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FIRM LEVEL EFFECTS FOR APPORTIONMENT FORMULA CHANGES

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Abstract

In the last decade state corporate income tax collections have failed to keep up with overall trends in economic growth. Although part of this trend can be explained by federal corporate income tax policy, corporate tax collections also have responded to a myriad of state corporate tax policy changes designed to stimulate business investment and job creation in an increasingly competitive economic development environment. One tax-based economic development policy that has received an especially great deal of attention in state legislatures and the academic literature in recent years is the modification of apportionment formulae used to allocate the taxable income of multistate corporations across the states in which it does business.

To date studies of the economic effects of these strategic apportionment policies have used only highly aggregated, state-level data. Our study uses data at the individual firm level, which is provided by a population of corporate income tax returns from the State of Georgia over the period 1992 – 1998. Looking at the firm level, we find elasticities sufficiently large to lead to substantial effects on sales (9 percent), payroll (1 percent) and property (0.75 percent) following a move to double-weighted sales. For the average firm, increases in Georgia payroll and property were $20,123 and $68,032, respectively, while the decrease in Georgia sales for the average firm was $938,962. Based on 1994 figures (the year prior to double-weighting), this amounts to state-wide increases in payroll and property of $316.5 million and $1.1 billion, respectively, and decreases in gross receipts of approximately $15.0 billion.

Executive Summary

The corporate income tax has made a remarkable decline in its importance to state revenue coffers over the last 20 years. In the late 1970s, corporate income taxes contributed over 10 percent of total state tax collections, but today the corporate tax share is about 6 percent, despite relatively little change in tax rates. In Georgia, the corporate tax share fell from 9.2 percent to 5.3 percent over that period. Part of this trend can be explained by changes in federal corporate income tax policy, but corporate tax collections also have responded to a myriad of state corporate tax policy changes designed to stimulate business investment and job creation in an increasingly competitive economic development environment. One tax-based economic development policy that has received an especially great deal of attention in state legislatures and the academic literature in recent years is the modification of apportionment formulae used to allocate the taxable income of multistate corporations across the states in which they do business.

The formulary apportionment method allocates a firm's profit to each state based on the relative distribution of the firms' total sales, payroll, and property in that state. Although traditionally states have given each of these factors equal weight (1/3) in the apportionment formula, a significant trend in recent years has been to place a heavier weight on the sales factor (and therefore uniformly lower weights on payroll and property). Georgia changed its apportionment formula from an equally weighted three-factor formula to a double-weighted sales formula in 1995. This policy is intended not only to stimulate economic development, but also to export part of the corporate tax burden out of the state by providing favorable tax treatment to firms that produce in-state but sell out-of-state.

Of the 47 states (including the District of Columbia) that currently impose a corporate income tax, a large majority now weight the sales factor more heavily than the payroll and property factors. The most common formula places a double-weight on the sales factor, although several states now employ a single-factor sales formula (100 percent weight on sales). Other states offer optional formulas with greater sales

factor weights. In most states, the shift away from uniformly weighted apportionment formulas was made in the 1990s, which reflects the increasingly competitive nature of taxation and economic development across the states.

The use of formulary apportionment renders an incidence pattern for state corporate income taxes that is in many ways very different from the standard incidence results for corporate income taxes. To the extent tax rates vary across jurisdictions, formula-apportioned corporate income taxes are similar in their incidence to a set of implicit excise taxes on the apportionment factors. That is, the economic effects of a state corporate income tax mimic the combined effects of sales taxes, payroll taxes, and property taxes. It stands to reason that placing a relatively greater weight on the sales factor (with commensurate reductions in property and payroll factor weights) would diminish the implicit excise tax on productive factors and hence encourage business location or expansion in that state. Moreover, firms with a large share of productive activity in the state relative to sales activity would see their tax liabilities diminish relative to sales-intensive firms, and hence corporate income taxes would in some sense be exported to out-of-state enterprises.

We examined the economic development and revenue consequences of modifying corporate income apportionment formulas by analyzing the tax returns of corporations doing business in Georgia over the period 1992-1998, which covers three years prior to and four years following Georgia's switch to a double-weighted sales formula in January, 1995.

The data used in this analysis consists of a panel of the population of multistate corporate income tax returns filed in the State of Georgia over the period 1992 – 1998, which were provided by the Georgia Department of Revenue. The data includes all information provided on the corporate tax return (Form 600) other than identifying information.

The formula-apportioned corporate income tax plays out in part as a tax on profits, but as mentioned above, also plays out as three separate taxes on the apportionment factors: sales, payroll, and property. The implicit excise taxes arise from tax differentials [see the appendix of Edmiston (2001) for a description], that is,

the difference between the product of Georgia's tax rate and factor weight and a weighted average of the same for all other states. These tax differentials served as the basis for our empirical analysis. In particular, we investigated, using regression analysis, whether changes in the tax differentials had an effect on a firm's sales, payroll, and property in the state.

The key variables in our analysis, the tax differentials, were found to be virtually all statistically significant, had the signs we expected, and had reasonable magnitudes. This means that tax differentials were found to be negatively related to the level of sales, payroll, and property of most firms doing business in the State of Georgia. The estimated elasticities on payroll and property are –0.04 and –0.03, respectively. Thus, lowering the weight on productive factors from 1/3 to 1/4 (a 25 percent reduction) lead to increases in Georgia payroll and property of 1.00 percent (–0.04 x 25) and 0.75 percent respectively, on average. For the sales portion of the tax the elasticity is a much more substantial –0.18, which means that the average multistate corporation in Georgia decreased its sales in the state by 9.0 percent in response to the shift to double-weighted sales (recall that in moving from an equally weighted formula to a double-weighted sales formula the sales portion of the tax increases by 50 percent). While theory suggests that sales from multistate corporations should decline in the state following a move to double-weighted sales, the magnitude of this result is rather surprising.

For the average firm, increases in Georgia payroll and property were $20,123 ($2,012,315 x 0.01) and $68,032, respectively, while the decrease in Georgia sales for the average firm was $938,962. Based on 1994 figures (the year prior to double-weighting), this amounts to state-wide increases in payroll and property of $316.5 million and $1.1 billion, respectively, and decreases in sales of approximately $15.0 billion.

With an average effective personal income tax rate of 2.36 percent in the State of Georgia (Edwards and Wallace, 2002), the payroll increase amounts to an addition to state personal income tax coffers of $7.5 million in 1995. The increase in property undoubtedly had a positive impact on personal income tax collections as

well, but the owners of property are expected to be distributed throughout the U.S. and the world, which makes the property impact on personal income tax collections impossible to estimate. To the extent this property is taxable, local governments enjoyed substantial gains in property tax collections.

To the extent that the decline in sales by corporations in the state were not captured by increased sales elsewhere, both the state and the counties lost significant sales tax revenues. For example, if 10 percent of the sales were uncaptured by other firms and 50 percent of these sales were sales-taxable, the state's revenue loss would have amounted to $30 million (0.04 x 0.50 x 0.10 x $15.0 billion). While unfortunately there is no way to accurately calculate the figure, the $30 million example would be a rather conservative guess.

Changes in corporate tax collections for individual firms over the period 1995-1998, which we are able to calculate directly from the returns, ranged widely from – $24.9 million (1997) to +$22.4 million (1996). These amounts include both the static and dynamic effects of the apportionment formula change, but do not include changes in corporate income tax collections arising from changes in corporate net income or specific allocations.

Although the corporate income tax gains and losses tend to receive the greatest scrutiny in state governments considering a more aggressive apportionment formula, we show that changes in other tax bases may be quite substantial. An important consideration here, however, is that these numbers apply only to multistate corporations. To the extent that production by local Georgia firms decreased and sales increased in response to the change in corporate tax policy, the revenue figures for personal income tax, property tax, and sales tax may differ substantially from those estimated here.

1. Introduction

The corporate income tax has made a remarkable decline in its importance to state revenue coffers over the last 20 years. In the late 1970s corporate income taxes contributed over 10 percent of total state tax collections, but today the corporate tax share has fallen to about 6 percent, despite relatively little change in tax rates. Part of this trend can be explained by changes in federal corporate income tax policy,[1] but corporate tax collections also have responded to a myriad of state corporate tax policy changes designed to stimulate business investment and job creation in an increasingly competitive economic development environment. One tax-based economic development policy that has received an especially great deal of attention in state legislatures and the academic literature in recent years is the modification of apportionment formulae used to allocate the taxable income of multistate corporations across the states in which they do business.

The formulary apportionment method allocates income to each state based on the relative distribution of the firms' total sales (*S*), payroll (*P*), and property (*R*) in that state. Formally, the apportionment of some firm's net income to state j (ϕ_j) is:

$$\phi_j = f_j^S\left(S_j / S\right) + f_j^P\left(P_j / P\right) + f_j^R\left(R_j / R\right) \tag{1.1}$$

The terms f_j^S, f_j^P, and f_j^R are state j's weights on sales, payroll, and property factors, respectively, in its apportionment formula; and S_j, P_j, and R_j are the firm's sales, payroll, and property in state j.

Although traditionally states have given each of these factors equal weight (1/3) in the apportionment formula, a significant trend in recent years has been to place a heavier weight on the sales factor (and therefore uniformly lower weights on payroll and property). This policy is intended not only to stimulate economic

[1]Perhaps chief among these are "check the box" rules and other incentives to avoid corporate income taxes altogether by passing income through directly to individuals *via* s-corporations, partnerships, and LLCs. Virtually all state tax returns begin the calculation of taxable income with the federal tax base. While federal corporate income taxes increased at an annual rate of approximately six percent over the period 1995-2000, state corporate tax collections grew at only a three percent rate (see Mazerov, 2002).

development, but also to export part of the corporate tax burden out of the state by providing favorable tax treatment to in-state firms. Of the 47 states (including the District of Columbia) that currently impose a corporate income tax, a large majority now weight the sales factor more heavily than the payroll and property factors. The most common formula places a double-weight on the sales factor, although several states now employ a single-factor sales formula (100 percent weight on sales).[2] Other states offer optional formulas with greater sales factor weights. In most states, the shift away from uniformly weighted apportionment formulas was made in the 1990s, which reflects the increasingly competitive nature of taxation and economic development across the states.

The use of formulary apportionment renders an incidence pattern for state corporate income taxes that is in many ways very different from the standard incidence results for corporate income taxes. A series of papers in the 1980s established that, *to the extent tax rates vary across jurisdictions*, formula-apportioned corporate income taxes are similar in their incidence to a set of implicit excise taxes on the apportionment factors (McLure, 1980; McLure, 1981; Mieszkowski and Morgan, 1984; Mieszkowski and Zodrow, 1985, Gordon and Wilson, 1986). That is, the economic effects mimic the effects of sales taxes, payroll taxes, and property taxes. It stands to reason that placing a relatively greater weight on the sales factor (with commensurate reductions in property and payroll factor weights) would diminish the implicit excise tax on productive factors and hence encourage business location or expansion. Moreover, firms with a large share of productive activity in the state relative to sales activity would see their tax liabilities diminish relative to sales-intensive firms, and hence corporate income taxes would in some sense be exported to out-of-state enterprises.

Empirical studies recently have surfaced to test the notion that heavier sales factor weights (relative to weights on productive factors) stimulate productive

[2]Iowa, Massachusetts, Missouri, Nebraska, Texas, Maine, Illinois, and Connecticut have adopted single-factor sales formulas. Single-factor sales formulas have been proposed in Arizona, Pennsylvania, Wisconsin, Oregon, New York, and Georgia. For analyses of proposals in Wisconsin and Georgia, see Goolsbee, Maydew, and Schadewald (2000) and Edmiston (2001), respectively.

activity. Weiner (1994) found no relationship between the choice of apportionment formula and investment. Although she did find some evidence of a link in a later study (1996), the effects were very small and only marginally significant. Lightner (1999) also found little or no impact, suggesting that differences in apportionment factor weights do not have statistically significant explanatory power in cross-state employment equations once controls for tax *rates* are included in the analysis.[3] Later work has been much more positive on the effects of apportionment formula changes. Goolsbee and Maydew (2000), who utilized panel data for the U.S. states from 1978-1994, found that the payroll factor weight is a significant determinant of state manufacturing employment. Specifically, their study suggests that for the average state, reducing the payroll factor weight from 1/3 to 1/4 (double-weighted sales) results in a 1.1 percent increase in manufacturing employment. Further, Klassen and Shackelford (1998) provide evidence that companies have strategically structured their shipments in an effort to reduce sales in states that apply a relatively high assessment on gross receipts through the apportionment system. Finally, Gupta and Hofmann (2000) find the elasticity of new capital expenditures with respect to the property burden (defined as the product of the property factor weight and the top statutory tax rate) to range between 0.05 and 0.35.

In a very different methodological approach, Edmiston (2002) uses an eight-region applied general equilibrium model to simulate the effects of heavier sales factor weights on economic development and corporate tax revenues. He finds that while heavier sales factor weights may have a significantly positive impact on economic development in the very long run, the short run effects are negligible. Moreover, he finds that the economic development impact can vary substantially across states depending on the industrial structure and other characteristics of the state.

[3]Goolsbee and Maydew (2000), discussed below, included controls for tax rates in their analysis as well, as did Weiner in her studies.

To date studies of the economic effects of strategic apportionment policies[4] have used only highly aggregated, state-level data. Our study uses data at the individual firm level, which is provided by a population of corporate income tax returns from the State of Georgia over the period 1992 – 1998. The benefits of using firm-level data are many. First, while studies utilizing state-level data are able to estimate the aggregate effect of strategic apportionment policies on capital, employment, or sales, they are not able to explore firm-level reactions to these policies, nor to control for firm-level characteristics that may affect the degree to which a given firm responds to policy changes. Second, previous empirical studies have used the product of the tax rate and the factor weights to measure the excise-like effects of formula-apportioned corporate income taxes on the apportionment factors. Utilizing data from tax returns, we are able to much more closely approximate the actual tax differentials yielding these excise-like effects, and to use them in our empirical analysis. Third, the use of a very different and much richer data source should help to resolve the somewhat conflicting results of previous empirical studies and to help reach a consensus on the issue. Fourth, the firm-level data allows us to place actual dollar figures on the economic effects of strategic apportionment policies, both for individual firms and for the state as a whole. Looking at the firm level, we find elasticities sufficiently large to lead to substantial effects on sales (9 percent), payroll (1 percent) and property (0.75 percent) following a move to double-weighted sales.

The remainder of the paper proceeds as follows. Section 2 discusses the recent experience of the State of Georgia with modifying corporate income apportionment formulas by examining the aggregate effects of its 1995 switch to a double-weighted sales formula and by analyzing changes in tax liabilities across firms. Section 3 discusses the empirical model we use to measure the effects of double-weighted sales on the in-state levels of sales, payroll, and property of multistate firms. Finally, Section 4 presents the results of our empirical analysis, and Section 5 concludes.

[4]Following Edmiston (2002), we refer to a policy that places a relatively greater weight on the sales factor than productive factors as a "strategic apportionment" policy.

2. The Georgia Experience with Double-Weighted Sales

2.1 Data

The data used in this analysis consists of a panel of the population of multistate corporate income tax returns filed in the State of Georgia over the period 1992 – 1998, which were provided by the Georgia Department of Revenue. The data includes all information provided on the corporate tax return (Form 600) other than identifying information such as company name and street address. The Georgia Department of Revenue scrambled the federal taxpayer ID number in a consistent fashion, which allowed us to construct a panel of individual corporations over time while maintaining the anonymity of individual taxpayers. Table 1 provides mean values of the included data for the most relevant variables for this analysis.

There were roughly 20 thousand individual observations per year, ranging from a low of 9,123 in 1998, which reflects partial data for that year, to a high of 21,626 returns in 1996. Federal taxable income for the average multistate corporation filing a tax return in the State of Georgia varied widely across the time period of the panel, from a low of $1.0 million in 1992 to a high of $8.7 million in 1994.

2.2 Aggregate Effects

Corporate tax collections in Georgia, as in every other state, are quite volatile. Given this volatility, the dynamic effects of policy changes are especially difficult to gauge because it is nearly impossible to properly identify and isolate the sources of variation. Nevertheless, we attempt to judge the dynamic effects of Georgia' double-weighted sales apportionment formula by examining the time path of corporate tax collections before and after the switch to a double-weighted sales formula in 1995.

Several factors are critical in determining the direction and magnitude of revenue changes under a strategic apportionment scheme. To explore these factors, we first note that total corporate tax collections in any state j is given by:

TABLE 1. MEAN VALUES OF SELECTED DATABASE ITEMS OVER TIME GEORGIA FORM 600 TAX RETURNS, MULTISTATE FIRMS, 1992 – 1998

Formula Regime		Equally Weighted Formula			Double-Weighted Sales Formula			
Item \ Year		1992	1993	1994	1995	1996	1997	1998
[1] Federal Taxable Inc ($ thousands)		1,003.4	6,849.4	8,647.9	3,195.6	3,636.8	3,771.5	2,566.8
[2] Sales ($ thousands)	Ga	14,481.4	15,136.2	15,751.7	16,125.4	15,151.6	16,168.7	10,163.9
	Tot	324,138.1	359,282.5	414,249.6	316,621.3	303,079.0	336,393.2	462,750.2
	%	4.5	4.2	3.8	5.1	5.0	4.8	2.2
[3] Payroll ($ thousands)	Ga	1.532.1	1,514.4	1,620.6	1,645.0	1,712.3	1,955.4	2,137.9
	Tot	44,338.5	47,581.7	51,102.6	33,852.1	33,377.9	37,328.0	45,843.8
	%	3.5	3.2	3.2	4.9	5.1	5.2	4.7
[4] Property ($ thousands)	Ga	7,204.3	7,744.4	7,768.0	8,052.7	7,224.7	8,239.5	9,572.7
	Tot	205,416.5	237,823.4	254,421.2	165,700.5	164,685.9	182,145.9	234,627.4
	%	3.5	3.3	3.1	4.9	4.4	4.5	4.1
[5] Observations	No.	17,925	18,614	19,506	20,622	21,626	20,959	9,123

*Partial Year Data

$$(2.1) \quad T_j = t_j \sum_i \phi_{ij} \pi_i$$

where ϕ_{ij} is the percentage of firm i's profits apportioned (by formula) to state j, π_i is firm i net income subject to apportionment, and t_j is the statutory corporate income tax rate in j. The change in state j's corporate tax collections from a given change in its sales factor weight is then given by:

$$(2.2) \quad \Delta T = t \left\{ \sum_i \left[\overline{\pi}_i \Delta \phi_i + \overline{\phi}_i \Delta \pi_i \right] \right\} \Delta f_j^S$$

where a superscore represents an initial value and the state (j) subscript is dropped for clarity.[5] For any given change in the sales factor weight, the revenue gains and losses arising from the $\Delta \pi_i$ terms are shared across states according to their $\overline{\phi}_i$'s, and there is little reason or evidence to suggest that this effect in any one state would be large. We must therefore look to the $\Delta \phi_i$ term as the major source of revenue impacts with an increased sales factor weight, which represents the revenue implications that arise because the formula itself has changed.

There are several avenues through which higher sales factor weights may affect the apportionment of taxable income (the ϕ_i's). First, if state j is a "market region" rather than a "production region," that is,[6]

$$(2.3) \quad \sum_i \pi_i \left[\left(S_j / S \right)_i - \frac{1}{2} \left(P_j / P + R_j / R \right)_i \right] > 0$$

then placing a heavier weight on the sales factor will lead to greater revenues, all else equal. Because this factor ignores policy-induced shifts in sales and production, we can think of the sales/production intensity factor as the "static," or immediate revenue effect.

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[5]As a general rule, factor weights sum to one in all states that impose a corporate income tax, although there are rare exceptions (Edmiston, 2002, 11*n*), and traditionally states have lowered payroll and property factor weights proportionately with an increase in the sales factor weight.

[6]For an extended analysis of this issue, see Lopez and Martinez-Vazquez (1997).

Second, to the extent that placing a greater weight on the sales factor drives away sales in the state, corporate tax revenues will be diminished because a reduction in state *j*'s share of total sales implies a reduction in its apportionment percentage, all else equal. Similarly, to the extent that a heavier sales factor weight encourages an inflow of production activity, revenues will be enhanced through increases in *j*'s share of total firm property and/or payroll. We can think of these revenue impacts as "dynamic," or longer-term effects.

To begin our analysis of Georgia's experience, we note that the change in tax liability for some firm in year *t* from the preceding year *t*-1 can be written as

$$\Delta T_t = T_t - T_{t-1} = (\phi_t \pi_t + \alpha_t) - (\phi_{t-1}\pi_{t-1} + \alpha_{t-1}) \tag{2.4}$$

where Δ indicates an annual change, T_t is the firm's tax liability in year t, ϕ_t is the share of the firm's taxable income *apportioned by formula* to Georgia, and α_t is the amount of income *allocated* to Georgia in year t. [7] With a little algebraic manipulation, we may then rewrite the change in the firm's tax liability in year t as:

$$\Delta T_t = \left[(\phi_t - \phi_t^E) + (\phi_t^E - \phi_{t-1}^E) + (\phi_{t-1}^E - \phi_{t-1})\right]\pi_t + \phi_{t-1}(\Delta\pi_t) + \Delta\alpha_t \tag{2.5}$$

where ϕ_t^E is the apportionment of the firm's taxable income under an equally weighted formula in year t.

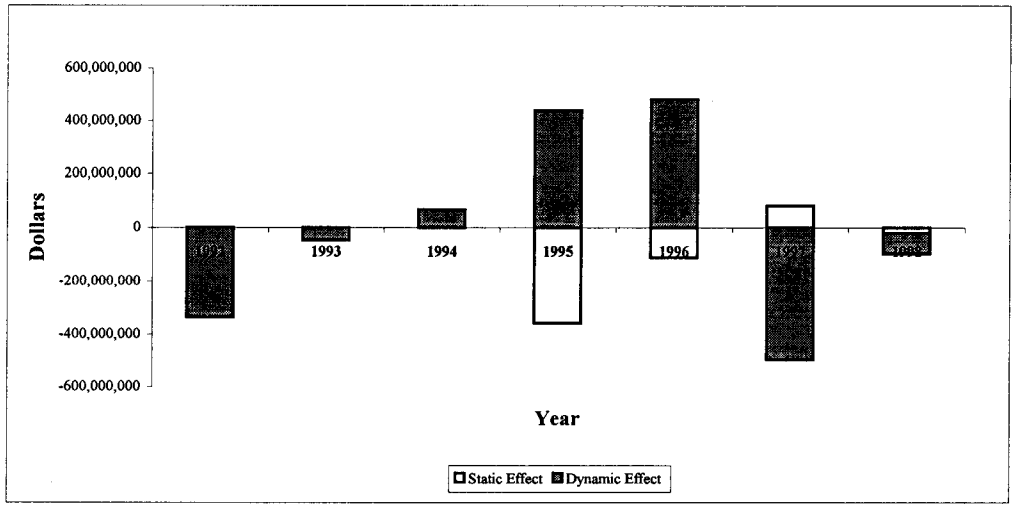
Our primary interest is in the bracketed expression, which shows the effects of changes in the apportionment formula and can be further decomposed into static and dynamic effects. The direction of the static effect is determined by (2.3), and as noted before, tends to comprise the bulk of revenue changes. In (2.5), the static effect is the sum of the first and third terms of the bracketed expression, or $(\phi_t - \phi_t^E) + (\phi_{t-1}^E - \phi_{t-1})$. The dynamic effect represents the change in tax liability that arises because a firm produced and sold more or less in Georgia in year t than in year t-1, and is given by the second term in the bracketed expression, $(\phi_t^E - \phi_{t-1}^E)$.

[7] Generally states will apportion "business income" and apply specific allocation to "nonbusiness income." See Pomp and Oldman (2000) for details.

In years prior to 1995 the static effect will be zero because Georgia imposed an equally weighted formula. Because Georgia was a "market state" in 1994-95, as defined by (2.3), we know that in 1995 the static effect will be negative. In years 1996 and beyond the static effect will tend toward zero in magnitude. In this sense (assessing tax *changes*) the static revenue loss is a one-time affair.

As seen in Figure 1, the static effect of double-weighted sales in Georgia shows the pattern we would expect in examining changes in taxable income over time. There is a relatively large negative effect in the initial year of $358.2 million, which amounts to a revenue decrease of $21.5 million, but the effect gradually tapers off in the succeeding two years. Of course, the reader should keep in mind that we are evaluating *changes* in taxable income rather than *levels* of taxable income. That is, the static loss in 1995 is not recovered in succeeding years.

FIGURE 1. ANNUAL CHANGES IN APPORTIONED TAXABLE INCOME (MULTI-STATE CORPORATIONS)



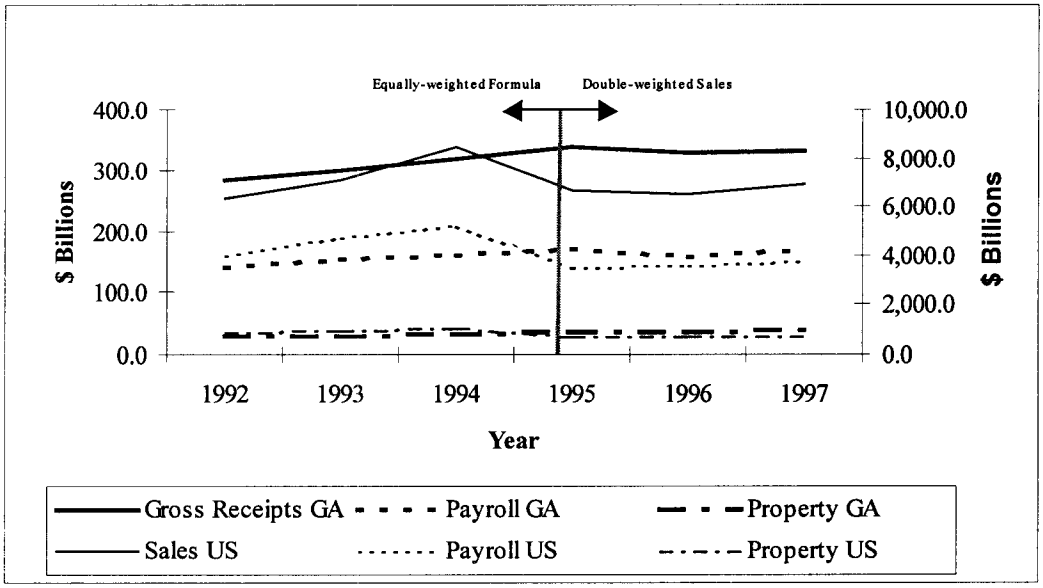
In analyzing the dynamic revenue effect, we essentially ask "if Georgia had maintained an equally weighted formula, but firms behaved as they did under the double-weighted formula with regard to the location of sales, payroll, and property, how much would Georgia tax collections have changed?" To the extent that firms responded to the incentives offered by the double-weighted sales formula by locating

additional payroll and property in the state (relative to the nation as a whole), we would expect this effect to be positive. Likewise, to the extent that firms are discouraged from making sales in the state following the imposition of a double-weighted sales formula, we would expect the dynamic effect to be negative. Of course firms may change the allocation of their sales, payroll and property across states for many reasons other than legislative changes in formulary apportionment policy, and thus the dynamic effect is nonzero both before and after 1995.

The dynamic effect shows a surprising amount of variation over the relatively short time frame of this analysis, and at first glance, the effects suggest that firms responded vigorously to the double-weighted sales incentives by locating additional productive activity in the state. In 1995 and 1996, the first two years of the double-weighted sales formula, the dynamic revenue effect yielded increases in Georgia taxable income of $439.8 million and $481.1 million respectively, which added $26.4 million and $28.9 million, respectively, to Georgia's corporate tax coffers in those two years. The pertinent question is whether or not the double-weighted sales policy was responsible for these substantial shifts. A strong clue is provided to us by the results from 1997, the third year of the double-weighted sales formula regime, which saw a substantial decrease in Georgia taxable income of $496.2 million, yielding a $29.8 million revenue loss. The volatility suggests that perhaps the double-weighted sales policy was not largely responsible for the large positive dynamic effects enjoyed in 1995 and 1996.

Rows [2] – [4] of Table 1 show the distribution of sales, payroll, and property in Georgia relative to the nation as a whole for corporations doing business in Georgia over the time period of our analysis. Most notable is that the percentage of the firms' total payroll and property located in Georgia was significantly higher after 1995, the first year for which Georgia's double-weighted sales apportionment formula was in place, which suggests that this policy had a substantial impact on production in the state. As illustrated in Figure 2, it is clear that these changes came

FIGURE 2. SALES, PAYROLL, AND PROPERTY OF GEORGIA FIRMS

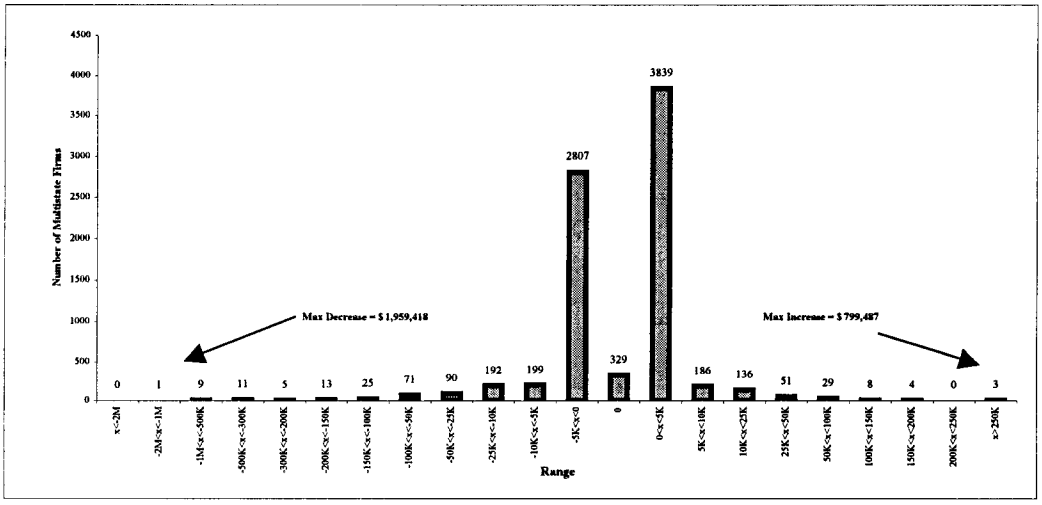


largely from decreases in the national levels of payroll and property by corporations filing returns in Georgia, rather than from an influx of payroll and property into the state. From 1994 to 1995, which represented the bulk of the changes, Georgia payroll increased by 2.1 percent, while national payroll declined by 35.1 percent. Likewise, Georgia property increased by 3.6 percent while national property decreased by 34.9 percent. Of course, that Georgia payroll and property did not follow national trends is indicative of a considerably positive response to the double-weighted sales factor. Complicating the analysis further is that Georgia's share of national sales also increased substantially from 3.8 percent in 1994 to 5.1 percent in 1995. To the extent that these changes represent responses to double-weighted sales, the changes are in the wrong direction. That is, we should have observed a tendency to move sales away from rather than to the State of Georgia (see Klassen and Shakelford, 1998).

2.3 Distributive Effects

Often the distribution of tax changes is as important as the aggregate change, perhaps more important. The (static) revenue loss associated with Georgia's switch to a double-weighted sales formula does not imply that all firms in the state enjoyed a reduced tax burden. Rather, there were very clear winners and losers. Nor did the winners (losers) share the benefit (burden) equally, even as a percentage of their taxable income. Figure 3 provides a frequency distribution of winners and losers from Georgia's switch to double-weighted sales. The (static) gain or loss was calculated by computing the 1998 tax liability of Georgia firms (latest available data) using an equally weighted formula, and then subtracting that amount from their actual 1998 tax liability, which was computed using the double-weighted sales formula.

FIGURE 3. DISTRIBUTION OF STATIC TAX LIABILITY CHANGES UNDER A DOUBLE-WEIGHTED SALES FORMULA (1998 VS. EQUALLY WEIGHTED FORMULA)



Most striking is that 21 corporations enjoyed tax reductions of more than $500 thousand in 1998 over what would have been the case under an equally weighted three-factor formula, one of which saw a tax cut of almost $2 million. On the other end of the distribution, three firms saw their tax liabilities increase by $250 thousand or more. Despite the relatively large numbers, few firms actually were affected by the change in policy in any significant way. Of all firms with a corporate income tax liability over $1,000 under an equally weighted formula, almost 50

percent saw a change in their tax liability with a move to double-weighted sales formula in 1998 of less than 10 percent in magnitude. Several firms saw very substantial tax reductions or increases, however. Roughly 0.2 percent of all firms had their corporate income tax liability eradicated entirely,[8] while approximately 0.6 percent suffered a tax liability increase of 100 percent or more. In total, 53.1 percent of all firms enjoyed a tax reduction, 42.7 percent of firms suffered a tax increase, and 4.1 percent of firms saw no change in tax liability.

[8]This comes about only for firms (14) with an *allocated income loss* that is smaller in magnitude than *positive apportioned income* under an equally weighted formula, but larger in magnitude than apportioned income under a double-weighted sales formula, driving taxable profits to less than zero, and hence causing a zero tax liability for these firms.

3. Model and Econometric Issues

Consider a multistate firm that produces and/or sells in M states and optimizes an objective function given by

$$(3.1) \quad \max_{K_j, L_j} \ \pi^* = (S - P)\left[1 - \textstyle\sum_j t_j \phi_j\right] - R \quad j = 1, \ldots, M$$

where states are indexed by j; $S = q\sum_j F(K_j, L_j)$, $P = w\sum_j L_j$, and $R = r\sum_j K_j$ are the firm's sales, payroll, and property nationally, where $F(\bullet)$ is the production function and r, w, and q are market prices for capital (K), labor (L), and output, respectively; t_j is the corporate tax rate in state j, and ϕ_j is the apportionment of the firm's taxable profits (defined as $S - P$) to state j, as in (1.1).

Maximization of (3.1) yields the following first-order conditions:

$$(3.2) \quad qF_{K_j} \textstyle\sum_{h'} \theta_{h'} \left[1 - \sum_h t_h \phi_h - (\pi / S)\left(f_{h'}^S t_{h'} - \sum_h (S_h / S) f_h^S t_h\right)\right] =$$

$$\left[1 + (\pi / R)\left(f_j^R t_j - \textstyle\sum_h (R_h / R) f_h^R t_h\right)\right] r$$

and

$$(3.3) \quad qF_{L_j} \textstyle\sum_{h'} \theta_{h'} \left[1 - \sum_h t_h \phi_h - (\pi / S)\left(f_{h'}^S t_{h'} - \sum_h (S_h / S) f_h^S t_h\right)\right] =$$

$$\left[1 - \textstyle\sum_h t_h \phi_h + (\pi / P)\left(f_j^P t_j - \sum_h (P_h / P) f_h^P t_h\right)\right] r$$

where states are indexed by h and h'; $\pi = S - P$ is taxable (normal) profits, and $\theta_{h'}$ is the proportion of marginal output sold in state h'.

Equations (3.2) and (3.3) reflect the familiar result that the marginal revenue product of each factor should be equal to the marginal factor cost (net of taxes). These equations also elucidate two separate effects of the formula-apportioned corporate income tax. The first effect, which is represented by the ϕ terms, captures the impact on the firm's corporate income tax liability from the increased profits that arise when the firm employs additional capital or labor in the state (a profits tax effect). The second effect, which is represented by the parenthetical terms, reveals an

implicit excise tax or subsidy on each factor that arises because the firm's overall activity in state j increases relative to its activity in other states, as measured by the apportionment formula (an excise tax effect).[9] Thus, through these first-order conditions, the formula-apportioned corporate income tax can be seen to be equivalent to four separate *firm-specific* taxes (see Edmiston, 2002): a nation-wide profits tax rate given by

$$(3.4) \quad \tau^{\pi} = \sum_h t_h \phi_h ,$$

and excise taxes (or subsidies) on sales, payroll, and property in each state j given by

$$(3.5) \quad \tau_j^S = (\pi / S)\left[t_j f_j^S - \sum_h (S_h / S) t_h f_h^S\right],$$

$$(3.6) \quad \tau_j^P = (\pi / P)\left[t_j f_j^P - \sum_h (P_h / P) t_h f_h^P\right], \text{ and}$$

$$(3.7) \quad \tau_j^R = (\pi / R)\left[t_j f_j^R - \sum_h (R_h / R) t_h f_h^R\right].$$

The profits tax rate is given by the weighted average corporate tax rate across all states where the firm does business, where the weights are the apportionment percentages as measured in (1.1). The excise taxes (subsidies) arise from deviations from this average. Only in the case of uniform tax rates and apportionment formulas will the excise effects disappear, and a system of formula-apportioned corporate income taxes resemble a corporate tax levied at the national level.

The tax differentials in (3.5) – (3.7) serve as the basis for our empirical analysis. Ideally, we would like to measure the tax differentials using (3.5) – (3.7) directly. Unfortunately we cannot construct the factor average across states with the available data, which includes only Georgia tax returns. Instead we use a relatively close variant:

$$(3.8) \quad \tau_F = (\pi / F) t_{GA} f^F \left[1 - F_{GA} / F\right].$$

[9]The sum of these implicit excise taxes and subsidies for each apportionment factor sum to zero across states.

We choose as our dependent variable the factor amount in Georgia; that is, the value of property, payroll, and sales in Georgia for each firm *i* at each date *t*. Given data requirements, our remaining explanatory variables must necessarily come from information on the tax returns. Fortunately, we are able with only these variables, as detailed below, to explain between 54 and 72 percent of the total variation in factor values across firms over time.

The amount of each factor any firm places in Georgia will depend in large part on its overall levels of the factors nationally. To account for this we include the national value of each factor in the regression equations ($F_{Nat'l}$).[10] Obviously, all else equal, firms with a larger share of their total economic activity in the state of Georgia also will have higher amounts of each factor in the state. We account for the overall presence of each firm in the state by including its apportionment percentage under an equally weighted three-factor formula:

$$\text{(3.8)} \quad \text{Pres} = \frac{1}{3}\left[S_{GA}/S + P_{GA}/P + R_{GA}/R \right]$$

The profit margin on each factor is likely to influence the use of that factor, and thus we include the profit margin of the relevant factor (π / F) as a separate regressor in addition to interacting it with the tax variable. The variable Mkt indicates the degree of market (positive) or production presence (negative) in the state as measured by (2.3):

$$\text{(3.9)} \quad \text{Mkt} = S_{GA}/S - \frac{1}{2}\left[P_{GA}/P + R_{GA}/R \right]$$

Finally, because of diminishing marginal factor productivity, we expect the capital-labor ratio, as measured by *R/P*, to negatively effect the use of capital and to positively effect the use of labor. The capital-labor ratio is not expected to influence the amount of sales in the state.

[10]Throughout the discussion of the model and results, we use "F" to represent an arbitrary factor (sales, payroll, or property).

Given these explanatory variables, we estimate three separate regressions, given in (3.10):[11]

(3.10)

$$F_{GA} = \alpha_0 (F_{Nat'l})^{\alpha_1} (\tau f^F)^{\alpha_2} (\pi / F)^{\alpha_3} [(\tau f^F)(\pi / F)]^{\alpha_4} (\text{Pres})^{\alpha_5} (\text{Mkt})^{\alpha_6} (R / P)^{\alpha_7} \exp(\varepsilon)$$

which we estimate in double-log form. The error term is assumed to have a two-way fixed effects structure. That is,

(3.11) $\varepsilon_{it} = \mu_i + \lambda_t + \nu_{it}$

where the μ_i pick up non-time-varying firm-specific effects that are not captured by the data, and the λ_t pick up date-specific effects that do not vary across firms, such as macroeconomic conditions and other state policy changes that may have occurred over the period. The remaining error is assumed to be normally distributed with zero mean, but is allowed to be heteroscedastic. Sample statistics from the data are presented in Table 2.

TABLE 2. SAMPLE STATISTICS

	Mean	Std. Dev.
S_{GA}	10,432,913	95,772,490
S	347,601,961	4,276,373,819
P_{GA}	2,012,315	13,505,211
P	48,109,991	425,419,680
R_{GA}	9,070,869	124,577,971
R	232,945,231	2,313,672,403
π	9,919,156	102,078,582
Pres	0.1676	0.2652
Mkt	36.73	4,253

[11] Firm and time subscripts are dropped for presentation.

4. Results and Analysis

Results from estimating the regressions in (3.10) are presented in Table 3. The key variables in our analysis, the tax measures given in row 3, are virtually all significant, have the signs we would expect, and have reasonable magnitudes.

TABLE 3. REGRESSION RESULTS

	R	P	S
[1] Intercept	0.0260	- 0.0375*	0.0147
	(0.0196)	(0.0162)	(0.0142)
[2] $\log(F_{Nat'l})$	0.7817**	0.7594**	0.8271**
	(0.0050)	(0.0041)	(0.0034)
[3] $\log[(\pi/F)^t f^F (1-F_{GA}/F)]$	-0.0291**	- 0.0421**	- 0.1825**
	(0.0079)	(0.0078)	(0.0070)
[4] $\log(\pi/F)$	0.0484**	0.0655**	0.2024**
	(0.0081)	(0.0079)	(0.0073)
[5] log(Pres)	0.8084**	0.7804**	0.7094**
	(0.0047)	(0.0039)	(0.0030)
[6] log(Mkt)	- 0.2929**	- 0.2330**	0.2268**
	(0.0029)	(0.0024)	(0.0018)
[7] $\log(R/P)$	- 0.0160**	0.0334**	- 0.0081**
	0.0027	(0.0030)	(0.0017)
[8] Adj R^2	0.5432	0.6251	0.7180
[9] No. Obs.	48,639	48,335	69,112

Standard errors in parentheses
** indicates significance at the 99 percent confidence level
* indicates significance at the 95 percent confidence level

The tax elasticities on payroll and property are $\partial\log(P_{GA})/\partial\log(\tau f^P) = -0.04$ and $\partial\log(R_{GA})/\partial\log(\tau f^R) = -0.03$, respectively, and both are significant at the 99 percent confidence level. Thus, lowering the factor weight on productive factors from 1/3 to 1/4 (a 25 percent reduction), lead to increases in Georgia payroll and property of 1.00 percent (–0.04 x 25) and 0.75 percent respectively, on average. For the sales portion of the tax the elasticity is a much more substantial –0.18, which means that the average multistate corporation in Georgia decreased its sales in the state by 9.0 percent in response to the shift to double-weighted sales (recall that in moving from an equally weighted formula to a double-weighted sales formula the sales portion of the tax increases by 50 percent).

While theory suggests that sales from multistate corporations should decline in the state following a move to double-weighted sales, the magnitude of this result is rather surprising.

For the average firm, increases in Georgia payroll and property were $20,123 ($2,012,315 x 0.01) and $68,032, respectively, while the decrease in Georgia sales for the average firm was $938,962. Based on 1994 figures (the year prior to double-weighting), this amounts to state-wide increases in payroll and property of $316.5 million and $1.1 billion, respectively, and decreases in gross receipts of approximately $15.0 billion.

With an average effective personal income tax rate of 2.36 percent in the State of Georgia (Edwards and Wallace, 2002), the payroll increase amounts to an addition to state personal income tax coffers of $7.5 million in 1995. The increase in property undoubtedly had a positive impact on personal income tax collections as well, but the owners of property are expected to be distributed throughout the U.S. and the world, which makes the property impact on personal income tax collections impossible to estimate. To the extent this property is taxable, local governments enjoyed substantial gains in property tax collections.

Changes in corporate tax collections over the period 1995-1998, which we are able to calculate directly from the returns, ranged widely from – $24.9 million (1997) to +$22.4 million (1996). These amounts include both the static and dynamic effects of the apportionment formula change, but do not include changes in corporate income tax collections arising from changes in corporate net income or specific allocations.

Although the corporate income tax gains and losses tend to receive the greatest scrutiny in state governments considering a more aggressive apportionment formula, we show that changes in other tax bases are likely to be much more substantial. An important consideration here, however, is that these numbers apply only to multistate corporations. To the extent that production by local Georgia firms decreased and sales increased in response to the change in corporate tax policy the revenue figures for personal income tax, property tax, and sales tax may differ substantially from those estimated here.

Despite the fact that our data choices were restricted to the information available on Georgia corporate income tax returns, we were able to put together regression equations that explained a significant majority of the total variation in Georgia factor use across firms over time. The R^2s ranged from a low of roughly 54 percent to a high of almost 72 percent. Most of our other explanatory variables were found to be statistically significant, with expected signs and reasonable magnitudes. The use of factors or sales in the State of Georgia tends to follow closely the use of factors and sales nationally, with elasticities that ranged from 0.76 to 0.83. Not surprisingly, more local firms, as measured by (3.9), used payroll and property and made more sales in Georgia than did firms with a lower presence in Georgia, all else equal. Also as expected, firms that were market oriented in Georgia, a measured by (3.10), tended to sell more in the state and produce less than production-oriented firms. Finally, profitability tended to encourage the use of property and payroll in the state, and to stimulate sales in the state.

5. Conclusion

This paper utilizes panel data from a population of corporate tax returns filed in the State of Georgia over the period 1992 – 1998 in an effort to gauge the degree to which individual firms respond to aggressive apportionment policies, such as double-weighted sales. We find that the switch from an equally weighted formula to a double-weighted sales formula in 1995 had a significant positive impact on the use of productive factors by multistate firms in the state and a significant negative impact on sales in the state. This, in turn, lead to significant changes in non-corporate-income tax bases.

The results of our analysis support the findings of Goolsbee and Maydew (2000), Gupta and Hoffman (2000), Weiner (1996), and Edmiston (2002) which suggests that increased sales factor weights (and therefore lower weights on productive factors) should have a positive impact on the utilization of productive factors in the acting state. The results also support the findings of Klassen and Shackelford (1998) and Edmiston (2002) that suggests a detrimental effect on sales of increased sales factor weights in apportionment formulas. Our work expands the existing literature by measuring firm-level behavioral responses to aggressive apportionment policies, and from there determining aggregate economic impacts. Looking at the firm level, we find elasticities sufficiently large to lead to substantial effects on sales (9 percent), payroll (1 percent) and property (0.75 percent) following a move to double-weighted sales, and we are able, for the first time, to associate dollar amounts with apportionment effects, both for the average firm and in the aggregate.

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