Fiscal Research Program

THE MANIPULATION OF STATE CORPORATE INCOME TAX APPORTIONMENT FORMULAS AS AN ECONOMIC DEVELOPMENT TOOL

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APPORTIONMENT FORMULAS AS AN ECONOMIC DEVELOPMENT TOOL

ABSTRACT

This paper examines the economic development, revenue, and welfare impacts of disproportionate sales factor weighting in state corporate income tax apportionment formulas. We find that although disproportionate sales factor weighting is unlikely to be a substantial boon to economic development efforts, the policy clearly has positive development effects, and regional characteristics such as size, industrial make-up, and levels of statutory tax rates can significantly affect the policy's success. Moreover, we find that revenue impacts are relatively much larger in magnitude than are development impacts, and that regional welfare is diminished by disproportionate sales factor weights.
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ABSTRACT

This paper examines the economic development revenue and welfare impacts of
intergovernmental state corporate income tax apportionment formulas. We find that
alternative apportionment strategies foster greater revenue equality opportunities to be
exploited by policy makers. We also discuss the potential for revenue equality
characteristics such as size, industry, and region to influence economic development
outcomes. The paper concludes with recommendations for future research.
THE MANIPULATION OF STATE CORPORATE INCOME TAX APPORTIONMENT FORMULAS AS AN ECONOMIC DEVELOPMENT TOOL

I. Introduction

Competition among states for new investment and business expansion has greatly intensified over the last several years, especially with regard to the use of tax incentives. For example, over the last two decades the number of states providing corporate income tax exemptions has increased from 21 to 37, and the number of states allowing accelerated depreciation of industrial equipment has grown from 25 to 41 (Site Selection, various issues). With interjurisdictional competition accelerating, aggressive tax policy measures aimed at encouraging state and local economic development are being put forth with little or no formal analysis. The danger is that large amounts of scarce government resources will be poured into development efforts that have little chance of succeeding or that may not be cost-effective.

A case in point is disproportionate weighting of the sales factor in state corporate income tax apportionment formulas, a trend that has gained much momentum in recent years. Although this policy has been endlessly debated on legal fronts (McClure, 1986; Simafranca, 1995; Peters, 1998), there has been little formal economic analysis.¹ This paper seeks to fill the void by examining the impact of disproportionate sales factor weighting on economic development, corporate tax collections, and welfare.

Formula apportionment, as used by U.S. states, assumes that the proportion of a multistate firm’s income earned in a given state is a weighted average of the proportion of the firm’s total sales,

¹ This is not to say that there has been no formal analysis of formula-apportioned corporate income taxes. McClure (1980, 1981), Mieszkowski and Zdrow (1985), and Gordon and Wilson (1986) examine the incidence of the state corporate income tax, but they do not consider the manipulation of factor weights.
payments to property, and payroll in that state. Specifically, the formula for apportioning some firm’s profits to some state i is given by

$$
\phi_i = \sigma_i \frac{S_i}{S} + \rho_i \frac{R_i}{R} + \lambda_i \frac{W_i}{W}
$$

where $\phi_i$ is the apportionment (in percentage terms) of the firm’s profits to state i; $\sigma_i$, $\rho_i$, and $\lambda_i$ are state i’s weights on gross receipts (sales), property, and payroll, respectively, in its apportionment formula; $S_i$, $R_i$, and $W_i$ are the firm’s gross receipts, property, and payroll in state i; and S, R, and W are the firm’s gross receipts, property, and payroll nationally.

The framers of the Uniform Division of Income for Tax Purposes Act (UDITPA, 1957), which set out the three-factor apportionment formula shown in equation (1), intended for states to employ an equally weighted three-factor formula ($\sigma = \rho = \lambda = 1/3$) so as to provide for uniformity in state tax structures and avoid multiple taxation of corporate income across states. Recently, however, many states have moved towards a greater weight on the sales portion of the state corporate income tax (raising $\sigma$ and lowering $\rho$ and $\lambda$) in an effort to export more of the corporate income tax burden and to encourage economic development. Other states have offered optional formulas with greater sales factor weights. By increasing the sales factor weight, production in the state becomes relatively less expensive because firms face lower (implicit) tax burdens on property and payroll than they would under equal factor weights.

Of the 47 states (and District of Columbia) that currently impose a corporate income tax, 29 weight the sales factor more heavily than property and payroll factors, and most (17) made the switch from a uniform formula in the 1990s. Much of this recent rush to alter apportionment formulas can be attributed to the increasingly competitive nature of economic development at the state level. While in the past disproportionate weighting was an “offensive” move intended to generate industrial
development, now states are putting disproportionate weights on sales factors in a purely defensive posture -- they do so because they believe that the tax structures of other states put them at a disadvantage when it comes to economic development. Given the large number of states moving to a disproportionate sales factor weight in the last few years, it is reasonable to project that most if not all other states will soon move in that direction. Most states have opted for a double-weighted sales factor formula, but those states desiring to stay ahead of the economic development game have now begun implementing single factor sales apportionment formulas.

In the remainder of the paper, a two-region, eight-sector computable general equilibrium (CGE) model is developed to evaluate the likely impact of disproportionate sales factor weighting on economic development, tax revenues, and welfare. We find that although disproportionate sales factor weighting is unlikely to be a substantial boon to economic development efforts, the policy clearly has positive development impacts, and regional characteristics such as size, industrial make-up, and levels of statutory tax rates can significantly affect the degree of success. Moreover, we find that revenue impacts are relatively much larger in magnitude than are development impacts, and that regional welfare is diminished by disproportionate sales factor weighting.

II. Formula Apportionment and Firm Behavior

In this section we consider individual firm responses to changes in corporate income apportionment formulas in a partial equilibrium setting. This behavior is later incorporated into a formal model presented in Section III.

We begin by writing the objective function for some multistate corporation as

\[ \pi_N = (S - W)(1 - \sum_{i=1}^{N} t_i \phi_i) - R \]  

(2)
where states are indexed by i and \( t_i \) is the statutory corporate income tax rate in state i. Following convention, the tax on normal profits is incorporated by disallowing a deduction for capital costs in the determination of taxable income. First-order conditions for profit maximization are given by substituting (1) into (2) and differentiating with respect to capital and labor utilization in each state i. To simplify the exposition, we assume that the output arising from a marginal addition of capital or labor in state i is sold solely to consumers in state i, giving:

\[
MRPK_i \left[ 1 - \sum_{j=1}^{N} t_j \phi_j - \frac{\pi_i}{S} \left( \sigma f_i - \sum_{j=1}^{N} S_j \sigma f_j \right) \right] = \left[ 1 + \frac{\eta_i}{s} \left( \rho f_i - \sum_{j=1}^{N} S_j \rho f_j \right) \right] r_i \tag{3}
\]

and

\[
MRPL_i \left[ 1 - \sum_{j=1}^{N} t_j \phi_j - \frac{\pi_i}{S} \left( \sigma f_i - \sum_{j=1}^{N} S_j \sigma f_j \right) \right] = \left[ 1 - \sum_{j=1}^{N} t_j \phi_j + \frac{\pi_i}{w} \left( \lambda f_i - \sum_{j=1}^{N} W_j \lambda f_j \right) \right] w_i \tag{4}
\]

for \( i = 1, \ldots, N \) where marginal revenue products are given by \( MRPZ_i = \sum_{j=1}^{N} p_j \partial x_j / \partial Z_i \) for \( Z_i = K_i, L_i, \) and \( \pi_i \) is taxable profits (S-W).

Equations (3) and (4) elucidate two separate effects of the formula-apportioned corporate income tax. The first effect, which is represented by the \( \phi \) terms, captures the impact on the firm's corporate income tax liability from increased profits that arise when the firm employs additional capital or labor. The second effect, which is represented by the parenthetical terms, reveals an implicit excise tax or subsidy that arises because the firm's overall activity in state i (relative to other

\[\text{footnote}{2}\]

This is a very reasonable assumption for (4) but completely realistic for (3) only in the case where capital is owned regionally. Nevertheless, the assumption is not made because it is realistic, but because it aids in the interpretation of the first-order conditions. This assumption is relaxed in the formal model.
states), as measured by the apportionment formula, changes when the firm employs additional capital or labor in that state.

The excise effects of a national system of formula-apportioned corporate income taxes can be interpreted as tax differentials weighted by taxable profit margins. For example, the excise effect on the cost of capital in state $i$, which is given by

$$\pi_R \left( \frac{\rho f_i}{R} - \sum_{j=1}^{N} \frac{R_j}{R} \rho f_j \right)$$

is the firm’s taxable profit margin on capital ($\pi_R / R$) multiplied by the tax differential between state $i$’s factor-weighted-adjusted (FWA) corporate tax rate ($\rho f_i$) and the national weighted-average FWA corporate tax rate, where the weights are each state’s share of total firm property. Similar interpretations hold for the sales and payroll factors.

Now consider a move by state $i$ to increase its sales factor weight, and hence, lower its payroll and property factor weights. We first note that the factor weights in apportionment formulas must sum to one, which requires that $d\rho = d\lambda = -\frac{1}{2} d\sigma$ if states uniformly lower $\rho$ and $\lambda$, as always has been the case in the past. The effect of disproportionate sales factor weighting on the “profits tax” burden is given by

$$\frac{\partial (\Phi_{\lambda})}{\partial \sigma_i} = t_i \left[ \frac{S_i}{S} - \left( \frac{1}{2} \frac{R_i}{R} - \left( \frac{1}{2} \frac{W_i}{W} \right) \right) \right]$$

Whether or not the firm’s profits tax burden increases, decreases, or stays the same depends on the relative magnitudes of state $i$’s share of the firm’s total gross receipts, payroll, and payments to property. If these shares are equal, then there will be no change in the firm’s profits tax burden. However, if state $i$’s share of the firm’s total gross receipts is relatively larger (smaller) than its share of the firm’s total payroll and payments to property, then the firm’s profits tax burden will increase (decrease) in state $i$. 

5
The effects of an increase in the sales factor weight on a firm's "excise tax" burdens are determined by differentiating the implicit excise tax rates arising from formula apportionment with respect to the sales factor weight, giving:

\[
\frac{\partial}{\partial \sigma_i} \left( \frac{\pi_i}{S} \left( \alpha_{f_i} - \sum_{j=1}^{N} \frac{S_j}{S} \alpha_{f_j} \right) \right) = \frac{\pi_i}{S} \left( 1 - \frac{S_i}{S} \right) > 0
\]  

(6)

\[
\frac{\partial}{\partial \sigma_i} \left( \frac{\pi_i}{R} \left( \rho_{f_i} - \sum_{j=1}^{N} \frac{R_j}{R} \rho_{f_j} \right) \right) = -\frac{1}{2} \left( \frac{\pi_i}{R} \left( 1 - \frac{R_i}{R} \right) \right) < 0
\]  

(7)

\[
\frac{\partial}{\partial \sigma_i} \left( \frac{\pi_i}{W} \left( \lambda_{f_i} - \sum_{j=1}^{N} \frac{W_j}{W} \lambda_{f_j} \right) \right) = -\frac{1}{2} \left( \frac{\pi_i}{W} \left( 1 - \frac{W_i}{W} \right) \right) < 0
\]  

(8)

These effects elucidate states' incentives to double-weight their sales factors. By doing so, the states reduce the excise burdens associated with productive activity in their states and hence encourage economic development. However, these economic development incentives come at a cost of discouraging sales in the state and raising tax-inclusive consumer prices. It is important to note that disproportionate sales factor weighting encourages all firms to produce more, regardless of the effect of the policy on their overall tax liability. Even for states that have relatively more sales than productive activity in the acting state, tax liabilities are diminished by shifting production to the acting region.

The preceding analysis assumed that sales factors are situated at destination rather than at origin. Although gross receipts generally are situated at destination for the purposes of
apportionment, it is administratively difficult to situs some sales at destination, so they must be sitused on an origin basis, similar to the situsing of payroll and property. When gross receipts are sitused at destination, the implicit property and payroll excise taxes are independent of the implicit gross receipts excise tax because the situsing of gross receipts is independent of the location of production. When gross receipts are sitused at origin, however, the independence no longer holds, and the implicit gross receipts excise tax becomes a cost of production. That is, the implicit excise tax cost associated with a marginal increase in the use of capital in some state i is the implicit excise tax on one unit of capital (7) plus the implicit gross receipts tax on the marginal revenue product arising from the use of that capital (6). An increase in the gross receipts factor weight (and uniform reduction in property and payroll factor weights) encourages the use of capital in state i only if

$$\frac{1}{2} \left( \frac{\pi_T}{R} \left( 1 - \frac{R_i}{R} \right) \right) \geq \frac{\pi_T}{S} \left( 1 - \frac{S_i}{S} \right) \frac{p}{\partial k_i}$$

(9)

where \( p \) is the average consumer price paid for one unit of firm output. Assuming constant returns to scale and recognizing that \( S_i / S = \bar{p} q_i / \bar{p} q = q_i / q \), (9) can be rewritten as

$$\frac{1}{2} \left( \frac{\pi_T}{R} \left( 1 - \frac{R_i}{R} \right) \right) \geq \frac{\pi_T}{S} \left( 1 - \frac{q_i}{q} \right)$$

(10)

Because the ratio \( R_i / R \) is likely to be very close to the ratio \( q_i / q \), it is unlikely that (10) would be satisfied.³

III. Model Structure

The formal model consists of M regions which operate in an otherwise closed economy. Each region consists of a homogeneous cohort of citizens governed by a single autonomous government. There are N industries, each of which is represented by a single corporation that

³ If \( R_i / R \) were significantly different from \( q_i / q \), it would have to be the case that firms use very different technology from one region to another or that firms produce very heterogenous products from region to region.
operates nationally and produces and sells in every region, and M unincorporated firms that operate autonomously in each region. In some simulations, the unincorporated firms are redefined to serve as proxies for entirely local corporations; therefore, only corporations are allowed to engage in interstate activity.

**Government Sector**

In an effort to isolate tax incidence from expenditure incidence, a constant government budget assumption is employed. The government purchases a fixed bundle of goods and services at market prices, and following a change in tax policy, obtains sufficient revenues from an alternative source to enable the purchase of this same bundle at the new equilibrium prices. This fixed bundle is then costlessly packaged into a uniform public good which does not affect the enjoyment of private consumer goods, positively or negatively. Similar to Ballard et al. (1985), this model assumes that government expenditures are a component of final demands but do not enter consumers’ utility functions directly. Revenue sources include formula-apportioned corporate income taxes, personal income taxes, and a lump-sum tax. The normal profits of unincorporated firms are taxed as personal income, which is consistent with the way in which proprietorships and partnerships are actually taxed. In order to isolate the effects of formula apportionment policies from the effects of revenue adjustments, the endogenous revenue source is necessarily given by the lump-sum tax instrument.

**Production**

Production technology for each industry is characterized by a linearly homogeneous constant elasticity of substitution (CES) production function. Following Ballard, et. al (1985), Cobb-Douglas technology is used for industries in which no empirical measures of the elasticity of substitution exist. Because industries are assumed to operate with linearly homogeneous technology,
industry behavior is identical to firm behavior. Therefore, industries are treated as optimizing firms in the model. Labor and capital are assumed to be homogeneous across industries and regions, labor is fixed in regional supply, and capital supply is fixed nationally. Capital is assumed to be completely mobile across industries and across regions, while labor is mobile across industries but geographically immobile.\footnote{Labor must be immobile geographically for the lump sum taxes used in the model to be non-distorting. The sensitivity of the results to labor mobility is explored in Section VI.} The objective of each industry is to maximize after-tax economic profits ($\pi_N$). Because all industries operate in a competitive environment, $\pi_N = 0$ for all industries in equilibrium.

Corporate firms optimize not only with respect to the use of capital and labor, but also with respect to the location of production. There are many factors that enter into a firm’s production location decision, including transportation costs, proximity to resources, the “friendliness” of civic leaders to business, the quality of workers, and a host of other issues. For the purposes of this model, these factors are incorporated into a linearly homogeneous aggregation function $q_{i,c} = q_{i,c} \left( q_{i,c,1}, q_{i,c,2}, \ldots, q_{i,c,M} \right)$, where $q_{i,c}$ is national production by corporate industry $i$ and $q_{i,c,j}$ is production by corporate industry $i$ in region $j$. Because there are no empirical measures of the elasticity of substitution ($\delta$), the simulations proceed under the assumption that $\delta = 1$, a standard assumption in such cases (Shoven and Whalley, 1992). A sensitivity analysis presented in Section VI explores the implications of alternative values of $\delta$ on the results.

For unincorporated firms, the personal income tax rate plays out as an added cost of capital, similar to the methodology used by Harberger (1962) and others to model the federal corporate income tax in the U.S. Because each unincorporated firm operates in geographic isolation, there is no location decision to be made for these firms, and the production location functions discussed in the context of corporations are not relevant.
Household Income and Consumption

Consumers are assumed to be homogeneous in preferences and income within a given region. These preferences are represented by a Cobb-Douglas utility function, and consumers are allowed to have preferences for corporate vs. noncorporate output. Consumers in each region maximize utility subject to budget constraints. Sources of personal income include wages and capital income.

The consumers in each region $j$ are initially endowed with a fixed amount of labor given by $\bar{L}_j$ and a fixed share of the national capital stock: $\bar{K}_j = \theta_j \bar{K}$. The population is defined such that one unit of labor corresponds to one individual. Personal consumption income for an individual in region $j$ ($Y_{d,j}$) is thus given by

$$Y_{d,j} = \left[ w_j + \frac{\theta_j}{L_j} \sum_{m=1}^{N} \sum_{m=1}^{M} r_{m} K_{lm} \right] \left( 1 - t_{wj} \right) - \frac{H_j}{L_j} \quad (11)$$

where $H_j$ is lump sum tax collections in region $j$ and $t_{wj}$ is the personal income tax rate in region $j$.

IV. Data and Calibration

The model presented above was aggregated to two regions and eight industrial sectors (SIC1) and was calibrated to data from the 1992 U.S. economy. The primary regional specification employed is comprised of the North, which consists of the North Central and Northeast Census Bureau regions, and South, which consists of the South and West Census Bureau regions. In other regional specifications, the geographic division is between a single BEA region and the rest of the U.S. While most of the analysis utilizes the North-South specification, alternative regional specifications are employed to highlight the effects of geographic size and levels of statutory tax
rates on the results. In the benchmark equilibrium data set, it was assumed that all states employed an equally weighted three-factor apportionment formula.

Sources for data included Friedenberg and Beemiller (1997), Internal Revenue Service (1994, 1995a, 1995b), U.S. Census Bureau (1994), and various issues of Survey of Current Business, Bureau of Economic Analysis. The benchmark equilibrium data set was constructed from the raw data using linear and nonlinear programming models developed in Edmiston (1998), and calibration proceeded along the lines of Shoven and Whalley (1992), and Ballard et al. (1985).

Ad Valorem Equivalents for Formula-Appointed Corporate Income Taxes

The solution of the CGE model requires writing explicit factor demands for corporations, which is problematic with formula apportionment because the tax rates themselves are functions of the degrees of factor utilization across regions. For this reason, formula-appointed corporate income taxes were programmed in their ad valorem equivalent form. For example, the firm j-specific tax-inclusive marginal cost of capital in region i is given by

\[ r_{ji}^* = \left[ 1 + \frac{\pi_j}{\pi_j} \right] t_{ei} \rho_i - \sum_{h=1}^{2} \frac{S_{ih}}{S_{ij}} t_{eh} \rho_h \right] r \]

Equilibrium was computed with firms optimizing behavior given these ad valorem tax rates. Tax rates were then updated and equilibrium recomputed in an iterative fashion until the ad valorem equivalent tax rates in the last iteration \((i+1)\) were very close to the tax rates computed in iteration \(i\). The tolerance criterion was set at \( |t_{i+1} - t_{i}| < 1.0 \times 10^{-10} \).
V. Simulation Results

Restricting the analysis to the three most common apportionment formulas: (1) equally weighted three-factor formula (EWF), (2) three-factor formula with double-weighted sales (DWS), and (3) single factor sales formula (SFS), there are nine possible policy "states of the world" that can prevail in a two-region economy. One state is an equally weighted three-factor apportionment formula in both regions (EWF, EWF), which is the benchmark case in this study. The other possible policy states are given by:

A. DWS, EWF  
B. EWF, DWS  
C. DWS, DWS  
D. SFS, DWS  
E. DWS, SFS  
F. SFS, EWF  
G. EWF, SFS  
H. SFS, SFS  

Because the stated goal of apportionment formula manipulation is to encourage economic development, no jurisdiction would be expected to employ an apportionment formula with heavier weights on payroll and property than on gross receipts, so the equally weighted formula provides a lower bound for sales factor weights. Likewise, because a single-factor sales formula provides the heaviest possible weight on gross receipts (100%), it serves as an upper bound for sales factor weights. The effects of any possible combination of factor weights between these two bounds can be inferred from the results of the policy experiments given by A-H. In the analysis that follows, the economic impact of these alternative policies (A-H) are simulated, and the numerical results are then compared with the benchmark case in an effort to evaluate the implications of disproportionate sales factor weighting for economic development, tax collections, and welfare.

Economic Development Effects

The economic development impacts of disproportionate sales factor weighting are evaluated in terms of net capital flows, changes in the location of production, and wage changes. As expected based on the discussion in Section II, a disproportionately heavy weight on the sales factor resulted
in a net inflow of capital in every experiment (Table 1, Columns 4 and 5). Nevertheless, the magnitudes of these flows were small. In no case did any of the policies result in greater than a 0.24 percent change in any region's capital stock. The most efficacious policy was the imposition of a single-factor sales formula, especially when the other region imposed an equally weighted three-factor formula. In cases where the two regions pursued identical policies, the North region consistently came out the winner, primarily because of the higher statutory corporate income tax rate in the North and its relatively small size.\(^5\)

Not surprisingly, changes in production levels were on the order of the changes in capital stocks. Increased sales factor weights did lead to increased production in the corporate sector, but not to a substantial degree. Noncorporate production was dampened in the acting region, while noncorporate production in the other region increased slightly. This result reflects a decline in the cost of production in the corporate sector relative to the unincorporated sector in the acting region.

The decline in implicit payroll excise tax rates that occurred with increased sales factor weights served to increase the demand for labor in the acting region at the expense of the other region. Because labor was fixed in regional supply, however, changes in the demand for labor were reflected in wage increases in the acting region and wage declines in the other region (see Table 1, columns 2 and 3). What little flow of capital did occur worked to further boost (depress) the price of labor in the gainer (loser) region. The magnitudes of these changes in the price of labor were even less substantial (in percentage terms) than those associated with capital flows. To some degree, these wage changes offset the capital flows caused by changes in implicit property excise taxes. Although a geographically mobile labor force and unemployment are not incorporated in the model, the increased demand for labor arising from disproportionate sales factor weighting suggests that an

\(^5\) This result is discussed in more detail later in this section.
aggressive formula apportionment policy may be effective in reducing unemployment and/or increasing immigration. The sensitivity analysis presented in Section VI, which shows results for the mobile labor case, confirms this result, indicating a net inflow of labor into the acting region.

The situating rule for the sales factor has enormous implications for the economic development impacts of disproportionate sales factor weighting. Table 2, which shows selected simulation results for policy experiments A and B, indicates that the impact of disproportionate weighting of the sales factor on the services industry is the opposite of the impact on the industries in which gross receipts are situated at destination. Increased sales factor weights reduced the implicit excise tax on property in the acting region for the services industry, as for every other industry; however, with an origin-based situating of the sales factor, the value of output in the services industry was taxed at a higher (implicit) rate following an increase in the sales factor weight, which tended to increase the cost of capital (and labor) in the acting region. The results indicate that the second effect dominated the first in these experiments, which explains why the services industry decreased its capital utilization in the acting region while other industries increased their capital utilization. These countervailing effects also serve to explain why the services industry saw effects of much smaller magnitude than did the other industries.

Now consider variances in economic development impacts across all industries. As detailed in Table 3, which shows relevant simulation results from experiments A and B, the degree to which an industry increases its use of capital in the acting region is determined in large part by two factors: the industry’s capital-labor ratio and the change in the industry’s gross-of-tax price of capital.

Increases in factor utilization in the acting region were very strongly related to the initial capital-labor ratios. The industries with the greatest K/L ratios, mining (3.747) and TPU (1.734), saw the largest capital flows, both positively and negatively. The industry with the smallest K/L
ratio, construction (0.294), saw the smallest capital flows. For the North region, the corresponding correlation factor was approximately \( |\rho_{KL, \%\Delta K} | = 0.94 \) across all industries, and for the South, \( |\rho_{KL, \%\Delta K} | = 0.92 \) across all industries, both of which were significant at better than the \( \alpha = 0.005 \) level. These correlation coefficients were robust across policy experiments, ranging no more than \( \pm 0.003 \) from the mean \( |\rho| \) across policy experiments. Because capital is the only mobile factor in the model, more capital-intensive industries find it much easier, and less costly, to expand production than do the more labor-intensive industries.

The change in the gross-of-tax price of capital following a change in policy also had significant implications for changes in capital utilization. The greater the decline (increase) in the gross-of-tax price of capital, the greater the increase (decrease) in capital utilization. Variations in the gross-of-tax price of capital across industries are a function of variations in the implicit excise tax/subsidy on capital across industries, which in turn are functions of the regional distribution of property payments. As shown in equation (7), the change in the implicit property tax arising from an increase in the sales factor weight is given by 
\[
-\frac{1}{2} \left[ \frac{n_s}{R} \left( 1 - \frac{R}{r} \right) \right],
\]
which is strictly decreasing in \( R_s / R \). Simulation results indicate a perfect negative correspondence between the change in the gross-of-tax price of capital and the proportion of property payments located in the acting region vs. the non-acting region.

Looking at the results from a single regional specification, it is difficult to explore the effects of region size in isolation from the effects of statutory corporate tax rate differences on the results because the two effects cannot be separated. For example, in the North-South model used thus far, the South region is larger *and* has a lower statutory corporate tax rate. Any policy impact differences across the two regions could be explained by either differences in tax rates or region size. For this
reason, two additional regional specifications were employed to examine the issues of region size and variance in tax rates: SWROUS and FWROUS.

In the SWROUS specification, regions consist of the Southwest BEA region (Texas, Oklahoma, New Mexico, and Arizona) and the rest of the U.S. (ROUS). The Southwest region (SW) is characterized by a small size and a low statutory corporate income tax rate relative to the ROUS. In the FWROUS specification, regions consist of the Far West BEA region (Washington, Oregon, California, Nevada, Alaska, and Hawaii) and the rest of the U.S. (ROUS). The Far West region (FW) is characterized by relatively small size and a relatively high corporate tax rate.

Comparing the results of these two specifications, we can discern the relative importance of region size and statutory tax rate differences on the results. To the extent that policies affect the FW and SW regions in the same way, but differently than the ROUS regions, it can be inferred that the incongruities are due to differences in region size. Likewise, to the extent that policies impact the SW and ROUS (FW) regions in similar ways, but impact the FW and ROUS (SW) regions differently, the incongruities are likely due to differences in statutory tax rates.6

Selected results from simulations with these two alternative regional specifications are presented in Table 4. Although the direction of impacts on capital flows and wages are the same as in the North-South model, the magnitudes of the impacts tell a story that is not apparent in that model’s results.

The first salient result from comparing the SWROUS and FWROUS specifications is that small regions gain relatively more capital when they employ the more aggressive formula apportionment policy, and lose relatively more when they impose the less aggressive policy, than do

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6 The results from alternative BEA-ROUS regional specifications were examined for consistency with the SW-ROUS and FW-ROUS results, but are not reported here. The results from these alternative specifications support the statements made in this section regarding the effects of region size and statutory tax rates.
large regions. This result suggests that capital is more elastic in small regions than in large regions, which supports similar arguments made by Murphy (1984) in his analysis of capital mobility in the OECD countries. Much of the reason for the greater elasticity of capital in small regions can be explained very simply. For any given shift in capital, the inflows are necessarily equal to the outflows with a fixed national capital stock. Because the initial capital stock is smaller in the small region, the percentage change in capital is necessarily larger.

Although the level of initial capital stocks explain part of the greater elasticity of capital in small regions, it does not tell the entire story because the results held for absolute as well as for relative changes. The idea that relatively small regions have more to gain from lowering tax rates is hardly a novel concept. For example, Kanbur and Keen (1993) make this argument for sales tax rates, Markusen and Wigle (1989) for tariffs, and Wilson (1991) for production taxes. The argument is best explained by extending Kanbur and Keen's (1993) analysis to the present case. The degree to which capital flows from one region to another depends crucially on its gross-of-tax price elasticity. From the perspective of an entire region, and with a fixed national capital stock, this elasticity comes from inter-regional shifts in capital. A small region has a much greater potential for capital inflow (e.g., take the case of a complete shift) than does the large region, and hence perceives a greater elasticity. Just as industries with the smallest proportion of their total property in the acting region see the greatest gains, so too do the regions with the smallest shares of national property.

Another result apparent in the SWROUS and FWROUS specifications is that high-tax regions tend to gain more capital when they impose the more aggressive formula apportionment policy than they lose when imposing the less aggressive policy. The explanation for this result can be found by looking at the impacts of disproportionate sales factor weighting on tax differentials.
When a high-tax region double-weights its sales factor (or more generally, increases its sales factor weight), existing tax differentials on property are diminished, and therefore, excise effects become smaller relative to total factor costs. Likewise, when a low-tax region double-weights its sales factor, tax differentials are exacerbated, and hence excise effects become larger relative to total factor costs.

To further examine this issue, we doubled, tripled, and quadrupled the statutory corporate tax rates for both regions and resimulated policy experiment A, where the North double-weights the sales factor and the South maintains an equally weighted three-factor formula (Table 5). As expected, the sensitivity analysis shows that the responses of capital and production to changes in sales factor weights are sensitive to statutory corporate income tax rates.Appearances suggest that percentage changes in capital stocks and corporate production following a policy change are

proportional to the corporate tax rate. Hence, for any tax rate \( \theta_t \), we would expect the magnitude of the vector economic development effects to be \( \theta \xi \) if the effects with a tax rate of \( t \) are given by \( \xi \).

Revenue Effects

Although the impetus of most states for altering their corporate income tax apportionment formulas has been economic development, the revenue consequences also deserve careful attention. Table 6 demonstrates that the revenue consequences of altering apportionment formulas can be considerable relative to the economic development effects. While changes in capital stocks were at most 0.24 percent, corporate income tax revenues changed by as much as 1.51 percent. Throughout the range of policy experiments, it was generally the case that revenue consequences were substantially larger (in percentage terms) than were the economic development consequences.

The North region consistently enhanced its corporate tax coffers by placing a larger weight on the sales factor, while the South region generally saw revenue losses. The magnitudes of any region’s gains/losses had more to do with its own policy decision than the decision of the other
region. For example, the North region enjoyed a revenue gain of approximately 1.5 percent every
time it employed a SFS formula, regardless of the formula employed by the South. Nevertheless,
for both regions there was a marginal improvement in revenue position when the competitor region
imposed a less aggressive formula.

This result begs the question, "what determines whether a region gains or loses revenues
when it places a heavier weight on its sales factor? The change in any region j’s corporate tax
collections from a given change in its sales factor weight (\( \partial T_j / \partial \sigma_j \)) is given by

\[
\frac{\partial T_j}{\partial \sigma_j} = t_j \sum_{i=1}^{N} \left| \frac{\partial b_j}{\partial \sigma_j} \frac{\pi_i}{\bar{\pi}_j} + \Phi_j \frac{\partial \pi_i}{\partial \sigma_j} \right|
\]  

(13)

where the superscore represents an initial value. For any given change in \( \sigma_j \), we know that the
revenue gains/losses arising from the \( \partial \pi_i / \partial \sigma_j \) terms will be shared across regions according to
their \( \bar{\phi}_j \)'s. That being the case, we must look to the \( \partial \phi_j / \partial \sigma_j \) terms for an explanation of
differences in revenue impacts of formula manipulation across regions.

There are several ways in which apportionment formula manipulation may affect a region’s
\( \phi \)'s. First, if the acting region is a “market” region vs. a “production” region, then placing a heavier
weight on the sales factor will lead to greater tax revenues.\(^7\) Second, to the extent that placing a
heavier weight on the sales factor drives away sales in the region, corporate tax revenues will be
diminished because a reduction in \( S_j/S \) implies a reduction in \( \phi_j, ceteris paribus \). Finally, to the

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\(^7\) A firm has a market presence in a region \( j \), as opposed to a production presence, if region \( j \)'s share of the
firm’s total sales is greater than its share of the firm’s total production, as given by the arithmetic mean of its payroll
and property shares. A market region is meant as a region in which most economic activity is undertaken by
“market firms,” as defined above, and the effect of an increase in the sales factor weight, exclusive of policy-
induced shifts in sales and production, is to apportion more taxable profits to the region. Of course, it remains the
case that sales must be equal to income in all regions. That is, budget constraints are always met with equality in
every region.
extent that a weightier sales factor encourages an inflow of capital or increases wages, corporate tax revenues will be enhanced through increases in $R_f/R$ and $W_f/W$.

Simulations with alternative regional specifications suggest that region size is an important factor in determining the magnitude of revenue impacts with disproportionate sales factor weighting, but is not a factor in determining the direction of the impacts. In almost every experiment the smaller regions saw revenue impacts of much larger magnitude than did the large regions, almost 40 times the magnitude in some cases. Nevertheless, there is no clear pattern relating region size to the direction of revenue impacts. As was the case in the North-South specification, whether a region gained or lost corporate tax revenues with an aggressive formula apportionment policy depended on the relative “market presence” vs. “production presence” of industry in that region. The more “market-intensive” regions improved their corporate tax revenue position with a heavier weight on the sales factor, while the more “production-intensive” regions suffered revenue losses when they pursued an aggressive policy.

Welfare Effects

Thus far the analysis of simulation results has concentrated on the economic development and revenue aspects of formula manipulation; however, central to any economic analysis of government policy is a discussion of welfare impacts. Table 7 shows welfare changes in each region, as measured by the percentage change in the indirect utility function ($V$), for all of the policy experiments undertaken in this analysis. For the purpose of exposition, percentage changes in corporate income tax revenues, personal income net of taxes, and the cost-of-living index (Konus, 1939) are also included.

Heavier weights on the sales factor benefitted the North region both in terms of economic development and revenues, yet the welfare consequences were negative in every case where the
North's policy was at least as aggressive as the South's policy. The South also suffered welfare losses when it pursued the more aggressive policy, despite its economic development gains. These welfare losses with heavier sales factor weights can be explained by looking to policy-induced changes in consumer prices and government revenues.

Because heavier weights on the sales factor push up consumer prices in the acting region, as Mieszkowski and Zodrow (1985) predict for an increase in the statutory tax rate, the cost-of-living index tended to rise in the acting region. Consumers suffer utility losses with a rise in the general price level if income does not keep pace. Changes in the Köhns index were consistently larger, usually 100 percent larger, than changes in income for the South region, which provides much of the explanation for why the South suffered welfare losses with heavier sales factor weights and welfare gains otherwise. For the North, changes in income were slightly larger in magnitude than changes in the Köhns index in five of the eight policy experiments (A, B, C, E, and H). In cases C, E, and H, the North replaced non-distorting lump sum tax revenues with distortionary corporate income tax revenues, which explains some of the welfare losses in those cases.

Perhaps more important than the change in the overall price level (as compared to changes in income) was the policy-induced change in relative consumer prices. Changes in relative prices brought on by a change in tax structure tend to have substitution effects (efficiency losses) that reduce consumer welfare. In all cases for both regions, there was likely some utility loss associated with changes in relative consumer prices and the substitution of corporate and noncorporate goods.

Another salient result from Table 7 is that the North region suffered more severe welfare losses with heavier sales factor weights than did the South, while the South generally enjoyed greater welfare gains than did the North. This result again points to changes in revenue structure: the North
saw corporate income tax revenue gains with heavier sales factor weights, while the South saw corporate income tax revenue losses.

In order to see how the choice of budget-balancing tax adjustment instrument affected the welfare impacts of formula manipulation, the policy simulations were run with a personal income tax adjustment rather than a lump sum tax adjustment. Surprisingly, there was virtually no difference in welfare impacts, at most fifth or sixth order differences in percentage terms. This result suggests that changes in relative consumer prices and the overall price level had much greater effects on welfare than did changes in tax structure. Perhaps an even greater reason for similarity of results in the two models is that with a fixed labor supply and no savings, the personal income tax played out much like a lump sum tax, except to the extent that personal income tax revenues are derived from the profits of unincorporated firms.8

VI. Sensitivity Analysis

Elasticity of Substitution in the Location of Production

In the discussion of the model’s structure, it was noted that there are no empirical estimates of the elasticity of substitution between production locations (δ) and that a value of δ=1 was assumed in the analysis. The parameter δ may have nontrivial consequences for the results, however, in which case there is a need to explore those consequences. A sensitivity analysis was performed on δ, and the results (Table 8) are presented and discussed below. Only one policy experiment was considered in the sensitivity analysis: North double weights the sales factor and South maintains an equally weighted formula.

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8 Endogenizing labor supply and/or incorporating an investment sector and dynamics is beyond the scope of this model and the paper. Marginal larger welfare effects would be expected with an endogenously adjusting personal income tax rate and labor supply.
As expected, the sensitivity analysis shows that the responses of capital and production to changes in sales factor weights are sensitive to the choice of $\delta$, but not remarkably so. Nevertheless, the sensitivity analysis suggests that we must be careful in making specific numerical estimates of policy responses based on these results in light of the absence of a reliable empirical estimate of $\delta$.

Qualitatively the results are the same regardless of $\delta$'s value, and we can safely argue that heavier weights on the sales factor do lead to gains in capital and production, and that the magnitudes of these gains are somewhat dependent on the elasticity of production across regions.

**Regional Mobility of Labor**

Labor was assumed to be interregionally immobile to (1) assure that lump sum taxes will be non-distorting, (2) allow the analysis to pick up the effects of policies on fixed as well as mobile factors, and (3) provide a convenient way to capture the mobility of capital relative to labor in the real world. Nevertheless, a fixed labor supply restricts to some degree the change in output that is possible from an inflow of capital because any change in output is likely to push up wages. As a result, the inflow of capital from a given policy change is likely to be smaller in the immobile labor case than in mobile case. To explore the implications of a fixed regional labor supply for the policy impacts analyzed above, policy experiments A and B were simulated with a fully mobile labor supply using the North-South specification. Table 9 compares the results for the mobile labor case with the same experiments in the immobile case.

Allowing labor to be geographically mobile resulted in capital flows of larger magnitude than in the immobile labor case; however, differences were not substantial. Based on these results, we can argue that increased sales factor weights will yield greater inflows of capital to the acting region when labor is also mobile, or more generally, in the relatively longer run because all factors are increasingly mobile with time. Perhaps more importantly, these results show that disproportionate
sales factor weighting is likely to result in a net inflow of labor to the acting region, suggesting that some unemployment may be alleviated with an aggressive formula apportionment policy.

VII. Conclusion

The economic development effects of disproportionate sales factor weighting are clearly positive, resulting in a net inflow of capital, wage increases, and increased production. Moreover, the analysis suggests that relatively small states that have a capital-intensive industrial base, a relatively small portion of total firm property, and relatively high statutory tax rates have the most to gain with disproportionate sales factor weighting. At the same time, states should be aware that the services industry, or any other industry in which gross receipts are situated at origin, is likely to be damaged by disproportionate sales factor weighting.

Finally, although the economic development impact of disproportionate sales factor weighting is clearly positive, the effects seem small relative to the estimated impacts of alternative policies. Bartik (1991, 1994) suggests that the long-run elasticity of state or metropolitan area economic activity with respect to state and local business taxes is between -0.1 and -0.6. Here, elasticities of capital with respect to the sales factor weight ranged from -0.0008 to -0.0029. It is important to keep in mind, however, that economic development impacts are greater the greater are the elasticities of substitution in the location of production, the more mobile is the labor force, and the higher are the statutory corporate income tax rates.

Of course, economic development gains must be measured against other effects such as revenue and welfare impacts. For states that would enjoy revenue gains, disproportionate sales factor weighting provides for a rare win-win policy choice, an opportunity to encourage economic development while simultaneously padding corporate income tax revenue coffers. For states that
would see revenue losses, on the other hand, the policy will potentially do more harm than good, as revenue effects are likely to be substantial relative to economic development effects (in percentage terms). Finally, despite gains in economic development, and for some revenue gains, states should expect welfare declines with disproportionate sales factor weighting.
References


Data Sources


### Table 1. Factor Prices and Movements
(Percent Change from Benchmark)

<table>
<thead>
<tr>
<th>Policy Experiment</th>
<th>$P_k$ (1)</th>
<th>$P_L$ North (2)</th>
<th>$P_L$ South (3)</th>
<th>$K$ North (4)</th>
<th>$K$ South (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) DWS N, EWF S</td>
<td>-0.0120</td>
<td>0.0275</td>
<td>-0.0457</td>
<td>0.0600</td>
<td>-0.0540</td>
</tr>
<tr>
<td>(B) EWF N, DWS S</td>
<td>0.0097</td>
<td>-0.0169</td>
<td>0.0323</td>
<td>-0.0404</td>
<td>0.0363</td>
</tr>
<tr>
<td>(C) DWS N, DWS S</td>
<td>-0.0042</td>
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<td>-0.0153</td>
<td>0.0196</td>
<td>-0.0177</td>
</tr>
<tr>
<td>(D) SFS N, DWS S</td>
<td>-0.0284</td>
<td>0.1028</td>
<td>-0.1410</td>
<td>0.1995</td>
<td>-0.1797</td>
</tr>
<tr>
<td>(E) DWS N, SFS S</td>
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<td>0.0914</td>
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<td>(F) SFS N, EWF S</td>
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<td>-0.0706</td>
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### Table 2. Factor Flows and Changes in the Location of Production,
Services and All Other Industries

<table>
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<tr>
<th>%Δ $K_N$</th>
<th>%Δ $K_S$</th>
<th>%Δ $Q_{CN}$</th>
<th>%Δ $Q_{CS}$</th>
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<tr>
<td>a. Policy Experiment A (BASE)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
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<tr>
<td>All Other industries</td>
<td>0.0791</td>
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<td>0.0446</td>
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<tr>
<td>b. Policy Experiment B (BASE)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>0.0050</td>
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<tr>
<td>All Other Industries</td>
<td>-0.0480</td>
<td>0.0486</td>
<td>-0.0280</td>
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Table 3. Factor Flows and Changes in the Location of Production, 
by Industry and Region

<table>
<thead>
<tr>
<th>Industry</th>
<th>K°/L°</th>
<th>%ΔK_N</th>
<th>%ΔK_S</th>
<th>%ΔQ_CN</th>
<th>%ΔQ_C,S</th>
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<tbody>
<tr>
<td>A. Policy Experiment A (BASE)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<td>0.0346</td>
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<td>0.2075</td>
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<td>Construction</td>
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<td>-0.0348</td>
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</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>K°/L°</th>
<th>%ΔK_N</th>
<th>%ΔK_S</th>
<th>%ΔQ_CN</th>
<th>%ΔQ_C,S</th>
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<td>B. Policy Experiment B (BASE)</td>
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<tr>
<td>Agriculture</td>
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<td>-0.037</td>
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Table 4. Factor Prices and Movements, SWROUS and FWROUS (Percent Change from Benchmark)

<table>
<thead>
<tr>
<th>Policy</th>
<th>SWROUS</th>
<th>FWROUS</th>
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</thead>
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<tr>
<td></td>
<td>$P_L$</td>
<td>$P_L$</td>
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<tr>
<td>DWS L, EWF S</td>
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<tr>
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<td>SFS L, DWS S</td>
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</tr>
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<td>EWF L, SFS S</td>
<td>0.0124</td>
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<td>SFS L, SFS S</td>
<td>-0.0464</td>
<td>-0.2821</td>
</tr>
</tbody>
</table>

S indicates the small region (SW or FW), L indicates the large region (ROUS)

Table 5. Sensitivity of Policy Impacts to Statutory Corporate Tax Rates

<table>
<thead>
<tr>
<th>Policy Experiment</th>
<th>North</th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%Δ $K$</td>
<td>%Δ $Q_r$</td>
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<td>Original Corporate Tax Rate</td>
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<td>0.0281</td>
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<tr>
<td>Corporate Tax Rate Doubled</td>
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<td>0.0567</td>
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<tr>
<td>Corporate Tax Rates Tripled</td>
<td>0.1837</td>
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<tr>
<td>Corporate Tax Rates Quadrupled</td>
<td>0.2476</td>
<td>0.1157</td>
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Table 6. Government Revenues (Percent Change from Benchmark)

<table>
<thead>
<tr>
<th>Policy</th>
<th>CIT North (1)</th>
<th>PIT North (2)</th>
<th>LST North (3)</th>
<th>CIT South (4)</th>
<th>PIT South (5)</th>
<th>LST South (6)</th>
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<tbody>
<tr>
<td>(A) DWS N, EWF S</td>
<td>0.3953</td>
<td>0.0123</td>
<td>0.0093</td>
<td>-0.0505</td>
<td>-0.0311</td>
<td>-0.0486</td>
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<tr>
<td>(B) EWF N, DWS S</td>
<td>-0.0212</td>
<td>-0.0066</td>
<td>-0.0218</td>
<td>-0.3085</td>
<td>0.0224</td>
<td>0.0513</td>
</tr>
<tr>
<td>(C) DWS N, DWS S</td>
<td>0.3774</td>
<td>0.0038</td>
<td>-0.0149</td>
<td>-0.3538</td>
<td>-0.0106</td>
<td>0.0003</td>
</tr>
<tr>
<td>(D) SFS N, DWS S</td>
<td>1.4991</td>
<td>0.0518</td>
<td>0.0303</td>
<td>-0.4728</td>
<td>-0.0930</td>
<td>-0.1349</td>
</tr>
<tr>
<td>(E) DWS N, SFS S</td>
<td>0.3319</td>
<td>-0.0141</td>
<td>-0.0793</td>
<td>-1.3148</td>
<td>0.0587</td>
<td>0.1582</td>
</tr>
<tr>
<td>(F) SFS N, EWF S</td>
<td>1.5069</td>
<td>0.0659</td>
<td>0.0618</td>
<td>-0.1846</td>
<td>-0.1079</td>
<td>-0.1768</td>
</tr>
<tr>
<td>(G) EWF N, SFS S</td>
<td>-0.0769</td>
<td>-0.0190</td>
<td>-0.0791</td>
<td>-1.2847</td>
<td>0.0973</td>
<td>0.2162</td>
</tr>
<tr>
<td>(H) SFS N, SFS S</td>
<td>1.4836</td>
<td>0.0170</td>
<td>-0.0558</td>
<td>-1.3880</td>
<td>-0.0405</td>
<td>0.0018</td>
</tr>
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</table>
## Table 7. Welfare

<table>
<thead>
<tr>
<th>Policy</th>
<th>North</th>
<th></th>
<th></th>
<th></th>
<th>South</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%Δκ</td>
<td>%ΔY</td>
<td>%ΔCITR</td>
<td>%ΔV</td>
<td>%Δκ</td>
<td>%ΔY</td>
<td>%ΔCITR</td>
<td>%ΔV</td>
</tr>
<tr>
<td>(A) DWS N, EWF S</td>
<td>0.0112</td>
<td>0.0119</td>
<td>0.3953</td>
<td>-0.0131</td>
<td>-0.0621</td>
<td>-0.0307</td>
<td>-0.0505</td>
<td>0.0121</td>
</tr>
<tr>
<td>(B) EWF N, DWS S</td>
<td>-0.0046</td>
<td>-0.0052</td>
<td>-0.0212</td>
<td>0.0100</td>
<td>0.0447</td>
<td>0.0212</td>
<td>-0.3085</td>
<td>-0.0093</td>
</tr>
<tr>
<td>(C) DWS N, DWS S</td>
<td>0.0031</td>
<td>0.0048</td>
<td>0.3774</td>
<td>-0.0030</td>
<td>-0.0209</td>
<td>-0.0115</td>
<td>-0.3538</td>
<td>0.0028</td>
</tr>
<tr>
<td>(D) SFS N, DWS S</td>
<td>0.0550</td>
<td>0.0517</td>
<td>1.4991</td>
<td>-0.0426</td>
<td>-0.1636</td>
<td>-0.0921</td>
<td>-0.4728</td>
<td>0.0390</td>
</tr>
<tr>
<td>(E) DWS N, SFS S</td>
<td>-0.0071</td>
<td>-0.0085</td>
<td>0.3319</td>
<td>0.0272</td>
<td>0.1169</td>
<td>0.0542</td>
<td>-1.3148</td>
<td>-0.0252</td>
</tr>
<tr>
<td>(F) SFS N, EWF S</td>
<td>0.0753</td>
<td>0.0646</td>
<td>1.5069</td>
<td>-0.0527</td>
<td>-0.2178</td>
<td>-0.1055</td>
<td>-0.1846</td>
<td>0.0483</td>
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<tr>
<td>(G) EWF N, SFS S</td>
<td>-0.0046</td>
<td>-0.0013</td>
<td>-0.0769</td>
<td>0.0402</td>
<td>0.1928</td>
<td>0.0927</td>
<td>-1.2847</td>
<td>-0.0373</td>
</tr>
<tr>
<td>(H) SFS N, SFS S</td>
<td>0.0156</td>
<td>0.0208</td>
<td>1.4836</td>
<td>-0.0122</td>
<td>-0.0803</td>
<td>-0.0440</td>
<td>-1.3880</td>
<td>0.0112</td>
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</table>
Table 8. Sensitivity of Policy Impacts to the Elasticity of Substitution in Location of Production (Percent Change from Benchmark)

<table>
<thead>
<tr>
<th>Elasticity of Substitution (all firms)</th>
<th>Sensitivity of Capital Flows</th>
<th>Sensitivity of Changes in the Location of Corporate Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%ΔK North</td>
<td>%ΔK South</td>
</tr>
<tr>
<td>δ = 0.5</td>
<td>0.0528</td>
<td>-0.0476</td>
</tr>
<tr>
<td>δ = 1.0</td>
<td>0.0600</td>
<td>-0.0540</td>
</tr>
<tr>
<td>δ = 2.0</td>
<td>0.0710</td>
<td>-0.0640</td>
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<tr>
<td>δ = 10.0</td>
<td>0.1301</td>
<td>-0.1172</td>
</tr>
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</table>

Table 9. Sensitivity of Policy Impacts to the Degree of Labor Mobility (Percent Change from Benchmark)

<table>
<thead>
<tr>
<th>Policy Experiment</th>
<th>P_K (1)</th>
<th>P_L North (2)</th>
<th>P_L South (3)</th>
<th>K North (4)</th>
<th>K South (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) DWS N, EWF S</td>
<td>-0.0120</td>
<td>0.0275</td>
<td>-0.0457</td>
<td>0.0600</td>
<td>-0.0540</td>
</tr>
<tr>
<td>(B) EWF N, DWS S</td>
<td>0.0097</td>
<td>-0.0169</td>
<td>0.0323</td>
<td>-0.0404</td>
<td>0.0363</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy Experiment</th>
<th>P_K (1)</th>
<th>P_L North (2)</th>
<th>P_L South (3)</th>
<th>K North (4)</th>
<th>K South (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) DWS N, EWF S</td>
<td>-0.0024</td>
<td>-0.0005</td>
<td>0.0579</td>
<td>-0.0546</td>
<td>0.0804</td>
</tr>
<tr>
<td>(B) EWF N, DWS S</td>
<td>0.0095</td>
<td>0.0082</td>
<td>-0.0389</td>
<td>0.0367</td>
<td>-0.0540</td>
</tr>
</tbody>
</table>
ABOUT THE AUTHOR

Kelly Edmiston is an Assistant Professor of Economics and Senior Associate with the Fiscal Research Program of the School of Policy Studies, Georgia State University. Dr. Edmiston received his Ph.D. in economics from the University of Tennessee. His research interests include state and local public finance, state and local economic development, tax modeling, and taxation in federal systems.

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