales taxes, as well as by issuing public debt. The federal government makes transfers to and levies taxes on firms and consumers in all states, while each state government makes transfers to and levies taxes on firms and consumers in its own state only.

Income tax is applied to the returns to labor and capital of residents in the state. More specifically, the income tax on wages is treated as a withholding tax that is paid directly by the firm that employs the labor. The income on returns to capital is paid directly by the consumer. State sales taxes are imposed on final goods and services, and thus we do not account for the potential pyramiding of state sales taxes. Tax rates are average effective tax rates, calculated as actual state and local tax revenue for the specific tax in the base year

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[3] See Condon, et al. (2014) for a description of consumer behavior, which is quite standard.

divided by the implied tax base in the base year. We do not account for increasing marginal tax rates.

We assume that all tax rates, other than for our exogenous tax policy change, remain unchanged over time; that government spending on public goods is proportional to each state's value of production; and that government transfers, on the other hand, are proportional to each state's total income. We calibrate the values of government spending and government investment for all periods in the base case scenario, and we then use these calibrated values for the periods in the counterfactual analyses that assume different tax rates in Georgia. Thus tax policies may vary, but government expenditures are fixed. Governments can run surpluses or deficits. Other approaches to modeling government expenditures are certainly meaningful, but would distract from our focus on tax instruments.

We model the following revenue neutral tax reforms, where revenue neutrality means that tax revenue in the first year of any tax reforms equals the tax revenue in the first year of the baseline. For Tax Reform Option A, we expand the sales tax base to include purchases of services and use the revenue to reduce the PIT rate. For Tax Reform Option B, we add services to the sales tax base and increase the sales tax rate to recover the revenue lost by the elimination of the PIT. Tax Reform Option C is similar to Option B except that the sales tax rate is increased to recover the revenue lost from the elimination of both the CIT and PIT. Note that Option C eliminates the CIT but not the property tax on capital.

Baseline Simulation

We begin by describing the baseline simulation which we use as a benchmark to gauge the effect of Georgia's tax reforms on its economy, on each of the five comparison states, and on the ROUS. The model is calibrated to a single year. Hence the baseline simulation is used for purposes of comparison and should not be interpreted as a statistical forecast of future performance.

Table 2 reports the results of the baseline simulation for four key macroeconomic variables, namely personal income, consumption of goods, labor supply, and demand for capital by state and by period. We report the results for 10 periods since the changes in period-to-period growth rates are small for additional periods. We index each endogenous variable by setting it equal to 100 in the base year, which is reported in the column labelled

TABLE 2. BASELINE SIMULATION OF KEY MACROECONOMIC VARIABLES BY STATE AND BY PERIOD

State	0	1	2	3	4	5	6	7	8	9	10
						PERSONAL INCOME					
Alabama	100.0	101.4	103.4	106.1	109.3	112.7	116.2	119.8	123.6	127.5	131.6
Florida	100.0	101.2	103.0	105.2	108.0	110.8	113.6	116.5	119.3	122.3	125.2
Georgia	*100.0*	*102.0*	*105.0*	*108.4*	*112.3*	*116.4*	*120.6*	*125.0*	*129.6*	*134.3*	*139.3*
North Carolina	100.0	102.7	106.7	111.2	116.2	121.4	126.7	132.3	138.1	144.2	150.6
South Carolina	100.0	100.9	101.8	103.4	105.4	107.5	109.6	111.7	113.9	116.0	118.1
Tennessee	100.0	100.8	101.6	103.1	105.0	107.1	109.2	111.3	113.5	115.6	117.8
Rest of USA	100.0	101.3	103.6	106.1	108.7	111.3	113.9	116.5	119.2	121.8	124.5
USA	100.0	101.4	103.6	106.2	108.9	111.6	114.3	117.1	119.9	122.7	125.6
						CONSUMPTION OF GOODS					
Alabama	100.0	101.1	102.9	105.5	108.7	112.1	115.6	119.2	123.0	127.0	131.1
Florida	100.0	100.7	102.2	104.2	106.9	109.7	112.5	115.2	118.0	120.9	123.8
Georgia	*100.0*	*101.8*	*104.7*	*108.2*	*112.2*	*116.4*	*120.7*	*125.2*	*129.9*	*134.8*	*139.9*
North Carolina	100.0	102.7	106.8	111.7	117.0	122.6	128.4	134.4	140.7	147.3	154.2
South Carolina	100.0	100.5	101.1	102.4	104.2	106.2	108.1	110.0	111.9	113.9	115.8
Tennessee	100.0	100.5	101.0	102.2	104.0	106.0	107.9	109.9	111.8	113.8	115.8
Rest of USA	100.0	101.0	103.2	105.6	108.1	110.6	113.2	115.7	118.2	120.8	123.3
USA	100.0	101.0	103.2	105.7	108.3	110.9	113.6	116.3	119.0	121.8	124.5
						LABOR SUPPLY					
Alabama	100.0	100.7	100.5	100.7	101.3	102.1	103.1	104.0	105.1	106.2	107.3
Florida	100.0	100.8	100.7	100.5	100.7	101.0	101.4	101.8	102.2	102.6	103.0
Georgia	*100.0*	*101.3*	*102.0*	*102.7*	*103.7*	*104.8*	*106.0*	*107.2*	*108.5*	*109.7*	*111.1*
North Carolina	100.0	100.7	101.1	101.7	102.6	103.7	104.9	106.2	107.6	109.0	110.6
South Carolina	100.0	100.8	100.4	100.1	100.3	100.8	101.2	101.7	102.2	102.7	103.1
Tennessee	100.0	100.7	100.3	99.9	100.1	100.5	100.9	101.3	101.8	102.2	102.6
Rest of USA	100.0	100.9	101.5	102.2	102.7	103.2	103.8	104.3	104.8	105.3	105.8
USA	100.0	100.9	101.5	102.0	102.6	103.1	103.6	104.2	104.8	105.3	105.9
						DEMAND FOR CAPITAL					
Alabama	100.0	102.8	105.8	109.4	113.6	118.0	122.8	127.8	133.1	138.5	144.2
Florida	100.0	103.0	106.5	110.3	114.4	118.7	123.0	127.4	131.8	136.3	140.9
Georgia	*100.0*	*104.9*	*110.2*	*116.0*	*122.1*	*128.5*	*135.0*	*141.7*	*148.6*	*155.7*	*163.0*
North Carolina	100.0	105.3	111.2	117.8	124.8	131.9	139.3	147.0	155.0	163.3	172.0
South Carolina	100.0	101.6	102.6	103.7	105.3	107.1	109.0	110.8	112.6	114.3	116.1
Tennessee	100.0	101.5	102.2	103.2	104.8	106.6	108.4	110.2	112.0	113.7	115.5
Rest of USA	100.0	101.9	104.1	106.3	108.5	110.7	112.9	115.1	117.3	119.4	121.6
USA	100.0	102.2	104.6	107.1	109.6	112.2	114.8	117.4	120.0	122.7	125.3

Source: Authors' calculations.

zero; thus the percent growth from the base year is easily interpreted from the values in Table 2. North Carolina's economy out performs the other five states as well as the ROUS over the 10 periods. Personal income in North Carolina increases by slightly more than 50 percent over the 10 periods, which is equivalent to an average annual increase of 4.2 percent. Using the growth in personal income as a performance benchmark, Georgia's economy ranks second among the six states with a compound growth rate of 3.4 percent over the 10 periods. The compound growth rates of personal income in the baseline simulation for the remaining states and that of the ROUS are substantially smaller than that of North Carolina and Georgia. Georgia's average simulated growth rate in per capita (worker) income is 2.29 percent. In contrast, Georgia's average growth rate in real per capita income for the period 1990 to 2008 is 1.24 percent. Thus, our model generates a higher average growth rate in personal income per capita than Georgia's recent historical experience.

As might be expected, North Carolina and Georgia also lead the other states in the growth rate of consumption of goods and the growth rate in the demand for capital over the 10-period horizon of the baseline simulation. Finally, Georgia leads all other states and the ROUS in terms of the 10-period growth rate in labor supply. North Carolina ranks second in terms of the 10-period growth rate in labor supply, followed by Alabama. The remaining regions have 10-period growth rates of labor supply in the 3 to 6 percent range.

Tax Reform Simulations

We begin the analysis by examining the effect of the tax reform options considered here on Georgia's tax structure. Table 3 shows the share of taxes by source and state in period 10 for the baseline and for each tax reform option. Tax Reform Option A (broadening the sales tax base and a revenue neutral reduction in the PIT rate) results in a 92 percent decrease in the share of PIT revenue in total tax revenue relative to the baseline. The share of revenue from taxes on capital in total tax revenue is virtually unchanged; whereas, the share of sales tax revenue increases by 53 percent. Tax Reform Option B eliminates the PIT, which therefore no longer contributes to total taxes, while the share of sales tax revenue increases to 60 percent of total tax revenue. After this reform, there is only a slight decrease in the share of revenue from taxes on capital relative to the baseline. Finally, fundamental tax reform (Tax Reform Option C) or repeal of both the CIT and PIT and a revenue neutral

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TABLE 3. TAX STRUCTURE IN PERIOD 10 BY STATE AND BY TAX REFORM

State	Baseline			Tax Reform A[1]			Tax Reform B[2]			Tax Reform C[3]		
	Capital Tax	Sales Tax	PIT	Capital Tax	Sales Tax	PIT	Capital Tax	Sales Tax	PIT	Capital Tax	Sales Tax	PIT
Alabama	37.9	41.8	20.3	37.7	42.2	20.1	37.5	42.5	20.0	37.6	42.4	20.0
Florida	56.6	43.4	0.0	56.5	43.5	0.0	56.4	43.6	0.0	56.4	43.6	0.0
Georgia	41.4	33.9	24.7	41.5	51.8	6.7	40.0	60.0	0.0	42.2	57.8	0.0
North Carolina	36.3	33.7	30.0	36.1	34.1	29.8	35.9	34.3	29.7	36.0	34.2	29.8
South Carolina	43.1	33.7	23.2	43.1	33.9	23.0	43.0	33.9	23.0	43.1	34.0	23.0
Tennessee	41.1	57.5	1.4	41.0	57.7	1.4	40.8	57.8	1.4	40.8	57.8	1.4
ROUS	43.1	32.4	24.5	43.0	32.5	24.5	42.9	32.6	24.4	43.0	32.6	24.4

Notes:
[1] Tax Reform A: Broaden sales tax base to include services and a revenue neutral reduction in the PIT rate.
[2] Tax Reform B: Eliminate the PIT and a revenue neutral increase in the sales tax rate on the broaden sales tax base.
[3] Tax Reform C: Eliminate the PIT and the CIT and a revenue neutral increase in the sales tax rate on the broaden sales tax base.
Source: Authors' calculations.

increase in the sales tax rate on the broadened sales tax base has a surprising effect on Georgia's tax structure. Relative to the previous reform (the set of columns labeled Tax Reform B in Table 3) results in a slight decrease in the share of revenues from sales tax and a slight increase in the share of revenues from taxes on capital. Apparently, repeal of the CIT has a positive effect on revenues from property taxes; hence, the increase in the share of revenue from taxes on capital. As one would expect, these reform options have a negligible effect on the tax structures of the comparison states and the ROUS.

We now examine the effect of each reform option on the four macroeconomic variables used to describe the baseline simulation. We begin with the impact of adding services to Georgia's sales tax base and a revenue neutral decrease in the PIT rate (Option A). The results of this simulation are reported in Table 4.

As a result of this reform, personal income in Georgia increases from 139.3 in period 10 of the baseline simulation to 148.5 in period 10 of Tax Reform Option A. This is a 6.6 percent increase in personal income. In the baseline, the compound growth rate of personal income is 3.37 percent which increases to 3.88 percent as a result of this reform. This is a 0.51 percentage point increase in the compound growth rate in personal income. In contrast, as a result of Georgia's tax reform, the growth rate in personal income declines in the five comparison states and the ROUS, with the largest decline in percentage terms occurring in Alabama. Georgia's labor supply increases by 11 percent by period 10 of the baseline relative to the base year, and by 21 percent over the same period in the reform simulation. This is a 90 percent increase in Georgia's labor supply over the 10 periods as a result of Tax Reform Option A, with small declines in labor supply in the comparison states and the ROUS. The largest decline in labor supply in percentage terms occurs in Alabama; the smallest declines occur in South Carolina and Tennessee. After 10 periods, Georgia's demand for capital increases by 14.3 percent due to the reform. There are small declines in the demand for capital in the comparison states and the ROUS, with the largest decline in percentage terms occurring in Alabama and the smallest decline occurring in Florida.

Turning now to the effect of Georgia's tax reform on personal consumption of final goods and services, which is a measure of the welfare effects of the reform, we find that it increases from 139.9 in period 10 of the baseline simulation to 150.4 in period 10 of the reform. This is an overall increase in consumption of 7.5 percent or a 0.41 percentage point

TABLE 4. THE EFFECT OF TAX REFORM OPTION A ON KEY MACROECONOMIC VARIABLES BY STATE AND BY PERIOD[1]

State	Period										
	0	1	2	3	4	5	6	7	8	9	10
PERSONAL INCOME											
Alabama	100.0	101.2	103.0	105.7	108.7	111.8	115.1	118.4	121.9	125.4	129.0
Florida	100.0	101.1	102.5	104.9	107.5	110.2	112.8	115.5	118.2	120.9	123.6
Georgia	*101.5*	*103.8*	*107.7*	*111.9*	*116.4*	*121.2*	*126.2*	*131.4*	*136.9*	*142.6*	*148.5*
North Carolina	100.0	102.6	106.3	110.7	115.5	120.4	125.5	130.8	136.3	142.0	148.0
South Carolina	100.0	100.7	101.4	103.1	105.0	107.0	109.0	110.9	112.9	114.9	116.8
Tennessee	100.0	100.6	101.2	102.7	104.6	106.6	108.5	110.5	112.4	114.3	116.3
Rest of USA	100.0	101.3	103.6	106.1	108.5	111.0	113.5	116.1	118.6	121.1	123.6
USA	100.1	101.4	103.7	106.2	108.8	111.4	114.0	116.7	119.4	122.1	124.8
CONSUMPTION OF GOODS											
Alabama	100.0	101.1	102.9	105.6	108.7	112.0	115.4	119.0	122.8	126.7	130.7
Florida	100.0	100.8	102.2	104.3	106.9	109.7	112.3	115.0	117.8	120.5	123.3
Georgia	*103.3*	*105.8*	*109.3*	*113.4*	*118.0*	*122.9*	*128.0*	*133.2*	*138.8*	*144.5*	*150.4*
North Carolina	100.0	102.7	106.8	111.7	117.0	122.5	128.2	134.2	140.4	146.9	153.7
South Carolina	100.0	100.5	101.2	102.5	104.2	106.1	108.0	109.8	111.7	113.5	115.4
Tennessee	100.0	100.5	101.1	102.3	104.0	105.9	107.8	109.7	111.6	113.5	115.4
Rest of USA	100.0	101.1	103.3	105.7	108.1	110.6	113.0	115.5	118.0	120.4	122.9
USA	100.1	101.2	103.4	105.9	108.5	111.1	113.7	116.3	119.0	121.7	124.4
LABOR SUPPLY											
Alabama	100.0	100.3	99.9	100.0	100.5	101.3	102.1	102.9	103.8	104.7	105.7
Florida	100.0	100.5	99.9	99.9	100.1	100.4	100.7	101.0	101.3	101.6	101.9
Georgia	*98.9*	*100.4*	*102.6*	*104.6*	*106.7*	*108.8*	*111.0*	*113.2*	*115.4*	*117.6*	*119.9*
North Carolina	100.0	100.4	100.4	100.9	101.7	102.7	103.8	105.0	106.3	107.8	109.3
South Carolina	100.0	100.4	99.7	99.6	99.9	100.4	100.8	101.3	101.7	102.1	102.5
Tennessee	100.0	100.4	99.5	99.4	99.7	100.1	100.5	100.8	101.2	101.6	102.0
Rest of USA	100.0	100.9	101.5	102.1	102.6	103.1	103.6	104.1	104.5	105.0	105.5
USA	100.0	100.8	101.4	101.9	102.5	103.0	103.5	104.1	104.6	105.2	105.7
DEMAND FOR CAPITAL											
Alabama	100.0	102.5	105.3	108.8	112.7	116.9	121.3	126.0	130.8	135.9	141.0
Florida	100.0	102.8	106.2	110.1	114.1	118.3	122.5	126.7	130.9	135.2	139.5
Georgia	*100.0*	*105.2*	*111.9*	*118.9*	*125.9*	*133.1*	*140.5*	*148.0*	*155.8*	*163.8*	*172.0*
North Carolina	100.0	105.1	110.9	117.3	124.0	130.9	138.0	145.5	153.2	161.2	169.5
South Carolina	100.0	101.4	102.1	103.4	105.0	106.7	108.4	110.0	111.7	113.3	114.9
Tennessee	100.0	101.2	101.6	102.8	104.4	106.1	107.7	109.4	111.0	112.6	114.2
Rest of USA	100.0	101.9	104.1	106.2	108.3	110.4	112.4	114.5	116.5	118.6	120.6
USA	100.0	102.1	104.5	107.0	109.5	112.0	114.4	116.9	119.4	121.9	124.4

[1] Georgia's tax reform is a revenue neutral expansion of the sales tax base and a reduction in the personal income tax rate.
Source: Authors' calculations.

increase in the compound growth rate of consumption. There are small and nearly uniform declines in consumption in percentage terms in the comparison states and the ROUS.

Next, we simulate the effect of Tax Reform Option B, eliminating Georgia's PIT and recovering the lost revenues by increasing the sales tax rate on the expanded sales tax base. The results of this simulation are reported in Table 5. Relative to period 10 of Tax Reform Option A, Option B results in a further 2.0 percent increase in personal income; a 4.5 percent increase in the consumption of goods; a 4.8 percent increase in labor supply; and a negligible increase in the demand for capital in Georgia. Compared to the benchmark, the compound growth rate of personal income over the 10 periods is 0.67 percentage points higher. There are relatively modest decreases in these four macroeconomic indicators in the comparison states and the ROUS after 10 periods.

Finally, we simulate Tax Reform Option C or fundamental tax reform. The simulation results of this simulation are reported in Table 6. Interestingly, there is almost no effect on the four macroeconomic indicators when comparing period 10 of Tax Reform Option C to period 10 of Option B. More specifically, there is a 1.2 percent decrease in Georgia's personal income; a 0.2 percent increase in the consumption of goods; a 0.5 percent increase in labor supply; and a 0.9 percent decrease in the demand for capital. The reform requires a further increase in the sales tax rate, which causes further distortions. It is these distortions that are likely the explanation for the smaller increase in personal income relative to Option B. With only a few exceptions, there are very slight declines in these indicators for the comparison states and the ROUS in period 10 of Tax Reform Option C relative to the corresponding period of Option B. However, there are slight increases in labor supply in South Carolina and Tennessee and in the demand for capital in Alabama, Florida, and North Carolina.

Table 7 reports the percent change in economic activity by sector and by state due to fundamental tax reform in period 10 relative to period 10 of the baseline. In Georgia, manufacturing increases by 12.5 percent, trade by 16.9 percent, transportation by 19.2 percent, finance by 14.0 percent, with much smaller increases in real estate and services. Interestingly, state and local government enjoys the largest growth rate as a result of fundamental tax reform. Georgia's growth in these sectors mostly comes at the expense of

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TABLE 5. THE EFFECT OF TAX REFORM OPTION B ON KEY MACROECONOMIC VARIABLES BY STATE AND BY PERIOD[1]

State	0	1	2	3	4	5	6	7	8	9	10
					PERSONAL INCOME						
Alabama	100.0	101.1	102.9	105.5	108.4	111.4	114.6	117.8	121.1	124.5	128.0
Florida	100.0	100.9	102.3	104.7	107.3	109.9	112.5	115.1	117.7	120.3	122.9
Georgia	*101.9*	*104.3*	*108.7*	*113.1*	*117.9*	*122.9*	*128.1*	*133.5*	*139.2*	*145.2*	*151.4*
North Carolina	100.0	102.5	106.1	110.4	115.1	119.9	124.9	130.1	135.5	141.1	146.9
South Carolina	100.0	100.5	101.3	102.9	104.9	106.8	108.7	110.6	112.5	114.3	116.2
Tennessee	100.0	100.4	101.1	102.6	104.4	106.3	108.2	110.1	111.9	113.8	115.6
Rest of USA	100.0	101.3	103.6	106.0	108.4	110.8	113.3	115.8	118.2	120.6	123.0
USA	100.0	101.4	103.6	106.1	108.7	111.2	113.8	116.5	119.1	121.7	124.3
					CONSUMPTION OF GOODS						
Alabama	100.0	101.1	102.9	105.6	108.6	111.9	115.4	118.9	122.6	126.5	130.5
Florida	100.0	100.8	102.3	104.3	106.9	109.6	112.2	114.9	117.6	120.3	123.1
Georgia	*105.6*	*108.4*	*112.3*	*116.8*	*121.8*	*127.1*	*132.6*	*138.4*	*144.4*	*150.6*	*157.1*
North Carolina	100.0	102.7	106.8	111.7	117.0	122.4	128.1	134.0	140.2	146.7	153.4
South Carolina	100.0	100.5	101.2	102.4	104.2	106.1	107.9	109.7	111.5	113.3	115.2
Tennessee	100.0	100.5	101.1	102.3	104.0	105.9	107.7	109.6	111.4	113.3	115.1
Rest of USA	100.0	101.0	103.3	105.7	108.1	110.5	113.0	115.4	117.8	120.3	122.7
USA	100.1	101.3	103.5	106.0	108.5	111.1	113.7	116.4	119.0	121.7	124.4
					LABOR SUPPLY						
Alabama	100.0	100.2	99.7	99.8	100.3	100.9	101.7	102.5	103.4	104.2	105.1
Florida	100.0	100.3	99.7	99.6	99.8	100.1	100.4	100.7	101.0	101.3	101.5
Georgia	*101.0*	*102.8*	*105.5*	*108.0*	*110.4*	*112.8*	*115.2*	*117.7*	*120.2*	*122.8*	*125.6*
North Carolina	100.0	100.3	100.2	100.6	101.4	102.3	103.4	104.6	105.9	107.3	108.8
South Carolina	100.0	100.3	99.5	99.5	99.8	100.2	100.7	101.1	101.5	101.9	102.3
Tennessee	100.0	100.2	99.4	99.3	99.6	100.0	100.3	100.7	101.1	101.4	101.7
Rest of USA	100.0	100.9	101.5	102.0	102.5	103.0	103.5	104.0	104.4	104.9	105.3
USA	100.0	100.8	101.4	101.9	102.5	103.0	103.6	104.1	104.6	105.2	105.7
					DEMAND FOR CAPITAL						
Alabama	100.0	102.4	105.1	108.5	112.2	116.1	120.5	124.9	129.5	134.3	139.2
Florida	100.0	102.6	106.0	109.9	114.0	118.0	122.1	126.3	130.5	134.6	138.8
Georgia	*100.0*	*105.4*	*112.3*	*119.2*	*126.2*	*133.3*	*140.7*	*148.2*	*155.9*	*163.9*	*172.1*
North Carolina	100.0	104.9	110.6	116.8	123.3	130.1	137.1	144.3	151.8	159.7	167.8
South Carolina	100.0	101.2	102.0	103.4	105.0	106.6	108.2	109.8	111.4	112.9	114.3
Tennessee	100.0	100.9	101.5	102.8	104.4	106.0	107.6	109.2	110.7	112.2	113.6
Rest of USA	100.0	101.9	104.0	106.1	108.1	110.2	112.2	114.2	116.1	118.0	119.9
USA	100.0	102.1	104.5	106.9	109.4	111.8	114.2	116.6	119.0	121.5	123.8

[1] Georgia's tax reform is a revenue neutral expansion of the sales tax base and an increase in the sales rate and the elimination of the personal income tax.
Source: Authors' calculations.

TABLE 6. THE EFFECT OF TAX REFORM OPTION C ON KEY MACROECONOMIC VARIABLES BY STATE AND BY PERIOD[1]

State	0	1	2	3	4	5	6	7	8	9	10
					Period						
					PERSONAL INCOME						
Alabama	100.0	101.0	102.8	105.5	108.3	111.3	114.4	117.6	120.8	124.2	127.5
Florida	100.0	100.8	102.3	104.7	1073	109.8	112.4	115.0	117.6	120.2	122.8
Georgia	*102.1*	*104.6*	*108.8*	*113.2*	*117.9*	*122.9*	*128.1*	*133.4*	*139.0*	*144.9*	*151.0*
North Carolina	100.0	102.4	106.0	110.3	114.9	119.7	124.6	129.7	135.0	140.6	146.3
South Carolina	100.0	100.5	101.3	103.0	104.9	106.8	108.7	110.6	112.5	114.3	116.1
Tennessee	100.0	100.4	101.0	102.6	104.4	106.3	108.2	110.1	111.9	113.8	115.6
Rest of USA	100.0	101.3	103.6	105.9	108.4	110.8	113.3	115.7	118.1	120.5	122.9
USA	100.0	101.4	103.6	106.1	108.6	1112	113.8	116.4	119.0	121.6	124.2
					CONSUMPTION OF GOODS						
Alabama	100.0	101.1	102.9	105.6	108.6	111.9	115.3	118.9	122.6	126.4	130.4
Florida	100.0	100.8	102.3	104.3	106.9	109.6	112.2	114.9	117.6	120.3	123.0
Georgia	*105.8*	*108.6*	*112.6*	*117.1*	*122.1*	*127.4*	*132.9*	*138.6*	*144.6*	*150.9*	*157.4*
North Carolina	100.0	102.7	106.8	111.7	117.0	122.4	128.1	134.0	140.2	146.6	153.4
South Carolina	100.0	100.5	101.2	102.5	104.2	106.1	107.9	109.7	111.5	113.3	115.1
Tennessee	100.0	100.5	101.1	102.3	104.0	105.9	107.7	109.6	111.4	113.2	115.1
Rest of USA	100.0	101.1	103.3	105.7	108.1	110.5	112.9	115.4	117.8	120.2	122.6
USA	100.1	101.3	103.5	106.0	108.5	111.1	113.7	116.4	119.0	121.6	124.3
					LABOR SUPPLY						
Alabama	100.0	100.05	99.6	99.8	100.2	100.9	101.6	102.4	103.2	104.0	104.9
Florida	100.0	100.18	9968	99.6	99.8	100.1	100.4	100.7	101.0	101.3	101.5
Georgia	*101.1*	*102.86*	*105.5*	*107.8*	*110.1*	*112.5*	*114.9*	*117.3*	*119.8*	*122.3*	*125.0*
North Carolina	100.0	100.18	100.0	100.4	101.2	102.1	103.2	104.3	105.6	107.0	108.5
South Carolina	100.0	100.15	99.5	99.6	99.9	100.3	100.8	101.2	101.6	102.0	102.4
Tennessee	100.0	100.08	99.4	99.4	99.7	100.1	100.4	100.8	101.2	101.5	101.9
Rest of USA	100.0	100.85	101.5	102.0	102.5	103.0	103.5	104.0	104.4	104.9	105.3
USA	100.0	100.83	101.4	101.9	102.5	103.0	103.5	104.1	104.6	105.2	105.7
					DEMAND FOR CAPITAL						
Alabama	100.0	102.4	105.2	108.6	112.3	116.4	120.7	125.3	130.0	134.8	139.8
Florida	100.0	102.7	106.0	110.0	114.0	118.1	122.2	126.4	130.5	134.7	138.9
Georgia	*100.0*	*105.4*	*112.6*	*119.7*	*126.8*	*134.1*	*141.6*	*149.2*	*157.1*	*165.2*	*173.7*
North Carolina	100.0	105.0	110.7	117.0	123.6	130.4	137.4	144.8	152.3	160.2	168.4
South Carolina	100.0	101.2	101.9	103.3	104.9	106.5	108.1	109.7	111.3	112.8	114.3
Tennessee	100.0	101.0	101.5	102.7	104.3	105.9	107.5	109.1	110.6	112.1	113.6
Rest of USA	100.0	101.9	104.0	106.1	108.2	110.2	112.2	114.2	116.2	118.1	120.0
USA	100.0	102.1	104.5	106.9	109.4	111.8	114.3	116.7	119.1	121.6	124.0

[1] Georgia's tax reform is the elimination of the corporate and personal income taxes and a revenue neutral increase in the state sales tax rate on a broadened sales tax base.

Source: Authors' calculations.

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TABLE 7. PERCENT CHANGE IN ACTIVITY BY SECTOR IN PERIOD 10 DUE TO GEORGIA ADOPTING TAX REFORM OPTION C RELATIVE TO THE BASELINE[1]

State	Manufacturing	Trade	Transportation	Finance	Real Estate	Services	State and Local Government
Alabama	-8.1	-3.4	-5.5	-1.3	-1.5	-2.0	-1.0
Florida	-3.0	-2.1	-2.5	-1.2	0.2	-2.2	-1.0
Georgia	*12.5*	*16.9*	*19.2*	*14.0*	*3.2*	*3.8*	*21.0*
North Carolina	-4.4	-4.7	-5.7	-2.7	-0.1	-2.6	-0.7
South Carolina	-2.7	-1.8	-2.0	-1.0	-0.3	-1.7	-0.7
Tennessee	-3.0	-1.8	-2.3	-1.0	-0.3	-1.8	-0.8
Rest of U.S.A.	-3.4	-1.7	-2.2	-0.7	-0.5	-1.1	-0.5
United States	-3.0	-1.1	-1.4	-0.4	-0.3	-1.1	0.1

[1] Georgia's Tax Reform Option C is the elimination of the corporate and personal income taxes and a revenue neutral increase in the state sales tax rate on a broadened sales tax base.
Source: Authors' calculations.

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Alabama and North Carolina, with smaller declines in these sectors for the remaining three states and the ROUS. It is interesting to note that with the single exception of state and local government, there are small declines in the total level of activity in these sectors for the United States as a whole.

Interestingly, fundamental tax reform in Georgia leads to a slight reduction in the demand for capital in the United States as a whole relative to the baseline. In contrast to fundamental tax reform at the national level, which increases capital formation, fundamental tax reform in a single state has a small negative effect on capital formation for the country as a whole. In this sense, fundamental state tax reform is truly "beggar thy neighbor." This observation illustrates the importance of using a dynamic open economy model to simulate state tax reforms. This finding also suggests that tax harmonization among the states, as opposed to a single state independently pursuing tax reform which is the case examined here, may have a greater benefit to the U.S. economy as a whole.

We can summarize our main findings as follows. Tax Reform Option A results in a 0.51 percentage point increase in the compound growth rate of personal income and a 0.41 percentage point increase in consumption relative to the baseline. Option B, relative to the baseline, increases the compound growth rate of personal income by 0.67 percentage point and a 0.64 percentage point increase in consumption; and, finally, Option C or fundamental tax reform increases the compound growth rate of personal income and consumption relative to the baseline by 0.62 and 0.64 percentage points, respectively. Relative to the baseline, the increases in compound growth rates of personal income and consumption as a result of these three tax reform options range between 12 and 20 percent.

By decomposing fundamental state tax reform into three incremental reforms, we find that there are diminishing returns to decreasing the distortionary tax on capital income and increasing the distortionary tax on consumption in terms of the 10-period growth rate of personal income. In fact, the net effect of these two opposing effects is approximately zero when comparing the index of personal in period 10 of Tax Reform Option C (151.0) to that of Option B (151.4).

Conclusion

We have used a multi-state, dynamic, open economy, general equilibrium model to gauge the economic impact of three revenue neutral tax reforms in Georgia. These reforms would decrease the CIT and PIT rates eventually to zero, broaden the sales tax base to include services, and increase the sales tax rate. The dynamic and multi-state specification of our model is a substantial advance over previous simulation models used to evaluate state tax reforms. Unlike previous models, we use a non-Armington approach in which goods traded between states are viewed as being identical and thus perfect substitutes in production and consumption. In our model, capital is perfectly mobile across states and industries, while labor is both state and industry specific in the short run. The model is solved backwards to yield sector and state wage rates, while there is a single price for capital, and the prices for final goods are set at the national level.

As expected, we find that fundamental state tax reform has an economically substantial positive effect on the growth rate of personal income and the level of consumption. The benefits to Georgia from tax reform come at the expense of its comparison states and the ROUS. Essentially, Georgia attracts capital and labor from its neighbors. However, the aggregate increases in economic activity as a result of fundamental tax reform in Georgia may not be as dramatic as some advocates of such reforms claim.

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