ON THE EFFECTIVENESS OF SINGLE SALES FACTORS FOR STATE TAXATION

Charles Swenson

Professor and Leventhal Research Fellow

Marshall School of Business

University of Southern California

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ABSTRACT

This study models and empirically tests the impact on local employment from switching to a single sales factor (SSF) formula for state corporate income tax purposes. The study first models the optimal location choice decisions of a firm in response to differential state income apportionment rules while controlling for different tax structures. The model is then tested in five states which recently switched to single factor apportionment rules. Results indicate that SSF increased net employment in the five states examined. However, this net employment increase was comprised of an employment increase for locally-based firms, and a decrease for out of state-based firms. The study uses a new database which provides establishment level data, by exact locations, for both public and privately-owned firms.

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1. INTRODUCTION

A major government policy frequently utilized by states to attract new business is tax incentives. One such tax incentive is placing heavy emphasis on sales in apportionment formulae; over time, a number of states have switched to the use of a single sales factor (or SSF) in apportioning income, which places 100% weighting on sales[1]. The intent of the SSF is to attract business to a state. The purpose of this paper is to analytically and empirically examine the incentive effects of SSFs using multistate firms. The model's predictions are empirically supported using five states which recently switched from double-weighted sales factors to single sales tax factors: Georgia, Louisiana, New York, Oregon, and Wisconsin. The results have significant policy implications, not only because lawmakers apparently rely on this incentive in an attempt to attract new business investment into their states, but also because the direct costs (of lost corporate income tax revenues) of these incentives may be substantial[2].

This paper models a firm which can avail itself of favorable sales apportionment rules by locating/expanding to a new state with these rules. Because the firm's decision is also affected by state tax rates and structures, the model also allows for varying tax rates, and for both combined reporting and separate accounting tax structures. To test the impact of factor weightings, the study next examines natural experiments: five states switching from double-weighted sales factors to SSF after 2005. Georgia switched to SSF with a three year phase-in starting with sales weightings of 80% in 2006, 90% in 2007, and 100% by 2008[3]. Louisiana completely switched to SSF after 2005[4] . New York switched to 80% sales weighting in 2006, and 100% in 2007 and later years[5]. Oregon completely switched to SSF after July 1, 2005[6] . Wisconsin switched to 60% sales weighting in 2006, 80% in 2007, and 100% in 2008 and later years[7].

This study uses a newly-available database which provides establishment level data, by exact locations, for both public and privately-owned firms. Using both this National Enterprise Time Series (NETS) database, and a differences-in-differences research design which identifies affected

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[1] In January 2011, New Jersey switched to SSF. The legislation's sponsor (Louis Greenwald, Democratic Assembly member) said in a January 6, 2011 statement that the new law would give businesses "significant tax relief". This represents an increasing trend toward SSF; currently, 13 of the 46 states with income taxes have SSF, and another 10 states allow SSF for certain industries. See Appendix I.
[2] For example, the tax expenditure budget for California estimates that the cost of adopting the SSF would be $800 million annually.
[3] O.C.G.A Sec. 48-7-31.
[4] Sec. 47:287.95(F)(2)(a).
[5] Sec. 210 (3)(a)(10) Tax Law.
[6] Sec. 314.650 ORD
[7] Sec. 71.25(6) Wisc. Stats.

versus unaffected firms, the results suggest that such states experienced significant net increases in employment after SSF enactment However, this net employment increase was comprised of an employment increase for locally-based firms, and a decrease for out of state-based firms. Because resource allocation/re-allocation effects are strongly altered by formula apportionment and unitary tax structures, these are discussed in the next section.

2. STATE TAX RATES AND STRUCTURES

2.1 Income Tax Rules, and Throwback Rules

All but four states in the U.S. impose a state corporate income tax. Rates range from 12% (Iowa) to 3.4% (Indiana). Although rates do not typically have large annual swings, rate changes of 1% can occur in any particular state, in order for that state to meet policy objectives or to balance budgets. Equally as important as rates, are the rules which determine the tax base, such as apportionment and whether the state follows unitary or separate accounting rules. All states require that the income of a corporation be apportioned to the taxing state based on a factor formula; for most states, it is the three factor formula of the ratio of taxing state's sales, payroll, and property, to the corporation's total sales, payroll, and property. Thus, if a corporation has operations in more than one state, income taxable in each apportioning state will be the firm's business income (both within and outside the state) multiplied by the state apportionment factor as determined by that particular state's apportionment formula. Since the majority of states double weight the sales factor in the apportionment formula, the income apportioned to a state can be represented as:

$$\text{Business Income} \cdot \left(\frac{2 \cdot \text{Sales}_s}{\text{Total Sales}} + \frac{\text{Payroll}_s}{\text{Total Payroll}} + \frac{\text{Property}_s}{\text{Total Property}} \right) \cdot \frac{1}{4} \quad . \tag{1}$$

Business income includes either income solely from a single corporation (separate accounting), or from a combined group of entities which are part of the same "unitary group" (combined reporting, or unitary taxation). For "unitary"/combined reporting states (primarily, those west of the Mississippi River), the unitary method is applied to determine the extent to which a corporation's affiliates are included in apportionable income, and in a three-factor apportionment formula. The so-called "unitary tax" defines apportionable income, and includes in the apportionment formula, income from operations in separate entities considered to be part of a unitary business of the corporation operating in its state. The basic characteristics of a unitary business are that the corporation's operations are dependent upon, or contribute to, the business conducted by the group, and that there is at least a 50 percent common ownership or control between the corporation and the corporate group[8]. Unitary states require filing of a combined corporate income tax report, which includes all affiliates considered to be part of the unitary business.

Instead of the unitary/combined reporting method, some states use the separate accounting method, whereby only the income of the entity conducting business in the state is included on the corporate income tax return. Taxes in unitary states are affected by changes in property, payroll, or sales. Since these are real economic choices, tax optimization may result in decreased pre-tax economic performance, both vis-a-vis a no-tax situation, and vis-a-vis the non-unitary setting. Accordingly it is important to understand not just the incentive of SSF specifically, but of general factor apportionment effects on the tax base and tax rates as well. The next section discusses such incentive effects.

The absence of a throwback rule to compute the sales factor and extra weighting of that sales factor are favorable tax treatments since sales to other states, where the firm has no nexus, escape state income taxation. Between 1980 and 2000, five states repealed their throwback rules, and (as shown in Appendix I) the number of states which placed more than equal weight on the sales factor went from 8 (17%) to 28 (62%). Absence of sales throwback rules essentially converts a state into a territorial tax, i.e., no tax on out-of-state sales. To see this, assume a firm manufactures in State A, and sells its output to States A and B. Also assume the firm has no "nexus" (taxable presence) in B. The firm will be taxed on State A sales. Since it has no nexus in B, it cannot be taxed by B. If State A is a non-throwback state, sales in B are not taxed by State A either. It is widely believed that the absence of a throwback rule encourages firms to locate in that State, if they have direct sales to out-of-state customers.

A similar effect occurs with placing extra apportionment weights on the sales factor in the apportionment formula. As discussed in the next section, a firm's multistate income is apportioned into a state based on the ratios of property, payroll, and sales in that state, to property, payroll, and sales in all states (or worldwide, if no water's edge limitation is available). The higher the weight a state places on the sales factor, the lower the weights placed on the property and payroll factors (because the three weights must sum to 100%). Because apportionment is essentially a separate tax on each of the three factors (as illustrated in the model), lower weights on property and payroll are essentially lower taxes on facilities located in the state. Accordingly, the marginal tax costs of

[8] The "contribution and dependency test" is one of several tests for unity. The others are the "three unities" test (unity of ownership, unity of use, and unity of operations); strong centralized management; and even "flows of value".

locating a facility (which has out of state sales) in a single sales factor (SSF) state may be lower, ceteris paribus, than costs in non-single factor states. Such lowered costs of investment should act as an inducement to location to (or expansion in) such a state.

There is also a separate income effect resulting from SSF, which is discussed in the next section.

2.2 Direct (Income) Tax Effects of the Single Sales Factor (SSF)

To illustrate the direct tax effects of the SSF, assume the following examples. In these examples we show that switching to an SSF can either increase or decrease a firm's tax payments. Figure 1 shows the difference in tax for a firm based in a state, comparing taxes under SSF and double weighted sales. This sample firm has $10 million of national profits and sells nationwide, but has most of its operations in the SSF state. The state has 80 percent each of the firm's property and payroll, but just 20 percent of its sales. The figure shows that this locally-based firm would be able to reduce its tax bill by 60 percent by switching from the current double-weighted sales factor formula to the new single sales factor (SSF). In contrast, Figure 2 shows the same calculation for an out-of-state firm that has relatively high sales in the state (14 percent) compared to its shares of property and payroll (4 percent each). This firm would lose $44,200 from the switch to SSF from double-weighted sales.

As the above numerical example shows, when a state switches to SSF there is an immediate cash flow effect.[9] This effect is positive for companies based in that state, and negative for firms based out of state. To the extent to which firms make no subsequent adjustments, there is also a similar ongoing income effect. This income effect shifts the firm's budget line, allowing in-state based companies to invest in more employees, plants, and/or equipment. In contrast, the income effect shifts an out of state firm's budget line inward, potentially reducing the firm's ability to continue its current level of investment in workers, plant, and/or equipment.

2.3 Indirect (Substitution) Tax Effects of the Single Sales Factor (SSF)

In addition to the above income effect, there should also be a substitution effect, across states, due to the SSF. That is, if a state switches to SSF, there is no tax cost to increasing payroll and property investment in that state, after SSF enactment. To the extent that such additional investment comes from outside the state, then there is a substitution effect across states, and we would expect to see increased investment in the SSF state after SSF adoption. This effect should

[9] The "tipping point" at which a firm pays more taxes from switching from double weighted sales to SSF is a sales ratio (in to out of state sales ratio) of 50%. To see this, set S=ratio of instate sales to out of state sales, and KL as the average of instate capital and labor, to out of state capital and labor. Assuming s double weighted sales formula, rearranging, and factoring out the constant, we have: S/KL. So long as this ratio is less than 1, an increase in the sales factor reduces the firm's tax bill.

occur whether the firm is based in that state, or based out of state. However, there are countervailing effects which may not result in observed investment increases.

The first countervailing effect is due to the income effect, which would apply to out of state firms only (as noted above the income effect is positive in state-based firms). The second countervailing effect is transaction costs. Even if it makes sense to engage in substitution of operations in or out of the SSF state, if the transactions costs are too large, the substitution will not occur.

The third countervailing influence on the substitution effect relates to the state's tax structure. As explained and modeled in subsequent sections, if the SSF state follows separate accounting, the substitution effect is likely to be weaker. A similar effect should occur if the state has sales "throwback". If the state has throwback, then any sales to other states, in which the firm is not tax liable, are thrown back into the sales formula numerator, as if those sales occurred in the state of origin. Here, SSF acts to increase taxes by placing more weight on such thrown back sales. Of course, this would only occur to the extent has such sales into states where it is not taxed (it has no nexus). As will be shown analytically in Section 3, these effects are very complex, with the only clear-cut predictions being that if the SSF state has unitary/combined reporting, the substitution effect is generally positive, but the effects of sales throwback in the SSF state generally have a negative substitution effect.

2.4 EMPIRICAL PREDICTIONS

In summary, the SSF is expected to result in both an income and a substitution effect, as follows:

- For locally-based multistate firms, the income effect will be positive, and the substitution effect potentially positive or negative, resulting in increased investment in the SSF state
- For out of state based multistate firms, the income is negative and the substitution effect potentially positive, resulting in countervailing influences on investment.
- The net overall investment effect on the SSF state is an empirical issue, depending on the magnitude of the positive effect of the locally-based multistate firms, versus the potentially negative effect of the out of state based multistate firms.

For both instate and out of state firms, the substitution effect will be higher for states with unitary (combined reporting) structures, and lower for states with sales throwback. This substitution effect will be explained analytically in Section 3.

2.4 PREVIOUS RESEARCH

Numerous theoretical studies (cited in Wilson, 1999) have examined state tax rates from a macro, welfare-implications perspective. None of these studies considered the effects of SSF. However, there have been a few theoretical studies which have focused on the effects of the unitary tax on the firm. McClure (1981) found that formula apportionment is similar to a separate tax on payroll, property, and sales. Focusing on incidence, McClure found that formula-based state corporate income taxes were likely to be borne by residents of the taxing state (consumers, owners of land, and immobile capital). Following up on the McClure's (1981) idea that the unitary tax is actually three separate taxes, Gordon and Wilson (1986) separately analyzed the effects of the factors. Their model found that when states had different tax rates, the sales factor encouraged cross-hauling of output (selling in another state), the property factor provided incentives not to concentrate operations in one state, and the payroll factor induced firms to consolidate operations into one state.

Williams, Swenson, and Lease (2001) modeled the interaction of unitary/separate accounting structures and changing tax rates on interstate resource allocation, assuming the firm already had existing operations in both states (i.e., there was not a new choice location decision per se). They found that when the firm faced unitary structures in both states, rate changes encouraged the firm to move resources from the higher tax rate state to the lower tax rate state. In contrast, when the firm's operations were only in separate accounting states, tax rate differentials between states had no affect on resource allocation. When the firm operated in both a unitary and separate accounting state, only rate changes affecting the unitary state resulted in resource allocation, and even then, the resource reallocation was less than that of firms which operated exclusively in unitary states.

An excellent summary of empirical evidence on the impact of state taxes can be found in Hoffman (2002). With respect to the impact of combined reporting is provided by Moore, et al. (1989), who found that foreign firms' location choices were unresponsive to overall tax rates, but were negatively influenced by the presence of unitary tax structures. The findings of Moore, et al. (1989) were essentially replicated and corroborated by Coughlin, et al.(1991). More recently, Gupta and Hofmann (2003) applied a panel data analysis across all states, using a location choice model similar to Moore et al. Regression results found that new capital spending was negatively influenced by unitary tax structures. The study also found that lower tax rates and incentives for assets (in that order) increased capital spending.

With regard to absence of throwback, and extra weighting on sales, no theoretical and only three empirical studies exist on these two effects. Empirically, Klassen and Shakelford (1999) found that while manufacturers' shipments from throwback states were decreasing in corporate tax states, such shipments were not sensitive to sales weighting factors. By their own admission (p. 387), the study results should be viewed cautiously because of the aggregate nature of the data (state totals, instead of firm data, were used).

Previous research has demonstrated that higher weights on sales factors generally increase economic growth (and in particular, employment) in states which have such higher weights[10]. Using aggregate data, Lopez and Martinez-Vazquez (1998) found that industries varied significantly in having their incomes either under- or over-apportioned by various states. Lightner (2000) empirically found that state tax rates, more so than formula apportionment, negatively affect state employment growth. Edmiston and Arze (2002) used macro simulation models to predict that switching from single to double-weighted sales factors would increase in state employment and capital. Gupta et al (2009) use aggregate state data in their study, and estimate that up to 16% of the corporate income tax base (for states having increased sales weights) has eroded due to the extra weighting of the sales factor. Omer and Shelley (2004) finds that states shifting apportionment weights away from property and payroll and toward sales lowers the cost of these factors and increases capital investment and employment in those states.

Similarly, Edmiston and del Granado (2006), using Georgia data at the firm level for 1992-2002, find that changing apportionment factors towards sales and away from property and payroll resulted in decreased local sales, but increased payroll and property. Anand and Sansing (2000) addresses the differential impact of tax rules on different industries, noting that what is optimal depends in part on factors such as the location of natural resources, as states that have natural resources are more likely to benefit from apportionment rules that tax production factors (employment and property) since industries such as mining must produce at the location of the natural resource, while states that import natural resources benefit more from taxing sales. Dubin (2010) estimates that tax capacity (the corporate income tax base) increased for some states, but decreased for others, as a result of increased weighting of sales by states from 2001-2008.[11]

One study specifically looked at the impact of California switching to SSF. Using a dynamic computable general equilibrium (CGE) model, Hamm et al (2005) estimated that such a switch

[10] See Goolsbee, A. and E. Maydew "Coveting Thy Neighbor's Manufacturing: the Dilemma of State Income Apportionment", *Journal of Public Economics* 75(2000), and cites therein.

[11] States also compete. Goolsbee and Maydew (2000) show that when one state makes a tax change that creates a more favorable business climate, other states that do not respond in kind suffer negative externalities from the changes. Like Goolsbee and Maydew this study includes state and year dummies in specifications, but since this study is at the establishment level, we are also able to distinguish between establishment sizes and industries, and we include controls for these factors in regression specifications.

would result in increased California employment and tax revenues[12]. By their own admission, Hamm et al acknowledged that CGE models are significantly driven by assumptions. Finally, surveying the literature, the California Legislative Analyst's Office (LAO) concluded that SSF adoption would increase California employment when put into effect in 2011.[13]

In contrast to the above studies, which used largely aggregate data, this study uses an establishment level econometric estimation methodology. This unique methodology is enabled by the recent availability of establishment level data, discussed later in the paper. Firm and location level studies allow more precise estimates of effects (here, the introduction of the SSF) than macro models, and allow for specific, firm level predictions.

3. MODELING THE SUBSTITUTION EFFECT OF SSF

3.1 General Model

As noted previously, introduction of the SSF has an immediate income effect which causes an increase (decrease) in investment by instate (out of state) based firms. The substitution effect, between the SSF and other states in which the firm operates, is more complex. To guide subsequent empirical tests, we start off with a model. The analysis begins with a simple model of a firm which operates in a multi-state environment. Although I use a manufacturing example, in principle, the model can be generalized to any multi-state enterprise where value is added by various components of the enterprise. To examine the effects of SSF, it is important to also consider the collateral (and sometimes countervailing) effects, that other aspects of state tax structures and rates may have. To accomplish this, the model of Williams, Swenson, and Lease (2001; hereafter WSL) which examined the effects of unitary tax structures (combined reporting) and tax rates, is extended by examining the effects of SSF. The WSL (2001) model is also extended to include the effects of sales throwback.

Consistent with WSL (2001), this study models a stylized manufacturing firm with operations in State 1 and State 2. State 1 can be thought of as where the firm is based or headquartered. The next few pages review the LSW setup, and then add the effects of SSF. To add the effects of sales throwback, we enhance the WSL setup by assuming that State 1 operations can also sell directly to customers in nearby State 3 (where the firm has no nexus), and

[12] Hamm, W., Alberto, J. and C. Groves, "Apportioning Corporate Income: If California Adopts the Single Factor, What Will be the Economic and Revenue Impact?". Mimeo, August 2005.

[13] *Reconsidering the Optional Single Sales Factor: An LAO Report*. Sacramento: Legislative Analyst's Office (May 26, 2010)

State 2 operations can also sell to customers in nearby State 4 (where the firm has no nexus). The firm is considering shifting operations into either State 2 due to the State 2's switch from double weighted sales to SSF, or alternatively, into State 1, assuming State 1 switches from double weighted sales to SSF. Thus, the firm does not face a location choice decision per se. This serves as a useful starting point to the pure location choice model, discussed later in the paper. To simplify the analysis, the study assumes that the transactions costs of moving resources to either State 1 or 2 are equal and exceed return on investment requirements. Thus location costs can be ignored without generality. The firm is a "classic" example of a unitary business, in that its multistate operations are functionally dependent on each other, with its headquarters in one state, and operations in another state; and it clearly has taxable "nexus" (or business connection) in each of the two states with facilities (States 1 and 2). The model is shown graphically in Figure 3.

The manufacturing process begins at the firm's headquarters in State 1, and the firm maintains production facilities in State 1 as well. The firm completes production and services customers in a regional market from the local facility. The firm also completes production in State 2, where output is also sold on a regional basis[14]. The study models the manufacturing process as potentially divisible at any stage. That is, at any point in the manufacturing process, the firm could ship the intermediate (or partially completed) product from the manufacturing center at the headquarters to the local facilities for completion and sale. The firm incurs a shipping charge for sending the product from the headquarters to the local facility in State 2 based on the number of units shipped. The study assumes that the local facility that completes the product and sells to customers from State 1 is adjacent to the headquarters, and thus no shipping charge is incurred on those units. The quantities sold to customers from States 1 and 2 are denoted, respectively, as Q_1 and Q_2.

As management's objective is to maximize the firm's pretax profit, the study initially ignores state income taxes. Based on the firm's revenue function and the costs it faces, management chooses the level of capital (K) and labor (L) to employ at each of the firm's three facilities (the manufacturing center and the local facilities in each state) so as to maximize the excess of revenue over cost. In making these decisions, management is constrained by exogenously determined production functions. Management must also choose the point in the manufacturing process at which production will shift from headquarters to the local production facilities (the degree of centralization). Denote this as the choice of ϕ the fraction of the manufacturing process performed at the headquarters, with ($1-\phi$) being the percentage performed at the local production facilities,

[14] In LSW, production is sold only to customers in the same state. Here, we allow each manufacturing unit to sell production to other nearby states.

which is between zero and one. More formally, management chooses K_i, L_i, and ϕ (Є {*m*, *1*, *2*}[15]) so as to

$$\max \pi = R(Q_1, Q_2) - C(Q_1, Q_2), \tag{1a}$$

subject to the production functions for the manufacturing facilities.

Assume the firm operates in an imperfectly competitive market and faces a downward-sloping demand curve in each state. Specifically, assume the inverse demand function is $P = a_j - bQ_j$, where *j* Є {*1*, *2*}. This leads to the firm's revenue function:

$$R(Q_1, Q_2) = \left(a_1 Q_1 - bQ_1^{\ 2}\right) + \left(a_2 Q_2 - bQ_2^{\ 2}\right). \tag{1b}$$

Assume the cost of production consists of the rental rate (or, in the alternative, the rate of return) on capital (*r*), the wage rate paid for labor (*w*), and the cost (*s*) of shipping a unit from the manufacturing center to the local production facilities in State 2. Assuming a single rental rate on capital for all facilities, however, allows wage rates to differ between the states. Formally, model the cost of production as:

$$C(Q_1, Q_2) = \left(w_1 L_m + rK_m\right) + \left(w_1 L_1 + rK_1\right) + \left(w_2 L_2 + rK_2\right) + sQ_2\,. \tag{1c}$$

Assume that production follows a generalized Cobb-Douglas production function where $Y_i = L_i^{\alpha} K_i^{\ \beta}$ with *i* Є {*m*, *1*, *2*}, α and β >0 and < 1. For the headquarters, $Y_m = \phi\,(Q_1 + Q_2)$. For the local production facilities, $Y_j = Q_j(1-\phi)$ with *j* Є {*1*, *2*}. Assume that the productivity of capital does not depend on its location; accordingly, β is the same for all three production facilities. A realistic setting should allow for differences in labor between workers in different states. For example, the average skill level is likely to be different as is the average level and quality of education. One way of viewing this is to assume that workers with the requisite skill and educational levels are available in each state, but that local differences in the supply and demand for those workers will potentially result in different prices for their labor.[16] The study however, instead reflects these differences in the wage rates, w_i, rather than in α.

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[15]For notational purposes, I use the subscript *m* to indicate production or factors of production at the firm's manufacturing center, and I use the subscripts *1* and *2* to indicate production or factors of production at the firm's local production facilities in, respectively, states 1 and 2.

[16] Another way to view this is to consider the labor variable, *L*, as reflecting some unit of human productivity rather than some number of worker-hours. That workers in one state may take longer to achieve that unit of human productivity is

Combining equations (1a) and (1b) and specifying the production function constraints, the pretax model is shown symbolically in (2):

$$Max\ \pi = (1-\tau_u)\left(a_1Q_1 - bQ_1^{\ 2} + a_2Q_2 - bQ_2^{\ 2} - w_1(L_m + L_1) - w_2L_2 - r(K_m + K_1 + K_2) - sQ_2\right)$$

subject to:

$$\phi(Q_1 + Q_2) = Y_m = L_m^{\ \alpha} \cdot K_m^{\ \beta},$$

$$(1-\phi)Q_1 = Y_1 = L_1^{\ \alpha} \cdot K_1^{\ \beta}, \text{ and}$$

$$(1-\phi)Q_2 = Y_2 = L_2^{\ \alpha} \cdot K_2^{\ \beta}. \tag{2}$$

When pretax profits are maximized, $\frac{MP_K}{MP_L} = \frac{r}{w}$ (with $\frac{MP_K}{MP_L}$ = $\frac{\beta L}{\alpha K}$). Therefore, $\frac{r}{w} = \frac{\beta L}{\alpha K}$,[17] which is rearranged as

$$K = \frac{\beta w L}{\alpha r} \text{ (adding the appropriate subscripts).} \tag{3}$$

To solve this problem, the first step is to substitute (3) into each constraint for (2), and solve for the respective *L* in terms of the *Q*'s, ϕ, and exogenous variables. This result is then substituted into (2). The next step is to hold the *Q*'s constant and solve for ϕ by differentiating the resultant equations with respect to the exogenous variables to obtain the first order conditions (FOC).

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reflected, ceteris paribus, in a higher effective wage rate, *w*. The fact that it would take workers in one state longer to achieve this unit of higher productivity could be reflected in a lower nominal wage rate, but other factors may also influence the nominal wage rate, so the effective wage rates may still differ between the states. I believe this model is generalizable in two important respects. First, I believe it is general enough to encompass both the decision of how to employ resources within existing facilities and the decision as to the size and scope of new facilities. The model ignores the transactions costs associated with these decisions, but if the opening of a new facility (or the expansion of an existing facility) is done through renting a building and equipment and hiring local employees, the transactions costs should be relatively low. Secondly, the model can be generalized to the cases of merchandisers and service companies. In both cases, if proximity to customers and clients is necessary or expected, the firm's choice of how big a facility to employ (capital) and how fully to staff it (labor) will affect the firm's effective state income tax rate. This impact on effective state tax rates could influence, for example, a consulting firm's decision whether to open an office in another state on a full- or part-time basis. While the specification of the parameters (e.g., α and β) are likely to change, the general form of the model should still apply, and the results may be qualitatively similar.

The next few sections enhance the basic model by considering the effects of switching to SSF when the firm faces a variety of unitary/separate accounting and sales throwback situations. The examples are not meant to be comprehensive, and instead illustrate some general themes.

3.2 SSF State Uses Separate Accounting

Before examining the effects of SSF, it is useful to first examine the effects of non-unitary taxation (separate accounting) on resource allocation. First, assume that the firm's out of state operations are all in separate accounting states.

3.2.1 Firm Separately Incorporates Each Operation, and Operates only In Separate Accounting States

The simplest case is where the firm separately incorporates all operations. First, note that non-unitary taxation of a subsidiary with only single-state operations, does not involve the use of factor apportionment.[18] Hence, taxation of the firm is similar to a tax on pure profits, which is non-distortionary. With multi-state taxation and a transfer price set equal to average unit cost, I can separate total profits into two pieces, corresponding to the tax code as follows:

$$\begin{aligned}
&\pi = \pi_1 + \pi_2, \\
&\pi_1 = (1-\tau_1)(a_1 Q_1 - bQ_1^{\,2} - w_1 L_1 - rK_1 - p_t Q_1), \quad \text{and} \\
&\pi_2 = (1-\tau_2)(a_2 Q_2 - bQ_2^{\,2} - w_2 L_2 - rK_2 - p_t Q_2 - sQ_2).
\end{aligned} \tag{4}$$

Note that the manufacturing center costs are included implicitly, since $p_t(Q_1 + Q_2) = w_1 L_m + rK_m$. The transfer prices designate how much of the manufacturing center cost is deductible in each state. Technically, all those costs are deductible in State 1, but the State 1 firm must also recognize revenue from sales to State 2 of the unfinished product equal to $p_t Q_2$.

If the transfer price is treated as fixed, then the two states' production and sales decisions can be made independently. In that case, the taxes are proportionate to economic profits. It is a well-known result in public economics that a tax on pure profits does not distort factor inputs or sales decisions. Hence, any effect of a non-unitary tax on resource allocation must be due to an effect on the transfer price itself, which would be second order in nature. Here, differences in tax

[18] Technically, factor apportionment may be employed, but since the three factors are 100% because the subsidiary has operations in only one state; it is "as if" factor apportionment is ignored in this case.

rates have no effect on labor or capital between the two states. Even if the transfer price is not fixed, as shown in equations (A1) and (A2) in Appendix 2, differences in tax rates have very little effect on labor and capital decisions.

The same analysis applies where one state switches to SSF. Assume State 2 switches from a double weighted sales factor, to SSF. Since 100% of State 2 net income is still taxed in State 2, the switch to SSF is generally irrelevant and does not affect labor or capital choices. The same non-effect occurs if it is State 1 which switches to SSF. Moreover, the effect of sales throwback is irrelevant, since 100% of profits are taxed in each state in any event; see Equations (A3) through (A5) in Appendix 2.

The overall result is that there is no effect on resource allocation, due to SSF, when the firm operates solely in separate accounting states, and incorporates each operation.

3.2.2 Firm Does Not Separately Incorporate Out of State Operations

Suppose again that the firm has operations in State 2, but in this case, does not separately incorporate them. Thus, while both State 1 and State 2 tax the firm, the firm's operations will be apportioned between the two states based on their relative three factor formulas.

Before examining the effects of SSF, it is useful to first examine the general effects of tax structures on production and investment decisions. Here, the profit equation (2) is multiplied by tax rates, resulting in (where τ_t is the firm's total multistate tax, and assuming initially that a double weighted sales factor is used):

$$Max\,\pi = (1-\tau_t)[a_1Q_1 - bQ_1^2 + a_2Q_2 - bQ_2^2 - w_1(L_m + L_1) - w_2L_2 - r(K_m + K_1 + K_2) - sQ_2]$$

subject to:

$$\phi(Q_1 + Q_2) = Y_m = L_m^{\alpha} \cdot K_m^{\beta},$$

$(1-\phi)Q_1 = Y_1 = L_1^{\alpha} \cdot K_1^{\beta}$, and

$(1-\phi)Q_2 = Y_2 = L_2^{\alpha} \cdot K_2^{\beta}$, with

$$\tau_t = \frac{\tau_1}{4}\left(\frac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2L_2} + \frac{K_m + K_1}{K_m + K_1 + K_2} + 2\cdot\frac{a_1Q_1 - bQ_1^2}{a_1Q_1 - bQ_1^2 + a_2Q_2 - bQ_2^2}\right)$$

$$+\frac{\tau_2}{4}\left(\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}+\frac{K_2}{K_m+K_1+K_2}+2\cdot\frac{a_2Q_2-bQ_2^{\;2}}{a_1Q_1-bQ_1^{\;2}+a_2Q_2-bQ_2^{\;2}}\right) \quad . \qquad (5)$$

Note that the apportioned total tax, τ_t, is the standard apportionment formula, equation (1) shown in the beginning of the paper, adapted to the property, payroll, and sales parameters of the model.

In comparing (1) and (5), we see that taxes are, as noted by McClure (1981) and Gordon and Wilson (1986), similar to a separate tax on each of the company's sales, capital, and labor. As with the non-tax model above, it is too complex to solve analytically as an entire system. However, by making some simplifying assumptions, some comparative statics can be derived.

The effects of tax rates in this tax setting are as follows (shown in WSL, and reproduced in Appendix 2 equations A6 through A14). First, higher rates in State 1 (or lower rates in State 2) result in decreases in ϕ, decreased Q_1, increased Q_2, increased L_2 and K_2, and decreased L_m and K_m. Second, higher rates in State 2 (or lower rates in State 1) result in increased ϕ, decreased Q_2 and increased Q_1, decreased L_2 and K_2, and increased L_m and K_m. Finally, there is no prediction on the effects of taxes on L_1 and K_1. The previous discussion essentially states that the firm will simply move factors of production from the high tax rate state to the low tax rate state, in order to decrease (increase) the amount of income allocated to the high (low) tax rate state[19].

Before we can say anything about the effects of switching to SSF, we must know whether one of the states is a "throwback" state. Note that throwback is important since each of the firm's two state operations sell into another state, in which it has no nexus. Assume State 2 switches to SSF, and that State 2 is a throwback state. In this case, the incentive effects of switching to an SSF are muted. A simple example is as follows. Suppose the firm has 80% of its payroll and property, each in State 2, and 10% of its sales. Assume that the other 90% of sales for State 2 are made to a variety of other states in which the firm has no nexus. Suppose that State 2 has a throwback rule, so that the other 90% of sales is thrown back into the State 2 sales formula. Here, increasing the weights on sales, from double weights to SSF in State 2, results in no tax savings since it is as if sales to all other states from State 2 are part of State 2 for tax purposes. In fact, the

[19] As noted in WSL (2001), these are ceteris paribus conditions. Because of decreasing returns, additional capital and additional labor are more expensive per unit as the firm demands more of them in the low tax state. Similarly, the price of the firm's output, per unit, declines as the firm produces and sells more in the low tax rate state, due to price elasticity in the output market. In contrast, per unit factor costs decline, and per unit sales prices increase, in the high tax state, as the firm scales back operations there. These two effects should actually reduce pretax profits. The question then becomes to what degree the firm moves factors of production (or substitutes between them) and sales in order to maximize after-tax profits.

overall State 2 apportionment would go to 100%. Hence, there is no incentive to move production from State 1 to State 2.

Suppose instead that State 2 (which switches to SSF), does not have a throwback rule. Recall that State 2 operations also sell into nearby State 4, where the firm has no production facilities and no nexus. Θ_2 is the fraction of State 2 production sold to State 2 customers, and 1-Θ_2 is the proportion sold to State 4 customers. (Similarly, Θ_1 is the fraction of State 1 production sold to State 1 customers, and 1-Θ_1 is the proportion sold to State 3 customers). Since States 2 and 4 are contiguous, assume that demand functions are similar between the two states. When there is no sales throwback rule, and sales are double-weighted, the last term in (5) is rewritten as:

$$\tau_t = \frac{\tau_1}{4}\left(\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}+\frac{K_m+K_1}{K_m+K_1+K_2}+2\cdot\frac{a_1Q_1-bQ_1^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta_1\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta_1\right)\left(a_2Q_2-bQ_2^{\,2}\right)}\right)$$
$$+\frac{\tau_2}{4}\left(\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}+\frac{K_2}{K_m+K_1+K_2}+2\cdot\frac{a_2Q_2-bQ_2^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta_2\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta_2\right)\left(a_2Q_2-b_4Q_2^{\,2}\right)}\right)\text{(5a)}$$

With no adjustments to the decision variables, the tax constraints (5a)<(5). Since the numerator of the sales term in State 2 does not include sales to all other states, there is both an income and a substitution effect for the firm in State 2. Overall production is shifted to State 2 (Q_2 increases). This latter effect actually has a positive externality to State 1: the numerator of the sales factor decreases resulting in a decrease in τ_t. But there is also a negative externality to State 1; increased production at the main plant increases the transfer price.

To examine the impact of apportionment weights, define the weights for sales, property, and payroll as S_w, K_w, and L_w, respectively. Since each is defined as a per cent, the sum of the three weights must equal one. The effects of increased weighting of the sales factor are as follows. Again assume State 2 switches to SSF. Rewrite (5a) to include apportionment weights for sales, property, and payroll as follows, assuming throwback:

$$\tau_t = \tau_1\left(\begin{array}{l} L_{w1}\{\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}\}+K_{w1}\{\frac{K_m+K_1}{K_m+K_1+K_2}\}+ \\ S_{w1}\{\frac{a_1Q_1-bQ_1^{\,2}+a_2Q_3-b_3Q_3^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta_1\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta_1\right)\left(a_3Q_2-b_3Q_2^{\,2}\right)}\} \end{array}\right)$$
$$+\tau_2\left(\begin{array}{l} L_{w2}\{\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}\}+K_{w2}\{\frac{K_2}{K_m+K_1+K_2}\}+ \\ S_{w2}\{\frac{a_2Q_2-bQ_2^{\,2}}{a_1Q_1-bQ_1^{\,2}+a_2Q_2-bQ_2^{\,2}+a_3Q_3-b_3Q_3^{\,2}}\} \end{array}\right) \quad (6)$$

Assuming no change in resource allocation, the tax constraints (6)<(5a). In fact, (6)<(5). So in this setting, a switch to SSF results in a shift of resource allocation, due to SSF, into the SSF state, when the firm operates in a separate accounting state and its out of state operations are not separately incorporated.

3.2.3 Firm Separately Incorporates Each Operation, and Out of State Operations are Only In A Unitary (Combined Reporting) State

Before examining the impact of SSF, the general impact of the unitary/separate accounting structures is examined. Under this specification, and assuming that: State 1 is the non-unitary state; that the firm separately incorporates its operations in each state[20]; and that both states use a double weighted sales factor, (4) is rewritten:

$$Max\,\pi = (1-\tau_{u1})[a_1Q_1 - bQ_1^2 + a_2Q_2 - bQ_2^2 -$$
$$w_1(L_m + L_1) - w_2L_2 - r(K_m + K_1 + K_2) - sQ_2] - Tax_2$$

subject to:[21]

$$Max\ \pi = (1-\tau_{u2})[a_1Q_1 - bQ_1^2 + a_2Q_2 - bQ_2^2 - w_1(L_m + L_1) - w_2L_2 - r(K_m + K_1 + K_2) - sQ_2] - Tax_1,$$

$$\tau_{u2} = \frac{\tau_2}{4}\left(\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2} + \frac{K_2}{K_m+K_1+K_2} + 2\cdot\frac{a_2Q_2 - bQ_2^2}{a_1Q_1 - bQ_1^2 + a_2Q_2 - bQ_2^2}\right), \quad \text{and}$$

$$Tax_1 = \tau_1\cdot\left(a_1Q_1 - bQ_1^2 - p_tQ_1 - w_1(L_m+L_1) - r(K_m+K_1)\right).$$

$$p_t = \frac{rK_m + w_1L_m}{Q_1 + Q_2} \qquad . \qquad (7)$$

Here, p_t is the transfer price charged by the manufacturing plant at the headquarters for the intermediate goods transferred to the facilities in State 2. The transfer price is the average unit

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[21] The previously stated production functions constraints continue to apply but are omitted here so as to concentrate on the income taxes.

cost of the manufacturing center. Note that the transfer price is not a decision variable in the optimization, although it does depend on total sales.

A priori, whether (7) results in a higher tax than in (5), depends on relative values of K, L, and Q in each state. The amount of potential shifting of resources out of (into) the unitary state is a matter of degree, limited by the downward slopes of demand in the two states, as well as the decreasing returns nature of production at each site. As shown in WSL (2001), if tax rates are higher (lower) in the non-unitary state, this causes a roughly proportionate decrease (increase) in after-tax profits from that state regardless of production and sales decisions. Hence, we would expect a minimal shift in resource allocation. The only clear prediction is that if State 1 is the non-unitary state, then higher (lower) levels in its tax rate will have a more favorable (unfavorable) impact on its sales and production than if State 2 is the non-unitary state.

With regard to throwback, again assume that some State 2 production can be sold in nearby State 4. Absence of sales throwback in State 2 encourages additional sales being sourced into State 4. When State 2 is the unitary state, rewrite the tax constraints in (7) as:

$$\tau_{u2} = \frac{\tau_2}{4}\left(\begin{array}{l} \dfrac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2 L_2} + \dfrac{K_m + K_1}{K_m + K_1 + K_2} + \\ 2 \cdot \dfrac{a_1 Q_1 - bQ_1^{\,2}}{a_1 Q_1 - bQ_1^{\,2} + \Theta_2\left(a_2 Q_2 - bQ_2^{\,2}\right) + \left(1 - \Theta_2\right)\left(a_3 Q_2 - b_3 Q_2^{\,2}\right)} \end{array}\right),$$

$$Tax_1 = \tau_1 \cdot (a_1 Q_1 - bQ_1^{\,2} - p_t Q_1 - w_1(L_m + L_1) - r(K_m + K_1), \quad \text{and}$$

$$p_t = \frac{rK_m + w_1 L_m}{Q_1 + Q_2}. \tag{8}$$

Again, the absence of throwback encourages the firm to increase Q_2. This increased production increases K_2, L_2, and p_t. Increased p_t results in a negative externality to State 1. State 1 tax actually decreases to the extent that the sales factor denominator increases (due to an overall increase in $Q_1 + Q_2$). State 2 taxes increase, since the numerator of all components of τ_{u2} increase faster than the denominators.

Next, assume that State 2, which has no throwback, switches to SSF. Rewrite the profit equation (4) for State 2 operations as:

$$\pi_2 = (1-\tau_2)\Theta_2[(a_2 Q_2 - bQ_2{}^2) + (-w_2 L_2 - rK_2 - p_t Q_2 - sQ_2)] \\ + [(1-\tau_2)(1-\Theta_2)(a_3 Q_2 - b_3 Q_2{}^2)]. \tag{4a}$$

Comparing (4a) to (4), we see that the firm will shift sales sourced from State 2 to State 4, ceteris paribus (that is, assuming the demand curves and shipping costs for products sold in the two states are the same). It can also be shown that Q_2 increases due to increased marginal profit (due to non-taxability of State 4 sales). As with the analysis in (6), $\partial Q_2 / \partial \tau_2 \succ 0$; conversely, a drop in the effective τ_2 results in an increase in Q_2 and a drop in Q_1. As with the analysis in (6), the effect on ϕ is ambiguous, and the transfer price increases in both states, causing higher costs (a negative externality) in State 1.

The forgoing analysis ignores the effects of apportionment weights, i.e., a switch to SSF. As noted above, a switch to SSF for a firm operating in only separate accounting states has no effect on across-state investment. On the other hand, it can potentially affect where revenues are generated, as discussed above. In this situation rewrite the profit equation for the throwback state as:

$$\pi_2 = [(1-S_w\tau_2)\Theta_2(a_2 Q_2 - bQ_2^2)] - [(1-L_w\tau_2)(w_2 L_2)] - [(1-K_w\tau_2)(rK_2)] \\ - [(1-\tau_2)(p_t Q_2 - sQ_2)] + [(1-S_w\tau_2)(1-\Theta_2)(a_3 Q_2 - b_2 Q_3^2)] \tag{4b}$$

Differentiating (4b) sequentially for increases in S_{w2}, decreases in K_{w2} and L_{w2}, and factoring out τ_2 (an exogenous constant here), we get:

$$\Theta_2\left(-a_2 Q_2 + bQ_2^2\right) + \left(1-\Theta_2\right)\left(-a_3 Q_2 + bQ_2^2\right) = w_2 L_2 + rK_2 . \tag{4c}$$

Thus, increased weights on sales have a muted incentive effect, in this setting. The intuition is as follows. Increased sales weights are effectively a tax on sales; the marginal revenue product curve for the firm shifts down (in) at every level of Q_2 sold in State 4. Similarly, lower weights on labor and capital are tax benefits at every level of factor inputs, shifting the marginal cost curve down/in. Thus, the net effect (depending on the shape of both curves) is little or no change in Q_2, with no resultant effect on other decision variables.

3.3 SSF State Uses Unitary Accounting/Combined Reporting

3.3.1 Out of State Operations are in Unitary States, or are Not Separately Incorporated

The analysis here is identical to that of Section 3.2.2, that is, where the firm does not separately incorporate its out of state operations. In this setting, the two states' unitary systems treat all operations, in both states, "as if" they are part of a single entity, and apply multistate apportionment accordingly. Here, SSF results in increased investment into the SSF state.

However, this effect is muted to the extent the firm sells into other states (where it is not taxable) and the SSF state has sales throwback. Assuming that State 2 switches to SSF and that State 2 is also unitary, rewrite the tax constraints as:

$$\tau_{u1} = \frac{\tau_1}{4}\left(\begin{array}{l} \frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2} + \frac{K_m+K_1}{K_m+K_1+K_2} + \\ 2\cdot\frac{a_1Q_1-bQ_1^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta_2\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta_2\right)\left(a_3Q_2-bQ_2^{\,2}\right)} \end{array} \right),$$

$$\tau_{u2} = \tau_2\left(\begin{array}{l} L_{w2}[\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}] + K_{w2}[\frac{K_m+K_1}{K_m+K_1+K_2}] + \\ S_{w2}[\frac{a_1Q_1-bQ_1^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta_2\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta_2\right)\left(a_3Q_2-b_3Q_2^{\,2}\right)}] \end{array} \right). \qquad (9)$$

3.3.2 Out of State Operations Are in Separate Accounting States

Assume that State 1 is unitary and switches to SSF. State 2 uses separate accounting. In general, SSF decreases weights put on labor and capital in the unitary state, but has no collateral effect on the separate accounting state's tax, since that state taxes 100% of the State 2 profits in any event. Here, there is an incentive in moving capital and labor into the unitary SSF state.

If State 1 also has sales into a State 3 where it is not taxable, and if State 1 has sales throwback, switching to SSF may actually increase taxes. To see this, first examine the general effect of sales throwback before the effects of SSF are examined. Where State 2 is the separate accounting state, write the tax constraints as:

$$\tau_{u1} = \frac{\tau_1}{4}\left(\begin{array}{l} \frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2} + \frac{K_m+K_1}{K_m+K_1+K_2} + \\ 2\cdot\frac{a_1Q_1-bQ_1^{\,2}}{a_1Q_1-bQ_1^{\,2}+\Theta\left(a_2Q_2-bQ_2^{\,2}\right)+\left(1-\Theta\right)\left(a_3Q_2-bQ_2^{\,2}\right)} \end{array} \right),$$

$$Tax_2 = \tau_2 \cdot (a_2 Q_2 - bQ_2{}^2 - p_t Q_2 - w_2 L_2 - rK_2 - sQ_2)\,, \quad \text{and}$$

$$p_t = \frac{rK_m + w_1 L_m}{Q_1 + Q_2} \quad . \tag{10}$$

The additional State 3 sales of Q_1 cause two externalities in State 2. Because of concave production, the increase in Q_3 results in a higher transfer price from the primary manufacturer for both states. Taxes actually increase in State 1 since the denominator of all terms in τ_{u1} decrease due to decreases in L_2, K_2, and Q_2.

Next, consider the effects of State 1 switching to SSF. Rewrite the State 1 tax constraints as:

$$\tau_{u1} = \tau_1 \left(\begin{array}{l} L_{w1}\{\dfrac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2 L_2}\} + K_{w1}\{\dfrac{K_m + K_1}{K_m + K_1 + K_2}\} + \\ S_{w1}\{\dfrac{a_1 Q_1 - bQ_1{}^2 + a_2 Q_3 - b_3 Q_3{}^2}{a_1 Q_1 - bQ_1{}^2 + \Theta_1\left(a_2 Q_2 - bQ_2{}^2\right) + \left(1 - \Theta_1\right)\left(a_3 Q_2 - b_3 Q_2{}^2\right)}\} \end{array} \right) \tag{11}$$

As with previous analysis, the switch to SSF in such a setting (the home state) is clearly tax reducing in State 1. The analysis is more complex if State 2 switches to SSF. Since State 2 has separate accounting, rewrite State 2 tax constraints as:

$$Tax_2 = \tau_2 \cdot [S_{w2}(a_2 Q_2 - bQ_2{}^2) - p_t Q_2 - L_{w2}(w_2 L_2) - K_{w2}(rK_2) - sQ_2)], \tag{12a}$$

if no throwback, and

$$Tax_2 = \tau_2 \cdot [S_{w2}(a_2 Q_2 - bQ_2{}^2 + a_3 Q3 - bQ_3{}^2) - p_t Q_2 - L_{w2}(w_2 L_2) - K_{w2}(rK_2) - sQ_2)], \tag{12b}$$

with sales throwback.

It is intuitive that $\partial Q_2 / \partial S_{w2} > 0$ because the absence of taxes on State 4 sales increases the marginal revenue product of State 4, so K_2, L_2, and P_t all increase beyond the levels caused by the absence of throwback. A negative externality to State 1 results from the increased transfer price. A positive externality for State 1 results from the increase in the denominator of τ_{u2}.

3.4 SUMMARY OF SUBSTITUTION EFFECTS

The model presented in Sections 3.1 through 3.3 show that the substitution effect is quite complex. The substitution effect depends on the tax structure in the SSF state versus the other states in which the firm operates (combined reporting versus separate reporting), and throwback rules used in the states where the firm operates. The model gives a reasonable first approximation by simplifying the world by assuming the firm operates in only one other state besides the SSF state, when in reality, the non-SSF state is likely to be a number of states having a variety of reporting and throwback rules. Empirically, we see that the data only allow us to know with certainty the firm's SSF operations by state, although we can be sure if the firm has multistate operations, if it is primarily based in the SSF state or primarily based elsewhere, etc. However, we do have the clear-cut predictions that if the SSF state has unitary/combined reporting, the substitution effect is generally positive, and that sales throwback in the SSF state generally has a negative substitution effect.

3.5 FIRM CAN CHOOSE BETWEEN TWO STATES

The previous analyses assumed that a given firm faced a choice of changing existing operations in a state(s) in which it already operates. The model is robust to situations where a single facility is expanded, or new facilities are added to augment existing facilities (assuming some interdependence of operations in the same state). Where the firm faces a choice of locating a new facility in a new state, under very restrictive conditions, the firm's location choice is a simple corner solution; holding all other effects constant, the firm would locate in the state having the most generous tax benefits. Of course, tax costs of one type may offset tax benefits of another type, in any one state. Holding all such factors constant, the firm would chose to locate in an SSF state (versus a non-SSF state) if, as noted in Section 2.2, its out of state sales intensity is high relative to its plant (labor plus capital) intensity. At one extreme, if at the new facility the firm intended to serve only that state's customers, sales weighting factors would have only limited effect. At the other extreme, if the firm locates a large facility which serves a large number of other states, an SSF state would be beneficial. Such benefits are increased, if the state uses unitary accounting (combined reporting), and decreased if the state has sales throwback.

4. EMPIRICAL TESTS

To test the above predictions about the effects of single sales factors, we utilize "natural experiments" which occurred recently in five states: Georgia, Louisiana, New York, Oregon, and Wisconsin. Georgia switched from double-weighted sales factors to SSF with a three year phase-in, with sales weightings of 80% in 2006, 90% in 2007, and 100% by 2008[22]. Louisiana completely switched to SSF after 2005[23]. New York switched to 80% sales weighting in 2006, and 100% in 2007 and later years[24]. Oregon completely switched to SSF after July 1, 2005[25]. Wisconsin switched to 60% sales weighting in 2006, 80% in 2007, and 100% in 2008 and later years[26].

4.1 Econometric Approach

In this section, the econometric approach and the unit of analysis for measuring the labor and sales impact, from a state switching to a single sales factors (SSF) designation in 2006, is described. Only firms with multi-state operations are affected, and are denoted as SSFA. The paper examines the impact of the SSF at the establishment level, for every location of the firm. The advantages of using establishment-level locations, instead of aggregate firm operations, are: 1. comparisons to non- SSF firms are less influenced by size effects (SSF firms tend to be larger than non-SSF firms, but this is less severe when individual establishment locations are examined); and 2. more powerful tests are enabled with a larger number of observations. The analysis considers the effects of trends by using a differences in differences (DID) estimation method[27]. In contrast to a within-subjects estimate of the treatment effect (that measures the difference in an outcome after and before treatment), or a between-subjects estimate of the treatment effect (that measures the difference in an outcome between the treatment and control groups), the DID estimator represents the difference between the pre-post, within-subjects differences of the treatment and control groups.

The basic premise of DID is to examine the effect of some sort of treatment by comparing the treatment group after treatment, both to the treatment group before treatment, and to some other control group. While it might be tempting to consider simply looking at the treatment group before and after treatment, to try to deduce the effect of the treatment, a number of other factors might be going on at the exact same time as the treatment. DID uses a control group to control for the effects of other changes at the same time, assuming that these other changes were similar

[22] O.C.G.A Sec. 48-7-31
[23] Sec. 47:287.95(F)(2)(a)
[24] Sec. 210 (3)(a)(10) Tax Law
[25] Sec. 314.650 ORD
[26] Sec. 71.25(6) Wisc. Stats.
[27] For examples of the DID method, see Card and Kreuger (1994); and also Ham, Swenson, Imrohoroglu, and H. Song (2011)

between the treatment and control groups.

Because only some of the firms in a state have multi-state operations and are affected by the SSF, the control group of firms was designated which are single-state only, and are not affected by the SSF (denoted as SSFN). With DID estimation methods, we can use this latter group of firms as a control. Unfortunately, using matched pairs of SSFA and SSFN firms is problematic; because SSFA and SSFN firms may vary on a number of attributes, any resultant matching appears difficult. Instead, these two groups of firms are pooled in state-by-state regressions. Because the analysis did not have access to a national firm dataset (such a dataset is prohibitively costly[28]), standard errors may be inflated, which would bias against finding results. Later, we shall see that despite such a conservative approach, the data reveals the significant impacts of SSF adoption. The DID estimation method is discussed next.

Assume a state switches to SSF in year t. Consider SSFA and SSFN firm locations i. The employment changes in t+1 for these locations, are

$$Y_{it+1} = X_{it+1}\beta + \alpha_i + \delta SSFA + \gamma_i T_{t+1} + \sum_{i=1}^{T} \eta_j \left(T_{t+1}\right)^l + \varepsilon_{it+1} \tag{13}$$

where X_{it+1} is a vector of explanatory variables not affected by the SSFA designation, and *T* is time. Note that we are assuming that both SSFA and SSFN areas share general trends, and we can allow higher order trends as well.

The corresponding outcomes for t and t-1 for i (and omitting the δ SSFA terms) are

$$Y_{it} = X_{it}\beta + \alpha_i + \gamma_i T_t + \sum_{i=1}^{T} \eta_j \left(T_t\right)^l + \varepsilon_{it} \ , \tag{14}$$

and

$$Y_{it-1} = X_{it-1}\beta + \alpha_i + \gamma_i T_{t-1} + \sum_{i=1}^{T} \eta_j \left(T_{t-1}\right)^l + \varepsilon_{it-1} \ , \tag{15}$$

respectively.

For each i we take first differences between t+1 and t in the outcome,

$$Y_{it+1} - Y_{it} = \left(X_{it+1} - X_{it}\right)\beta + \delta SSFA_{t+1} + \gamma_i + \eta_j \left[\left(T_{t+1}\right)^l - \left(T_t\right)^l\right] + \varepsilon_{it+1} - \varepsilon_{it} \tag{16}$$

as well as differences in the outcome between

$$Y_{it} - Y_{it-1} = \left(X_{it} - X_{it-1}\right)\beta + \delta SSFA_{t-1} + \gamma_i + \eta_j \left[\left(T_t\right)^l - \left(T_{t-1}\right)^l\right] + \varepsilon_{it} - \varepsilon_{it-1} \ . \tag{17}$$

[28] A full national dataset costs in excess of $100,000. One potential limitation of not having a national dataset is that we cannot compare outcomes (employment and sales) to similar, multistate firms in other states. The counter-argument is that by including multiple states into the analysis, we potential introduce idiosyncratic state effects (from another of other states) into the analysis.

Double differencing by subtracting (17) from (16) for each i yields

$$\begin{aligned} Z_i &= \left[\left(Y_{it+1} - Y_{it}\right) - \left(Y_{it} - Y_{it-1}\right)\right] \\ &= \left[\left(X_{it+1} - 2X_{it} + X_{it-1}\right)\right]\beta + \delta SSFA_{t+1} \\ &+ \eta_j\left[\left(T_{t+1}\right)^{\gamma} - 2\left(T_t\right)^{\gamma} + \left(T_{t-1}\right)^{\gamma}\right] + \left(\varepsilon_{it+1} - 2\varepsilon_{it} + \varepsilon_{it-1}\right) \quad . \end{aligned} \tag{18}$$

A research design questions is: what set of SSFN firms do we use as a control group? In the following analyses we use two such control groups: all other firms in the SSF state; and all other firms in the state which are multi-location (but have no multistate operations). This latter control group may bear more similarity to SSF firms, but the trade-off is that there are fewer of them, and this reduces the power of our tests.

As a validation of the DID approach, we also use a simple levels change model, which looks at levels of employment over time in both the SSF and SSFN firms, as a function of the prior year's employment, as follows:

$$Y_{it-1} = X_{it}\beta + \alpha_i + \delta\, SSFA_t + \zeta_t YR_t + \varepsilon_{it} \quad , \tag{19}$$

where YR are year indicator variables. SSFA is set to 1 if the firm is subject to SSF (and zero otherwise), and the year is set to 1 after SSF enactment (and zero otherwise).

As a final specification test, we run the above models state-by-state, and also with all five states pooled.

4.2 Data

The 2008 National Establishment Time-Series (NETS) Database is a unique, firm (and location) specific database derived from the Dun & Bradstreet data, the latter of which is used commercially. This data set became available to academics in 2007. The 2008 NETS Database includes an annual time-series of information on over 36.5 million U.S. establishments from January 1990 to January 2008. Since the current Database is based on 19 "snapshots" taken every January of the Dun and Bradstreet data, it reflects the economic activity of the previous years (1989-2008). The Database is as close to an annual census of American business as exists. Among other establishment level items, this database reports sales, employment, industry (at 8 digit levels), exact location, and affiliation with other establishments (parents, subsidiaries, number of other establishments within the same legal entity).

A number of academic papers have begun to use this database.[29] It is important to note that each observation is a single location, i.e., observations are not aggregated to the entity level. Such disaggregation allows for very powerful tests by increasing the number of observation, and

[29] For example, N. Wallace (U.C. Berkeley) has a paper on "Agglomeration Economies and the HiTech Computer Sector": http://repositories.cdlib.org/iber/fcreue/fcwp/292 and "The Role of Job Creation and Job Destruction Dynamics" in Glaeser & Quigley, Housing Markets and the Economy (2009).

avoiding any “masking” of effects, which might occur with aggregate data, if firms simply move employees from one location to another.

Recall from earlier in the paper that we predict potentially different results for in-state based firms, versus out of state firms. Accordingly, we identify each location as belonging to either set[30] for the SSFA firms. Although the primary variable of interest is employment, the NETS data also reports sales, so we examine this variable as a collateral measure of business expansion.

4.4 Results

4.4.1 Georgia

Descriptive statistics for Georgia are shown in Table 1 for 2002 through 2008. There are 1,182,732 observations (recall that observations are individual locations). However, only 298,675 have complete sets of data; on average (sales and employment from 2002 through 2008), 45,668 of the complete observations belong to the SSFA group.

The overall state sample (both SSFA and SSFN firms) shows a mean sales decline of 21% for 2006-2008 (post SSF). Throughout the analysis, it is important to note that the recession began in late 2007, and continued through 2008. Accordingly, we would expect downward trends in employment during this period. SSFA firms show sales changes in the same time period of +3.7%. Thus, average SSFA locations showed higher sales growth after SSF enactment. For employment, the Table shows that for all firms, employment declined 18.3%, post-SSF adoption, while SSFA firms exhibit a 4.1% employment growth, after Georgia became an SSF state.

Regression results for Georgia are reported in Table 6. Regression results for sales are shown in the left side of the Table. Model 1 uses all non SSF firms as the control (omitted) group; Model 2 uses only multi-location, single state firms as a control group. Both models use a difference in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification, simply models annual sales as a lagged function of previous years’ sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state-based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF dominated the positive substitution effect.

Regression results for employment, using the same three model specifications, are shown in the right side of Table 6. Consistent with expectations, locally based firms increased employment

[30] In the NETS dataset, a multi-state firm is out of state if its DUNSHQ state is different form the state in which in which the location operates. An instate, multi-state firm has a DUNSHQ in the same state.

(for all models, at a .001 level of significance) after enactment of SSF. Two of the three models show that out of state-based firms decreased their local employment, indicating that the negative income effect dominated the positive substitution effect.

4.4.2.Louisiana

Descriptive statistics for Louisiana are shown in Table 2 for 2002 through 2008. Note that major hurricanes hit Louisiana in late 2005, but their aftermaths have unclear differential effects on SSF versus non-SSF firms, a priori. There are 532,386 observations (recall that observations are individual locations). However, only 248,526 have complete sets of data, and on average (sales and employment from 2002 through 2008), 40,511 of these belong to the SSFA group.

The overall state sample (both SSFA and SSFN firms) shows a mean sales increase of 13% from 2006 to 2008 (post SSF). SSFA firms show sales growth in the same time period of 3.7%. For employment, the Table shows that for all firms, employment declined 17% post-SSF adoption, while SSFA firms exhibit a 7% employment growth after Louisiana became an SSF state.

Regression results for Louisiana are reported in Table 7. Regression results for sales are shown in the left of the Table. Model 1 uses all non SSF firms as the control (omitted) group; model 2 uses only multi-location, single state firms as a control group. Both models use a difference in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification, simply models annual sales as a lagged function of previous years' sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF, dominated the positive substitution effect.

Regression results for employment, using the same three model specifications, are shown in the right side of Table 7. Consistent with expectations, locally based firms increased employment (for all models, at a .001 level of significance) after enactment of SSF. For out of state based firms, there is not much change in employment (although one of the three models shows a significant employment decline), indicating that the negative income effect may have offset the positive substitution effect.

4.4.3 New York

Descriptive statistics for New York are shown in Table 3 for 2002 through 2008. There are 2,433,791 observations (recall that observations are individual locations). However, only 1,098,706 have complete sets of data; on average (sales and employment from 2002 through 2008), 122,819 of these observations with complete data belong to the SSFA group.

The overall state sample (both SSFA and SSFN firms) shows a 22.7% sales decline for 2006-2008 (post SSF). As noted previously, it is important to note that the recession began in late 2007, and continued through 2008. SSFA firms show sales changes in the same time period of +7.1%. Thus, average SSFA locations showed higher sales growth after SSF enactment. For employment, the Table shows that for all firms, sales declined 12.5% post-SSF adoption, while SSFA firms show sales growth of 3.1% for post SSF adoption.

Regression results for New York are reported in Table 8. Regression results for sales are shown in the left side of the Table. Model 1 uses all non SSF firms as the control (omitted) group; Model 2 uses only multi-location, single state firms as a control group. Both models use a differences in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification, simply models annual sales as a lagged function of previous years' sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF, dominated the positive substitution effect.

Regression results for employment, using the same three model specifications, are shown in the right side of Table 8. Consistent with expectations, locally based firms increased employment (for all models, at a .001 level of significance) after enactment of SSF. Two of the three models show that out of state-based firms decreased their local employment, indicating the negative income effect, dominated the positive substitution effect.

4.4.4 Oregon

Descriptive statistics for Oregon are shown in Table 4 for 2002 through 2008. There are 538,231 observations (recall that observations are individual locations). However, only 235,198 have complete sets of observations; on average (sales and employment from 2002 through 2008), 31,841 of these observations with complete data belong to the SSFA group.

The overall state sample (both SSFA and SSFN firms) shows mean sales declines of 3.7% for 2006-2008 (post SSF). As noted previously, it is important to note that the recession began in late 2007, and continued through 2008. SSFA firms show sales increases in the same time period of 12.5%. Thus, average SSFA locations showed higher sales growth after SSF enactment. For employment, the Table shows that for all firms, employment declined 8.5% post-SSF adoption, while SSFA firms show 6.6% increases in employment post-SSF adoption.

Regression results for Oregon are reported in Table 8. Regression results for sales are shown in the left side of the Table. Model 1 uses all non SSF firms as the control (omitted) group; Model 2 uses only multi-location, single state firms as a control group. Both models use a difference in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification; simply models annual sales as a lagged function of previous years' sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state-based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF, dominated the positive substitution effect.

Regression results for employment, using the same three model specifications, are shown in the right side of Table 8. Consistent with expectations, locally-based firms increased employment (for all models, at a .001 level of significance) after enactment of SSF. Two of the three models show that out of state-based firms decreased their local employment, indicating the negative income effect, dominated the positive substitution effect.

4.4.5 Wisconsin

Descriptive statistics for Wisconsin are shown in Table 5 for 2002 through 2008. There are 602,327 observations (recall that observations are individual locations). However, only 298,675 have complete sets of data; on average (sales and employment from 2002 through 2008), 45,668 of these observations with complete data belong to the SSFA group.

The overall state sample (both SSFA and SSFN firms) shows a mean sales decline of 8.1% for 2006-2008 (post SSF). As noted previously, it is important to note that the recession began in late 2007, and continued through 2008. SSFA firms show sales changes in the same time period of +9.2%. Thus, average SSFA locations showed higher sales growth after SSF enactment. For employment, Table 5 shows that for all firms, employment declined 12.2% post-SSF adoption, while SSFA firms exhibit a 4.3 % employment growth after Georgia became an SSF state.

Regression results for Wisconsin are reported in Table 10. Regression results for sales are shown in the left side of the Table. Model 1 uses all non SSF firms as the control (omitted) group; Model 2 uses only multi-location, single state firms as a control group. Both models use a difference in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification, simply models annual sales as a lagged function of previous years' sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF, dominated the positive substation effect.

Regressions results for employment, using the same three model specifications, are shown in the right side of Table 6. Consistent with expectations, locally-based firms increased employment (for all models, at a .001 level of significance) after enactment of SSF. Two of the three models show that out of state-based firms did not significantly change their local employment, indicating the negative income effect may have offset the positive substitution effect.

4.4.6 All States Combined

The advantage of analyzing each of the five SSF states individually is that it allows for differing state trends. However, the effects of individual state policies, such as unitary versus separate accounting, and sales throwback, cannot be directly tested since the same policy applies to all firms in that state. If we pool observations from all states, we can test the mitigating effects of such state policies on investment after SSF, noting that noise may be introduced into the sample due to differing economic trends across the states.

For this analysis, we add two dummy variables if the state follows unitary accounting/combined reporting (one for locally-based multistate firms, and one for out of state based multistate firms, and each set to zero for all other firms). Recall from the theory, that if the SSF state is also unitary, there is an additional tax advantage to investment in the state after SSF enactment (a positive substitution effect), which should be an increasing function of investment in that state (i.e., more significant for locally-based firms). Here, only Oregon follows unitary (combined) reporting.[31]

We also add two dummy variables if the state has sales throwback (one for locally-based multistate firms, and one for out of state based multistate firms, and each set to zero for all other firms). Recall from the theory, that if the SSF state has sales throwback, there is a decreased tax advantage to investment in the state after SSF enactment (a negative substitution effect), which should be an increasing function of investment in that state (i.e., more significant for locally-based firms). Here, only Oregon and Wisconsin have sales throwback.[32]

Regression results are reported in Table 11. Regression results for sales are shown in the

[31] Note that *after* 2008, Wisconsin switched to combined reporting, and New York began requiring combined reporting for firms with substantial inter-company transactions
[32] For each dummy variable (unitary and throwback), the omitted state (to avoid colinearity) is Georgia, which follows separate accounting, and does not have throwback.

left side of the Table. Model 1 uses all non SSF firms as the control (omitted) group; Model 2 uses only multi-location, single state firms as a control group. Both models use a difference in differences (DID) design. Model 3 uses all non-SSF firms as controls, and instead of a DID specification; simply models annual sales as a lagged function of previous years' sales. Consistent with expectations, all three models show that locally-based multi-state firms expanded operations (in terms of local sales, significant at .001 for all models) after SSF enactment. In contrast, all models show that out of state based firms scaled back their operations (in terms of locally based sales), indicating that the negative income effect of the SSF, dominated the positive substation effect. Both of these findings are consistent with the by-state regression results.

For throwback, we see that locally-based firms experience reduced sales in throwback states, after SSF enactment, in all regressions. In contrast, out of state-based firms' sales are not significantly affected by SSF in throwback states. Consistent with expectations, out of state-based firms experience sales growth after SSF enactment in unitary states, but there is very little effect for out of state-based firms.

Regressions results for employment, using the same three model specifications, are shown in the right of Table 11. Consistent with expectations, locally based firms increased employment (for all models, at a .001 level of significance) after enactment of SSF. Two of the three models show that out of state-based firms did not significantly change their local employment, indicating the negative income effect may have offset the positive substitution effect. For throwback, consistent with expectations, we see a negative effect for locally-based firms, and relatively little effect for out of state-based firms. For unitary tax structures, we see that employment increased for locally-based firms (in two out of the three models) in unitary states, but there was no effect for out of state-based firms in unitary states.

In summary, the pooled states' regressions are supportive of predictions. That is, after SSF enactment: locally-based firms expanded their operations; out of state-based firms did not change or decreased their operations; states with unitary tax structures (here, Oregon) resulted in incremental business activity for locally-based firms (but not out of state-based firms); and states with sales "throwback" (Oregon and Wisconsin) had a dampening effect on locally-based businesses (but not out of state-based businesses).

Recall from the theory section that there may be some accentuation of policy effects based on tax rates. While the tax rate effects are relative (rates in the state switching to SSF, versus rates in all other states where the firm operates) and we can only observe tax rates in the SSF state, we might nonetheless be able to detect some tax rate effects. Accordingly, variables were multiplied by average (of 2005-8) top corporate rates for each of the SSF states. Regression results from these newly-measured variables are reported in Table 12. As can be seen results are not much different from Table 11 results, and F tests show these new models' fits are about the same as those shown in Table 11. The apparent lack of incremental explanatory power of tax rates may be due to the modest differences in tax rates across the 5 states examined, or alternatively, due to the inability (with the data available) to test for the effects of relative tax rates.

5. CONCLUSION

This study examines whether switching to an SSF weighting system for corporate state income taxation is effective in attracting business to a state. Because a firm's overall state tax liability is a function of where its payroll (people), property (factories or facilities) and sales are located, relative differences in state apportionment rules should result in the firm making such resource decisions. Results of a firm model find that the firm would make such resource allocation changes to minimize company-wide state taxes, but only under certain conditions. The theory's predictions are then empirically tested using firm/location specific data for five states which switched from double-weighted sales to SSF in 2006: Georgia, Louisiana, New York, Oregon, and Wisconsin. Using a difference in differences econometric model which is able to discern firms which are affected by SSF, the model finds that SSF does in fact increased overall employment in these states after adoption. However, this net employment increase was comprised of an employment increase for locally-based firms, and a decrease for out of state-based firms.

The policy implications of this may be important since policy-makers have assumed that switching to SSF would attract businesses to their states, and/or encourage expansion of already existing businesses. This study provides results which suggest that the policy-makers are generally right, but there will also be "winners" (locally-based firms) and losers (out of state based firms). Of course, such policy implications should be tempered; the use of a general equilibrium model may be appropriate to examine the total effects on both a state's economy and its overall tax base.

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Appendix 1

Table 1a-General[33] Factor Apportionment, and Sales Throwback, by State for Time Period Examined (as of 12/31/2008; top statutory corporate income tax rate in parentheses)

State (Top Marginal Rate)	Sales, Property, and Payroll Weights:	Sales Throwback	State (Top Marginal Tax Rate)	Sales, Property, and Payroll Weights	Sales Throwback
			Missouri (6.25%)	1/3 each	Yes
Alabama (6.5%)	1/3 each	Yes	Montana (6.75%)	1/3 each	Yes
Arizona (6.968%)	.5,.25,.25	No	Nebraska (7.81%)	1.0,0,0	No
Arkansas (6.5%)	.5,.25,.25	Yes	Nevada	N/a-no tax	N/a-no tax
California (8.84%)	.5,.25,.25	Yes	New Hampshire (8.5%)	.43,.285,.285	Yes
Colorado (4.63%)	1/3 each	Yes	New Jersey (9%)	.5,.25,.25	No
Connecticut (7.5%)	.5,.25,.25	No	New Mexico (7.6%)	1/3 each	Yes
Delaware (8.7%)	1/3 each	No	New York (7.5%)	1.0,0,0	No
Florida (5.5%)	.5,.25,.25	No	North Carolina (6.9%)	.5,.25,.25	No
Georgia (6%)	1.0,0,0	No	North Dakota	1/3 each	Yes
Hawaii (6.4%)	1/3 each	Yes	Ohio (6.8%)*	.5,.25,.25	No
Idaho (7.6%)	.5,.25,.25	Yes	Oklahoma (6%)	1/3 each	No
Illinois (4.8%)	1.0,0,0	Yes	Oregon (6.6%)	1.0,0,0	Yes
Indiana (8.5%)	.5,.25,.25	Yes	Pennsylvania (9.99%)	.5,.25,.25	No
Iowa (12%)	1.0,0,0	No	Rhode Island (9%)	1/3 each	No
Kansas (4%)	1/3 each	Yes	South Carolina (5%)	1/3 each	No
Kentucky (7%)	.5,.25,.25	No	South Dakota	N/a-no tax	N/a-no tax
Louisiana (8%)	1.0,0,0	No	Tennessee (6.5%)	.5,.25,.25	No
Maine (8.93%)	.5,.25,.25	Yes	Texas*(4.5%)	1.0,0,0	
Maryland (7%)	.5,.25,.25	No	Utah (5%)	1/3 each	Yes
Massachusetts (9.5%)	1.0,0,0	Yes	Vermont (8.9%)	1/3 each	Yes

[33] Note that these formulas are general; certain industries may elect (or are required) to use different formulas

Michigan* (1.9%)	.9,.05,.05	Yes
Minnesota (9.8%)	.7,.15,.15	No
Mississippi (5%)	1/3 each	Yes
Virginia (6%)	1/3 each	No
Washington	N/a-no income tax	N/a-no income tax
West Virginia (9%)	.5,.25,.25	No
Wisconsin (7.9%)	1,0,0	Yes
Wyoming	N/a-no tax	N/a-no tax

*Michigan, Ohio, and Texas had structural changes largely effective after 2008 which are not reflected in the above table

Appendix 1

Table 1b-Updated Factor Apportionments (As of 2010)

State	Sales, Property, and Payroll Weights:	State	Sales, Property, and Payroll Weights
		Missouri	1/3 each[34]
Alabama	1/3 each	Montana	1/3 each
Arizona	.5,.25,.25	Nebraska	1.0,0,0
Arkansas	.5,.25,.25	Nevada	N/a-no tax
California	.5,.25,.25	New Hampshire	.43,.285,.285
Colorado	1/3 each[35]	New Jersey	.5,.25,.25
Connecticut	.5,.25,.25[36]	New Mexico	1/3 each
Delaware	1/3 each	New York	1.0,0,0
Florida	.5,.25,.25	North Carolina	.5,.25,.25
Georgia	1.0,0,0	North Dakota	1/3 each
Hawaii	1/3 each	Ohio	1.0,0,0[37]
Idaho	.5,.25,.25	Oklahoma	1/3 each
Illinois	1.0,0,0	Oregon	1.0,0,0
Indiana	.5,.25,.25[38]	Pennsylvania	.5,.25,.25
Iowa	1.0,0,0	Rhode Island	1/3 each
Kansas	1/3 each[39]	South Carolina	1/3 each[40]
Kentucky	.5,.25,.25	South Dakota	N/a-no tax
Louisiana	1.0,0,0	Tennessee	.5,.25,.25
Maine	1.0,0,0	Texas	1.0,0,0
Maryland	.5,.25,.25[41]	Utah	1/3 each
Massachusetts	1.0,0,0	Vermont	1/3 each
Michigan	.9,.05,.05[42]	Virginia	.5,.25,.25
Minnesota	1.0,0,0	Washington	N/a-no income tax
Mississippi	1.0,0,0	West Virginia	.5,.25,.25
		Wisconsin	1,0,0
		Wyoming	N/a-no tax

See also notes in text about SSF restrictions to certain industries, for certain states.

[34] SSF is elective
[35] Starting in on or after January 1, 2009, multistate corporations must use SSF
[36] Financial service companies, broadcasters, and manufacturers must use SSF
[37] Under commercial activity tax
[38] SSF is being phased in and will be complete in 2011.
[39] SSF applies to certain industries
[40] SSF applies to certain industries
[41] SSF applies to certain industries
[42] SSF applies to certain situations

Appendix 2

Supporting Equations

Second Order Effects Of Tax Rates Where Firm Operates In Only Separate Accounting States

As noted, the transfer price is the average unit cost of the manufacturing center. Since the production function exhibits decreasing returns to scale, the transfer price is increasing in total sales. This means that each state imposes an externality on the other state. By increasing sales in one state, costs increase for the other state. Given this externality, in the global optimum solution, it is desirable to under-produce in each state such that the marginal after-tax profit in each state of an additional unit exactly equals the externality imposed on the other state. If the tax rate increases, the marginal pre-tax profit must increase to maintain this balance. Therefore, sales can be expected to decline slightly in response to a tax rate increase due to this indirect effect. Analytically, given (4) and with π_{S1}^{p} defined as State 1 pretax profit:

$$(1-\tau_1)\frac{\partial \pi_{S1}^{p}}{\partial Q_1} = (1-\tau_2)Q_2\frac{\partial p_t}{\partial Q_1},$$

$$\frac{\partial p_t}{\partial Q_1} / \frac{\partial \pi_{S1}^{p}}{\partial Q_1} = \frac{(1-\tau_1)}{(1-\tau_2)Q_2}. \tag{A1}$$

The left hand side of (5) is a function of Q_1. Define it as

$$h(Q_1) = \frac{\partial p_t}{\partial Q_1} / \frac{\partial \pi_{S1}^{p}}{\partial Q_1}.$$

Given that the transfer price is convex (since production is concave) and pre-tax profits are concave in output, h is monotone increasing, which implies that its inverse is also monotone increasing. Define that inverse as $H = h^{-1}$. Then $H' > 0$. From (A1),

$$Q_1 = H\left[\frac{(1-\tau_1)}{(1-\tau_2)Q_2}\right],$$

$$\frac{\partial Q_1}{\partial \tau_1} = \frac{-1}{(1-\tau_2)Q_2} H'\left[\frac{(1-\tau_1)}{(1-\tau_2)Q_2}\right] < 0. \tag{A2}$$

It can be readily demonstrated that $\partial Q_2 / \partial \tau_1 > 0$ since a decrease in Q_1 decreases the transfer price, providing an incentive to increase Q_2 (this effect will partially offset the change in p_t, so that on net the impact of the tax rate on the transfer price will be small). The effect of the tax rate on Φ is unclear; it is possible for the sign to be either positive or negative. As a consequence, the effect of the tax rate on labor and capital is also unclear, although labor and capital in each state are likely to move in the same direction as sales.

The analysis of τ_2 is identical to the analysis of τ_1. The effects of tax rates in this setting are summarized as follows. First, higher rates in State 1 will decrease that state's sales and increase the State 2 sales (from 6). Conversely lower rates in State 1 will increase that state's sales, and decrease sales in the State 2. Second, tax rates have an ambiguous effect on other decision variables in the firm. Finally, all effects of tax rates are second order in nature.

Effects Of Sales Throwback Where Firm Only Operates in Separate Accounting States

Since taxes are the identical on sales into either state (both are taxed by state 2 under throwback), they are non-distortionary on interstate sales decisions. The rate of substitution between state sales is:

$$\Theta_2 = \frac{(a_2 - 2b_2)(1-\tau_2)}{(a_3 - 2b_3)(1-\tau_2)} \tag{A3}$$

The tax rates cancel out, and Θ_2 is unaffected by taxes. On the other hand, where State 2 has no throwback, State 3 sales escape income taxation, and (4) is rewritten:

$$\pi_{S2} = (1-\tau_2)\Theta_2[(a_2Q_2 - bQ_2^2) + (-w_2L_2 - rK_2 - p_tQ_2 - sQ_2)] + \left(a_3Q_2 - b_3Q_2{}^2\right)(1-Q) \tag{A4}$$

and the rate of substitution of sales between states is:

$$\Theta_2 = \frac{(a_2 - 2b_2)(1-\tau_2)}{(a_3 - 2b_3)} \tag{A5}$$

Thus, depending on the relative state demand curves, some sales may be shifted from State 2 to State 4.

Effects of Tax Rates in Purely Unitary Setting, Or Where State 2 Operations are Not Separately Incorporated

First consider the effect of changes in tax rates on ϕ (holding the *Q*'s constant). Consider the first order condition for the optimal choice of ϕ :

$$\frac{\partial \pi}{\partial \phi} = -\frac{\partial \tau_u}{\partial \phi}\pi^p - (1-\tau_u)\left[w_1\left(\frac{\partial L_m}{\partial \phi} + \frac{\partial L_1}{\partial \phi}\right) + w_2\frac{\partial L_2}{\partial \phi} + r\left(\frac{\partial K_m}{\partial \phi} + \frac{\partial K_1}{\partial \phi} + \frac{\partial K_2}{\partial \phi}\right)\right] = 0 \tag{A6}$$

where π^p is pre-tax profit. Define

$$f(\phi) = w_1\left(\frac{\partial L_m}{\partial \phi} + \frac{\partial L_1}{\partial \phi}\right) + w_2\frac{\partial L_2}{\partial \phi} + r\left(\frac{\partial K_m}{\partial \phi} + \frac{\partial K_1}{\partial \phi} + \frac{\partial K_2}{\partial \phi}\right). \tag{A7}$$

Also define $F = f^{-1}$. It can easily be shown that $\frac{\partial^2 L_i}{\partial \phi^2} > 0$ and $\frac{\partial^2 K_i}{\partial \phi^2} > 0$ for all *i*. Thus, $f'(\phi) > 0$. The inverse of every monotone function is also monotone; hence, $F' > 0$. Rearranging (A7) ,

$$f(\phi) = -\frac{\pi^{\mathrm{p}}}{1-\tau_u}\frac{\partial \tau_{\mathrm{u}}}{\partial \phi}, \quad \text{and}$$

$$\phi = \mathrm{F}\left(-\frac{\pi^{\mathrm{p}}}{1-\tau_u}\frac{\partial \tau_{\mathrm{u}}}{\partial \phi}\right).$$

Holding the Q's constant, ϕ 's only effect on τ_u is through a shift in property and payroll between the manufacturing center and the State 2 final production center. Increasing ϕ increases the weight given to State 1 for those two components:

$$\frac{\partial \tau_u}{\partial \phi} = \frac{(\tau_1 - \tau_2)}{4}\left[\partial \frac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2 L_2} / \partial \phi + \partial \frac{K_m + K_1}{K_m + K_1 + K_2} / \partial \phi\right].$$

Both partial derivatives in the brackets are positive, thus $\partial\left(\frac{\partial \tau_u}{\partial \phi}\right) / \partial(\tau_1 - \tau_2) > 0$. Given (A5),

$$\frac{\partial \phi}{\partial(\tau_1 - \tau_2)} = -F'\left(-\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial \phi}\right)\frac{\pi^p}{1-\tau_u}\partial\left(\frac{\partial \tau_u}{\partial \phi}\right) / \partial(\tau_1 - \tau_2) < 0. \qquad \text{(A9)}$$

Note that in the above differentiation, the minor effect that the tax rate differential can have on $\frac{\pi^p}{1-\tau_u}$. is ignored. That is a necessary simplification that is not expected to affect the results.

Now consider the effect of changes in tax rates on sales quantities, holding ϕ constant. The first order condition is

$$\frac{\partial \pi}{\partial Q_i} = -\frac{\partial \tau_u}{\partial Q_i}\pi^p - (1-\tau_u)\left(-a_1 + 2bQ_i + w_1\frac{\partial L_m}{\partial Q_i} + w_i\frac{\partial L_i}{\partial Q_i} + r\left(\frac{\partial K_m}{\partial Q_i} + \frac{\partial K_i}{\partial Q_i}\right) + s\frac{\partial Q_2}{\partial Q_i}\right) = 0\,. \qquad \text{(A10)}$$

Define

$$g_i(Q_i) = -a_1 + 2bQ_i + w_1\frac{\partial L_m}{\partial Q_i} + w_i\frac{\partial L_i}{\partial Q_i} + r\left(\frac{\partial K_m}{\partial Q_i} + \frac{\partial K_i}{\partial Q_i}\right) + s\frac{\partial Q_2}{\partial Q_i}.$$

Also define $G_i = g_i^{-1}$. Due to decreasing returns to scale, the second derivatives of capital and labor usage with respect to Q_i are all positive. The second derivative of Q_2 with respect to Q_i is 0. Therefore, $g_i' > 0$ and $G_i' > 0$. Rearranging (A7) yields

$$g_i(Q_i) = -\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial Q_i}.$$

$$Q_i = G_i\left(-\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial Q_i}\right).$$

$$\frac{\partial Q_i}{\partial(\tau_1 - \tau_2)} = -G_i'\left(-\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial Q_i}\right)\frac{\pi^p}{1-\tau_u}\partial\left(\frac{\partial \tau_u}{\partial Q_i}\right) / \partial(\tau_1 - \tau_2). \qquad \text{(A11)}$$

Holding ϕ constant, increasing Q_i increases state *i*'s weight on all three factors.

$$\frac{\partial \tau_u}{\partial Q_i} = \frac{(\tau_1 - \tau_2)}{4}\left[\partial \frac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2 L_2} / \partial Q_i + \partial \frac{K_m + K_1}{K_m + K_1 + K_2} / \partial Q_i + 2\partial \frac{a_1 Q_1 - bQ_1^{\,2}}{a_1 Q_1 - bQ_1^{\,2} + a_2 Q_2 - bQ_2^{\,2}} / \partial Q_i\right].$$

The partial derivatives are all positive for *i* = 1 and negative for *i* = 2. Thus,

$$\partial\left(\frac{\partial \tau_u}{\partial Q_1}\right) / \partial(\tau_1 - \tau_2) > 0 \quad \text{and} \quad \partial\left(\frac{\partial \tau_u}{\partial Q_2}\right) / \partial(\tau_1 - \tau_2) < 0.$$

Given that $G_i' > 0$, (12) implies that

$$\frac{\partial Q_1}{\partial(\tau_1 - \tau_2)} < 0 \quad \text{and} \quad \frac{\partial Q_2}{\partial(\tau_1 - \tau_2)} > 0. \qquad \text{(A12)}$$

The effect of tax rates on the labor and capital inputs can be derived from the effects on the *Q*'s and ϕ. Unfortunately, these effects rarely all work in the same direction, so comparative statics are clear in only two cases, those involving L_2 and K_2. Both of those are increasing in Q_2, decreasing in ϕ, and unaffected by Q_1. Therefore,

$$\frac{\partial L_2}{\partial(\tau_1 - \tau_2)} > 0 \quad \text{and} \quad \frac{\partial K_2}{\partial(\tau_1 - \tau_2)} > 0\,. \qquad \text{(A13)}$$

The effect of tax rates on L_1 and K_1 is unclear since they are positively affected by Q_1 and negatively affected by ϕ, leading to a conflicting effect with an ambiguous net result. L_m and K_m are also ambiguous since they are positively affected by ϕ, Q_1, and Q_2. The effects of Q_1 and Q_2 are roughly offsetting, so it is likely that the ϕ effect dominates, in which case

$$\frac{\partial L_m}{\partial(\tau_1 - \tau_2)} < 0 \quad \text{and} \quad \frac{\partial K_m}{\partial(\tau_1 - \tau_2)} < 0. \qquad \text{(A14)}$$

Table 1
Descriptive Statistics
Georgia

All Firms (298,675 locations*)					**Purely Multi-state Firms (45,668 locations*)**		
	Mean	**Mini-mum**	**Maximum**		**Mean**	**Mini-mum**	**Maximum**
Sales-2002	$2,931,292	0	$30,641,819,300		$12,653,724	$258	$30,641,819,300
Sales-2003	$2,618,963	0	$38,472,998,100		$12,573,779	$446	$38,472,998,100
Sales-2004	$2,335,852	0	$39,479,732,100		$12,039,723	$237	$39,479,732,100
Sales-2005	$2,262,225	0	$37,115,475,400		$12,220,759	$500	$37,115,475,400
Sales-2006	$2,342,061	0	$122,324,566,000		$15,136,786	$500	$122,324,566,000
Sales-2007	$1,953,795	0	$21,205,800,000		$12,795,421	$104	$21,205,800,000
Sales-2008	$1,793,890	0	$23,295,600,000		$12,670,457	$900	$23,295,600,000
Employees-2002	18.23	1	31,680		70.04	1	31,680
Employees-2003	16.37	1	30,000		69.75	1	30,000
Employees-2004	15.70	1	30,000		69.33	1	30,000
Employees-2005	15.07	1	30,000		70.01	1	30,000
Employees-2006	13.82	1	32,000		72.87	1	30,500
Employees-2007	13.29	1	34,000		72.95	1	30,500
Employees-2008	12.30	1	36,000		72.85	1	31,000

	All Firms	**SSF Firms**
Change in Mean Sales: 2005-2008:	-21.0%	+3.7%
Change in Mean Employment: 2005-2008:	-18.3%	+4.1%

*represents number of locations without missing values, average of 2002 through 2008.

Table 2
Descriptive Statistics
Louisiana

All Firms (248,526 locations*)					**Purely Multi-state Firms (40,511 locations*)**		
	Mean	**Mini-mum**	**Maximum**		**Mean**	**Mini-mum**	**Maximum**
Sales-2002	$2,981,158	0	30,641,819,300		$12,452,498	$1	$30,641,819,300
Sales-2003	$2,831,592	0	38,472,998,100		$12,992,438	$100	$38,472,998,100
Sales-2004	$2,653,019	0	$39,479,731,200		$13,098,552	$906	$39,479,731,200
Sales-2005	$2,651,500	0	$37,115,475,400		$13,278,639	$906	$37,115,475,400
Sales-2006	$2,760,453	0	$82,520,508,000		$15,187,409	$8600	$82,520,508,000
Sales-2007	$2,405,525	0	$10,000,060,000		$13,308,060	$7966	$10,060,000,000
Sales-2008	$2,305,506	0	$20,069,000,000		$13,769,021	$359	$20,069,000,000
Employees-2002	19.51	1	31,680		71.07	1	31,680
Employees-2003	17.82	1	30,000		71.26	1	30,000
Employees-2004	17.06	1	30,000		70.76	1	30,000
Employees-2005	16.98	1	30,000		71.14	1	30,000
Employees-2006	16.52	1	30,500		74.29	1	30,500
Employees-2007	15.93	1	30,500		74.56	1	30,500
Employees-2008	14.95	1	31,000		76.10	1	31,000

	All Firms	**SSF Firms**
Change in Mean Sales: 2005-2008:	13.0%	+3.7%
Change in Mean Employment: 2005-2008:	-12.0%	+7.0%

*represents number of locations without missing values, average of 2002 through 2008.

Table 3
Descriptive Statistics
New York

All Firms (1,098,706 locations*)					**Purely Multi-state Firms (122,819 locations*)**		
	Mean	**Mini-mum**	**Maximum**		**Mean**	**Mini-mum**	**Maximum**
Sales-2002	$2,262,655	0	$190,587,00,0000		$9,613,417	$258	$13,285,000,000
Sales-2003	$2,2175,44	0	$376,401,000,000		$9,709,666	$1	$15,727,600,000
Sales-2004	$2,132,121	0	$386,267,060,200		$9,557,946	$1	$16,385,600,000
Sales-2005	$2,258,790	0	$369,962,420,000		$9,880,471	$1	$21,000,000,000
Sales-2006	$2,389,812	0	$437,978,563,000		$11,120,419	$1	$82,520,508,000
Sales-2007	$2,330,815	0	$566,189,235,300		$10,306,572	$1	$21,205,800,000
Sales-2008	$1,745,115	0	$363,004,959,400		$10,589,152	$1	$23,295,600,000
Employees-2002	14.37	1	31,680		61.05	1	31,680
Employees-2003	12.82	1	30,000		60.78	1	30,000
Employees-2004	12.56	1	30,000		62.01	1	30,000
Employees-2005	12.39	1	30,000		62.41	1	30,000
Employees-2006	12.08	1	32,000		64.36	1	32,000
Employees-2007	11.61	1	34,000		63.87	1	34,000
Employees-2008	10.84	1	36,000		64.33	1	36,000

	All Firms	**SSF Firms**
Change in Mean Sales: 2002-2005	0%	+2.8%
Change in Mean Employment: 2005-2008:	-12.5%	+3.1%

*represents number of locations without missing values, average of 2002 through 2008.

Table 4
Descriptive Statistics
Oregon

All Firms (236,198 locations*)					**Purely Multi-state Firms (31,841 locations*)**		
	Mean	**Mini-mum**	**Maximum**		**Mean**	**Mini-mum**	**Maximum**
Sales-2002	$2,699,061	0	$13,285,000,000		$15,035,816	$800	$13,285,000,000
Sales-2003	$2,509,898	0	$15,727,600,000		$15,457,535	$1300	$15,727,600,000
Sales-2004	$2,426,035	0	$16,385,600,000		$15,780,647	$1900	$16,385,600,000
Sales-2005	$2,454,225	0	$19,386,000,000		$16,245,671	$2400	$19,386,000,000
Sales-2006	$3,246,997	0	$122,324,566,000		$24,085,507	$3800	$122,324,566,000
Sales-2007	$2,432,327	0	$21,205,800,000		$17,538,015	$1756	$21,205,800,000
Sales-2008	$2,364,386	0	$23,295,600,000		$18,275,436	$1	$23,295,600,000
Employees-2002	17.63	1	31,680		86.84	1	31,680
Employees-2003	16.11	1	30,000		88.14	1	30,000
Employees-2004	15.74	1	30,000		88.38	1	30,000
Employees-2005	15.51	1	30,000		87.97	1	30,000
Employees-2006	15.41	1	32,000		91.95	1	30,500
Employees-2007	15.03	1	34,000		92.39	1	30,500
Employees-2008	14.19	1	36,000		93.79	1	31,000

	All Firms	**SSF Firms**
Change in Mean Sales: 2002-2005	-9.1%	+8.0%
Change in Mean Employment: 2005-2008:	-8.5%	+6.6%

*represents number of locations without missing values, average of 2002 through 2008.

Table 5
Descriptive Statistics
Wisconsin

All Firms (298,675 locations*)					**Purely Multi-state Firms (45,688 locations*)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2002	$2,834,363	0	$13,285,000,000		$13,136,735	$200	$13,285,000,000
Sales-2003	$2,795,799	0	$15,727,600,000		$13,305,929	$400	$15,727,600,000
Sales-2004	$2,622,070	0	$16,385,600,000		$13,733,820	$400	$16,385,600,000
Sales-2005	$2,592,110	0	$19,386,000,000		$13,768,048	$500	$19,386,000,000
Sales-2006	$2,924,127	0	$122,324,566,000		$17,324,920	$500	$122,324,566,000
Sales-2007	$2,505,768	0	$21,205,800,000		$14,586,134	$102	$21,205,800,000
Sales-2008	$2,381,445	0	$23,295,600,000		$15,036,254	$850	$23,295,600,000
Employees-2002	19.68	1	31,680		80.03	1	31,680
Employees-2003	18.96	1	30,000		79.25	1	30,000
Employees-2004	18.18	1	30,000		79.22	1	30,000
Employees-2005	17.69	1	30,000		79.63	1	30,000
Employees-2006	17.13	1	32,000		82.34	1	32,000
Employees-2007	16.67	1	34,000		82.61	1	34,000
Employees-2008	15.53	1	36,000		83.02	1	36,000

	All Firms	**SSF Firms**
Change in Mean Sales: 2002-2005	-8.5%	+4.8%
Change in Mean Employment: 2005-2008:	-12.2%	+4.3%

*represents number of locations without missing values, average of 2002 through 2008.

Table 6
Regression Results
Georgia

Parameter (expected sign)	Change in Sales (Model 1)	Change in Sales (Model 2)	Sales (Model 3)	Change in Employment (Model 1)	Change in Employment (Model 2)	Employment (Model 3)
Intercept	.4222 (.0091)***	-.0184 (.0244)	3.459 (.0063)***	.0803 (.0009)***	.0097 (.0053)	.1247 (.0001)***
Locally-Based Multistate Firms (+)	6.372 (.0347)***	.4132 (.1413)***	2.691 (.0142)***	.2325 (.0032)***	.0414 (.01244)***	.1475 (.0018)***
Out of State Multistate Firms (+ or -)	-.5332 (.0307)***	-.1001 (.0385)***	-.8799 (.0165)***	-.0732 (.0060)***	-.0027 (.0080)	-.0193 (.0029)***
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.5754 (.0007)***			
Lagged Employment (+)						.8581 (.0009)***
Model F	11197.6***	5.23***	205600***	1644.56***	2.42**	1059676***
No. Observations	1,159,768	142,418	1,159,768†	1,159,768	142,418	1,159,768†
Durbin-Watson D			1.264			1.715

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 7
Regression Results
Louisiana

Parameter (expected sign)	**Change in Sales (Model 1)**	**Change in Sales (Model 2)**	**Sales (Model 3)**	**Change in Employ-ment (Model 1)**	**Change in Employ-ment (Model 2)**	**Employ-ment (Model 3)**
Intercept	.3274 (.0123)***	-.0089 (.0138)	2.371 (.0086)***	.0722 (.0013)***	.0001 (.0069)	.0970 (.0007)***
Locally-Based Multistate Firms (+)	6.5409 (.0513)***	.4642 (.1783)***	2.842 (.0188)***	.1767 (.0046)***	.1162 (.0397)***	.1218 (.0026)***
Out of State Multistate Firms (+ or -)	-.4780 (.0443)***	-.1487 (.0534)***	-.4566 (.0229)***	-.0857 (.0084)***	-.0144 (.0108)	-.0051 (.0042)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.6736 (.0001)***			
Lagged Employment (+)						.8687 (.0012)***
Model F	6111.39***	5.54**	152834***	509.29***	2.91*	536801***
No. Observations	521,599	685,235.	521,599†	521,599	685,235	521,599†
Durbin-Watson D			1.289			1.714

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 8
Regression Results
New York

Parameter (expected sign)	Change in Sales (Model 1)	Change in Sales (Model 2)	Sales (Model 3)	Change in Employ-ment (Model 1)	Change in Employ-ment (Model 2)	Employ-ment (Model 3)
Intercept	.1558 (.0059)***	.0737 (.0167)***	2.2810 (.0039)***	.0409 (.0006)***	.0085 (.0034)***	.0618 (.0003)***
Locally-Based Multistate Firms (+)	6.654 (.0319)***	1.0568 (.1542)***	3.5104 (.0127)***	.1816 (.0030)***	.1361 (.0293)***	.1865 (.0017)***
Out of State Multistate Firms (+ or -)	-.3614 (.0270)***	-.2942 (.0324)***	-.4383 (.0141)***	-.0474 (.0052)***	-.0159 (.0065)**	.0152 (.0026)***
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.6382 (.0004)***			
Lagged Employment (+)						.8641 (.0006)***
Model F	5849.23***	62.48***	582431***	1330.76***	9.05***	2467300***
No. Observations	2,395,613	230,036	2,395,613†	2,395,613	230,036	2,395,613†
Durbin-Watson D			1.313			1.761

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 9
Regression Results
Oregon

Parameter (expected sign)	Change in Sales (Model 1)	Change in Sales (Model 2)	Sales (Model 3)	Change in Employ-ment (Model 1)	Change in Employ-ment (Model 2)	Employ-ment (Model 3)
Intercept	.0553 (.0128)***	.1229 (.0356)***	2.4159 (.0088)***	.0585 (.0012)***	.0319 (.0078)*	.0634 (.0001)***
Locally-Based Multistate Firms (+)	6.875 (.0524)***	.6005 (.2120)***	3.5203 (.02258)***	.2022 (.0045)***	.03700 (.0405)	.1718 (.0026)***
Out of State Multistate Firms (+ or -)	-.3049 (.0507)***	-.3774 (.0621)***	-.0179 (.0281)	-.0728 (.0099)***	-.0476 (.0127)***	.0267 (.0052)***
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.6204 (.0001)***			
Lagged Employment (+)						.8792 (.0013)***
Model F	5672.34***	31.86***	113431***	629.37***	7.51***	577348***
No. Observations	528,499	52,833	528,499†	528,499	52,833	528,499†
Durbin-Watson D			1.286			1.754

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 10
Regression Results
Wisconsin

Parameter (expected sign)	Change in Sales (Model 1)	Change in Sales (Model 2)	Sales (Model 3)	Change in Employ-ment (Model 1)	Change in Employ-ment (Model 2)	Employ-ment (Model 3)
Intercept	.3995 (.0107)***	-.0327 (.0281)	2.253 (.0079)***	.0466 (.0011)***	-.0032 (.0062)	.0773 (.0006)***
Locally-Based Multistate Firms (+)	6.1803 (.0550***	.4947 (.1437)***	4.0718 (.0249)***	.1859 (.0047)***	.0615 (.0279)**	.1529 (.0028)***
Out of State Multistate Firms (+ or -)	-.5576 (.0449)***	-.1458 (.0523)***	-.5543 (.0241)***	-.0554 (.0091)***	-.0058 (.0110)	-.0062 (.0048)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.7002 (.0008)***			
Lagged Employment (+)						.8881 (.0011)***
Model F	5608.51***	6.24**	206473***	458.73***	.71	749489***
No. Observations	592,671	77,162	592,671†	592,671	77,162	592,671†
Durbin-Watson D			1.327			1.793

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 11
Regression Results
All States Combined-Without State Tax Rates

Parameter (expected sign)	**Change in Sales (Model 1)**	**Change in Sales (Model 2)**	**Sales (Model 3)**	**Change in Employ-ment (Model 1)**	**Change in Employ-ment (Model 2)**	**Employ-ment (Model 3)**
Intercept	.2641 (.0041)***	.0080 (.0124)	2.5921 (.0028)***	.0557 (.0004)***	-.0013 (.0025)	.0848 (.0002)***
Locally-Based Multistate Firms (+)	6.1765 (.0214)***	1.0133 (.1325)***	3.2258 (.0085)***	.2093 (.0020)***	.1622 (.0255)***	.1677 (.0011)***
Out of State Multistate Firms (+ or -)	-.4393 (.0188)***	-.1932 (.0226)***	-.5536 (.0098)***	-.0603 (.0036)***	-.0040 (.0045)	.0116 (.0018)***
State has Throwback: Locally Based Firms (-)	-.2217 (.0582)***	-.4325 (.2241)*	-.8098 (.0246)***	-.0293 (.0050)***	-.0890 (.0446)*	-.0139 (.0030)***
State has Throwback: Out of State Based Firms (-)	-.0191 (.0483)	-.0098 (.0491)	.1781 (.2066)	-.0079 (.0097)	-.0077 (.0099)	.0164 (.0501)
State is Unitary: Locally Based Firms (+)	.3648 (.0745)***	.7184 (.3081)*	.7068 (.0319)***	.0289 (.0064)***	.0700 (.0776)	.0011 (.0060)*
State is Unitary: Out of State Based Firms (+)	-.0827 (.0684)	-.0884 (.0694)	.-0768 (.0374)***	-.0069 (.0314)	-.0885 (.0136)	.0053 (.0070)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			.6251 (.0003)***			
Lagged Employment (+)						.8553 (.0004)***
Model F	13238.3***	26.41***	490762***	1650.41***	5.47***	1975041***
No. Observations	5,080,596	504,192	5,080,596†	5,080,596	504,192	5,080,596†
Durbin-Watson D			1.319			1.720

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Table 12
Regression Results
All States Combined—With State Tax Rates

Parameter (expected sign)	**Change in Sales (Model 1)**	**Change in Sales (Model 2)**	**Sales (Model 3)**	**Change in Employ-ment (Model 1)**	**Change in Employ-ment (Model 2)**	**Employ-ment (Model 3)**
Intercept	.2661 (.0041)***	.0086 (.0124)	2.5939 (.0028)***	.0558 (.008)***	-.0007 (.0025)	.0847 (.0002)***
Locally-Based Multistate Firms (+)	89.1752 (.3128)***	14.5449 (1.8758)* **	.46.4377 (.1243)***	2.9769 (.0286)***	2.3497 (.3654)***	.1677 (.0111)***
Out of State Multistate Firms (+ or -)	-6.433 (.2721)***	-2.8519 (.3272)***	-7.7769 (.1425)***	-.8886 (.05200)***	-.0792 (.0643)	.0116 (.0018)***
State has Throwback: Locally Based Firms (-)	-8.212 (.7523)***	-7.201 (3.0789)*	-4.627 (.3167)***	-.7003 (.0644)***	-1.4298 (.5901)***	-.0140 (.0030)***
State has Throwback: Out of State Based Firms (-)	.6047 (.6750)	.2748 (.6358)	1.2242 (.7439)	.0224 (.1249)	-.0748 (.1274)	.0164 (.0151)
State is Unitary: Locally Based Firms (+)	21.4743 (1.0325)***	12.3079 (5.9655)*	-.6514 (.4431)	.8865 (.0889)***	2.2386 (1.1360)**	.0001 (.0038)
State is Unitary: Out of State Based Firms (+)	-2.404 (.9674)**	1.8465 (.9813)	.2742 (.5474)	-.2751 (.1890)	-.1569 (.1921)	.0053 (.0070)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Sales (+)			2.5939 (.0028)***			
Lagged Employment (+)						.8553 (.0004)***
Model F	13075***	26.91***	490434***	1602***		1975401***
No. Observations	5,080,596	504,192	5,080,596†	5,080,596	504,192	5,080,596†
Durbin-Watson D			1.276			1.729

***significant at .001 or better
**significant at .01 or better
*significant at .05 or better
† per year, 2002-2008
Sales and employment are in natural logs; standard errors (in parentheses) calculated using robust estimation methods

Figure 1
Income Effect of Single Sales Versus Double-Weighted Sales:
Locally-Based Firm

	Double-Weighted	Single Sales
Payroll	80%	80%
Property	80	80
Sales	20	20
Apportionment ratio	50%	20%
X Total U.S. profits (millions)	$10.0	$10.0
= State taxable profits (millions)	5.0	2.0
State Tax Payment at 8 Percent	**$400,000**	**$160,000**

Figure 2
Income Effect of Single Sales Versus Double-Weighted Sales:
Out-of-State Firm

	Double-Weighted	Single Sales
Payroll	4%	4%
Property	4	4
Sales	14	14
Apportionment ratio	9%	14%
x Total U.S. profits (millions)	$10.0	$10.0
= State taxable profits (millions)	0.9	1.4
State Tax Payment at 8 Percent	**$72,000**	**$112,000**

Figure 3
Inter-State Production Model