Coveting Thy Neighbor's Manufacturing: The Dilemma of State Income Apportionment

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ABSTRACT

This paper investigates the economic impact of the apportionment formulae used to divide corporate income taxes among the states. Most apportionment formulae, by including payroll, turn the state corporate income tax at least partially into a payroll tax. Using panel data from 1978-1994, the results show that this distortion has an important effect on state-level employment. For the average state, reducing the payroll weight from one-third to one-quarter increases manufacturing employment around 1.1%, concentrated in manufacturing and with larger effects in the long-run. The results also suggest that apportionment changes have important negative externalities on other states. On average, the aggregate effects of apportionment formula changes are close to zero.

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1. Introduction

Faced with the continuing devolution of resources and responsibilities from the federal government back to the states and the decline of manufacturing employment throughout the country, state governments have repeatedly changed their tax systems in the last 20 years to encourage employment and investment. Enterprise zones, tax concessions and corporate rate cuts have been common and have also been the subject of extensive academic research.[1] Most work has matched aggregate data on employment or investment to general tax measures like the average corporate tax burden in a state or the statutory corporate tax rate but found negligible effects of tax policy. More recent studies looking at micro-level investment decisions or at more specific tax incentives, such as Bartik (1985), Papke (1991), or Hines (1996), have found larger effects.

An important feature of state taxation that has been relatively neglected in empirical work is the state income apportionment formula by which companies allocate their national income across state tax jurisdictions.[2] This formula usually attributes income based on a firm's geographic distribution of payroll, property, and sales. McLure (1980) first demonstrated that formula apportionment largely transforms the state corporate income tax into three separate taxes on the factors in the apportionment formula. Since payroll is usually one of the factors, the formula could have important effects on employment.

State legislatures and their constituents seem to understand this and have actively attempted to modify their states' apportionment formulae to stimulate employment and investment. The theoretical work of Gordon and Wilson (1986) and later Anand and Sansing (1997), however, indicates that the tax choices of individual states can have negative externalities on their neighbors and this may put states into a prisoner's type dilemma that can lead to a series of beggar-thy-neighbor policies.

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[1] For a discussion of the literature see Carroll and Waslynko (1990).

[2] Exceptions include the empirical work of Weiner (1996a), and Klassen and Shackelford (1998).

The impact of state tax policy on economic performance and the externalities of tax policy on other states are central to public finance and the apportionment formula provides an excellent place to examine such issues. In addition, the rising interest in inter-jurisdictional tax issues as well as the recent proposals to convert the taxation of multinational companies to a cross-country formula apportionment system similar to the system used within the United States has generated considerable interest among policy makers in the economic effects of formula apportionment.[3]

In this paper, we use panel data for the U.S. states from 1978-1994 and control for a variety of non-tax factors to examine the relationship between employment and state apportionment formulae. In doing so, our results establish two important facts about these state tax policies.

One, we provide the first robust evidence that the apportionment formula has a significant real effect on a state's economy. The results suggest that the payroll weight is a significant determinant of state employment, although there may be other unobserved policy changes contributing to the result. We find that for the average state, reducing the payroll weight from one-third to one-quarter increases manufacturing employment by approximately 1.1%. Further, we show that these significant employment effects imply that although increasing the sales weight in a state may lead to corporate income tax revenue losses (see Pomp, 1987), the increased employment generates an indirect source of additional personal income tax revenue. The results suggest that this additional revenue reduces and may even exceed the corporate revenue loss for some recently proposed formula changes.

Two, we are able to explore the externalities that one state's apportionment formula has on other states. We show that while the within state employment effect of changing the apportionment formula is large, the aggregate effect is close to zero. Employment does increase in states that reduce their payroll weight but the same change reduces employment in other states. In this way our results show why it is difficult to maintain harmony in the formulae across states, a fact fully consistent with

[3] For discussions of these proposals see Shackelford and Slemrod (1998), Wetzler (1995), or Weiner (1996b).

theoretical predictions and with the ongoing trends in apportionment decisions. The negative externality suggests that the U.S. as a whole might be better off moving away from a decentralized system to a nationally uniform apportionment formula along the lines of Canada.

The paper proceeds in six parts. Section 2 presents a simple theoretical model of how formula apportionment affects the employment decisions of firms and describes the existing literature in the area. Section 3 discusses the panel data and the empirical specification. Section 4 presents the results. Section 5 discusses the revenue implications and measures the external effects. Section 6 concludes.

2. The Theory and Literature of Formula Apportionment

Each state taxes corporate income at its own rate but corporations often do business in more than one state. The states, therefore, must decide how to apportion income between the firm's states of operation in order to avoid multiple taxation of the same income. Their solution has been to use an apportionment formula. The most common formula is to apportion firm income using three factors: property, payroll, and sales. If a firm's overall profit is π, then the profit attributed for tax purposes to state j, π_j, is

$$\pi_j = \left(\alpha_j^P \frac{P_J}{P} + \alpha_j^L \frac{L_J}{L} + \alpha_j^S \frac{S_J}{S} \right) \pi \qquad (1)$$

where P is total property, L is the total payroll and S is total sales while P_j and L_j and S_j are property, payroll and sales in state j and α_j^f is the weight in the apportionment formula for factor f in state j. The most common formula has been a one-third weight on each factor (also known as the equal-weighted sales formula).

McClure (1980) has shown that using this apportionment formula largely transforms the corporate income tax into a direct tax on the factors in the formula. To see why note that the overall corporate tax rate in an individual state with formula apportionment and a statutory marginal tax rate t_j is:

$$t_j = \left(a_j^P \frac{P_j}{P} + a_j^L \frac{L_j}{L} + a_j^S \frac{S_j}{S} \right) t_j \qquad (2)$$

and the firm's overall marginal tax rate, t, is simply the sum of the t_j over all its states of operation:

$$t = \sum_j t_j a_j^P \left(\frac{P_j}{P} \right) + \sum_j t_j a_j^L \left(\frac{L_j}{L} \right) + \sum_j t_j a_j^S \left(\frac{S_j}{S} \right). \qquad (3)$$

Formula (3) makes clear that if a firm alters the location of its workers, even with no change in its profitability, this will have a direct effect on its marginal tax rate. At the margin, if a firm changes payroll in state j by shifting payroll from other states but leaving its total payroll unchanged (i.e., $\partial L / \partial L_j = 0$), the firm's overall marginal tax rate will change according to [4]

$$\frac{\partial \tau}{\partial L_j} = \left(\frac{1}{L} \right) \left(t_j \alpha_j^L - \sum_{i \neq j} t_i \alpha_i^L \frac{L_i}{\sum_{i \neq j} L_i} \right). \qquad (5)$$

This equation shows that changing employment at the margin raises the firm's marginal tax rate by an amount that depends positively on state j's payroll tax burden and negatively on the weighted average of the other states' payroll tax burdens. In our empirical work, we will use these terms to measure the payroll tax burden in each state and in the nation as a whole.

By reducing the payroll and property weights in the apportionment formula and increasing the sales weight, states can reduce the tax burden on origin based factors like labor and capital and switch

[4] This assumes, for simplicity, that the shift from each state is proportional to it current share of payroll.

it to more destination based factors like sales with the consequent benefit for economic development.[5] Depending on how mobile the factors are, it may be possible for states to export their corporate tax burdens onto out-of-state companies who have relatively less labor and more sales in the state. Policy makers understand these arguments and have repeatedly changed state apportionment formulae to increase the sales weight.[6] Gordon and Wilson (1986) and Anand and Sansing (1997) have shown that such apportionment maneuvers can have negative externalities on other states. In other words, holding other things equal, the nation might be better off if the states could cooperate when setting their formulae, but that this is not a sustainable equilibrium.

Although the theoretical work of McLure (1980), Gordon and Wilson (1986), and Anand and Sansing (1997) has suggested that the apportionment formula should affect economic decisions, existing empirical work has not been so clear. Weiner (1994) finds no evidence that apportionment affected investment cross-sectionally in 1977. Weiner (1996a) presents cross-sectional evidence that formula apportionment has no independent effect on capital labor ratios and that, looking at the change from 1982 to 1990, apportionment formula changes have only a modest and borderline statistically significant influence on capital spending. Klassen and Shackelford (1997) do find evidence that the formula matters for the location of sales, but not for decisions about real factors (employment and property).

We believe that one of the primary reasons that these papers have not found a more important role for the apportionment formula is that they have not been able to fully control for unobservables because they used only cross-sectional or very limited panel data.[7] By moving to richer data, our

[5] The sales factor is not purely destination based because some fraction of firm sales are within the state of production. If this fraction is high, the sales weight also becomes, effectively, an origin based tax.

[6] Actually, Gordon and Wilson (1986) show that the apportionment formulae can have much more complex effects, as well. Depending on the form of apportionment, there may be incentives for mergers across states, for "cross-hauling" of output, or for companies selling more than one good to locate all their production in a single state. They also show that these distortions could be eliminated by abolishing the corporate income tax and replacing it with direct taxes on the factors.

[7] Specifically, Klassen and Shackelford (1998) do not conduct a panel data analysis so they do not control for fixed

results are able to bring the empirical results in line with the theoretical findings and to highlight the importance of state level decisions. Our primary objective is to estimate the employment impact of a state's apportionment formula for itself and for others.

3. Methodology and Data

Our study compiles a panel data set on the apportionment formulae and corporate tax rates for states from 1978-1994. There have been approximately 20 different state apportionment formula changes over this period and this variation allows us to develop reasonably precise estimates of their economic effects. Because of the long time period, we are also able to control for economic factors that independently influence employment.

The scope of our study is limited in that we focus mainly on the manufacturing sector. We do so primarily because that is where apportionment issues are most likely to be important and also because it has been the primary area of academic study and policy making. Other sectors such as banking or services have special apportionment issues as we will discuss below.

The data used in our study are as follows. First the time series on the apportionment formulae cover all states with a corporate income tax. These data are gathered from Commerce Clearing House's *State Tax Handbook*, various state tax codes, issues of *Significant Features of Fiscal Federalism* and discussions with the departments of revenue in several states

Figure 1 shows the number of states that have adopted more than the standard 1/3 weight on sales in their apportionment formulas over this sample, not counting states with optional apportionment formulae.[8] Although not required, every state that has changed its apportionment formula to raise the

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effects or state trends in their work. Weiner (1996a) first differences the data and thus avoids the fixed effects problem. Weiner has, however, only one time period and so cannot distinguish state specific trends nor does she have many state specific economic controls.

[8] Since we are also implicitly assuming that taxable income is the same across states, we exclude Michigan from the analysis after 1988 because its "single business tax" is more like a value-added type of tax.

sales weight has done so by reducing the payroll and property shares equally. This is probably to prevent apportionment induced factor substitution (e.g., capital for labor) within the state, restricting the impact to an output effect.

There is a consistent upward trend that begins after 1978 with the Moorman case in which the Supreme Court ruled that Iowa's use of the single factor sales apportionment formula was constitutional. With the constitutionality of increased weight on the sales factor established, states have shown themselves quite willing to try increasing employment and economic development by raising the sales weight. Over this time period, no state has ever lowered its sales weight.

We match these apportionment formulae with state employment and earnings data compiled by the Bureau of Economic Analysis. These data include total private employment and total manufacturing employment by year for each state and are compiled from the ES-202 series of the Bureau of Labor Statistics and reported in the B.E.A.'s *State Personal Income* database. We also include the growth rate of average state personal income from the same source. For the national economy, we use data on the unemployment rate and the log of national employment. We allow the coefficient on the latter to vary by state in an attempt to control for population changes in a way that is not endogenous. The descriptive statistics for the data in our sample are listed in Table 1.

Using these data, our basic empirical specification will regress the log of employment in state j in year t as follows:

$$\ln(EMPL_{jt}) = \alpha_j + \beta_1(Tax_{jt}) + \beta_1(\overline{Tax_t}) + \Gamma_1' Z_t + \Gamma_2' X_{jt} + \varepsilon_{jt} \qquad (6)$$

where TAX_{jt} includes measures of the apportionment induced tax burden on payroll in the state as measured by the state corporate income tax multiplied by the payroll weight.[9] $\overline{Tax_t}$ is the weighted average tax burden on payroll for all states in that year. The Z_t are annual controls to account for macroeconomic factors that independently influence state employment (e.g., the national

[9] In a previous version of this paper (Goolsbee and Maydew, 1998), we showed that the results did not change if we also incorporated the federal deductibility of state taxes so we neglect that issue here for simplicity.

unemployment rate) or year dummies which absorb common macro variation, and the X_{jt} are state level controls as well as state specific time trends.

The basic approach is to estimate whether, conditional on the state of the economy and other variables, employment is higher when a state puts less weight on the payroll factor in its apportionment formula. As mentioned above, the payroll weight in every state is the same as the property weight. For the same reason we argue that reductions in the payroll weight can increase state employment, reductions in the property weight should increase the state capital stock. In fact, the two are likely to go hand-in-hand if apportionment changes lead firms to build new factories and hire new workers. We do not have data on changes in the state capital stocks, however, so our focus will be only on employment.

4. Results

4.1 Main Results.

Column (1) of Table 2 presents a basic panel regression for the log of manufacturing employment in a state on the tax terms, state fixed effects, state time trends, the state personal income growth rate, the national unemployment rate, and the log of national employment interacted with the state dummies to account for growth in the labor force. Following the theory presented above, our tax terms are the state corporate tax rate interacted with the payroll weight in the apportionment formula and the weighted average of the same variable for all states in that year (states are weighted by average manufacturing employment over the sample). Because the states have very different sizes, and so on, we correct for heteroskedasticity in all of our regressions using White standard errors.

In this basic specification, the coefficients are significant and have the predicted signs. The non-tax variables are unsurprising and the tax variables are statistically significant. Reducing the tax burden on payroll in the state by reducing the corporate rate or the payroll weight in the apportionment formula increases manufacturing employment significantly. When other states reduce their payroll tax

burden it does the opposite, lowering employment in the state. The magnitude of the own-tax coefficient indicates that for a state with the mean corporate tax rate of .073, changing from a one-third to a one-quarter payroll weight (also known as a "double-weighted sales" formula) reduces the payroll tax burden by .00586 (calculated as .073*[.25-.33]) thus increasing manufacturing employment by approximately 1.1%. Note that the structure of the payroll burden formula implies that the impact of changing the apportionment formula from single to double weighted sales is the same as reducing the marginal corporate tax rate by the same relative amount (at the mean, reducing the corporate tax rate from .073 to .055). This provides a simple comparison to a direct change in tax policy.

The coefficients in column 1 suggest the apportionment formula and the corporate tax rate may be important for firm employment decisions. The apparent effect of apportionment changes, however, might be caused by spurious correlation with some other variable. Firms may respond only to the corporate rate, for example, and by including only an interaction term this makes the payroll weight look significant. On the other hand, if the true marginal tax rate facing the firm differs from the statutory rate, this will tend to reduce the estimated effect of the apportionment formula in the interaction term.

Columns (2), therefore, repeats the specifications of (1) but breaks the payroll burden into two components: the payroll weight and the corporate tax rate. In both specifications, the corporate tax rate does not reduce the importance of the payroll weight. Indeed, in both cases the coefficient on the tax rate is not significantly different from zero while the coefficient on the payroll weight is both significant and the estimated effect is quite large, suggesting that there may be significant measurement error in the measure of the true marginal tax rate or that corporate taxes do not change enough in the sample to identify the effect on employment separately from the state fixed effects.[10] Moving from

[10] The results were almost identical when we calculated the marginal effects of the tax rate and the payroll weight from a regression including both terms individually as well as an interaction term.

one-third to one-quarter payroll weight in column (2) increases manufacturing by 3.1% and if other states reduce their payroll tax burden this reduces employment in the state.

4.2 Extended Results: Endogeneity

Since these first two regressions indicate that changes in the apportionment formula are correlated with changes in state employment, we first want to understand whether these effects are caused from spurious correlation due to endogenous tax policy. If policy makers, for example, change the apportionment formula based on their states' economic performance which in turn affects employment, this will bias the coefficients in the regressions presented. This is unlikely to cause coefficients such as the ones in columns (1) and (2), however, since we controlled for state income growth in the regressions and because if there is endogeneity, we normally envision tax stimuli as being counter-cyclical (i.e., policy makers reducing the payroll weight to encourage employment when it is at its lowest). If anything, that would tend to bias the results against finding that apportionment changes increase employment.

A more sophisticated story might be that states adopt lower payroll weights at points when they are particularly labor intensive and the political power of labor is high or perhaps adopt such weights as one element of a broader "pro-business" outlook on the part of the government causing the apportionment changes to be correlated with other, unobservable policy changes which are, in fact, the source of the estimated employment effects. Such policies might include things like regulatory changes, expenditure differences affecting employees, and tax holidays. In some sense, we can only acknowledge this latter possibility as opposed to truly correcting for it given the large number of such potential policies and the lack of systematic data on them across states and across time.

We can look, however, at how observable factors such as state growth, state corporate income tax rates, state personal tax rates, or the payroll weights in other states appear to influence apportionment formulae decisions. We do this in Table 3 by estimating a probit policy regression. The

dependent variable is a binary decision of whether to cut the payroll weight (any size cut is treated as a 1). The explanatory variables are the current and lagged state corporate income tax rate, top state marginal individual tax rate, mean payroll weight in other states, and the lagged levels of state income growth and the national unemployment rate. The coefficients give the marginal effects of the covariates.

The results suggest that competition with other states is the only strong determinant of short run changes to the apportionment formula. Among the economic factors, none is significant at the 5% level. The sign on lagged state income growth does suggest that apportionment reform is potentially counter-cyclical since higher growth makes a payroll cut less likely. The sign on the personal tax rate does suggest a business climate story since when personal taxes fall, the probability of cutting the payroll weight also rises. The coefficient on the corporate rate points the opposite way, however, and all of the magnitudes are small. Changing the personal rate, for example, by the average change of one and a half percentage points raises the probability of cutting the payroll weight by only 1%.

This policy regression certainly does not disprove the business climate story. Indeed, the explanatory power of the policy regression is quite small. It does suggest, however, that some common observable factors do not seem to have much relationship with changes in the payroll weight so perhaps the endogeneity of apportionment formula changes is not too problematic for our purposes.

Another way control for many unobservable factors is to note that there is both time-series and cross-sectional variation in the apportionment formulae and to include year dummies to absorb the effects of economy wide shocks. We estimate this regression in columns (3) and (4) of table 2. The national unemployment rate and the effect of average tax rates in a given year are now absorbed in the year dummies but the effect of the apportionment formula within the state is still identified. In this equation, the year dummies are very significant, indicating that significant macro shocks affecting all states do exist. The impact of the apportionment formula in (1) has approximately the same point estimate as in the previous results but the standard error is larger because of the minimal variation in

the corporate tax rate changes within years. Breaking out the payroll and corporate rate components in column (4) shows that the apportionment formula still has the same significant impact on employment that it had before.

4.3 Extended Results: Shifting Across Sectors

Next, we examine the employment results of Table 2 but in distinct sectors. It is possible, for example, that manufacturing companies expand employment primarily at the expense of other sectors within the state, i.e., workers merely shift from non-manufacturing to manufacturing.[11] If so, the payroll weight should have a negative effect on employment in the sectors people give up to move into manufacturing. Likewise, manufacturing should respond more to apportionment changes than other sectors do and more capital intensive manufacturing should respond more than less capital intensive manufacturing. Non-manufacturing should have smaller effects from apportionment changes and some sectors within non-manufacturing such as services and finance, ought to have no response because they are treated somewhat differently for apportionment purposes.

Columns (1) through (6) of Table 4, examine these employment effects in some detail. Column (1) repeats the results for manufacturing employment from above. Columns (2) and (3) then break manufacturing into durable and non-durable goods. Durable goods manufacturers are, on the whole, more capital intensive industries than are non-durable manufacturers. The coefficients demonstrate that employment in the more capital intensive manufacturing sector is more responsive to the payroll weight than in the less capital intensive manufacturing sector. At the mean corporate tax rate of .073, moving to the double weighted sales formula increases employment in durable goods manufacturing by 1.6% and employment in non-durable goods manufacturing by 0.9%.

[11] This is not necessary, of course, since the workers could come from other states or from the unemployed.

Column (4) then examines non-manufacturing employment. The coefficient has the same sign, suggesting that there is not shifting out of the sector into manufacturing. The coefficient is noticably smaller, however, suggesting that employment effects are muted in non-manufacturing. The double weighted sales formula at the mean corporate tax rate here would raise employment by 0.7% (versus 1.1% for manufacturing). Column (5) and (6) then examine the employment effects in services and finance where there should not be any effects from changing the payroll weight. If there are, it is likely to imply that there are important unobserved variables at work. In both industries, the coefficient is quite small and not significantly different from zero. In services (column 5), moving to double weighted sales raises employment only 0.2%. In finance (column 6), the point estimate is actually positive, though again small and insignificant.

4.4 Advanced Results: Shifting Across States

The results of table 4 suggest that there may be manufacturing employment increases resulting from lessening the payroll weight that do not arise merely from other sectors within the same state. In this section we examine whether the employment comes from workers moving from other states or rather from the unemployed within a state somewhat in the spirit of Blanchard and Katz (1992). It is important to note that if a policy change leads a state's employment to rise and its unemployment rate to fall and a neighboring state's employment to fall and unemployment rate to rise, the policy can affect employment within and between states even if no individual worker actually moves from one state to the other.

To examine these issues we use annual state population data from the *Statistical Abstract of the United States* to examine whether the payroll weight has an impact on the log of state population. As column (1) of Table 5 shows, there seems to be little relationship between changes in the apportionment formula and people moving into the state. The point estimate is even of the wrong sign. This is not fully satisfactory, however, since the annual population data may have serious error in it

from interpolation and because the labor flows may be too small to make much of a difference on average, even if they matter on the margin.

In column (2) we examine the total employment to population ratio in the state as the dependent variable to see if the payroll weight affects the overall employment rate. The results show that, indeed, it does. Column (3) matches data on the state unemployment rate from the Bureau of Labor Statistics' *Local Area Unemployment Statistics* to our apportionment formula data to examine whether the payroll weight appears to change the unemployment rate. There is a significant relationship of precisely the same form as in the employment statistics. At the mean corporate income tax rate, reducing the payroll weight from one third to one quarter reduces the state unemployment rate by almost 0.5% (mean unemployment is 6.73%).

Finally, column (4) interacts the (lagged) employment to population ratio with the payroll burden to examine whether employment effects in manufacturing are smaller when the employment to population ratio is already high. The coefficients are only borderline significant after the White correction of the standard errors but the results do suggest that when employment in a state is particularly high relative to its population, the employment effect of reducing the payroll weight is smaller than when employment is low. The manufacturing employment response to double weighting sales increases by an additional 0.5% for every one standard deviation reduction in the lagged employment to population ratio.

4.5 Advanced Results: Long-Run Effects

Finally we explore whether the effects of apportionment reform are larger in the long-run than in the short-run. It is likely, for example, that it takes time for firms to fully adjust to tax changes and that they are more elastic to differences in tax systems across states in the longer-run than they are immediately. The results in column (5) present the standard specification but includes lags of the payroll tax burden to estimate a longer run effect. Each of the coefficients is negative indicating that

the effect gets larger over time. The sum of the coefficients after several years is estimated precisely and is also somewhat larger than the short run estimates. Here, moving to double weighted sales raises manufacturing employment by about 2.8%. Only one quarter of this effect happens in the first period.

5. Revenues, Externalities, and Deadweight Loss

5.1 Externalities and the Apportionment Formula

The results in the previous tables, in addition to documenting the potential importance of state apportionment decisions on that states employment, have indicated that there may be important negative effects of one state's decisions on the employment in other states. While a reduction in the payroll weight raises employment in a state, it also lowers employment in other states through the mean tax burden term. This negative externality effectively places states into a tax competition.

To demonstrate the size of the externality, we look at the long run specification of column 5 in Table 5. We calculate the within and across state impact for a state of the mean size with the mean corporate tax rate. Mean manufacturing employment is about 417,000 for a single state and 17,970,000 for the nation. If the mean state reduces its payroll weight from one-third to one-quarter, in the long run, this increases within state manufacturing employment by 2.8%—an increase of approximately 11,800 jobs.

Taking into account the size of the average state, this same change of .083 in the payroll weight, will (at the mean state corporate income tax) lower the average national payroll tax burden by .000136. Using the coefficients in column (5) on the mean tax burden term, this implies a decrease in employment for every state of .071%. While this percentage seems small, with 17,553,000 workers in manufacturing who do not reside in the state changing its apportionment formula, these small effects add up to a reduction in the jobs of other states of 12,500 jobs—basically one for one. On average, each of the jobs created in the state seems to come directly from a job lost in other states. Obviously

the exact estimate depends on the choice of specification but in no case is the net change significantly different from zero.[12]

This puts the dilemma of income apportionment in clear focus. Each state can have a positive impact on its level of employment by cutting the payroll weight unilaterally but such an action will hurt other states by approximately the same amount. Since each state faces the same incentive, consensual agreement on an equally weighted apportionment formulae is just the prisoner's dilemma writ large. This distortion to cross-state production can also lead to a deadweight loss, even though the aggregate effect is negligible.[13]

The negative externality suggests that the country might be better off if the apportionment formulae were set at the federal level as in a standard race-to-the-bottom type argument. This conclusion depends on holding other things equal (i.e., Tiebout-type considerations) but promoting uniformity might improve national welfare by preventing the beggar-thy-neighbor changes at the state level. This lesson in externalities has important implications for the ongoing discussions about converting international taxation in the U.S. to an apportionment formula style system rather than the current, multiple-books system (see Shackelford and Slemrod, 1998; Wetzler, 1995; Weiner, 1996b). If each nation can choose its apportionment formula in such a scheme, then each nation will face the same incentive to change its formula that the states face today and each nation may have the same negative externality on its neighbors that we see here. Such a system would not be stable.

5.2 Revenue Implications and the Cost per Job

[12] We tried to estimate whether there were different externalities within regions or between geographical neighbors than for the country as a whole but we did not find significant evidence that more local areas were closer "competitors" than the nation as a whole.

[13] Anderson and Meyer (1997) discuss the issue of DWL arising from cross-sectional distortions. A careful calculation of the true DWL from state corporate income taxation would need to account for the property and sales portions of the income tax as well as the general equilibrium effects arising from taxing different firms differently in the same states and even the states' relative rates of personal taxation (see Gordon and Mackie Mason 1994; 1997 or Goolsbee, 1998). These are beyond the scope of this paper.

The results have shown that apportionment changes can significantly stimulate job growth. Yet when state departments of revenue calculated the consequences of apportionment reform for tax revenues, they routinely look only at the revenue losses on the corporate side.[14] Our results suggest that by stimulating job creation, apportionment reform generates indirect revenue from the personal income tax that may offset some of the corporate revenue losses.[15]

An interesting comparison, however, is to look at the revenue cost of the proposal divided by the jobs created. This "dollars-per-job" measure is a common way to evaluate business incentives such as enterprise zones or other jobs programs. Papke (1993) cites several studies of this measure which range from about $4,500 to as much as $60,000 but averaging around $10,000. To evaluate apportionment changes, we take the costs estimated by the Departments of revenue in New Jersey and Pennsylvania in 1995 for moves to double weighted sales. New Jersey forecast a $33 million reduction in corporate tax revenue. Pennsylvania forecast a $41 million cost. In our baseline specification, our results suggested that the change would increase manufacturing employment by 1.1%. For New Jersey this is an increase of between 11,000 and 17,500 jobs for a cost of approximately $6000 per job. For Pennsylvania, whose manufacturing sector is larger, the cost is between $1200 and $2000 per job. If we use the specification for total employment or the long-run results, the costs are even lower.

As a means of stimulating job creation, apportionment changes may be a relatively cost effective way to increase employment when compared with other economic development policies. It is important to note, however, that part of this cost savings may arise because government jobs programs are targeted to help those not on the margin. In other words, it may not be surprising that the cost per

[14] Some argue that these corporate revenue losses may be underestimated by state departments of revenue (Pomp, 1987).
[15] Actually, the sign of the impact of apportionment change for revenues depends on how labor, property, and sales "intensive" the state is relative to the national average. We assume that state departments of revenue take these factors into account when making their calculations of revenue losses such as the ones used below. We have little information on how the forecasts are actually created, however.

job of inducing a firm to hire a very unskilled person living in a depressed area is higher than inducing the firm to expand its current production by one worker.

6. Conclusion

Economic theory predicts that a state corporate income tax puts a distortionary burden on the factors in the apportionment formula. As a result, changing the apportionment formula to reduce the weight on payroll should affect employment. Our results verify this with panel data on state employment from 1978-1994. The results suggest that switching from one-third to one-quarter payroll weight increases manufacturing employment in a state by approximately 1.1%. This employment effect means static revenue calculations taking into account only corporate tax revenue effects are likely misstate the total revenue effects of such a change.

The results also show that state decisions negatively affect employment in other states with the aggregate effects of state apportionment changes approximately equal to zero. The externality creates pressure for states to act first in changing their formulae and may imply that the nation would be better off with uniform state apportionment formulae, as in Canada.

The results confirm that state tax policies can have important effects on state economies and that externalities are important. The results may encourage states to reduce their apportionment formulae in an effort to stimulate employment but may also encourage the federal government to try to coordinate the state formulae to prevent the ongoing breakdown of cooperation. The results should give pause to those who advocate worldwide formula apportionment for multi-national companies; the dilemma of income apportionment raised in this paper probably do not end at the water's edge.

Figure 1

Number of States That Have Adopted an Increased Weighting on Sales Factor

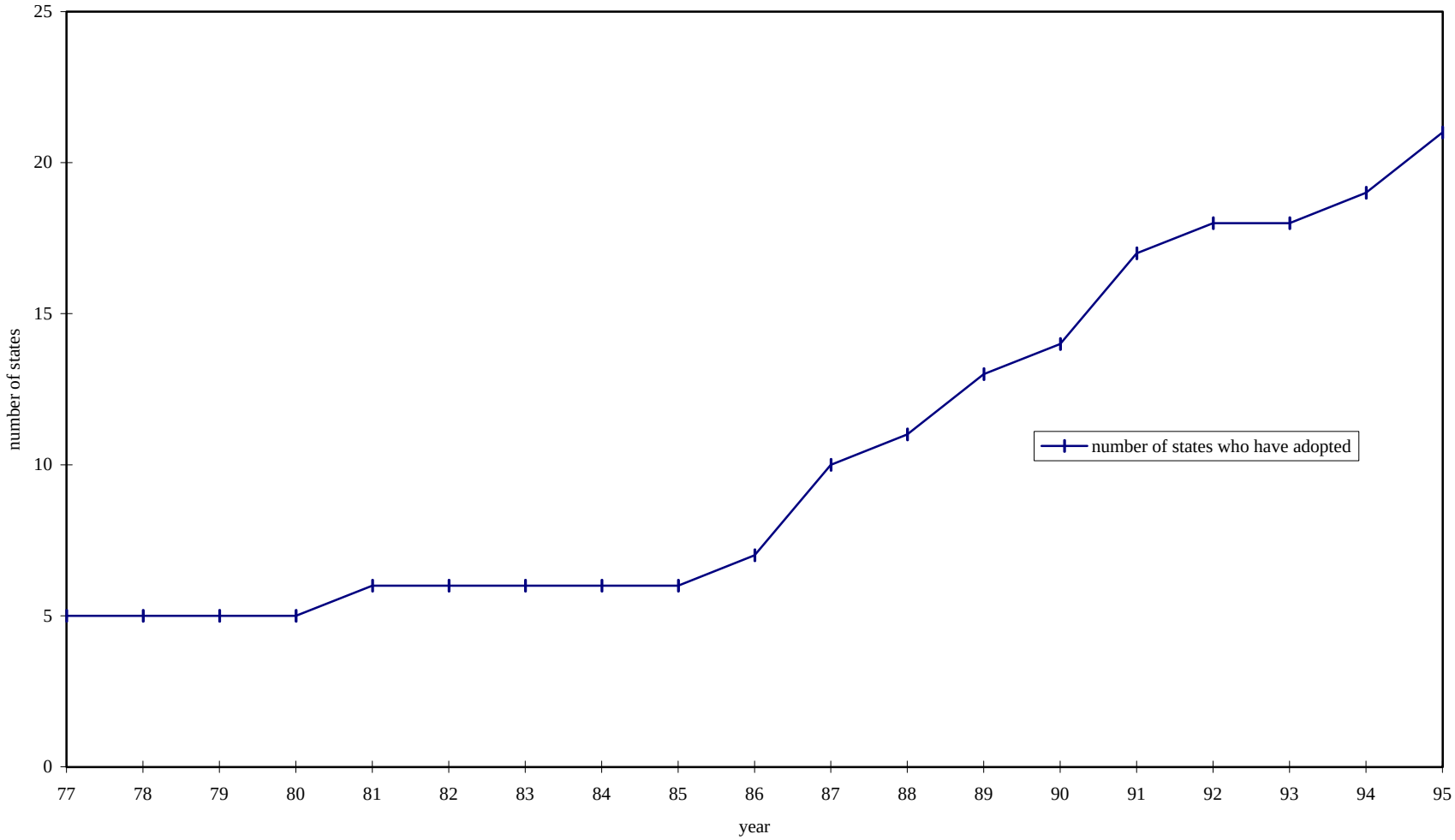

Table 1

Descriptive Statistics for State Panel from 1978-95

Variables[a]	*Mean*	*Standard deviation*
Ln(manufacturing employment)	12.432	1.095
Payroll weight	0.313	0.047
State corporate tax rate	0.073	0.022
State personal tax rate	0.058	0.039
State unemployment rate	0.067	0.022
National unemployment rate	0.069	0.012
State personal income growth rate	0.017	0.022
Employment / Population	0.422	0.053
Number of Observations	732	

[a] Ln(*manufacturing employment)* is the log of manufacturing employment.
Payroll weight is the payroll weight in the apportionment formula (e.g., 33%, 50%, 100%).
State corporate tax rate is the top corporate statutory rate imposed by the state.
State personal tax rate is the maximum state personal tax rate.
State unemployment rate is the state unemployment rate.
National unemployment rate is the national unemployment rate.
State personal income growth rate is the state's growth rate in per capital personal income.
Employment / Population is the state employment to population.

Table 2

Basic Results: Regressions of Manufacturing Employment on the Weight on Payroll in the Apportionment Formula and Control Variables

Independent variables	(1)	(2)	(3)	(4)
State payroll burden	-1.920 (0.876)		-0.731 (0.853)	
State corporate tax rate		-0.229 (0.333)		0.183 (0.317)
Payroll weight		-0.366 (0.113)		-0.297 (0.105)
Mean payroll burden	6.252 (2.726)	5.721 (2.777)		
State income growth	0.380 (.089)	0.390 (0.089)	0.816 (0.124)	0.825 (0.124)
National unemployment	-2.092 (0.362)	-2.004 (0.365)		
(National employment) x (state dummies)	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
State trends	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes
R^2	0.99	0.99	0.99	0.99
Number of observations	732	732	732	732

Notes: The dependent variable in each regression is the log of manufacturing employment. Standard errors are in parentheses. Each regression includes the dummies listed at the bottom of the column and allows the coefficients on the log of national employment to vary by state.

Table 3

Policy Probit

Independent Variables	*Coefficient*	*Standard Error*
Mean payroll weight of other states	-6.200	(2.094)
Mean payroll weight of other states (t-1)	6.449	(2.920)
Mean payroll weight of other states (t-2)	-0.407	(2.167)
State corporate tax rate	0.545	(0.421)
State corporate tax rate (t-1)	-0.054	(0.298)
State corporate tax rate (t-2)	-0.391	(0.465)
Maximum state personal tax rate	-0.783	(0.440)
Maximum state personal tax rate (t-1)	0.592	(0.514)
Maximum state personal tax rate (t-2)	0.081	(0.350)
State income growth (t-1)	-0.387	(0.229)
State income growth (t-2)	0.156	(0.203)
National unemployment (t-1)	-0.005	(0.007)
National unemployment (t-2)	0.002	(0.008)
N	635	

Notes: the dependent variable takes on a value of one if the state decreases the weight on payroll in its apportionment formula during the year.

Table 4

Sectoral Results: Regressions of Employment by Sector
on the Weight on Payroll in the Apportionment Formula and Control Variables

Independent variables	(1) Manufacturing	(2) Durables	(3) Non-durables	(4) Non-manuf.	(5) Services	(6) Finance
State payroll burden	-1.920	-2.741	-1.524	-1.223	-0.363	0.908
	(0.876)	(1.294)	(0.554)	(0.458)	(0.331)	(0.702)
Mean payroll burden	6.252	8.721	3.449	-2.316	-1.701	-14.787
	(2.726)	(3.891)	(2.011)	(1.781)	(1.407)	(2.872)
State income growth	Yes	Yes	Yes	Yes	Yes	Yes
National unemployment	Yes	Yes	Yes	Yes	Yes	Yes
(National employment) x (state dummies)	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State trends	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.99	0.99	0.99	0.99	0.99	0.99
Number of observations	732	732	732	732	732	732

Notes: The dependent variable in each regression is the log of employment in the sector listed at the top of the column. Standard errors are in parentheses.
Each regression includes the variables listed at the bottom of the column, whose coefficients are not listed for simplicity.

Table 5

Advanced Results: Regressions of Population, Employment and Unemployment on the Weight on Payroll in the Apportionment Formula and Control Variables

	Dependent Variables				
Independent variables	(1) *Ln(manufacturing employment)*	(2) *Ln(total employment)*	(3) *Ln(employment/ population)*	(4) *Ln(manufacturing average real wage)*	(5) *Ln(manufacturing employment)*
Payroll burden	0.320 (0.189)	1.514 (0.481)	0.833 (0.218)	-7.979 (4.596)	-1.089 (0.746)
Payroll x (Employment / Population) (t-1)				19.453 (10.681)	
Employment / Population (t-1)				2.043 (0.284)	
Payroll burden (t-1)					-2.162 (0.660)
Payroll burden (t-2)					-1.415 (0.661)
SUM					-4.666 (1.221)
Mean payroll burden	0.760 (0.731)	-0.905 (1.717)	1.635 (0.833)	0.898 (1.667)	5.279 (2.222)
State income growth	Yes	Yes	Yes	Yes	Yes
National unemployment	Yes	Yes	Yes	Yes	Yes
(National employment) x (state dummies)	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
State trends	Yes	Yes	Yes	Yes	Yes
R^2	0.99	0.99	0.99	0.99	0.99
Number of observations	732	732	732	688	644

Notes: The dependent variable in each regression is listed at the top of the column. Standard errors are in parentheses. Each regression includes the variables listed at the bottom of of the column, whose coefficients are not listed for simplicity. The variables are defined in the text. The *SUM* in column 5 is simply the sum of the three payroll burden coefficients.

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