ON THE IMPACT OF A SINGLE SALES FACTOR ON CALIFORNIA JOBS AND ECONOMIC GROWTH

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Executive Summary

The purpose of this study is to estimate the potential impact to the state of California by switching to a Single Sales Factor (SSF) for state corporate income tax purposes. This report predicts that such a switch to the SSF will:

- Stimulate business and industrial growth in the state as measured by increased employment;
- Help attract business into the state;
- Help retain and expand business and industry; and
- Create increased job opportunities for all Californians

To most efficiently and effectively address those objectives, this study first estimates the employment and sales effects on five states which recently switched to SSF. Using the estimates (or parameters) from studying these five states, the study then predicts what such similar effects would be in California, and estimates the net tax revenue effects to California from such a switch. This net tax revenue effect includes the loss of corporate income tax revenues, offset by the increase in other taxes.

This study estimates that the switch to SSF could, in the long run, create approximately 144,000 permanent jobs (in equilibrium) and result in an annual net revenue gain of $411 million to the state.

The report that follows provides detailed information derived from the intensive study conducted for this program.

While no predictive study can claim to be prescient, the results and related predictions are methodologically sound and follow from plausible findings. The information contained in this report is both accurate and relevant to help determine the overall value of California's switching to an SSF method of apportionment.

Introduction

Recent legislation allows California multistate taxpayers switch to single sales factor (SSF) apportionment starting in 2011[1]. Briefly, SSF allows a firm to apportion its business income into California based solely on the ratio of its sales in California to its total sales. Currently, California employs a three factor apportionment formula, based on the relative ratios of (California versus total) property, payroll, and sales, where the sales factor accounts for 50% of the weight used in this apportionment formula. Since a single sales factor would give no weight to property and payroll, it is widely believed to be an incentive for a firm to locate or expand its facilities in the state since there would be no income tax cost of doing so.

Understanding this incentive effect, numerous states have gradually switched from property, payroll and single sales-weighted tax factors to double-weighted sales factors[2]. More recently a number of states (including Georgia, Louisiana, New York, Oregon, and Wisconsin) have switched from double weighted sales factors to SSF[3]. But have such states experienced the economic growth hoped for by such a switch? In short, they have; on average (in equilibrium), hundreds of thousands of jobs appear to have been created. This study uses the results from these five states as a benchmark to predict what similar economic gains would be to California in terms of job growth, and finds that such growth could be a potential permanent increase of 144,000 jobs in the next two years.

An important consideration in the adoption of SSF is also its effect on the state's tax revenues, especially in light of a predicted $20 billion deficit in 2010. Here, this study predicts that, after taking account of direct costs to the state from lost corporate income taxes, and also increased personal and business taxes from business expansion, the state could actually gain $411 million in net tax revenues annually, in the next few years.

Methodology

In examining economic impacts of any program, having the most accurate and detailed data is critical. This study utilizes the NETS (National Establishment Time Series) database which contains enterprise level data for all firms in every state from 1990 to 2008, and is derived from Dun & Bradstreet survey data. The data allows examination of location-specific sales and employment by firm, industry membership, and other attributes. Also, the data allows for distinguishing between firms that will be affected by SSF (firms which have multi-state sales) versus those which do not. This latter distinction allows the creation of "treatment" versus "control" groups of firms after the enactment of an SSF. Such bifurcation allows the controlling for factors other than the SSF which might affect whether a firm moves into a state after the SSF is enacted, or whether it expands its operations after the SSF enactment.

Predicted Impact of the SSF on California

First, the study examines the impact to switching to SSF by other states. This is not a trivial exercise; although simple economic intuition (corroborated by rigorous economic theory, as

[1] California Revenue and Taxation Section 25128.5.
[2] See chart in Chapter 3 of Gupta, Swenson, et al, *State Taxation: Principles and Planning* (2003). JRoss Publishing
[3] This represents an increasing trend toward SSF; 14 of the 46 states with income taxes have SSF, and another 10 states allow SSF for certain industries.

shown in the Technical Paper in the Appendix) predicts that such a switch should induce additional growth into a state, yet few studies have examined whether this is in fact the case. Economic growth in SSF states (after controlling for non-SSF factors) might not occur if firms do not react to the law change due to transaction costs of moving/expanding, uncertainty as to whether such law changes will be permanent, etc.

Fortunately, a number of "natural experiments" to test whether switching to SSF is effective exist. In 2006, five states—Georgia, Louisiana, New York, Oregon, and Wisconsin—switched to SSF. Testing the impact of SSF on these states provides robust results due to the wide variety of states and firms which operate within them. Using the NETS database for all firms in these states from 2003 through 2008, this study estimates that the SSF increased state-wide employment (on average) by approximately .83%[4] within two years. The methodology employed controls for trends by using a differences in differences estimation method, and examines a control group of firms which were not affected by the SSF.

The Table below shows employment effects for these states.

Table 1
Estimated Two Year Employment Changes in States Recently Adopting SSF

State (Total Number of Firm Locations / Number of Firm Locations Affected by SSF)	**Increase in Employment Using Regression Coefficients**
Georgia (1,181,782 / 3,109)	30,491
Louisiana (532,386 / 1,711)	52,330
New York (2,433,791/ 4,860)	104,158
Oregon (538,231 / 1,474)	19,554
Wisconsin (602,397 / 1,796)	12,203

Using parameter estimates from econometric models (see Technical Paper in the Appendix), this study forecasts potential employment effects for California (using NETS data for California) for the firms affected by the SSF. This result is a permanent increase (i.e., in equilibrium) of 134,000 jobs[5]. A comparison estimation method, using changes in average states' employments, is 154,000 jobs (this method may slightly overstate since it equally weights state parameters). Taking the average of these two estimates yields an estimated 144,000 California jobs. It is important to note, however, that the aforementioned job growth predictions are conservative in the sense that they do not directly consider Type II multiplier effects.

While the above predicted job growth statistics are promising, they would be untenable if they resulted in a net revenue loss to the state. The FTB has estimated the direct costs of SSF

[4] Since New York and Wisconsin actually lost jobs on a state-wide basis during this time, the above figures (for these two states) should be viewed as jobs retained.
[5] There were 1,649,650 people employed in SSF-affected firms in California as of 2008 (derived from the NETS data), which were related to separate 4,304 corporations having a total of over 5,300 locations. These corporations generated $121 billion in revenues from their California locations.

adoption, in terms of lost California corporate franchise and income taxes, at $800 million annually. Using sales growth from econometric models for the above five states (see tables in the Technical Paper in the Appendix), this study is able to estimate predicted sales growth (due to business expansion), which is then multiplied by industry profit ratios (from California Franchise Tax Board publications), and then multiplied by the average "effective business tax rate" for California (see Swenson, 2005; revised 2010, cited in the Appendix) to obtain estimated gains in business taxes to the State[6]. These estimates are reported in the top half of Table 2. Similarly, using predicted employment growth in California due to the SSF from regression coefficients, and average state taxes paid by individuals, the study estimates gains in personal taxes paid by individuals to the State. This latter estimate is shown in the lower half of Table 2.

Table 2
Estimated Annual Increase in California Tax Collections From Adopting SSF

Change in Business Tax Collections:	
Direct Change in Business Income	**$2.4 Billion**
Average Effective Overall Business Tax Rate in California[7]	**x19.45%**
	$467 Million
Change in Personal Income Tax Collections (personal income and sales taxes)	**$744 Million**
Less: Direct Cost in Lost Franchise Taxes[8]	**-$800 Million**
Net Increase in California Tax Collections	**$411 Million**

As shown in the Table, business taxes may increase by $467 million. Since some of the increased collections would be due to increased property taxes, some of this increase would accrue to local governments. The Table shows that personal tax collections may increase by $744 million. When we subtract out the estimated $800 million direct cost of lost franchise taxes,

[6] It is important to note that the overall business tax rate does not include sales/use taxes paid by businesses. Accordingly, additional (but unknown) state and local revenues should be added to the above change in business tax collections. As a practical matter, it is very difficult to separate sales taxes paid into business verses personal components.
[7] Approximately half of this tax rate is attributable to corporate income taxes; the remainder is due to miscellaneous taxes, and a small amount is due to property taxes (see prior footnote)
[8] To the extent the current economic downturn continues, such lost revenues may be lower. Accordingly, the $411 million estimated gain to the state could be higher. Also, it is unknown how much less the $800 million estimate would be if SSF were made mandatory (i.e., some firms would pay more taxes under required SSF, so the $800 million figure would be lower).

the potential annual net gain to the state is estimated to be $411 million, in the long run[9].

Conclusion

Using results for states recently switching to the SSF as a benchmark, this study estimates that adoption of the SSF could result in a permanent (in equilibrium) increase of 144,000 jobs, and a net annual revenue gain to the State of $411 million in the long run. It is important to note that unpredictable factors—such as a continued economic downturn in the State—could have an effect on these estimates. A final observation is that the California SSF is elective, in contrast to a number of states where this method is mandatory. From that perspective, the California SSF would generally appear to be harmless to firms which chose not to utilize it.

Recently Released Study by the LAO

In a study dated May 26, 2010[10], the California Legislative Analyst's Office (LAO) concluded that the single sales factor rule for California should be retained. They noted that the SSF promotes job growth, and that the absence of an SSF would put California firms at a competitive disadvantage.

[9] Such revenue gains can be used to fund, among other things, public education. Note that some double-counting (albeit offsetting) may be inherent in the above revenue estimates, as follows. The overall effective business tax rate includes both taxes paid by, and income related to, pass-through entities. On the other hand, the personal income tax collections do not include incomes from such business entities. Finally, note that the potential annual revenue gains to the State might be as high as $1.8 Billion assuming that the Hamm et al (2005) general equilibrium effects occur.

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

About the Author

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APPENDIX: TECHNICAL PAPER ON THE EFFECTIVENESS OF SINGLE SALES FACTORS FOR STATE TAXATION

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ABSTRACT

This study models and empirically tests the impact of 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 and tax rates. The model is then tested in five states which recently switched to single factor apportionment rules. Results indicate that SSF increased employment in the five states examined.

ON THE EFFECTIVENESS OF SINGLE SALES FACTORS FOR STATE TAXATION

1. INTRODUCTION

A major policy utilized by states to attract new business is tax incentives. One tax incentive is placing heavy emphasis on sales in apportionment formulae; recently, five states have switched to the use of a single sales factor (or SSF) in apportioning income, which places 100% weighting on sales[11]. The intent of the SSF is to attract business to a state. The purpose of this paper is to analytically and empirically examine these incentive effects using a multistate firm. 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 these incentives may be substantial[12].

This paper models a firm which can avail itself of favorable sales apportionment rules, in locating/expanding to a new state. Because the firm's decision is also affected by state tax rates and structures, the model also allows for varying tax rates and both unitary and separate accounting tax structures. The firm faces two common scenarios. The first scenario is where the firm has narrowed down its location choice to one state due to compelling non-tax considerations. Resources are then allocated to this state in response to varying tax rates, sales weighting and sourcing rules, and overall tax structures (unitary versus separate accounting). The second scenario assumes that the firm faces a choice between two states, each having varying tax rates, sales rules, and unitary versus separate accounting tax structures.

To test the impact of factor weightings, this study examines natural experiments designed to give a "best shot" for a measurable effect: five states switching to from double-weighted sales factors to

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[11] This represents an increasing trend toward SSF; 13 of the 46 states with income taxes have SSF, and another 10 states allow SSF for certain industries.

[12] For example, the tax expenditure budget for California estimates that the cost of adopting the SSF would be $800 million annually.

SSF after 2006. 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[13]. Louisiana switched to SSF after 2005[14]. New York switched to 80% sales weighting in 2006, and 100% in 2007 and later years[15]. Oregon switched to SSF after July 1, 2005[16]. Wisconsin switched to 60% sales weighting in 2006, 80% in 2007, and 100% in 2008 and later years[17]. Using detailed, location-specific firm data with millions of operations (from the NETS database), and a differences-in-differences research design which identifies affected versus unaffected firms, the analysis suggests that such states experienced significant increases in employment after SSF enactment. 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

All but four states 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% are not uncommon for any particular state, in order to meet policy objectives or 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 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 sales, payroll, and property within the taxing state 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

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[13] O.C.G.A Sec. 48-7-31. Georgia's SSF applies to only manufacturers, producers, and sellers of tangible person property.
[14] Sec. 47:287.95(F)(2)(a). Louisiana's SSF applies to only manufacturers and merchandisers.
[15] Sec. 210 (3)(a)(10) Tax Law. New York's SSF appears to apply to all industries except financials institutions.
[16] Sec. 314.650 ORD
[17] Sec. 71.25(6) Wisc. Stats. Wisconsin's SSF applies to all industries.

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:

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

Business income either includes income solely from a single corporation (separate accounting), or from a combined group of entities which are part of the same "unitary group" (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 branches and 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 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[18]. 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 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 specifically of SSF, but of general factor apportionment effects on the tax base and tax rates as well. The next section discusses such incentive effects.

[18] 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".

2.2 Incentive Effects of No Throwback Rule, and Extra Sales Factor Weighting

Absence of a throwback rule to compute the sales factor and extra weighting of that sales factor are favorable tax treatments. Between 1980 and 2000, five states repealed their throwback rules, and 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 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. 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 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 locating a facility (which has out of state sales) in a single factor 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.

2.3 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 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(1981) idea that the unitary tax is 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 and Swenson (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 in the case of where the firm operated exclusively in unitary states.

Empirical evidence on the unitary tax is provided by Moore, et al. (1989) who applied the Carlton (1983) location choice model to foreign investment. Foreign firms were used because the literature suggested that they should respond much more to regional incentives (given favorable tax incentives) than should domestic firms. The tax variable was bifurcated into overall effective tax rates (calculated using the models in Vines, et al. 1994), and dummy variables were used to indicate the presence of unitary tax structures. Results indicated that foreign firms' location choices were unresponsive to overall tax rates, but 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.

The reasons for expecting the disincentive effects of unitary tax structures were not guided by formal theory i.e., (modeling,) in the above empirical studies. Similarly, these studies were not guided by formal theory with respect to the interaction of tax rates and differences in structures (unitary versus non-unitary taxation). These studies also implicitly assumed that lower tax rates and/or an absence of unitary accounting methods would automatically provide an incentive to invest in a state. This is not necessarily the case, since location choice affects factor and point-of-sale locations, which in turn affect income allocations between states. Thus, it may be possible for lower tax rate states to have little or no comparative advantage.[19]

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), results should be cautioned because of lack of a rich theory, and 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[20]. 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, affect state employment growth. One study specifically looked at the impact of California switching to SSF. Edmiston and Arze (2002) used

[19] Other state income tax studies not examining the impact of unitary structures (or their interactions with tax rates and incentives) can be found in literature reviews by Bartik (1994) and Wasylenko (1997). Similarly, the interested reader is referred to Goolsbee and Maydew (2000), Papke (1987; 1991), Anand and Sansing (2000), Weiner (1996), Edmiston (2002), Edmiston and Arze (2002), Hines (1996), and Klassen (1999).

[20] 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.

macro simulation models to predict that switching from single to double-weighted sales factors increase in state employment and capital. Using a dynamic computable general equilibrium (CGE) model, based in part on Goolsby's empirical model, Hamm et al (2005) estimated that such a switch would result in increased California employment and tax revenues[21]. By their own admission, Hamm et al acknowledged that CGE models are significantly driven by assumptions. Gupta et al (2009) use aggregate state data and estimate that up to 16% of the corporate income tax base (for states having increased sales weights) has eroded due to extra weighting of the sales factor. 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.[22] Finally, surveying the literature, the California Legislative Analyst's Office (LAO) concluded that SSF adoption would increase California employment when effective in 2011.[23]

In contrast to the above studies which used largely aggregate data, this study proposes to use a firm level econometric estimation methodology. This unique methodology is enabled by the recent availability of firm level data, discussed below. Firm 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. MODEL

3.1 General 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

[21] 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.
[22] A literature review of pre-2006 SSF studies can also be found in Mazerov, M. (2005), "The Single Sales Factor for State Corporate Taxes: A Boon to Economic development or a Costly Giveaway". Mimeo, Center on Budget and Policy Priorities.
[23] *Reconsidering the Optional Single Sales Factor: An LAO Report*. Sacramento: Legislative Analyst's Office (May 26, 2010)

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 Gordon and Wilson (1986) is extended by examining the effects of the most prevalent incentives: the absence of a sales throwback rule, and extra-weighting of the sales factor. In doing so, it considers the effects of all three factors simultaneously (sales, labor, and capital); Gordon and Wilson considered each of these factors independently. This three-factor setting allows for a more realistic study, providing for substitution of factors of production and sales both within and across states. Additionally, this study examines control for the case of a multistate firm operating in both a unitary and non-unitary state. The setting is important because over half of the states follow non-unitary accounting, and it is thus likely that many multistate companies encounter both types of states, simultaneously, in their operations. Finally, since tax rate differentials can encourage firms to alter resource allocation, the study controls for differential tax rates in the model as well.[24]

The study models a stylized manufacturing firm with customers in State 1 and potential customers in State 2. The firm is considering expanding operations into State 2 due to favorable demand conditions. 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 transactions costs of moving resources to any State 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 clearly has taxable “nexus” (or business connection) in each of the states. 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 from the respective local facility. 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)

[24] It is important to note some differences between this study and that of Gordon and Wilson (1986). Their study examines only unitary tax structures, whereas this paper looks at both unitary and non-unitary structures. Also, this study assumes that capital is fully tax deductible, whereas Gordon and Wilson assume 50% deductibility. With regard to this latter difference, additional simulations with 50% deductibility were conducted, and no qualitative differences were found.

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 in State 1 is adjacent to the headquarters, and thus no shipping charge is incurred on those units. The quantities sold to customers in 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-ϕ) being the percentage performed at the local production facilities, which is between zero and one. More formally, management chooses K_i, L_i, and ϕ $_i$(Є {*m*, *1*, *2*}[25]) so as to

$$\max \pi = R(Q_1, Q_2) - C(Q_1, Q_2), \qquad (1a)$$

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:

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

[25]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.

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:

$$C(Q_1, Q_2) = (w_1 L_m + rK_m) + (w_1 L_1 + rK_1) + (w_2 L_2 + rK_2) + sQ_2 . \quad (1c)$$

Assume that production follows a generalized Cobb-Douglas production function where $Y_i = L_i^{\alpha} K_i^{\beta}$ with $i \in \{m, 1, 2\}$, 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 $j \in \{1, 2\}$. 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.[26] The study however, instead reflects these differences in the wage rates, w_i, rather than in α. The model is shown graphically in Figure 1.

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

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[26] 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 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.

$$Max\ \pi = a_1 Q_1 - bQ_1^2 + a_2 Q_2 - bQ_2^2 - w_1(L_m + L_1) - w_2 L_2 - r(K_m + K_1 + K_2) - sQ_2 ,$$

subject to:

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

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

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

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, $\frac{r}{w} = \frac{\beta L}{\alpha K}$,[27] which is rearranged as

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

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). Unfortunately, the resultant equations involve high degree polynomials for which a continuous form solution cannot be found for the entire system simultaneously. However, some partial findings can be derived as shown in the following pages.

3.2 MODEL WHERE FIRM HAS SELECTED ONE STATE: Both States Use Separate Accounting

Before examining the effects of tax incentives, it is useful to first examine the effects of non-unitary taxation on resource allocation. Here, one can look separately at the effects on each state. First, note that non-unitary taxation of a subsidiary with only single-state operations, does not involve the use of factor apportionment.[28] 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:

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[28] 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.

$$\pi = \pi_{S1} + \pi_{S2},$$
$$\pi_{S1} = (1-\tau_1)(a_1 Q_1 - b Q_1^{\,2} - w_1 L_1 - r K_1 - p_t Q_1), \quad \text{and} \qquad (4)$$
$$\pi_{S2} = (1-\tau_2)(a_2 Q_2 - b Q_2^{\,2} - w_2 L_2 - r K_2 - p_t Q_2 - s Q_2).$$

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 (e.g., Atkinson and Stiglitz, 1980, p. 132) 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.

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:

$$(1-\tau_1)\frac{\partial \pi_{S1}^{p}}{\partial Q_1} = (1-\tau_2) Q_2 \frac{\partial p_t}{\partial Q_1},$$
$$\frac{\partial p_t}{\partial Q_1} \Big/ \frac{\partial \pi_{S1}^{p}}{\partial Q_1} = \frac{(1-\tau_1)}{(1-\tau_2) Q_2}. \qquad (5)$$

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 (5),

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

$$\frac{\partial Q_1}{\partial \tau_1} = \frac{-1}{(1-\tau_2)Q_2} H'\left[\frac{(1-\tau_1)}{(1-\tau_2)Q_2}\right] < 0. \qquad (6)$$

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.

To examine the effects of different weighting schemes and the absence or presence of a throwback rule, one can add a new, nearby State 3, into which the firm sells (from its State 2 operations), but has no nexus (labor or capital). We must first make an assumption about sales made into State 3 which have been partly manufactured in State 2. Assume that goods made in State 2 can be sold both in State 2 and nearby State 3. Θ is the fraction of State 2 production sold to State 2 customers, and 1-Θ is the proportion sold to State 3 customers. Since States 2 and 3 are contiguous, assume that demand functions are similar between the two states. Rewrite the third equation in (4) where there is throwback of State 3 sales (Q_3) into State 2 (i.e., State 3 sales are taxed by State 2) as:

$$\pi_{S2} = (1-\tau_2)\Theta[(a_2 Q_2 - bQ_2{}^2) + (-w_2 L_2 - rK_2 - p_t Q_2 - sQ_2)] + [(1-\tau_2)(1-\Theta)(a_3 Q_2 - b_3 Q_2{}^2)] \quad (4a)$$

Since taxes are the identical on sales into either state, they are non-distortionary on interstate sales decisions. The rate of substitution between state sales is:

$$\Theta = \frac{(a_2 - 2b_2)(1-\tau_2)}{(a_3 - 2b_3)(1-\tau_2)} \quad (4b)$$

The tax rates cancel out, and Θ is unaffected by taxes. Where State 2 has no throwback, State 3 sales escape income taxation, and (4) is rewritten:

$$\pi_{S2} = (1-\tau_2)\Theta[(a_2 Q_2 - bQ_2^2) + (-w_2 L_2 - rK_2 - p_t Q_2 - sQ_2)] + \left(a_3 Q_2 - b_3 Q_2{}^2\right)\left(1-Q\right) \quad (4c)$$

The rate of substitution of sales between states is:

$$\Theta = \frac{(a_2 - 2b_2)\left(1-\tau_2\right)}{(a_3 - 2b_3)} \quad (4d)$$

Comparing (4b) to (4d), we see that the firm will shift sales sourced from State 2 to State 3, ceteris paribus. It can also be shown that Q_2 increases due to increased marginal profit (due to non-taxability of State 3 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. 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. Rewrite the profit equation for the throwback state as:

$$\pi_{S2} = [(1 - S_w\tau_2)\Theta(a_2Q_2 - bQ_2^2)] - [(1 - L_w\tau_2)(w_2L_2)] - [(1 - K_w\tau_2)(rK_2)] \\ -[(1-\tau_2)(p_tQ_2 - sQ_2)] + [(1 - S_w\tau_2)(1-\Theta)(a_3Q_2 - b_2Q_3^2)] \quad (4e)$$

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

$$\Theta\left(-a_2Q_2 + bQ_2^2\right) + \left(1-\Theta\right)\left(-a_3Q_2 + bQ_2^2\right) = w_2L_2 + rK_2 \quad (4f)$$

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 3. 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 MODEL WHERE FIRM HAS SELECTED ONE STATE: Both States Use Unitary Accounting

Before examining the effects of apportionment factors and sales throwback, it is useful to first examine the effects of unitary tax structures production and investment decisions. To examine the effects of a unitary tax structure in both states, the profit equation (2) is multiplied by tax rates, resulting in:

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

subject to:

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

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

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

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

$$+\frac{\tau_2}{4}\left(\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}+\frac{K_2}{K_m+K_1+K_2}+2\cdot\frac{a_2Q_2-bQ_2{}^2}{a_1Q_1-bQ_1{}^2+a_2Q_2-bQ_2{}^2}\right) \quad . \quad (7)$$

Note that the apportioned unitary tax, τ_u, 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. Sales are doubled-weighted in the apportionment formula.

In examining (1) and (7), we see that the unitary tax is, as noted by McClure (1981) and Gordon and Wilson (1986), similar to a separate tax on each of 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. Essentially, an increase (decrease) in the tax rate in one state results in a movement of production and sales out of (into) that state and into (out of) the other state.

The effects of tax rate changes are much more complex in the unitary tax setting because of the apportionment factor. In order to analytically determine the effect of changes in tax rates on the decision variables, it is necessary to separately consider the effects on the sales quantities (Q_1 and Q_2) and on ϕ. The labor and capital variables are solely determined by the sales quantities and ϕ, through the standard Cobb-Douglas relationships, given w_1, w_2, and r. Unfortunately, the interaction between the Q's and ϕ is too complex to facilitate analysis without simplifying assumptions. When analyzing the effect of tax rates on Q_1 and Q_2, assume that ϕ does not change. Similarly, when analyzing the effect of tax rates on ϕ, assume that Q_1 and Q_2 do not change. The indirect effects ignored are likely to be of very low order, so the simplifying assumptions should not be problematic, although this is not known with any certainty.

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:

$$\frac{\partial \pi}{\partial \phi} = -\frac{\partial \tau_u}{\partial \phi}\pi^p - (1-\tau_u)\left[w_1(\frac{\partial L_m}{\partial \phi} + \frac{\partial L_1}{\partial \phi}) + w_2\frac{\partial L_2}{\partial \phi} + r(\frac{\partial K_m}{\partial \phi} + \frac{\partial K_1}{\partial \phi} + \frac{\partial K_2}{\partial \phi}) \right] = 0 \qquad (8)$$

where π^p is pre-tax profit. Define

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

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 (8),

$$f(\phi) = -\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial \phi}, \quad \text{and} \qquad (9)$$

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

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 (9),

$$\frac{\partial \phi}{\partial(\tau_1 - \tau_2)} = -F'\left(-\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial \phi} \right)\frac{\pi^p}{1-\tau_u}\partial\left(\frac{\partial \tau_u}{\partial \phi}\right) / \partial(\tau_1 - \tau_2) < 0. \qquad (10)$$

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 expect ed to affect the results.

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

$$\frac{\partial \pi}{\partial Q_i} = -\frac{\partial \tau_u}{\partial Q_i}\pi^p - (1-\tau_u)\left(-a_1 + 2bQ_i + w_1\frac{\partial L_m}{\partial Q_i} + w_i\frac{\partial L_i}{\partial Q_i} + r(\frac{\partial K_m}{\partial Q_i} + \frac{\partial K_i}{\partial Q_i}) + s\frac{\partial Q_2}{\partial Q_i} \right) = 0 \qquad (11)$$

Define

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

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 (11) yields

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

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

$$\frac{\partial Q_i}{\partial(\tau_1-\tau_2)} = -G_i'\left(-\frac{\pi^p}{1-\tau_u}\frac{\partial \tau_u}{\partial Q_i}\right)\frac{\pi^p}{1-\tau_u}\partial\left(\frac{\partial \tau_u}{\partial Q_i}\right)/\partial(\tau_1-\tau_2). \qquad (12)$$

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

$$\frac{\partial \tau_u}{\partial Q_i} = \frac{(\tau_1-\tau_2)}{4}\left[\partial\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}/\partial Q_i + \partial\frac{K_m+K_1}{K_m+K_1+K_2}/\partial Q_i + 2\partial\frac{a_1Q_1-bQ_1^2}{a_1Q_1-bQ_1^2+a_2Q_2-bQ_2^2}/\partial Q_i\right].$$

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

$$\frac{\partial Q_1}{\partial(\tau_1-\tau_2)} < 0 \quad \text{and} \quad \frac{\partial Q_2}{\partial(\tau_1-\tau_2)} > 0 \qquad (13)$$

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,

$$\frac{\partial L_2}{\partial(\tau_1-\tau_2)}>0 \quad \text{and} \quad \frac{\partial K_2}{\partial(\tau_1-\tau_2)}>0. \qquad (14)$$

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

$$\frac{\partial L_m}{\partial(\tau_1-\tau_2)}<0 \quad \text{and} \quad \frac{\partial K_m}{\partial(\tau_1-\tau_2)}<0. \qquad (15)$$

In summary, the effects of tax rates in the pure unitary tax setting are as follows. First, higher rates in State 1 (or lower rates in State 2) result in decreases in ϕ (from 10) decreased Q_1 and increased Q_2 (from 13), increased L_2 and K_2 (from 14), and decreased L_m and K_m (from 15). Second, higher rates in State 2 (or lower rates in State 1) result in increased ϕ (from 10), decreased Q_2 and increased Q_1 (from 13), decreased L_2 and K_2 (from 14), and increased L_m and K_m (from 15). Finally, there is no prediction on the effects of taxes on L_1 and K_1.

The following paragraph essentially says 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. Of course, 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.

The effects of (no) sales throwback rule are as follows. With throwback, the previous results are unchanged, since it is as if State 3 is part of State 2 for tax purposes. When there is no sales throwback rule, and sales are double-weighted, the last term in (7) is rewritten as:

$$\tau_u = \frac{\tau_1}{4}\left(\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}+\frac{K_m+K_1}{K_m+K_1+K_2}+2\cdot\frac{a_1Q_1-bQ_1^2}{a_1Q_1-bQ_1^2+\Theta\left(a_2Q_2-bQ_2^2\right)+(1-\Theta)\left(a_3Q_2-bQ_2^2\right)}\right)$$

$$+\frac{\tau_2}{4}\left(\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}+\frac{K_2}{K_m+K_1+K_2}+2\cdot\frac{a_2Q_2-bQ_2^2}{a_1Q_1-bQ_1^2+\Theta\left(a_2Q_2-bQ_2^2\right)+(1-\Theta)\left(a_3Q_2-bQ_2^2\right)}\right) \quad (7a)$$

With no adjustments to the decision variables, (7a)<(7). Since the numerator of the sales term in State 2 does not include State 3 sales, there is both an income and a substitution effect for the firm in State 2. State 2 sales are shifted to State 3; both Q_2 and Q_3 increase as well. This latter effect actually has a positive externality to State 1: the denominator of the sales factor increases resulting in a decrease in τ_1. But there is also a negative externality to State 1; increased production at the main plant increases the transfer price.

The effects of increased weighting of the sales factor in State 2 is as follows. Rewrite (7) to include apportionment weights for sales, property, and payroll as follows, assuming throwback:

$$\tau_u = \tau_1\left(L_{w1}\{\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}\}+K_{w1}\{\frac{K_m+K_1}{K_m+K_1+K_2}\}+S_{w1}\{\frac{a_1Q_1-bQ_1^2+a_2Q_3-b_3Q_3^2}{a_1Q_1-bQ_1^2+\Theta\left(a_2Q_2-bQ_2^2\right)+(1-\Theta)\left(a_3Q_2-b_3Q_2^2\right)}\}\right)$$

$$+\tau_2\left(L_{w2}\{\frac{w_2L_2}{w_1(L_m+L_1)+w_2L_2}\}+K_{w2}\{\frac{K_2}{K_m+K_1+K_2}\}+S_{w2}\{\frac{a_2Q_2-bQ_2^2}{a_1Q_1-bQ_1^2+a_2Q_2-bQ_2^2+a_3Q_3-b_3Q_3^2}\}\right) \quad (7b)$$

What happens when the tax regime in State 2 places increased weight on sales? There are countervailing effects on resource allocation. While the firm's marginal cost curve shifts downward (due to decreased weight, and thus tax, on property and payroll), the marginal revenue curve shifts downward as well (due to increased weight, and thus tax, on sales).

Assuming the presence of a throwback rule, (7) is rewritten with apportionment weights:

$$\tau_u = \tau_1\left(L_{w1}\{\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2}\}+K_{w1}\{\frac{K_m+K_1}{K_m+K_1+K_2}\}+S_{w1}\{\frac{a_1Q_1-bQ_1^2}{a_1Q_1-bQ_1^2+\Theta\left(a_2Q_2-bQ_2^2\right)+(1-\Theta)\left(a_3Q_2-b_3Q_2^2\right)}\}\right)$$

(7c)

There is no effect on the second term, following the arguments above related to (7b). Nor is there any change in State 3 sales (the last term), since these sales are not subject to income tax anyway.

3.4 MODEL WHERE FIRM HAS SELECTED ONE STATE: One State Unitary, One State Uses Separate Accounting

Finally, a mixed tax structure is analyzed, in which one of the states is unitary, and the other has a non-unitary tax structure. Before examining the impact of tax credits, the impact of the unitary/separate accounting structures is examined. Under this specification and assuming that State 2 is the non-unitary state and that the firm separately incorporates its operations in each state[29], (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:[30]

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

$$Tax_2 = \tau_2 \cdot (a_2Q_2 - bQ_2^2 - p_tQ_2 - w_2L_2 - rK_2 - sQ_2), \quad \text{and}$$

$$p_t = \frac{rK_m + w_1L_m}{Q_1 + Q_2} \qquad (16)$$

If State 1 is the non-unitary state, a similar transformation of (4) applies:

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

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

$$Tax_1 = \tau_1 \cdot \left(a_1Q_1 - bQ_1^2 - p_tQ_1 - w_1(L_m + L_1) - r(K_m + K_1)\right). \qquad (17)$$

---

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

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 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 and ϕ, with p_t increasing in both. Upon examination of (16), it is clear that the two taxes enter the objective function in very different ways, leading to very different implications of changing either rate. First, if there are relatively higher (lower) rates in the state subject to the unitary tax (state 1 in the above example), the firm has the incentive to move property, payroll, and sales out of (into) the state to reduce the fraction of profits apportioned to the state. As with the case of two unitary states, the amount of 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.

Second, 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 direction of that shift, however, is unclear as a number of conflicting forces exist. The main consideration is the nature of the externality that the non-unitary state imposes on the other state by increasing its sales and production. There are multiple externalities. The net effect of these externalities could be positive or negative but is more likely to be positive if the non-unitary state is state 1 since one externality is an increase in factor weights for the manufacturing center which is favorable for the unitary state if the unitary state does not contain the manufacturing center and unfavorable if it does. The existence of an externality induces the firm to deviate from the non-unitary state's decentralized profit-maximizing sales (i.e., the optimum ignoring the externality imposed on the other state). Specifically, the firm will tradeoff efficiency losses in the non-unitary state with externality benefits for the unitary state. The higher the non-unitary state's tax rate, the lower the after-tax cost of deviating from the decentralized optimum (since the government shares in any reduction in pre-tax profits in that state). Therefore, whatever distortion is induced by the externality will be exacerbated by an increase in the non-unitary state's tax rate. The tax rate in the unitary state has an equivalent effect to the tax rates in the previous model where both states are unitary. All comparative statics follow.

The non-unitary tax rate, however, is more complicated. Recall that when both states are non-unitary, tax rates have an effect on resource allocation only because an externality exists (due to decreasing returns to scale at the manufacturing center) that induces overproduction in each state relative to the decentralized optimum. At higher tax rates even greater underproduction is warranted to balance the externality. In the case where the other state is unitary, three externalities exist for sales in the non-unitary state. Specifically, increased sales in the non-unitary state result in: higher unit cost at the manufacturing center, increasing costs for the other state (negative externality), higher factor weights for the non-unitary state, reducing taxes in the other state (positive externality), and higher factor weights for the manufacturing center state, increasing or reducing taxes in the other state depending on whether that state contains the manufacturing center (positive externality if State 1 and negative externality if State 2).

The overall incentive to under- or over-produce in the non-unitary state (relative to the decentralized optimum) depends on the net effect of these externalities. If the negative externalities dominate, the state will underproduce and higher tax rates will lead to a reduction in sales. If the positive externalities dominate, the state will overproduce and a higher tax rate will lead to an increase in sales. It is impossible to definitively sign the net externality effect; however, given the nature of the third externality, the effect of the non-unitary tax rate on in-state sales should be much more positive if State 1 is the non-unitary state than if State 2 is the non-unitary state.

As in the case with both states non-unitary, the effect of the non-unitary tax rate on ϕ is ambiguous. The effects on labor and capital are likewise ambiguous, but are likely to correspond to the change in sales. In summary, the effect of tax rates in the case where one state has unitary taxation and the other state does not are as follows. First, when the tax rate is higher in the unitary state, resources flow out of it, and into the non-unitary state (except for K_1 and L_1, for which there are no prediction). Second, when the tax rates are higher in the non-unitary state, the effects on resource allocation are ambiguous. However, if the non-unitary state is State 1, the effect on that state's sales will be more favorable than if the non-unitary state is State 2. Thus, higher (lower) tax rates in the unitary state should result in a decrease (increase) in resources and sales in that state, and an increase (decrease) in the non-unitary state's resource usage and sales. Conversely, any change in the relative tax rate of the non-unitary state should result in a slight (perhaps insignificant) change in resources and sales in both states, with ambiguous signs. 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, as in all other settings, absence of throwback does not alter any resource allocations. Absence of sales throwback in State 2 encourages additional sales being sourced into State 3. Where State 2 is the separate accounting state, rewrite the tax constraints in (16) as:

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

$$Tax_2 = \tau_2\cdot(a_2Q_2-bQ_2^2-p_tQ_2-w_2L_2-rK_2-sQ_2)\,,\quad \text{and}$$

$$p_t = \frac{rK_m+w_1L_m}{Q_1+Q_2} \qquad (16a)$$

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

When State 2 is the unitary state, rewrite the tax constraints in (17) as:

$$\tau_{u2} = \frac{\tau_2}{4}\left(\frac{w_1(L_m+L_1)}{w_1(L_m+L_1)+w_2L_2} + \frac{K_m+K_1}{K_m+K_1+K_2} + 2\cdot\frac{a_1Q_1-bQ_1^2}{a_1Q_1-bQ_1^2+\Theta\left(a_2Q_2-bQ_2^2\right)+\left(1-\Theta\right)\left(a_3Q_2-b_3Q_2^2\right)}\right),$$

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

$$p_t = \frac{rK_m + w_1 L_m}{Q_1 + Q_2}. \tag{17a}$$

Again, the absence of throwback encourages the firm to increase Q_3. 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 $Q_2 + Q_3$). State 2 taxes increase, since the numerator of all components of τ_{u2} increase faster than the denominators.

What of the effects of increased weights on sales for State 2? If State 2 has separate accounting, rewrite State 2 tax constraints in (16) as:

$$Tax_2 = \tau_2 \cdot [S_{w2}(a_2 Q_2 - bQ_2^{\;2}) - p_t Q_2 - L_{w2}(w_2 L_2) - K_{w2}(rK_2) - sQ_2), \tag{16c}$$

if no throwback, and

$$Tax_2 = \tau_2 \cdot [S_{w2}(a_2 Q_2 - bQ_2^{\;2} + a_3 Q3 - bQ_3^{\;2}) - p_t Q_2 - L_{w2}(w_2 L_2) - K_{w2}(rK_2) - sQ_2), \tag{16d}$$

with sales throwback.

As in (16b), it is intuitive that $\partial Q_2 / \partial S_{w2} > 0$ because the absence of taxes on State 3 sales increase the marginal revenue product of State 3, 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}. The same effects, albeit less pronounced, occur when State 2 has throwback.

If State 2 has unitary taxation, rewrite the State 2 tax constraint from (17) as:

$$\tau_{u2} = \tau_2 \left(L_{w2}[\frac{w_1(L_m + L_1)}{w_1(L_m + L_1) + w_2 L_2}] + K_{w2}[\frac{K_m + K_1}{K_m + K_1 + K_2}] + S_{w2}[\frac{a_1 Q_1 - bQ_1^{2}}{a_1 Q_1 - bQ_1^{\;2} + \Theta\left(a_2 Q_2 - bQ_2^{\;2}\right) + \left(1 - \Theta\right)\left(a_3 Q_2 - b_3 Q_2^{\;2}\right)}] \right) \tag{17b}$$

where the weight are explained previously. As with the analysis relating to (7b) and (7c), there is no impact on resource allocation here.

3.5 OVERALL PREDICTIONS

Predictions of the impacts of tax incentives in State 2, for all four combinations of unitary and separate accounting settings, are reported in Table 1. Tax rate reductions are effective in unitary states, but only if the original state is also unitary. Absence of a sales throwback rule results in increased production, although the primary effect is a shifting of interstate sales (from State 2 and into State 3). Increased weighting of sales is a more effective stimulant if the state does not have a sales throwback rule. In most cases, there are externalities to State 1 operations as a result of State 2 incentives.

3.6 VALIDATING THE MODEL: SIMULATED DATA

As noted previously, some aspects of the model are too complex (without making some substantial assumptions) to solve. Accordingly, I use simulations to solve the equations. The simulations also serve to test the veracity of the model. The simulations were written in Mathematica, and run off of a UNIX server. The simulation first generates a range of observations for the exogenous variables, s, w_2, r, and all tax –related variables (rates, unitary structures, credits, throwback or its absence, and weighting of the sales factor), Next, optimization algorithms determine firm-wide maximum profits by substituting numerous values of the choice variables, L_m, L_1, L_2, K_1, K_2, Θ, and ϕ. To add some realism, all parameters take on values from the computable general equilibrium (CGE) literature. These values are discussed in Table 2 of the Appendix; they represent an average firm, and are derived from empirical observations. The study then regresses the solved for values of sales, capital , labor, Θ, and ϕ on the corresponding manipulated values of τ_1, τ_2, χ_2, ψ_2, r, s, and indicator variables for throwback, 100% sales weighting, and the interaction of throwback and 100% sales weighting. The solved-for regression parameters show the average effects of changes in exogenous variables on endogenous variables, across the wide array of simulation data. Before running these regressions, the natural log of all continuous-form variables is taken; this allows an interpretation of regression parameters as percents. The next three sections report the results of these regression results on the simulated firm data.[31]

Regression results are reported in Table 2. Results for non-tax variables are consistent with expectations and will not be discussed further. Effects of tax variables are reported in the shaded rows of the Table. For Both State use Separate Accounting, all results are consistent with expectations, specifically:

- Absence of sales throwback in State 2 increases production/sales in State 2, and has the opposite effect on State 1, i.e. a negative externality to State 1.
- 100% weighting of the sales factor has a muted effect, unless accompanied by absence of a throwback rule. When there is such a combination, the shifting of resources out of State 1 and into State 2 is more dramatic.

For Both states Use Unitary Accounting, regression results, where both states are unitary, are reported in Table 3. Results for non-tax variables are consistent with predictions, where predictions were possible. Regression results for tax variables are reported in the shaded rows of the table. Results support predictions, as follows:

- Absence of sales throwback, especially when accompanied by 100% sales weighting, increases State 2 output (as well as labor and capital) and decreases output (and labor, capital) at the primary manufacturer.

Regression results for the case of where State 1 is unitary and State 2 uses separate accounting are shown in Table 4. Results for State 1 is non-unitary, and State 2 is unitary as shown in Table 5. In general, all results are consistent with theory as follows:

- As in other settings, absence of a throwback rule in State 2 increases State 2 production (where most of the increase is sold to State 3). However, externalities result: primary

[31] Although the equations are nonlinear, the high R^2 indicate that a linear statistical model is a reasonable approximation.

manufacturer activity drops, while State 1 increases secondary manufacturer activity.

- Extra weighting of State 2 sales, when combined with absence of a throwback rule, results in a significantly greater impact on all factors.

3.7 FIRM CAN CHOOSE BETWEEN TWO STATES

Under very restrictive conditions, the firm's location choice is a simple corner solution. For example, holding all other effects constant, the firm would locate in the state having the most generous tax credits. However, such situations are likely rare; typically, the firm must consider trading off higher tax benefits of one type for lower benefits of another type, when choosing between states. The model and simulation in the previous section lays much of the groundwork for the two-state choice model. The following examines the situations of the parent company is located in a separate accounting state, or is located in a unitary state, in that order.

When the parent is choosing between two non-unitary states, it will select the one with the lowest rate. In such a pure non-unitary setting, taxes have no pretax distortionary effect; hence, the firm will locate where the after tax rate of return is higher. When the parent firm faces a choice between two unitary states, again, the lower tax rate state is favored. Although (as demonstrated in the previous section) the firm can partly mitigate taxes in a unitary state, there is still a loss in after-tax income due to distortions induced. Thus, lower tax rates are always preferred. Finally, consider the case of where the firm can chose between locating its new business in a unitary versus non-unitary state. As pointed out in the previous section, the complexity of the analytics suggests an appeal to the simulation results. As shown in Rows 3 and 4 of Table 2 (and as modeled) tax rate changes in State 2 have no effect on resource allocation or firm-wide profitability. On the other hand, Table 5 reveals that (due to the transfer-price related externality discussed in the previous section) lower rates (higher rates) in unitary State 2 actually reduce (attract) resources to the state, albeit small in magnitude (less than a .01% change for each 1% change in tax rates). Thus, the firm will be indifferent between unitary and non-unitary locations, based on tax rates alone.

If (and only if) the firm plans to use the new state as a production platform for sales into a third state, then absence of a throwback rule (especially if coupled with 100% weighting of sales) is a strong incentive. Since this is invariant across unitary/non-unitary regimes, any state having no throwback will be chosen over a state which does have throwback, *ceteris paribus*. In fact, examining coefficients in the tables, absence of throwback (combined with 100% weighting of sales) has a stronger incentive effect than lowered tax rates. Of course, this conclusion is sensitive to the parameters chosen. Where the parent company is located in a unitary state, the incentive effects of no throwback/100% weighting of sales are identical to the discussion in the previous section.

4. EMPIRICAL TESTS

To test the above predictions about the effects of single sales factors, we have "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 starting with sales weightings of 80% in 2006, 90% in 2007, and 100% by 2008[32]. Louisiana switched to SSF after 2005[33]. New York switched to 80% sales weighting in 2006, and 100% in 2007 and later years[34]. Oregon switched to SSF after July 1, 2005[35]. Wisconsin switched to 60% sales weighting in 2006, 80% in 2007, and 100% in 2008 and later years[36]. Industries for which SSF does not apply (see previous footnotes) are controlled for.

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

[32] O.C.G.A Sec. 48-7-31
[33] Sec. 47:287.95(F)(2)(a)
[34] Sec. 210 (3)(a)(10) Tax Law
[35] Sec. 314.650 ORD
[36] Sec. 71.25(6) Wisc. Stats.

the impact of the SSF at the firm location level; this precise unit provides detailed levels of employment and sales for every location. The analysis considers the effects of trends by using a differences in differences (DD) estimation method[37]. Because only some of the firms in a state have multi-state operations and are affected by the SSF, a control group of firms was designated which are single-state only, and not affected by the SSF, denoted as SSFN. With DD estimation methods we can use this latter group of firms as a control. Unfortunately, using matched pairs of SSFA and SSFN firms is problematic. 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), standard errors may be inflated, which would bias against finding results. Later, we shall see that despite such a conservative approach, the data reveal significant impacts of SSF adoption. The DD 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

$$Y_{it+1} = X_{it+1}\beta + \alpha_i + \delta SSFA + \gamma_i T_{t+1} + \sum_{i=1}^{T} \eta_j \left(T_{t+1}\right)^l + \varepsilon_{it+1} \qquad (18)$$

where X_{it+1} is a vector of explanatory variables not affected by the SSFA designation. 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

$$Y_{it} = X_{it}\beta + \alpha_i + \gamma_i T_t + \sum_{i=1}^{T} \eta_j \left(T_t\right)^l + \varepsilon_{it} \qquad (19)$$

[37] For an example of the DD method, see Ham, J. Imrohoroglu, A., and C. Swenson, Government programs can improve local labor markets: evidence form state enterprise zones, Federal empowerment zones, and Federal enterprise communities. (2009). Conditionally accepted, *Journal of Public Economics*.

And

$$Y_{it-1} = X_{it-1}\beta + \alpha_i + \gamma_i T_{t-1} + \sum_{i=1}^{T} \eta_j (T_{t-1})^l + \varepsilon_{it-1} \qquad (20)$$

respectively.

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

$$Y_{it+1} - Y_{it} = (X_{it+1} - X_{it})\beta + \delta SSFA_{t+1} + \gamma_i + \eta_j \left[(T_{t+1})^l - (T_t)^l\right] + \varepsilon_{it+1} - \varepsilon_{it} \qquad (21)$$

as well as differences in the outcome between

$$Y_{it} - Y_{it-1} = (X_{it} - X_{it-1})\beta + \delta SSFA_{t-1} + \gamma_i + \eta_j \left[(T_t)^l - (T_{t-1})^l\right] + \varepsilon_{it} - \varepsilon_{it-1} \qquad (22)$$

Double differencing by subtracting (22) from (21) for each i yields

$$\begin{aligned} Z_i &= \left[(Y_{it+1} - Y_{it}) - (Y_{it} - Y_{it-1})\right] \\ &= \left[(X_{it+1} - 2X_{it} + X_{it-1})\right]\beta + \delta SSFA_{t+1} \\ &+ \eta_j \left[(T_{t+1})^l - 2(T_t)^l + (T_{t-1})^l\right] + (\varepsilon_{it+1} - 2\varepsilon_{it} + \varepsilon_{it-1}) \quad . \end{aligned} \qquad (23)$$

4.2 Data

The 2008 National Establishment Time-Series (NETS) Database is a unique, firm 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.

Unlike other program-readable annual firm data bases (such as Standard and Poor's Compustat), NETS reports exact geographic locations of the firm and of its subsidiaries. Also, it shows dates of location move (and where moved to) so we can examine location choices of firms both before and after SSF is adopted in a state. One valuable aspect of the NETS Database is the 8-digit SIC classification system (over 18,500 industries) that allows the researcher to "drill down" to specific sectors of interest (well below the 4-digit SICs). A number of academic papers have begun to use this database.[38]

4.3 Identifying SSF-Affected Firms

Recall that the SSFA firms will have multistate operations. While the NETS dataset does not specify such status, there are several dummy variables which I can use to identify "more likely than not" SSFA versus SSFN status, as follows:

Variable Name	Description/Specification
SINGLE	Set to 1 if location is only location for that business, and zero otherwise (more likely NOT to be SSFA)
PUBLIC	Set to 1 if location belongs to a publicly-traded firm (more likely to be SSFA)
SIC<5200	Set to 1 if SIC code less than 5200. This eliminates firms which are NOT likely to be SSFA: retail[39], services, nonprofits, etc, which tend to serve local markets
SUBS	Integer for number of subsidiaries which this location has. Indicates location is more likely to be SSFA
CORP	Set to 1 if location is a corporation. Although some multistate firms use LLCs,

[38] D. Neumark, J. Zhang and B. Wall have a series of working papers (http://www.ppic.org/main/publication.asp?i=640) as well as a working paper comparing the NETS Databases to various alternative government sources (http://www.nber.org/papers/W11647). Nancy Wallace (UC 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).

[39] There are a number of large, multi-state retailers which operate within these states which would be affected by SSF, if not for the fact that SSF does not apply to these industries in most of the five states examined.

	operations tend to incorporate subsidiaries and parents (more like to be SSFA)

The SIC<5200 variable also controls for the fact that in some of the states (see previous discussions) certain industries are not eligible for SSF treatment. Also included are 4 digit SIC codes as fixed effects to control for non-modeled, industry-specific effects. These affects include some relatively minor tax law changes which affected certain industries during this time period (no major, across-industry tax law or rate changes occurred in these states during the time period examined)[40].

4.4 Results

4.4.1 Georgia

Descriptive statistics for Georgia are shown in Table 6 for 2003 through 2008. There are 1,182,732 observations, 3,109 of which belong to the SSFA group. I define SSFA firms as those which meet ALL of the following criteria: public, corporate, have subsidiaries, belong to SIC<5200, and are not single locations. This is a strict set of criteria and may bias against more powerful tests by excluding any observation from the treatment group which is missing one of the criteria.

The overall state sample (both SSFA and SSFN firms) shows sales declines of 13.6% for 2003-2005 (pre- SSF change) and 23.4% for 2006-2008 (post SSF). SSFA firms show sales changes in the same two time periods of +1.2% and -21.63%, respectively. Although SSFA firms fail to show marked changes relative to all firms post SSF adoption by the state, there is an enormous surge in SSFA sales in 2006, the year of SSF start. Recall that 2006 is omitted from the analysis since it assumes a phase-in of SSF effects which may take up to a year. For employment, the Table shows that for all firms, employment declined 7.8% and 10.8% pre- and post-SSF adoption, respectively, while SSFA firms show a .5% decline in employment prior to SSF adoption. They exhibit a 1.2% employment growth after Georgia became an SSF state.

Regression results for Georgia are reported in Table 11. Regression results for sales are shown in the left of the Table; the model F is 5.93 (p<.0001), and coefficients for SIC<5200, PUBLIC, and

[40] Some industry-specific tax changes did occur, including credits for film production in certain states such as Louisiana.

CORPORATION all point to a significant increase in sales for SSFA firms post-SSF adoption. Coefficients for employment (right side of the Table) show that SIC<5200, PUBLIC, SUBSIDIARIES, and SINGLE indicate that SSFA rims increased employment after Georgia adopted SSF rules. Using parameter estimates, there is an estimated 30,491 jobs created after the adoption of SSF.

4.4.2.Louisiana

Summary statistics for Louisiana are shown in Table 7. There are 532,386 observations, of which 1,711 are in the SSFA category. Overall firm sales declined 6.4% and 16.5%, respectively, in the pre- and post-SSF periods. Comparable sales declines for the SSFA firms were .7% and 31%, respectively. As with Georgia, there is a curious, large increase in sales for SSFA firms in 2006. Employment declined for all firms 4.7% and 9.4% for the pre- and post-SSF periods, respectively. SSFA rims' employment fell 3.9% before SSF, but increased by 3.7% after Louisiana became an SSF state.

Regression results are reported in Table 12. Results for sales (left side of the Table) show significant effects for all variables, with a model F of 19.29 (p<.0001). Coefficients for all variables support the prediction that SSFA firms enjoyed increased sales after SSF designation. Similarly, regression results for employment show that all parameters support the conclusion that SSFA firms increased employment after SSF designation. Using regression parameters, SSF increased Louisiana employment by 52,330.

4.4.3 New York

Summary statistics for New York are shown in Table 8. There are 2,433,791 observations, of which 4,860 are in the SSF-AF category. Overall firm sales declined 22.8% in the pre- and post-SSF periods. In contrast, sales increased for the SSFA firms by 7.7% in the post-SSF period. Employment declined for all firms .6% and 7.3% for the pre- and post-SSF periods, respectively. SSFA firms' employment increased by 2% after New York became an SSF state.

Regression results are reported in Table 13, with sales on left side of the Table, and employment on the right. Coefficients for the variables support the prediction that SSFA firms enjoyed increased sales and employment after SSF designation. Using regression parameters, SSF increased New York employment by 104,158.

4.4.4 Oregon

Summary statistics for Oregon are shown in Table 9. There are 538,231 observations, with 1,474 in the SSFA group. Overall Oregon sales declined .2% and 27% for the pre- and post-SSF periods, respectively. Similar statistics for the SSFA firms were +12% and -30%, respectively. The same curious surge in 2006 sales, for SSFA firms, occurred in Oregon as with other states. Overall Oregon employment declined 7.7% and 7.9% for the pre- and post-SSF periods, respectively. For the SSFA firms, employment declined 2.2% before SSF but increased 2.8% after SSF designation.

Regression results are shown in Table 14. Results for sales (shown on the left side of the Table) indicate that SIC<5200, SUBSIDIARIES, and CORPORATE all have expected signs. Results for employment are similar to that for sales. Using regression parameters, SSF is estimated to increase employment by 19,554.

4.4.5 Wisconsin

Descriptive statistics are shown in Table 10. There are 602,397 and 1,796 overall and SSFA observations, respectively. Overall sales declined 7.3% and 18.5% for pre- and post-SSF periods, respectively. SSFA firms enjoyed increase of 1.3% and 7.92% increases during these time periods, respectively. Overall state employment declined 6.8% and 9.4% pre- and post-SSF, respectively. SSFA firms showed .8% declines and .8% employment increases during these time periods, respectively.

Regression results are shown in Table 15. The left side shows results for sales. Although the overall model fit is satisfactory, only two of the regression coefficients have signs consistent with expectations. Results are improved for employment, with signs for PUBLIC, SUBSIDIARIES, and

SINGLE consistent with expectations. Using regression parameters, SSF is estimated to increase employment by 12,203.

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 tax rates and rules should result in the firm making such resource decisions. Results of a firm model (corroborated by simulation results) find that the firm would make such resource allocation changes to minimize company-wide state taxes. 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 differences in differences econometric model which is able to discern firms which are affected by SSF, the model finds that SSF in fact increased employment in these states after adoption. The policy implications 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 right. Of course, such policy implications should be tempered; the use of general equilibrium model may be appropriate to examine the total effects on both a state's economy and its overall tax base.[41]

[41] For example, Hamm et al (2005) obtain much larger employment effects than this study by allowing for multiplier effects using a general equilibrium setting.

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Appendix

Table 1a-General[42] 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
Michigan* (1.9%)	.9,.05,.05	Yes	Virginia (6%)	1/3 each	No

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

Minnesota (9.8%)	.7,.15,.15	No	Washington	N/a-no income tax	N/a-no income tax
Mississippi (5%)	1/3 each	Yes	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					

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Appendix

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

State	Sales, Property, and Payroll Weights:	State	Sales, Property, and Payroll Weights
		Missouri	1/3 each[43]
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[44]	New Jersey	.5,.25,.25
Connecticut	.5,.25,.25[45]	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[46]
Idaho	.5,.25,.25	Oklahoma	1/3 each
Illinois	1.0,0,0	Oregon	1.0,0,0
Indiana	.5,.25,.25[47]	Pennsylvania	.5,.25,.25
Iowa	1.0,0,0	Rhode Island	1/3 each
Kansas	1/3 each[48]	South Carolina	1/3 each[49]
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[50]	Utah	1/3 each
Massachusetts	1.0,0,0	Vermont	1/3 each
Michigan	.9,.05,.05[51]	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

[43] SSF is elective
[44] Starting in on or after January 1, 2009, multistate corporations must use SSF
[45] Financial service companies, broadcasters, and manufacturers must use SSF
[46] Under commercial activity tax
[47] SSF is being phased in and will be complete in 2011.
[48] SSF applies to certain industries
[49] SSF applies to certain industries
[50] SSF applies to certain industries
[51] SSF applies to certain situations

APPENDIX

Table 2—Simulation Parameters

"Real World"*		Simulation
	REVENUE	
Downward-sloping demand function; Price elasticities range from -.38 to –5.00		For all states, *P*=1-.1*Q*; Demand elasticities vary, with mean of –3.26, and range of –4.73 to –2.59. Elasticities varied such that States 1, 2, 3 and demand functions always unique
	OUTPUT	
Cobb-Douglas; approximate ratio of capital to output (*K:Q*)=3:1; approximate ratio of capital:labor=.60:.40.		$\phi(Q_1+Q_2)=Y_m=\Theta(L_m^{\alpha}\cdot K_m^{\beta}),$ for main plant, and $\phi Q_i=Y_i=\Theta(L_i^{\alpha}\cdot K_i^{\beta}).$ for secondary plants. □ = 3, which is chosen so that *K:Q* is approximately 3. In fact, *K:Q* varies somewhat for each of three plants, with mean = 3.05, and range of 2.11 to 4.53 across all observations. ϕ is solved for, with mean=.33 and range of .15 to .55 across all observations. □and□set at .48 and .32, respectively (ie, .60:.40 relative ratio). *L* and *K* are solved for, for all three plants.
	COSTS	
Statewide per capita personal income varies from 71 (Mississippi) to 142 (Connecticut) percent of the national average.		*w* is a numeraire.
The cost of capital is the interest rate adjusted for risk. Risk-free interest rates (one year Treasuries) have varied between 3.18 and 7.14 percent since 1990.		Values of model have no risk so *r* takes on the conserva value of the highest risk rate of 7 percent.
Shipping cost (s) is unknown and likely to vary widely by industry.		*s* takes on the values of 0, 5, 10, 15, or 20 percent of the maximum possible sales price.
		TAXES
State tax rates range from 0 to 14%		When both states are unitary, τ_1 - τ_2 takes on the values of -14, -12, -10, -8, -6, -4, -2, 0, 2, 4, 6, 8 when at

	least one state is non-unitary, τ_1 and τ_2 each takes on the values 0, 2, 4, 6, 8, 10, 12, or 14 percent
Apportionment factors; see Table 1 in Appendix	Sales weight 50% or 100%; capital labor weights 25% or 0% each.
Throwback-varies by state; see Table 1 in Appendix	Set to 0 or 1

*See Berck et al. (1996) and Cooley (1996) for non-tax parameters

Table 1
Summary of Comparative Statics
Impacts of Incentives on Resource Allocation

New State Incentive	Both States Separate Accounting	Both States Unitary	Original State Separate Accounting, New State Unitary	Original State Unitary, New State Separate Accounting
Decrease in Tax Rate ($\downarrow \tau_2$)	None	$\downarrow\varphi \downarrow Q_1 \uparrow Q_2 \downarrow L_m \downarrow K_m \uparrow L_2 \uparrow K_2$	Unknown	Slight $\uparrow K_2$ Slight $\uparrow K_2$
No Sales Throwback ($\tau_2 \cdot s_3=0$)	$\uparrow Q_2 \uparrow \Theta \uparrow L_1 \uparrow K_1 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow L_1 \uparrow K_1 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow L_1 \uparrow K_1 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow L_1 \uparrow K_1 \downarrow Q_1$
Increased Weighting for Sales (S_{w2}=1.00) with throwback	None	None	None	None
Increased Weighting for Sales (S_{w2}=1.00) No throwback	$\uparrow Q_2 \uparrow \Theta \uparrow K_2 \uparrow L_2 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow K_2 \uparrow L_2 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow K_2 \uparrow L_2 \downarrow Q_1$	$\uparrow Q_2 \uparrow \Theta \uparrow K_2 \uparrow L_2 \downarrow Q_1$

Table 2
Regression Results For Simulated Data: Both States Non-Unitary
(State Tax Incentive Effects in Shaded Areas)

Independent Variable:	Dependent Variable: Firm Pretax Profit	State 1 Sales	State 2 Sales	State 1 Labor	State 2 Labor	State 1 Capital	State 2 Capital	Primary MFG Capital	Primary MFG Labor
Constant	1.46	1.45	1.61	-1.10	-.46	2.58	2.13	1.23	-2.45
τ_1	.00	.01	-.01	-.03	-.04	.00	-.05	.09	.08
τ_2	.09**	-.02**	.13**	.28**	.95**	.44**	-.09**	-.75**	-.75**
ψ_2	.18**	-.03**	.20**	.19**	-.04**	.26**	.50**	-.81*	-.81**
No Sales Throwback	.22**	-.0 4**	Ψ.25**	-.10**	.22**	-.11**	.26**	.21*	(.17)**
S_{w2}=1.0, Throwback	.00	.00	Ψ-.01	(.000)	-.02	.00	.00	.02	.00
S_{w2}=1.0, No Throwback	.19**	-.04**	.27**	-.01*	.25**	-.06**	.30**	-.42**	-.42**
R	-3.69	-2.54	-2.56	3.13	4.13	-15.36	-16.87	-13.42	7.58
S	-1.14	.03	-1.40	.07	-1.72	.04	-1.71	-.80	-.80
τ_1	-.00	-.01	.01	.07	.06	-.01	.05	-.12	-.10
Model R^2	1.00	.95	.99	.55	.97	.98	.97	.92	.89

**Indicates tax rate or credit coefficient significant at .01 level or better (t statistics omitted). All data subject to logarithmic transformation.

Table 3
Regression Results For Simulated Data: Both States Unitary
(State 2 Tax Incentive Effects in Shaded Areas)

Independent Variable:	Dependent Variable: Firm Pretax Profit	State 1 Sales	State 2 Sales	State 1 Labor	State 2 Labor	State 1 Capital	State 2 Capital	Primary MFG Capital	Primary MFG Labor
Constant	1.29	1.04		-1.10	-.46	2.58	2.13	1.24	-2.44
τ_2	.02**	-.13**	.22**	.72**	1.01**	.73**	1.39**	-1.65**	-1.52**
τ_1	.13**	-.02**	.13**	.29**	.96**	.44**	-.08**	-.75**	-.75**
Ψ_2	.18**	-.01**	.20**	.35**	-.12**	.36**	.95**	-.78*	-.78**
No Sales Throwback	23.**	-.05**	Ψ.28**	-.12**	.23**	-.13**	.27**	.22**	.19**
S_{w2}**=1.0, Throwback**	.01**	-.01**	Ψ.10**	.01	.59**	.01	.62**	-.41**	-.41**
S_{w2}**=1.0, No Throwback**	.21**	-.06*	Ψ.31	-.03**	.38**	-.07	.41**	-.52**	-.52**
S	-1.23	.02	-1.40	.11	-1.72	.03	-1.71	-.81	-.81
τ_1	-.03**	-.22**	.21**	.38**	.84**	.53**	1.19**	-1.89**	-1.69**
Model R^2	1.00	.95	.99	.55	.97	.98	.97	.92	.89

ΨSum of State 2 plus State 3 sales.
**Indicates tax rate or credit coefficient significant at .01 level or better (t statistics in parentheses).
All data subject to logarithmic transformation.

Table 4
Regression Results For Simulated Data: State 1 is Unitary; State 2 is Non-Unitary
(State 2 Tax Incentive Effects in Shaded Areas)

Independent Variable:	Dependent Variable: Firm Pretax Profit	State 1 Sales	State 2 Sales	State 1 Labor	State 2 Labor	State 1 Capital	State 2 Capital	Primary MFG Capital	Primary MFG Labor
Constant	1.30	1.04	1.20	-1.11	-.48	2.56	2.12	1.13	-2.54
τ_2	.00	-.00	-.01**	.00	.00	-.03**	-.03	-.03**	.03
No Sales Throwback	.22**	-.03**	Ψ.25**	-.11**	.21**	-.11**	.25**	.21**	.16**
S_{w2}=1.0, Throwback	.01	-.01	Ψ.01	.00	.01	-.01	.01	-.01	-.01
S_{w2}=1.0, No Throwback	.21**	-.05**	Ψ.30**	-.01**	.27**	-.07**	.31**	-.45**	-.45**
R	-5.91	-2.66	-2.53	2.01	3.50	-15.94	-17.74	-11.27	9.54
S	-1.23	.01	-1.36	.13	-1.72	-.05	-1.71	-.69	-.70
τ_1	-.03	-.23	.24	.31	.84	.55	1.22	-1.86	-1.66
Model R^2	1.00	.96	.99	.51	.98	.98	.98	.91	.90

Ψ.Sum of State 2 plus State 3 sales.
**Indicates tax rate or credit coefficient significant at .01 level or better (t statistics omitted). All data subject to logarithmic transformation.

Table 5
Regression Results For Simulated Data: State 1 Non-Unitary; State 2 Unitary
(State 2 Tax Incentive Tax Effects in Shaded Areas)

Independent Variable:	Dependent Variable: Firm Pretax Profit	State 1 Sales	State 2 Sales	State 1 Labor	State 2 Labor	State 1 Capital	State 2 Capital	Primary MFG Capital	Primary MFG Labor
Constant	1.29	1.04	1.21	-1.11	-.45	2.58	2.13	1.35	(-2.34)
τ_2	.02**	-15**	.22**	.68**	1.01**	.73**	1.38**	-1.67**	-1.53**
No Sales Throwback	.21**	-.03**	$^{\Psi}$.25**	-.10**	.21**	-.05**	.29**	-.39**	-.39**
S_{w2}=1.0, Throwback	.00	-.01	$^{\Psi}$.01	.00	.01	-.00	.01	-.01	-.01
S_{w2}=1.0, No Throwback	.22**	-.04**	$^{\Psi}$.25**	-.10**	.22**	-.05	.30**	-.41**	-.41**
R	-5.89	-2.40	-2.58	4.65	5.12	-14.29	-15.57	-15.75	5.37
S	-1.21	.10	-1.43	.21	-1.70	.24	-1.68	-.86	-.85
τ_1	.02	.13	.01	.09	-.04	.13	-.04	.16	.16
Model R^2	1.00	.93	.99	.61	.96	.97	.96	.93	.89

$^{\Psi}$.Sum of state 2 plus State 3 sales

**Indicates tax rate or credit coefficient significant at .01 level or better (t statistics omitted). All data subject to logarithmic transformation.

Table 6
Descriptive Statistics
Georgia

All Firms (n=1,181,732)					**Purely Multi-state Firms (N=2410)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2003	$2,618,963	0	$38,472,998,100		$71,943,039	$1,600	$5,132,283,500
Sales-2004	$2,335,852	0	$39,479,732,100		$72,917,063	$18,384	$4,740,000,000
Sales-2005	$2,262,225	0	$37,115,475,400		$73,039,743	$4,289	$5,468,443,000
Sales-2006	$2,342,061	0	$122,324,566,000		$114,660,591	$25,200	$8,252,050,8000
Sales-2007	$1,953,795	0	$21,205,800,000		$85,966,270	$38,000	$7,859,096,000
Sales-2008	$1,793,890	0	$23,295,600,000		$89,875,209	$37,500	$7,242,157,000
Employees-2003	16.37	1	30,000		415.61	1	30,000
Employees-2004	15.70	1	30,000		419.03	1	30,000
Employees-2005	15.07	1	30,000		412.89	1	30,000
Employees-2006	13.82	1	32,000		430.99	1	30,500
Employees-2007	13.29	1	34,000		436.42	1	30,500
Employees-2008	12.30	1	36,000		434.57	1	31,000
% Public	3.52				100		
% SIC<5200	.72				100		
% Corporations	.27				100		
% Single Locations	.87				0		
No. Other Locations in U.S.	114.55	0	31057		250.8		5432

Change in Sales: 2003-2005 -13.6% +1.52%
Change in Sales: 2007-2008: -23.4% -21.6%
Change in Employment: 2003-2005: -7.8% -.5%
Change in Employment: 2005-2008: -10.8% +1.2%

Table 7
Descriptive Statistics
Louisiana

All Firms (n=532,386)					**Purely Multi-state Firms (N=1711)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2003	$2,831,592	0	$38,472,998,100		$84,965,658	$1,092	$5,132,283,500
Sales-2004	$2,653,019	0	$39,479,731,200		$83,809,170	$906	$4,740,000,000
Sales-2005	$2,651,500	0	$37,115,475,400		$84,327,462	$906	$5,468,443,000
Sales-2006	$2,760,453	0	$82,520,508,000		$152,113,194	$25,200	$8,252,050,800
Sales-2007	$2,405,525	0	$1,060,000,000		$99,900,396	$40,000	$7,859,096,000
Sales-2008	$2,305,506	0	$2,069,000,000		$104,273,789	$36,000	$7,242,157,000
Employees-2003	17.82	1	30,000		465.24	1	30,000
Employees-2004	17.06	1	30,000		458.42	1	30,000
Employees-2005	16.98	1	30,000		447.46	1	30,000
Employees-2006	16.52	1	30,500		463.97	1	30,500
Employees-2007	15.93	1	30,500		474.76	1	30,500
Employees-2008	14.95	1	31,000		480.92	1	31,000
% Public	3.6				100		
% SIC<5200	26.9				100		
% Corporations	27.0				100		
% Single Locations	85.6				0		
No. Other Locations in U.S.	139.56				230.65		

Change in Sales: 2003-2005	-6.4%	+.7%
Change in Sales: 2007-2008:	-16.5%	-31.0%
Change in Employment: 2003-2005:	-4.7%	-3.9%
Change in Employment: 2005-2008:	-9.4%	+3.7%

Table 8
Descriptive Statistics
New York

All Firms (n=2,433,791)					**Purely Multi-state Firms (N=4860)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2003	$2,048,962	0	$376,401,000,000		$57,297,975	$16,000	$376,401,000,000
Sales-2004	$1,952,736	0	$386,262,706,000		$57,020,684	$28,000	$386,262,706,000
Sales-2005	$2,145,793	0	$369,962,420,000		$57,948,592	$32,050	$369,962,420,000
Sales-2006	$2,380,906	0	$437,978,563,000		$61,983,003	$25,200	$437,978,563,000
Sales-2007	$2,454,989	0	$566,189,235,300		$63,677,375	$50,000	$566,189,235,300
Sales-2008	$1,776,569	0	$363,004,959,400		$66,777,999	$40,500	$363,004,959,400
Employees-2003	12.51	1	36,000		314.75	1	36,000
Employees-2004	12.50	1	36,000		317.50	1	36,000
Employees-2005	12.43	1	36,000		313.50	1	36,000
Employees-2006	12.07	1	36,000		323.00	1	36,000
Employees-2007	11.93	1	36,000		327.50	1	36,000
Employees-2008	11.01	1	36,000		331.75	1	36,000
% Public	2.2				100		
% SIC<5200	26.6				100		
% Corporations	29.8				100		
% Single Locations	88.8				0		
No. Other Locations in U.S.	130.1				266.7		

Change in Sales: 2003-2005: 2.1% -6.1%

Change in Sales: 2007-2008: -22.8% 7.7%

Change in Employment: 2003-2005: -.6% .07%

Change in Employment: 2005-2008: -7.3% 2.0%

Table 9
Descriptive Statistics
Oregon

All Firms (n=538,231)					**Purely Multi-state Firms (N=1474)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2003	$2,509,898	0	$15,727,600,000		$102,102,549	$34,721	$5,132,283,500
Sales-2004	$2,426,035	0	$16,385,600,000		$102,357,266	$80,000	$4,740,000,000
Sales-2005	$2,454,225	0	$19,386,000,000		$103,341,965	$70,000	$5,468,443,000
Sales-2006	$3,246,997	0	$122,324,566,000		$180,838,746	$65,200	$82,520,508,000
Sales-2007	$2,432,327	0	$21,205,800,000		$121,787,309	$54,842	$7,859,096,000
Sales-2008	$2,364,386	0	$23,295,600,000		$126,868,441	$32,096	$7,242,157,000
Employees-2003	16.11	1	30,000		576.49	1	30,000
Employees-2004	15.74	1	30,000		571.43	1	30,000
Employees-2005	15.51	1	30,000		564.09	1	30,000
Employees-2006	15.41	1	32,000		583.37	1	30,500
Employees-2007	15.03	1	34,000		596.48	1	30,500
Employees-2008	14.19	1	36,000		599.88	1	31,000
% Public	2.4				100		
% SIC<5200	33.1				100		
% Corporations	22.2				100		
% Single Locations	89.1				0		
No. Other Locations in U.S.	97.70				245.10		

Change in Sales: 2003-2005 -13.6% +1.52%
Change in Sales: 2007-2008: -23.4% -21.6%
Change in Employment: 2003-2005: -7.8% -.5%
Change in Employment: 2005-2008: -10.8% +1.2%

Table 10
Descriptive Statistics
Wisconsin

All Firms (n=602,327)					**Purely Multi-state Firms (N=1796)**		
	Mean	**Minimum**	**Maximum**		**Mean**	**Minimum**	**Maximum**
Sales-2003	$2,795,799	0	$15,727,600,000		$92,241,655	$3,052	$5,132,283,500
Sales-2004	$2,622,070	0	$16,385,600,000		$92,900,726	$68,000	$4,740,000,000
Sales-2005	$2,592,110	0	$19,386,000,000		$93,475,154	$67,600	$5,468,443,000
Sales-2006	$2,924,127	0	$122,324,566,000		$99,232,614	$66,900	$5,968,000,000
Sales-2007	$2,505,768	0	$21,205,800,000		$103,712,462	$66,700	$6,197,928,800
Sales-2008	$2,381,445	0	$23,295,600,000		$107,118,226	$71,400	$6,333,826,200
Employees-2003	18.96	1	30,000		526.18	1	30,000
Employees-2004	18.18	1	30,000		532.38	1	30,000
Employees-2005	17.69	1	30,000		521.65	1	30,000
Employees-2006	17.13	1	32,000		538.23	1	30,500
Employees-2007	16.67	1	34,000		545.21	1	30,500
Employees-2008	15.53	1	36,000		542.64	1	31,000
% Public	2.9						
% SIC<5200	33.7						
% Corporations	27.1						
% Single Locations	85.9						
No. Other Locations in U.S.	111.75						

Change in Sales: 2003-2005 -7.3% +1.3%
Change in Sales: 2007-2008: -18.5% +7.9%
Change in Employment: 2003-2005: -6.8% -..8%
Change in Employment: 2005-2008: -9.4% +.8%

Table 11
Regression Results
Georgia

Parameter	Sales		Employment	
SIC<5200	450239		.15	
Public	4622043		1.14	
No. Subsidiaries	-683		.01	
Corporation	794181		-.54	
Single Location	1051985		-.92	
Intercept	-1261592		1.06	
Industry Dummies	Yes		Yes	
Model F (prob.)	5.93(.0001)		7.06(.0001)	
No. Observations	311,592		316,425	

***significant at .001 or better
**significant at .01 or better

For standard errors under OLS, robust estimation methods, and weighted least squares, contact the author.

Table12
Regression Results
Louisiana

Parameter	**Sales**		**Employment**	
SIC<5200	792852		.91	
Public	2228319		7.19	
No. Subsidiaries	1659		.01	
Corporation	89084		-.71	
Single Location	-218022		-1.27	
Intercept	182882		1.39	
Industry Dummies	Yes		Yes	
Model F (prob.)	19.29(.0001)		14.91(.0001)	
No. Observations	154913		158484	

***significant at .001 or better
**significant at .01 or better
For standard errors under OLS, robust estimation methods, and weighted least squares, contact the author.

Table 13
Regression Results
New York

Parameter	Sales		Employment	
SIC<5200	67633		.479	
Public	309697		-1.12	
No. Subsidiaries	1763		-.03	
Corporation	161343		.056	
Single Location	-497123		.074	
Intercept	450723		-.034	
Industry Dummies	Yes		Yes	
Model F (prob.)	1.19		16.53(.0001)	
No. Observations	955264		1003916	

***significant at .001 or better
**significant at .01 or better
For standard errors under OLS, robust estimation methods, and weighted least squares, contact the author.

Table 14
Regression Results
Oregon

Parameter	Sales		Employment	
SIC<5200	923378		.02	
Public	-1066923		4.43	
No. Subsidiaries	25		.01	
Corporation	272072		-.51	
Single Location	915278		-1.00	
Intercept	-1093492		1.17	
Industry Dummies	Yes		Yes	
Model F (prob.)	2.87(.0136)		6.25(.0001)	
No. Observations	154242		156412	

***significant at .001 or better
**significant at .01 or better
For standard errors under OLS, robust estimation methods, and weighted least squares, contact the author.

Table 15
Regression Results
Wisconsin

Parameter	Sales		Employment	
SIC<5200	780294		-.39	
Public	-132128		4.66	
No. Subsidiaries	-201		.01	
Corporation	186683		-.79	
Single Location	577479		-.92	
Intercept	-675349		1.39	
Industry Dummies	Yes		Yes	
Model F (prob.)	2.66(.014)		8.39(.0001)	
No. Observations	203432		206981	

***significant at .001 or better
**significant at .01 or better
For standard errors under OLS, robust estimation methods, and weighted least squares, contact the author.

Figure 1
Inter-State Production Model
Existing Operations (State 1)